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THE EMERGENCE OF PALATAL SONORANTS AND ALTERNATING DIPHTHONGS IN OLD SPANISH

Abstract. The loss of contrastive vowel length in Late Latin is argued to have given rise to important changes in the consonantal system, whereby moraic status was affected according to increasing sonority: first was the reduction of obstruent geminates and the vocalization of syllable-final velars and *l*, then the simplification of the sonorants *nn, ll* to *n, l* in Galician/Portuguese but to palatal *ñ, ll* in Spanish, where merger avoidance was an issue. Further, the reanalysis of Latin stress led to the formulation of a constraint requiring stressed vowels to be lengthened, and heavy Germanic influence in pre-Old Spanish, including the imposition in a dominant position of a constraint that disfavored long lax vowels, led to diphthongization of /ɛ́, ó/ to [je, we]. An Optimality-Theoretic account of these changes is presented here, one in which the listener/learner plays a crucial role, as do systemic factors, in shaping the path of phonological evolution.

Keywords: Degemination, diphthongization, Germanic influence, lexicon optimization, merger avoidance, moraic theory and sonority classes, palatalization, role of the learner and listener, systemic factors in simplification, Latin, Hispano-Romance, Spanish, Galician/Portuguese.

0. INTRODUCTION[1]

In this chapter I explore the consequences for Old Spanish and Galician/Portuguese of the loss of vowel length in Latin. I show the effects of the step-wise rise of a constraint NOMORAICCONSONANTS on the evolution of moraic segments in Latin, affecting first the least sonorous obstruents, followed by the geminate sonorants /nn, ll/. I argue that the listener is important in reaching the final outcome of the evolution of these segments, /n, l/ in Galician/Portuguese, but /ɲ, ʎ/ in Spanish, and that systemic factors and considerations of merger avoidance (*MERGE) were crucial in determining the language-specific resolution. Further, I argue that speakers came to reformulate the Latin Stress algorithm 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, including the formation and phonologization of the Spanish diphthongs /je, we/ (< /ɛ́, ó/).

The chapter is organized as follows: after presenting the relevant data and framing the principal issues (§1), I discuss consequences of the loss of contrastive vowel length, first for obstruents (§1.1), then for sonorants (§1.2), namely simplification of *nn, ll* in Galician/Portuguese (§1.2.1) and the formation of the palatals *ñ, ll* (ɲ, ʎ) in Old Spanish (§1.2.2). I then turn to the consequences of the

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reanalysis of the Latin Stress Rule for Hispano-Romance vowels (§1.3), discuss the effects of a constraint STRESS-TO-WEIGHT in Hispano-Romance (§1.3.1), namely the lengthening of tonic vowels and the formation of the alternating diphthongs *ie, we* ([je, we]) in Old Spanish. In §2 I summarize the various constraint rankings and classes of moraic segments in the historical stages treated here, and in §3 provide a general summary and offer conclusions.

1. THE PHENOMENA TO ANALYZE IN HISPANO-ROMANCE

One of the principal traits that separate Spanish from Galician/Portuguese is the retention in the latter of the seven-vowel system of Late Spoken Latin that developed from the Classical Latin ten-vowel system:

Table 1. The vocalic system of Classical Latin

Stage 1: **Stable short:long opposition**	**Stage 2:** **Leading to later elimination of length**
iː i uː u	iː uː
	ɪ ʊ
eː e oː o	eː oː
	ɛ ɔ
aː a	aː a

Examples:

MĪSĪ	BIBIT	TŪ	BUCCAM	BIBIT > [bɪbɪ(t)]	BUCCAM > [bʊka(m)]
SĒTA	PEDEM	SŌLEM	ROTAM	PEDEM > [pɛðɛ(m)]	ROTAM > [rɔda(m)]
	MĀTER	PATER			

As discussed in Holt (1997, 1999), in the earliest period of Latin, phonological length was realized by means of longer or shorter duration,[2] with articulatory differences being negligible. The phonetic manifestation of length came, however, to include differences in tongue height and tension; that is, quite early on, /iː, uː/ began to differ from /i, u/ articulatorily, as did /eː, oː/ from /e, o/. While the long vowels were stable, the short vowels became somewhat lower and laxer. The result is that /i/ and /u/ opened to [ɪ, ʊ], and /e/ and /o/ opened to [ɛ, ɔ] (stage 2 above). The eventual result is the merger of Latin /i, u/ ([ɪ, ʊ]) with /eː, oː/ (stage 3 below). As phonological length is now also phonetically realized with distinct vowel quality, this quality difference would be sufficient to maintain contrast, and would be easier to articulate and perceive than vowel length (Pulgram 1975:260); this conjunction of factors led to the abandonment of length as a phonologically independent feature (summarized from Lloyd 1987:71-75, 110-111).

Table 2. Vowel systems of Late Spoken Latin, Hispano-Romance and Old Spanish

Stage 3: ***Late Spoken Latin, Hispano-Romance (also Galician/Portuguese)***	**Stage 4:** ***Old Spanish***
i u	i u
e o	e o
ɛ ɔ	é > je ó > 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 ‘prairie’		pr[a]do	

A schematic representation of these changes is given below:

Table 3. Summary of steps in the loss of contrastive vowel length

Stage 1:	Stage 2:	Stage 3:
$/V_{\mu}/ > [V_{\mu}]$	$/V_{\mu}/ > [V'_{\mu}]$	$/V'_{\mu}/ < [V'_{\mu}]$ (lexicalization[3] of new quality of short vowels)
$/V_{\mu\mu}/ > [V_{\mu\mu}]$	$/V_{\mu\mu}/ > [V_{\mu\mu}]$	$/V_{\mu}/ < [V_{\mu\mu}]$ (< $/V_{\mu\mu}/$)
(only duration distinguishes long and short vowels)	(short vowels are now laxer and lower, and so now differentiated by both quantity and quality)	(quantity eliminated: formerly long vowels shortened because quality alone now distinguishes them; lexicalization of this. System reanalyzed.)

(Stage 4, retention vs. diphthongization of [é, ó], treated in §1.3.1.)

Another characteristic that distinguishes Old Spanish from Old Galician/ Portuguese is the treatment in each of the Latin sonorants /nn, ll/.[4] These simplified in both Old Spanish and Galician/Portuguese, but with differing results depending on how Latin simple /n, l/ developed: in Spanish they have been 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/).

Table 4. Results of the simplification of Latin /nn, ll/

	Old Spanish	***Galician/Portuguese***	***Gloss***
a.	(< Lat. /nn/) (= /n_{μ}/)	(< Lat. /nn/)[5] (= /n_{μ}/)	
	caña [ɲ]	*cana*	'cane'
	año	*ano*	'year'
	paño	*pano*	'cloth'
b.	(< Lat. /ll/) (= /l_{μ}/)	(< Lat. /ll/)[6] (= /l_{μ}/)	
	bello [ʎ]	*belo*	'pretty'
	castillo	*castelo*	'castle'
	caballo	*cavalo*	'horse'

I will show that the changes seen in these two sets of data (diphthongization from Hispano-Romance to Old Spanish and the simplification of /nn, ll/) ultimately derive from this loss of vowel length (discussed further in Holt 1997, 1999). If the analysis here withstands scrutiny, then this unexpected result adds to our understanding of these historical changes.[7]

1.1. Consequences of the loss of vowel length for the evolution of Latin geminate obstruents and syllable-final velars

Consequent to the loss of contrastive vowel length was the gradual elimination of moraic (geminate and syllable-final) consonants to regain systemic parity (Holt 1997, 1999).[8] That is, the elimination of phonologically long vowels suggests that geminate consonants should not exist in the language, as the latter are less sonorous elements, extending the argumentation of Zec (1995). I have argued that systemic recovery occurred via the gradual elimination of the moraic status of consonants, a process that took place according to the sonority of the segments in question.

First, let us consider the relevant data:

Table 5. Geminates in Latin

pp	CUPPA	'wine glass'	(> MSp. *copa*)
tt	CATTUS	'cat'	(> MSp. *gato*)
kk	BUCCA	'mouth'	(> MSp. *boca*)
bb (rare)	ABBATE	'abbot'	(> MSp. *abad*)
dd (rare)	ADDITUS	'added'	
gg (rare)	AGGER	'rampart'	
ff	AFFLARE	'to blow'	
ss	CASSA	'empty'	
mm (rare)	FLAMMA	'flame'	(> MSp. *llama*)
(see §1.2)			(10^{th} or 11^{th} c.)
nn	ANNU	'year'	(> MSp. *año*)
ll	BELLU	'pretty'	(> MSp. *bello*)
rr	CARRU	'cart'	(> MSp. *carro*)

The process of simplification affected the obstruents first, then the sonorants.[9] Below are given representative data that show that the velar consonants (stops, and *l* – see note 10) of velar-coronal clusters (the only clusters that remained) were also simplified, vocalizing to [j]:

Table 6. Remaining syllable-final consonants

/-kt-/	OCTO	'eight'	(Hispano-Romance *oito*)
/-gn-/	PUGNUS	'fist'	(Hispano-Romance *pu*[ɲ]*o*)
/-lC-/	MULTU	'much'	(Hispano-Romance *muito*)

The changes that affected the consonants followed the sonority hierarchy (vowels > glides > liquids > nasals > obstruents), and segmental structure was progressively changed so that moraicity could be maintained. The loss of the ability of consonants to bear a mora affected the least sonorous segments, the obstruents, first, with the geminates simplifying and the syllable-final velars becoming [+sonorant] ([-j], later lexically optimized to /j/) and thus able to bear a mora.[10] Thus, *anno* 'year', *bello* 'pretty', etc. still exist, though they eventually simplified around the 10th or 11th century; all long segments were finally eliminated, leaving Hispano-Romance with a system of only short segments.

The constraints whose interaction is relevant are the following:

(1) NOMORAICCONSONANTS (NMC)[11]
$*C_{\mu}$
'Consonants may not bear a mora.'

(2) FAITHFULNESS (Correspondence version; McCarthy 1995)
'Preserve lexical contrast.' (Kager 1999:5)

MAXIMALITY (MAX)
'Every element in the input has a correspondent in the output.'
('No deletion.')

DEPENDENCY (DEP)
'Every element in the output has a correspondent in the input.'
('No insertion.')

IDENTITY-[F] (IDENT)
'Correspondent segments have identical values for feature [F].'
('No feature changing.')

The initial state of affairs described above is depicted here:

Tableau 1. First reranking of faithfulness vis-à-vis sonority/moraicity hierarchy

a - - - - - - - - - - →

/-k, -g/		NOMORAIC OBSTRUENTS (NMO)	MAX/IDENT[12]	NOMORAIC SONORANTS (NMS)
		(Syllable-final obstruents vocalize to bear mora)		
$-k_\mu$, $-g_\mu$		*!		
☞ $-j_\mu$			* <+cons> * <-son>	*
/k_μ, g_μ/		(Intervocalic moraic obstruents lose their mora, simplifying)		
k_μ, g_μ		*!		
☞ k, g			* <μ>	
j_μ			* <+cons> *! <-son>	*
/n_μ, l_μ/		(Sonorant geminates still valid mora-bearers at this stage)		
☞ n_μ, l_μ				*
n, l			*! <μ>	

However, the relationship between faith and the sonority hierarchy continues to shift in the same direction, and eventually even the sonorant consonants lose their license to bear a mora. This is treated in the next section.

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

NMC continues to rise vis-à-vis faithfulness 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 in Table 7.[13]

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. That is, this appears to be a case where systemic factors and phonological universals indeed influence change (Martinet 1952, Jakobson 1972, Padgett to appear, this volume).[14]

Table 7. Development of Latin /-n-, -l-/

	Old Spanish	***Old Galician/Portuguese***	***Gloss***
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'

1.2.1. Simplification of /nn, ll/ in Galician/Portuguese

Given that Latin /-n-, -l-/ had been lost in Galician/Portuguese, the next step-wise rise of NMC, the reranking of NOMORAICSONORANTS (NMS) above MAX/IDENT, leads to simplification of the geminate sonorants /nn, ll/.[15] As a result of the new dominant ranking of NMS, nasals and laterals have lost their ability to bear a mora, and their length is lost. (The reader may verify this by referring to Tableau 1.) 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/). In the end, all relevant markedness constraints now dominate all relevant faithfulness constraints. (Additionally, for younger speakers forming their grammar, the lack of evidence that nasals and laterals may be moraic also affects the reranking of NMS (or NMC more generally) from its initial position. That is, if one assume an initial ranking of M » F, ambient data will not motivate any demotion/reranking of relevant constraints, and the mature ranking relationship will match the initial state.)

1.2.2. 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 NMC, that of NMS above MAX/IDENT (via the demotion of MAX/IDENT below NMS) will cause the loss of the moraic status of /nn, ll/ ($/n_{\mu}$, l_{μ}/), 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 /ɲ, 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/. Analogous to the analysis of vowel length and quality in Holt (1997) and above, once such a phonetic distinction existed 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 to 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 NMC, 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*, STEPHANUM > *Esté*[v]*an* , CASAM 'house' > *ca*[z]*a*), and little confusion arose because original /b, d, g/ had become [β, ð, ɣ] (which frequently deleted intervocalically, e.g., CREDO 'I believe' > *creo*, REGINAM 'queen' > OSp. *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, 1987:243), apparently sufficiently few to impede merger.

Geminate /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 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 Spanish /nn, ll/. That is, this is an instance where systemic factors influence the learner/listener to restructure the grammar in a particular way, such that former communicative distinctions are maintained, while at the same time continuing to reestablish systemic parity in the distribution of moraic segments according to sonority.

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, with the articulatory force originally spent on prolonging contact of the articulators now spent on enlarging the region of contact between the tongue and the roof of the mouth. A palatal quality would result, and this 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 singleton 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 via involvement of the tongue dorsum)... > [n^{j}(n)] (not as long as before, but correspondingly more palatal (via more dorsal articulation))...[ɲ] (fully palatal (corono-dorsal), fully short). (/l_{μ}/ would have undergone an analogous 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/. However, under the assumption that 'palatal' segments are actually doubly-articulated corono-dorsal structures (Keating 1988, Lipski 1989), notice that speakers in a sense actually do maintain some realization of 'doubleness'. That is, while the mora resulted originally in extended (double) duration, it is now realized in extended (double) articulation, original COR and new DOR, i.e., 'palatal' (e.g., Keating 1988 and Lipski 1989). This is schematized here:

Tableau 2. Merger avoidance in Old Spanish of nn, n *by palatalization of* nn

/nn n/	NMS	*MERGE	MAX/IDENT/DEP
a. n n n h f COR	*!		
b. n n		*!	* <μ>
☞ c. ɲ n 1 COR DOR			* <μ> * +DOR

This tableau should be interpreted slightly differently than the typical one: following Padgett (1997, to appear, this volume),[16] what is being evaluated here is a system of inputs, not an individual segment. That is, the contrast between segments is considered, and a constraint *MERGE ('No output word has multiple correspondents in the input'; 'Maintain contrast', in effect) plays a role in the evolution of the long sonorants. The high ranking of NMS forces loss of moraic status, yet doing so without further change would result in loss of the contrast *nn:n* (and also of *ll:l*). If faithfulness is ranked below *MERGE, then a change to /ɲ, ʎ/ will preserve contrast. Candidate (a) represents the previously optimal state where geminate sonorants are licit, and contrast with the singletons. The double association to COR is intended to represent the fact that in production, the coronal articulation is lengthened (more precisely, that the release is delayed, prolonging total time). Candidate (b) shows what would happen if the previously moraic *nn* were to lose its mora: merger with *n*, contrary to fact. Candidate (c) shows the result in Old Spanish: moraic status is still lost, but a change in articulation (the addition of DOR) allows the preservation of contrast between *nn:n*, now *ɲ:n*. The double implementation of COR is now replaced by the double articulation of COR-DOR. (The dotted line under the faithfulness constraints is used to show which segment of the contrasting pair undergoes change.) For Galician/Portuguese, given that /-n-, -l-/ were lost, elimination of the moraic status of /n_μ, l_μ/ does not violate *MERGE, and so nothing motivates a segmental change.

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, systemic factors have influenced evolution: loss of length and contrast preservation forced a 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).[17]

1.3. Reanalysis of Latin stress: consequences for Hispano-Romance vowels

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.[18] 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 algorithm 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.[19] I formulate this as the following constraint:

(3) STRESS-TO-WEIGHT (STW)
$\sigma = \mu\mu$
'A stressed syllable is bimoraic.'

(Also known as Peak Prominence; see inter alia Prince 1990, Anttila 1997b, Morén 1999, as well as numerous other works cited in Holt 1997.)

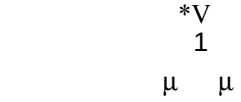
(That is, while in earlier Latin, stress is assigned to a particular syllable because of vowel bimoraicity, now speakers add a mora to a vowel because it occurs in a stressed syllable.)

1.3.1. The effects of STRESS-TO-WEIGHT in Hispano-Romance

Williams (1962:11) 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. 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 (see Meillet 1970). Support for this assumption is that there was increased syncope of the posttonic penultimate vowel and 'fracture' of tonic /ɛ́, ɔ́/ into diphthongs.[20]

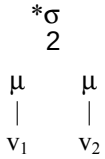
Vowel lengthening in Hispano-Romance. Given that stressed syllables must be heavy to satisfy STW, there will be other factors that determine how this condition will be met. The most obvious solution is to lengthen the nuclear vowel, and if this is the minimal violation of the constraint hierarchy, lengthening will occur. Another possibility is for some sort of diphthong to arise. These alternatives will incur a violation of either the constraint *LONG-VOWEL or NODIPHTHONG, respectively, formulated here:

(4) *LONG-VOWEL[21] (Holt 1997, 1998)



'No long vowels'; 'Long vowels are disfavored.'

(5) NODIPHTHONG (Rosenthall 1994:17)



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 NODIPHTHONG will determine the output. The Hispano-Romance evidence suggests that in this period all vowels were lengthened, not diphthongized. (For discussion, see Lloyd 1987:116-30, 184-87, Penny 1991:43-4.)

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, 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 faithfulness allows this.) The lengthening that this ranking permits affected all vowels in Hispano-Romance.[22]

Tableau 3. Vowel lengthening in Hispano-Romance

/prado/ 'prarie' (/sɛte/ 'seven', /mesa/ 'table', /ida/ 'departure', /duro/ 'hard', /odio/ 'hatred', /bɔno/ 'good')	STW	NODIPHTHONG	*LONG-VOWEL
a. prado (etc.)	*!		
b. praa̲do (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 (violating low ranked DEP, not shown); 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.

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, though 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 documented. 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 1985:93-4; 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 1985:116).

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

(6) *LONG-[-ATR]

$*V_{\mu\mu}$
|
[-ATR]

'Long lax vowels are disfavored.'

(Holt 1997, based on Donegan, Moulton, Wängler, Benware; see also Miglio & Morén, this volume, for *SHORT[TENSE].)

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 1985:219). An example from Modern German also illustrates this. In northern Germany, [eː] 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 1969:11).

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 before the appearance of the first documents 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. (Williams 1962, pp. 11-13, 53, 56-57, 78, 87-88.)

Table 8. Evidence suggesting a less intense stress accent in pre-Galician/Portuguese

Fewer cases of syncope:

Latin	*Galician/Portuguese*	*Spanish*	*gloss*
-ABILEM	*-ável*	*-able*	'-able'
ANGELUM	*angeo* (> *anjo*)	*angel*	'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*[23]	'to repent'

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'

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)

Failure of /ɛ, ɔ/ to diphthongize:

Galician/Portuguese	*Spanish*	*gloss*
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:

Tableau 4. Diphthongization in Old Spanish

/bɔno/ 'good'	STW	*LONG-[-ATR]	NODIPHTHONG	*LONG-VOWEL
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). 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 1985:118).

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/.[24, 25]

This concludes the exploration of two highly significant responses to the loss of distinctive vowel length from Late Latin to Hispano-Romance: the rise of the constraint disfavoring moraic consonants and the further evolution of vowels lengthened under stress, with Germanic influence in Old Spanish leading to the diphthongization of the mid vowels. The rise of NMC is now complete (that is,

markedness now fully dominates faithfulness, which has been successively demoted by learners), and Old Spanish no longer has long consonants, having now a phonemic inventory that is uniformly simple or short.

We have seen along the way that the listener/learner has played a crucial role at all stages, and that systemic/phonological factors have guided the path of evolution.[26]

2. SUMMARY OF CONSTRAINT RANKINGS AND MORAIC CLASSES

By way of summary, I schematize here the changes that affected the geminate sonorants /nn, ll/ of Late Spoken Latin and its seven-vowel system:

Table 9. Evolution of geminate sonorants /nn, ll/

	Surface Form (Output)		**Underlying Form (Input)**	*Constraint rankings*
Late Spoken Latin:	nn, ll	=	n_{μ}, l_{μ}	NMO » MAX/IDENT » NMS
(Only sonorants may bear a mora and surface as geminate at this stage of Latin. See Tableau 1.)				
Galician/Portuguese:	n, l	<	n_{μ}, l_{μ}	{NMO, NMS} (= NMC) » MAX/IDENT
(/n, l/ lost in intervocalic position, so simplification occurred without merger; in the modern languages, /n, l/ now underlying representation)				
pre-Old Spanish:	ɲ, ʎ	<	n_{μ}, l_{μ}	{NMO, NMS; *MERGE} » MAX/IDENT/DEP (gradual palatalization via increasing involvement of tongue dorsum)
Old Spanish and Modern Spanish:	ɲ, ʎ	=	ɲ, ʎ	{NMO, NMS} (= NMC) » MAX/IDENT/DEP

(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. While length was double in Latin and Hispano-Romance, a double articulation in Place comes to be realized, maximizing faithfulness to systemic contrast (*MERGE), though differently under pressure from the loss of consonantal moraicity due to the domination of NMS (NMC) » MAX/IDENT. A progressively shorter and more palatal segment results, until reaching Old Spanish [ɲ, ʎ]. See Tableau 2.)

Table 10. Constraint rankings in the evolution of Hispano-Romance /ɛ, ɔ/

a. **Hispano-Romance:** (see Tableau 3)
- STRESS-TO-WEIGHT » FAITH (i.e. DEP 'no insertion')
  (tonic vowels lengthen)
- 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:** (see Tableau 3)
Same as Hispano-Romance

c. **Old Spanish:** (see Tableau 4)
- STRESS-TO-WEIGHT » DEP ('no insertion')
  (tonic vowels lengthen)
- STRESS-TO-WEIGHT » ***LONG-[-ATR]** » NODIPHTHONG
  (lax vowels may not be long, and diphthongize under heavy Germanic influence)
- STRESS-TO-WEIGHT » NODIPHTHONG » *LONG-VOWEL
  (tense vowels (and /a/) lengthen, do not diphthongize)

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:

Table 11. Sonority classes from Latin to Old Spanish and Galician/Portuguese

a. **Latin:**	b. **Hispano-Romance:**	c. **Old Spanish, Galician/Portuguese:**
μ = unrestricted	μ = [+sonorant]	μ = [-consonantal]
(thus vowels and sonorant and obstruent consonants may be moraic)	(thus only vowels and sonorant consonants may be moraic)	(thus only vowels may be moraic)

3. GENERAL SUMMARY AND CONCLUSIONS

I now recapitulate the principal findings of this chapter. Complexities of the vocalic system of Late Latin led to the abandonment of length as a distinctive feature, and a gradual process ensued that eliminated (via the rise of a constraint NOMORAICCONSONANTS) the moraic status of less sonorous segments, affecting first obstruent geminates and syllable-final velars and *l*, then sonorants. In addition, we saw that simplification of the geminate sonorants /nn, ll/ by the continued rise of NMC (specifically NMS) 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 (*MERGE), which was not a danger for speakers of Galician/Portuguese.

Further, after the abandonment of distinctive length, a constraint STRESS-TO-WEIGHT (Peak Prominence) gives rise to lengthened tonic vowels in Hispano-Romance; later, pre-Old Spanish came to diphthongize lengthened lax vowels (perhaps due to heavier Germanic influence, reflected in the newly high ranking of *LONG-[-ATR]). Subsequent cycles of dissimilation and lexicon optimization led to /je, we/ (*ie, we*). Interaction and reranking of the limited number of constraints given above (STRESS-TO-WEIGHT, *LONG-VOWEL, *LONG-[-ATR], NODIPHTHONG) achieved these results.

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 NMC (that is, step-wise demotion of faithfulness) 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 (supported by evidence of poetic meter) 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 NMC versus MAX/IDENT (also understood as the ultimate demotion of faithfulness) 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 NMC 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 NMC has completed its ascension above MAX/IDENT in Old Spanish as well, also satisfying *MERGE.

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), as well as the importance of systemic factors in shaping phonological evolution, and model these intuitions according to the theoretical machinery of Optimality Theory.

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4. NOTES

[1] I'd like to thank Fernando Martínez-Gil, Alfonso Morales-Front, Regina Morin, Jaye Padgett, Tom Walsh, Lisa Zsiga, and two anonymous reviewers for helpful criticisms, suggestions, and advice at various stages in the development of this work, as well as Theresa McGarry, for proofreading this manuscript and assisting in its formatting.

[2] Following McCarthy & Prince 1986, Hayes 1989, Zec 1995 and many others, I assume here that segment length is mediated via the mora, a unit of syllabic weight. In such a system, a short vowel is a one associated to a single mora and a long vowel is one associated to two moras. Likewise, a short consonant is usually nonmoraic, but may bear a mora if in syllable-final position (weight-by-position); geminate consonants are single monomoraic segments associated to both the coda of one syllable and the onset of the next.

[3] For extensive discussion of lexicalization as Lexicon Optimization (Prince & Smolensky 1993, Inkelas 1995), see my introduction to this volume, especially §2.1.

[4] 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 [r], as in Modern Spanish (see Lloyd 1987:246 for discussion). Under the analysis to be presented below, the (lexicalized) simplification of /rr/ to /r/ 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 [r] in Late Latin, lexicalized /r/ 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 [r-] (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 /r/ 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 [r], and Morales-Front 1994a for an OT analysis.

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

[6] 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 loans from Spanish (Williams 1962:74).

[7] This chapter is a much revised and reorganized version of Holt 1997:ch. 3, itself an expanded and greatly modified version of Holt 1996. To the best of my knowledge, these data had not previously been viewed as formally related to one another.

[8] This section summarizes the findings of Holt 1999, to which the reader is referred for discussion.

[9] This is part of a series of changes collectively known in Romance literature as *lenition*; the other changes are voicing of obstruents and fricativization of originally voiced obstruents, not treated here.

[10] Given that /l/ is already [+sonorant], on first glance we would not expect it to vocalize to improve the sonority-mora relationship (Zec 1995). However, the restrictions on sonority target all relevant features, and the primary place of articulation of the doubly-articulated corono-dorsal lateral (Walsh Dickey 1997) is [-continuant], which contributes least to sonority, and so is first to be affected. See Holt 2002 for discussion of the [±continuant] (that is, [+] *and* [-]) status of laterals.

[11] In previous work I have employed the abbreviation *C_{μ}, but I use NMC here to aid in pronunciation and for typographical convenience. The following tableau is a somewhat simplified depiction for expository purposes; a more accurate representation of my views requires the decomposition of NMC into constraints that militate against the particular features that contribute to sonority ([consonantal], [sonorant], [continuant]), NoMoraicObstruents (NMO), NoMoraicSonorants (NMS), etc. The presentation of the constraints on moraicity here is, therefore, more in line with the formulation of Sherer 1994. Further, [j] most likely resulted from the intermediate stages [ç] < [x]; see Holt 1999. Finally, not shown in the tableau here is the highly ranked constraint that favors assigning a mora to the syllable-final /-k, -g/, Weight-by-Position ('Coda consonants are moraic'), following Hayes 1989.

[12] While it may appear unusual to not rank Max » Ident (to encode the fact that erosion of an offending segment is better than total loss, the ranking of Max/Ident with respect to the sonority hierarchy

achieves the same result, and has the advantage of relating vocalization to reduction of geminates, both being the result of the rise of NMC.

[13] 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 remains 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 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 & Holt 1997, where we attributed loss to a process of nucleation (Colman 1983).

[14] 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 have been a push-chain after all.

For discussion of merger avoidance, see the discussion of Tableau 2.

[15] Whether this is to be interpreted as reranking of constraints leading to change, or of change leading to reranking of constraints (an issue discussed in the Introduction to this volume) depends on where we assume that systemic factors hold. If systemic factors hold in the constraint hierarchy, then indeed the constraint reranking must occur first (in at least some speakers), with concomitant surface simplification. This state of affairs would then be (re)analyzed by (other) listeners/learners via a new constraint ranking; that is, with the change now leading to a modified constraint hierarchy vis-à-vis that of speakers of the previous generation. (Active constraint 'reranking' within a single grammar is, of course, distinct from the construction in acquisition of a modified hierarchy. See Reiss, this volume, for discussion of the importance of this point.) If systemic factors hold outside the hierarchy, then reanalysis occurs first, and the constraint hierarchy is reranked, presumably across generations, with learners hypothesizing M » F with in this case no moraic consonants at all. If the initial state is M » F, no learning is necessary; if the initial state is otherwise, then learning is required to arrive at the new steady state.

[16] Building on Flemming's 1995a Dispersion Theory, Padgett couches in OT terms the structuralist notions of maximization of perceptual distinctiveness in contrast and minimization of articulatory effort (Saussure 1916, Martinet 1964).

[17] It might be tempting to suggest that the fortis articulation of the geminates led to their palatalization, and that this enabled subsequent simplification; however, there is no evidence for the palatality of these sounds prior to the loss of weight, to the best of my knowledge. 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 1987:144 in discussion of the processes of lenition that affected Latin obstruents.)

[18] As 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 article, 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.

[19] Hyman 1976:416 considers phonological change to be perception-oriented, even though the seeds for a change may be articulatory. 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, instantiated by the 'activation' or promotion of the universally available constraint requiring stressed syllables be heavy.

[20] For further discussion of the evidence for Germanic influence in Romance (a position not without controversy), see Lleó, this volume, as well as Hall 1965, Purczinsky 1965, Haudricourt & Juilland 1970, von Wartburg 1950 and Duffell 1999. Hall, Purczinsky and Duffell present and discuss evidence in support of the position that Old Spanish verse was stress-timed, rather than syllable-timed, occasioned by the vowel lengthening characteristic of Germanic now imposed on Romance.

[21] See also, Kaye 1989, Paradis 1988, Prince & Smolensky 1993, Marotta & Savoia 1994:58, Rosenthall 1994:15-16, Sherer 1994:ch. 2, Benua 1995, Hammond 1997:9, and Keer 1999. See Morén 1999 for an alternative view as to how to constrain long vowels; I believe the general approach regarding the evolution of consonants advocated here remains valid despite any alterations that the formulation of this constraint might require.

[22] The lengthening that is argued to have begun with the reanalysis of the Latin Stress Rule appears to still be 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.)

[23] 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, see Menéndez Pidal 1982:§54, where he attributes the *t* of the Spanish form to learnèd influence.

[24] 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 & 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 yielded the unmarked vowel [e]. Diphthongizing /ɔ/ therefore yields [we]. Likewise, diphthongizing /ɛ/ yields [je]. See Morales-Front 1994b 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 the present discussion, he formulates constraints that favor rising or falling sonority (SONRISE and SONFALL, respectively).

[25] 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, e.g., Burzio 1997 and Morin 1997 for further discussion of this approach to the relatedness of forms.

[26] 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.