THE ROLE OF THE LISTENER IN THE HISTORICAL PHONOLOGY OF SPANISH AND PORTUGUESE: AN OPTIMALITY-THEORETIC ACCOUNT

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ABSTRACT

In this dissertation I study the application to historical sound change of a constraint-based approach to phonology. I employ Optimality Theory (Prince and Smolensky 1993, McCarthy and Prince 1993a,b) in the analysis of the principal changes in syllable structure that developed from Latin to Spanish and Portuguese. I argue that historical sound change is driven by the incorporation of phonetic factors into phonology for reasons of lexicon and grammar optimization, and show that the role of perception and reinterpretation by the listener is crucial in achieving this optimization. Additionally, reanalysis of underlying forms may have profound effects on the constraint hierarchy of the grammar, leading to the step-wise rise of markedness constraints versus faithfulness constraints.

Furthermore, several steps in the historical development of certain phenomena of syllable structure and phonological/phonetic forms are best understood as resulting from effects of perception and (re-)interpretation by the hearer.

Chapter 1 discusses the need for theoretical approaches to historical change in additional to traditional ones, introduces theoretical machinery (Optimality Theory, lexicon optimization, moraic theory and its relation to sonority) and reviews previous OT approaches to variation and change.

In Chapter 2 I show that reanalysis by the listener of phonetic differences leads to loss of vowel length distinctions in Late Latin, initiating massive changes in the distribution of long segments: a constraint disfavoring moraic consonants begins to rise, first reducing obstruent geminates and vocalizing syllable-final velars.

Chapter 3 continues to explore results of the loss of phonological vowel length. I first treat the evolution of the seven-vowel system of Late Spoken Latin, and argue that reanalysis of the Latin Stress Rule led to vowel lengthening. Later developments lead to diphthongization of stressed open mid vowels in Old Spanish. I then show that geminate consonants are progressively simplified, with the sonorants now being affected. Reduction leads to /n, l/ in Galician/Portuguese, but palatal /ɲ, ʎ/ in Old Spanish, where merger with Latin /n, l/ would have resulted.

Chapter 4 shows that the listener may (mis)interpret one sound for a less marked one based on great acoustic similarity. In the development of Latin *Cl* clusters to Spanish, Galician and Portuguese -*ch*-, I argue that voicing assimilation yielded a cluster that was interpreted as [tʃ]. The Uniformity Condition is also reconsidered.

Chapter 5 summarizes the results of this study and offers several conclusions about historical sound change in Optimality Theory.

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To my family for your confidence in me

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DEFINITIONS OF LANGUAGE TERMS

I define here several language terms I will use in the dissertation.

When I refer to 'Latin', in most instances I will mean the Latin spoken in the late Roman Empire and after its fall to the Visigoths and other Germanic tribes in the fifth century A.D.; other senses of the term 'Latin' will be explicitly noted (e.g., Classical Latin).

This Late Spoken Latin was not, however, a fully unified language, and it developed differently in the various regions of the Roman world. The spoken Latin that developed in Hispania, particularly between the fall of the Empire and the invasion of the Moors in 711, is here called Late Hispanic Latin. This variety subsequently gave rise to the various Ibero-Romance dialects. The term 'Late Hispanic Latin' is used to indicate the stage in the development of spoken Latin when what are now Galician, Portuguese, Leonese, Castilian ('Spanish'), Aragonese and Catalan formed a more or less unitary language. 'Hispano-Romance' will normally be used to designate the stage when Galician, Portuguese and Spanish were fairly unified, though where noted it will designate phenomena that are common to more than one modern dialect. 'Pre-Old Spanish' or 'pre-Galician/Portuguese' will refer more specifically to the varieties of Hispano-Romance that immediately preceded the attested stages that followed, i.e., Old Spanish and Galician/Portuguese.

Lastly, throughout the dissertation I will employ the term 'Galician/Portuguese' to indicate the stage before Portuguese became distinct from Galician. After Afonso Henriques obtained the title of king from Alfonso VII of Castile and León in 1143, Portuguese evolved independently from Galician and Spanish. Documents that may strictly be called 'Old Portuguese' begin to appear at the end of the twelfth century (an 1192 division of inheritance). Documents in Old Spanish appear earlier (*Glosas emilianenses*, c. 950; *Glosas silenses*, second half of 10th c.). More recognizable Spanish texts appear in the twelfth century, such as the *Auto de los reyes magos* (toward the end of the twelfth century) and the *Cantar de mio Cid* (late 12th-early 13th c.). See Sampson 1980.

INTRODUCTION

In this dissertation I will study the application to historical sound change of a constraint-based approach to phonology. I employ Optimality Theory (Prince and Smolensky 1993, McCarthy and Prince 1993a,b) in the analysis of the principal changes in syllable structure that developed from Latin to Spanish and Portuguese. I argue that historical sound change is driven by the incorporation of phonetic factors into phonology for reasons of lexicon and grammar optimization. I will show that the role of perception and reinterpretation by the listener is crucial in historical change as a means to achieve this optimization. We will see that reanalysis of underlying forms may have profound effects on the organization of the constraint hierarchy of the grammar, leading to the step-wise rise of markedness constraints versus faithfulness constraints.

To date there has been little research into historical Hispano-Romance phonology using this model, and this dissertation aims to help fill that gap. While offering an analysis of several classic historical phenomena, it also makes a contribution to the development of phonological theory and the emerging Optimality Theory ('OT'), while advancing a novel model of language change.

Within a constraint-based approach, and one that intends to be universal, how is language change to be characterized? This is new ground, and only recently have researchers begun to apply OT to sound change (Jacobs 1994, 1995; Hutton 1996;

Gess 1996; Green 1997—these are reviewed in Chapter 1). Jacobs and Gess investigate Old French, but lacking still at this point are in-depth treatments of the phonological history of both Spanish and Portuguese. Because this would in fact constitute an entire research program, in this dissertation I will limit myself to an exploration of the role of lexicon optimization in sound change and its effects on syllable structure.

I show that several characteristics that distinguish Spanish from Portuguese can be attributed to the divergent ranking of a limited number of constraints. We will see that the history of these languages is composed of a series of stages, each of which exhibits a specific constraint hierarchy. This must be understood in diachronic terms, not in serially derivational ones, which would be antithetical to the tenets of OT, which in its strongest form allows for only a single step from base to surface. That is, I propose a series of stages in the OT grammar, but these are to be understood as historical stages, not intermediate stages of a single synchronic grammar.

To support these assertions, I present and motivate a series of phonological structure conditions (constraints) whose interaction and relative importance account for the historical changes addressed here. I show that slight reranking of these constraints, that is, variation in the relative importance of the constraints from one language to another and from one time period to another, elegantly and simply captures cross-linguistic variation in the syllable structure and phonological/phonetic forms of these languages.

Likewise, several steps in the historical development of certain phenomena are best understood as resulting from effects of perception and (re-) interpretation by the hearer. Furthermore, several phonological processes and historical changes can be seen here as interrelated for the first time, a result of assuming the constraint-based approach employed in this dissertation.

Chapter 1 presents a discussion of the need for theoretical approaches to historical change in addition to traditional ones. Once the theoretical assumptions adopted here are introduced (Optimality Theory, lexicalization and lexicon optimization, and moraic theory and its relation to sonority), there is a discussion of previous OT approaches to variation and change and their relevance to the present study. Chapter 1 concludes with a brief discussion of the direction the present work will take.

Chapter 2 begins the analysis of the Hispano-Romance data. I show that reanalysis by the listener of previously phonetic differences leads to loss of vowel length distinctions in Late Latin. This will be argued to initiate far reaching changes that lead to the eventual recovery of systemic balance in the distribution of long segments. The step-wise climb of a constraint $*C_{\mu}$ ('no moraic consonants') leads to the reduction of geminate voiceless obstruents and the vocalization of the first segment in the clusters /kt, ks, lt, gn/. Also crucial here is the reanalysis of the Latin Stress Rule.

Chapter 3 continues to treat the effects of reanalysis by the listener of loss of distinctive vowel length. One major result is that the Latin Stress Rule is reanalyzed as a constraint requiring that stressed syllables be bimoraic; subsequent developments in pre-Old Spanish led to diphthongization of open mid vowels /ɛ, ɔ/. The other principal effect of loss of Latin vowel length is the step-wise rise of $*C_{\mu}$, as seen in Chapter 2; here it continues to rise, resulting in simplification of the next-most sonorous elements, the geminate sonorants /nn, ll/. Previous loss of /-n-, -l-/ in Galician/Portuguese allowed for simplification of /nn, ll/ to /n, l/; in Old Spanish, however, the retention of Latin /-n-, -l-/ led to simplification-cum-palatalization, yielding /ɲ, ʎ/. An appendix to this chapter explores coarticulation of nasal and lateral codas in Andalusian and Caribbean Spanish.

Chapter 4 gives additional support for the proposition that the listener is key in effecting sound change. In this chapter, I offer an innovative account of another characteristic that sharply differentiates Spanish from Galician/ Portuguese, the development of clusters of voiceless consonant plus /l/. In addition to further cases of the lexicon optimization of added features to avoid violations of DEP, we will see that the listener may play another role as well. Here it is the acoustic similarity of marked [cʎ̥] that leads to reinterpretation by the listener as [tʃ]. I offer an OT reconsideration of the Uniformity Condition and suggest that it is important in leading to the reanalysis of certain *Cl* clusters as /tʃ/. Two appendices to Chapter 4 treat further several theoretical issues raised in the course of this dissertation: the first discusses the phonetic plausibility of the change [Cl] > [tʃ]. The second adduces additional phenomena in Hispano-Romance that may be best accounted for by appealing to constraint conjunction as an alternative to the Uniformity Condition.

Chapter 5 briefly summarizes the principal results of this study that show that the role of the listener is crucial in effecting sound change. This chapter also gives several conclusions regarding historical sound change in Optimality Theory, including that consideration of phonetic factors and lexicon and grammar optimization are important in understanding historical change.

CHAPTER ONE

THEORETICAL CONSIDERATIONS

1.0 Introduction. I first present a discussion of the need for application of advances in theoretical phonology to historical change, in addition to traditional approaches (§1.1). Next, I discuss the conception of historical change in generative phonology (§1.2), and I follow this with a presentation of the theoretical framework and notions necessary to proceed with the analysis offered in this study (Optimality Theory, lexicon optimization, moraic theory; §1.3). I then review previous OT approaches to variation and change (§1.4). This chapter concludes with some comments about the aims of the present work (§1.5).

1.1 Historical change. How historical change should be characterized remains controversial. There are many open questions, in any framework, such as 'Why do languages change?', 'How may these changes best be formulated or modeled?', 'Why are some changes absolute, while others seem to affect only a subset of the potential targets?', and many others that are still open questions within any framework. Earlier investigation into Romance linguistics by such researchers as Diez (1874), Meyer-Lübke (1895) and Menéndez Pidal (1904), and more recently Lapesa (1986), Lloyd (1987), Malkiel (1963-4) and Penny (1991) was largely descriptive, and the data these authors collected, the observations they made, and the laws they formulated are still the fundamental foundations upon which current investigation must build. Malkiel (1963-4:144) acknowledges this, while at the same time recognizing that another step must be taken to reach another level of adequacy:

> Romance scholarship, throughout the first decades of this century, has concentrated almost exclusively—to the extent that its spokesmen bothered to attack problems of phonology—on minute geographical delimitations and on the painstaking accumulation of shreds of historical evidence, neglecting—with rare exceptions—the equally urgent task of concomitant theoretical refinement. The collection of raw data must, of course, continue at undiminished pace, but the discussion of theoretical fundamentals underlying any profitable attempt at elucidating these facts can no longer be with impunity postponed.

1.2 Historical change in generative phonology. The advent of generative phonology coincides chronologically with the thinking propounded by Malkiel. Historical change in this period is now characterized differently; Hartman (1974:123) summarizes this shift in perspective well:

> Kiparsky (1965) and King (1969)—with the impetus of Halle (1962)—have given us a theory of language change that differs from earlier theories in that it implies that language history is two-dimensional: that is, a historical grammar is not simply a list of sound-change laws in chronological order, but a diachronic series of synchronic grammars. Each synchronic grammar consists of a list of ordered rules, and historical changes include not only rule addition, but also rule loss, rule reordering, rule simplification, and restructuring of underlying forms. It is these additional types of change—principally rule reordering and simplification—that make phonological history different from synchronic phonology and thus interesting in its own right.

Harris (1969) and Hartman (1974) initiate this undertaking with specific regard to Spanish (and only peripherally for Portuguese). These authors elaborate a series of rules for the changes that differentiate Spanish from Latin. Later advances in generative phonology also had an impact on the treatment of historical change, such as Martínez-Gil's accounts (1990, 1994) of a number of changes from Latin into Spanish (including the development of syllable and metrical structure, intrusive stop formation, velar vocalization, and lenition), applying different aspects of nonlinear phonology (autosegmental theory, metrical theory, underspecification, etc.). Each of these authors has made important contributions to the advancement of our understanding of both diachronic linguistics in general and of Spanish in particular. Unfortunately, there has been little research within the generative approach dedicated to the comparable study of Portuguese, and what there is has been synchronic, not diachronic (cf. Pardal 1977, López 1979, Girelli 1988, Wetzels 1991).

In recent years, growing dissatisfaction with the rule-based approach to generative grammar has come to a head. Ever since the inception of generative grammar there has been the need to posit constraints, filters or conditions alongside rules; the interplay among these has been problematic and has undergone much scrutiny. Another criticism has been that we ought to have observable evidence that the grammar is indeed a series of rules. In fact, we only have evidence for the output (what we actually orally produce), and only indirect or theory-internal evidence for the input (underlying representations) such as morphological alternations.

These and other criticisms have led to the development of alternative frameworks in which constraints play the principal or only role, to wit: the Theory of Constraints and Repair Strategies (‘TCRS’, Paradis 1988, 1993); Harmonic Phonology (Goldsmith 1994); and Optimality Theory (‘OT’, Prince and Smolensky 1993). Of these, OT has gained the most followers in part because this purely constraint-based approach makes strong claims about the nature of constraints and the interrelation of languages via constraint ranking.

At this point it is necessary to present an excursus on the nature of OT for those accustomed to traditional or nontheoretical frameworks. (The reader familiar with OT may skip to (5) below, where I present specific constraints upon which my analysis will rely.) After outlining the principal theoretical assumptions I adopt in this study, I shall return to the discussion of historical change.

1.3 Theoretical assumptions. In this section I introduce the theoretical framework I will follow in the elaboration of the analysis of the historical phonology of Spanish and Portuguese. I first present a general discussion of Optimality Theory (§1.3.1), and then discuss lexicalization and lexicon optimization in OT and previous models (§1.3.2). Lastly, I discuss moraic theory and its relation to sonority (§1.3.3).

1.3.1 Optimality Theory. Optimality Theory (Prince and Smolensky 1993) posits that a grammar is a set of ranked 'soft' or violable universal constraints. A component called the Generator (GEN) produces a set of candidate output forms whose satisfaction of the constraint hierarchy (CON) is determined in parallel by the Evaluator (EVAL). The optimal output form violates minimally the ranked set of constraints that define the grammar of the particular language under study. Put another way, a surface form may (and, indeed, will) fail to satisfy all the constraints of a language, yet still be optimal or preferable to others that violate higher-ranked constraints. These constraints are argued to be a part of Universal Grammar: what is language-specific is their particular ordering or the dominance relations that obtain between them. An OT grammar operates only on static representations rather than active derivations. That is, in its strongest form, OT assumes that an underlying form is mapped to its surface form in a single step, not that a form will undergo many intermediate stages to arrive at its final form.

The sample tableaux in (1) below illustrate how an OT grammar functions. The assumed underlying form is given in the upper left cell of the tableau and potential output forms are listed as candidates in the first column. Across the top of the tableau are the constraints whose relative importance is indicated by the ranking they are given; the more dominant a constraint the further left it appears in the tableau. Constraints separated by a solid line are strictly ordered: the constraint to the left dominates the constraint to the right. Constraints separated by broken lines are unranked with respect to one another; that is, there is no evidence to indicate that one constraint is higher-ranked than the other. An asterisk in a cell indicates a violation of the constraint that heads that column, and an exclamation point indicates that a violation is 'fatal,' that is, that this particular violation is the reason the candidate output is eliminated from consideration when compared to the optimal output. √, though not usually indicated in the OT literature, here signals that a candidate satisfies a relevant constraint. ☑ is used here to indicate the optimal candidate, i.e., the one that represents the correct surface or output form for the language.

(1.) Sample tableau

(a)

/input form/	Constraint 1	Constraint 2
Candidate output 1	*!	√
Candidate output 2 ☑	√	**

(b)

/input form/	Constraint 1	Constraint 2
Candidate output 1	*	**!
Candidate output 2 ☑	*	*

(c)

/input form/	Constraint 1	Constraint 2	Constraint 3
Candidate output 1 ☑	*		
Candidate output 2		*	*!

In (1a) Candidate output 1 violates Constraint 1, and because Candidate output 2 does not violate Constraint 1, Candidate 1 is eliminated from consideration. For (1a) then, Candidate output 2 is optimal, even though it incurs two violations of lower-ranked Constraint 2. In (1b) both Candidates violate Constraint 1, and the determination of optimality is effected by the satisfaction of Constraint 2. Here, Candidate 1 twice violates Constraint 2, while Candidate 2 violates it only once. Hence, the fatality of the second violation of Constraint 2 is indicated with '!'. Optimal Candidate 2 is indicated by ☑.

In sample tableau (c) the broken line that separates Constraint 1 from Constraint 2 indicates that a dominance relation between the two cannot be established (the ordering of such constraints in the tableau is therefore somewhat arbitrary). Consequently, the violation of Constraint 1 by Candidate 1 and of Constraint 2 by Candidate 2 are of equal standing, and it is the violation of Constraint 3 by Candidate 2 that eliminates this Candidate from consideration for optimality. Thus Candidate 3 is identified as the optimal candidate and is marked by the symbol ☑.

For the sake of conciseness and ease of reference, I summarize the basic tenets of Optimality Theory:

(2.) Principles of Optimality Theory (McCarthy and Prince 1993a:5, adapted from Akinlabi 1994):

(a) Universality: Universal Grammar provides a set of constraints CON that are universal and universally present in all grammars.

(b) Violability: Constraints are violable, but violation is minimal.

(c) Ranking: The constraints of CON are ranked on a language-particular basis; the notion of minimal violation is defined in terms of this ranking. A grammar is a ranking of the constraint set.

(d) Inclusiveness: The constraint hierarchy evaluates a set of candidate forms that are admitted by very general considerations of structural well-formedness.

(e) Parallelism: Optimal satisfaction of the constraint hierarchy is computed over the whole hierarchy and the whole candidate set. There is no serial derivation.

Additionally, Optimality Theory assumes that Universal Grammar is composed of these three components:

(3.) Components of UG:

(a) CON: The set of constraints out of which grammars are constructed.

(b) GEN: A function defining, for each possible input *i*, the range of candidate linguistic analyses available to *i*.

(c) EVAL: A function that comparatively evaluates sets of forms with respect to a given constraint hierarchy X, a ranking of CON.

According to Optimality Theory, then, GEN produces a set of candidate analyses consistent with a given input (e.g., lexical entry); EVAL assesses the various candidate output forms according to the given constraint hierarchy, and the candidate that best satisfies or minimally violates the grammar's constraint ranking is the 'optimal' candidate (i.e., the actual form of the language) (McCarthy and Prince 1993a:1-5).

I move now from a general explication of how an OT tableau works to the exemplification of several types of constraints that comprise an OT grammar. One important group of constraints that comprise the grammar of a language is the faithfulness family of constraints, which serve to regulate the relation of features and structures between underlying representations and their surface manifestations. Correspondence between the two levels is mediated via these ranked families of constraints:[1]

(4.) Faithfulness constraints (abbreviated 'FAITH'; Correspondence version, see, e.g., McCarthy 1995):

(a) MAX ('no deletion'; formerly PARSE, 'the surface form should maximally retain underlying features or segments')

(b) IDENT(ITY)-[F] ('input and output segments have identical values for feature [F]', e.g., [place of articulation], [consonantal], [voice])

(c) DEP(ENDENCY) ('no insertion or epenthesis'; formerly FILL, 'output specifications should depend on underlying specifications')

In addition to the family of correspondence constraints, which may be decomposed into constraints referring to specific featural specifications that may be independently ranked, I will also employ in my analysis the following constraints:

(5.) Additional constraints employed in this dissertation:

(informal definitions; further discussion and references will be given in the sections where these constraints are first employed)

(a) STRESS-TO-WEIGHT (abbreviated 'STW'; 'a stressed syllable is bimoraic'; this is also called the Strong Rhyme Condition)

(b) *LONG-VOWEL (abbreviated '*LONG-V'; 'no long vowels'; 'long vowels are disfavored.' (This will be made more precise in Chapter 2.))

(c) $*C_{\mu}$ ('no moraic (long or syllable-final) consonants'; 'long or syllable-final consonants are disfavored'. (More accurately, $*C_{\mu}$ is shorthand for the family of constraints that determines which consonants may be moraic in a given language; this will be decomposed in Chapter 2.))

(d) NODIPHTHONG ('diphthongs are disfavored')

(e) *LONG-[-ATR] ('long lax vowels are disfavored')

These are the principal constraints whose interaction I will argue accounts for the changes and variation addressed in this study.

1.3.2 Lexicalization and lexicon optimization in Optimality Theory and previous models. OT and previous frameworks have had need to appeal to some kind of principle of lexicalization, though the motivation for this has varied greatly in each of the various approaches. I begin the discussion of this topic with the OT principle of lexicon optimization.

This principle says that given the surface form of a morpheme and knowledge of the grammar, a learner will select the optimal underlying representation for that morpheme:

(6.) Lexicon optimization (Prince and Smolensky 1993:192):

> Suppose that several different outputs I_1, I_2, ..., I_n when parsed by a grammar G lead to corresponding outputs O_1, O_2, ..., O_n, all of which are realized as the same phonetic form Φ -- these inputs are all *phonetically equivalent* with respect to G. Now, one of these outputs must be the most harmonic, by virtue of incurring the least significant violation marks: suppose this optimal one is labeled O_k. Then the learner should choose, as the underlying form for Φ, the input I_k.

Inkelas (1995) paraphrases this as follows:

> [O]f all the possible underlying representations that could generate the attested phonetic form of a given morpheme, that particular underlying representation is chosen whose mapping to phonetic form incurs the fewest violations of highly ranked grammatical constraints.

This idea is not new to OT, though such a principle does run counter to the claim made in many traditional generative frameworks that underlying representation should be as underspecified as possible; maximal elimination of redundancy is encouraged in these models because the rules of the grammar are sufficient to generate the correct output forms of the language.

Under lexicon optimization in OT, however, underlying forms (inputs) may be fully specified; only alternating structure is unspecified, as EVAL will consider optimal those candidate output forms with fewer violations of faithfulness constraints like MAX and IDENT. This has the effect of maximizing the harmony of the grammar, roughly defined as the minimization of constraint violations. In nontechnical terms, this means that a speaker mentally stores that which he or she hears produced; positing of a more abstract underlying form will only occur when there are phonologically or morphologically related groups of words whose shared segments vary only in certain features. Though this places a higher burden on lexical representation, it reduces that placed on the grammar.

This is similar in spirit, if not identical, to the Natural Generative Phonology tenet that lexical representations of nonalternating parts of morphemes are identical to their phonetic representations (e.g., Vennemann 1973, cited in Golston 1996, who concurs; see also Hooper 1976).

A pre-OT (i.e., generative) statement of this principle is given in Girelli (1988), in which he analyzes several segments in Brazilian Portuguese (e.g., *s*, *l* and *n*) whose realizations vary by context (for *s*, [s, z, ʃ]; for *n*, [~, n]; for *l*, [l, w, j]). He assumes that speakers (beginning with children) adhere to the Neutral Ground Hypothesis, which he states as follows:

(7.) Neutral Ground Hypothesis (Girelli 1988:116)

> When a segment alternates for some features in different contexts, in the lexicon it is specified, with unmarked values for the features for which it alternates.

That is, where a segment alternates it is unmarked for those features for which it alternates (p. 157).

Turning to literature on child language, we find that full specification is the standard assumption, at least for the earliest stages of acquisition (Kiparsky and Menn 1977, Kiparsky 1970). Jaeger (1986) argues for the assumption that words are stored in a form close to their pronunciation. She states that "the most straightforward hypothesis about young children's representations is that they are isomorphic with their pronunciations, with perhaps some mismatches due to production constraints" (p. 72). She concludes by saying that nearly all studies of speech production and perception indicate that something close to surface forms exist in memory and that words are stored with much redundancy, enabling access from a number of paths (p. 71). Likewise, Jusczyk (1997) adds that it is also assumed that specific characteristics of a given utterance are somehow removed during speech processing (e.g., intonation, voice quality, etc.), leaving a normalized lexical representation that is basically a phonetic description of the information heard in the utterance.

While this increases lexical storage, it reduces the work of the grammar, an idea consistent with Bever (1975). Bever discusses the psychological reality of grammar, and proposes that once coordination of the outputs of perception and production systems is achieved, “the grammar need not play any direct role in on-line processing; that is, grammatical rules are not necessarily executed as steps during processing, nor does processing require computing the kinds of representations that are associated with derivations of sentences” (cited in Jusczyk 1997:194).

OT studies of child language like Hale and Reiss (1996a,b) and Smolensky (1996) (and references given in both) follow the assumption that children’s lexical representations are fully specified (though they are diametrically opposed in other aspects of their analyses). Yip (1995) agrees.

The relevance of lexicon optimization for historical change should be obvious. When the listener hears an output form that differs from its underlying representation, it will consider storing that phonetic output in mental representation. This will occur if the output in question always occurs with the same phonetic form; lexicalizing it reduces faithfulness violations (MAX, IDENT or DEP) because whatever change might happen in fact always happens. Therefore, making that information part of underlying representation maximizes the harmony of the grammar by eliminating these faithfulness constraint violations.

This is very similar to Neogrammarian theory of phonological change, as reviewed in Kiparsky (1965, 1965/1982:1). He discusses Hermann Paul's *Prinzipien der Sprachgeschichte* (1886), stating that phonological change takes place continually as articulatory representations are revised to match shifts in execution due to the natural tendency toward articulatory drift. This drift may occur provided that the resulting auditory deviation does not reach the level of conscious perception.

For instance, the devoicing of final obstruents in German is learned via observation of alternations of the type *bun[t]:bun[d]e*; however, words like *ab*, *ob*, *weg* never alternate, so their final segment will always surface as voiceless (by devoicing). Consequently, succeeding generations may omit the specification [+voice] from the underlying representation of the final segment of these forms, bringing about restructuring in this part of the lexicon (Kiparsky 1965/1982:17). We will see many similar examples in the course of this dissertation.

Indeed, this process is known as 'lexicalization' in traditional historical linguistics. That is, what for one generation of speakers is taken as a rule-produced variant is misinterpreted as a lexical item by younger speakers, who never make the inference of the underlying form of their elders. Lexicalization is, then, the loss of a more abstract underlying representation for the retention of the surface phonetic shape now entered as the primary lexical representation of the item (Maher 1980:113).

This principle is adapted into OT under the term lexicon optimization. With regard to historical change, on the assumption that younger members of a linguistic community are important in spreading change, newer generations of listeners will lack evidence that a phonetic feature (or its absence) is due to a phonological process or alternation, and will consequently posit the surface form as a lexical item (or, faced with morphological alternations, the nonalternating structure common to the related forms).

There is an interesting extension of this argumentation under the strict OT assumption that a grammar is composed of ranked violable constraints. That is, given an initial ranking of faithfulness and well-formedness constraints, not only does the phonetic output lead the listener to posit surface-true lexical items, it also leads the learner to demote (or not) constraints from their original ranking.[2] That is, for a constraint with an initially high ranking, the lack of phonetic evidence that it is violated will allow the listener to leave it in its original position. Likewise, when a listener does hear phonetic forms that violate a certain constraint, she will demote the constraint to allow for the grammaticality of the output form heard. I assume that newer speakers are not aware of a change in the ranking of constraints; instead, they learn what the final ranking of constraints should be based on the phonetic evidence. (Maher (p. 113) also argues that it is necessary to recognize the surface phonetic form as a theoretically relevant level).

This is in large part what I mean in the Introduction by “historical change is driven by the incorporation of phonetic factors into phonology for reasons of lexicon and grammar optimization.”

1.3.3 Moraic theory. Following Hyman (1985), Itô (1989), Hayes (1986, 1989, 1995) and Zec (1995) (among others), I assume that the mora, a unit of syllabic weight, is the primitive subsyllabic constituent.[3] Thus, I assume that geminate consonants are moraic. Simple consonants are not moraic in onset position, but may be in syllable-final position (i.e., if coda consonants figure in stress assignment). I will assume here that simple and contrastive long vowels are underlyingly monomoraic and bimoraic, respectively. This is shown in the following chart:

(8.) Underlying and surface moraic status of vowels and consonants:

Short vowel	$/V_{\mu}/$	$[V_{\mu}]$

Long vowel	$/V_{\mu\mu}/$	$[V_{\mu\mu}]$
Short consonant	/C/	[C] (onset only)
Short consonant	/C/	$[C_{\mu}]$ (coda, if weight by position)
Geminate consonant	$/C_{\mu}/$	$[C_{\mu}]$ (coda and onset)

Zec (1995) explores the relationship between sonority and moraicity. She argues that the best way to understand the moraicity of segments is through their sonority. That is, following the well-established observation (made by Saussure 1959, Clements 1990 and many previous researchers) that more sonorous segments occupy the peak position of the syllable (nucleus) and less sonorous ones occur toward the syllable margins (coda and onset), she argues that sonority constraints are imposed directly on prosodic structure (that is, moraic status), and immediately affect structure below this level (that is, segments).

According to this line of reasoning, the major class features that determine sonority are thus sufficient to determine potential moraicity. The major class features of segments and the corresponding sonority classes that result are these:

(9.) Major class features of segments:

	[cons]	[son]
vowels	-	+

sonorants	+	+
obstruents	+	-

(10.) Major sonority classes (and, hence, classes of moraic segments):

a.	[-cons]	=	vowels	(only vowels are moraic)
b.	[+son]	=	vowels and sonorants	(vowels and sonorants are moraic)
c.	—	=	all segments	(all segments are moraic)

To make further distinctions one would add features that contribute to sonority. For instance, to distinguish liquids from nasals the feature [liquid] (see Walsh 1995) could be added; Inkelas and Cho (1993:532) suggest that [continuant] or [+constricted glottis] may also be invoked on a language-particular basis to draw further distinctions in sonority ranking.

The sets of moraic segments that result from the above require at least moraic vowels. This is the case of Khalkha Mongolian and Yindiñ, which only permit vowels to be moraic. The next least permissive group of languages allow only vowels and sonorants, but not obstruents, to be moraic. Lithuanian and Tiv are examples of this type. The most permissive group of languages places no restriction on the sonority of moraic segments. Thus, in English and Arabic dialects (e.g., Cairene, Damascene), vowels, sonorants and obstruents may all be moraic. This is also the case of Latin. (Latin also has geminates, while English does not, at least underlyingly.)

I will explore further the implications of the relationship between sonority and moraicity in Chapters 2 and 3. I will show that this point is crucial in initiating the rise of $*C_{\mu}$ ('no moraic consonants'). We will see that the development of Latin into Old Spanish and Galician/Portuguese is characterized by the progressive restriction on the type of sonority requirements imposed on moraic segments. Thus, while Classical Latin is of class (7c), Late Spoken Latin is of class (7b) and Old Spanish and Galician/Portuguese are of class (7a).

1.4 Previous OT approaches to variation and historical change. Now that the basic machinery of Optimality Theory has been introduced, in this section I briefly review several previous OT approaches to language variation and change. Since this is a relatively new area of application of OT, the number of works to be discussed is limited. The reader is referred to the original articles for more complete discussion and further references.

1.4.1 OT approaches to variation.

1.4.1.1 Zubritskaya (1994). One of the earliest OT analyses of variation is Zubritskaya (1994), who treats the loss of palatalization assimilation in consonant clusters in Modern Russian. She explores the idea that whole families of functionally similar constraints interact in such a way that a change operates as a gradual weakening or strengthening of that family. Her conception of sound change is that it is restructuring of the constraint hierarchy, the reasons for which are not always clearly understood. In the case of palatalization assimilation she treats, the constraint requiring assimilatory spreading (MAXIMIZE LICENSING in her account) is reranked below the entire family of constraints that militate against secondary articulation (that is, palatalization by having a secondary coronal articulation):

(11.) MAXLIC. →

```
*Dor      >>     *Lab  >>     *Cor
  |                |             |
 Cor              Cor           Cor
```

Given this fixed markedness hierarchy (that is, it is worse for dorsal segments to be palatalized than labials, and both are more marked than palatalized coronals), Zubritskaya argues that the directionality of the sound change of loss of palatalization assimilation is determined by the implicational relation described. She suggests that not only is the directionality of change natural (from more to less marked) but that it is the only direction possible. The speaker does not have to learn the directionality of a sound change with respect to functionally similar environments since the directionality is determined by the universal markedness ranking. Such markedness hierarchies, then, allow one to make explicit predictions about the possible directionality of a sound change. She suggests that optionality in the choice of output (that is, synchronic variation) is to be modeled via competition between a single constraint and a whole constraint family.

I make a similar argument in proposing that degemination of obstruents, syllable-final weakening and loss (Chapter 2) and simplification of /nn, ll/ (Chapter 3) are due to the step-wise reranking of $*C_{\mu}$ versus the faithfulness constraints.

1.4.1.2 Anttila (1995). Anttila (1995) discusses variation of Finnish genitives. His proposal is that both categorical and variable outputs, as well as statistical preferences for a given form over another, follow from syllable prominence, which he defines as a combination of stress, weight and sonority. Under his analysis, variation depends on how successfully these properties harmonize. That is, if a stem yields a very harmonic form it shows no variation, while if it yields several almost equally-optimal forms, variation arises.

He captures this insight in the following way: Given three constraints for a language A, B, C, and the rankings A >> B; A >> C, we really have only a partial ranking, since there is no ranking relation between B and C. This relationship may be represented as follows:

(12.)

	A	B	C
a. Candidate 1	*	*!	
b. Candidate 2 ☑	*		*

(13.)

	A	C	B
a. Candidate 1 ☑	*		*
b. Candidate 2	*	*!	

It is important to note here that these two tableaux correspond to one grammar; this is in contrast to the situation given above in (1b) or (1c), in which we saw that when candidates tie with respect to some constraint the immediately dominated constraint continues to evaluate optimality and eventually determines a clear and unique winner. The difference is that in those cases it is assumed (that is, it has been shown in the grammar) that there is a total ranking of constraints, in which case categorical and unique results obtain. In the model proposed by Anttila, when no such total ranking has been established, multiple tableaux exist that correspond to a single grammar. In the case where there are more constraints whose rankings are underdetermined there will be more tableaux. A variable form is one that is optimal according to one of the tableaux thus constructed. Statistical preference is derived from the number of tableaux according to which a given form is optimal.

As Anttila states, partial ordering offers a new perspective on the hypothesis that variation is due to competing grammars in the community or individual; whether his model is of competing grammars depends on how a grammar is defined. If a grammar is defined as a total ordering of constraints then we have multiple grammars; however, if a partial ordering qualifies as a grammar there is a single grammar.[4]

1.4.2 OT approaches to historical sound change.

1.4.2.1 Jacobs (1994, 1995). Perhaps the earliest work on historical change in OT is by Jacobs (1994, 1995), who treats Old French. Jacobs (1994) studies lenition, while Jacobs (1995) discusses a change in syllable structure as well as the loss of the possibility of enclisis of object pronouns. In the first work, Jacobs characterizes lenition as the reranking of PARSE and MARKEDNESS constraints (he calls the latter 'anti-association' constraints). In his account of the change in syllable structure and phonological enclisis he relies on a reordering of Alignment and PARSE constraints. In addition, for the loss of certain word-final consonants he also employs NOCODA.

1.4.2.2 Hutton (1996). Hutton (1996) addresses historical change more directly. That is, he addresses historical change in OT from a general perspective, and does not invoke OT to account for a series of changes within a particular language. In other words, his is a metatheoretical discussion and treatment of phonological change (though he does cite individual cases of change in a language).

He begins with the Synchronic Base Hypothesis, stated below:

(14.) Synchronic Base Hypothesis:

> All input candidates produced by GEN are based on the current output form. Earlier forms of the language are no longer available as underlying representations on which GEN operates.

This means that historical forms are not inherited genetically, but are eliminated from the lexicon. Put another way, it means that language change is not a matter of derivation, but of substitution of one input for another. Though Hutton does not explicitly state so, it also seems to imply that the listener stores the output form of one stage of the grammar as the input for changes that take place in the immediately following stage (cf. discussion above of the Neogrammarian approach to phonological change). For example, a form like MSp. *leche* [letʃe] 'milk', is not derived synchronically from the form /LAKT-/, though its Latin etymon is indeed

LACTE. This is because the phonological shape of the historical source is too far removed from the modern form, and so the historical form may not serve as its underlying representation. I adopt the Synchronic Base Hypothesis, and argue that it is necessary for a more intuitively satisfying understanding of several of the changes to be addressed.

As Hutton states, OT envisions grammar as a state, not a derivation. Although the constraint hierarchy is in a state of equilibrium, it may undergo reranking. For Hutton, the reranking of constraints does not drive historical change, but instead results from it. He suggests that while the hierarchy may be altered on the basis of random internal factors (which is the case he suggests for unconditioned changes), it is more likely to be altered on the basis of conditions on the output (that is, external factors). Possible alternations are given below:

(15.) Alternations to the constraint hierarchy:

a. The promotion of constraints

b. The demotion of constraints

c. The creation of new connections between constraints

$A, B \rightarrow A >> B$

d. The dissolution of connections between constraints

$A >> B \rightarrow A, B$

e. The alteration of the dominance relationship between two constraints

$A >> B \rightarrow B >> A$

The latter three are subtypes of (a) and (b), since they necessarily involve promotion or demotion of constraints. Type (e) has been denied by Cho (1995), who instead proposes a stage of free variation. If this is possible, it may be akin to the nonranking suggested above by Anttila in partially-ranked grammars. As he states, when the ranking of a constraint changes, it is often unclear whether this should be understood as the promotion of a lower-ranked constraint or the demotion of a higher-ranked one. I will argue that both promotion and demotion are possible. For instance, in the erosion of syllable-final consonants we will see that markedness constraints are promoted above faithfulness constraints (as in Green 1997; see below). Conversely, an example of demotion of constraints is found in the development of initial *ch-* in Galician/Portuguese, where I argue that the demotion of a constraint against complexity allowed for [*Cʎ] to develop (later [*cʎ̥]), with concomitant reanalysis to [tʃ].

Hutton argues that conditioned language change should not be based solely on random changes in the constraint hierarchy, for this would seem to divorce such changes from the phonetic characteristics of the output.[5] To put Hutton's terms another way, these changes are often if not always based on constraints that are grounded in functional motivation. He suggests that without some sort of restriction on the way one form replaces another (as with the Synchronic Base Hypothesis), sound change would be completely random. I will show later on that, at least for the changes discussed in this dissertation, this may be viewed as a case of lexicon and grammar optimization, in that phonetic output forms are as close as possible to phonological inputs, and that when modifications are made, they are reanalyzed by the listener to be the new input. This maximizes the harmony of the grammar because output forms that more closely match the input will incur fewer constraint violations.[6]

Hutton also argues that individual constraints may be demoted once the phonetic conditions on the output cease to be relevant. In other words, a constraint may become redundant. When this occurs such constraints are relegated to the lowest division of the constraint hierarchy, where what he calls the 'unranked occulted constraints' reside. Though I will not assume here that there are unranked constraints (this is a weaker view of OT, and the present work sheds no light on whether this move is necessary), I argue in Chapter 4 that demotion of this type allows for an explanation of the divergent outcome in Spanish and Portuguese of initial *Cl* clusters in Latin. I note also the parallel between this point and that given in the discussion at the end of §1.3.2 regarding the impact of lexicon optimization on the acquisition process.

1.4.2.3 Gess (1996). Returning to Old French, Gess (1996) is, to the best of my knowledge, the first dissertation to employ OT in explaining historical change. Gess analyzes certain changes in the development of syllable structure in French. To this end he employs NOCODA constraints, which he formulates in terms of Align-Right (that is, the requirement that certain features be aligned with the rightmost edge of the syllable). He shows that what determines the erosion of syllable-final consonants is the reranking of the distributional constraint on sonorants with respect to PARSE constraints. While I do not employ Alignment constraints here, the gradual increase in the restriction of sonority with respect to the moraic status of consonants is due to the progressively lower ranking of MAX (thus, higher ranking of $*C_{\mu}$).

1.4.2.4 Summary. This concludes the review of previous OT work done on historical variation and change.[7] These remarks have been somewhat brief, but given the limited research conducted in this area to date, I believe they give an accurate picture of the thinking of several current researchers on these matters. In the course of the dissertation I will explore many of the options they have suggested and present other ways of approaching sound change, and although we will not always reach the same conclusions regarding historical variation and change, I believe there are many shared insights that will provide fertile ground for future research.

1.5 Directions for the present study. Within OT, then, historical change and dialectal variation may be characterized as the reranking of one or more constraints on faithfulness, markedness or structure, as well as by the restructuring of underlying forms by the listener for reasons of markedness, perceptual similarity or lexicon optimization. In the chapters that follow I show how the principles of OT can be applied to the historical changes treated here to yield innovative analyses that overcome many of the shortcomings of previous approaches to these phenomena and that allow for several changes to be seen as interrelated for perhaps the first time.

Notes to Chapter 1

[1] Similarly, in the Theory of Constraints and Repair Strategies, much of the work of these faithfulness constraints derives from the following two principles:

(i) Minimality Principle:
A repair must apply at the lowest phonological level to which the violated constraint it preserves refers. (Paradis 1993:222)

(ii) Preservation Principle:
Preserve as much of the input as possible, according to the constraints of the language. (LaCharité and Paradis 1993:25).

[2] There is debate over the initial ranking of faithfulness and well-formedness constraints; see Hale and Reiss 1996a,b for critical discussion (in favor of the ranking FAITH >> WELL-FORMEDNESS). I believe that the general point remains valid regardless of one's assumptions on this matter.

[3] Some phenomena that are elegantly accounted for by appealing to such a representation are restrictions on the minimal size or weight of a syllable or word, compensatory lengthening and total assimilation, stress assignment in weight-sensitive systems, antihiatic insertion, etc. For Romance, Morales-Front 1994b provides a mora-based account of diphthongization, Crowhurst 1992 analyzes diminutive and augmentative affixation allomorphy in Mexican Spanish, and Repetti 1989 discusses gemination in Classical and Late Latin and Modern Italian.

[4] While outside the scope of this dissertation, such an approach opens up an intriguing possibility in the analysis of variable Old Spanish forms such as *cadnado* ~ *candado* ~ *cañado* ~ *caldano* (< Lat. CATENATU 'chain'), *pondrá*, *ponrá*, *porná* (< /poner + á/ 's/he will put, place'), *adnado* ~ *andado* ~ *adrado* ~ *alnado* ~ *anado* ~ *annado* (Lat. ANTENATU 'forbearer', *redondo* ~ *rodendo* ~ *rodedno* ~ *torrendo* ~ *torredno* (< Lat. *RETUNDU 'round'), *serondo* ~ *seruendo* ~ *zarando* ~ *seroño* (< Lat. SEROTINU 'late (of fruit)'), *dadnos* ~ *dandos* '2pl give us', *hazednos* ~ *hazendos* 'do to/for us', *espadla* ~ *espalda* ~ *espalla* (< Lat. SPATULA 'shoulder, back'), *peydra* ~ *pendra* ~ *prenda* (< Lat. PIGNORA 'garment'), and many others that show variability in outcome when certain segments are brought into contact. In the cases cited here we see, at the least, metathesis, assimilation, weakening, strengthening and intrusive stop formation. For an analysis of the cases involving metathesis, see Holt 1994.

[5] Changes of this type do appear to occur, being unconditioned sound changes. Hutton argues that these are due to more or less spontaneous alterations to the constraint hierarchy. He cites as an example the First Consonant Shift (Grimm's Law) in Proto-Germanic, in which IE /b^h, d^h, g^h/ > /β, δ, γ/, /b, d, g/ > /p, t, k/ and /p, t, k/ > /f, θ, x/.

[6] This may perhaps be incorporated directly into the constraint hierarchy, rather than being a metatheoretical desideratum, by assuming a set of output-input constraints. Previous proposals have extended correspondence relations from input-output (see above) to output-output (mainly to deal with reduplication and allomorphy; see, e.g., McCarthy 1995, Burzio, 1997). The addition of output-input constraints, then, continues the cycle. (Input-input constraints, conceivably, would complete it). I leave further exploration of this suggestion to further research.

[7] There are two other very recent works which I have not been able to consult (aside from the abstract for each): Green's 1997 dissertation also touches on historical matters, though its main concern is an examination of the prosodic structure of the closely related Goidelic languages Irish, Scots Gaelic and Manx. He suggests that phonological change happens when a constraint against a marked phonological pattern is promoted above other constraints. This seems similar in spirit to the approach taken by Zubritskaya, and is precisely what I claim drives the gradual elimination of all moraic consonants in Old Spanish and Galician/Portuguese.

Additionally, Reiss 1997 treats analogical change from an OT perspective. In his account, he invokes aspects of acquisition, the role of sociolinguistic diffusion and the nature of language change. He argues that a parsing-based account is superior to an output-output correspondence one because it offers a more constrained theory of grammar.

CHAPTER TWO

THE EVOLUTION OF LATIN VOWEL LENGTH AND GEMINATE OBSTRUENTS

2.0 Introduction. In this chapter I begin my exploration of the thesis that historical sound change is driven by the incorporation of phonetic factors into phonology for reasons of lexicon and grammar optimization. I will give arguments in support of this assertion that rely on the role of perception and reinterpretation by the listener. We will see that some cases of reinterpretation have profound effects on the further development of the language.

In this chapter I present an analysis of the collapse of the quantitative distinctions in the vowel system of Latin. I will assume that this is due to the abandonment of a redundant feature, length, once other components of duration became sufficiently distinct to sustain contrast. This has the effect of eliminating violations of a constraint prohibiting contrastively long vowels, *LONG-VOWEL, and initiates further changes in the segmental inventory of Latin.

I will then extend the argumentation in Zec (1995), and suggest that this initiates the corresponding elimination of long consonants so as to reestablish systemic parity. The first change in the grammar is the elimination of the moraic status of occlusives. I will argue that this is the first, and minimal, step of many in the elimination of all moraic consonants. This eliminates occlusive geminates and vocalizes the velar-coronal clusters that existed. This is captured in the grammar by the rise of a constraint *C_μ, which disfavors moraic (long or syllable-final) consonants.

2.1 Distinctive length in Latin. I begin with the stage of Latin that permitted length distinctions of both vowels and consonants. In OT, for underlying length to be realized on the surface the faithfulness constraints must be ranked above constraints that militate against marked structure. The faithfulness constraints relevant here are MAX and DEP. MAX disfavors deletion of phonological information, while DEP disfavors insertion.

The preference for short segments over long ones may be encoded via the following two constraints. The first captures the typological generalization that long vowels are more marked than short vowels, perhaps based on the lesser articulatory energy that is required for the latter's realization. The second extends this line of reasoning to long consonants:

(1.) *LONG-VOWEL (abbreviated *LONG-V; further discussion below)

$*V_{\mu\mu}$

'Avoid long vowels'; 'Long vowels are disfavored'

(Kaye 1989, Paradis 1988, Rosenthall 1994:15-16, Sherer 1994:ch. 2, Marotta and Savoia 1994:58; Hammond 1997:9)

(2.) *LONG-CONSONANT (abbreviated *LONG-C; first approximation[1])

$*C_{\mu}$

'Avoid long consonants'; Long consonants are disfavored'

Thus, since Latin had both long vowels and long consonants, its grammar would contain the following constraint ranking:

(3.) Constraint ranking characterizing the existence of both long and short vowels and consonants:

	FAITH (MAX)	FAITH (DEP)	*LONG-CONSONANT ($*C_{\mu}$)	*LONG-VOWEL ($*V_{\mu\mu}$)
$/V_{\mu}/$				
$[V_{\mu}]$ ☑				√
$[V_{\mu\mu}]$		*!		*

/$V_{\mu\mu}$/				
[V_{μ}]	*!			√
[$V_{\mu\mu}$] ☑				*

/C/				
[C] ☑			√	
[C_{μ}]		*!	*	

/C_{μ}/				
[C]	*!		√	
[C_{μ}] ☑			*	

We see here that underlyingly moraic status of vowels and consonants is maintained. For underlyingly short vowels, the underlying single mora is maintained, and adding another is gratuitous if nothing else forces it (here nothing does). An underlyingly bimoraic vowel surfaces as long because eliminating a mora violates high-ranked MAX. Turning to the consonants, since simple consonants are nonmoraic, the output that reflects this is optimal. Finally, for a contrastively long consonant, the underlying mora will surface, violating only lower ranked *LONG-CONSONANT (*C_{μ}).

I turn now to the collapse of the quantity system in distinguishing the Latin vowels.

2.1.1 Vowel quantity in Latin. The vowel system of Latin had ten phonemes. These were /a, e, i, o, u/ and /a:, e:, i:, o:, u:/. According to Lloyd (1987:71-75), on whom this section depends greatly, it appears that at the very earliest period the phonological difference of length was realized primarily by means of greater or lesser duration. Evidence that bears this out comes from Latinisms that were borrowed into Basque, where the articulatory differences between long and short vowels must have been sufficiently small for them to be identified as the same vowel. For example, CIRRU 'lock, curl' was borrowed as *kirru*, indicating that this took place before Latin short /i/ merged with the result of long /e:/ (see below). Further evidence that in Latin vowel quality of long and short vowels was very similar or identical comes from Sardinian. This very conservative Romance language merged long and short vowels into the simple counterpart.

However, in the phonetic realization of phonological length, phonological length turns out to be rarely, if ever, manifested solely as greater duration. He cites modern studies that show that length is in phonetic terms a composite of several features in addition to duration. These include differences in tongue position (that is, quality or timbre) and tension. These studies suggest that it may not even be possible to decide which phonetic feature is truly the distinctive one, and because of the co-extension of various features it may be impossible to determine which component is redundant and which is basic.

Again according to Lloyd, it was quite early that Latin long vowels began to show greater tongue height and tension, while short vowels developed to be lower and more lax. Thus, although /i:/ was still pronounced as a long high front unrounded vowel, the pronunciation of short /i/ became somewhat lower, probably [ɪ]. Likewise, while /u:/ was stable, /u/ developed to /ʊ/. Long mid vowels were pronounced somewhat above their original position, and their short correspondents tended to be pronounced as [ɛ, ɔ]. Long and short /a/ were probably not affected. The result of this phonetic change is that short /i, u/ and long /e, o/ are pronounced nearly identically.

There exists evidence that these phonetic differences may have been reinforced by language contact, though this is not uncontroversial. The argument is that Oscan and Umbrian, other ancient languages spoken in Italy which were related to Latin, exhibited noticeable qualitative distinctions in their vocalic system before Latin did. As Latin spread from Rome, it is conceivable that the Italic speakers that adopted Latin continued to produce these same qualitative distinctions in their pronunciation of Latin. Lloyd points out that even if this is not a factor in this case, it is likely that qualitative distinctions would have continued to develop, since quality and quantity go hand in hand in languages that have phonological vowel length. Hungarian and Czech are two such examples (cited in Lloyd, p. 74). The case of Italic, if true, would at least reinforce the native tendency.

In further support of this hypothesis is inscriptional evidence from Pompeii, which was destroyed in 79 A.D. We find that long /e:/ was sometimes written with the letter I: FILIX, FILICITER, VALIS for FELIX, FELICITER, VALES (cited in Lloyd, p. 74). Cicero (106-43 B.C.) also remarked on a rustic friend who pronounced /e/ instead of /i/.

Data of this sort lead Pulgram (1975) to conclude that quantity distinctions were actually secondary for most Latin speakers. Lloyd concludes his discussion of this data with the cautious statement that differences in tongue height were probably rather slight at first and only gradually became great enough to be recognized by speakers, as short high vowels began to be more qualitatively similar to the long mid vowels than to their original long partners (p. 75).

Adding to these characteristics specific to Latin are more general considerations. Lloyd states that the drift in Indo-European has been the tendency to eliminate distinctive quantity as a feature of the vowel system. This tendency reached Latin before the breakup of the Roman Empire, yielding a vowel system that distinguished only differences in vowel quality not quantity. When this occurred, length ceased to be a phonologically distinctive feature, instead depending on phonetic factors (Lloyd, p. 108).

These factors included the position of accent in the word. Citing cross-linguistic studies, Lloyd presents data showing that duration is unstable in providing distinction. For instance, the position of the syllable in the word and factors of tempo and emphasis all affect duration. Most important is the fact that accented syllables are usually longer than unaccented ones (Janson 1979:34). This seems to have had the effect of making most unstressed vowels short, and as a result, it appears that phonological vowel length was maintained primarily in stressed syllables.

Another final factor considered here is that in terms of communicative efficiency, distinctions of length, with only two degrees (long or short), are less efficient than distinctions of height, tenseness and laxness, which are less limited and appear to be more easily articulated and perceived (Pulgram 1975:260, cited by Lloyd, p. 108). This being the case, when quantity and quality go together the speaker may not be able to determine, or may determine incorrectly, which feature depends on the other. The less efficient feature, length, may well then be abandoned without further confusion.

Lloyd (pp. 110-11) summarizes the factors that affected the vowel system of Latin as: (i) the relative inefficiency of length in determining contrast as opposed to quality; (ii) the limitation of the differences between long and short vowels to three positions only (recall that short /i, u/ have become identified with /e:, o:/); and (iii) the effect of the accent, which limited length distinctions to tonic syllables. The combined weight of these factors resulted in the complete abandonment of length as a phonologically independent feature of the system. He thus assumes that the qualitative distinctions had become noticeable before quantity became dependent on other factors.

In the next section I incorporate these insights and arguments into the theoretical approach presented here.

2.1.2 The role of phonetics and the listener in eliminating vowel length. Let me begin by stating that I adopt wholesale the arguments given by Lloyd. They are both convincing and intuitively appealing. It has long been accepted in the traditional literature that phonetics and the listener play crucial roles in determining phonological evolution. These factors have been recognized by theoreticians as well, but their somewhat indeterminate and irregular character has made this intuition difficult to incorporate into theoretical approaches that require hard-and-fast rules. However, the notions of lexicon optimization and constraint violability in Optimality Theory allow us to begin to incorporate previous findings (see §1.3.2).

For the case at hand, the insignificant phonetic nuances that naturally arise in pronunciation come to be noticeable to the listener. While at first these differences in vowel quality may not be phonemic, I suggest that with the realization that there are systematic qualitative differences between long and short vowels, markedness constraints may come into play to simplify the system. Specifically, the redundant feature length is eliminated to simplify the system. Although long vowels are less marked than long consonants, it is also true that long vowels are more marked than short vowels;[2] because noticeable qualitative distinctions had come to be able to identify contrast, long vowels are eliminated. Put another way, at this stage the contrasts the listener observes in the output are compatible with a lexicon that does not posit bimoraic elements, and consequently redundancy is reduced.

This may be formalized in one of two ways. The first possibility is that *LONG-VOWEL is promoted to above MAX (or equivalently, that MAX is demoted to below *LONG-VOWEL) in reaction to the new redundancy of length. This would have the effect of eliminating as optimal the retention of underlyingly bimoraic status, since any vowel will now surface short. The lack of long vowels on the surface would then lead the listener to lexically optimize this fact and to posit only underlyingly simple vowels, now distinguished by quality.

A second possibility is that once the listener has recognized that there are no distinctively long vowels he incorporates this fact directly into the lexicon by eliminating, by fiat as it were, one of the two moras of the formerly long vowels. Given that other phonetic factors continue to maintain contrast, length is a feature that is redundant and may be eliminated. The position of *LONG-VOWEL in the constraint hierarchy, under this scenario, would remain unchanged.

I am not sure which possibility to select on this theory-internal matter, but the fact that vowel length came to be increased in tonic syllables suggests that *LONG-VOWEL ultimately occupies a dominated position. For the grammar in the first scenario to yield this, *LONG-VOWEL would first have to raise to dominate FAITH, and then return to its original position.

In either case, for younger speakers in the process of forming their grammar, there is no evidence for distinctively long vowels, and all vowels will be underlyingly monomoraic. Evidence of lengthening of tonic vowels will indicate that STRESS-TO-WEIGHT dominates *LONG-VOWEL and DEP; likewise, given that gemination of the following consonant does not occur under stress, $*C_\mu$ will also dominate *LONG-VOWEL in the listener's ultimate constraint hierarchy. (See discussion at the end of §1.3.2 on whether this implies demotion or promotion (or not) of a constraint from its innate initial position.)

The reanalysis of vowel length and quality is schematized in the following chart:

(4.) Steps in the loss of contrastive vowel length:

(a) Stage 1: $/V_\mu/ \rightarrow [V_\mu]$ (only duration distinguishes long

$/V_{\mu\mu}/ \rightarrow [V_{\mu\mu}]$ and short vowels)

(b) Stage 2: $/V_\mu/ \rightarrow [V_\mu]$

		$/V_{\mu\mu}/ \rightarrow [V'_{\mu\mu}]$	(now also differentiated by quality)
(c)	Stage 3:	$/V_{\mu}/ \rightarrow [V_{\mu}]$	(originally short vowels maintained; formerly bimoraic vowels short since quality alone may distinguish them; quantity eliminated)
		$/V'_{\mu}/ \leftarrow [V'_{\mu\mu}]$ ($<$ $/V_{\mu\mu}/$)	(lexicon optimization of this fact)

(At stages two and three, vowel lengthening occurs in tonic syllables.)

2.2 Consequences of the loss of contrastively long vowels. I argued above that the loss of contrastively long vowels reasserts the primacy of short vowels and their unmarked status when compared to long vowels. I argue here that the loss of contrastive vowel length initiates changes in the series of long consonants.

Indeed, the chain of events that was put into action follows nicely from the system of Zec (1995). To recapitulate the discussion in §1.3.3, she shows that the set of weight-bearing (i.e., moraic) segments corresponds to the sonority classes that a language has established. Since the major class features determine sonority, at least according to a prevalent view, the class of moraic segments depends on the sonority classes distinguished.

The principal sonority, and thus moraic, classes are thus the following. The most basic division in sonority is based on the feature [consonantal]. The primary sonority class contains segments that are [-consonantal]. This entails that only vowels will be moraic. The next division in sonority classes separates segments that are [±sonorant]. If a language chooses the class of [+sonorant] segments, then all vowels and sonorant consonants will be moraic. The third principal sonority class consists of those segments that are [-cons, -son]. In this case, all segments will be moraic. Thus, if a language has moraic obstruents this necessarily entails that both sonorant consonants and vowels are moraic (see her (5), (9) and (60)).

The elimination of long vowels from Late Spoken Latin disturbs this implicational relation. Elimination of phonologically long vowels suggests that geminate consonants (i.e., underlyingly moraic consonants, not necessarily ambisyllabic consonants created by GEN) should not exist in the language.[3] The series of changes that follows minimizes the loss of contrast, but as in the case of the vocalic system, some phonological distinctions are lost (e.g., Sp. *ñ*, *ll* each derive from several distinct sources, like Sp., Gal./Ptg. *e*, *o*). How does the grammar of the language cope with this situation?

I propose that the step-wise rise of $*C_\mu$ (‘no moraic consonants’) is a means by which the implication regarding moraicity may be met while allowing for simplification of geminate consonants to occur in a sensible fashion. In this way the universal implication is maintained that if a language allows moraic obstruents it will also allow moraic sonorant consonants and moraic vowels. Here, since long vowels have been eliminated, long consonants begin to be eliminated as well (according to their sonority).

I thus adopt a 'push-chain' approach to the changes addressed here. However, the present push-chain approach differs in a major way from typical push-chain shifts. Specifically, while most push-chains incorporate some mechanism of merger avoidance (otherwise we would expect members of the chain to become identical), here I have not invoked teleology. The only assumption needed to implement my proposal is that the rise of $*C_{\mu}$ should happen in a step-wise manner, a view consistent with the gradual nature of language change and the chronology of the steps in simplification treated here. As this constraint becomes more dominant in the grammar, certain phonetic differences may be exploited in determining contrast, and consequently be phonologized. When this occurs (or perhaps as a result of this), $*C_{\mu}$ takes its next upward step.

To summarize the relevance of this discussion in a sentence, the loss of the underlying bimoraic status of vowels is the motivation for the increasing dominance of $*C_{\mu}$.

2.3 The sonority hierarchy and *LONG. As argued above, the effects of *LONG-VOWEL incite *C_μ to take action. Evidence from the evolution of Latin into Spanish and Portuguese shows that the latter constraint did impose itself, but in a gradual manner that turns out to mirror the sonority hierarchy.

As given in Clements (1990), principal divisions in the sonority hierarchy (as determined by the major class features) fall between the following classes of segments:

(6.) The sonority hierarchy:

	More sonorous		Less sonorous	
vowels	glides	liquids	nasals	obstruents

It is important to keep in mind that although the formulation of the sonority hierarchy given here uses the terms ‘vowel’, ‘glide’, ‘liquid’, ‘nasal’ and ‘obstruent’, these are to be understood merely as convenient labels for the grouping of features that define these classes. This is, as we have seen, the approach of Zec (1995).

To incorporate this into Optimality Theory, we may invert this hierarchy and formulate a series of constraints that militate against the moraic status of each class (cf., e.g., Prince and Smolensky 1993, Sherer 1994:ch. 2 and Hammond 1997). The resulting hierarchy of constraints might be as follows:

(8.) One conception of the sonority hierarchy in Optimality Theory:

$*O_{\mu} >> *N_{\mu} >> *L_{\mu} >> *G_{\mu} >> *V_{\mu}$

The hierarchy given in (5) is inverted here so that the generalizations captured by the standard sonority hierarchy are captured in Optimality Theory. This is because the violation of constraints further up in the constraint hierarchy is worse than violation of lower-ranked constraints. The hierarchy in (6) thus captures this by encoding that of all the potentially moraic segments in a language, obstruents are the worst, then nasals, then liquids, then glides, then vowels.

The hierarchy above, however, does not by itself derive Zec's formulation of the relation between sonority and moraicity. This is accomplished via the interaction of the FAITH constraints with the constraints of the hierarchy in (6). Thus, if a language allows only [-consonantal] segments to be moraic, MAX would be placed above $*V_{\mu}$. This has the effect of eliminating any input mora there might be that accompanied a glide, lateral, nasal or obstruent. (This would be the case of Khalkha Mongolian and Yidiɲ.) For languages like English and Arabic dialects, MAX would be placed at the top of the hierarchy (i.e., above $*O_{\mu}$), thus allowing all segments to be moraic. We saw above that this is also the case of Latin. For languages that take a middle ground, like Lithuanian and Tiv, MAX would be placed directly below $*O_{\mu}$.

This has the effect of permitting only sonorants to be moraic. In visual form, the relationship between MAX and the sonority hierarchy for each language discussed thus far is shown here:

(10.) Ranking of MAX in the sonority hierarchy for several languages:

MAX (English, Arabic dialects)

↓ MAX (Lithuanian, Tiv)

↓ MAX[4] (Yidiŋ, Khalkha Mongolian)

↓

$*O_{\mu} >> *N_{\mu} >> *L_{\mu} >> *G_{\mu} >> *V_{\mu}$

Readers familiar with the history of the Romance languages will observe that Latin is, in this respect, identical to English and Arabic dialects. Likewise, Late Spoken Latin (the source from which all Romance languages grew) is, again in this respect, identical to Lithuanian and Tiv. That is, the constraint ranking necessary to account for these languages also yields the situation we find in Late Spoken Latin, where the first geminates to simplify were the obstruents. Later, Old Spanish and Galician/Portuguese reduce long sonorants as well.

This progressive reranking from Latin to Old Spanish and Galician/Portuguese of MAX with respect the members of the sonority hierarchy is shown here:

(12.) Stages in the ranking of MAX in the sonority hierarchy from Latin to Spanish and Portuguese:

MAX Latin

↓	MAX		Late Spoken Latin, Hispano-Romance
	↓	MAX	Modern Spanish, Galician, Portuguese
		↓	

$*O_{\mu} >> *N_{\mu} >> *L_{\mu} >> *G_{\mu} >> *V_{\mu}$

Thus, the position of MAX with respect to the members of the sonority hierarchy determines which segments may be moraic. Given this, the constraint I have termed '$*C_{\mu}$' is more precisely '$*O_{\mu}$, $*N_{\mu}$, $*L_{\mu}$, $*G_{\mu}$':[5]

(14.) $*C_{\mu}$ ('no moraic consonants') (revised)

$*O_{\mu} >> *N_{\mu} >> *L_{\mu} >> *G_{\mu}$

As mentioned, these constraints have the effect of eliminating moraic consonants, which when intervocalic would be geminate. A higher ranking constraint, of course, may allow the surface realization of a mora (e.g., in syllable-final position under some constraint akin to Weight-by-Position (Hayes 1989, many others)). Given this discussion, what I called '*LONG-CONSONANT' for expository reasons above in (2) and (3) in the discussion of underlying consonantal length in Latin is really an improper constraint; indeed there is no constraint that targets long consonants in particular. *LONG-CONSONANT implies $*C_{\mu}$, but the reverse does not obtain: a language may prohibit geminates yet permit syllable-final moraic consonants (as by weight-by-position). This indeed occurs, as in English.

Likewise, when I spoke above of the step-wise domination of $*C_\mu$, a more specific rendering of this term would employ phrasing to indicate that this is really the step-wise demotion of MAX in relation to the OT sonority hierarchy. Unless necessary to clarify the argumentation, I will continue to speak of '$*C_\mu$' and 'the rise of $*C_\mu$' in the simplistic sense.

Given the sonority hierarchy above, a reexamination of *LONG-VOWEL is in order as well. Because the sonority hierarchy is presumably universal, the ranking given above for the constraints militating against the moraic status of segments is fixed. Therefore, *LONG-VOWEL cannot simply be the double violation of $*V_\mu$, because we know there are languages that allow long (or lengthened) vowels but that do not allow moraic (at least geminate) consonants (like Late Hispanic Latin, Old Spanish and Galician/Portuguese). For this to be the case, $*V_\mu$ would have to be ranked above one or all of the constraints $*C_\mu$, but if the sonority hierarchy is universal (and if Zec is right that moraicity is mediated through sonority), then this ought not be able to occur, contrary to fact. Delinking *LONG-VOWEL from $*V_\mu$ allows us to make the right predictions.[6]

*LONG-VOWEL, therefore, is indeed an independently necessary constraint, and must specifically target [$V_{\mu\mu}$]. As an independent constraint, its ranking in the hierarchy is determined on a language-particular basis.[7]

2.4 The rise of *$C_{\mu\mu}$ in the loss of the moraic status of obstruents. In this section I apply this formulation of moraicity to the loss of moraic status of Latin geminates.

As stated previously, the drive to eliminate long consonants in Late Hispanic Latin is motivated by the earlier elimination of vowel length as a distinctive feature. I argued above that the Romance evidence bears out the assertion that this occurs in a gradual way that affects long segments according to their sonority. The first step, then, is the elimination of the least-sonorous geminates, the obstruents.[8]

The following presents the geminate obstruents that existed in Spoken Latin:

(16.) Geminate obstruents in Spoken Latin:

pp	LIPPUS	‘bleary-eyed’
	CUPPA	‘wine glass’
tt	CATTUS	‘cat’
	VITTA	‘ribbon, headband’
	GUTTA	‘drop’
kk	BUCCA	‘mouth’
	SICCU	‘dry’
bb (rare)	ABBATE	‘abbot’
dd (rare)	ADDITUS	‘added’
gg (rare)	AGGER	‘rampart’
ff (rare)	AFFLARE	‘to blow’
ss	CASSA	‘empty’

A number of the geminates /tt/ and /ss/ result from prior assimilation in the clusters /ps, pt, rs/:

(18.) Geminate /tt/ and /ss/ from prior assimilation (cited in Lloyd, p. 139; some documented as early as the time of Plautus (254(?)-184 B.C.)):[9]

	Earlier Latin	Later Latin	
/ps/	IPSE	ISSE	'self'
	GYPSU	YESSO	'plaster'
/pt/	SEPTE	**sette*	'seven'
	CAPTARE	**cattare*	'to taste, try'
	CAPTUS	CATTUS	'seized'
	SEPTIMIO	SETIMIO	'?'
	SEPTEMBRE	SETEMBRE (A.D. 219)	'September'
	OPTIMO	OTIMO	'optimal'
	SCRIPTUS	SCRITUS (A.D. 19)	'written'
/rs/	DORSUM	DOSSUM	'back'
	PERSICA	PESSICA (Appendix Probi[10])	'peach'
	URSUM	OSSO	'bear'
	RURSUM	RUSSUM	'backwards'
	SURSUS	SUSUS	'upwards'

(We know that the forms cited here with orthographic simple *t* in Later Latin were indeed geminate because these forms did not undergo the voicing that affected the simple stops.)

Recall from the beginning of this chapter that the original ranking of the constraints *LONG-V and *LONG-C (now understood as *C_μ, or *O_μ >> *N_μ >> *L_μ >> *G_μ) is below FAITH, meaning that faithfulness of underlying length will be maintained. The rise of *C_μ, as I have argued, begins with the baby step of eliminating the moraic status of obstruents. This is captured in the following tableau:

(20.) Initial rise of *C_μ, eliminating moraic obstruents:

/k_μ/ /n_μ/ /l_μ/	*O_μ	FAITHFULNESS (MAX)	*N_μ, *L_μ, *G_μ
k_μ	*!		
k ☑		* <μ>	
n_μ ☑			*
n		*! <μ>	
l_μ ☑			*
l		*! <μ>	

As we can see, this constraint ranking eliminates geminate obstruents while continuing to allow more sonorous segments to remain long. At this stage in the history of Latin, then, all the examples in (8) and (9) are reduced to yield phonetically simple obstruents, which are then lexically optimized.[11] Thus, we arrive at [gato], [boka], [seko], [abade], [kopa], [gota], etc.(see, e.g., Penny, p. 68). Examples such as *anno* [anno] 'year' and *bello* [bello] 'pretty' are still well formed. This corresponds to the facts.

The examples adduced in this tableau, however, are only cases of geminate consonants. Though these were the most frequent moraic segments, there were some still bisegmental clusters that remained, and their coda segments contributed to syllable weight. These are the sequences of /kt/, /ks/, /lC/, /gn/ (and sporadically /gr/; in addition, /-n, -s + stop/ existed, but were stable):

(22.) Remaining syllable-final consonants:

/-kt-/	OCTO	'eight'
	NOCTE	'night'
	FACTU	'fact'
	LACTE	'milk'
	STRICTU	'narrow'
/-ks-/	DIXI	'I said'

	MAXILLA	'cheek'
	TAXU	'yew'
	MATAXA	'skein'
/-lC-/	ALTARIU	'hill'
	TALPA	'mole'
	MULTU	'much'
	CULTELLU	'knife'
/-gn-/	AGNUS	'lamb'
	PUGNA	'fight'
	PUGNUS	'fist'
/-gr-/	INTEGRU	'whole'

The rise of *C_μ that leads to the loss of moraic status of obstruent geminates (resulting in their simplification) also affects these clusters.[12] Given that geminate /kk, gg/ were simplified to /k, g/, we might expect total loss of original /-k, -g/ to occur, contrary to fact. What happens instead is that /-k, -g/ vocalized to [j]. Slight refinement of the proposal presented thus far can account for these data as well.

A consideration of the structure of *O_μ provides us with a solution to the paradox presented here. Recall from the discussion of Zec in §1.3.2 and above that it is the presence of sonorous features that determines the ability of a segment to be moraic or not. This is a relevant point that must be made in the present discussion.

A closer look at $*O_\mu$ reveals that it is really only shorthand notation for the constraints $*\{[+\text{consonantal}]_\mu\ [-\text{sonorant}]_\mu\}$, a point I mentioned above in the discussion of the sonority hierarchy in Optimality Theory. Of these two features, we saw above that it is [+consonantal] that establishes the first major division in sonority and moraicity; at least vowels are moraic, though consonants need not be. The feature [-sonorant] establishes a further division between sonorant and obstruent consonants.

With this insight, we may now arrive at a constraint ranking of the components that comprise $*O_\mu$. Just as $*N_\mu$ occurs in the constraint hierarchy below $*O_\mu$ because it reflects a class of higher sonority, I propose that $*[+\text{consonantal}]_\mu$ is ranked below $*[-\text{sonorant}]_\mu$. This is because it is more important to maintain features that contribute more to sonority.

Let me demonstrate now the relevance of this decomposition of $*O_\mu$ to the analysis of syllable-final velars. The ranking argued for above means that the moraic status of candidates bearing the feature [-sonorant], violating $*[-\text{sonorant}]_\mu$ is more marked than the moraic status of candidates bearing the feature [+consonantal], violating $*[+\text{consonantal}]_\mu$. Likewise, moraic candidates that violate neither of these constraints would be more harmonic than ones that violate one or both of these constraints on moraicity/sonority.

Continuing, we may now see the initial rise of *C_μ as the minimal displacement of MAX/IDENT from the undominated position that ensures total faithfulness to the input to the position immediately below *[-sonorant]$_\mu$. With this ranking it is consequently a more serious violation to retain features or feature values that contribute less to sonority (and therefore violate more sonority constraints). Therefore, when comparing a candidate with moraic [-k_μ] to one with moraic [-j_μ], changing the offending features [+consonantal, -sonorant] (violating IDENT) will be the optimal solution. This is vocalization. Consider the following tableau:

(24.) Decomposition of *O_μ and its role in the vocalization of velars (/-k, -g/):

/-k, -g/	*[-sonorant]$_\mu$	MAX/IDENT	*[+consonantal]$_\mu$
-k_μ, -g_μ	*!		*
-j_μ ☑		* <+cons> * <-son>	

As the tableau shows, syllable-final /-k, -g/ will vocalize (by assuming the opposite values for [consonantal] and [sonorant]) to maintain their moraic status.[13] Changing the values of features that may not be moraic to those that may, then, yields the acceptable status of the weight-bearing segment.[14] The same ranking still accounts for loss of geminate obstruents:

(26.) Decomposition of $*O_\mu$ and the reduction of geminate obstruents:

$/k_\mu/$	$*[\text{-sonorant}]_\mu$	MAX/IDENT	$*[\text{+consonantal}]_\mu$
k_μ	*!		*
k ☑		* <μ>	
j_μ		* <+cons> *! <-son>	

Here we see that geminate obstruents will be simplified, as occurs at this stage. This means that the change from $/O_\mu/$ to [O] (and then /O/ by lexicon optimization) is the same change that vocalizes /-k/ to [-j] (again leading to /j/ by lexicon optimization). This is not easily formulated in a rule-based approach, if it can be done at all. Penny (p. 96) dates these changes as first vocalization of /-k/ to /-j/, then later simplification of geminates (though no argumentation is given for this particular chronology), contrary to the claim made here. The difference in relative order posited is secondary; what is important is the establishment here of a formal and necessary connection between these two historical processes.[15, 16]

2.5 Summary and conclusions. In this chapter I began to explore the role of the listener in historical sound change. I argued that the listener phonologizes phonetic differences that have come to be perceptually noticeable (following Lloyd and a long and distinguished tradition). For loss of vowel length distinctions, I suggested that this reinterpretation occurred by the elimination of a superfluous feature and that this was in accord with markedness tendencies, as well as the general drift in Indo-European (Lloyd, p. 108).

I also extended the argumentation of Zec (1995) regarding the relation between sonority and moraicity in simple segments, and argued that the loss of long vowels initiated the loss of long consonants to begin to reestablish systemic parity and unmarkedness. We saw that the move to eliminate moraic obstruents was not a wholesale one, but that it occurred in a step-wise fashion that mirrored the sonority hierarchy. The first step is the elimination of moraic obstruents, and we saw that the ranking of MAX/IDENT with relation to the sonority hierarchy, appropriately decomposed, accounted for vocalization of syllable-final velars and simplification of geminate obstruents. Once each of these changes had occurred they were then incorporated by the listener into the lexicon, thus optimizing the harmony of the grammar by reducing subsequent constraint violation.

At no time in the presentation of this push-chain did I resort to a mechanism of merger avoidance, a welcome result given the problematic nature of teleology. The only assumption I made in this regard was that the elimination of long consonants be done in a step-wise fashion. The results obtained here were due to the adoption of a constraint-based approach to phonology as opposed to a rule-based one, in which the interrelatedness of these changes may be unformalizable.

To anticipate the analysis presented in the next chapter, I will show that the same mechanisms that have driven the account given here continue to operate in affecting the long segments that remain. I will show that the steady ascension of $*C_{\mu}$, appropriately decomposed, interacting with FAITH (MAX, IDENT and DEP) and other constraints, and in conjunction with the role of the listener, led to the elimination of the Latin geminate sonorants that still remained at this stage of the language. We will also see how Galician/Portuguese developed nasal vowels, and how the reanalysis of the Latin Stress Rule affected the evolution of the open mid vowels in Old Spanish and Galician/Portuguese.

Notes to Chapter 2

1 Sherer (1994:ch. 2) phrases $*C_{\mu}$ as $*\mu_{cons}$. This constraint, along with *APPENDIX ('no nonmoraic syllable-final consonants') derives the results of the constraint NOCODA (which is therefore merely a cover term for these two constraints). I follow this decomposition of NOCODA more explicitly below.

The term *LONG-C is used here for expository purposes only, since the effect of $*C_{\mu}$ with which I am presently concerned is its relation to the ability of geminate consonants to surface. In §2.3 I decompose the *LONG constraints given in (1) and (2). (See Morales-Front and Holt 1997 for a general constraint *LONG.)

2 On the relative markedness of long consonants compared to long vowels, Décsy 1988:55, 62 cites statistics that 48% of the languages of the world have long vowels (with a high of 62% in North America and a low of 26% in South America), while only 14% have long consonants (with a high of 28% in Europe and a low of 1% in South America).

Evidence from Latin for the relative markedness of long vowels compared to short ones is that 70.5 percent of all vowels in a sample of 25,000 phonemes were short (from Lloyd, p. 76). Lloyd also notes (p. 108) that loss of contrastive vowel length was in accord with the characteristic drift in Indo-European to eliminate vowel quantity as a distinctive feature.

3 However, this cannot be stated more strongly as an inviolable universal of human language, since even within Romance there are exceptions (e.g., Sardinian and Italian, as well as Late Hispanic Latin). Neither Sardinian nor Italian appears to have taken the steps that Hispano-Romance has to eliminate geminates. Italian seems to have done nothing to advance beyond the stage of loss of distinctive vowel length (intervocalic voiceless consonants remain voiceless (they became voiced in Ibero-Romance)), and geminates are retained. Sardinian voiced voiceless consonants, but does not simplify geminates. There seems to be a varying level of tolerance for segmental change and merger.

4 Actually, given a constraint NUC that all syllables must have nuclei (Prince and Smolensky 1993:87), MAX may be ranked below $*V_{\mu}$. This is because if NUC is universally undominated, as Prince and Smolensky argue (p. 137), a vocalic mora (and nucleus) is therefore the minimal violation of the constraint hierarchy. If this is the case, the position of MAX above or below $*V_{\mu}$ is unimportant.

5 Sherer 1994:ch. 2 likewise decomposes his $*\mu_{\text{CONSONANT}}$ into $*\mu_{\text{OBSTRUENT}} >> *\mu_{\text{SONORANT}}$, a ranking he too claims is universal. Below I continue to extend this line of

reasoning to vowels as well, and find need to decompose the constraint against moraic consonants even further.

6 The gemination data of Wiyot and Koya from Sherer 1994 also requires the ranking *LONG-VOWEL >> *C_{μ}.

7 A possible interpretation of *LONG-VOWEL is as the local or self conjunction {*V_{μ} & *V_{μ}}. A conjoined constraint is ranked higher than the constraints that compose it, being a more serious violation than the simple violation of either component constraint individually.

Caution in the use of constraint conjunction is advisable, however, as Miglio and Fukazawa 1997 and Fukazawa and Miglio 1997 have pointed out. Conjunction is a very powerful device, and much work still remains to clarify under what circumstances its use is licit. If in principle any two (or more) separate constraints may be conjoined, many unattested patterns of constraint interaction are predicted. The conjunction of a constraint with itself raises further problems. This would effectively be recursive conjunction, and without restriction on its use such conjunction potentially undermines one of the basic tenets of OT that a single violation of a higher ranked constraint is worse than two (or three, or a hundred) violations of any lower ranked constraint. Appropriate self-conjunction undoes this effect. Given the dangers of recursive conjunction, here I assume the more conservative interpretation of *LONG-VOWEL as *$V_{\mu\mu}$.

For more discussion of constraint conjunction, see §4.1.2, and references given there.

8 If all that were involved were a strict interpretation of the sonority hierarchy, we might expect that vowels would be the last segments to be affected, not the first as happened in Latin (because vowels are most sonorous). However, the confusion of certain long and short vowels and the eventual redundancy of duration in determining contrast led to the elimination of long vowels even before less sonorous geminate consonants were affected. Perceptual factors, therefore, may affect the order of change and yield an order that may not be expected according to strict sonority or other markedness considerations. In Late Hispanic Latin, I am arguing here, confusion between more sonorous segments (vowels) led to simplification of the less sonorous geminates consonants. Though my system does not predict this sequence of changes, neither does it rule it out, given other phonetic considerations.

9 This assimilation must have occurred very early, in fact prior to the loss of vowel length distinctions. This is so because we would not expect the formation of obstruent geminates to take place if the moraic status of obstruents had already been eliminated, and this was the first step in the rise of *C_{μ}. Further evidence suggesting

that this assimilation predated the loss of vowel length comes from reduction of nasal-fricative segments, which reduced to a simple fricative, and lengthening the vowel. See, e.g., Allen 1978:28, who cites *forēsia, hortēsia* and *Megalēsia* for original FORENSIA, HORTENSIA and MEGALENSIA (Cicero, 106-43 B.C.). We would not expect this to be able to happen if contrastive vowel length had been eliminated.

Here I ignore the exact formulation of this historical process of assimilation and gemination. I note, however, that it did not affect all syllable-final consonants, particularly the sequences /kt, ks, lt/ (and perhaps /gn/). I return to these cases below.

10 Of writings by Latin grammarians, the Appendix Probi is a sixth- or seventh-century list of 227 forms that should be avoided in writing. Each recommended word is accompanied by that to be corrected (e.g., AURIS NON ORICLA, PERSICA NON PESSICA). Writings of this sort are an invaluable source of information about Late Spoken Latin.

11 As before, for younger speakers determining the constraint hierarchy of their language, the lack of obstruent geminates on the surface is also relevant to the demotion or promotion (or not) of constraints from their original position.

12 Though the /l/ of /-lC-/ clusters is not an obstruent and so should not be affected at this stage, it developed historically like the /ks, ks/ clusters. I ignore for present purposes the fact that /l/ developed either to /j/ or to /w/ depending on the quality of the preceding vowel (/j/ after Latin short /u/; /w/ otherwise). Since these issues are tangential to the rise of $*C_{\mu}$, I leave them aside.

Penny 1991:61 attributes the common development of /-l/ and /-k/ to the following: since /l/ was 'dark' in syllable-final position in Latin, this [-ɫ] would thus be velarized, and undergoes the processes that affect normal syllable-final velars, namely /k/ and /g/. For lack of a more principled explanation at present I adopt this suggestion.

Under the present analysis, such a stipulation is necessary; otherwise we would expect syllable-final /l/ to be affected at the same time geminate /ll/ was, but this geminate did not either simplify (as in Galician/Portuguese) or palatalize (as in Old Spanish) until the tenth or eleventh century. However, we know that syllable-final /-l/ became /j/ or /w/ (e.g., MULTU 'much, many' > H-R, Gal./Ptg. *muito*; ALTERU 'other' > H-R, Gal./Ptg. *outro*) very early since /-l/ appears in all Germanic and Arabic borrowings into Spanish and Portuguese. Invasions into the Iberian Peninsula by Germanic tribes began in 409 A.D. The Moslem conquest of Spain began in 711.

13 These segments, like all syllable-final consonants in Late Spoken Latin, were moraic, and as such the addition of a mora would be sanctioned by a high ranked constraint akin to Weight-by-Position (Hayes 1989). I have omitted candidates from this tableau with syllable-final nonmoraic [-k, -g], which would violate Weight-by-Position, as well as *APPENDIX (see Sherer 1994, and fn. 1 here). (For a discussion of the syllable- and word-final consonant clusters that were allowed in Latin, see Lloyd, pp. 82-6.)

I ignore here as a tangential matter why /-k, -g/ become [-j], though the fact that the following segment is coronal (/n, s, t/) surely is relevant.

14 While it may appear unusual not to separate MAX from IDENT, with the ranking MAX >> IDENT to encode the fact that erosion of the offending segment is better than total loss (here, by loss of the mora, therefore erasing the unlicensed consonant), the ranking of MAX/IDENT with respect to the sonority hierarchy achieves the same result. The current approach has the benefit of relating vocalization to reduction of geminates, both being the result of the rise of $*C_{\mu}$.

15 If the Mozarabic form *truhta* 'trout' (< TRUCTA) and others like *laxtayra* 'species of plant' (base LACTE 'milk') and *noxte* 'night' (< NOCTE) (all cited in Zamora Vicente 1989:48) are taken to indicate that /-k/ first changed to [x], further explosion of the sonority hierarchy will be necessary. The difference between [k] and [x] (like [g] and [ɣ] in INTEGRU 'whole', which yields H-R [entεiro], later Sp. *entero*) is one of continuancy. This is a feature that contributes very minimally to the sonority of a segment (cf. Inkelas and Cho 1993:552-53), so the placement of MAX/IDENT above a constraint $*[\text{-continuant}]_{\mu}$ will yield [truxta] from /trukta/, and still eliminate the geminate obstruents and not yield the glide [-j]. (This is the chronology posited by Otero 1971:297, 303.)

Another possibility is that the change from /k/ to [x] (and /g/ to [ɣ]) results from the weakening of syllable-final obstruents that preceded complete assimilation to the following onset, which was fully successful only with nonvelars (i.e., /pt/ > /tt/, /ps/ > /ss/, /rs/ > /ss/; see (9) above). This assimilation appears to have occurred before the loss of vowel length, and so before the rise of $*C_{\mu}$. If this is the case, it is the change from [x] or [ɣ] to [j] that is the result of the loss of moraic status of obstruents.

(Mozarabic is the name given to the variety of Late Hispanic Latin that developed in the territories occupied by the invading Moors.)

16 /jt/ remains stable in Galician and Portuguese (e.g., *muito* 'much, many', *noite* 'night', etc.); /js/ later developed to /ʃ/ (e.g., *freixo* [frejʃo] 'ash tree'). In Old Spanish, /j/ palatalized both /s/ and /t/, yielding /ʃ/ and /tʃ/ (written *x* and *ch*, respectively: *dixe* 'I said', *noche* 'night').

Latin /gn/ may have become /jn/, parallel to /kt, ks/ > /jt, js/, in which case /j/ also palatalized /n/, yielding /ɲ/ (e.g., Sp. *puño*, Ptg. *punho* [puɲo] < PUGNUS 'fist'). However, Lloyd (pp. 81, 140) claims that /gn/ first became [ŋn] then by assimilation [nn]; [nn] later developed with Latin /nn/ to /ɲ/. (The simplification and palatalization of /nn/ is treated in Chapter 3.) There is extensive evidence from a variety of sources that supports the assertion that Latin *gn* was pronounced [ŋn]:

Many Latinists argue that *gn* had the pronunciation [ŋn] (Allen 1978:23-25, Sturtevant 1940:27, 155), an assumption supported by inscriptional evidence such as INGNES for IGNES 'fire'; it also is in line with the general tendency of Latin to nasalize plosives before *n* (Lat. SOMNUS 'sleep', cognate with Skt. *svapnas*, from PIE /*swepno-/). This assumption would further explain the loss of *n* in COGNATUS 'related' (< Lat. CON + GNATUS), which would represent the simplification of [ŋŋ] from [koŋŋna:tus] (cf. inscription CONGNATUS). Furthermore, Latin short *e* regularly became *i* before [ŋ], as it did in words like DIGNUS 'worthy' and LIGNUM 'wood' (< DECET, LEGO). Finally, confirmatory evidence for [ŋn] comes from Plautus' play on words between IGNEM MAGNUM 'large fire' and INHUMANUM 'inhuman', and from Cicero's play on words between IGNOMINIA 'disgrace' and IN NOMINE 'in name'.

CHAPTER THREE

THE EVOLUTION OF LATE SPOKEN LATIN /ɛ, ɔ/ AND GEMINATE SONORANTS

3.0 Introduction. In this chapter I continue to explore the consequences for Old Spanish and Galician/Portuguese of the loss of vowel length. I will argue that speakers came to reformulate the Latin Stress Rule as a constraint that favored stressed syllables to be heavy (STRESS-TO-WEIGHT), and that this constraint interacted with others that militate against long elements (*LONG-VOWEL, *LONG-[-ATR], NODIPHTHONG) in shaping the evolution of the seven-vowel system of Late Spoken Latin. In the second part of this chapter I then show the effects of the continued rise of $*C_{\mu}$ on the evolution of the Latin geminate sonorants /nn, ll/. I argue that here too the listener is important in determing the final outcome of the evolution of these segments.

3.1 The phenomena to be analyzed in the history of Hispano-Romance. One of the principal traits that separates Spanish from Galician/Portuguese is the retention in Galician/Portuguese of the seven-vowel system of Late Spoken Latin:

(1.) | ***Late Spoken Latin, Galician/Portuguese*** | ***Old Spanish***

i	u	i	u
e	o	e	o
ɛ	ɔ	ɛ > je	ɔ > we
a		a	

Examples:

Old Galician/Portuguese		***Old Spanish***	
tr[i]ste ‘sad’	d[u]ro ‘hard’	tr[i]ste	d[u]ro
dorm[i]r ‘sleep’	m[u]ro ‘wall’	dorm[i]r	m[u]ro
m[e]sa ‘table’	s[o]l ‘sun’	m[e]sa	s[o]l
v[e]rde ‘green’	n[o]s ‘we’	v[e]rde	n[o]s
c[ɛ]u ‘sky’	m[ɔ]rte ‘death’	c[je]lo	m[we]rte
s[ɛ]te ‘seven’	f[ɔ]go ‘fire’	s[je]te	f[we]go
s[a]l ‘salt’		s[a]l	
pr[a]do ‘prarie’		pr[a]do	

Another characteristic that distinguishes Old Spanish from Old Galician/Portuguese is the treatment in each of the Latin sonorants /nn, ll/.[1] These simplified in both Old Spanish and Galician/Portuguse, but with differing results depending on how Latin simple /n, l/ developed: in Spanish they are maintained, while in Galician/Portuguese they were historically lost in intervocalic position. Consequently, when reduction of geminate sonorants occurred, /nn, ll/ became /n, l/. However, Old Spanish retained Latin /n, l/, a fact that favored palatalization along with simplification (i.e., /nn, ll/ > /ɲ, ʎ/).

(2.) Results of the simplification of Latin /nn, ll/:

	Old Spanish	***Galician/Portuguese***	
(a)	(< Lat. /nn/)	(< Lat. /nn/)[2]	
	caña	*cana*	'cane'
	año	*ano*	'year'
	paño	*pano*	'cloth'
(b)	(< Lat. /ll/)	(< Lat. /ll/)[3]	
	bello [ʎ]	*belo*	'pretty'
	castillo	*castelo*	'castle'
	caballo	*cavalo*	'horse'
	gallina	*galinha* [ɲ]	'hen'

I will show that the changes seen in these two sets of data ultimately derive from the loss of vowel length discussed in Chapter 2. To the best of my knowledge, these data have not been related to one another before now. If the analysis here withstands scrutiny, then this unexpected result adds to our understanding of these historical changes.[4]

3.2 Reanalysis of the Latin Stress Rule: Consequences for Hispano-Romance. In the Latin stress system, for words of more than two syllables, the penultimate syllable is stressed if it is heavy (i.e., contains either a long vowel or a short vowel followed by a tautosyllabic consonant); otherwise the antepenult is stressed.[5] Once contrastive vowel length is lost in Late Spoken Latin (probably because quality distinctions alone were sufficient to distinguish long and short vowels), length no longer determines phonematic distinctions, and the Latin Stress Rule is reanalyzed by the speaker.

Many researchers have suggested that by this point speakers had come to establish a correlation between a syllable bearing word stress and its being lengthened[6] (Mattoso Câmara 1972:16, Vogel 1982:65, Marotta 1985, Chierchia 1986:22, Lloyd 1987, Repetti 1989, Hualde 1990, Sluyters 1990, Prieto 1993, Wireback 1993, Marotta and Savoia 1994:54-5, Morales-Front 1994b, Bullock 1996). I formulate this as the following constraint:

(3.) STRESS-TO-WEIGHT (abbreviated 'STW' in subsequent discussion):[7, 8]

$\Sigma = \mu\mu$

'A stressed syllable is bimoraic.'

3.2.1 The effects of STRESS-TO-WEIGHT in Hispano-Romance. Williams (1962) suggests that probably the most important cause of differentiation between varieties of Latin was the intensified stress accent superimposed on Late Spoken Latin by the invading Germanic tribes (p. 11). These invasions began in the Iberian Peninsula in 409 A.D. and culminated with the fall of the Roman Empire in 476. According to Williams, the stress accent of popular speech was greatly intensified by the Goths, accenting words with the greater stress characteristic of their own language. Support for this assumption is that there was increased syncope of the posttonic penultimate vowel and 'fracture' of tonic /ɛ, ɔ/ into diphthongs.

3.2.1.1 Vowel lengthening in Hispano-Romance. Given that stressed syllables must be heavy to satisfy STW, there will be other factors that determine how this condition will be met. The most obvious solution is to lengthen the nuclear vowel. As we saw earlier, this incurs a cost in OT (everything does to some extent) by violating *LONG-VOWEL (*$V_{\mu\mu}$). If this is the minimal violation of the constraint hierarchy, lengthening will occur. Another possibility is for some sort of diphthong to arise. This too incurs a cost in OT, violating the constraint NODIPHTHONG, formulated here:

(4.) NODIPHTHONG (Rosenthall 1994:17)

```
 *σ
 / \
μ   μ
|   |
V1  V2
```

Given the new importance of establishing a heavy stressed penult, some sort of lengthened nucleus will result in order to fulfill this requirement, and the ranking of *LONG-VOWEL and *NODIPTHONG will determine the output. The Hispano-Romance evidence suggests that in this period all vowels were lengthened, not diphthongized. (For discussion, see Lloyd, pp. 116-30, 184-87, Penny, pp. 43-4.)

While Latin had eliminated distinctive vowel length by this time, the avoidance of long vowels is not guaranteed in all circumstances. Indeed, as many researchers have argued (e.g., those cited above in support of STRESS-TO-WEIGHT), subsequent linguistic development supports the argument that vowel lengthening under stress resulted from reanalysis of the Latin Stress Rule. As stressed vowels did not diphthongize in Hispano-Romance, NODIPHTHONG must dominate *LONG-VOWEL.

(Diphthongs from the destruction of hiatus did exist, but FAITH allows this.) The lengthening that this ranking permits affected all vowels in Hispano-Romance.[9]

(5.) Vowel lengthening in Hispano-Romance.

/prado/ ‘prarie’ (/sɛte/ ‘seven’ /mesa/ ‘table’ /ida/ ‘departure’ /duro/ ‘hard’ /odio/ ‘hatred’ /bɔno/ ‘good’)	STW	NODIPHTHONG	*LONG-V
a) prado (etc.)	*!		
b) praa̯do (etc.)		*!	
c) praado (etc.) ☑			*

Considering representative /prado/, we see that candidate (a) is maximally faithful to the input, but does nothing to meet the requirement of dominant STW that stressed syllables must be heavy; it is therefore eliminated from consideration. The remaining candidates add a mora to satisfy STW. However, candidate (b) is eliminated by the higher ranking NODIPHTHONG. Candidate (c), with lengthened vowel, is optimal. The same holds of /sɛte/, /ida/, /mesa/, /duro/, /odio/ and /bɔno/: lengthening is favored over diphthongization. These Hispano-Romance forms were maintained into

Galician/Portuguese, but Old Spanish came to favor diphthongization of the open mid vowels /ɛ, ɔ/. This is treated in the following section.

3.2.1.2 Diphthongization of /ɛ, ɔ/ in Old Spanish. We know from the earliest documents in Old Spanish that tonic /ɛ, ɔ/ diphthongized, and some scholars (including Menéndez Pidal and Penny) argue that there was first lengthening, as claimed above for all tonic vowels. Increased duration would allow for greater opportunity for the vowel to be articulated heterogeneously, but length alone is insufficient to cause diphthongization (Donegan 1985:210, 218).

An important factor yet to be considered is that it is only the lax vowels that diphthongize in Old Spanish; lengthened tense vowels are stable. This is a frequent crosslinguistic pattern, as Donegan and others have shown. Specifically, in vowel inventories of the world, there is a strong correlation between tense and long vowels, on the one hand, and lax and short vowels on the other. For instance, ‘long’ and ‘lax’ do not cooccur (except in low vowels) in many languages (e.g., Classical Latin, Samoan), nor do ‘short’ and ‘tense’ (e.g., Lithuanian, Kurdish, Khasi) (Donegan pp. 93-4; see also Moulton 1962:67, Wängler 1969:3, 11 and Benware 1986:51 for German). Furthermore, long vowels are especially susceptible to tensing, as both the historical development of many languages (e.g., English, the German of Berne and

Zurich, Scandinavian languages, Classical Latin, Hindi) and synchronic alternations in others (e.g., Hungarian, Kalispel and Palestinian Arabic) bear out (Donegan, p. 116).

Given the common tendency for long lax vowels to be disallowed, I propose to formalize this restriction as the following constraint:

(6.) *LONG-[-ATR]

$$\begin{array}{c} *V_{\mu\mu} \\ | \\ [\text{-ATR}] \end{array}$$

'Long lax vowels are disfavored.'

(Based on Donegan, Moulton, Wängler, Benware)

Such a constraint is active in those languages that disallow long vowels from being lax. As Donegan states, long vowels are especially susceptible to tensing because their greater duration allows time for the articulation of the tongue to reach the more extreme positions associated with their articulation (p. 118). This occurred in Germanic, where lengthened lax vowels diphthongized with great frequency in stressed syllables (Donegan, p. 219). An example from Modern German also illustrates this. In northern Germany, [e:] is substituted for /ɛ/ because "it is as if an open, lax vowel were believed to be contrary to the rules of vowel length. Length is generally associated with close, tense articulations" (Wängler, p. 11).

Here I follow Penny (1991:43-4) and Lloyd (1987:128) in assuming that at a historical stage subsequent to the reanalysis of the Latin Stress Rule (but still before the appearance of the first documents written in Old Spanish), the muscular tension associated with the added length led the two 'halves' of the long lax ([-ATR]) vowel to differ a bit in quality from one another, probably first [eɛ, oɔ]. (See Donegan, pp. 142-43 for the same claim that 'dissimilative tensing' occurred in Finnish, Old French, the Finca Valparaiso dialect of Pokomchi (Quichean) and pre-Old High German.) How might this situation arise in Old Spanish but not Galician/Portuguese?

One possibility is suggested by a host of evidence that appears to indicate that the stress accent of pre-Galician/Portuguese was weaker than that of pre-Old Spanish.

(7.) Evidence suggesting a less intense stress accent in pre-Galician/ Portuguese (Williams, pp. 11-13, 53, 56-57, 78, 87-88):

(a) Less syncope:

Latin	***Galician/ Portuguese***	***Spanish***	
-ABILEM	*-ável*	*-able*	'-able'
ANGELUM	*angeo* (> *anjo*)	*ángel*	'angel'
BIFERAM	*bêbera*	*breva*	'early fig'
CAPITULUM	*cabidoo* (> *cabido*)	*cabildo*	'chapter'
CUBITUM	*covedo* (old)	*codo*	'elbow'
DEBITAM	*dívida*	*deuda*	'debt'
DECIMUM	*dízimo*	*diezmo*	'tithe'
*DUBITAM	*dúvida*	*duda*	'doubt'
DURACINUM	*durázio*	*durazno*	'peach'
FRAXINUM	*freixeo* (> *freixo*)	*fresno*	'ash tree'
-IBILEM	*-ível*	*-ible*	'-ible'
JUVENES	*jovẽes* (> *jovens*)	*jóvenes*	'youths'
LEGITIMUM	*lídimo*	*lindo*	'legitimate'/ 'pretty'
PERSICUM	*pêssego*		'peach'

*RETINAM	*rédea*	*rienda*	'rein'
MACULAM	*mágua*	*mancha*	'stain'
NEBULAM	*névoa*	*niebla*	'fog'
PERICULUM	*perigoo* (> *perigo*)	*peligro*	'danger'
POPULUM	*povoo* (> *povo*)	*pueblo*	'people'
SPATULAM	*espádua*	*espalda*	'back'
TABULAM	*tábua*	*tabla*	'table'
(*ADRE)POENITERE	*arrepender*	*arrepentir*[10]	'to repent'

(d) Slow formation of yod (i.e., the palatal glide [j]):

(i) Indicated by voicing of intervocalic *p* in forms like *saiba* 's/he know (subj.)' (cf. Sp. *sepa* < Lat. SAPIA)

(ii) Lack of attraction (metathesis) in early forms like *sabia* (cf. Sp. *sepa* < [*sajpa] < [*sap^{j}a] < Lat. SAPIA)

(iii) Long retention of syllabic value of *e* in hiatus in forms like *fêmea* 'female' (from versification)

(e) Slow formation of wau (i.e., the labiovelar glide [w]):

Indicated by voicing of intervocalic *p* in SAPUIT > *soube*, vs. Sp. *supe* 'I knew, found out'

(c) Failure of /ɛ, ɔ/ to diphthongize:

c[ɛ]u	c[je]lo	'sky'
s[ɛ]te	s[je]te	'seven'
f[ɔ]go	f[we]go	'fire'
m[ɔ]rte	m[we]rte	'death'

It has been suggested (e.g., by Williams) that these traits are due to lesser Germanic influence, whose strong accent of intensity (Meillet 1970:38) was slower to take hold in the more geographically distant and isolated territory where Galician/Portuguese was to develop. If this is the case, Germanic influence in Hispano-Romance primarily affected pre-Old Spanish territory, and led to the adoption of their preference for long lax vowels to become tense.

For whatever reason, the constraint disfavoring long lax vowels that had been lower ranked in Late Spoken Latin became more dominant. This is shown below:

(8.) Diphthongization in Old Spanish.

/bɔno/ ‘good’	STW	*LONG-[-ATR]	NODIPHTHONG	*LONG-V
a) bɔno	*!			
b) bɔɔno		*!		*
c) boɔno ☑			*	

Reviewing the evaluation of this tableau, we see that both serious candidates have a heavy penult, satisfying STW (candidate (a) does not, and is eliminated from consideration).[11] Notice also that the ranking of NODIPHTHONG and *LONG-VOWEL has remained constant, a necessary assumption given that all other vowels (i.e., the tense vowels and /a/) remained lengthened, and did not come to diphthongize. For these vowels, phonetic conditions never yield a disfavored combination of length and [-ATR], so their lengthened status remains optimal. Put another way, only lengthened lax vowels lead to phonological diphthongization because of their marked status in combining features that are difficult to sustain together for articulatorily grounded reasons (Donegan, p. 118).

When speakers became aware (consciously or not) of this incipient tendency toward fracture, this led to the lexicalization of this alternation (see also Hyman 1976 for ‘phonemicization’ of incipient phonetic alternations). Lexicon optimization leads to reanalysis of [oɔ] (< /ɔ/) as /oɔ/ (and /eɛ/ from [eɛ] < /ɛ/). Subsequent dissimilation and lexicon optimization leads to /wo/ (as in Italian; later /we/ in Old Spanish) and /je/.

(This has implications for analyses of Modern Spanish. The current approach suggests that, at least for this stage in the history of Spanish, related pairs like *bueno* 'good' ~ *bondad* 'goodness' and *pienso* 'I think' ~ *pensar* 'to think' are not derived (in the naive sense of this word) from a common base /BON-/ or /PENS-/, but rather that these forms are related in the lexicon in meaning and much phonological form. See Burzio (1997) and Morin (1997) for further discussion of this approach to the relatedness of forms.)

This concludes the exploration of one of the most important reactions to the loss of distinctive vowel length from Latin. In the following sections I explore the other principal response to this loss, the rise of the constraint disfavoring moraic consonants, whose initial results we saw in Chapter 2.

3.3 Evolution of Latin geminate sonorants /nn, ll/ in Hispano-Romance. $*C_\mu$ continues to rise as before, having already eliminated moraic obstruents. The next effect is the reduction of geminate sonorants, which occurred in the 10th or 11th century (Williams 1962, Otero 1971). Results of this simplification, however, differ in the languages under study, and this is related to the retention or loss of /-n-, -l-/, exemplified here:[12]

(9.) Development of Latin /-n-, -l-/:

	Old Spanish	Old Galician/Portuguese	
(a)	(< Lat. /n/)	(< Lat. /n/)	
	bueno	*bom* [bõ]	'good'
	hermano	*irmão*	'brother'
	mano	*mão*	'hand'
	luna	*lua*	'moon'
	tener	*ter*	'to have'
(b)	(< Lat. /l/)	(< Lat. /l/)	
	cielo	*céu*	'sky, heaven'
	filo	*fio*	'thread'
	palo	*pau*	'stick'
	palacio	*pazo*	'palace'
	peligro	*perigo*	'danger'
	caliente	*quente*	'hot'
	silencio	*seenço*	'silence'

niebla	*névoa*	'fog, mist'
ángel	*angeo*	'angel'
cabildo	*cabidoo*	'chapter'
pueblo	*povoo*	'people'
espalda	*espádua*	'shoulder (blade)'
tabla	*tábua*	'table'
regla	*régua*	'rule'

Here I extend an argument made in Walsh (1991). He argues that once the Late Spoken Latin simple obstruents underwent lenition by fricativization of the voiced consonants, and voicing of the voiceless ones, the geminates were simplified. This is because, he suggests, long segments may exist only in opposition to their shorter counterparts. The effect of this intuitive notion is that the new simple stops do not merge with the original simple stops. We may now add another theoretical argument in its support.

That is, this is one of the implications of the reasoning presented in Zec (1995) and extended here. Specifically, the presence of long consonants might be taken to imply the presence of long vowels. This is because the moraic status of less sonorous segments entails the moraic status of more sonorous segments.

By extension of this argument, the presence of moraic *n* and *l* should entail the presence of nonmoraic *n* and *l*. In this way, the lack of a simple consonant entails that its moraic counterpart should not exist. The development of /nn, ll/ in Galician/Portuguese is in perfect accord with this line of reasoning.[13]

3.3.1 Simplification of /nn, ll/ in Galician/Portuguese. Given that Latin /-n-, -l-/ had been lost in Galician/Portuguese, the next step-wise rise of $*C_\mu$, the reranking of $*N_\mu$,$*L_\mu$ above MAX/IDENT, leads to simplification of the geminate sonorants /nn, ll/. As a result of the new dominant ranking of $*N_\mu$, $*L_\mu$ nasals and laterals have lost their ability to bear a mora, and their length is lost. By lexicon optimization, the lack of long nasals and laterals on the surface results in the elimination of the mora from the input. That is, lexicon optimization leads to /n, l/ from [n, l] (< /n_μ, l_μ/). (Additionally, for younger speakers forming their grammar, the lack of evidence that nasals and laterals may be moraic also affects the reranking of $*N_\mu$, $*L_\mu$ from their initial position.)

3.3.2 Palatalization of /nn, ll/ in Old Spanish. Latin /-n-, -l-/ were retained in Old Spanish, however, and this affects the evolution of /nn, ll/. As mentioned above, the next step-wise rise of $*C_\mu$, the rise of $*N_\mu$,$*L_\mu$ above MAX/IDENT, will cause the loss of the moraic status of /nn, ll/, and might be expected to yield /n, l/. Although /nn, ll/ were the only remaining long consonants in Old Spanish, they cannot simply lose their moraic status without occasioning merger, and they palatalized for some still unclear reason.

Penny (1991:71-2) suggests that simplification takes place in spite of the retention of *n* and *l*, with the resulting phonemes coming to differ in one of their features 'no doubt' in order to preserve the distinction between /n, l/ and simplified /nn, ll/. He seems to be suggesting, therefore, that /nn, ll/ became simple /ñ, ʎ/ directly.

Lloyd (1987:243) states that /nn, ll/ are phonetically strong or fortis in articulation, and that because of their relative frequency, merger with simple /n, l/ would have produced many confusions. He suggests that this fact would have helped incline speakers to seek another solution, such as a change in articulation, which would maintain contrast. Since geminates are produced with greater articulatory force, this force could be realized in some way other than simply prolonging the contact of the articulators. For instance, the tongue could spread out in its contact with the alveo-palatal region, and as a result this palatal quality would be sufficient to distinguish the simplified segments from originally-simple /n, l/.

As in the analysis in Chapter 2, once such a phonetic distinction exists between simple and long segments (here, sonorants), the redundant feature (that is, duration) could be lost; indeed, this is favored for reasons of economy, as suggested previously.

How might such a phonetic distinction come be established? Here I suggest an explanation along the lines of what Lloyd intimates.

In the production of the geminates /nn, ll/ a certain amount of energy is expended, and this is realized as length in [nn, ll]. With the gradual rise of $*C_{\mu}$, however, we should expect to see that /nn, ll/ become short. Indeed, this is the case in both Old Spanish and Galician/Portuguese. In Galician/Portuguese, on the one hand, /nn, ll/ become simple /n, l/. Given that original intervocalic /n, l/ had been lost in most cases, little to no confusion ensued.

Likewise for Late Hispanic Latin, when voiceless geminate obstruents /pp, tt, kk (ff, ss)/ simplified, original /p, t, k (f, s)/ had voiced to /b, d, g (v, z)/ (e.g., CUPPA 'cup' > *copa*, GUTTAM 'drop' > *gota*, PECCATUM 'sin' > *pecado*, vs. LUPUM 'wolf' > *lobo*, ACUTUM 'sharp' > *agudo*, DICO 'I say' > *digo*, CASAM 'house' > *ca*[z]*a*, STEPHANUM > *Esté*[v]*an*), and little confusion arose because original /b, d, g/ had become [β, δ, γ] (which frequently deleted intervocalically, e.g., CREDO 'I believe' > *creo*, REGINAM 'queen' > *reína*). When the infrequent voiced geminates /bb, dd, gg, mm/ simplified, merger occurred with /b, d, g, m/, though the number of cases is quite reduced (e.g., *INADDERE 'to add' > OSp. *eñadir*; FLAMMA 'flame' > *llama*; from Lloyd, p. 243).

/nn, ll/, however, occurred in many more words than the other voiced geminates. As we just saw above, /nn, ll/ were simplified directly to /n, l/ in Galician/Portuguese, with no great confusion resulting because original /n, l/ had been elided. In Old Spanish, on the other hand, /n, l/ were retained, and plain simplification of /nn, ll/ would have resulted in many more confusions than in Galician/Portuguese. As Lloyd states, this seems to have inclined speakers to find a different resolution to the possibility of merger. It appears, therefore, that merger avoidance was indeed a factor in the evolution of Sp. /nn, ll/.

As Lloyd suggests, one way of maintaining the distinction between simple and geminate nasals and laterals in the face of reduction of length was to modify the articulation of the geminates; the articulatory force originally spent on prolonging contact of the articulators now being spent on enlarging the region of contact between the tongue and the roof of the mouth. A palatal quality would result, and this new pronunciation would be sufficient to distinguish simplified /nn, ll/ from /n, l/.

This seems like a plausible line of reasoning. To try to capture this in theoretical terms I suggest the following: Geminates are intervocalic consonants with moraic status. This mora adds weight to an otherwise short consonant, and in implementation yields length, at least when intervocalic. A certain amount of energy is required to manifest this mora, and in production, length and energy are correlates of this unit of weight (i.e., the mora).

While the change from geminate to simpleton is phonologically abrupt, simplification was surely a gradual process, with originally long segments only eventually being realized with the same length as short ones. Most likely in order to avoid confusion between /nn, ll/ and /n, l/, the listener seems to have decoupled the correlates length and energy; as a result, the listener has in effect isolated energy as a manifestation of geminate status. Subsequently, as length is reduced via the erosion of the mora, this energy is maintained in spite of the loss of length (and weight). Thus, the same amount of energy is deployed at all times and at all stages of the production of /nn, ll/. Showing only /nn/ here, the stages that these segments underwent may be something like the following: /n_μ/ $\rightarrow$ [nn]... (fully long, fully alveo-dental) $\rightarrow$ [nn^j] (almost fully long, beginnings of palatalization)...$\rightarrow$ [n^j(n)] (not as long as before, but correspondingly more palatal)...[ɲ] (fully palatal, fully short). (/l_μ/ would have undergone the same series of stages to arrive at /ʎ/.) At all stages in the loss of length, original energy is preserved, but in the end it is all expended in a short and palatal segment. Because of the lack of danger of significant confusion between these long and short segments in Galician/Portuguese, however, the energy originally associated with length is not maintained in new short /n, l/.[14]

To conclude, whereas before I stated that a redundant feature may be reduced once the maintaining of contrast is ensured (or at least maximized), here it appears that reduction of length and creation of the new distinguishing feature went hand in hand. That is, loss of length forced a phonetic change to occur, not the reverse, that a phonetic change favored loss of length (as argued for loss of Latin vowel length above: length was lost once quality differences had been phonologized).

An intermediate position is possible as well, that once length began to be lost and the very earliest stages of palatalization had been established, a symbiotic relationship ensued that favored further reduction of length and consequently further palatalization. This cycle could have continued until fully short length and complete palatalization had been attained. (A similar point is made by Lloyd (p. 144) in discussion of the processes of lenition that affected Latin obstruents.)

In either case, the rise of $*C_{\mu}$ is complete: Old Spanish no longer has long consonants, having now a phonemic inventory that is uniformly simple or short.[15]

3.4 Summary of constraints, rankings and classes of moraic segments in Hispano-Romance. By way of summary, I schematize here the changes that affected the seven-vowel system of Late Spoken Latin and the geminate sonorants /nn, ll/:

(10.) Constraints and rankings in the evolution of Hispano-Romance /ɛ, ɔ/:

(a) Hispano-Romance:

- STRESS-TO-WEIGHT >> DEP ('no insertion')

  (tonic vowels lengthen; see (5))

- STRESS-TO-WEIGHT >> NODIPHTHONG >> *LONG-VOWEL

  (lengthened vowels do not diphthongize)

- STRESS-TO-WEIGHT >> NODIPHTHONG >> *LONG-[-ATR]

  (lax vowels lengthen, do not diphthongize)

(b) Galician/Portuguese:

Same as Hispano-Romance.

(c) Old Spanish:

- STRESS-TO-WEIGHT >> DEP (‘no insertion’)

  (tonic vowels lengthen; see (5))

- STRESS-TO-WEIGHT >> *LONG-[-ATR] >> NODIPHTHONG

  (lax vowels may not be long, and diphthongize; see (8))

- STRESS-TO-WEIGHT >> NODIPHTHONG >> *LONG-VOWEL

  (tense vowels (and /a/) lengthen, do not diphthongize)

(Lax long vowels come to be prohibited, perhaps due to greater influence of Germanic, where *LONG-[-ATR] dominant.)

(11.) Evolution of geminate sonorants /nn, ll/:

	Surface Forms (Output)		**Underlying Representations (Input)**	**Constraint rankings**
Late Spoken Latin:	nn, ll	=	n_μ, l_μ	(MAX/IDENT >> $*N_\mu$,$*L_\mu$)
Galician/Portuguese:	n, l	<	n_μ, l_μ	($*N_\mu$,$*L_\mu$ >> MAX/IDENT)

(/n, l/ were lost in intervocalic position, so simplification occurred without merger; in the modern languages, /n, l/ are now UR.)

pre-Old Spanish:	ɲ, ʎ < ... < n_μ, l_μ	(*N_μ,*L_μ >> MAX/IDENT, gradual palatalization via spreading out of articulators)
Old Spanish and Modern Spanish:	ɲ, ʎ = ɲ, ʎ	

(Retention of Latin /n, l/ inhibits simplification of /nn, ll/ to /n, l/ because many mergers would have resulted; instead, in the process of loss of length, original energy associated with the articulation of geminates is maintained by spreading out the region of contact of the tongue with the roof of the mouth. A progressively shorter and more palatal segment results, until reaching Old Spanish [ɲ, ʎ].)

Returning to the sonority classes, and therefore classes of moraic segments, discussed in Zec (1995), the evolution of these classes (from maximally permissive to maximally restrictive) is as follows:

(12.) Sonority classes from Latin to Old Spanish and Galician/Portuguese:

(a) Latin:

μ = unrestricted

(thus vowels, sonorants and obstruents may be moraic)

(b) Hispano-Romance:

μ = [+sonorant]

(thus only vowels and sonorants may be moraic)

(c) Old Spanish, Galician/Portuguese:

μ = [-consonantal]

(thus only vowels may be moraic)

3.5 General summary and conclusions. I now recapitulate the principal findings of this chapter. A constraint STRESS-TO-WEIGHT gives rise to lengthened tonic vowels in Hispano-Romance; later, pre-Old Spanish came to diphthongized lengthened lax vowels (perhaps due to more Germanic influence, including the high ranking of *LONG-[-ATR]). Subsequent dissimilation and lexicon optimization led to /je, we/. Interaction and reranking of the limited number of constraints given above (STRESS-TO-WEIGHT, *LONG-VOWEL, *LONG-[-ATR], NODIPHTHONG) achieved these results.

In addition, we saw that simplification of the geminate sonorants /nn, ll/ by the rise of $*C_\mu$ with respect to MAX/IDENT yielded /n, l/ in Galician/Portuguese (because of loss of original /n, l/), but /ɲ, ʎ/ in Old Spanish (which had retained Latin /n, l/).

Palatalization appears to have occurred because the listener-speaker wanted to avoid merger, which was not a danger for speakers of Galician/Portuguese.

I now summarize the steps that were taken in effecting the historical changes analyzed in this chapter:

The reanalysis of the Latin Stress Rule that accompanied the loss of distinctive vowel length in turn leads to the rise of $*C_\mu$ to reestablish the implicational relationship between sonority classes and the class of moraic segments (extending Zec 1995). A principle of STRESS-TO-WEIGHT is established, and (possibly) heavy Germanic influence in Castilian territory establishes the restriction that long vowels may not be lax. Suggestive evidence that this is the case is a host of conservative traits in Galician/Portuguese that may be attributed to the lesser Germanic presence there during the critical formative period (Williams 1962).

The eventual rise of $*C_\mu$ versus MAX/IDENT leads to simplification of /nn, ll/ to /n, l/ in Galician/Portuguese. Because Latin /n, l/ had been lost in intervocalic position, no merger resulted. At this stage all geminate sonorants have been eliminated from Galician/Portuguese, and the work of $*C_\mu$ is finished. That is, the situation no longer exists in which the language possesses underlyingly moraic consonants but not vowels. Simplification-cum-palatalization in Old Spanish indicates that $*C_\mu$ has completed its ascension above MAX/IDENT in Old Spanish as well.

The end result of these changes is that Old Spanish and Galician/Portuguese arrive at consonant inventories composed entirely of simple segments, having no mismatch with those segments that could be distinctively long (vowels and consonants in Latin, only sonorants in Early Hispano-Romance, none in Old Spanish and Galician/ Portuguese). Systemic parity has been reestablished.

Throughout the course of these developments, the listener is argued to have lexically optimized the output forms, minimizing predictable constraint violation. It was also suggested that increased dominance of a constraint leads to elimination of evidence of its effects for the subsequent generation. That is, lack of a particular surface form provides evidence to younger speakers that the constraint is inactive. During the process of acquisition, then, it may be the case that the original ranking of the constraint is unaltered.

The results obtained here reaffirm the position of previous researchers with respect to the role of the listener (Ohala, most notably), and incorporate this intuition into the theoretical machinery of Optimality Theory.

Notes to Chapter 3

1 There is little to say about the reduction of the other geminate sonorant, /rr/: Even in Latin, /-r.r-/ was probably pronounced as the multiple trill [r̄], as in Modern Spanish (see Lloyd 1987:246 for discussion). Under the analysis to be presented below, the (lexicalized) simplification of /rr/ to /r̄/ must have occurred by or at the time that /ll/ was reduced (because they are of the same sonority class). (This occurred around the tenth century.) However, given the pronunciation [r̄] in Late Latin, lexicalized /r̄/ may be much earlier, though probably after the period when the Latin Stress Rule came to be reanalyzed. This is because even though /rr/ may have been pronounced as [r̄-] (syllable- initial only), a penult with /-r.r-/ acted as heavy and attracted stress. Once the Latin Stress Rule was reanalyzed (and stress became a distinctive feature), [r̄] could become /r̄/ without affecting stress placement.

For historical discussion, see Mattoso Câmara 1972:38, 42-3 and Penny 1991:71-2; for theoretical approaches, see Harris 1983:62-71 for a generative account of Modern Spanish [r̄], and Morales-Front 1994a for an OT analysis.

2 There are a few Portuguese words with *nh* (=[ɲ]) whose Latin etyma contain /nn/: *antanho* 'yesteryear', *penha* 'rock, cliff' and *estanho* 'tin'. However, these are loans from Spanish (Williams 1962:75).

3 There are a few Portuguese words with *lh* (=[ʎ]) whose Latin etyma contain /ll/: *brilho* 'brightness, splendor', *grilho* (old) 'cricket', *cavalheiro* 'gentleman' and *castelhano* (OPtg. *castelhão*) 'Castilian'. These are borrowings from Spanish (Williams 1962:74).

4 This chapter is a much revised and expanded version of Holt 1996a, and the views presented here supersede those given in that work. The establishment here of a connection between these data and those of Chapter 2 (both as results of the rise of $*C_{\mu}$) and further consideration of certain theoretical issues has led to major changes.

5 A full discussion and analysis of the Latin Stress Rule and of the metrical system of Hispano-Romance is well beyond the scope of this dissertation. The summary remarks given here should suffice for present purposes. I should note that in Latin disyllabic words with light penults were accented on the penult as well. Once speakers establish a correlation between stressed syllables and bimoraicity and this supplants their former accentual system, I assume that disyllabic words with light penults would undergo allophonic lengthening of the stressed syllable as well. For arguments that tonic vowels were lengthened in Late Spoken Latin, see, inter alia, Penny 1991:43-4.

6 Hyman 1976 considers phonological change to be perception-oriented, even though the seeds for a change may be articulatory (p. 416). The case cited here is parallel to cases that Hyman describes as 'phonemicization' by the listener of phonetic-cum-phonological processes that involve segments and tones. The example given here would be a case of phonemicization at the metrical level, here instantiated by the 'activation' or promotion of the universally available constraint requiring that stressed syllables be heavy.

7 See also Donegan 1985, Sherer 1994:ch. 2:53, Rosenthall 1994, and Fitzgerald 1997. For Modern Brazilian Portuguese, Girelli 1988:82 also assumes that a stressed vocalic nucleus has branching structure.

The motivation for such a principle may be due to reasons of positional faithfulness (see Beckman 1997). That is, phonological contrasts are preferentially maintained in privileged linguistic positions of phonetic prominence (e.g., stressed syllables, onsets and long vowels). Here, phonetic prominence is instantiated by duration. Beckman argues that these positions have a functional advantage in perception and/or lexical access.

8 Borowsky et al. 1984 posit a similar rule for Danish. Their gemination rule (18) provides an additional grid position to syllables under stress. They note that this is a condition that holds in Yupik Eskimo, Italian and Biblical Hebrew as well. (Morén 1997 cites a similar restriction in Icelandic.) Depending on language-particular parameters, either a long vowel or a geminate results.

9 The lengthening that is argued to have begun with the reanalysis of the Latin Stress Rule is still active in the modern languages under discussion. For Spanish there is experimental evidence that tonic vowels are lengthened (Navarro Tomás 1957:199-206, 1968:50); likewise, studies of Portuguese show that stressed vowels are lengthened as well (Sá Nogueira 1958:37). (The same holds of open syllables in Modern Italian; see Castiglione 1957:17, Companys 1963:15.)

10 Additionally, this last pair of words also appears to show that the spread of syncope was slower in Galician/Portuguese territory, since intervocalic /-t-/ had already voiced to /-d-/. For an alternative analysis, cf. Menéndez-Pidal 1982:§54, where he attributes the *t* of the Spanish form to learned influence.

11 This is a simplified account for expository purposes. For winning candidate (c) another constraint requiring that elements of a nucleus share features yields [uo]. Such a constraint is proposed in Morales-Front and Holt 1997 to account for complex Portuguese nasal alternations analyzed there. Later, speakers favored an increase in the perceptual distance between the two vowels, and dissimilation yields the unmarked vowel [e]. Diphthongizing /ɔ/ therefore yields [we]. Likewise,

diphthongizing /ɛ/ yields [je]. See Morales-Front 1994 for a more detailed OT approach. See also Penny 1991:43. For a general approach to syllable-structure constraints, see Rosenthall 1994:ch. 1, where potentially relevant to present discussion, he formulates constraints that favor rising or falling sonority (SONRISE and SONFALL, respectively).

12 The motivation for such loss is unclear. Alarcos Llorach 1971:249-50 proposes that the drive to eliminate geminates forced loss of simple /n, l/ (as it supposedly motivated the spirantization of voiced obstruents and the voicing of voiceless ones). Why Old Spanish did not do the same remain unexplained under such an account.

Williams 1962:69 claims that /-l-/ was first gutturalized to [ɫ], then lost. In a similar vein, Entwistle 1975:288 suggests that *l* may have been construed in the same syllable as the preceding vowel (e.g., *pal-o*), and then have taken on the velar quality that resembles *u*, before being completely assimilated to the vowel. Brandão de Carvalho 1988 proposes a similar analysis for loss of *n*, *l*, and he assumes that *irmano*, too, passed through a stage of 'implosive' pronunciation (i.e., [*ir.maŋ.o]). On loss of *n*, *l* in Modern Portuguese pluralization, see Morales-Front and Holt 1997, where we attributed loss to a process of nucleation (Colman 1983).

13 The 'pull-chain' approach advocated in Walsh 1991 is in contrast to the 'push-chain' approach of Penny 1991:65-72. Penny suggests that the process of lenition began with the simplification of geminates, with a host of other changes occurring either simultaneously or subsequently. For Galician/ Portuguese, Alarcos Llorach 1971:249-50 likewise proposes a push-chain analysis, arguing that the simplification of the geminates forces the loss of 'weak' /n, l/.

I leave for future research exploration of the hypothesis that minute phonetic differences in short and long obstruents became phonologized as a result of the loss of the long segments' moraic status. That is, perhaps spirantization of voiced obstruents and voicing of voiceless ones are a result of simplification of geminate obstruents. In other words, lenition as a whole may be a push-chain after all.

Well beyond the scope of this dissertation is the implementation of a mechanism of merger avoidance, on which up to this point I have not had to rely (other than assuming that the rise of $*C_\mu$ is gradual and step-wise). For one possible interpretation, I refer the reader to Padgett 1997. Building on Flemming's 1995 Dispersion Theory, he couches in OT terms the structuralist notions of maximization of perceptual distinctiveness in contrast and minimization of articulatory effort (Saussure 1959, Martinet 1964). He suggests that candidate outputs are systems of contrasts, not individual words.

14 In Holt 1996a I appealed to a constraint SONCODA=[DORSAL] ('sonorant codas are preferably dorsal'), inspired by Trigo 1988:21, 46, and motivated by sonority dispersion (Clements 1990). (Coda dorsals show more vowel-like transitions, and so they minimize the fall in sonority from peak to coda more than labials and coronals would, at least according to some structure-based theories of sonority.) Additionally, I followed Keating 1988 and Lipski 1989 in assuming that palatal segments consist of both [coronal] and [dorsal] articulations; Hanoi Vietnamese, cited in Rice 1996:511, might be taken as supporting evidence: dorsals /k/ and /ŋ/ are realized as [c] and [ɲ] after the distinctively front vowels /i/ and /ê/.

However, the use of SONCODA=[DORSAL] raises many questions, such as why it would be active in Spanish but not Galician/Portuguese, why it was not active in Latin, how it came to be active in Spanish just at the moment it was needed to avoid merger of /nn, ll/ by creating /ɲɲ, ʎʎ/, etc. (Assignment of [dorsal] to coronal /nn, ll/ would yield long palatals, later simplified.) Also, syllable-final simple /-n, -l/ did not become /-ɲ, -ʎ/, so some appeal to original length and energy appears to be required under this account as well.

A potentially valid use for a constraint SONCODA=[DORSAL] is in languages that velarize /-l/, such as Catalan, Portuguese and English. See the appendix to this chapter for discussion of such a constraint in explaining the coarticulated nasal and later codas of certain varieties of Andalusian and Caribbean Spanish.

15 The results obtained here, that all moraic consonants were lost in the history of Spanish and Portuguese, has repercussions for the analysis of stress assignment in the modern languages. The evidence adduced here might be taken to support the position of those who have argued that Modern Spanish stress assignment is not sensitive to moras, though the parent language Latin was (as in Roca 1990 and Morales-Front 1994a). The great similarity in stress patterns between Spanish and Latin, under this scenario, is due to their historical link. Modern forms that show antepenultimate stress even when the penult is heavy (e.g., native *Frómista* and borrowed proper names like *Washington*, *Jefferson*, etc.) are allowed, though they would have been prohibited by the Latin Stress Rule that Modern Spanish seems to follow quite closely in other respects. I leave further exploration of the consequences of the present analysis for future research.

APPENDIX TO CHAPTER THREE

COARTICULATED NASAL AND LATERAL CODAS

IN ANDALUSIAN AND CARIBBEAN SPANISH

0. Introduction. In a previous treatment of the development of geminate sonorants in Old Spanish (Holt 1996a), I appealed to a constraint SONCODA=[DORSAL]. After fuller consideration of the ramifications of the use of this constraint, however, it appears untenable that SONCODA=[DORSAL] is a factor in the palatalization of Sp. /nn, ll/.

Nonetheless, there is evidence from other aspects of Spanish and Portuguese that SONCODA=[DORSAL] does indeed exist. Obvious support for this constraint comes from velarization of coda nasals and laterals. Additional support may come from tha coarticulation of coda nasals and laterals that is characteristic of certain varieties of Modern Spanish.

An informal definition of the constraint under discussion is given here:

(i) SONCODA=[DORSAL]

'Sonorant codas are preferably dorsal.'

(Inspired by Trigo 1988:21, 46)

The motivation for such a constraint is that the transitions of coda dorsals are more vowel-like than labials or coronals (Trigo, 21, 46); consequently, coda dorsals minimize the fall of sonority (see Clements 1990 on sonority dispersion). As such, this constraint appears to be part of a family of sonority-based constraints. The effect of this constraint is that sonorant codas that do not already bear the feature [dorsal] will be assigned it by GEN. With the sufficiently high ranking of this constraint, only sonorant codas that are dorsal will be selected as optimal according to EVAL. The case of velarization of /-l/ to [-ɫ] (as in Catalan, Portuguese and English) is easily explained in this way.

Further support comes from the data discussed below.

1. Coda nasals. As described in Guitart (1976), certain dialects of coastal and Caribbean Spanish exhibit characteristics in nasal assimilation that differ from those of standard Spanish. In these dialects standard nasal-obstruent place assimilation interacts with coda velarization:

(ii) Caribbean nasal assimilation.

un boleto	*u*[m/ŋ]*boleto*	'a ticket'
un francés	*u*[ɱ/ŋ]*francés*	'a Frenchman'

Under the analysis given here, the assignment of [dorsal] to the coda takes place in spite of the fact that the nasal has assimilated to the following obstruent. This is reflected in the high ranking of SONCODA=[DORSAL].

(iii) Creation of coarticulated nasal codas.

/un boleto/	SONCODA=[DORSAL]	ASSIMILATION
u[nb]oleto	*!	*
u[mb]oleto	*!	√
u[ŋb]oleto	√	*!
u[m/ŋ]boleto ☑	√	√

The first two candidates do not velarize the coda nasal, and so are eliminated from consideration. The third candidate velarizes the nasal, but fails to undergo nasal place assimilation. Only the last candidate satisfies both constraints, and so it is the optimal output in these dialects.

2. Coda laterals. A similar phenomenon occurs with syllable-final laterals. As is well known, there is often confusion or neutralization of syllable-final /r/ and /l/ in certain regions of Andalucia and the Caribbean, most famously Puerto Rico. As Amado Alonso (cited in Zamora Vicente 1989:315) states, the confusion of *r* and *l* yields a segment that is 'fonéticamente mixto' ('phonetically mixed'), as in *Pueṟto Rico*, *aḻma* 'soul', *aṟma* 'weapon'.

Here I would like to suggest that the same process of velarization that affects syllable-final nasals also affects syllable-final liquids. That is, what has been called neutralization may really be the assignment of the feature [dorsal] to coda /l/ and /r/. The resulting segment would be at the same time neither and both /r/ and /l/, and this ambiguity results in confusion. This is represented as follows:

(iv) Confusion/neutralization of coda liquids.

/-l/	/-r/	SONCODA=[DORSAL]	DEP
-l	-r	*!	
-l/-r ☑	-r/-l ☑	√	* +[dorsal]

This is a schematic and preliminary analysis to be sure, but in principle it allows for unified explanation of both nasal velarization and lateral confusion, which frequently co-occur. The coexistence of these phenomena has been correlated in many dialects, but to the best of my knowledge no previous account has attributed them both to a constraint favoring sonorant codas to be dorsal. I leave a fuller account of these data for a future occasion.

Among unresolved issues is why the assignment of [dorsal] to a coda lateral should yield [-ɫ] in Modern Portuguese but coarticulated (I propose) [-l/-r] in Caribbean Spanish. This may be due to syllable structure constraints that limit the number of place specifications in the coda, or perhaps instead the coalescence of input and assigned place specifications. Another matter arises those varieties of Spanish that velarize /-n/ but maintain /-l/, and from languages like English that velarize /-l/ but maintain /-n/. Coarticulation appears to be the result of the maximal effect of SONCODA=[DORSAL], while dialects and languages with more minimal effect indicate that other constraints (still undetermined) play an important role as well. I leave these issues open here, as there are many unexplored questions, and the structure of these coda laterals is still a matter without clear consensus (though see Walsh 1995 for a very recent attempt to clarify their internal structure).

CHAPTER THREE

THE EVOLUTION OF LATE SPOKEN LATIN /ɛ, ɔ/ AND GEMINATE SONORANTS

3.0 Introduction. In this chapter I continue to explore the consequences for Old Spanish and Galician/Portuguese of the loss of vowel length. I will argue that speakers came to reformulate the Latin Stress Rule as a constraint that favored stressed syllables to be heavy (STRESS-TO-WEIGHT), and that this constraint interacted with others that militate against long elements (*LONG-VOWEL, *LONG-[-ATR], NODIPHTHONG) in shaping the evolution of the seven-vowel system of Late Spoken Latin. In the second part of this chapter I then show the effects of the continued rise of $*C_{\mu}$ on the evolution of the Latin geminate sonorants /nn, ll/. I argue that here too the listener is important in determing the final outcome of the evolution of these segments.

3.1 The phenomena to be analyzed in the history of Hispano-Romance. One of the principal traits that separates Spanish from Galician/Portuguese is the retention in Galician/Portuguese of the seven-vowel system of Late Spoken Latin:

(1.)

	Late Spoken Latin, Galician/Portuguese		Old Spanish	
	i	u	i	u
	e	o	e	o
	ɛ	ɔ	ɛ > je	ɔ > we
	a		a	

Examples:

Old Galician/Portuguese		*Old Spanish*	
tr[i]ste ‘sad’	d[u]ro ‘hard’	tr[i]ste	d[u]ro
dorm[i]r ‘sleep’	m[u]ro ‘wall’	dorm[i]r	m[u]ro
m[e]sa ‘table’	s[o]l ‘sun’	m[e]sa	s[o]l
v[e]rde ‘green’	n[o]s ‘we’	v[e]rde	n[o]s
c[ɛ]u ‘sky’	m[ɔ]rte ‘death’	c[je]lo	m[we]rte
s[ɛ]te ‘seven’	f[ɔ]go ‘fire’	s[je]te	f[we]go
s[a]l ‘salt’		s[a]l	
pr[a]do ‘prarie’		pr[a]do	

Another characteristic that distinguishes Old Spanish from Old Galician/Portuguese is the treatment in each of the Latin sonorants /nn, ll/.[1] These simplified in both Old Spanish and Galician/Portuguse, but with differing results depending on how Latin simple /n, l/ developed: in Spanish they are maintained, while in Galician/Portuguese they were historically lost in intervocalic position. Consequently, when reduction of geminate sonorants occurred, /nn, ll/ became /n, l/. However, Old Spanish retained Latin /n, l/, a fact that favored palatalization along with simplification (i.e., /nn, ll/ > /ɲ, ʎ/).

(2.) Results of the simplification of Latin /nn, ll/:

	Old Spanish	***Galician/Portuguese***	
(a)	(< Lat. /nn/)	(< Lat. /nn/)[2]	
	caña	*cana*	'cane'
	año	*ano*	'year'
	paño	*pano*	'cloth'
(b)	(< Lat. /ll/)	(< Lat. /ll/)[3]	
	bello [ʎ]	*belo*	'pretty'
	castillo	*castelo*	'castle'
	caballo	*cavalo*	'horse'
	gallina	*galinha* [ɲ]	'hen'

I will show that the changes seen in these two sets of data ultimately derive from the loss of vowel length discussed in Chapter 2. To the best of my knowledge, these data have not been related to one another before now. If the analysis here withstands scrutiny, then this unexpected result adds to our understanding of these historical changes.[4]

3.2 Reanalysis of the Latin Stress Rule: Consequences for Hispano-Romance. In the Latin stress system, for words of more than two syllables, the penultimate syllable is stressed if it is heavy (i.e., contains either a long vowel or a short vowel followed by a tautosyllabic consonant); otherwise the antepenult is stressed.[5] Once contrastive vowel length is lost in Late Spoken Latin (probably because quality distinctions alone were sufficient to distinguish long and short vowels), length no longer determines phonematic distinctions, and the Latin Stress Rule is reanalyzed by the speaker.

Many researchers have suggested that by this point speakers had come to establish a correlation between a syllable bearing word stress and its being lengthened[6] (Mattoso Câmara 1972:16, Vogel 1982:65, Marotta 1985, Chierchia 1986:22, Lloyd 1987, Repetti 1989, Hualde 1990, Sluyters 1990, Prieto 1993, Wireback 1993, Marotta and Savoia 1994:54-5, Morales-Front 1994b, Bullock 1996). I formulate this as the following constraint:

(3.) STRESS-TO-WEIGHT (abbreviated ‘STW’ in subsequent discussion):[7, 8]

$\Sigma = \mu\mu$

‘A stressed syllable is bimoraic.’

3.2.1 The effects of STRESS-TO-WEIGHT in Hispano-Romance. Williams (1962) suggests that probably the most important cause of differentiation between varieties of Latin was the intensified stress accent superimposed on Late Spoken Latin by the invading Germanic tribes (p. 11). These invasions began in the Iberian Peninsula in 409 A.D. and culminated with the fall of the Roman Empire in 476. According to Williams, the stress accent of popular speech was greatly intensified by the Goths, accenting words with the greater stress characteristic of their own language. Support for this assumption is that there was increased syncope of the posttonic penultimate vowel and ‘fracture’ of tonic /ɛ, ɔ/ into diphthongs.

3.2.1.1 Vowel lengthening in Hispano-Romance. Given that stressed syllables must be heavy to satisfy STW, there will be other factors that determine how this condition will be met. The most obvious solution is to lengthen the nuclear vowel. As we saw earlier, this incurs a cost in OT (everything does to some extent) by violating *LONG-VOWEL (*$V_{\mu\mu}$). If this is the minimal violation of the constraint hierarchy, lengthening will occur. Another possibility is for some sort of diphthong to arise. This too incurs a cost in OT, violating the constraint NODIPHTHONG, formulated here:

(4.) NODIPHTHONG (Rosenthall 1994:17)

$$\begin{array}{cc} \multicolumn{2}{c}{*\sigma} \\ / & \backslash \\ \mu & \mu \\ | & | \\ v_1 & v_2 \end{array}$$

Given the new importance of establishing a heavy stressed penult, some sort of lengthened nucleus will result in order to fulfill this requirement, and the ranking of *LONG-VOWEL and *NODIPTHONG will determine the output. The Hispano-Romance evidence suggests that in this period all vowels were lengthened, not diphthongized. (For discussion, see Lloyd, pp. 116-30, 184-87, Penny, pp. 43-4.)

While Latin had eliminated distinctive vowel length by this time, the avoidance of long vowels is not guaranteed in all circumstances. Indeed, as many researchers have argued (e.g., those cited above in support of STRESS-TO-WEIGHT), subsequent linguistic development supports the argument that vowel lengthening under stress resulted from reanalysis of the Latin Stress Rule. As stressed vowels did not diphthongize in Hispano-Romance, NODIPHTHONG must dominate *LONG-VOWEL. (Diphthongs from the destruction of hiatus did exist, but FAITH allows this.) The lengthening that this ranking permits affected all vowels in Hispano-Romance.[9]

(5.) Vowel lengthening in Hispano-Romance.

/prado/ ‘prarie’ (/sɛte/ ‘seven’ /mesa/ ‘table’ /ida/ ‘departure’ /duro/ ‘hard’ /odio/ ‘hatred’ /bɔno/ ‘good’)	STW	NODIPHTHONG	*LONG-V
a) prado (etc.)	*!		
b) praa̯do (etc.)		*!	
c) praado (etc.) ☑			*

Considering representative /prado/, we see that candidate (a) is maximally faithful to the input, but does nothing to meet the requirement of dominant STW that stressed syllables must be heavy; it is therefore eliminated from consideration. The remaining candidates add a mora to satisfy STW. However, candidate (b) is eliminated by the higher ranking NODIPHTHONG. Candidate (c), with lengthened vowel, is optimal. The same holds of /sɛte/, /ida/, /mesa/, /duro/, /odio/ and /bɔno/: lengthening is favored over diphthongization. These Hispano-Romance forms were maintained into Galician/Portuguese, but Old Spanish came to favor diphthongization of the open mid vowels /ɛ, ɔ/. This is treated in the following section.

3.2.1.2 Diphthongization of /ɛ, ɔ/ in Old Spanish. We know from the earliest documents in Old Spanish that tonic /ɛ, ɔ/ diphthongized, and some scholars (including Menéndez Pidal and Penny) argue that there was first lengthening, as claimed above for all tonic vowels. Increased duration would allow for greater opportunity for the vowel to be articulated heterogeneously, but length alone is insufficient to cause diphthongization (Donegan 1985:210, 218).

An important factor yet to be considered is that it is only the lax vowels that diphthongize in Old Spanish; lengthened tense vowels are stable. This is a frequent crosslinguistic pattern, as Donegan and others have shown. Specifically, in vowel inventories of the world, there is a strong correlation between tense and long vowels, on the one hand, and lax and short vowels on the other. For instance, 'long' and 'lax' do not cooccur (except in low vowels) in many languages (e.g., Classical Latin, Samoan), nor do 'short' and 'tense' (e.g., Lithuanian, Kurdish, Khasi) (Donegan pp. 93-4; see also Moulton 1962:67, Wängler 1969:3, 11 and Benware 1986:51 for German). Furthermore, long vowels are especially susceptible to tensing, as both the historical development of many languages (e.g., English, the German of Berne and Zurich, Scandinavian languages, Classical Latin, Hindi) and synchronic alternations in others (e.g., Hungarian, Kalispel and Palestinian Arabic) bear out (Donegan, p. 116).

Given the common tendency for long lax vowels to be disallowed, I propose to formalize this restriction as the following constraint:

(6.) *LONG-[-ATR]

$$\begin{array}{c} *V_{\mu\mu} \\ | \\ [\text{-ATR}] \end{array}$$

'Long lax vowels are disfavored.'

(Based on Donegan, Moulton, Wängler, Benware)

Such a constraint is active in those languages that disallow long vowels from being lax. As Donegan states, long vowels are especially susceptible to tensing because their greater duration allows time for the articulation of the tongue to reach the more extreme positions associated with their articulation (p. 118). This occurred in Germanic, where lengthened lax vowels diphthongized with great frequency in stressed syllables (Donegan, p. 219). An example from Modern German also illustrates this. In northern Germany, [e:] is substituted for /ɛ/ because "it is as if an open, lax vowel were believed to be contrary to the rules of vowel length. Length is generally associated with close, tense articulations" (Wängler, p. 11).

Here I follow Penny (1991:43-4) and Lloyd (1987:128) in assuming that at a historical stage subsequent to the reanalysis of the Latin Stress Rule (but still before the appearance of the first documents written in Old Spanish), the muscular tension associated with the added length led the two ‘halves’ of the long lax ([-ATR]) vowel to differ a bit in quality from one another, probably first [eɛ, oɔ]. (See Donegan, pp. 142-43 for the same claim that ‘dissimilative tensing’ occurred in Finnish, Old French, the Finca Valparaiso dialect of Pokomchi (Quichean) and pre-Old High German.) How might this situation arise in Old Spanish but not Galician/Portuguese?

One possibility is suggested by a host of evidence that appears to indicate that the stress accent of pre-Galician/Portuguese was weaker than that of pre-Old Spanish.

(7.) Evidence suggesting a less intense stress accent in pre-Galician/ Portuguese (Williams, pp. 11-13, 53, 56-57, 78, 87-88):

(a) Less syncope:

Latin	***Galician/ Portuguese***	***Spanish***	
-ABILEM	*-ável*	*-able*	'-able'
ANGELUM	*angeo* (> *anjo*)	*ángel*	'angel'
BIFERAM	*bêbera*	*breva*	'early fig'
CAPITULUM	*cabidoo* (> *cabido*)	*cabildo*	'chapter'
CUBITUM	*covedo* (old)	*codo*	'elbow'
DEBITAM	*dívida*	*deuda*	'debt'
DECIMUM	*dízimo*	*diezmo*	'tithe'
*DUBITAM	*dúvida*	*duda*	'doubt'
DURACINUM	*durázio*	*durazno*	'peach'
FRAXINUM	*freixeo* (> *freixo*)	*fresno*	'ash tree'
-IBILEM	*-ível*	*-ible*	'-ible'
JUVENES	*jovẽes* (> *jovens*)	*jóvenes*	'youths'
LEGITIMUM	*lídimo*	*lindo*	'legitimate'/ 'pretty'
PERSICUM	*pêssego*		'peach'
*RETINAM	*rédea*	*rienda*	'rein'

MACULAM	*mágua*	*mancha*	‘stain’
NEBULAM	*névoa*	*niebla*	‘fog’
PERICULUM	*perigoo* (> *perigo*)	*peligro*	‘danger’
POPULUM	*povoo* (> *povo*)	*pueblo*	‘people’
SPATULAM	*espádua*	*espalda*	‘back’
TABULAM	*tábua*	*tabla*	‘table’
(*ADRE)POENITERE	*arrepender*	*arrepentir*[10]	‘to repent’

(d) Slow formation of yod (i.e., the palatal glide [j]):

(i) Indicated by voicing of intervocalic *p* in forms like *saiba* ‘s/he know (subj.)’ (cf. Sp. *sepa* < Lat. SAPIA)

(ii) Lack of attraction (metathesis) in early forms like *sabia* (cf. Sp. *sepa* < [*sajpa] < [*sap^{j}a] < Lat. SAPIA)

(iii) Long retention of syllabic value of *e* in hiatus in forms like *fêmea* ‘female’ (from versification)

(e) Slow formation of wau (i.e., the labiovelar glide [w]):

Indicated by voicing of intervocalic *p* in SAPUIT > *soube*, vs. Sp. *supe* ‘I knew, found out’

(c) Failure of /ɛ, ɔ/ to diphthongize:

c[ɛ]u	c[je]lo	‘sky’
s[ɛ]te	s[je]te	‘seven’
f[ɔ]go	f[we]go	‘fire’
m[ɔ]rte	m[we]rte	‘death’

It has been suggested (e.g., by Williams) that these traits are due to lesser Germanic influence, whose strong accent of intensity (Meillet 1970:38) was slower to take hold in the more geographically distant and isolated territory where Galician/Portuguese was to develop. If this is the case, Germanic influence in Hispano-Romance primarily affected pre-Old Spanish territory, and led to the adoption of their preference for long lax vowels to become tense.

For whatever reason, the constraint disfavoring long lax vowels that had been lower ranked in Late Spoken Latin became more dominant. This is shown below:

(8.) Diphthongization in Old Spanish.

/bɔno/ 'good'	STW	*LONG-[-ATR]	NODIPHTHONG	*LONG-V
a) bɔno	*!			
b) bɔɔno		*!		*
c) boɔno ☑			*	

Reviewing the evaluation of this tableau, we see that both serious candidates have a heavy penult, satisfying STW (candidate (a) does not, and is eliminated from consideration).[11] Notice also that the ranking of NODIPHTHONG and *LONG-VOWEL has remained constant, a necessary assumption given that all other vowels (i.e., the tense vowels and /a/) remained lengthened, and did not come to diphthongize. For these vowels, phonetic conditions never yield a disfavored combination of length and [-ATR], so their lengthened status remains optimal. Put another way, only lengthened lax vowels lead to phonological diphthongization because of their marked status in combining features that are difficult to sustain together for articulatorily grounded reasons (Donegan, p. 118).

When speakers became aware (consciously or not) of this incipient tendency toward fracture, this led to the lexicalization of this alternation (see also Hyman 1976 for 'phonemicization' of incipient phonetic alternations).

Lexicon optimization leads to reanalysis of [oɔ] (< /ɔ/) as /oɔ/ (and /eɛ/ from [eɛ] < /ɛ/). Subsequent dissimilation and lexicon optimization leads to /wo/ (as in Italian; later /we/ in Old Spanish) and /je/.

(This has implications for analyses of Modern Spanish. The current approach suggests that, at least for this stage in the history of Spanish, related pairs like *bueno* 'good' ~ *bondad* 'goodness' and *pienso* 'I think' ~ *pensar* 'to think' are not derived (in the naive sense of this word) from a common base /BON-/ or /PENS-/, but rather that these forms are related in the lexicon in meaning and much phonological form. See Burzio (1997) and Morin (1997) for further discussion of this approach to the relatedness of forms.)

This concludes the exploration of one of the most important reactions to the loss of distinctive vowel length from Latin. In the following sections I explore the other principal response to this loss, the rise of the constraint disfavoring moraic consonants, whose initial results we saw in Chapter 2.

3.3 Evolution of Latin geminate sonorants /nn, ll/ in Hispano-Romance.

$*C_{\mu}$ continues to rise as before, having already eliminated moraic obstruents. The next effect is the reduction of geminate sonorants, which occurred in the 10th or 11th century (Williams 1962, Otero 1971). Results of this simplification, however, differ in the languages under study, and this is related to the retention or loss of /-n-, -l-/, exemplified here:[12]

(9.) Development of Latin /-n-, -l-/:

	Old Spanish	Old Galician/Portuguese	
(a)	(< Lat. /n/)	(< Lat. /n/)	
	bueno	*bom* [bõ]	'good'
	hermano	*irmão*	'brother'
	mano	*mão*	'hand'
	luna	*lua*	'moon'
	tener	*ter*	'to have'
(b)	(< Lat. /l/)	(< Lat. /l/)	
	cielo	*céu*	'sky, heaven'
	filo	*fio*	'thread'
	palo	*pau*	'stick'
	palacio	*pazo*	'palace'
	peligro	*perigo*	'danger'
	caliente	*quente*	'hot'
	silencio	*seenço*	'silence'
	niebla	*névoa*	'fog, mist'
	ángel	*angeo*	'angel'

cabildo	*cabidoo*	'chapter'
pueblo	*povoo*	'people'
espalda	*espádua*	'shoulder (blade)'
tabla	*tábua*	'table'
regla	*régua*	'rule'

Here I extend an argument made in Walsh (1991). He argues that once the Late Spoken Latin simple obstruents underwent lenition by fricativization of the voiced consonants, and voicing of the voiceless ones, the geminates were simplified. This is because, he suggests, long segments may exist only in opposition to their shorter counterparts. The effect of this intuitive notion is that the new simple stops do not merge with the original simple stops. We may now add another theoretical argument in its support.

That is, this is one of the implications of the reasoning presented in Zec (1995) and extended here. Specifically, the presence of long consonants might be taken to imply the presence of long vowels. This is because the moraic status of less sonorous segments entails the moraic status of more sonorous segments.

By extension of this argument, the presence of moraic *n* and *l* should entail the presence of nonmoraic *n* and *l*. In this way, the lack of a simple consonant entails that its moraic counterpart should not exist. The development of /nn, ll/ in Galician/Portuguese is in perfect accord with this line of reasoning.[13]

3.3.1 Simplification of /nn, ll/ in Galician/Portuguese. Given that Latin /-n-, -l-/ had been lost in Galician/Portuguese, the next step-wise rise of $*C_\mu$, the reranking of $*N_\mu$,$*L_\mu$ above MAX/IDENT, leads to simplification of the geminate sonorants /nn, ll/. As a result of the new dominant ranking of $*N_\mu$, $*L_\mu$ nasals and laterals have lost their ability to bear a mora, and their length is lost. By lexicon optimization, the lack of long nasals and laterals on the surface results in the elimination of the mora from the input. That is, lexicon optimization leads to /n, l/ from [n, l] (< /n_μ, l_μ/). (Additionally, for younger speakers forming their grammar, the lack of evidence that nasals and laterals may be moraic also affects the reranking of $*N_\mu$, $*L_\mu$ from their initial position.)

3.3.2 Palatalization of /nn, ll/ in Old Spanish. Latin /-n-, -l-/ were retained in Old Spanish, however, and this affects the evolution of /nn, ll/. As mentioned above, the next step-wise rise of $*C_\mu$, the rise of $*N_\mu$,$*L_\mu$ above MAX/IDENT, will cause the loss of the moraic status of /nn, ll/, and might be expected to yield /n, l/. Although /nn, ll/ were the only remaining long consonants in Old Spanish, they cannot simply lose their moraic status without occasioning merger, and they palatalized for some still unclear reason.

Penny (1991:71-2) suggests that simplification takes place in spite of the retention of *n* and *l*, with the resulting phonemes coming to differ in one of their features 'no doubt' in order to preserve the distinction between /n, l/ and simplified /nn, ll/. He seems to be suggesting, therefore, that /nn, ll/ became simple /ñ, ʎ/ directly.

Lloyd (1987:243) states that /nn, ll/ are phonetically strong or fortis in articulation, and that because of their relative frequency, merger with simple /n, l/ would have produced many confusions. He suggests that this fact would have helped incline speakers to seek another solution, such as a change in articulation, which would maintain contrast. Since geminates are produced with greater articulatory force, this force could be realized in some way other than simply prolonging the contact of the articulators. For instance, the tongue could spread out in its contact with the alveo-palatal region, and as a result this palatal quality would be sufficient to distinguish the simplified segments from originally-simple /n, l/.

As in the analysis in Chapter 2, once such a phonetic distinction exists between simple and long segments (here, sonorants), the redundant feature (that is, duration) could be lost; indeed, this is favored for reasons of economy, as suggested previously.

How might such a phonetic distinction come be established? Here I suggest an explanation along the lines of what Lloyd intimates.

In the production of the geminates /nn, ll/ a certain amount of energy is expended, and this is realized as length in [nn, ll]. With the gradual rise of $*C_{\mu}$, however, we should expect to see that /nn, ll/ become short. Indeed, this is the case in both Old Spanish and Galician/Portuguese. In Galician/Portuguese, on the one hand, /nn, ll/ become simple /n, l/. Given that original intervocalic /n, l/ had been lost in most cases, little to no confusion ensued.

Likewise for Late Hispanic Latin, when voiceless geminate obstruents /pp, tt, kk (ff, ss)/ simplified, original /p, t, k (f, s)/ had voiced to /b, d, g (v, z)/ (e.g., CUPPA 'cup' > *copa*, GUTTAM 'drop' > *gota*, PECCATUM 'sin' > *pecado*, vs. LUPUM 'wolf' > *lobo*, ACUTUM 'sharp' > *agudo*, DICO 'I say' > *digo*, CASAM 'house' > *ca*[z]*a*, STEPHANUM > *Esté*[v]*an*), and little confusion arose because original /b, d, g/ had become [β, δ, γ] (which frequently deleted intervocalically, e.g., CREDO 'I believe' > *creo*, REGINAM 'queen' > *reína*). When the infrequent voiced geminates /bb, dd, gg, mm/ simplified, merger occurred with /b, d, g, m/, though the number of cases is quite reduced (e.g., *INADDERE 'to add' > OSp. *eñadir*; FLAMMA 'flame' > *llama*; from Lloyd, p. 243).

/nn, ll/, however, occurred in many more words than the other voiced geminates. As we just saw above, /nn, ll/ were simplified directly to /n, l/ in Galician/Portuguese, with no great confusion resulting because original /n, l/ had been elided. In Old Spanish, on the other hand, /n, l/ were retained, and plain simplification of /nn, ll/ would have resulted in many more confusions than in Galician/Portuguese. As Lloyd states, this seems to have inclined speakers to find a different resolution to the possibility of merger. It appears, therefore, that merger avoidance was indeed a factor in the evolution of Sp. /nn, ll/.

As Lloyd suggests, one way of maintaining the distinction between simple and geminate nasals and laterals in the face of reduction of length was to modify the articulation of the geminates; the articulatory force originally spent on prolonging contact of the articulators now being spent on enlarging the region of contact between the tongue and the roof of the mouth. A palatal quality would result, and this new pronunciation would be sufficient to distinguish simplified /nn, ll/ from /n, l/.

This seems like a plausible line of reasoning. To try to capture this in theoretical terms I suggest the following: Geminates are intervocalic consonants with moraic status. This mora adds weight to an otherwise short consonant, and in implementation yields length, at least when intervocalic. A certain amount of energy is required to manifest this mora, and in production, length and energy are correlates of this unit of weight (i.e., the mora).

While the change from geminate to simpleton is phonologically abrupt, simplification was surely a gradual process, with originally long segments only eventually being realized with the same length as short ones. Most likely in order to avoid confusion between /nn, ll/ and /n, l/, the listener seems to have decoupled the correlates length and energy; as a result, the listener has in effect isolated energy as a manifestation of geminate status. Subsequently, as length is reduced via the erosion of the mora, this energy is maintained in spite of the loss of length (and weight). Thus, the same amount of energy is deployed at all times and at all stages of the production of /nn, ll/. Showing only /nn/ here, the stages that these segments underwent may be something like the following: /n_{μ}/ → [nn]... (fully long, fully alveo-dental) → [nn^{j}] (almost fully long, beginnings of palatalization)...→ [n^{j}(n)] (not as long as before, but correspondingly more palatal)...[ɲ] (fully palatal, fully short). (/l_{μ}/ would have undergone the same series of stages to arrive at /ʎ/.) At all stages in the loss of length, original energy is preserved, but in the end it is all expended in a short and palatal segment. Because of the lack of danger of significant confusion between these long and short segments in Galician/Portuguese, however, the energy originally associated with length is not maintained in new short /n, l/.[14]

To conclude, whereas before I stated that a redundant feature may be reduced once the maintaining of contrast is ensured (or at least maximized), here it appears that reduction of length and creation of the new distinguishing feature went hand in hand. That is, loss of length forced a phonetic change to occur, not the reverse, that a phonetic change favored loss of length (as argued for loss of Latin vowel length above: length was lost once quality differences had been phonologized).

An intermediate position is possible as well, that once length began to be lost and the very earliest stages of palatalization had been established, a symbiotic relationship ensued that favored further reduction of length and consequently further palatalization. This cycle could have continued until fully short length and complete palatalization had been attained. (A similar point is made by Lloyd (p. 144) in discussion of the processes of lenition that affected Latin obstruents.)

In either case, the rise of $*C_{\mu}$ is complete: Old Spanish no longer has long consonants, having now a phonemic inventory that is uniformly simple or short.[15]

3.4 Summary of constraints, rankings and classes of moraic segments in Hispano-Romance. By way of summary, I schematize here the changes that affected the seven-vowel system of Late Spoken Latin and the geminate sonorants /nn, ll/:

(10.) Constraints and rankings in the evolution of Hispano-Romance /ɛ, ɔ/:

(a) Hispano-Romance:

- STRESS-TO-WEIGHT >> DEP ('no insertion')

  (tonic vowels lengthen; see (5))

- STRESS-TO-WEIGHT >> NODIPHTHONG >> *LONG-VOWEL

  (lengthened vowels do not diphthongize)

- STRESS-TO-WEIGHT >> NODIPHTHONG >> *LONG-[-ATR]

  (lax vowels lengthen, do not diphthongize)

(b) Galician/Portuguese:

Same as Hispano-Romance.

(c) Old Spanish:

- STRESS-TO-WEIGHT >> DEP (‘no insertion’)

  (tonic vowels lengthen; see (5))

- STRESS-TO-WEIGHT >> *LONG-[-ATR] >> NODIPHTHONG

  (lax vowels may not be long, and diphthongize; see (8))

- STRESS-TO-WEIGHT >> NODIPHTHONG >> *LONG-VOWEL

  (tense vowels (and /a/) lengthen, do not diphthongize)

(Lax long vowels come to be prohibited, perhaps due to greater influence of Germanic, where *LONG-[-ATR] dominant.)

(11.) Evolution of geminate sonorants /nn, ll/:

	Surface Forms (Output)		**Underlying Representations (Input)**	**Constraint rankings**
Late Spoken Latin:	nn, ll	=	n_μ, l_μ	(MAX/IDENT >> $*N_\mu$,$*L_\mu$)
Galician/Portuguese:	n, l	<	n_μ, l_μ	($*N_\mu$,$*L_\mu$ >> MAX/IDENT)

(/n, l/ were lost in intervocalic position, so simplification occurred without merger; in the modern languages, /n, l/ are now UR.)

pre-Old Spanish:	ɲ, ʎ	< ... <	n_μ, l_μ	($*N_\mu$,$*L_\mu$ >> MAX/IDENT,

gradual palatalization via
spreading out of articulators)

Old Spanish and Modern Spanish:	ɲ, ʎ	=	ɲ, ʎ

(Retention of Latin /n, l/ inhibits simplification of /nn, ll/ to /n, l/ because many mergers would have resulted; instead, in the process of loss of length, original energy associated with the articulation of geminates is maintained by spreading out the region of contact of the tongue with the roof of the mouth. A progressively shorter and more palatal segment results, until reaching Old Spanish [ɲ, ʎ].)

Returning to the sonority classes, and therefore classes of moraic segments, discussed in Zec (1995), the evolution of these classes (from maximally permissive to maximally restrictive) is as follows:

(12.) Sonority classes from Latin to Old Spanish and Galician/Portuguese:

(a) Latin:

μ = unrestricted

(thus vowels, sonorants and obstruents may be moraic)

(b) Hispano-Romance:

μ = [+sonorant]

(thus only vowels and sonorants may be moraic)

(c) Old Spanish, Galician/Portuguese:

μ = [-consonantal]

(thus only vowels may be moraic)

3.5 General summary and conclusions. I now recapitulate the principal findings of this chapter. A constraint STRESS-TO-WEIGHT gives rise to lengthened tonic vowels in Hispano-Romance; later, pre-Old Spanish came to diphthongized lengthened lax vowels (perhaps due to more Germanic influence, including the high ranking of *LONG-[-ATR]). Subsequent dissimilation and lexicon optimization led to /je, we/. Interaction and reranking of the limited number of constraints given above (STRESS-TO-WEIGHT, *LONG-VOWEL, *LONG-[-ATR], NODIPHTHONG) achieved these results.

In addition, we saw that simplification of the geminate sonorants /nn, ll/ by the rise of $*C_{\mu}$ with respect to MAX/IDENT yielded /n, l/ in Galician/Portuguese (because of loss of original /n, l/), but /ɲ, ʎ/ in Old Spanish (which had retained Latin /n, l/). Palatalization appears to have occurred because the listener-speaker wanted to avoid merger, which was not a danger for speakers of Galician/Portuguese.

I now summarize the steps that were taken in effecting the historical changes analyzed in this chapter:

The reanalysis of the Latin Stress Rule that accompanied the loss of distinctive vowel length in turn leads to the rise of $*C_\mu$ to reestablish the implicational relationship between sonority classes and the class of moraic segments (extending Zec 1995). A principle of STRESS-TO-WEIGHT is established, and (possibly) heavy Germanic influence in Castilian territory establishes the restriction that long vowels may not be lax. Suggestive evidence that this is the case is a host of conservative traits in Galician/Portuguese that may be attributed to the lesser Germanic presence there during the critical formative period (Williams 1962).

The eventual rise of $*C_\mu$ versus MAX/IDENT leads to simplification of /nn, ll/ to /n, l/ in Galician/Portuguese. Because Latin /n, l/ had been lost in intervocalic position, no merger resulted. At this stage all geminate sonorants have been eliminated from Galician/Portuguese, and the work of $*C_\mu$ is finished. That is, the situation no longer exists in which the language possesses underlyingly moraic consonants but not vowels. Simplification-cum-palatalization in Old Spanish indicates that $*C_\mu$ has completed its ascension above MAX/IDENT in Old Spanish as well.

The end result of these changes is that Old Spanish and Galician/Portuguese arrive at consonant inventories composed entirely of simple segments, having no mismatch with those segments that could be distinctively long (vowels and consonants in Latin, only sonorants in Early Hispano-Romance, none in Old Spanish and Galician/ Portuguese). Systemic parity has been reestablished.

Throughout the course of these developments, the listener is argued to have lexically optimized the output forms, minimizing predictable constraint violation. It was also suggested that increased dominance of a constraint leads to elimination of evidence of its effects for the subsequent generation. That is, lack of a particular surface form provides evidence to younger speakers that the constraint is inactive. During the process of acquisition, then, it may be the case that the original ranking of the constraint is unaltered.

The results obtained here reaffirm the position of previous researchers with respect to the role of the listener (Ohala, most notably), and incorporate this intuition into the theoretical machinery of Optimality Theory.

Notes to Chapter 3

1 There is little to say about the reduction of the other geminate sonorant, /rr/: Even in Latin, /-r.r-/ was probably pronounced as the multiple trill [r̄], as in Modern Spanish (see Lloyd 1987:246 for discussion). Under the analysis to be presented below, the (lexicalized) simplification of /rr/ to /r̄/ must have occurred by or at the time that /ll/ was reduced (because they are of the same sonority class). (This occurred around the tenth century.) However, given the pronunciation [r̄] in Late Latin, lexicalized /r̄/ may be much earlier, though probably after the period when the Latin Stress Rule came to be reanalyzed. This is because even though /rr/ may have been pronounced as [r̄-] (syllable-initial only), a penult with /-r.r-/ acted as heavy and attracted stress. Once the Latin Stress Rule was reanalyzed (and stress became a distinctive feature), [r̄] could become /r̄/ without affecting stress placement.

For historical discussion, see Mattoso Câmara 1972:38, 42-3 and Penny 1991:71-2; for theoretical approaches, see Harris 1983:62-71 for a generative account of Modern Spanish [r̄], and Morales-Front 1994a for an OT analysis.

2 There are a few Portuguese words with *nh* (=[ɲ]) whose Latin etyma contain /nn/: *antanho* ‘yesteryear’, *penha* ‘rock, cliff’ and *estanho* ‘tin’. However, these are loans from Spanish (Williams 1962:75).

3 There are a few Portuguese words with *lh* (=[ʎ]) whose Latin etyma contain /ll/: *brilho* ‘brightness, splendor’, *grilho* (old) ‘cricket’, *cavalheiro* ‘gentleman’ and *castelhano* (OPtg. *castelhão*) ‘Castilian’. These are borrowings from Spanish (Williams 1962:74).

4 This chapter is a much revised and expanded version of Holt 1996a, and the views presented here supersede those given in that work. The establishment here of a connection between these data and those of Chapter 2 (both as results of the rise of $*C_{\mu}$) and further consideration of certain theoretical issues has led to major changes.

5 A full discussion and analysis of the Latin Stress Rule and of the metrical system of Hispano-Romance is well beyond the scope of this dissertation. The summary remarks given here should suffice for present purposes. I should note that in Latin disyllabic words with light penults were accented on the penult as well. Once speakers establish a correlation between stressed syllables and bimoraicity and this supplants their former accentual system, I assume that disyllabic words with light penults would undergo allophonic lengthening of the stressed syllable as well. For arguments that tonic vowels were lengthened in Late Spoken Latin, see, inter alia, Penny 1991:43-4.

6 Hyman 1976 considers phonological change to be perception-oriented, even though the seeds for a change may be articulatory (p. 416). The case cited here is parallel to cases that Hyman describes as ‘phonemicization’ by the listener of phonetic-cum-phonological processes that involve segments and tones. The example given here would be a case of phonemicization at the metrical level, here instantiated by the ‘activation’ or promotion of the universally available constraint requiring that stressed syllables be heavy.

7 See also Donegan 1985, Sherer 1994:ch. 2:53, Rosenthall 1994, and Fitzgerald 1997. For Modern Brazilian Portuguese, Girelli 1988:82 also assumes that a stressed vocalic nucleus has branching structure.

The motivation for such a principle may be due to reasons of positional faithfulness (see Beckman 1997). That is, phonological contrasts are preferentially maintained in privileged linguistic positions of phonetic prominence (e.g., stressed syllables, onsets and long vowels). Here, phonetic prominence is instantiated by duration. Beckman argues that these positions have a functional advantage in perception and/or lexical access.

8 Borowsky et al. 1984 posit a similar rule for Danish. Their gemination rule (18) provides an additional grid position to syllables under stress. They note that this is a condition that holds in Yupik Eskimo, Italian and Biblical Hebrew as well. (Morén 1997 cites a similar restriction in Icelandic.) Depending on language-particular parameters, either a long vowel or a geminate results.

9 The lengthening that is argued to have begun with the reanalysis of the Latin Stress Rule is still active in the modern languages under discussion. For Spanish there is experimental evidence that tonic vowels are lengthened (Navarro Tomás 1957:199-206, 1968:50); likewise, studies of Portuguese show that stressed vowels are lengthened as well (Sá Nogueira 1958:37). (The same holds of open syllables in Modern Italian; see Castiglione 1957:17, Companys 1963:15.)

10 Additionally, this last pair of words also appears to show that the spread of syncope was slower in Galician/Portuguese territory, since intervocalic /-t-/ had already voiced to /-d-/. For an alternative analysis, cf. Menéndez-Pidal 1982:§54, where he attributes the *t* of the Spanish form to learned influence.

11 This is a simplified account for expository purposes. For winning candidate (c) another constraint requiring that elements of a nucleus share features yields [uo]. Such a constraint is proposed in Morales-Front and Holt 1997 to account for complex Portuguese nasal alternations analyzed there. Later, speakers favored an increase in the perceptual distance between the two vowels, and dissimilation yields the unmarked vowel [e]. Diphthongizing /ɔ/ therefore yields [we]. Likewise, diphthongizing /ɛ/ yields [je]. See Morales-Front 1994 for a more detailed OT approach. See also Penny 1991:43. For a

general approach to syllable-structure constraints, see Rosenthall 1994:ch. 1, where potentially relevant to present discussion, he formulates constraints that favor rising or falling sonority (SONRISE and SONFALL, respectively).

12 The motivation for such loss is unclear. Alarcos Llorach 1971:249-50 proposes that the drive to eliminate geminates forced loss of simple /n, l/ (as it supposedly motivated the spirantization of voiced obstruents and the voicing of voiceless ones). Why Old Spanish did not do the same remain unexplained under such an account.

Williams 1962:69 claims that /-l-/ was first gutturalized to [ɫ], then lost. In a similar vein, Entwistle 1975:288 suggests that *l* may have been construed in the same syllable as the preceding vowel (e.g., *pal-o*), and then have taken on the velar quality that resembles *u*, before being completely assimilated to the vowel. Brandão de Carvalho 1988 proposes a similar analysis for loss of *n*, *l*, and he assumes that *irmano*, too, passed through a stage of 'implosive' pronunciation (i.e., [*ir.maŋ.o]). On loss of *n*, *l* in Modern Portuguese pluralization, see Morales-Front and Holt 1997, where we attributed loss to a process of nucleation (Colman 1983).

13 The 'pull-chain' approach advocated in Walsh 1991 is in contrast to the 'push-chain' approach of Penny 1991:65-72. Penny suggests that the process of lenition began with the simplification of geminates, with a host of other changes occurring either simultaneously or subsequently. For Galician/ Portuguese, Alarcos Llorach 1971:249-50 likewise proposes a push-chain analysis, arguing that the simplification of the geminates forces the loss of 'weak' /n, l/.

I leave for future research exploration of the hypothesis that minute phonetic differences in short and long obstruents became phonologized as a result of the loss of the long segments' moraic status. That is, perhaps spirantization of voiced obstruents and voicing of voiceless ones are a result of simplification of geminate obstruents. In other words, lenition as a whole may be a push-chain after all.

Well beyond the scope of this dissertation is the implementation of a mechanism of merger avoidance, on which up to this point I have not had to rely (other than assuming that the rise of $*C_{\mu}$ is gradual and step-wise). For one possible interpretation, I refer the reader to Padgett 1997. Building on Flemming's 1995 Dispersion Theory, he couches in OT terms the structuralist notions of maximization of perceptual distinctiveness in contrast and minimization of articulatory effort (Saussure 1959, Martinet 1964). He suggests that candidate outputs are systems of contrasts, not individual words.

14 In Holt 1996a I appealed to a constraint SONCODA=[DORSAL] ('sonorant codas are preferably dorsal'), inspired by Trigo 1988:21, 46, and motivated by sonority dispersion (Clements 1990). (Coda dorsals show more vowel-like

transitions, and so they minimize the fall in sonority from peak to coda more than labials and coronals would, at least according to some structure-based theories of sonority.) Additionally, I followed Keating 1988 and Lipski 1989 in assuming that palatal segments consist of both [coronal] and [dorsal] articulations; Hanoi Vietnamese, cited in Rice 1996:511, might be taken as supporting evidence: dorsals /k/ and /ŋ/ are realized as [c] and [ɲ] after the distinctively front vowels /i/ and /ê/.

However, the use of SONCODA=[DORSAL] raises many questions, such as why it would be active in Spanish but not Galician/Portuguese, why it was not active in Latin, how it came to be active in Spanish just at the moment it was needed to avoid merger of /nn, ll/ by creating /ɲɲ, ʎʎ/, etc. (Assignment of [dorsal] to coronal /nn, ll/ would yield long palatals, later simplified.) Also, syllable-final simple /-n, -l/ did not become /-ɲ, -ʎ/, so some appeal to original length and energy appears to be required under this account as well.

A potentially valid use for a constraint SONCODA=[DORSAL] is in languages that velarize /-l/, such as Catalan, Portuguese and English. See the appendix to this chapter for discussion of such a constraint in explaining the coarticulated nasal and later codas of certain varieties of Andalusian and Caribbean Spanish.

15 The results obtained here, that all moraic consonants were lost in the history of Spanish and Portuguese, has repercussions for the analysis of stress assignment in the modern languages. The evidence adduced here might be taken to support the position of those who have argued that Modern Spanish stress assignment is not sensitive to moras, though the parent language Latin was (as in Roca 1990 and Morales-Front 1994a). The great similarity in stress patterns between Spanish and Latin, under this scenario, is due to their historical link. Modern forms that show antepenultimate stress even when the penult is heavy (e.g., native *Frómista* and borrowed proper names like *Washington*, *Jefferson*, etc.) are allowed, though they would have been prohibited by the Latin Stress Rule that Modern Spanish seems to follow quite closely in other respects. I leave further exploration of the consequences of the present analysis for future research.

APPENDIX TO CHAPTER THREE

COARTICULATED NASAL AND LATERAL CODAS

IN ANDALUSIAN AND CARIBBEAN SPANISH

0. Introduction. In a previous treatment of the development of geminate sonorants in Old Spanish (Holt 1996a), I appealed to a constraint SONCODA=[DORSAL]. After fuller consideration of the ramifications of the use of this constraint, however, it appears untenable that SONCODA=[DORSAL] is a factor in the palatalization of Sp. /nn, ll/.

Nonetheless, there is evidence from other aspects of Spanish and Portuguese that SONCODA=[DORSAL] does indeed exist. Obvious support for this constraint comes from velarization of coda nasals and laterals. Additional support may come from tha coarticulation of coda nasals and laterals that is characteristic of certain varieties of Modern Spanish.

An informal definition of the constraint under discussion is given here:

(i) SONCODA=[DORSAL]

‘Sonorant codas are preferably dorsal.’

(Inspired by Trigo 1988:21, 46)

The motivation for such a constraint is that the transitions of coda dorsals are more vowel-like than labials or coronals (Trigo, 21, 46); consequently, coda dorsals minimize the fall of sonority (see Clements 1990 on sonority dispersion). As such, this constraint appears to be part of a family of sonority-based constraints. The effect of this constraint is that sonorant codas that do not already bear the feature [dorsal] will be assigned it by GEN. With the sufficiently high ranking of this constraint, only sonorant codas that are dorsal will be selected as optimal according to EVAL. The case of velarization of /-l/ to [-ɫ] (as in Catalan, Portuguese and English) is easily explained in this way.

Further support comes from the data discussed below.

1. Coda nasals. As described in Guitart (1976), certain dialects of coastal and Caribbean Spanish exhibit characteristics in nasal assimilation that differ from those of standard Spanish. In these dialects standard nasal-obstruent place assimilation interacts with coda velarization:

(ii) Caribbean nasal assimilation.

un boleto	*u*[m/ŋ]*boleto*	'a ticket'
un francés	*u*[ɱ/ŋ]*francés*	'a Frenchman'

Under the analysis given here, the assignment of [dorsal] to the coda takes place in spite of the fact that the nasal has assimilated to the following obstruent. This is reflected in the high ranking of SONCODA=[DORSAL].

(iii) Creation of coarticulated nasal codas.

/un boleto/	SONCODA=[DORSAL]	ASSIMILATION
u[nb]oleto	*!	*
u[mb]oleto	*!	√
u[ŋb]oleto	√	*!
u[m/ŋ]boleto ☑	√	√

The first two candidates do not velarize the coda nasal, and so are eliminated from consideration. The third candidate velarizes the nasal, but fails to undergo nasal place assimilation. Only the last candidate satisfies both constraints, and so it is the optimal output in these dialects.

2. Coda laterals. A similar phenomenon occurs with syllable-final laterals. As is well known, there is often confusion or neutralization of syllable-final /r/ and /l/ in certain regions of Andalucia and the Caribbean, most famously Puerto Rico. As Amado Alonso (cited in Zamora Vicente 1989:315) states, the confusion of *r* and *l* yields a segment that is ‘fonéticamente mixto’ (‘phonetically mixed’), as in *Puer̲to Rico*, *al̲ma* ‘soul’, *ar̲ma* ‘weapon’.

Here I would like to suggest that the same process of velarization that affects syllable-final nasals also affects syllable-final liquids. That is, what has been called neutralization may really be the assignment of the feature [dorsal] to coda /l/ and /r/. The resulting segment would be at the same time neither and both /r/ and /l/, and this ambiguity results in confusion. This is represented as follows:

(iv) Confusion/neutralization of coda liquids.

/-l/	/-r/	SONCODA=[DORSAL]	DEP
-l	-r	*!	
-l/-r ☑	-r/-l ☑	√	* +[dorsal]

This is a schematic and preliminary analysis to be sure, but in principle it allows for unified explanation of both nasal velarization and lateral confusion, which frequently co-occur. The coexistence of these phenomena has been correlated in many dialects, but to the best of my knowledge no previous account has attributed them both to a constraint favoring sonorant codas to be dorsal. I leave a fuller account of these data for a future occasion.

Among unresolved issues is why the assignment of [dorsal] to a coda lateral should yield [-ɫ] in Modern Portuguese but coarticulated (I propose) [-l/-r] in Caribbean Spanish. This may be due to syllable structure constraints that limit the number of place specifications in the coda, or perhaps instead the coalescence of input and assigned place specifications. Another matter arises those varieties of Spanish that velarize /-n/ but maintain /-l/, and from languages like English that velarize /-l/ but maintain /-n/. Coarticulation appears to be the result of the maximal effect of SONCODA=[DORSAL], while dialects and languages with more minimal effect indicate that other constraints (still undetermined) play an important role as well. I leave these issues open here, as there are many unexplored questions, and the structure of these coda laterals is still a matter without clear consensus (though see Walsh 1995 for a very recent attempt to clarify their internal structure).

CHAPTER FOUR

THE ROLE OF COMPREHENSION, REINTERPRETATION AND THE UNIFORMITY CONDITION

4.0 Introduction. In this chapter I continue to develop the thesis that the listener is important, indeed vital in this case, in effecting historical change. As in Chapters 2 and 3, we will continue to see cases of phonologization of phonetic processes and subsequent lexicon optimization to reduce violation of DEP. The continued role of the listener in optimizing phonetics will be shown here to include interpretation of a marked segment as a simpler one based on acoustic equivalency, and the demotion of inactive constraints.

In doing this, I offer an analysis of the development of Latin clusters of voiceless consonant and /l/ that I believe is more explanatory and satisfying than previous accounts because it ties together facts not previously unified. In addition to offering a novel treatment of these data, in the course of the presentation of the analysis I will also consider a number or theoretical issues that have received little or no attention in the OT literature. Specifically, I examine the status and formulation of the Uniformity Condition (Kenstowicz 1994) and address the role of the listener in effecting sound change. Adopting the argumentation given in those sections allows for certain innovations in the analysis of the data treated that I hope will be seen as more explanatory than previous accounts.[1]

4.0.1 Data. As shown in (1), clusters of voiceless consonant /k, p, f/ and /l/ undergo a series of changes during the development of Latin into the various Hispano-Romance dialects:

(1.)		Latin	Spanish	Galician/Portuguese	
(a)					
initial	**CL** (/kl/)	CLAVE	*llave* (ʎ)	*chave* (tʃ)	'key'
		CLAMARE	*llamar*	*chamar*	'to call'
	PL	PLUVIA	*lluvia*	*chuva*	'rain'
		PLANCTU	*llanto*		'weeping'
		PLORARE	*llorar*	*chorar*	'to weep'
		PLAGA	*llaga*	*chaga*	'wound'
		PLICARE	*llegar*	*chegar*	'to arrive'
		PLENU	*lleno*	*cheio*	'full'

	FL	FLAMMA	*llama*	*chama*	'flame'
		FLACCIDU	*llacio*		'lank'
			(later *lacio*)		
(b)					
medial[2]	**CL**	**mancla*[3]	*mancha* (tʃ)	*mancha* (tʃ)	'stain'
		CONCH(U)LA	*concha*	*concha*	'shell'
		TRUNC(U)LU	*troncho*		'stalk'
		HINNIT-*(U)LARE	*reninchar*	*r(el)inchar*	'to whinny'
	PL	IMPLARE	*(h)enchir*	*encher*	'to fill'
	FL	INFLARE	*(h)inchar*	*inchar*	'to inflate'
(c)		**masclo*	*macho*	*macho*	'male, macho'
		AST(U)LA	*astilla*	*acha*	'splinter'; 'ax'
		AFFLARE	*hallar*	*achar*	'to find'; 'to think'
		CICERC(U)LA	*cizercha*		'blue vetch'
		SARC(U)LARE	*sachar*	*sachar*	'to weed'

(For exceptions, see Malkiel 1963-4)

The data can be summarized as follows: In both Spanish and Galician/Portuguese in medial position the result is /tʃ/, while in initial position the two languages differ, with Galician/Portuguese showing /tʃ/ (later /ʃ/), but Spanish showing a different outcome, /ʎ/. Previous authors' proposed derivations are in (2).

4.0.2 Previous accounts. Other researchers have addressed these changes:

(2.) Previous treatments of these data:

(a) Williams (1962):

Cl > Cj > tʃ (*ch*) (only Galician/Portuguese treated)

ex. CLAVE 'key > [*kjave] > *chave*

(b) Bourciez (1967):

Cl > ll > ʎ > tʃ

ex. CLAVE 'key' > [*llave] > [ʎave] > *chave*

(c) Lloyd (1987):

Cl > Cʎ > ʎ (> [tʃ] (*ch*) medially)

(*ch* later generalized to initial position in Galician/Portuguese)

ex. CLAVE 'key' > [*kʎave] > OSp. *llave*, but Gal./Port. *chave*

These proposed derivations have several shortcomings, however. First, Williams treats only Galician/Portuguese, and appears to deny that there was once a stage that unified it with Old Spanish. And although the first stage of his derivation from [Cl] to [*Cj] is analogous to the Italian data in (3)

(3.)	***Latin***	***Italian***	
	FLORE	*fiore*	'flower'
	PLATEA	*piazza*	'plaza'
	PLUVIA	*piove*	'rain'

something more needs to be said to explain why Italian stopped there, and did not develop palatal [tʃ] like Galician/Portuguese.[4] Also unexplained is the difference between the assibilation of /t, k/ + /i, e/, as in *Vicentza* for *Vicentia* (cited in Lloyd

1987:133), and *cena* [t^{s}e:na], and the full palatalization he assumes for the *Cl* clusters in Galician/Portuguese.

Second, Bourciez' account makes the unusual proposal that the initial *Cl* cluster became [*ll] (that is, long [l], not what *ll* represents in Modern Spanish orthography), which then palatalized to [*ʎ]. While long /ll/ did become [ʎ] in Old Spanish, it became simple /l/ in Galician/Portuguese, as in Lat. BELLO 'pretty' > OSp. *bello*, but Gal./Ptg. *belo*. This proposed historical stage of Bourciez', then, cannot be extended to Galician/Portuguese initial *ch*, since a long /l/ did not become /ʎ/ in that language, yet this is the stage that Bourciez claims precedes [tʃ].

Third, the first two authors fail to consider that Upper Aragonese shows /Cʎ/ (where 'C' represents /k, p, f/), and fail to treat Galician/Portuguese as having once shared a stage with Spanish.

In recognizing the importance of the Modern Upper Aragonese data, shown in (4), Lloyd begins to overcome the previous shortcomings, and is able to develop a more unified account of the various Hispano-Romance outcomes.

(4.)		*Latin*	***Upper Aragonese***[5]		
	CL	CLAVE	*cllau*	[kʎ]	'key'
	PL	PLOVERE	*pllover*	[pʎ]	'to rain'

FL	FLAMMA	*fllama* [fʎ]	'flame'

By recognizing the importance of these data, and by assuming that they reflect a stage shared with Hispano-Romance, Lloyd straightforwardly explains the Old Spanish reflexes of [ʎ] in initial position as the simplification of the complex cluster [*Cʎ]. Likewise, the Italian data may be accounted for easily by assuming that simplification of [*Cʎ] was to [Cj], for example Lat. FLORE 'flower' > [*fʎore] > Ital. *fiore*.

Lloyd's analysis is less satisfactory, however, in its treatment of medial position, which developed in both languages to [tʃ]. He states these facts, but does not offer motivation for this change. He assumes that both Old Spanish and Galician/Portuguese underwent the same series of changes, but that subsequently Galician/Portuguese generalized [tʃ] to initial position as well, on the analogy that both are 'strong' positions in the syllable in some sense and that there should be 'allophonic parity' (that is, that *Cl* should have the same pronunciation in all contexts). Why speakers of Old Spanish should not also have favored this allophonic parity is not discussed.

Furthermore, there is a shortcoming in analysis shared by all previous researchers: each assumes some sort of 'magic leap' from /*Cʎ/, /*ʎ/ or /*Cj/ to /tʃ/. That is, it is assumed that a voiceless consonant + front semivowel (in the case of Williams), a voiceless consonant + /*ʎ/ (in the case of Lloyd), or just /*ʎ/ (in the case of Bourciez) develops directly to /tʃ/. However, these are very different sounds, and none of these authors proffers an analysis as to *how* or *why* the situation and change should be as they are. On phonetic grounds many of these proposed changes are hard to justify given that they assume some kind of articulatory or acoustic gap for which no account is given.

4.0.3 Principal issues of this chapter. This chapter provides a unified approach to the outcomes of these clusters in several Hispano-Romance dialects, and provides an explanation for the 'magic leap' previously stipulated. This is based on evidence from within Hispano-Romance as well as parallel phenomena in other languages (discussed chiefly in the first appendix to this chapter). In addition, the present account also raises a number of theoretical issues, some of which are only beginning to be addressed in Optimality Theory:

(5.) Theoretical issues raised in this chapter:

(a) Phonetics → phonology → lexicon, then repeat the cycle (cf. Hyman 1976, Janda 1987)

(b) The Uniformity Condition played a role in this varied development (here construed in OT terms as conjunction of constraints and ranking of conjoined constraints)

(c) The role of the listener in historical change (cf. Ohala, Janson, Jonasson, etc.): Perception and comprehension lead to reinterpretation (here via acoustic equivalence, emergence of the unmarked and lexicon optimization)

(d) Certain similarity of historical change to learning algorithms (Pulleyblank and Turkel 1995a,b,c)

Implications for linguistics in general include the importance of considering phonetic factors in phonological change, and the benefit of, and need to, appeal to data from other related languages as well as language groups not closely related that lend support to the analysis of a given phenomenon. We will see that this is particularly valuable in the present context because we are confronted with a lack of written records that document intermediate historical stages that would validate the analysis to be presented. Specifically, the change from CL, PL and FL to *ll* or *ch* occurred more than a thousand years ago during the preliterary period of Hispano-

Romance and the stages advocated here will necessarily be open to a degree of uncertainty and skepticism. The appeal to general tendencies in other languages, then, allows one to develop and strengthen insights that would seem much less plausible otherwise.

The account presented here also recognizes, indeed presupposes, the importance of the listener, not just the speaker, in effecting sound change. This work, then, serves as additional support for theoreticians to broaden their scope of inquiry and explanation to include phonetic and other factors that have been ignored or downplayed in some previous research.

4.1 A unified approach.

4.1.0 Outline of the present analysis. The present account aims to overcome the shortcomings of the analyses mentioned above. To do so, I take Lloyd's analysis as the point of departure in assuming that the Modern Upper Aragonese forms reflect a stage shared with both Old Spanish and Galician/Portuguese. This shared stage /*Cʎ/ led to OSp. *ll-*, *-ch-* and Gal./Ptg. *ch*. I bridge the phonetic gap that separates [*Cʎ] from [tʃ] by adducing experimental evidence and citing similar processes that occur in Hispano-Romance and a wide variety of languages.

In brief, I will argue that common phonetic processes of assimilation played a major role in the development of these clusters and that certain intermediate stages were reinterpreted by the listener as /tʃ/. Likewise, the simplification of /*Cʎ/ to /ʎ/ that occurred in initial position in Spanish is shown to have also occurred in medial position in both Spanish and Galician/Portuguese. The divergent outcome *ch*- in initial position in Galician/Portuguese is argued here to be consistent with the more conservative nature of this language compared to Old Spanish (see Chapter 2 for discussion), not to generalization of /tʃ/ from medial position to initial position, contra Lloyd (1987).

4.1.1 Analysis of Sp. *ll*, Gal./Ptg. *lh*. I now offer my analysis of the series of changes that transformed Lat. *Cl* clusters to Old Spanish initial *ll*-, Old Spanish and Galician/Portuguese medial -*ch*- and Galician/Portuguese initial *ch*-.

The first stage has traditionally been taken to be the regressive assimilation of /l/ to /k/, yielding [*kʎ]. The articulation of /l/ is drawn toward the velar region where /k/ is pronounced, and a palatal sound is produced:

(6.) First proposed historical stage: *Phonetic assimilation*. /kl/ > [*kʎ]

(Hispano-Romance, medial position; later also initial position in pre-Old Spanish. See below for factors supporting this chronology.)

Hispano-Romance forms:			Later, also in pre-Old Spanish:		
*MACULA	> [*maŋkla]	> [*maŋkʎa]	CLAMARE	[klamar]	> [*kʎamar]
AURICULA	> [*orekla]	> [*orekʎa]	CLAVE	[klave]	> [*kʎave]

The view that it is these clusters that palatalized first is supported by Rumanian data:

(7.)	***Latin***	***Rumanian***	
	CLAVE	*cheie* [k-]	‘key’
but	PLUVIA	*ploaie*	‘rain’

The fact that only the /kl/ clusters palatalized, leaving /pl, fl/ unaltered, is generally taken as supporting the assumption that this was the first step (see Tuttle 1975:427, Lloyd 1987:224).

I assume that this begins as a phonetic process, but is then phonologized and lexicalized by the listener.[6] As we saw in Chapters 2 and 3, this means that what begins as a product of phonetics induces changes in the grammar and lexicon. Here, articulatory lag is encoded into the phonology by the addition by GEN of [dorsal] to the input /l/, with palatal [ʎ] now a result of the phonology. (Recall from Chapter 3 that I follow Keating 1988 and Lipski 1989 and assume that palatals are complex corono-dorsal segments.) These output forms allow for further potential processes to occur and thus effect the next historical change.[7]

That is, next the listener optimizes his or her lexicon by storing as input forms those that will increase the harmony of the grammar by reducing gratuitous constraint violation (here, faithfulness constraints). Concretely, the feature [dorsal] that is inserted to yield [ʎ] is incorporated into the underlying representation of words that have been affected. Thus, when /kʎave/ is submitted to EVAL, it will no longer violate DEP-[DORSAL]. This is in accord with the Synchronic Base Hypothesis of Hutton (1996) discussed in Chapter 1.

Continuing the presentation of the chronological order of changes, it is not only CL but also PL and FL that developed to /tʃ/ or /ʎ/. The extension of palatal [ʎ] to the clusters /pl, fl/ cannot be attributed to the same mechanism of phonetic assimilation, however, because the initial consonant of these clusters is produced with the lips, not the hard palate. There is therefore no phonetic factor that would motivate the change from /l/ to [ʎ].

We know that in these clusters /l/ became [*ʎ], and that the explanation for this change is not a phonetic one. The change must be an analogical one, therefore, and this has been the generally accepted assumption. Analogy here serves to unify the allophones of /l/ that occur after these voiceless obstruents:

(8.) Second proposed historical stage: '*Allophonic unification.*'[8]

/pl, fl/ > [*pʎ, *fʎ] by influence of /*kʎ/ (Tuttle 1975:407-8)

That this is a plausible assumption is suggested by the fact that /*kʎ/ was the most frequent *Cl* cluster. As such, it could have served as a robust model for analogical change: [*ʎ] is thus extended to /*pʎ, *fʎ/, as in Modern Upper Aragonese *pllover*, *fllama*.

The predominant source of /*kʎ/ was reduction of the diminutive suffix -ICULUS > -CLO (Repetti and Tuttle 1987:81, Wireback 1996a), e.g., OVICULA > [*ovekʎa]. Given the dorsality of GL clusters, it is likely that they were also pronounced [*gʎ] and likewise served as an additional impetus for this analogical change. Additional examples are given below (I show the complete historical derivation up to this stage for only the first example):

(9.) /*kʎ/ as model for 'allophonic unification' of /pl/, /fl/ to /*pʎ/, /*fʎ/:

(a)	AURICULA (for AURIS) > [*orek'la] > [*orekʎa]	'ear'
	(Sp. *oreja*, Ptg. *orelha*)	
	OVICULA (for OVIS) > [*ovekʎa]	'sheep'
	(Sp. *oveja*, Ptg. *ovelha*)	
	APICULA (for APIS) > [*abekʎa]	'bee'
	(Sp. *abeja*, Ptg. *abelha*)	
	CLAVICULA (from CLAVE) > [*k(l)avekʎa]	'peg, pin'
	(Sp. *clavija*, Ptg. *cavilha*)	
	OCULUS > [*okʎo]	'eye'
	(Sp. *ojo*, Ptg. *olho*)	
	SPECULUM > SPECLUM > [*espekʎo]	'mirror'
	(Sp. *espejo*, Ptg. *espelho*)	
	VETULUS > VECLUS > [*vɛkʎo]	'old'
	(Sp. *viejo*, Ptg. *velho*)	
	LENTICULA > [*lentekʎa]	'lentil'

(Sp. *lenteja*, Ptg. *lentilha*)

VERMICULU 'little worm' > [*bermekʎo] 'red'

(Sp. *bermillón*, Ptg. *vermelho*)

(b) COAGULU > [*koagʎo] 'curds'

(Sp. *coajo*, Ptg. *coalho*)

REGULA 'metal bar' > [*r̄egʎa] 'plowshare'

(Sp. *reja*, Ptg. *relha*)

TEGULA > [*tegʎa] 'roof tile'

(Sp. *teja*, Ptg. *telha*)

This assimilation applied only word-internally in Hispano-Romance at first, but its application spread to initial position, and did so more quickly in Old Spanish than in Old Portuguese. This is supported by the fact that there is much more variability of outcome in initial position, particularly in Portuguese.[9]

However, the articulation of clusters of this type is quite complex, and they are subsequently simplified. This reduction occurred in data of four types, given here:

(10.) Data supporting the existence of a tendency to simplify complex onset clusters:

(a) Simplification of /*-kʎ-/ in intervocalic position in Hispano-Romance:

All examples from (9a), e.g., AURIC(U)LA > [*orekʎa] > [oreʎa]

(b) Simplification of /*-gʎ-/ in intervocalic position in Hispano-Romance:

All examples from (9b), e.g., COAG(U)LU > [*koagʎo] > [koaʎo]

(c) Simplification of /*kʎ-/ (< /kl-/) in initial position in Old Spanish:

All examples from (1a), e.g., CLAVE > [*kʎave] > *llave* [ʎave]

(d) Simplification of /bl/ and /gl/ to /l-/ in Hispano-Romance:[10]

BLATTA	>	Sp. *lad-illa*	'crab louse'
BLASPHEMARE	>	Sp., Ptg. *lastimar*	'to damage'
FAB(U)LARE	>	Ptg. *falar*	'to speak'
GLANDINE 'acorn'	>	Sp. *landre*	'tumor'
	>	Ptg. *lande*	'acorn'
GLATTIRE 'to bark'	>	Sp. *latir*	'to beat'
	>	Ptg. *latir*	'to bark, yelp'
GLIRE	>	OSp. *lir* (MSp. *lirón*)	'dormouse'
GLOBELLU	>	OSp. *loviello* (MSp. *ovillo*)	'ball [of yarn]'

In OT terms, this generalization may be encoded as the following constraint:[11]

(11.) *COMPLEX:

No more than one consonant or vowel may associate to any syllable position node.

(Prince and Smolensky 1993:87, Hargus 1995)

The interaction of this constraint with MAX (which favors retention of underlying material) determines the simplification of these clusters. This is the third stage in the historical development treated here:

(12.) Third proposed historical stage: *Simplification*. /*Cʎ/ > /ʎ/

(Hispano-Romance, most positions; that is, all positions where there were /*Cʎ/ clusters.)

/*Cʎ/ > [ʎ]	*COMPLEX (ONSET)	MAX (SONORANT)	MAX (OBSTRUENT)
Cʎ	*!		
Cø		*!	
☑ øʎ			*

The listener then lexicalizes the loss of /C/, now representing [ʎ] as /ʎ/.[12] This occurred medially for both pre-Old Spanish and Galician/Portuguese, as well as for the initial /*Cʎ/ clusters of pre-Old Spanish:

(13.) <u>Hispano-Romance</u>[13] <u>Old Spanish</u>

OCULO	> [*okʎo]	> [oʎo]	CLAMARE	> [*kʎamar]	>	*llamar*
COAGULU	> [*koagʎo]	> [koaʎo]	PLUVIA	> [*pʎuvja]	>	*lluvia*
(MPtg. *olho, coalho*)			FLAMMA	> [*fʎama]	>	*llama*

The loss of the first rather than the second consonant is determined by the ranking of MAX(SONORANT) >> MAX(OBSTRUENT). This ranking is consistent with all data described in (10), and indeed reflects a general pattern of simplification observed from Latin to Hispano-Romance.[14]

To recapitulate the discussion thus far: What begins in Latin as assimilatory palatalization of /kl/ to [*kʎ] is lexicalized and extended by analogy to the medial clusters /pl, fl/ to /*pʎ,*fʎ/ (and to initial position in pre-Old Spanish), and these articulatorily complex clusters are simplified from /*Cʎ/ to /ʎ/.[15]

This is where we reenter the written record. That is, written documentation goes from Lat. -*Cl*- to OSp. -*ll*- (e.g., *hallar*), OPtg. -*lh*- (= [ʎ]), and from Lat. #*Cl*- > OSp. *ll*-. Also at this historically documented stage, *ch* ([tʃ]) appears in medial position in both Old Spanish and Galician/Portuguese.

4.1.2 Analysis of Sp., Gal./Ptg. -*ch*-. To the best of my knowledge, no previous analysis has adequately, if at all, explained why medial position should have developed differently from initial position. This difference has been observed, but not explained satisfactorily. The question is what the difference is between the two cases (i.e., initial vs. medial position, (1a) vs. (1b)).

I begin with the observation that what previous authors have called ‘medial’ or ‘postconsonantal’ position in most cases is more precisely ‘after a nasal consonant.’[16] We know that nasals tend to assimilate to a following obstruent (see below for a general formalization of assimilation), and my explanation for the difference between initial and medial position depends on this fact. That is, this linking of phonological structure that is the result of assimilation increases resistance to the constraint favoring simplification of the marked cluster /*Cʎ/. The intuition here is that loss affecting more than one segment is considered more costly by the listener than loss affecting a single segment. That is, /*NCʎ/ (where /N/ is any nasal preceding an obstruent) is more resistant to reduction than simple (word-initial or intervocalic) /*Cʎ/ because more segments would be affected.

The retention of the obstruent is well motivated for articulatory reasons as well. After articulation of the nasal consonant, the tongue is already in stop position, so there is nothing to be gained articulatorily by deleting or weakening the stop, as there would be if the reinforcing nasal were not there.[17]

How may this be formalized? I suggest that this may be handled via the OT instantiation of the Uniformity Condition (also called the Linking Constraint; see Hayes 1986), whose formulation is given here:

(14.) The Uniformity Condition:

> In order to change the feature content of a segment [A], every skeletal slot linked to [A] must satisfy the rule.
>
> (Kenstowicz 1994:413)

How may this be captured in a constraint-based approach like OT? I suggest that the effect of this condition may be characterized via constraint conjunction and the hierarchization of conjoined constraints with relation to other constraints (see Smolensky 1995, 1997).

Local conjunction of constraints has been posited in the OT literature to deal with cases where it appears that violations when considered together (that is, occurring in the same domain, or 'locally'), are more serious than the violation of each simple constraint when occurring separately. For instance, while the forms [tab.da] and [tad.ba] violate both NOCODA and *PLACE/LABIAL (they have a coda and a labial consonant) there are languages with labials and codas, but no labials in coda position. More frequently, codas will license only coronals, or no place at all. The idea, then, is that violations of NOCODA and *PLACE/LABIAL are worse when they occur in the same location (i.e., as when combined in coda [-b], like [tab.da] above) than when in separate locations (like [tad.ba] above). For languages where such a situation obtains, a conjoined constraint {NOCODA & *PLACE/LABIAL} is formed, and is ranked higher than its component constraints NOCODA and *PLACE/LABIAL. (Summarized from Smolensky 1995:§IV.)

Returning to medial /*NCʎ/ clusters, two segments would be affected by reduction of /*Cʎ to /ʎ/: the entire stop consonant and the place of articulation of the preceding nasal. I propose that this is disfavored by the conjunction of MAX constraints, MAXSEGMENT and MAXPLACE, yielding {MAXSEGMENT & MAXPLACE}. This conjoined MAX constraint is ranked higher than both *COMPLEX and simple MAX. In this way, deletion of the obstruent in /*Cʎ/ is thwarted because the nasal consonant that precedes it would also lose the PA that it shares with the obstruent ([ŋk, mp, ɱf]).[18, 19]

(15.) <u>Fourth proposed historical stage</u>: *Retention because of shared place of articulation*. (Hispano-Romance, medial position)

‘Blocking’ of cluster reduction because of nasal assimilation

/*NCʎ/ retained	{MAXSEGMENT & MAXPLACE}	*COMPLEX (ONSET)	MAX
ŋ__ʎ ∨ m__ʎ ∨ ɱ__ʎ ∨	*!		(*)
☑ ŋkʎ ∨ mpʎ ∨ ɱfʎ ∨		*	

Here we see that the optimal forms are those that retain the obstruent to which the nasal assimilates in place of articulation; this has the effect of thwarting *COMPLEX, which otherwise reduced /*Cʎ/ clusters to /ʎ/ (as in (12) above).

I propose that the retention of this cluster via nasal assimilation allows other processes of assimilation to continue to occur, in this case in voicing between the initial consonant and /*ʎ/.[20] The type of devoicing posited here should not be surprising given the analogous devoicing of liquids (and other sonorants) in English (*truck*, *plane*, etc.; Fromkin and Rodman 1988:99), French (*sucre* ‘sugar’, *pourpre* ‘purple’, *pied* ‘foot’, etc.; Carton 1974:30-31, 85; Gess, personal communication) and even many varieties of Modern American Spanish, where /tr/ takes on an acoustic similarity to *ch* (= [tʃ]), as in *tronco* ‘trunk’, often interpreted as *chonco* by the uninitiated (Canfield 1981:7, 13, and *passim*). Furthermore, these changes often go unnoticed consciously, and so may never be recorded in writing.[21]

The assimilation that I argued occurred is shown in the following tableau. (Lowercase [c] represents a voiceless palatal stop.)

(16.) Voicing assimilation applies because linked voiceless obstruent is retained. (Place assimilation also continues to occur.)

/*NCʎ/ > [*ɲcʎ̥]	{MAXSEGMENT & MAXPLACE}	*COMPLEX (ONSET)	MAX	ASSIMILATE[22]
NCʎ		*		*!*(vce, PA)
NCʎ̥		*		*!(PA)
Nøʎ	*!		(*)	
☑ ɲcʎ̥		*		

Examples: MACULA > [*maŋkʎa] > [*maɲcʎ̥a]

IMPLARE > [*empʎar] > [*eɲcʎ̥ir]

INFLARE > [*iɱfʎar] > [*iɲçʎ̥ar]

(where [ç] represents a voiceless palatal fricative)

The optimal candidate shows assimilation by both the nasal consonant to the following obstruent and by the obstruent to the following complex palatal lateral, and devoicing of /ʎ/ by the voiceless consonant has obtained. The segment [*ʎ̥] would sound quite similar to another voiceless palatal, [ʃ], and when following a voiceless consonant would be acoustically very similar to [tʃ].[23]

I suggest that this is the next stage in the historical process, that of reinterpretation of [(ɲ)cʎ̥] as [(n)tʃ] due to their high acoustic similarity. Acoustic evidence bears this out. Consider the following spectrogram:[24]

(17.) High acoustic similarity between [tʃ] and [cʎ̥]:

THIS SPECTOGRAM MAY BE FOUND AS A SEPARATE FILE TITLED <MANCHA.TIF> OR <MANCHA.GIF>

[mantʃa] **[maɲcʎ̥a]**

(18.) <u>Fifth proposed historical stage</u>: *Reinterpretation*. High acoustic similarity of [cʎ̥] to [tʃ]

This acoustic similarity leads to (mis)interpretation of [cʎ̥] by the listener as [tʃ], and then reanalysis as /tʃ/.[25] This would be favored by markedness considerations because given the two very different articulations for what is acoustically quite similar, the listener-turned-speaker may choose the simpler underlying representation of the two (i.e., a voiceless fricative vs. a devoiced sonorant). This further optimizes the lexicon by maximizing the harmony of the system (i.e., what is perceived is what is mentally represented, thus reducing the work of the constraints in the grammar.)

<u>Examples</u>**:** [*maɲcʎ̥a] perceived as [mantʃa], reanalyzed as /mantʃa/

[*eɲcʎ̥ir] = [entʃir] → /entʃir/ *henchir* (*encher* in MPtg.)

[*iɲcʎ̥ar] = [intʃar] → /intʃar/ *hinchar* (*inchar* in MPtg.)

(Additionally, /tʃ/ already exists in Old Spanish (< [jt], e.g., MULTU > H-R [mujto] (cf. MPtg. *muito*) > OSp. *mucho*.))

Here, what is perceived as a voiceless fricative becomes part of the lexicon. Thus, this replaces what exited the phonology as a devoiced sonorant, eliminating the violation of IDENT(VOICE), as well as that of the markedness constraint that sonorants are voiced ([sonorant] → [voice], or perhaps more specifically, *ʎ̥).

4.1.3 Analysis of Gal./Ptg. *ch-* Thus far I have given an account of the development of initial *ll-* in Spanish, medial [-ʎ-] (*lh*) in Portuguese (which in Spanish then became [ʒ], later [ʃ], eventually [x]), and of medial *-ch-* for both Spanish and Portuguese. This account has relied on the phonologization of phonetic tendencies by lexicon optimization and the role of the listener in reinterpreting and lexicalizing [*cʎ̥] as /tʃ/. I have not yet presented an explanation of how Portuguese came to show initial *ch-*.

Recall that I and others have argued that Galician/Portuguese is a more conservative variety of the development of Late Latin. (E.g., greatly reduced incidence of syncope, slower formation of yod [j] and wau [w], lack of diphthongization of tonic [ɛ, ɔ], slower advance of lenition, greater variation in results of initial *Cl* clusters. See Chapter 3, as well as fns. 9 and 27 of this chapter.)

One manifestation of this, it has been suggested above, is that the assimilation of /l/ to /k/ and the extension of /*ʎ/ to /*pʎ, *fʎ/ did not occur at the same rate in pre-Old Spanish and Galician/Portuguese. If this is the case, simplification of /*Cʎ/ to /ʎ/ did not occur in initial position in Galician/Portuguese because this cluster existed in the first stages of this change only medially in this language, not also initially as proposed for pre-Old Spanish.

Once all /*Cʎ/ clusters are simplified, the constraint *COMPLEX no longer has any candidates that it eliminates, and it fails to play any role in the continued development of these clusters. Given the lack of evidence that such a constraint is active in these languages at this point, I suggest that it comes to assume a lower position in the constraint hierarchy because it is 'inactive.'[26] This would be the sixth historical stage.

(19.) <u>Sixth proposed historical stage</u>: '*Demotion.*'

(Once /*(n)Cʎ/ is reanalyzed in Hispano-Romance as /(n)tʃ/ there will no longer be any input forms violating the constraint requiring simplification, so it is demoted; cf. Hutton's 'unranked occulted constraints.')

At this or a later historical stage, the tendency to assimilate /l/ to /k/ could indeed affect the initial *Cl* clusters of Galician/Portuguese, yielding [*Cʎ] (again, see Wireback 1996a for factors involved in retarded spread of this change in Galician/Portuguese). But because *COMPLEX is no longer highly ranked, the result is that the simplification of [*Cʎ] to [ʎ] that occurred previously is no longer the optimal outcome; instead, the new constraint ranking yields more fully assimilated forms, and [*cʎ̥] again leads to [tʃ]:[27]

(20.) Creation of *ch*- in Galician/Portuguese

Gal./Ptg. /*Cʎ/ > [*cʎ̥]	{MAXSEGMENT & MAXPLACE}	MAX (SON)	MAX (OBS)	*COMPLEX (ONSET)	ASSIMILATE
Cø		*!			
øʎ			*!		
Cʎ				*	*!*(vce, PA)
Cʎ̥				*	*!(PA)
☑ cʎ̥				*	

Examples: CLAVE > [*kʎave] > [*cʎ̥ave]

PLUVIA > [*pʎuvja] > [*cʎ̥uvja]

FLAMMA > [*fʎama] > [*çʎ̥ama]

As before with medial -*ch*- in both Old Spanish and Galician/Portuguese, [cʎ̥] is perceived as [tʃ], and is lexically optimized via reanalysis as /tʃ/ (*chave*, *chuva*, *chama*).

The creation of Gal./Ptg. initial *ch*-, to recapitulate, is due in large part to the same factors of assimilation that led to Sp. and Gal.//Ptg. medial -*ch*-. In the latter case, assimilation in voicing was able to occur as a result of increased resistance to simplification of complex clusters brought about by assimilation in place of articulation of the nasal to the following obstruent. After successful reduction of complex clusters, the position of the constraint which favored this came to be very low ranked in both Old Spanish and Galician/Portuguese. As a result, when new [*Cʎ] clusters are formed in Galician/Portuguese, simplification does not occur and assimilation in voicing again leads to interpretation as [tʃ] and lexicalization as /tʃ/.

This concludes the bulk of the analysis of the changes of CL, PL, FL from Latin to Old Spanish and Galician/Portuguese (the data given in (1a,b)).[28] In the next section I address the limited data that remain, those medial *Cl* clusters that were preceded by a nonnasal consonant.

4.1.4 Analysis of remaining data from medial position. These are the data of (1c), repeated here for ease of reference:

(1c)	*Latin*	*Spanish*	*Galician/Portuguese*	
	**masclo*	*macho*	*macho*	‘male, macho’
	ASTULA		*acha*	‘ax’
	AFFLARE	*hallar*	*achar*	‘to find’, ‘to think’
	CICERCULA	*cizercha*		‘blue vetch’
	SARCULARE	*sachar*	*sachar*	‘to weed’

These data differ from those in (1b) where medial *Cl* clusters were preceded by a nasal consonant. For those cases I argued above that nasal-obstruent clusters shared linked phonological structure (i.e., place of articulation), and that this impeded simplification and allowed assimilation in voicing to occur. These clusters were then reinterpreted as /tʃ/. However, the data in (1c) do not have linked nasal-obstruent sequences, so something more needs to be said. Although analogy may ultimately need to be invoked to account for these limited problematic data, in this section I attempt a theoretically motivated analysis.

The first case, **masclo* > *macho*, is amenable, I propose, to the treatment given for medial /NCl/ clusters. That is, assimilation in place of articulation may have occurred in these clusters as well, either of the alveolars to the dorsal, or vice versa. The first case would result in [ʃkʎ] (similar phenomena occur in Portuguese and

Judeo Spanish[29]); the second would result in [*stl]. Assimilation would result in shared phonological structure, and, as above, this makes these segments more resistant to weakening or loss. In the first case, then, the [k] of [*maʃkʎo] would be maintained in spite of the tendency for complex /*Cʎ/ clusters to be simplified (as in (9)-(13) above, e.g., APICULA > [*abekʎa] > H-R [abeʎa]). From here, [*ʃkʎ] develops to [tʃ] (probably first through a stage [*ʃtʃ] < [*ʃcʎ̥], whose components likely would have been difficult to pronounce and to perceive distinctly; they would then simplify to [tʃ]). In the second case, [*stl] could have led to devoicing of *l* (e.g., [*stl̥]) and subsequently have been reinterpreted as [tʃ]. (See the discussion of Ohala 1974a in the first Appendix to this chapter on a relevant case from Norwegian.)

Next, ASTULA > Gal./Ptg. *acha* may also be treated as was *macho*. (Sp. *hacha* comes from Fr. *hache*; Sp. *astilla* < *ASTELLA, from ASTULA.) It may be the case that when syncope of the posttonic vowel brings [t] and [l] into contact, [*ast'la], the [t] is modified to [k] (compare OLat. VETULUS 'old' > [*vet'lus] > VECLUS, with subsequent development to H-R [vɛʎo], and from (1b) HINNIT-*ULARE > [*renint'lar] > OSp. *reninchar*). This may be seen as an assimilation to the [dorsal] place of articulation of [l], which Walsh (1995) argues has both [coronal] and [dorsal] place nodes in the feature geometry. She cites the case of Jamaican English, where standard *little*, *handle*, *turtle* and *black wattle* ('a type of tree') are pronounced [lɪkl], [hæŋgl], [torkl] and [blak wakl] (pp. 20-21).

Assuming a historically intermediate form **ascla*, we might assume that syllable-final [s] here too partially assimilates to the following [k], whose pronunciation would approximate [*aʃkʎa]. This would then follow now familiar developments to arrive at [tʃ]. The difference between the development of VETULUS > H-R [vɛʎo] and ASTULA > Gal./Ptg. *acha*, then, is that in the latter case retention of the [k] of [ʃk] allowed for devoicing of [*ʎ] to occur, while in the former case nothing inhibited the regular simplification processes of Hispano-Romance to occur. (Alternatively, [*st'l] is allowed, and also leads to [tʃ], as discussed above.)

AFFLARE is an interesting case because its reflexes in Old Spanish and Galician/Portuguese developed differently. This may point to a differing analysis of this word by speakers of each language. The Spanish reflex *(h)allar* appears to have undergone the expected derivation: AFFLARE > [*aflar] > [*afʎar] > [aʎar]. The complex intervocalic cluster of this form is reduced, as are all of those in (10) and (11) above (e.g., OCULU > [*okʎo] > H-R [ɔʎo]). The Galician/Portuguese reflex, then, is the one in need of explanation. I would like to suggest that AFFLARE was treated by speakers of pre-Galician/Portuguese as were words like (AP)PLICARE 'to board (a ship), approach', which developed to *llegar* in Old Spanish, but to *chegar* in Galician/Portuguese. I argued above that the spread of the assimilatory process [Cl] > [*Cʎ] was slower to affect initial *Cl* clusters in Galician/Portuguese than in Spanish. Here, then, speakers of pre-Galician/Portuguese may have interpreted AFFLARE as (AF)FLARE, and as such the initial cluster would not have been affected until later, and would have regularly developed to *ch*-.

The last two cases, CICERCULA > *cizercha* and SARCULARE > *sachar* (both etymologies are given in Lloyd, p. 255) are more problematic, and I am unable to offer an explanation. Several questions arise with regards to these forms: First, why was flap [r] maintained in *cizercha* but not in *sachar*? Conceivably, for *sachar*, the medial [r] may have been lost by dissimilation to word-final [-r]. Second, how did [r] (in either or both words) help to maintain the following [*Cʎ] cluster for the voiceless consonant to devoice the following [*ʎ]? The phonological structure of [r] is not such that it would link in place of articulation to [k], and so the creation of [tʃ] in this instance is difficult to understand, and I am unable to answer the questions I have raised.

However, even though the analysis I have given above for the other cases, which are in fact the great majority, does not account for these words, I believe the present account is still more satisfactory than previous approaches which simply state that *Cl* clusters became *ch* 'in medial position after a consonant' (see, e.g., Lloyd

1987:226). The present approach has motivated this stipulation, and has provided argumentation for the steps that these clusters underwent in their development to *ch*, and has appealed to the application of general processes that played important roles in determining the final outcome in each case (simplification of complex clusters, palatalization of /l/, devoicing of laterals, etc.). I believe these are strengths in favor of the current analysis, and I hope that future research will overcome its shortcomings.

In the next sections I elaborate on several of the theoretical points raised in the previous discussion.

4.2 The listener as a source of sound change. Given that different vocal tract arrangements may yield similar acoustic speech signals, for the listener there may be articulatory ambiguity. However, the listener aims to pronounce words as nearly as possible in the way she has heard them from others (or thinks she has heard them) (Ohala 1974a,b, 1981, Slobin 1977, Greenlee and Ohala 1980, and for related points, Inkelas 1995, Hale and Reiss 1996, Yip 96).

Given the acoustic similarity of [cʎ̥] to [tʃ], the listener reconstructs /tʃ/ (incorrectly). This is parallel to the learning systems proposed by Clark and Roberts (1993:301) and Pulleyblank and Turkel (1995a,b,c): Several alternate grammars may adequately account for the input. When this happens, other factors determine the optimal grammar, which in the case described by Pulleyblank and Turkel (1995b) evolves to a more unmarked system.[30] This is in a sense a type of ‘emergence of the unmarked’ (McCarthy and Prince 1993, Smolensky 1996, numerous others) but at the level of the grammar.

To take the case of the linked clusters, in schematic graphic form we have the following, which shows the passage of phonetic processes to lexicon optimization and the emergence of the unmarked:

(21.) Stages in the development and lexicon optimization of *Cl*:

(a) /Cl/ > [Cʎ]		Articulatory lag incorporated into phonology (see (6))	
(b) [Cʎ] > /Cʎ/		Lexicon optimization of [Cʎ]	(see below (7))
(c) /Cʎ/ > [Cʎ̥]		Voicing assimilation	(see (16), (20))
(d)	(?)/Cʎ̥/ > [cʎ̥]	Place assimilation	(see (16), (20))
(e)	/tʃ/ = [tʃ]	Reanalysis occurs	(see (18))
		Does not violate MARKEDNESS(*ʎ̥), IDENT(VOICE)	

(Step (d) may not have existed as a lexicalized stage; more likely, changes affecting /Cʎ/ were lexicalized as /tʃ/.)

4.3 Summary and conclusion. To summarize, I have explained why Spanish shows a different outcome for *Cl* in initial and medial positions, and have motivated the 'magic leap' others have assumed for the passage of *Cl* to [tʃ]. This was argued to follow from the increased resistance to simplification due to linked phonological structure. This was enforced by an OT version of the Uniformity Condition, which then allowed the common processes of voicing and place assimilation to continue. Here the role of the listener is important: there is reinterpretation based on acoustic similarity, markedness considerations and lexicon optimization.

In schematized form, the principal points of this chapter are these:

<u>Data</u>: The historical order of changes is summarized below:

palatal assimilation > analogy/allophonic unification > simplification vs. linking (UC) > assimilation and reinterpretation. (The spread of assimilation of #*Cl* to *Cʎ was slower in Galician/Portuguese than in Spanish; when it did occur, the constraint ranking had changed so that reduction was no longer the optimal outcome.)

(An additional advance of the proposed analysis is that the process of simplification of /*Cʎ/ clusters has now been related to the creation of /tʃ/, which had not connected before.)

<u>Issues</u>: Phonetics → phonology → lexicon, then repeat cycle

The role of the listener (acoustic equivalency, intent to repeat faithfully what heard)

The Uniformity Condition (conjunction and hierarchization), which here prevented simplification from occurring, and allowed [*cʎ̥] to develop

Lexicon optimization and the emergence of the unmarked ([cʎ̥] vs. [tʃ], etc.)

Similarity of historical change to learning systems

I close this section with the sobering reminder that many of the steps argued for above are speculative, though not, I hope, without basis or merit. Likewise, a complete understanding of the reasons why a language undergoes a certain change that another does not, even a process presumably based on universal phonetic principles, still eludes us. On a more positive note, we have seen here the importance of considering factors not always adduced in support of such undocumented changes. Supporting evidence was proffered from languages not related to Hispano-Romance, and universal phonetic tendencies were brought to bear in the explanation of what others have considered a rather mysterious change, at least one that had not, to the best of my knowledge, been formally analyzed previously. Thus, independent external arguments have helped to fill a gap by giving force to a plausible account of this change in the history of Hispano-Romance, one that previously had resisted satisfactory explanation.[31]

Notes to Chapter 4

1 The analysis in this chapter does not differ in any major way from that of Holt 1996b. This chapter is a much expanded version of the previous work; here I discuss more fully previous approaches, several theoretical issues and certain additional data (e.g., those of (1c)) that for reasons of space I had to omit from the earlier paper.

2 In those Latin forms where the consonant and /l/ are not adjacent these two segments came into contact after syncope of the unstressed vowel that separates them. This is exemplified in (6), (8), (9) and (13) below.

3 Here and throughout, a form that has an asterisk before it is not reflected in the written record, but is hypothesized to have existed as an (historically) intermediate stage. Late Latin H represents the glottal continuant [h], which was probably weakly articulated. Hypothetical forms are not marked with an asterisk in the tableaux since all of these forms are all candidates that the grammar evaluates for optimality.

4 Genovese did develop [tʃ] from Latin *Cl*, though given the discussion of Lloyd immediately below, presumably through the stage /*Cʎ/.

5 Modern Upper Aragonese is spoken in the upper regions of the province of Aragon, north of Huesca in the Pyrenees of Spain. During the Middle Ages the area where Aragonese was spoken was much greater than that today.

6 This type of 'lifecycle' of a rule is explored in great detail in Janda 1987; I am indebted to Stuart Davis for making me aware of this work.

7 It may be the case that the output of those forms that participate in morphological alternations or correspondences is not lexicalized.

8 I tentatively suggest that 'allophonic unification' may be considered to aid in the economy of lexical representations, and that this kind of sequential constraint is a kind of lexicon optimization. This may be implemented via an output-output correspondence constraint. For the present discussion I will leave it at that. See McCarthy 1995 for a discussion of output-output (O-O) correspondence, and Burzio 1997 for its application to certain cases of stem allomorphy in English and Romance.

For a very recent OT approach to analogy that rejects an O-O correspondence account in favor of one that incorporates aspects of language acquisition, sociolinguistic diffusion and the nature of language change, see Reiss 1997 (which I have not yet been able to consult).

9 See Wireback 1996a for discussion of the factors involved in the spread of this sound change. For the 'conservatism' of Galician/Portuguese, see Lloyd 1987,

Repetti and Tuttle 1987, Penny 1991, as well as the relevant sections of Chapter 2 of this work.

10 Lloyd 1987 notes that initial clusters of these types were very infrequent. He cites Harper's Latin Dictionary as containing only nine words with /bl-/ and eighteen (not counting proper names or their derivatives) with /gl-/ (p. 224)

11 This formulation will suffice for present purposes. A more precise formulation of this constraint is necessary to more adequately describe the conditions under which all complex clusters simplify, since both Spanish and Portuguese have words beginning with *bl-*, *gl-*, *br-*, *gr-*, *tr-*, *fl-*, *fr-*, etc. Here, it might be better said that the members of a complex cluster may not themselves be complex (as is [*ʎ] in [*Cʎ]), though this leaves aside the data of (10d).

Furthermore, Prince and Smolensky (p. 87) note in their definition of *COMPLEX that the syllable-position nodes 'coda' and 'onset' are more precisely just the rightmost and leftmost daughters of the syllable node. That is, 'coda' and 'onset' are merely convenient labels for the right and left margins of the syllable. *COMPLEX, then, determines the structure of syllable margins.

12 Wireback 1996a proposes that [ʎ] (from [*Cʎ]) was lexicalized to /ʎ/ once the obstruent of [*Cʎ] underwent lenition, leaving simplified [ʎ]. This is a reasonable suggestion, though not a necessary one in the analysis presented here. On the OT assumption that lexicon optimization occurs to reduce predictable constraint violation, [ʎ] may become /ʎ/ once the assimilation of /l/ to [ʎ] is a regular alternation. This surely occurred prior to simplification of complex clusters.

13 Later, H-R [-ʎ-] underwent other changes in Old and Modern Spanish: delateralization to [(d)ʒ] (written *j* in Old Spanish), devoicing to [ʃ] (around 1500, sometimes written *x*) and velarization to [x] (written *j*, as in MSp. *oreja* 'ear'); Modern Portuguese maintains the final stage cited here. All examples of (9) undergo this change in Old Spanish, and Modern Portuguese maintains the simplified forms without further modification of [ʎ], written *lh* in Portuguese orthography.

14 Recall that degemination affected obstruents first, and that more sonorous segments are more resistant to change. This may be another factor in determining the retention of the sonorant here. Repetti and Tuttle 1987 argue that the general process of lenition that affected the voiced (spirant) consonants would have made their articulation quite weak. Conceivably, these lenited obstruents may have become so weak that the listener failed to perceive them. Acoustically, the main (only?) cue to an initial voiceless stop is its release. Therefore, if the release were obscured by the following /l/, it would not be surprising for the listener to 'drop' the stop.

When the listener failed to perceive the initial stop, [*(C)ʎ] was lexically optimized to /ʎ/.

The structure assumed by Walsh 1995 permits an additional possible explanation for the retention of /l/. If /l/ is a doubly-articulated segment, then an appeal to MAXPLACE may be in order. That is, retention of /l/ obtains because its two place specifications are preserved at the expense of loss of the single place specification of the obstruent; if the obstruent were retained at the expense of the lateral, two specifications would be lost to preserve the single specification of the obstruent.

However, the ranking is opposite that proposed for child language by Gnanadesikan 1995 (Eng. *please* /pliz/ → [piz]) and for Tiene (/bot, -L/ → [boot]) by Hyman and Inkelas 1997. Perhaps there are additional constraints operative here that override MAXPLACE. I leave this as a matter for further investigation.

15 Admittedly, this begs the question of why these clusters were allowed to form in the first place if they were subsequently simplified because they were too complex. Apparently, *COMPLEX was initially lower ranked, allowing assimilation to occur, only later rising up to simplify the newly formed complex articulation. This leaves unexplained why Upper Aragonese still shows *Cll*. These are questions that have perplexed traditional researchers of Romance phonology, and that continue unanswered today.

16 Repetti and Tuttle 1987:54-69 and Wireback 1996a,b assume that in postconsonantal position the voiceless obstruent was protected from lenition (i.e., loss), though it is unclear to me why they think this should be so. In this section and the next I offer my thoughts on why this should be the case.

I omit from the immediate discussion those cases where the consonant that precedes the *Cl* cluster is not a nasal (the data of (1c)). These are addressed at the end of this chapter.

17 A similar environment (nasal-fricative clusters) is where intrusive stops often occur.

18 This is quite similar in spirit to the constraint NEIGHBORHOOD proposed by Itô and Mester 1996 and earlier work by Joe Pater. This constraint penalizes processes that would affect structure on both sides of a given segment (‘the neighborhood of a segment must be preserved’). See the second appendix to this chapter for other cases that I suggest may be treated in a manner similar to that proposed here.

19 Fukazawa and Miglio 1997 and Miglio and Fukazawa 1997 discuss the OT literature that relies on constraint conjunction. They argue that this type of theoretical device would be overly powerful if its use were not restricted in some way. They propose that conjunction of constraints should be limited to the same constraint family

(markedness, faithfulness, OCP). The conjoined constraint proposed here is in accord with their argumentation, being of the family of faithfulness constraints.

{MAXSEGMENT & MAXPLACE} also shows similarities to 'self-conjunction' (Alderete 1996), according to which violating one constraint twice (or more) in the same domain is worse than a single violation of it. Here, violation is avoided in the case that a single segment would be affected that straddles two domains. That is, while the onset obstruent consonant lost or retained is a single segment, it shares structure with a segment belonging to the previous syllable.

It may be the case that the conjoined constraint targets the loss of Place of Articulation (i.e., {MAXPLACE & MAXPLACE}), which is deleted from two segments (the obstruent and the nasal that shared it), though for the obstruent the Root is lost as well. I leave further exploration of these matters for future research.

20 Penny 1991:63 makes a very brief passing statement that in postconsonantal medial position, the voiceless obstruent may have devoiced the following [ʎ], but he leaves it at that. Here I develop this thinking further and flesh out the details of motivation and implementation.

21 An additional example of a phonetic change that speakers do not realize is intervocalic voicing. Magne Oftedal 1985 noticed that in Canary Island Spanish there was a phonetic process of intervocalic voicing that speakers did not consciously perceive.

22 For present purposes this constraint may be formulated as one requiring that adjacent elements share phonological features. Other constraints on locality, markedness, etc. will intervene to limit the effects of such a broad imperative. Relevant results required are that adjacent consonants share place of articulation; here, nasals assimilate before obstruents and the nasal and obstruent of a nasal-obstruent-palatal lateral sequence become more like the complex palatal. Also, 'ASSIMILATE' must devoice a lateral after a voiceless obstruent. Articulatorily these assimilations seem quite natural. See Padgett 1995 for detailed discussion of assimilation along these general lines (mainly nasal place assimilation) and the formalization of the spreading imperative in Feature Class Theory under Optimality Theory.

23 In a similar vein, Repetti and Tuttle 1987:92 argue that prior to *ch*, the labials [*pj, *bj, *fj] (< [*pʎ, *bʎ, *fʎ]) were pronounced with palatal affrication; the great acoustic proximity of such forms to palatal affricates would favor the reconstruction of an intermediate /*pʃ/. This is similar in spirit to the account offered here, though different in important respects.

24 Because the hypothetical form [*maɲcʎ̥a] would be unpronounceable by speakers of Modern Spanish, Galician and Portuguese, as well as Modern English, the author pronounced the forms as they might have been pronounced during the stage in the evolution of *Cl* clusters proposed here. While /ʎ/ does still exist in Modern Portuguese and some varieties of Modern Spanish, it does not occur in clusters.

25 A very similar proposal is made in Ohala 1974a, where he refutes the purely phonological explanation given by Foley 1973 for the pronunciation in Norwegian of [oʃlo] for *Oslo*. He argues instead for the partial devoicing of [l] by [s]: he then shows that this [l̥] is acoustically similar to [ʃ], which he believes led to reinterpretation as /ʃ/. For fuller discussion of this and other similar data from Navajo, Algonquian and Itelman, see the first appendix to this chapter.

Malkiel 1963-4:161 notes that *Cl-* became *x-* in certain varieties of Old Asturo-Leonese. This suggests that [*ʎ̥] was reinterpreted in these dialects as [x], which also seems quite reasonable.

Mattoso Câmara 1972:43 cites two other partially parallel instances of cases where sounds that are foreign to the speaker's ear are modified. First, Germanic /w/ is adopted into Late Spoken Latin as /g^w/ (e.g., *guarnecer, guarnir* 'to garnish, adorn' (< *warnjan*); *guerra* 'war' (< *werra*); *guardar* (< **wardon* 'to guard, protest')). Second, the Arabic guttural is adopted as either /l/, as in *alfaiale* 'tailor', *alface* 'lettuce', or as /ʃ/, as in *xerife* 'sheriff', *xarope* 'syrup'.

26 Recall from discussion in previous chapters that this type of 'demotion' means that younger speakers of the newer generation hear no effects of a given constraint, and so it never assumes a ranking high enough for its effects to be seen. I remain silent on the issue of whether the initial ranking of constraints is FAITHFULNESS >> WELL-FORMEDNESS (as in Hale and Reiss 1996) or WELL-FORMEDNESS >> FAITHFULNESS (as in Smolensky 1996).

Hutton 1995 also discusses 'demotion' in his treatment of aspiration and loss from Proto-Italic to Latin of coda [s] > [*h] > [ø], e.g., [*kasnos] > [*kahnos] > *cānus* 'gray'. He proposes a constraint */h/-CODA, a type of NOCODA constraint that bans /h/ from post-nuclear position; this constraint is subsequently demoted once the phonetic conditions on the output cease to be relevant. As he states, the constraint becomes redundant.

27 Alternatively, the Galician/Portuguese reaction to *#Cʎ (or perhaps *#Cʎ̥) was different, with simplification to [ʎ-] in Spanish but reinterpretation as [tʃ-] in Galician/Portuguese. Since these changes happened in the preliterary period of both

Old Spanish and Galician/Portuguese, it is impossible to rule out this alternative, but the proposal given in the text may be more in line with the conservative tendencies attributed to Galician/Portuguese.

This is similar to the approach taken in Repetti and Tuttle 1987:105, where they assume that in more conservative dialects in the extreme west of the Roman Empire (that is, Galician/Portuguese), the advance of lenition (here, loss of the initial obstruent) was less rapid than in Castile. However, our approaches diverge here: they argue that the complex sequence [*kʎ] could only have been reduced through the elimination of laterality, yielding [*kj] and eventually [tʃ]. Recall that I have argued that the change was instead [*kʎ] > [*kʎ̥], which is then perceived and reinterpreted as /tʃ/.

28 Hartman 1974 offers an approach that is similar in some respects to the present analysis. He argues that the voiceless consonant of these clusters merged with the palatal lateral, giving [tʃ] as a result, though this is merely stipulated. He states that the difference between Spanish and Galician/ Portuguese in this regard is the absence of a single rule in Galician/Portuguese, one of obstruent deletion before palatal /ʎ/. His formulation of the rule for Spanish specifically mentions that this occurs word-initially, though he gives no support for this claim. (Above I argued that there was a general tendency in Hispano-Romance to simplify complex clusters but that due to the effect of the Uniformity Condition, which here disfavored excessive structure from being deleted, linked medial clusters were preserved.) Finally, in all positions in Galician/Portuguese, but only medially in Spanish, there is obstruent-lateral merger, such that /*Cʎ/ > /tʃ/, with the resulting segment inheriting features from both consonants, presumably the voicelessness of the initial consonant and the palatality of the lateral. Hartman is not specific on the details of this merger, but the result would seem to be [ʎ̥], which would then be reanalyzed as [ʃ], or [tʃ] if the [-continuant] specification of the consonant is assumed to be retained in the merger. While Hartman's schematic account is similar to the one proposed here, it fails to address several key points, such as why the consonant of /*Cʎ/ clusters is lost in Spanish in initial position, and why and how it is retained and merged with [ʎ] in Galician/Portuguese. Furthermore, it is not quite accurate to say that all word-internal /*Cʎ/ clusters were merged to /tʃ/, since we have, e.g., Sp. *hallar* < CLat. AFFLARE, not the result we would expect according to Hartman, **(h)achar*, which is the Galician/Portuguese reflex. I analyze Sp. *hallar* and the other remaining data from (1c) immediately below.

29 Judeo Spanish, also called Sephardic Spanish, is the Spanish that was spoken in Spain when the Jews were expelled by the Catholic Monarchs in 1492. While it shares some features and lexical items with Portuguese, Italian and the languages of other countries where the Jews migrated, it is chiefly known for the many features of Spanish that it conserves from that period. For a complete description of Judeo Spanish, see Zamora Vicente 1989:349-77.

30 This is similar to the notion developed in Pulleyblank and Turkel 1995b (building on proposals concerning language variation in Niyogi and Berwick 1995) that imperfect learning via misperception may affect language development, though in their analysis of ATR harmony this serves as evidence for constraint reranking. Here I am proposing that misperception leads to restructuring of underlying representations. Perhaps this restructuring may be viewed as the reranking of the constraints requiring faithfulness to the input specifications. In this way, misperception may play an analogous role both here and in the analysis of Pulleyblank and Turkel.

31 Not treated here are other Romance languages that maintained these *Cl* clusters, like French (but see fn. 1 of the first appendix to this chapter) and Catalan. Alarcos Llorach 1971:204-6 makes the observation that the change *Cl-* > *ll-* was avoided in areas where *l-* became *ll-*, as in Catalan. Zamora Vicente 1989:37 also cites Mozarabic. This would appear to another case of merger avoidance. This is a matter to which I must return on a future occasion.

FIRST APPENDIX TO CHAPTER FOUR

ON THE PHONETIC PLAUSIBILITY OF *Cl* > tʃ

Above I have argued that Latin *Cl* (where *C* is any voiceless consonant /p, k, f/) passed through a stage in which the lateral sonorant became [ʎ]. That this is plausible is supported by the Upper Aragonese dialects which to this day maintain [Cʎ] in initial position, although evidence from Italian dialects suggests that CL may become [kʲ] before becoming [tʃ] (as many authors have argued). That is, although it may not be strictly necessary to posit a stage /*Cʎ/ for Hispano-Romance, assuming such a stage does allow for unification of explanation of this data in the dialects in the Iberian peninsula, and is sensible given that /-*Cʎ-/ became [ʎ], and OSp. initial #*Cʎ also became [ʎ]. Thus, following Lloyd (1987) I posit that Spanish, Galician/Portuguese and Upper Aragonese all shared a /*Cʎ/ stage, though only the former varieties underwent further change. It is unclear, and perhaps ultimately unknowable, why some dialects develop in one direction while others follow another course.

That is, if, as I argued above, the sequence /*Cʎ/ was articulatorily complex and thus simplified in Spanish and Galician/Portuguese, why did this same pressure for simplification not also apply to Upper Aragonese? Likewise, if the sequence /*Cʎ/ is in some way too complex, why would it have been formed in the first place?

Standard French[1] and Catalan maintain initial *Cl* clusters without change; why did not Galician/Portuguese and Spanish as well? The answers to these perplexing questions must lie in phonetic, sociolinguistic and other factors, but they remain, at least for the time being, beyond my full comprehension, and I am unable to shed light on this perennial question.

Assuming here the stage /*Cʎ/, there are phonetic motivations for intermediate stages leading to [tʃ]. Examples of similar of parallel processes come from a wide range of languages, including English, French, German, Norwegian, Navajo, Algonquian, Spanish and Itelman.

English

As is well known by English linguists, liquids are (phonetically) devoiced after tautosyllabic voiceless consonants. This is a natural low-level phonetic process based in articulatory overlap. That is, the voicelessness of the consonant is continued during the production of the liquid, and the result is a partially or completely devoiced liquid, as in *train*, *plane*, *clock*, etc. Hence, the aspiration of the voiceless stops has an effect beyond the obstruent segment, though this effect is not consciously perceived by the untrained ear.

French, German and dialectal Spanish

Similar data obtain in French and German, e.g. Fr. *froid* ‘cold’, *clair* ‘clear’, *trésor* ‘treasure’ (see §4.1.2 and Carton 1974:30-1. 85); Gm. *Presse* ‘press’, *Krem* ‘cream’, *Tresor* ‘treasure’. /r/ also undergoes a similar change in certain Andalusian and Latin American dialects of Spanish, where *tr* is often interpreted as something close to [tʃ(r)], as in *tren* ‘train’, with assibilated [R] or [R̥] (see §4.1.2).

Turning now to cases more closely related to the change of *Cl* to *ch*, there is evidence from the other languages mentioned above that lends support to the phonetic plausibility of this change.

Specifically, in several languages there seems to be a relationship or correspondence between [l] and [ʃ]. I give examples from four languages: Algonquian, Navajo, Itelman and Norwegian.

Algonquian

The first case comes from Kiparsky (1971/1982), who discusses the reanalysis in Delaware of the change l > ʃ.[2] In some Algonquian languages, all /l/s started to become [ʃ] in certain palatalizing environments. Kiparsky reinterprets the reanalyses as the result of language learners failing to retain the underlying phonological distinctions in their synchronic grammars, and instead setting up a rule *l* ® ʃ, which some /l/s have to be marked as not undergoing. Subsequently, this mark is either removed from all /l/s (i.e., all /l/s become regular--the usual change) or the rule itself is eliminated (the Delaware change, no palatalization). That is, the reanalyses proceed from a non-abstract synchronic analysis of the merged segments.

The relevance of this example lies in the correspondence between the lateral and the palatal [ʃ]; Kiparsky's concern is the process of reanalysis, and so he does not offer a phonological analysis of the change in question.

<u>Navajo</u>

A second case is that of another Amerindian language, Navajo. The data come from Kari (1976). In Navajo, voiceless /l̥/ devoices *z*- or *zh*- and is then deleted, which Kari states as

l̥ → ø / ___ s, sh	ex.	/yi + di + l̥ + záás/	
		s	devoicing
		ø	deletion of /l̥/
		[yidisáás]	phonetic form

Kari gives as an additional context for loss of /l̥/ in front of /l̥/, as in

/di + ni + l̥ + lid/	(includes root for 'cause to burn')
l̥	devoicing
ø	deletion of /l̥/
øø	deletion of /ni/
[díl̥id]	phonetic form

In two other contexts segments are lost when alongside /l̥/: *sh* ® *ø / í___ l̥*, e.g. /ghi + í + sh + l̥ + chɔ/ → [yíl̥cho]; and *h* ® *ø / ___ l̥C*, e.g., /ha # oh + l̥ + zheeh/ → [haol̥zheeh] (includes root for 'to hunt').

In all of these cases, it is possible that phonetic (specifically, acoustic-auditory) factors favor or lead to loss, though these processes occur only in certain morphological contexts. One possible phonological explanation is that under these (ill-defined) circumstances there is some sort of merger under identity; in this case one of the segments is deleted because the two are identical or nondistinct. Another phonological explanation might be that there is multiple correspondence of the output segment to both underlying segments. That is, the segment [l̥] may represent both underlying /l̥/ and a *s, sh or* /l̥/ that is created at some point in the derivation. (See Russell 1995 for a similar proposal of multiple correspondence for unrelated data.)

Either of these possibilities might in principle be encouraged by the phonetic/acoustic/perceptual similarity of the segments in question. If not primary motivation for these changes, it is quite conceivable that the role played by the listener is important in propagating or generalizing the loss of /l̥/ and *sh*. In other words, the listener may make certain assumptions regarding the input based on what she hears in the output, and may then incorporate them into her phonological input forms. This has the effect of phonologizing a phenomenon based in phonetic principles. We have seen several cases of this in this dissertation. In the present context, however, what is most important about the above data is that there appears to be some phonetic or phonological characteristic that links these two types of segments.

Itelman

There are two further languages that show similarly relevant alternations. The first is Itelman, a language spoken in Siberia. The data come from Bobaljik (1996, personal communication). Bobaljik (p.c.) discusses the distribution of the present tense allomorphs /s, z, əs, əz/. Generally, the schwa appears after consonant-final stems, and the voicing alternation is conditioned by the following segment. However, for a large class of verbs with stems ending in voiceless /l̥/ (including the future/desiderative suffix /-al̥-/, /l̥/ disappears in the present tense, but the present tense marker is always voiceless /s/ regardless of the following segment:

t-zun-s-kiCen	*t-zunl̥-əs-kiCen	1sg ‘to live’
zun-s-in	*zunl̥-əz-in	3sg

A further example is the minimal pair *il̥* ‘to go’ versus *il*- ‘to drink’:

3s nonpresent	il̥-in	‘she went’
	il-in	‘she drank’
3s present	i-s-in	‘she is going’
	il-əz-in	‘she is drinking’

However, there is a complication for the behavior shown by /l̥/ in the presence of *s*-initial suffixes. The alternations seen above appears to be morpho-phonological, since /l̥/ remains before -*sx*, the second person plural subject suffix:

	zunl̥-sx	‘live’, past, 2pl
cf.	zun-s-sx	‘live’, present, 2pl

What these facts may show is the compatibility or similarity between voiceless /l̥/ and /s/. That is, in [i-s-in] ‘she is going’, the final /l̥/ of the stem appears to be lost before the suffix *s*- of the present tense. One explanation for this may be that the two segments are merged under partial identity, or that the output [s] multiply corresponds to (that is, represents) both /l̥/ and /s/, similar to the analysis suggested above for Navajo.

To sum up to this point, the three cases treated thus far demonstrate the phonetic similarity among laterals, the voiceless fricative /s/ and palatal /ʃ/. Though the correspondence varies in each of the preceding cases (l → ʃ for Algonquian; l̥ → ø / s, sh, l̥, sh, h → ø / ___l̥ in Navajo; l̥ ~ s in Itelman) they together lend support to the argument made above that the change from CL to [tʃ] is a phonetically plausible one, and is not at all an inexplicable leap that might be stipulated or ignored. This has been the case in many previous treatments (Hartman, Lloyd, Menéndez-Pidal, inter alia).

Norwegian

A final case, and the one most strikingly analogous to that of Hispano-Romance, is that of Norwegian, where [s] became [ʃ] before [l] but not [n]:

Oslo	O[ʃ]lo	‘Oslo’
snakke	[s]nakke	‘talk’

Foley (1973) claims that this change is not a phonetically plausible one, since both [l] and [n] are dental consonants, and as such, we might expect [s] to behave similarly before either of them. Furthermore, the change of [s] to [ʃ] before dental [l] appears more like dissimilation, not assimilation, a common phonetic process. Instead, he argues for a phonological analysis by which the change of [s] to [ʃ] before [l] is viewed as phonological ‘strengthening’. He claims (p. 51) that [l] is stronger than [n], and that [s] is strengthened by proximity to [l], but not by proximity to the relatively weaker [n]; ‘strengthened’ [s] is then realized as [ʃ].

Ohala (1974a), any many others, has criticized Foley’s strength hierarchy as undefined and unjustifiable. He criticizes Foley’s approach, and further chastises Foley for defending the assertion that the above palatalization of [s] cannot be accounted for according to phonetic principles, and for Foley’s hesitance, shared by many phonologists, to embrace phonetic explanations for linguistic change. Indeed, he charges that Foley, in fact many phonologists of whom Foley is but one example, neglect phonetically, and in this case specifically acoustically conditioned changes.

Ohala cites phonetic studies like those of Einar Haugen (1942) and Gunnar Fant (1960), whose data show that /sl/ is likely to become [sl̥l], where /s/ partially devoices the following /l/. Ohala’s Figure 2 (p. 255) gives the spectra of these segments, and concludes that [l̥], acoustically a fricative, is more similar to [ʃ] than to [s]. Thus, [sl̥l] could appear to be [sʃl], with a subsequent acoustic assimilation of [s] to the following fricative, yielding either [l̥l] or [ʃl], both pronunciations attested by Haugen. Furthermore, /sn/ is unlikely to become [ʃn] because even if the [s] were to partially devoice the following [n], the hearer would not confuse the spectra of [sn̥n] with those of [ʃn]. This is a phonetically sound analysis, and does not rely on ill-defined notions of phonological strength. It furthermore shows the value of basing one's argument first on established phonetic principles before looking for answers beyond where their motivations may rest.

This example, like that of Algonquian that Kiparsky cites, shows the relationship that may exist between [l] and [ʃ]. Though Kiparsky does not give an in-depth analysis of the Algonquian facts, it is possible that phonetic factors identical or similar to those argued for by Ohala are operative here as well.

What relevance does this have for Old Spanish and Galician/Portuguese /tʃ/? One might point out, quite rightly, that the facts presented in this section might be considered tangential to the principal concern of Chapter 4 and the assertions I make that CL passed through a stage *Cʎ on the way to becoming [tʃ]. Based on the Norwegian facts, for instance, one might posit that CL evolved to [tʃ] through the stage [Cl̥]: the voiceless [l̥] might be interpreted as [ʃ], and further phonological and phonetic processes of assimilation and reinterpretation would yield [tʃ] from [kl̥], [pl̥] or [fl̥].

Such an approach has several disadvantages. First, while it would account for Galician/Portuguese, which shows [tʃ] in all positions, and for postconsonantal medial position in Spanish, also with [tʃ], it leaves aside as different other contexts in Spanish. That is, the origin of initial [ʎ] and of intervocalic medial [ʎ] (as in AFFLARE

> Sp. *hallar* 'to find') must be explained differently. This leads to the second principal criticism of an approach that posits that Hispano-Romance [tʃ] came from [C̥l]. Namely, a more unified approach to the changes in all positional contexts appears to be justifiable on independent grounds. First, recall that Modern Upper Aragonese shows /Cʎ/ as the reflex of Latin CL. Second, this overlooks the more general tendency in Hispano-Romance toward simplification (as /-*Cʎ-/ > /ʎ/, [*okʎo] > [oʎo], pre-OSp. [*kʎamar] > [ʎamar], but also *bl*- and *gl*- > *l*-, as in BLASPHEMARE > Sp. *lastimar*, GLANDINE > Sp. *landre*, FABULARE > Gal./Ptg. *falar*). Third, universal (or at least cross-linguistically common) phonological and phonetic tendencies are likely to play a major role here.

To recapitulate arguments made above, the sequence /*Cʎ/ faced a tendency to simplify to /ʎ/ (/*oklo/ > /*okʎo/ > /oʎo/); however, this may be blocked when a preceding nasal consonant has assimilated to the obstruent, which I claimed was due to the linking of phonological structure and may be considered an instance of the application of the Uniformity Condition. This resistance to loss allows other phonetic and phonological processes of assimilation to apply: the voiceless of the obstruent spreads to ʎ, and this phonetic process becomes phonologized; assimilation in place of articulation between the lateral and the obstruent also continues, leading from /*Cʎ̥/ to [*cʎ̥]. Eventually, the listener plays an important role in the development of this change, and [*cʎ̥] is reinterpreted by the listener as [tʃ], with concomitant restructuring of the underlying forms. That is, by making the reasonable assumption (made, for instance, by Lloyd 1987) that at a proto-stage Spanish, Galician/Portuguese and Upper Aragonese had /*Cʎ/, and by further assuming the existence and relevance of assimilation in voicing and place of articulation, the various outcomes in these languages are interrelated, if not expected.

This is the approach I followed in Holt (1996b), though I was not aware at that time of the facts from Algonquian, Navajo, Itelman and Norwegian, and it is the course taken here.[3] Similar to the argumentation of Ohala (1974a), in Holt (1996b) I showed spectrograms that compared /*Cʎ̥/ to [tʃ]. Similar spectrograms are shown in §4.1.2. I found that the voiceless palatal [ʎ̥] and the palatal fricative [ʃ] are quite similar acoustically, and so might conceivably be confused by the listener. When the listener turns speaker (either a child or an adult, though perhaps more likely the former for developmental reasons), she might produce a segment that is articulatorily more simple ([tʃ] versus [cʎ̥]) given the close acoustic-perceptual similarity. This appeal to markedness considerations may not be required for the core of the analysis to hold, though I believe in this case that it is intuitively realistic and plausible.

This is an example that reinforces the point made by Ohala in much of his work. A quintessential quote on this matter is the following, in which he emphasizes that phonetics is an indispensable tool for the phonologist:

> The manner in which acoustic constraints effect sounds is well known: a speech sound X as produced by a speaker is acoustically similar to sound Y; a listener hears the sound as Y and reproduces it that way when he turns speaker. This is an excellent mechanism for producing phonetically abrupt sound changes (that is, abrupt from the point of view of articulation). (Ohala 1974a:254; a similar quote is found in Ohala 1980:90.)

To summarize this section, there are several pieces of evidence from a wide variety of languages that lend support to the phonetic plausibility of the change from CL to [tʃ]. We have seen that [l], [l̥], [s] and [ʃ] may be phonologically and phonetically related in several languages. And although there is no attested evidence that proves that there was a devoicing of /l/ or /ʎ/ in Hispano-Romance, we do know that this would be a natural process since it is common cross-linguistically and follows from basic principles of articulatory phonetics. Likewise, it is a reasonable assumption that Hispano-Romance passed through a stage /*Cʎ/, since this is attested in Modern Upper Aragonese, and this allows for a more unified approach to the divergent outcomes in Galician/Portuguese and Spanish.

Furthermore, there is a definite acoustic/perceptual similarity between the voiceless palatal liquid [ʎ̥] and the voiceless palatal fricative [ʃ], and it is quite plausible that [ʎ̥] might be interpreted as the articulatorily simpler [ʃ], perhaps aided by markedness considerations and developmental physical articulatory constraints of child language learners. Several of these issues are discussed in other sections of the dissertation.

Notes to the first Appendix to Chapter 4

1 However, data from the *Atlas linguistique de la France* (1902) show non-Standard French forms with palatalization of /l/, as in *flute* [fyut], *fleurir* [fyœrir], *les fleur* [le fyœr], *fleche* [fyee], peuplier [popye], *pleurer* [pyœre].

2 There is also anecdotal evidence from child-language English that this happens. (Mark Lieberman posting to the Optimality listserver on 16 November 1995, and personal observation.)

3 I thank two WECOL 1996 participants for pointing me toward others' work: Stuart Davis for making me aware of Richard Janda's dissertation, which first alerted me to Ohala's treatment of the Norwegian data; I also thank Jonathan Bobaljik for making me aware of the Itelman, Navajo and Algonquian data, and for suggesting references for the latter two.

SECOND APPENDIX TO CHAPTER FOUR

OTHER CASES OF THE ‘UNIFORMITY CONDITION’

In addition to the case mentioned in the text, I present here additional sets of data that appear to be amenable to a similarly-reformulated Uniformity Condition in which a conjoined constraint blocks an otherwise successful alternation:

(a) Loss of stop element of Proto Indo-European *g^w or *gh^w is blocked when a nasal consonant precedes it: e.g. PIE *g^wīōu > CLat. VIVUS ‘living’ vs. *dn̥gh^wā > LINGUA ‘tongue’ (Ohala 1983).

The data are essentially identical to those presented in tableaux (13) and (15) above, in which I argued that the linking of the nasal consonant to the following segment blocked the process of simplification. Here, simplification of the complex segment [*g^w] or [*gh^w] to [w] is blocked, with retention of the original segment. In contrast to tableau (16) (where /Cʎ/ became [Cʎ̥] by voicing assimilation), however, no other changes occur to further modify the original segment.

PIE /*g^{w}/ reduced, but /*ng^{w}/ retained into CLat.	{MAXSEGMENT & MAXPLACE} (NEIGHBORHOOD)	*COMPLEX (SEGMENT)	MAX
*g^{w}īōu > VIVUS	irrelevant	simplified √	* <g>
*dn̥gh^{w}ā > LINGUA	retained √	*	√

As in (16), without the stricter prohibition against linked elements being affected ({MAXSEGMENT & MAXPLACE}), we should expect simplification to yield *LINUA, parallel to CLat. VIVUS, contrary to the attested outcome.

(b) Vocalization-cum-palatalization in Old Spanish (examples taken principally from Penny 1991:61-62):

(i) DIXI 'I said' > [*dixse] OSp. *dixe* (= [diʃe] in Old Spanish)

FACTU 'deed' > [*faxto] > OSp. *fecho* (later *hecho*)

LACTE 'milk' > [*laxte] > H-R. [lejte] > OSp. *leche*

MULTU 'much' > H-R [mujto] > OSp. *mucho*

NOCTE 'night' > [*noxte] > H-R [nojte] > OSp. *noche*

OCTO 'eight' > [*oxto] > H-R [ojto] > OSp. *ocho*

STRICTU 'narrow' > [*estrexto] > H-R [estreito] > OSp. *estrecho*

This may be analyzed in simplified fashion as the following (recall that syllable-final velars have vocalized by this point):

(I appeal here to the oversimplified constraints NOCODA, 'no coda segments allowed' and NOPALATALIZATION, 'palatalized articulations are disfavored')

jt > tʃ js > ʃ	NO CODA	NO PALATALIZATON
fa[j]to = fa[j]to	*!	
fa[jto] > *fa[tʃ]o ☑		*

This is thwarted, however, when more than one consonant would be affected:

(ii) LECTORIL 'lectern' > *letril* (later *atril*), not [*letʃr'il]

FRAXINU 'ash tree' > *freisno* > *fresno* , not [*freʃɲo]

PECTINARE 'to comb' > *peinar*, not [*petʃɲar]

PIGNORA 'garment' > *peydra*, *pendra*, *prenda*, not [*peɲɾ'a]

VULTURE 'vulture' > *buitre*, not [*butʃr'e]

While some of these may be analyzed as the result of a prohibition against palatals in coda position (Lloyd 1987:254, Penny 1991, Harris 1983), e.g., *fresno*, *peinar*, others may not, since the sequence resulting from syncope ought to yield an acceptable onset cluster /tr-/. This is the case of *buitre* and *letril*:

jtC = jtC	NO LINKED PALATALIZATION	NO CODA	NO PALATALIZATON
bu[j]tre = bu[j]tre ☑		*	
bu[j]tre > *bu[tʃr’]e	*!		*

Nevertheless, this type of conjoining of constraints must be a language-specific option, since this particular case (blocking of palatalization when two consonants would be affected) does not hold in Carib. As discussed in Walsh (1995:§3.4.2.2), there are few consonant clusters in Carib, and a palatalization process that occurs therefore usually only affects one consonant, as seen in (i):

	Underlying	Surface	Gloss
(i)	pi:po	pi:p^{j}o	skin
	kuita	kuit^{j}a	spindle
	paisa:wa	paiʃa:wa	cluster of fruits

Nonetheless, Carib does have a limited number of consonant clusters, most of which are homorganic nasal + stop. Walsh suggests that since homorganic clusters share a place specification, it is understandable that both members of the cluster are affected by palatalization (which under her account is the spreading of a V-Place Coronal of the high vowel [i]):

	Underlying	Surface	Gloss
(ii)	poiŋgo	poiŋg'o	boar
	aixku:ru	aicçu:ru	fluid

As seen above, this contrasts with the Old Spanish data of the sort VULTURE > *buitre*, LECTORIL > *letril*, and PECTORALE > *peitral*, where the onset cluster resists palatalization.

Thus, the creation of a conjoined constraint appears to be language-specific. That is, the '&' operator is a device allowed universally, but the actual conjunction and instantiation of such a constraint is left to the individual language to determine.

(c) Posttonic loss in nonstandard Modern Portuguese, i.e., *fígado* ‘liver’ $\rightarrow$ nonstandard *figo*, but *estômago* ‘stomach’ $\rightarrow$ nonstandard *estombo*, not **estomo* (Cristina Schmitt, personal communication). (I use ‘$\hookrightarrow$’ here to indicate that this is not a historical process but a synchronic phonological reduction.)

Here, the loss of the posttonic vowel in [*fíg’do], leads to [figo] with loss of onset [d]. For the present purposes we may formulate this as the informal constraint ‘HAPLOLOGY’, by which the posttonic vowel and the following consonant are lost. This is shown below:

/figado/	HAPLOLOGY	MAX
figado	*!	
figdo	*! ([d] present)	*
fido	*! ([d] present, <g> missing)	**
figo ☑	√ <ad>	**

However, in *estômago*, [*estóm’go], leads to [estómbo], rather than **estomo* or perhaps **estogo*. Here, linking between the place of articulation of the ‘syllable-final’ [-m] and the following consonant prevents loss. This may be analyzed in a manner identical to that of the medial Hispano-Romance clusters [-NCʎ-] discussed above in (15). That is, simple evaluation of the number of segments lost (violations of MAX) yields the wrong results; instead, evaluation must take into consideration the linked structure of the [NC] cluster of [*estom'go] (← *estômago*). As above, this conjoined violation ({MAXSEGMENT & MAXPLACE}) must be a more serious violation than simple MAX:

/estomago/	{MAXSEGMENT & MAXPLACE} (NEIGHBORHOOD)	HAPLOLOGY	MAX
estomago		*!	
estomo	*!	√	**
estogo	*!	* ([g] present, <m> missing)	**
estomgo ☑	√	* ([m] present)	*
estombo ☑	√	* ([m] present)	*

If we were not to consider {MAXSEGMENT & MAXPLACE} a more highly-ranked violation than HAPLOLOGY, the optimal output *estombo* would be unexplained, since **estomo* is the output parallel to *figo* given above.

One other aspect of the above data needs to be considered, the retention of the consonant that appears in coda position after syncope of the unstressed vowel, at the expense of the onset consonant. This contrasts with what typically happened in Late Latin and Old Spanish:

(i) OLat. FRIGIDAM 'cold' > CLat. FRIDAM

CUBITU 'elbow' > OSp. *cobdo* > MSp. *codo*

DEBITA 'debt' > OSp. *debda* > MSp. *deuda*

Compare this with the typical case of Standard Portuguese, where posttonic syncope is rare:

(ii) BIFERAM 'early fruit of a fig tree' > *bêbera*

CUBITUM 'elbow' > *covedo* (old)

DEBITAM 'debt' > *dívida*

DECIMUM 'tithe' > *dízimo*

SPATULAM 'shoulder blade' > *espádua*

Considering these data, one sees that the process involved here is an exceptional one. Even accepting for present purposes the analysis sketched above, the formulation of HAPLOLOGY to target the posttonic vowel and the following consonant is clearly ad hoc and stipulative. However, in the hypothetical intermediate forms [*estom'go] and [*fig'do] that I suggest exist, the [m] or [g] in coda position might be expected to undergo weakening, change or loss, not the following consonant in the stronger and more stable onset position. For some reason in these two cases it is the coda consonant that is in some sense more dominant: in the case of *figado* → *figo* the [g] is retained, and in *estômago* → *estombo* the [m] is retained. Furthermore, quite unexpectedly, the [m] also gives its place of articulation to the following consonant, modifying [g] to [b]. This is contrary to the well established practice in Hispano-Romance and other languages of nasal consonants assimilating to following obstruents. Whatever the correct analysis is of these processes will determine the reason that the final example in the tableau above (with [mb]) should be the optimal one. These are interesting points, but I must leave further exploration and explanation of these data to a future time. The discussion given here is admittedly incomplete and preliminary, but my principal aim to show that linking of consonants can inhibit the successful application of other processes should hold true under the final analysis.[1]

(d) Data from Wireback (1996b): metathesis in Portuguese of yod with one segment, but loss of yod when it would have to jump two segments:

(i) BASIU > [*basjo] > *baixo* [bajʃo] ‘low’ not **baso*

CAPIAM > [*kapja] > *caiba* ‘s/he fit’ not **capa*

CASEU > [*kasjo] > *queijo* [kejʒo] ‘cheese’ not **caso*

CORIU > [*korjo] > *coiro* [kojru] ‘leather’ not **coro*

RABIA > [*ravja] > *raiva* [rajva] ‘anger’ not **rava*

SAPIAT > [*sapja] > *saiba* [sajba] ‘s/he know’ not **saba*

(ii) NERVIU > [*nervjo] > *nervo* ‘nerve’ not **neirvo* or **nervio*.

LIMPIDU > [*lempjo] > *limpo* ‘clean’ not **leimpo* or **lempio*

TURBIDU > [*turvjo] > *turvo* ‘muddy’ not **tuirvo* or **turvio*

In examples of the sort seen in (i), the yod metathesizes to end up in the position before the single consonant. While this would incur a violation of LINEARITY, the constraint governing metathesis (see Hume 1995), this apparently came to be preferable to the preceding stage which showed a rising diphthong, and probably later a palatalized consonant.

/basio/	NO PALATALIZATION	MAX	NO METATHESIS (LINEARITY)
bas^{j}o	*!		
baso		*!	
bajso ☑			*

([*bajso] is the form hypothesized to have preceded the palatalization of [s] leading to MPtg. *baixo* [baiʃo].)

However, in examples of the sort given in (ii), the yod would have to jump over two segments, both the consonant in the onset of the syllable it originally occupied and the final consonant of the preceding syllable. The hypothetical examples **neirvo*, **leimpo* and **tuirvo* never could have occurred, in principle, because the metathesis of the yod would have been too costly, in the sense that it would have doubly violated LINEARITY:

/nervio/	NO PALATALIZATION	NO DOUBLE METATHESIS	MAX	NO METATHESIS (LINEARITY)
nerv^{j}o	*!			
nejrvo		*!		(**)
☑ nervo			*	

It is crucial here, however, for this double metathesis to be considered a more costly violation than the mere double violation of LINEARITY, which we saw in the first tableau to be necessarily ranked below MAX, otherwise loss should be the preferred outcome for the data in (i), contrary to fact.

Furthermore, there are plausible phonetic reasons for this dual behavior as well. The palatal gesture (as in the glide [j], e.g. /basjo/) is a relatively slow tongue body gesture, and may begin relatively early with respect to the consonant that precedes it. If this gesture were produced early enough, it could easily overlap the preceding consonant enough to have an acoustic effect on the preceding vowel. If this were to occur, it would likely lead the listener to perceive [ba^{j}sjo], and to interpret this effect as a preceding patalal glide.

However, even if this early realization were to occur in cases like /nervjo/, the same amount of anticipation would not be perceived as affecting the preceding vowel; instead, there would merely be overlap with the second preceding consonant. That is, early realization of the palatal gesture leads to the appearance of metathesis when one consonant precedes the palatal glide, but it is not early enough to cross two consonants.

Notes to second Appendix to Chapter 4

1 These data are quite similar to the child language truncation data of Pater and Paradis 1995, analyzed in Hironymous 1997:

(i)	*broccoli*	[baki]
	buffalo	[bʌfo]
	camera	[kæmə]
	chocolate	[takət]
	favorite	[fevɪt]
	Margaret	[margɛt]
	spatula	[bætʃə]

Hironymous, in an optimality-theoretic implementation of key ideas of Clements 1990, argues that the consonant that is retained in the truncated form is the one lowest in sonority, and as such, that maximizes the sonority cline between the onset and the following nucleus. Thus, for her first example *broccoli* → [baki], not [*bali], the attested form is optimal because [k] is lower in sonority than [l], and thus the sonority cline between [k] and [i] is greater than between [l] and [i] in the unattested and suboptinal form [*bali]. She implements this via the interaction of constraints on truncation, alignment of feature values and anchoring.

The data are quite similar to the Portuguese data discussed here, but in the examples given above, the resulting sonority cline does not seem to be a factor in determining the outcome; in *figado*, it is unclear that sonority distinctions are made within the series of voiced obstruents, so the choice of *figo* appears to be due to other constraints. In the case of *estômago*, the optimal output *estombo* retains the nasal consonant along with the obstruent. Here, if only sonority were decisive, we should expect **estogo* because obstruents are less sonorous than nasals.

The data Hironymous cites contain no examples parallel to *estômago* → *estombo*, so we cannot see the effect of a constraint like {MAXSEGMENT & MAXPLACE} here, though presumably if there were such cases this constraint could be interleaved in the constaint hierarchy to yield results like the Portuguese data discussed here.

CHAPTER FIVE

SUMMARY AND CONCLUSIONS

My goal in this dissertation has been to show the importance of phonetic factors and the role of the listener in historical sound change. I showed that these intuitive notions were susceptible of incorporation into the constraint-based approach adopted here via the process of lexicon optimization and grammar simplification. The analyses presented bear out the hypothesis that the role of perception and reinterpretation by the listener is crucial in driving historical change. We also saw that when reinterpretation does occur it may trigger further profound changes.

In Chapter 2 we saw that this was the case of the perception of quality distinctions that accompanied 'length,' leading to the elimination of the more marked feature duration. In turn, the loss of long vowels motivated the gradual rise of a prohibition against moraic consonants. The effects of this step-wise 'repair' were the elimination of the moraic status of obstruents, producing simplification of obstruent geminates and vocalization of syllable-final velars.

Chapter 3 showed the continued effects of the loss of distinctive vowel length from Latin. In the first part of the chapter I argued that a major concomitant of loss of phonological length was reanalysis of the Latin Stress Rule as the imposition of a constraint requiring that tonic syllables be bimoraic. At first, Late Spoken Latin allowed all tonic vowels to lengthen, but in Castilian territory a constraint disfavoring long lax vowels came to dominate, perhaps due to the influence of the invading Germanic tribes. This caused the diphthongization of tonic /ɛ, ɔ/, which by dissimilation and lexicon optimization became /je, we/.

In the second part of Chapter 3 I addressed the continued rise of $*C_{\mu}$, which now affected the evolution of the next-most sonorous geminates, /nn, ll/. In Galician/Portuguese, intervocalic /n, l/ had been lost, and the simplification of geminates yielded new /n, l/. Old Spanish retained Latin /n, l/, however, and the possibility of merger that would have resulted from simplification of /nn, ll/ appears to have inclined speakers to modify the original articulation of the geminates. The alteration and simplification that resulted was hypothesized to have occurred via the gradual loss of length accompanied by a correspondingly gradual increase in palatality. This was argued to be due to the spreading out of the region of contact between the tongue and the roof of the mouth in order to maintain the energy originally associated with the geminates, apparently in order to avoid merger with simple /n, l/.

Chapter 4 presented another case in which the listener could play a role in determining historical change in addition to optimizing the lexicon. Just as the perception of differences in vowel quality of the originally long vowels led to the loss of quantity and a reduction in markedness, so does the interpretation of acoustic equivalency between [c̥ʎ] and [tʃ] lead to the selection of the less-marked underlying representation *ch* for original *Cl*.

The difference between Old Spanish initial *ll*- and Galician/Portuguese initial *ch*- was posited to be due to the more conservative spread of the initial step in the creation of [tʃ], assimilation of /Cl/ to /*Cʎ/. When these sequences were simplified in early Hispano-Romance, initial Galician/Portuguese /Cl/ was not affected. However, after the constraint disfavoring complexity was demoted because it no longer had any inputs to simplify and in a sense was 'inactive,' the spread of /*Cʎ/ does reach initial position, and conditions in the grammar again yield [tʃ].

I also showed that an Optimality-Theoretic formulation of the Uniformity Condition (here, the conjoined {MAXSEGMENT & MAXPLACE}) impeded simplification of /*-NCʎ-/, allowing further phonetic tendencies to have an effect, leading to the perception of [-tʃ-].

Taken as a whole, the results obtained here lend ample support to the assumption that the listener is a significant source of sound change. Specifically, the listener is intimately involved in a cycle of change that typically follows the order phonetics > phonology > lexicon optimization > grammar optimization. We also saw that this process may impact the acquisition of the rankings of the constraints in the grammar of speakers of newer generations.

Though I necessarily left certain issues aside and did not pursue exhaustively some of the implications of the analysis, an overall picture has begun to take shape that this intuitive notion may be incorporated successfully into theoretical approaches to phonology. It is the adoption of the constraint-based Optimality Theory that has allowed for the establishment of a relation between many of the changes discussed here. The analyses here are innovative, and I hope elegant, in that sense, though they rely heavily on traditional argumentation to sustain them.

In conclusion, the incorporation of phonetics and the role of the listener into the explanation of historical sound change provides us with a firmer base for understanding the phenomena analyzed here, and suggests that this is an area for further fruitful investigation.

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