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5 Palatalization in Romance

Abstract: Palatalization represents one of the phonological processes that restructured the Romance consonantal inventory the most. In this chapter, we examine the phonological and articulatory complexities underlying this process. We mainly deal with palatalization within Calabrese's (2005) feature-based phonological model. We compare this analysis with a number of competing models: those based on articulatory phonetics, perception, phonological grounding, and Optimality Theory. Our take is that Calabrese's constraint-and-repair model is the only framework able to account for the wide spectrum of variation across Romance varieties with a minimal number of theoretical, though phonologically motivated, stipulations.

Keywords: palatalization, coronalization, velar fronting, affrication, constraint-and-repair model

1 Introduction

Among the many phonological processes that have affected and affect consonants in the Romance languages, the assimilatory process of palatalization – a pervasive process that led to a major restructuring of the Romance consonantal inventory – is characterized by complexities that distinguish it from far simpler consonantal assimilatory processes such as labialization and velarization. For example, it is characteristically associated with changes in manner of articulation usually lacking in the latter processes. In this chapter, we will examine these complexities, discuss how they are treated in the literature, and propose an account for them.

Palatalization is commonly triggered by front vocoids (vowels and glides), and targets all types of consonants, but most often velars and coronals. We will use palatalization as the general cover term to refer to all consonantal changes triggered by front vocoids, and analyze it as involving two different changes. First, consonants change in place of articulation and, if not already coronals, turn into coronals (coronalization: e.g., Sut. [kuˈɾeɟa] 'strap'; Clements 1976; 1991; but cf. also Jacobs 1989; Mester/Itô 1989; Lahiri/Evers 1991). Second, palatalized consonants may additionally change in manner and turn into affricates or fricatives (affrication: e.g. It. *ami*[k]*o/ami*[tʃ]*i* 'friend$_{\text{M.SG/PL}}$'). The two processes will be discussed below by looking at the wide spectrum of variation across Romance.

In what follows, we aim to provide a simplified outline of the general facts characterizing palatalization processes and discuss the theoretical analyses accounting for them. In Section 2, we briefly describe the data.[1] In Section 3, we go over the different treatments of palatalization in the past: namely, as a phonological or phonetic (articulatory or perceptual) process. In Section 4, we discuss the rule-based phonological account proposed in Calabrese (2005) for Italian palatalization and show that it can be readily extended to the whole spectrum of Romance. In Section 5, we discuss the competing accounts of palatalization within the Optimality Theory (OT) framework; in doing this, we show that these accounts need to make ad-hoc stipulations that are instead not necessary in Calabrese's account. Section 6 concludes.

2 Data

Latin had the consonantal inventory in Table 1:

	Bilabial	Labio-dental	Dental	Alveolar	Velar	Labialized Velar	Glottal
Plosive	p b			t d	k g	kw gw	
Fricative		f		s			h
Nasal	m			n			
Lateral				l			
Trill				r			

Table 1: Latin consonantal inventory.

This consonantal inventory developed into that of the Romance languages through the action of two palatalization processes, which occurred in two different historical periods and created both palato-alveolar consonants such as [ʧ ʤ ʃ ɲ ʎ] and coronal anterior consonants such as [ts dz s z θ ð]. The first palatalization process occurred between the 1st and 2nd century CE; the second one after the 5th century CE (Tekavčić 1980; Rohlfs 1966). The characteristic properties of the first and second palatalizations are illustrated in (1):

[1] Cf. also Loporcaro (2010) and Repetti (2016) for excellent descriptions of the history of the Romance palatalization processes and of their synchronic outcomes.

(1.) a. The first palatalization:

- was triggered by the glide [j] (both underlying and derived);
- affected all consonants;
- occurred in all Romance languages;
- has as its output a geminated consonant.[2]

b. The second palatalization:

- was triggered by close front vowels /i e/;
- affected only the velar plosives /k ɡ/;
- did not occur in Sardinian and in Dalmatian;
- had as its output a short consonant.

The first and second palatalizations are responsible for synchronic alternations in the Romance languages. Note that in many Romance languages such as Italian, labial consonants were not affected in place of articulation, but were only geminated by the first palatalization (but cf. Section 4 for further discussion of labials and voiced plosives). In the following subsections, we will describe the major palatalization-driven realizations in Romance.

2.1 First palatalization

The first palatalization involved all obstruents and was triggered by front vowels, which became glides before back vowels. It mostly affected the verbal system and derivational morphology. Coronal and velar obstruents /t d/ and /k ɡ/ (Tables 2a–b) share the same set of palatalized realizations: affricates (e.g. [ʧ ʤ]), fricatives (e.g. [s z ʒ]), or the glide [j]. Palatalized voiced plosives are often neutralized with high front glides; the outcomes of the latter are given in Table 2c: they are mainly the affricates [ʤ dz] and the fricative [ʒ].

/tj/			/dj/		
	example	etymon		example	etymon
[ʧ]	Northwestern Friul. [poʧ]	PUTEU(M)	[ʤ]	It. [ˈradʤo]	RADIU(M)

[2] Eventually, geminated palatals were degeminated in some varieties, as can be seen further below. The intermediate gemination stage is, however, generally accepted because it explains why geminated palatalized outcomes do not display voicing: e.g. Por. *faço* ‘do$_{1SG}$’ < FACIO, Fr. *place* ‘square’ < PLATEA(M) (Loporcaro 2010, 144; cf. also Meyer-Lübke 1934, 124).

[s]	Eastern Friul.	[pos]	‘well’	[z]	Rm.	[ˈrazə]	‘ray’
[ts]	Cal.	[ˈputtsu]		[dz]	Cors.	[ˈmeddzu]	MEDIU(M) ‘half’
[θ]	Com.	[poθ]		[ð]	Com.	[ˈmeðo]	
[ʃ]	Picard	[kaˈʃø]	CAPTIATORE(M) ‘hunter’	[j]	Cal.	[ˈraju]	RADIU(M) ‘ray’
				[ɟ]	Cors.	[ˈoɟi]	HODIE ‘today’

Table 2a: Outcomes of the first palatalization in coronal obstruents /t d/.

/kj/				/gj/			
	example		etymon		example		etymon
[ʧ]	Tusc.	[ˈbratʧo]	BRACCHIU(M) ‘arm’	[ʤ]	Tusc.	[koˈredʤa]	CORRI-GIA(M) ‘strap’
[ts]	Lig.	[ˈbrattsu]		[dz]	Sur.	[kuˈredza]	
[s]	Ven.	[bras]		[ʒ]	Sut.	[kuˈvreʒa]	
[θ]	Com.	[ˈaθa]	ACIE(M) ‘ax’	[j], [0]	Friul.	[koˈrɛ(j)a]	
[ʃ]	Tusc.	[ˈaʃʃa]		[ɟ]	Sut.	[kuˈreɟa]	
				[ʃ]	Sal.	[kuˈreʃa]	

Table 2b: Outcomes of the first palatalization in velar obstruents /k g/.

/j/			
	example		etymon
[ʤ]	Tusc.	[ˈmadʤo]	MAIU(M) ‘May’
[dz]	Sur.	[dziˈdzin]	IEIUNU(M) ‘fasting’
[ʒ]	Fascian	[ʒaˈʒun]	
[j]	Cal.	[ˈmaju]	MAIU(M) ‘May’
[0]	Fr.	[me]	
[ɟ]	Cors.	[peˈɟu]	PEIORE(M) ‘worse’
[z]	Ven.	[peˈzo]	
[x][3]	Sp.	[ˈxweɣo]	IOCU(M) ‘game’

Table 2c: Outcomes of the of the first palatalization in the coronal glide /j/.

In some languages, labial obstruents did not palatalize at all (Table 3a). In some other languages, they palatalize as affricates [ʧ ʤ], complex affricates [pʧ bʤ], and

[3] Glides in Spanish underwent a fortition process and became fricative ([j] > [ʝ]). They further were backed before back vocoids ([ʝ] > [x]); cf. Recasens (2011).

fricatives [ʃ ʒ]. Similar realizations are also seen for the labial sonorant consonant [m] (Table 3b).

/pj/			/bj vj/		
	example	etymon		example	etymon
[pj][4]	It. [ˈsappja]	SAPIAT ‘know$_{3SG.SUBJV}$’	[bj]	Tusc. [ˈrabbja]	RABIA(M) ‘anger’
[ptʃ]	OOc. [ˈsaptʃa]		[bdʒ]	OOc. [ˈrobdʒe]	RUBEU(M) ‘red’
[tʃ]	Sic. [ˈsattʃu]		[dʒ]	Sic. [ˈgaddʒa]	CAVEA(M) ‘cage’
[ʃ]	Fr. [saʃ]		[ʒ]	Fr. [ʁaʒ]	RABIA(M) ‘anger’

Table 3a: Outcomes of the first palatalization in the labial obstruents /p b v/.

/mj/		
	example	etymon
[mj]	It. [venˈdemmja]	VINDEMIA(M) ‘grape harvest’
[mɲ]	Oc. [venˈdemɲa]	
[ɲ]	Lig. [venˈdeɲa]	
[mdʒ]	Egd. [vinˈdemdʒa]	

Table 3b: Outcomes of the first palatalization in the labial nasal /m/.

Finally, non-labial sonorant consonants [l n] palatalized as [ɲ ʎ] or as the glide [j] (Table 4).

	/nj/			/lj/		
		example	etymon		example	etymon
a.	[ɲ]	Fr. [ˈviɲə]	VINEA(M) ‘vineyard’	[ʎ]	It. [ˈpaʎʎa]	PALEA(M) ‘straw’
b.	[j][5]	Por. [ˈvĩjɐ]		[j]	Rm. [paj]	

[4] We assume that the outcomes [jp jv jm] found in Portuguese involve an alternative way of dealing with the complex onset labial + [j], i.e. metathesis instead of gemination (cf. Calabrese 2005 for discussion); cf. *saiba* [ˈsajbɐ] ‘know$_{3SG.SUBJV}$’ < SAPIAT (the voicing of the labial plosive is due to an unrelated, though interacting rule applying in intervocalic position), *raiva* [ˈrajvɐ] ‘anger’ < RABIA(M), *vindima* [vĩˈdimɐ] ‘grape harvest’ < VINDEMIA(M).. Another possible strategy of fixing such a complex onset involves deleting the glide [j] as in Venetian [venˈdema] ‘vineyard’.

[5] The palatal glide may be lost before front vowels (Rm. *vie* ‘vineyard’ < VINEA(M)), or

Table 4: Outcomes of the first palatalization in the non-labial sonorant consonants /l n/.

2.2 Second palatalization

The second palatalization generally involved velar obstruents only and had the same realizations as those seen for the first palatalization for the same obstruents (Table 5).[6]

	/ki ke/				/gi ge/			
		example		etymon		example		etymon
a.	[ʧ]	It.	[ˈʧera]	CERA(M) 'wax'	[ʤ]	It.	[ˈʤenero]	GENERU(M) 'son-in-law'
b.	[s]	Fr.	[siʁ]		[j]	Sp.	[ˈjerno]	
c.	[θ]	CastSp.	[ˈθera]		[ð]	OVen.	[ˈðɛnaro]	
d.	[ts]	Mountain Lig.	[ˈtsera]		[dz]	Ven.	[ˈdzenero]	
e.					[ɟ]	Cors.	[ˈɟenaru]	
f.					[ʒ]	Fr.	[ʒɑ̃dʁ]	

Table 5: Outcomes of the second palatalization in the velar obstruents /k g/.

The second palatalization is characteristically responsible for morphophonemic alternations in inflectional morphology. For example, in Italian nominal morphology, palatalization occurs before the masculine plural suffix /-i/.

undergo fortition into an affricate (e.g. Sard. *mu*[dz]*ere* 'wife' < MULIERE(M)) or a fricative (Fr. *linge* [lɛ̃ʒ] 'linen' < LINEU(M)). In Spanish, the glide first became a palatal fricative [ʝ], which palatalized as [ʃ ʒ] and finally velarized as [x], regardless of the nearby vowel: e.g. *paja* [ˈpaxa] 'straw' < PALEA(M); *mujer* [ˈmuxer] 'woman' < MULIERE(M) (Tagliavini 1949).

[6] A problem for any theory is the palatalization of velar plosives before low vowels. This change is found in some Gallo-Romance varieties and is independent from the first and second palatalizations (e.g. Fr. *chèvre* [ʃɛvʁ] 'goat' < CAPRA(M); *cheval* [ʃəˈval] 'horse' < CABALLU(M); *jambe* [ʒɑ̃b] 'leg' < GAMBA). It is often assumed that this change is due to a front pronunciation of the low vowels. The fact that this process in French operated also before /aw/ where a front realization of /a/ is to be excluded given the further evolution of this diphthong into a back rounded vowel (*chose* [ʃoz] 'thing' < CAUSA(M)) bars such a hypothesis (Loporcaro 2010). The fact that palatalization before low vowels cannot be due to their being fronted is further corroborated by the fact that in Friulian velars are also palatalized before /a/ which was never historically fronted: e.g. *cjasa* [ˈcaze] 'house' < CASA(M), *cjalcja* [calˈca] ″ <, *gjal* [ɟal] 'rooster' < GALLU(M) (Vanelli 2005). We will not discuss this development further here.

(2.)	a.	It.	*ami*[k]*o*/*ami*[ʧ]i	‘$\text{friend}_{\text{M.SG/PL}}$’
	b.	It.	*gre*[k]*o*/*gre*[ʧ]i	‘$\text{greek}_{\text{M.SG/PL}}$’

3 The problem

This section deals with the issues that any theory of palatalization must solve.[7] The issues that will be discussed here are the following:

(a) *Coronalization.* How do front vowels and glides modify non-coronal, and especially dorsal, consonants in such a way as to obtain coronal segments?

(b) *Affrication/fricativization.* How do affricate and fricative consonants result from palatalization processes?

The coronalization of dorsal plosives before front vowels is particularly problematic in all theories of phonology. In what follows, we briefly review the three main sets of theories that have attempted to account for coronalization.

3.1 Articulatory-feature phonological models

An adequate account of palatalization is problematic in phonological models based on articulatory features such as that of Chomsky/Halle (1968). Although it is an obvious case of assimilation, it cannot be treated as such. In these models, vowels such as [i] and [e] are dorsal [-back] segments, and therefore it is unclear how a dorsal consonant can assimilate to them and become coronal. This inability to deal with palatalization also characterizes the latest phonological model of articulatory features: Halle/Vaux/Wolfe’s (2000) Articulator Theory (AT). AT accounts for sounds in terms of the activity of the six movable parts of the vocal tract, the so-called articulators: lips, tongue blade, tongue body, soft palate, tongue root, and larynx (cf. also Halle 1995; Sagey 1986). Each articulator is capable of a restricted set of actions

[7] In this chapter, we will not deal with the phenomenon of gemination co-occurring with the first palatalization. On this matter, it is enough to say that it was the outcome of the elimination of Latin hiatus configurations involving non-low vowels before other vowels. The prevocalic vocoids became glides. The further removal of the onset clusters with glides triggered a syllabic readjustment that led to gemination (and palatalization; cf. Calabrese (2005) for detailed discussion of this process).

of its own, and each of these actions is associated with a particular feature. There are two kinds of features: articulator-bound ones and articulator-free ones. Articulator-bound features such as [round] and [back] are necessarily executed by one and the same articulator; articulator-free features such as [continuant] and [consonantal] are executed by different articulators in different phonemes. The articulator executing the articulator-free features of a phoneme is called the designated articulator (indicated with a plus '+' and the uppercase initial letter, as shown in Figure 1a: e.g. [+Labial]).

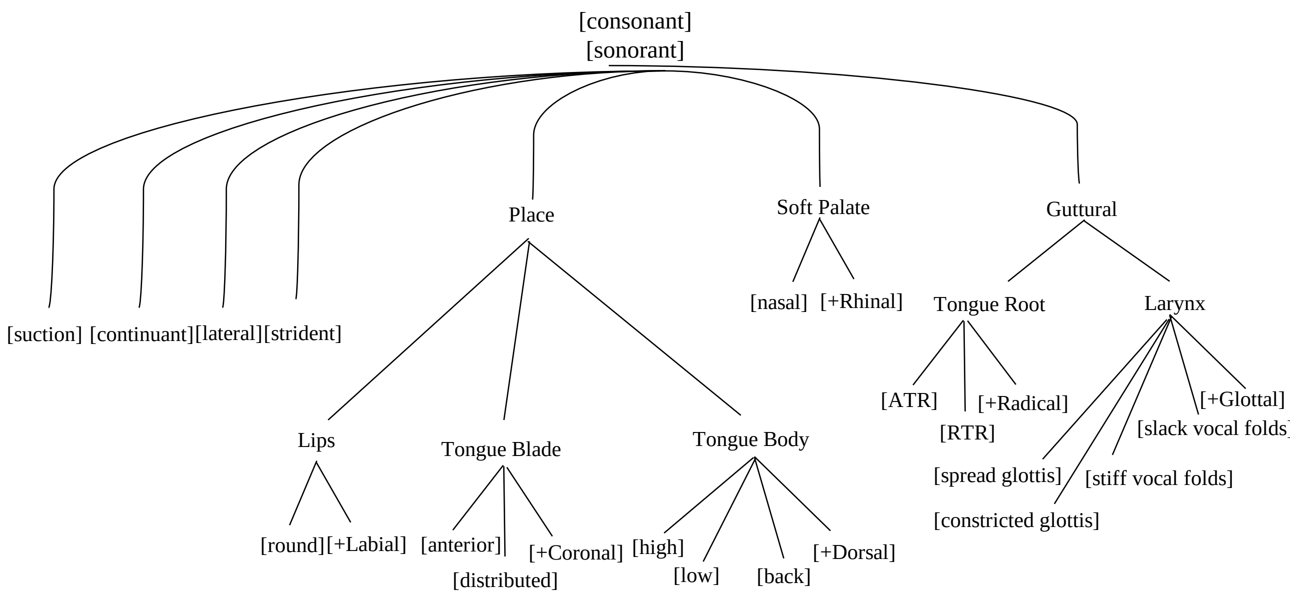

Figure 1a: The Articulatory Theory model (Halle/Vaux/Wolfe 2000).

Every phoneme must have a designated articulator. To exemplify the AT notion of designated articulator, let us consider the distinction between a labio-velar plosive /k͡p/ and a labialized velar /kʷ/. In the case of /k͡p/, the plosive stricture is simultaneously implemented by both the labial and dorsal articulators. In contrast, in the case of /kʷ/, the plosive stricture is implemented only by the dorsal articulator. By using the notion of designated articulator, one can represent the labio-velar plosive /k͡p/ as in Figure 1b: it has the two designated articulators [+Dorsal] and [+Labial]. The labialized velar /kʷ/ in Figure 1c, instead, has only [+Dorsal] as a designated articulator but not [+Labial], although it is characterized by the labial feature [+round]. The two structures can be compared to the plain dorsal consonant /k/, represented as in Figure 1d, which has the designated articulator [+Dorsal] but no labial node.

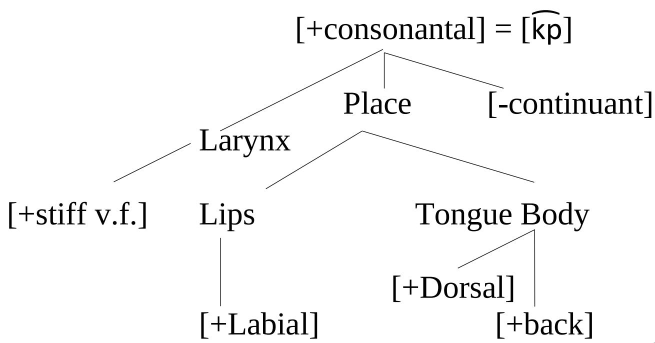

Figure 1b: Phonological representation of the labio-velar plosive /k͡p/ in the AT model.

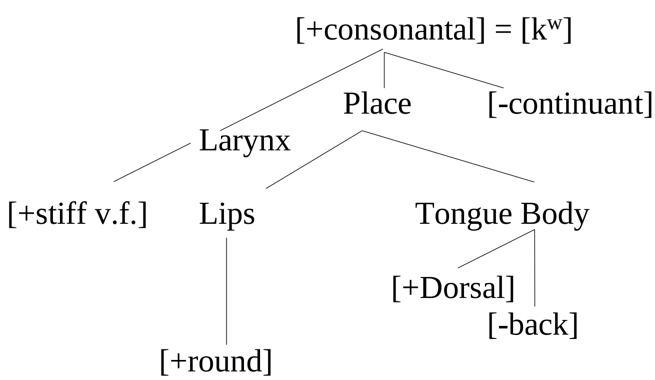

Figure 1c: Phonological representation of the labio-velar plosive /kʷ/ in the AT model.

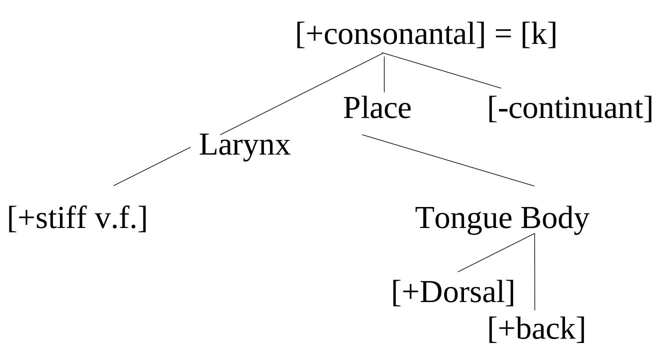

Figure 1d: Phonological representation of the plosive /k/ in the AT model.

In this model, assimilatory processes are anatomically constrained. This implication has an obvious appeal, for it unifies under a single heading two otherwise unrelated aspects of speech sounds: their articulatory implementation and their behavior in the phonological process of assimilation. The coronalization process one observes in palatalization remains a problem in AT. Vowels are obtained by the different displacements of the tongue body, which are then further modulated by the different behaviors of the lips and tongue root. There is no active involvement of the tongue blade, especially in the case of the non-high vowels. Therefore, front vowels in AT are simply [Dorsal, -back], but do not have coronal features. Therefore, they can trigger fronting of velars but there is no way of directly accounting for why the latter can become coronal [-anterior, +distributed] by an assimilation process.

3.2 Articulatory phonetic models

Phonetic articulatory models do not fare better in this regard. Consider Recasens (2011), who proposes an account for Romance palatalization processes in Articulatory Phonology, the most recent model of this type. In this model, the articulatory gesture is the basic unit of the phonological representation and its physical actualization. Each gesture involves a group of articulators that act together to form and release a constriction in the vocal tract, such as labial closure, glottal opening, or velar frication. Representations may thus differ in the presence of a gesture (*had* vs. *add*), in the articulator set used (*bad* vs. *dad*), or in the parameters of constriction location or degree (*shad* vs. *sad* vs. *tad*). Phonological changes are expressed in terms of reorganization in the temporal patterning of gestures: gestures may overlap one another to a greater or lesser extent and gestural magnitude may increase or decrease. Gestures never change into, nor add to, other gestures (cf. Browman/Goldstein 1989). Here, we refer to this phenomenon as the *no-tampering condition.*

An articulatory mechanism that is very important for Recasens' analysis of palatalization is that of *blending.* According to Browman/Goldstein (1992), blending occurs when two gestures that control the same articulator set overlap in time. In this case, each gesture exerts its influence on the articulator, which reaches a position intermediate between the two targets. In Recasens' framework, the formation of the coronal consonants [ʎ ɲ c ɟ ç ʝ] is due to the basic mechanism of gestural blending. Gestural blending operates on sequences composed of a consonant and a front glide or vowel and "yields an articulation produced at an intermediate location between the two original adjacent phonetic segments or else encompassing their closure or constriction areas” (Recasens 2011, 190). Recasens does not provide explicit details of how this mechanism of gestural blending operates in the case of palatalization processes. Here we will attempt to make it more explicit by using an Articulatory Phonology gestural score (Figures 2–6). In a gestural score, the horizontal dimension represents the duration of the gesture, namely the period of time that the articulator set is actively controlled; the vertical dimension reports the vocal tract variables, each associated with the corresponding articulators and the descriptor values.[8]

Let us first consider the changes affecting the coronal anterior plosives [t d] in sequences such as /tj dj/. According to Recasens (2011, 190), the palatalization of dental or alveolar consonants into (alveolo-)palatal consonants [ʎ ɲ c ɟ ç ʝ] is implemented through an increase in dorsal contact towards the palate median line and some closure or constriction retraction. Abstractly, the sequences [tj dj] could be represented as in Figure 2, where we have a tongue tip alveolar closure followed by a palatal-postalveolar gesture, activated sequentially in time.[9]

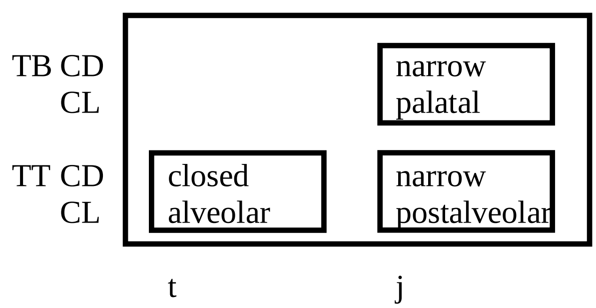

Figure 2: Representation of the cluster /tj/ in Articulatory Phonology.

Blending creates the gestural score in Figure 3.

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[8] *Articulators*: TB tongue body; TT tongue tip; *Descriptor values*: CD constriction degree (close, critical, narrow, mid, wide), CL constriction location (protruded, labial, dental, alveolar, postalveolar, palatal, velar, uvular, pharyngeal).

[9] We only consider the change in place of articulation here. Affrication and fricativization must be treated independently in this model, as in the other models discussed in this chapter with the exception of the acoustic one discussed in 3.3.

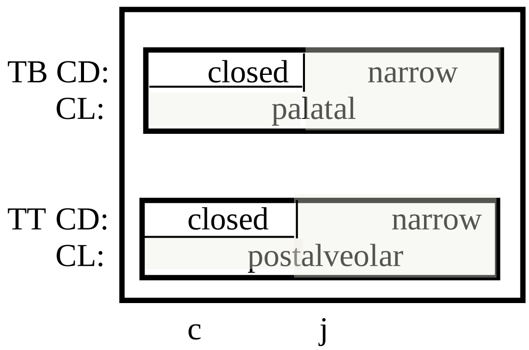


Figure 3: The effect of blending. The descriptor values being blended are shaded.

Therefore, blending in this case yields an adjustment of the plosive coronal articulation due to the following palatal glide. Note that blending in this case appears to totally overwhelm the articulation of the plosive that changes from apico-alveolar to lamino-post-alveolar. If this is correct, blending is acting like a rule spreading the coronal features of the vowel regardless of the constriction type of the gestures that are involved in the assimilation – something to be expected given Zsiga's (1997, 231) observation that the elements employed by Articulator Theory and Articulatory Phonology are essentially identical, with the exception of the encoding of gestural timing in the latter. An issue is, however, the fact that, as observed by Recasens, the segments that are the outcome of this process are alveolopalatal and thus articulated simultaneously in the alveolar and palatal zones (Recasens/Fontdevila/Pallarès 1995), as shown in Figure 3. Thus, palatalization is also adding a palatal closure. Therefore, in this case, blending yields a consonant which not only includes a newly adjusted tongue blade gesture, but which has also an inserted palatal tongue body gesture, thus violating the no-tampering condition mentioned above.

This problem is also evident in the case of the coronalization of dorsal consonants before front vowels as in the sequence /k/ + /i/ (Figure 4), where we have a velar (i.e., in our terms, back) tongue body gesture followed by a palatal-postalveolar gesture, activated sequentially in time.

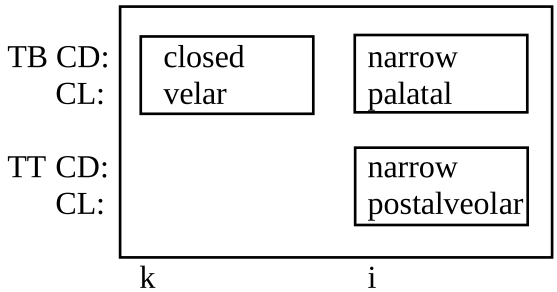


Figure 4: Representation of the sequence /ki/ in Articulatory Phonology.

This sequence may undergo velar fronting (e.g. it. [ˈspɔrko]/[ˈspɔrkʲi] *sporco/sporchi* ‘dirty$_{\text{M.SG/PL}}$’) or coronalization (and eventually affrication). In Articulatory Phonology, both phenomena result from blending. As for velar fronting, the plosive gesture and the vocalic gesture overlap, causing the tongue body to reach a position in between the fully palatal target of the vowel and the velar target of the plosive (where we are assuming that high front [i] includes a palatal-postalveolar narrowing gesture). Crucially there is no tongue tip involvement in the consonant; so, the consonant is a fronted velar:

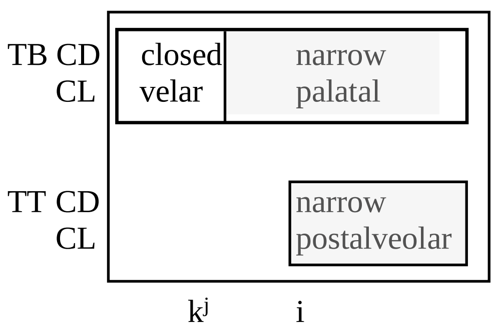


Figure 5: Velar fronting in Articulatory Phonology. The shading represents the descriptor values of each articulator involved in blending. In this case, blending affects a temporal portion of the velar constriction location of the tongue body, which therefore is fronted.

As for coronalization (namely, the process whereby the velar plosive becomes a laminal post-alveolar plosive [c]), the blending operation generates a consonant in which the tongue body gesture is changed to palatal, and a brand-new tongue blade gesture is added. Notice that this operation again violates again the no-tampering condition of Articulatory Phonology (see above).

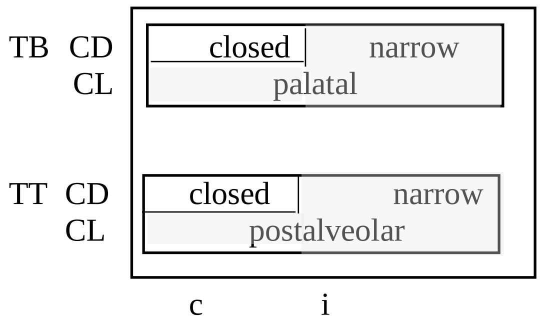


Figure 6: Coronalization in Articulatory Phonology. The shading represents the descriptor values of each articulator involved in blending.

In our view, violation of the no-tampering condition suggests that, in the case of palatalization, blending operates in featural terms rather than in gesture overlap. First, it is spreading the palatal features of the vowel regardless of the constriction type of the gestures that are involved in the assimilation. Second, it is adding a tongue blade articulation to the palatal plosive (cf. the promotion operation discussed below). In particular, it is not clear what the motivation is for the addition of the tongue blade closure gesture; rather, it appears to be an arbitrary postulation in this model.[10]

3.3 Perception-based models

In order to cope with the issues of the articulatory theories above, Chang/Plauché/Ohala (2001) and Guion (1998) have proposed a model in which palatalization is due to perceptual misidentifications produced in acoustics. Guion (1998) discusses three experiments showing that the rate at which the sequence [ki] is misidentified by listeners of English as [tʃi] is much higher than the misidentification rate of [ka] as [tʃa]. This is interpreted as evidence for two hypotheses: 1) there is an

[10] A further issue that Recasens' (2011) model does not seem to be able to account for is how a gradient operation like gestural blending can operate in categorical terms and explain allomorphic alternations such as It. *spor*[k]*o*/*spor*[kʲ]*i* 'dirty$_{\text{M.SG/PL}}$' vs. *por*[k]*o*/*por*[tʃ]*i* 'pig$_{\text{M.SG/PL}}$', where access to lexical diacritics is needed (cf. 4.1). It is truly unclear how morphophonological instructions could directly manipulate the modalities of blending operations in the phonetic module.

auditory similarity between the velar plosive and the palato-alveolar affricate before a palatal vowel; 2) this similarity is the cause of the change [k] > [tʃ].[11] Thus, [ki] may be confused with [ti] at the perceptual level. The proposal is then that this change is not associated with a shift in place of articulation towards the front palate but with the spectral similarity between the velar plosive burst and the frication noise of the palato-alveolar affricate, which share a similar frequency peak about 2500–3500 Hz. More recent research, however, has shown that, in principle, the acoustic equivalence hypothesis just referred to can account for the change [k] > [tʃ] if the velar plosive is aspirated but not if unaspirated. Thus, Żygis/Recasens/Espinosa (2008) (cf. also Recasens/Espinosa 2009) show that Guion's findings must be restricted to languages with aspirated velar plosives such as English or German because aspirated plosives exhibit longer and more intense bursts than unaspirated plosives – a property that makes them more similar acoustically to affricates, and cannot be extended to languages where there are no aspirated plosives (cf. Catalan and Polish, for example). Unaspirated [k], which is the prevailing realization in Romance, cannot possibly be confused perceptually with [tʃ]. Furthermore, there is no evidence for reconstructing a stage of Romance in which plosives were aspirated. Hence acoustic similarity cannot account for the coronalization and affrication of velar plosives before front vowels in Romance.

3.4 Phonologically grounded models (Clements 1991)

Clements' (1976; 1991) model (cf. also Hume 1992; Lahiri/Evers 1991; Broselow/Niyondagara 1991) at first sight provides a simple account of coronalization. Features in Clements' model are grounded in phonological behavior. This means that if vowels and consonants interact in an assimilatory way, they must have a common feature; thus, for front vowels to trigger coronalization, they must be assumed to be coronal. However, there are various problems with the proposal that front vowels are coronal. The first obvious issue with this idea is from the point of view of articulatory phonetics, in the light of the fact that there is an anatomical motivation for not identifying front non-high vowels as coronal (Kenstowicz 1994):

[11] It is also noteworthy that in Guion's (1998) experiments, [ku] was misidentified by listeners as [tʃu], as often as [ki] as [tʃi], and that the white noise that was used to mask the stimuli and achieve misidentification may have caused a too low signal-to-noise ratio and created a situation in which the perception of the stimuli was different than that in normal speech conditions (Żygis/Recasens/Espinosa 2008).

while coronal consonants are articulatorily implemented by the intrinsic longitudinal muscles of the tongue, front non-high vowels are produced by contraction of the genioglossus, an external muscle that connects the tongue body to the jaw.

There are also phonological problems with the model (cf. Halle/Vaux/Wolfe 2000; Kenstowicz 1994). First, Clements assumes that in consonants [Coronal] dominates the features [anterior] and [distributed]. It is a fact that the outcome of palatalization is usually a consonant that is [-anterior, +distributed]. Front vowels should then be specified with these features. However, it is not clear within his system how these features are implemented in vowels, or even if they exist for vowels. Since in Clements' framework [Coronal] in vowels is directly equivalent to traditional [-back], he must treat [Coronal] as a terminal feature in vowels, whereas it behaves as a nonterminal node in consonants (Halle/Vaux/Wolfe 2000).

Furthermore, if front vowels are assumed to be coronal, one is also forced to assume that what appear to be unitary processes of [back]-harmony found in Turkish (Clements/Sezer 1989), Hungarian (Ringen/Vago 1998), and numerous other languages actually involve two distinct harmonic phenomena, one of which spreads [Coronal] and the other spreads [Dorsal]. Nor is it clear why segments with lexical [Dorsal] or [Coronal] specifications block harmony in such languages (Halle/Vaux/Wolfe 2000).

In what follows, we discuss a recent phonologico-articulatory model for palatalization (Calabrese 2005) and show that it can effortlessly be extended further, thus accounting for palatalization Romance-wide.

4 Palatalization revisited

Calabrese (2005) attempts to account for the change in place of articulation seen in palatalization processes by enriching Articulator Theory described above (3.1) as follows. Calabrese assumes that, in addition to redundant features in primary articulations, there could be redundant passive secondary articulations. The identification of non-contrastive passive secondary articulations is based on the proprioceptive experience of the action of the articulators in the vocal tract. We know that there are certain given orosensory patterns associated with each articulator. Following Perkell (1980, 338), we can say that "these orosensory patterns consist of proprioceptive, tactile, and more complicated air pressure and airflow information from the entire vocal tract". Calabrese assumes that these non-contrastive aspects need to be represented phonologically. For example, instead of assuming that front vowels and coronal consonants share the same feature (as assumed in Clements' 1991 model), Calabrese proposes that they share a redundant passive secondary articulation that can participate in assimilatory processes. This can be formally expressed as a correlation between a primary articulatory configuration and a secondary one. For example, consider fronted velars. These consonants are produced by making a dorso-palatal constriction by raising and fronting the tongue body. The raising and fronting of the tongue body that is necessary to produce such a constriction also involves an automatic raising of the posterior part of the tongue blade. The passive raising of the tongue blade causes lateral contact with molars up to the post-alveolar zone (cf. Recasens 1990, 276; Keating/Lahiri 1992, 90). According to Calabrese, this lateral contact of the tongue blade is characterized "proprioceptively" by the speakers as a secondary aspect of [$_{\text{Tongue Body}}$ +Dorsal, +high, -back] sounds. This is formally expressed in the correlation statement in (3).

(3.) [$_{\text{Tongue Body}}$ +high, -back] ® [$_{\text{Tongue Blade}}$ -anterior, +distributed]

A fronted velar should then be represented as in Figure 7, with [+Dorsal] as the designated articulator and a coronal secondary articulator (not specified here because of its non-primary status).

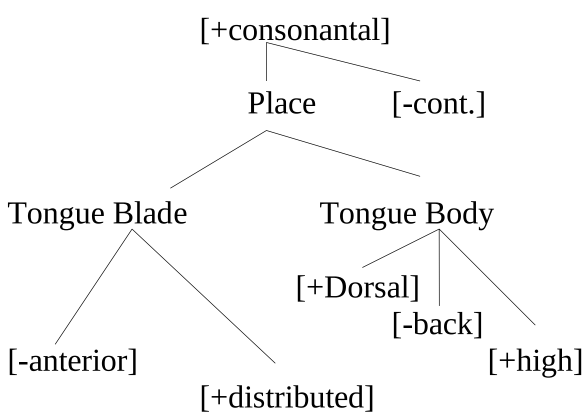


Figure 7: AT configuration of a fronted velar.

The relation in (3) appears to be bidirectional, as shown in (4). In palato-alveolar sounds such as [ʧ] and [ʃ], the raising of the blade and the predorsum also causes an automatic raising of the entire tongue dorsum and, thus, an increase of contact area over the entire palatal surface (cf. Recasens 1990, 270). However, this tongue dorsum involvement is secondary with respect to the primary laminal constriction. Thus, palato-alveolar sounds [ʧ] and [ʃ] can be represented as in Figure 8 with a designated coronal articulator and a fronted and raised tongue body.

(4.) [$_{\text{Tongue Body}}$ +high, -back] ™ [$_{\text{Tongue Blade}}$ -anterior, +distributed]

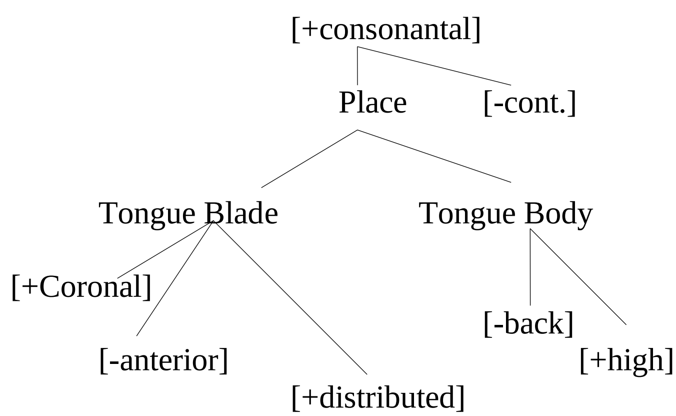


Figure 8: AT configuration of palato-alveolar sounds [ʧ] and [ʃ].

At the same time, given (4), the high vocoids [i y] are represented as follows (irrelevant features are not mentioned):

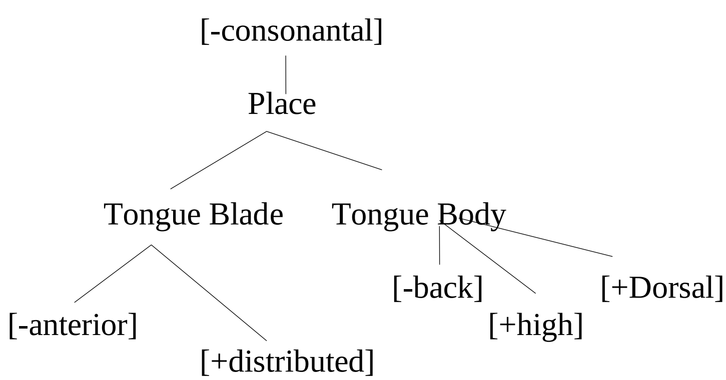
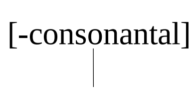


Figure 9: AT configuration of high vocoids [i y].

In contrast, non-high vowels are to be represented as in Figure 10, where only the dorsal node is present.



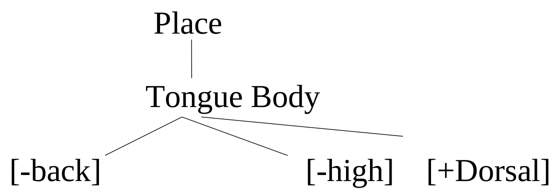


Figure 10: AT configuration of non-high vowels.

Evidence for this analysis is provided by the well-known fact that whereas front vowels as a class primarily target velar consonants in palatalization processes (cf. the second Romance palatalization, Tekavčić 1972; or the velar palatalization of Slavic, Chomsky/Halle 1968; Meillet/Vaillant 1924; Vaillant 1950), front close vowels and glides as a class primarily target coronal consonants (cf. Bhat 1978; Czaykowska-Higgins 1988).

Under this assumption, palatalization is argued to result from a multi-step process involving all consonants. Three main steps are identified: *raising/fronting* and *coronalization* (step 1; cf. 4.1); *coronal anteriorization* (step 2; cf. 4.2); *affrication/fricativization* (step 3; cf. 4.3):

4.1 Step 1: coronal raising; velar fronting and coronalization

The first step of palatalization processes results from the featural assimilatory interaction between a front high vowel and a consonant. We may have three different kinds of outcomes depending on the place of articulation of the consonant and the height of the vowel involved. Coronal consonants receive the coronal terminal features of high front vocoids as shown in Figure 11.[12] This process is traditionally known as *coronal raising* (Bhat 1978).[13]

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[12] We follow Halle's (1995) proposal that only terminal features are spread in assimilatory processes.

[13] Note that coronal raising may also lead to [+anterior] affricates and fricatives. A possible account for this would be to assume a rule spreading only the terminal feature [+distributed] of the palatal glide. Spreading of the feature [-anterior] of the high front vocoid is blocked in so far as it would generate a retroflex consonant. Retroflection requires a [+back] tongue body configuration (cf. Hamann 2003; Stevens/Keyser/Kawasaki 1986; Stevens/Keyser 1989), which is incompatible with the [-back] configuration of the front high vocoid.

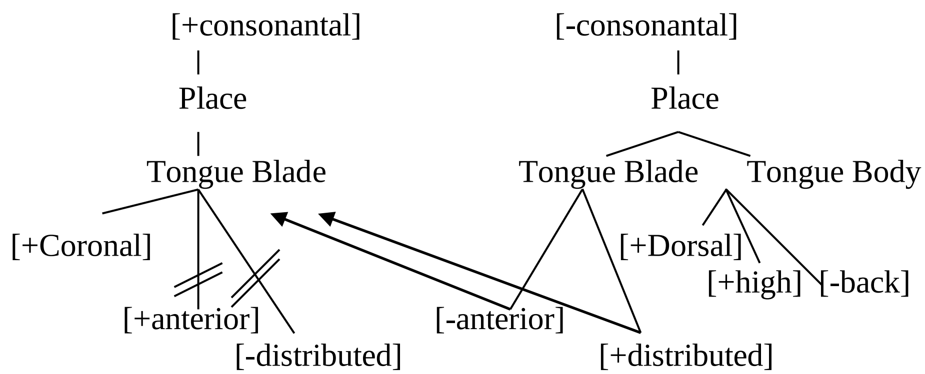

Figure 11: Coronal raising. The [-anterior] and [+distributed] features spread back to the preceding consonant.

The rule above applies to both sonorant and obstruent coronal consonants, and it is triggered only by front high vowels and glides. Sonorant coronal consonants [l n] palatalize into [ʎ ɲ] (cf. Table 4: Fr. *vigne* [ˈviɲə] 'vineyard' < VINEA(M), It. *paglia* [ˈpaʎʎa] 'straw' < PALEA(M)), while the obstruent coronal unvoiced consonant [t] gets raised and undergoes further changes (cf. steps below).

Dorsal (velar) consonants receive the dorsal terminal feature [-back] of front (both high and non-high) vowels as shown in Figure 12. This process is traditionally known as *velar fronting*.

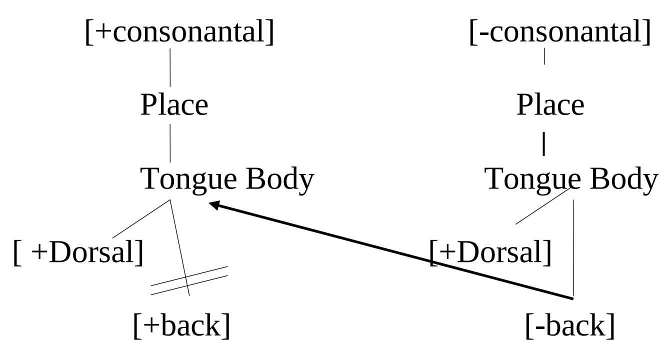

Figure 12: Velar fronting. The [-back] feature spreads back to the preceding consonant.

Velars are [+high]; thus, once the rule in Figure 12 applies, they are assigned the features [$_{\text{Tongue Blade}}$ -anterior, +distributed] by the correlation statement in (4):

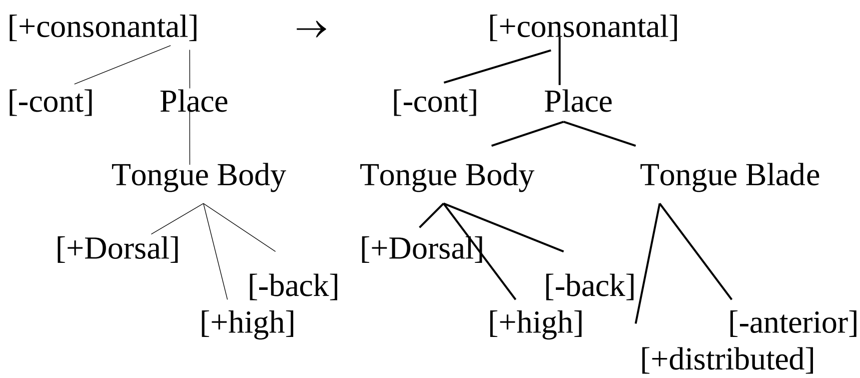

Figure 13: Additional feature assignment in a fronted velar by correlation in (4).

At this point, fronted velars change into coronals (*coronalization*); this is the crucial change in place of articulation that we typically see in palatalization processes. Coronalization involves the promotion of the secondary coronal articulation in Figure 13 to primary status, i.e. a change in which a non-designated articulator becomes a designated articulator (Figure 14). The promotion of a secondary articulator to primary status is a well-attested sound change (cf. Calabrese 2005 for more evidence and discussion; cf. also Clements 1991).[14]

[14] This accounts for why the postalveolar palatal plosives [c ɟ], developed from velars, show a larger tongue contact surface than the outcomes of the palatalization of dentals. In fact, in the latter case we are dealing simply with coronal raising (Figure 8). In contrast, in the former case, velar fronting + promotion generate a complex segment with both coronal and dorsal closures. Various alternative phonetic theories have tried to account for such complexity. For example, according to Straka (1965), this may be due to the fact that raising the posterior tongue body involves the activation of the sublingual elevator muscles as well as of intrinsic tongue muscles which cause tongue fronting to occur. Scripture (1902) attempts to account for this fact in terms of palate shape: the fact that the palate surface is higher and more curved at the mediopalate and postpalate than in the postalveolo-prepalatal zone renders the formation of a firm and precise linguopalatal target harder at the former location than at the latter; consequently, a consonantal closure or constriction must spread over a relatively large area if performed in the medio-postpalatal zone with the tongue dorsum (cf. also Millardet (1910); Rousselot (1897–1908); Recasens (2011).

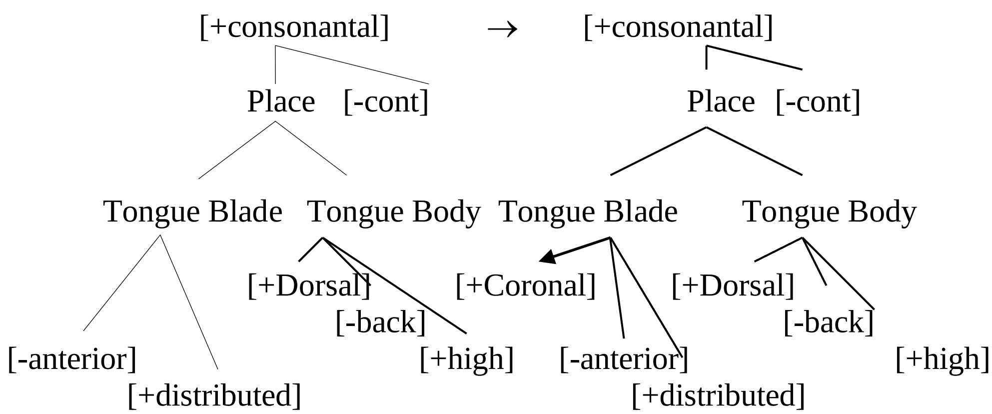

Figure 14: Coronalization: promotion of the second articulator [+Coronal] to primary articulator (as signaled by the arrow).

It is important to emphasize that velar fronting and velar coronalization are two separate phonological processes. While coronalization is contingent on velar fronting, the latter is completely independent of the former. Evidence for this comes from Tuscan Italian. In this variety, masculine nouns must be divided into two lexical classes, depending on the outcome of the root-final velar before the masculine plural morpheme **-***i*. Nouns of the first class in (5a) undergo velar fronting only (i.e. [k] → [k^j]); nouns of the second class (5b) undergo velar fronting, coronalization and, finally, affrication (i.e. [k] → [k^j] → [ʧ]).

(5.)	a.	Class I:	*spor*[k]*o* / *spor*[k^j]*i*	‘dirty$_{\text{M.SG/PL}}$’
	b.	Class II:	*por*[k]*o* / *por*[ʧ]*i*	‘pig$_{\text{M.SG/PL}}$’

4.2 Step 2: coronal anteriorization

After coronalization, dorsals look as shown in Figure 15:

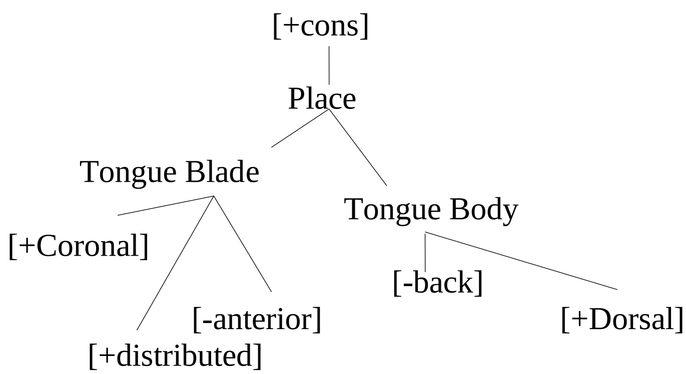

Figure 15: Coronalized dorsals.

The configuration in Figure 15 represents a multiply articulated plosive with two primary articulators: a coronal and a dorsal one. However, corono-dorsal articulated segments are highly complex and seem to never surface in plosives (whereas they are far more common in sonorants; cf. Recasens 1990 and Ladefoged/Maddieson 1996; Maddieson 1984). To account for this, Calabrese (2005) assumes the marking statement in Figure 16 which states that plosives with both coronal and dorsal designated articulators are marked.[15]

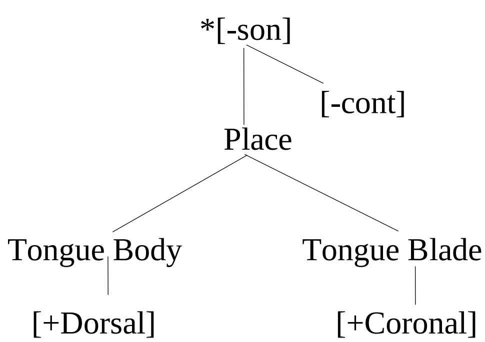

Figure 16: Constraints against the co-existence of the dorsal and coronal articulators.

The constraint in Figure 16 accounts for the wide spectrum of variation in the palatalization of coronal plosives. Crucially, the constraint in Figure 16 only forbids

[15] As discussed in Calabrese (1995; 2005), marking statements (and the associated repairs) are grounded in the sensorimotor system. They are the way in which auditory, perceptual and articulatory restrictions and complexities are made legible to the grammatical system.

plosives from being endowed with multiple designated articulators. Violations to this constraint may be repaired in two ways. The first strategy removes the terminal designated articulator [+Dorsal]; this creates the configuration in Figure 17.

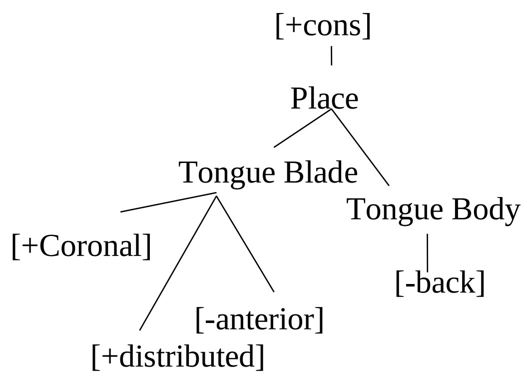

Figure 17: Coronalized dorsals after removing the articulator [+Dorsal].

This is a plain palato-alveolar plosive, which eventually undergoes affrication and results in [ʧ] and [ʤ]. The second strategy deletes the dominating articulator node Tongue Body; this creates the configuration in Figure 18.

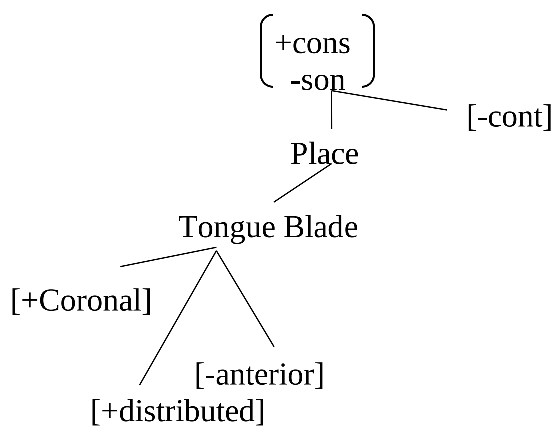

Figure 18: Coronalized dorsals after removing the node Tongue Body.

Recall that the correlation statement in (4) expresses an interdependence between [$_{\text{Tongue Body}}$ -back] and [$_{\text{Tongue Blade}}$ -anterior, +distributed]. Given this interdependence, we assume that, when [$_{\text{Tongue Body}}$ -back] is removed, [$_{\text{Tongue Blade}}$ -anterior, +distributed] can no longer stay as such; this is stated formally in (6).

(6.) If not [$_{\text{Tongue Body}}$ -back], then not [$_{\text{Tongue Blade}}$ -anterior, +distributed]

The preferred repair for this disallowed configuration – the one that produces the best outcome in this case – involves changing the feature [-anterior] into [+anterior]. This is shown below.

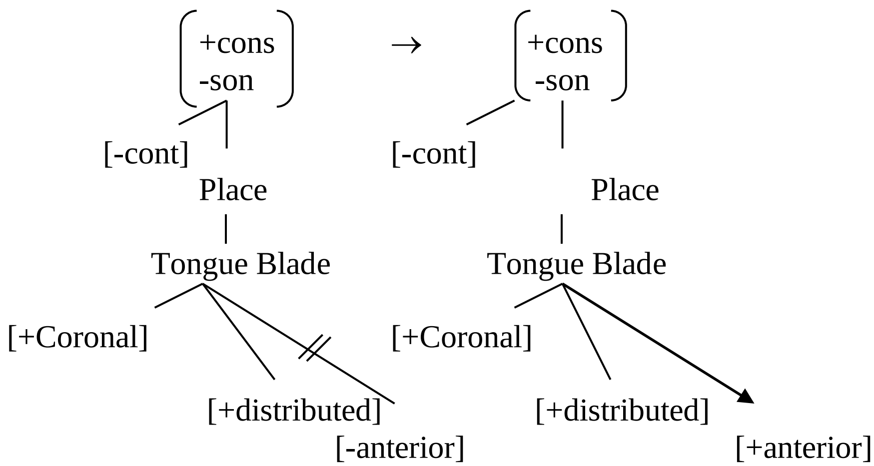

Figure 19: Coronal anteriorization.

The operation shown in Figure 19 is crucial to account for all the possible outcomes of palatalization across Romance. In particular, this process (which we may call *coronal anteriorization*) is the necessary, preliminary step before actual affrication/fricativization, which leads to outcomes such as [ts s θ] (cf. step 3 in the following section).[16] Evidence for this analysis is seen in the outcomes of the first palatalization in Ligurian, a northern Italian dialect. In this dialect, Latin /tj/ developed into the fricative [ʃ] and Latin /kj/ developed into the fricative [s]: e.g. *ra*[ʃ]*on* 'reason' < RA[tj]ONE(M); *bra*[s]*u* 'arm' < BRA[kkj]U(M). If we just consider

[16] Traditionally, the appearance of coronal [+anterior] segments from the palatalization of velar plosives is accounted for by assuming a further process of depalatalization which changes the palatal or palato-alveolar outcomes of palatalization to dental or alveolar consonants. The hypothesis is that we obtain dental/alveolar segments in palatalization processes always through sequences of developments such as:

(i) a. c → ʧ
b. ʧ → ts

Such a chain of sound changes is not needed in Calabrese's framework.

the place of articulation of the segments that are the outcome of palatalization, we can observe immediately that we cannot account for the emergence of the alveolar consonant [s] in this process by assuming a depalatalization process that affects an intermediate palato-alveolar consonant [ʃ]. This depalatalization rule, in fact, would have also affected the palato-alveolar [ʃ], which is the outcome of /kj/, and thus caused a merger between the outputs of /tj/ and /kj/. We can account for the Ligurian facts by assuming that the difference between the outcomes of /tj/ and /kj/ is due to different rules: in the case of the coronals, coronal raising (Figure 11) applies; in the case of velars, after velar fronting (Figure 12) and coronalization (Figure 14) apply, the representation in Figure 15 may be repaired by delinking the Tongue Body node.

4.3 Step 3: affrication/fricativization

Targets of palatalization processes are generally affected in their place of articulation, in that they get raised and fronted (thus eventually becoming coronal). Additionally, plosives typically become affricates or fricatives.

The usual solution to the problem of affrication and fricativization of plosives in palatalization processes found in the literature relies on redundancy rules that change the output of palatalization rules into an affricate. The assumption is that affrication in the palato-alveolar region is predictable and therefore expressed by a rule (Sagey 1986; Lahiri/Evers 1991). Thus, affrication of palato-alveolar plosives is expressed as in (7) where palato-alveolar plosives are characterized by the features [+distributed, -anterior].[17]

(7.) $[_{\text{Tongue Blade}}$ +distributed, -anterior$] \rightarrow$ ‘affricate’ / ____ [-continuant]

One could propose that a rule such as (7) has a phonetic justification, in that the plosive closure is difficult to execute with the laminal articulation of palato-alveolar plosives. In particular, given the length of the constriction characterizing laminal plosives, the tongue cannot have sufficient mobility to obtain the abrupt release that is crucial for the proper articulation of a plosive consonant (cf. Catford 1977, 152;

[17] This is the position adopted by Steriade (1993; 1994) who assumes that the fricative release of affricates is not a distinctive property, but rather is the surface realization of an underlying distinction in point of articulation. In particular, she assumes that individual languages may have the option of realizing laminopalatal plosives with a significantly delayed release, which results in frication noise. In such a framework, affrication of the configuration [+distributed, -anterior] must be stipulated a priori, but no theoretical explanation can be given.

Lahiri/Blumstein 1984, 42). Still, there is no clear phonetic reason for why there should be affrication in this case.[18] Note furthermore that a purely phonetic account of this adjustment would imply that affrication is beyond the cognitive control of the speakers. This would be incompatible with the possible suppression of affrication that, for example, we see in the laminal palato-alveolar plosive [c] of Czech or Friulian. Speakers must obviously be able to control this adjustment and produce non-affricated laminal consonants, even if they are difficult articulatorily. Therefore, the adjustment characterizing affrication cannot be an automatic phonetic implementation process that is by definition beyond speakers' control.[19]

Calabrese (2005) proposes that this adjustment is due to representational rather than purely articulatory properties of laminal plosives. Affrication is phonological in nature, not phonetic, because it results from repairing a phonologically marked configuration involving the feature [distributed]. The feature [distributed] identifies sounds that "are produced with a constriction that extends for a considerable distance along the direction of the airflow" (Chomsky/Halle 1968, 312). Non-distributed sounds are sounds that instead "are produced with a constriction that extends only for a short distance in this direction" (Chomsky/Halle 1968, 312). Laminal consonants (namely, laminal palato-alveolars and lamino-dentals) are characteristically [+distributed] and are the typical outcome in palatalization, regardless of the underlying place of articulation (Bhat 1978; Lunt 1997; Keating 1988). Recall from

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[18] Consider for example the frequently quoted passage by Catford (1977, 152):

> It is quite easy to make a clear-cut sudden breakaway of the tongue point from the alveolar ridge (in apico-alveolar plosives), but, when the point is lowered and the contact is made with the blade (lamino-alveolar), it is more difficult to break away cleanly. The blade withdraws from the alveolar ridge more slowly, passing through a perceptible moment of approximation when there is an [s]-like central channel between the blade and the alveolar ridge – hence the tendency for lamino-alveolar plosives to be affricated.

This passage implies that affrication is an adjustment meant to fix the problem posed by the laminal type of plosive release. The issue remains, however, of why we have affrication as an adjustment in this case, in particular, there is no explanation of why the blade should withdraw more slowly forming 'an [s]-like central channel' in the case of the laminal plosives (cf. also fn. 22).

[19] We are therefore assuming that only properties that are grammatically (i.e. phonologically) represented can be under cognitive control. It follows that only articulatory and auditory properties that are encoded in phonological representations and processes can be under cognitive control.

(4) that the feature [distributed] of the tongue blade tightly correlates with feature [-back] of the tongue body: when the tongue body is fronted and raised, there is a wide contact area in the articulation of the consonant also involving the tongue blade, i.e. a [+distributed] behavior of the front of the tongue is observed. Crucially, this [+distributed] behavior of the tongue blade becomes problematic when a primary occlusive constriction is implemented with the same articulator (i.e. when the tongue blade is the designated articulator).

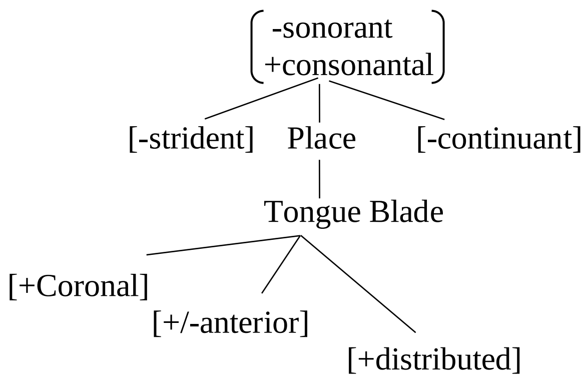

Figure 20: AT configuration of a laminal plosive.

The configuration [-continuant, +distributed] is characterized by a high degree of complexity; this comes from the fact that, given the length of the constriction characterizing laminal plosives, the tongue blade cannot have sufficient mobility to obtain the abrupt release crucial for the proper articulation of a plosive consonant. Support for this can be found in Stevens/Keyser (1989), who claim that the optimal coronal plosive has a short constriction (namely, it is specified as [-distributed]). The complexity of laminal plosives is also supported by the fact that these types of plosives are very rare cross-linguistically (Lahiri/Blumstein 1984; Ladefoged 1964; Chomsky/Halle 1968). In Calabrese's (2005) terms, the high degree of complexity of Figure 20 can be formalized as the constraint (8) below.[20]

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[20] Palatal laterals and nasals behave differently than palatal plosives: the laminal configuration of the tongue is not as problematic in their case, as shown by the fact that they frequently occur across languages. Therefore, (8) needs to be restricted to palatal plosives, as below. However, the specification [-sonorant] is omitted in the constraint (8) for the sake of simplicity.

*[-continuant, +distributed]/ [-sonorant, +Coronal, ____]

(8) *[-continuant, +distributed] / [$_{\text{Tongue Blade}}$ +Coronal, ___]

As result of steps 1 and 2 above, the constraint in (8) may be violated. Such violation triggers one of the two following repair operations, which ultimately give rise to affricates or fricatives. First, the illicit configuration in (8) may be repaired by *fission*. Fission is an operation that splits a feature bundle containing a disallowed configuration into two successive bundles, each containing one of the mutually incompatible features (Calabrese 1995; 2005). By way of fission, the illicit configuration in (8) is broken down into two different, phonologically licit configurations (Calabrese 1988; 1995).

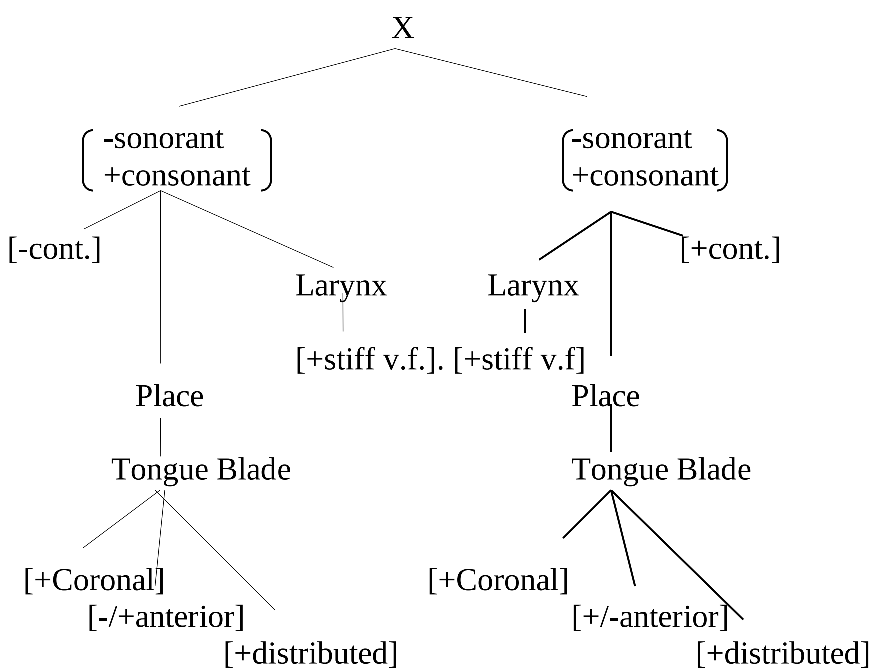
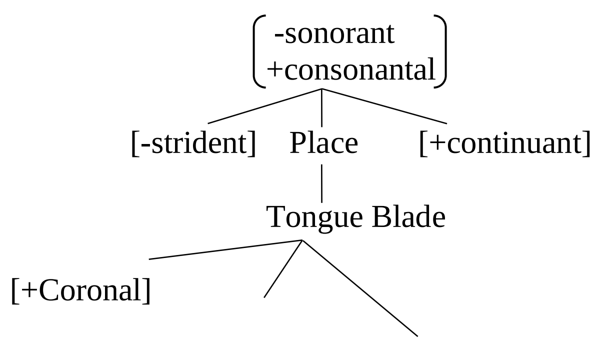


Figure 21: AT configuration of affricates.

Note that it is not merely the tongue configuration to be an issue here as would be assumed in Catford's phonetic account of fn. 18. His account would, in fact, predict the appearance of an [s]-like central channel' in the pronunciation of palatal laterals and nasals, something that is unattested. What matters is the entire phonological configuration of the target segments as implied by the constraint above.

As shown in Figure 21, fission simplifies the complex articulatory unit involving a plosive release with a long constriction by splitting this unit into two simpler units: in the first unit, closure is associated with the same long constriction; in the second unit, the long constriction is associated with a fricative release. Thus, the two simultaneous articulatory maneuvers of total closure and tongue front flattening implemented in laminal plosive production are sequenced in time. The segment obtained in Figure 21 is an affricate: [ʧ ʤ] (cf. Table 2a–c: Northwestern Friul. [poʧ] 'well' < PUTEU(M), It. [ˈradʤo] 'ray' < RADIU(M); Tusc. [ˈbratʧo] 'arm' < BRACCHIU(M), Tusc. [koˈredʤa] 'strap' < CORRIGIA(M); Tusc. [ˈmadʤo] 'May' < MAIU(M); cf. Table 5: It. [ˈʧera] 'wax' < CERA(M), It. [ˈʤenero] 'son-in-law' < GENERU(M)) if palato-alveolar, or [ts dz] if dental/alveolar after the application of the rule in Figure 19 (cf. Table 2a–c: Cal. [ˈputtsu] 'well' < PUTEU(M), Cors. [ˈmeddzu] 'half' < MEDIU(M); Lig. [ˈbrattsu] 'arm' < BRACCHIU(M), Sur. [kuˈredza] 'strap' < CORRIGIA(M); Sur. [dziˈdzin] 'fasting' < IEIUNU(M); cf. Table 5: Mountain Lig. [ˈtsera] 'wax' < CERA(M), Ven. [ˈdzenero] 'son-in-law' < GENERU(M)) (cf. 4.2).

The second way the illicit configuration in (8) may be repaired is by *delinking* (or *deletion*); by way of delinking, a feature is deleted from the representation. Assume that the feature [-continuant] of the illicit configuration (8) is deleted. After the application of delinking, we then obtain the configuration in Figure 22 (where as discussed in Calabrese (1995; 2005), deletion of a feature specification is followed by automatic insertion of its opposite value, [+continuant] in this case):[21]



[21] Delinking of the feature [+distributed] is not attested. We can account for this fact if we consider that given the correlation (4), in laminal post-alveolar segments, there is also involvement of a raised and fronted tongue body, which is not affected by the repair. Changing [+distributed] into [-distributed] would create a retroflex consonant. Retroflection would be incompatible with the tongue body configuration characterizing these segments. A prohibition against this would always disallow replacing [+distributed] with [-distributed]; cf. also fn.14.

[+/-anterior]

[+distributed]

Figure 22: AT configuration of the outcome of delinking of [-continuant].

Observe that this configuration contains the [-strident] feature value, since plosives are generally characterized by the feature [-strident] (Stevens/Keyser 1989). Now, the configuration [+continuant, -strident] is highly complex though, and may be marked as illicit.

(9) *[+continuant, -strident]

If (9) is not active in a given language, such a configuration is allowed, thus surfacing as [θ ð] (cf. Table 2a–b: Com. [poθ] 'well' < PUTEU(M), Com. [ˈmeðo] 'half' < MEDIU(M); Com. [ˈaθa] 'ax' < ACIE(M); cf. Table 5: CastSp. [ˈθera] 'wax' < CERA(M), OVen. [ˈðɛnaro] 'son-in-law' < GENERU(M)). This is, for example, the case of the Sardinian dialect of Nuoro (Pittau 1972):[22]

(10) Dialect of Nuoro
[kanˈθone] 'song' < CANTIONE(M)
[lanˈθare] 'wield a lance$_{INF}$' < LANCEARE

However, if (9) is active in a given language, such a configuration needs repairing. This may be done by delinking either feature. On the one hand, delinking [+continuant] in the representation in Figure 21 does not resolve the issue, since it brings back the representation [-continuant, +distributed] that started the derivation, an operation that we assume is excluded by reasons of economy. On the other hand, delinking [-strident] abides by the constraints at play, and the strident fricatives [ʃ s] therefore come about (cf. Table 2a–b: Eastern Friul. [pos] 'well' < PUTEU(M), Picard

[22] Observe that it is very difficult to hypothesize an intermediate stage /ts/ before the final outcome [θ] in the case of the Sardinian dialect of Nuoro because of the presence of another sound change that occurred probably at the same time as the palatalization process or shortly after it. This sound change affected front glides after sonorants (namely /lj/ and /nj/) and changed them into voiceless alveolar affricates:

lan[ts]*are* 'tear apart$_{INF}$' < LANIARE
mu[ts]*a* 'wife' < MULIERE(M)

If there was a deaffrication process that changed an intermediate /ts/ from /tj kj/ into the non-strident [θ], it should have also changed the affricate [ts] from /j/ after /l/ and /n/. But this did not occur.

[kaˈʃø] 'hunter' < CAPTIATORE(M); Tusc. [ˈaʃʃa] 'ax' < ACIE(M); cf. Table 5: Fr. [siʁ] 'wax' < CERA(M)).[23]

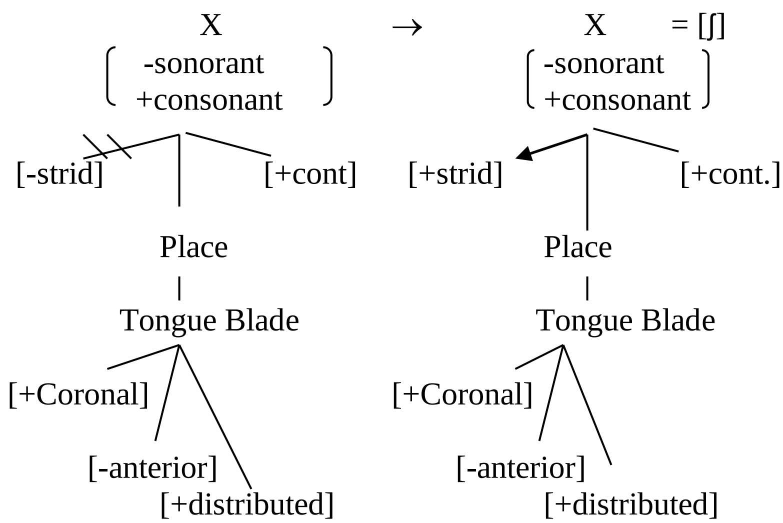


Figure 23: AT configuration after repairing the violation of constraint in (9) by delinking.

4.4 Palatalization in labials and voiced plosives

A separate discussion must be held regarding palatalization of labial and voiced plosives. Cross-linguistically, these two classes of sounds undergo palatalization changes different from those discussed above. Let us first consider labials. Labials rarely undergo palatalization (cf. Table 3a–b: It. [ˈsappja] 'know$_{\text{3SG.SUBJV}}$' < SAPIAT, Tusc. [ˈrabbja] 'anger' < RABIA(M); It. [venˈdemmja] 'grape harvest' < VINDEMIA(M)) (cf. Bateman 2007; 2010; 2011). In varieties where they do undergo this process, however, labials change to complex segments composed of a non-

[23] Changes in manner of articulation also characterize consonantal processes such as fortition and lenition. We point out that, whereas palatalization processes may be argued to be due to assimilation-triggered articulatory adjustments, it is unclear how the same treatment may be reserved for fortition and lenition processes. In fact, as argued by Katz (2016), the changes in manner of articulation of the latter processes are due to totally different phonological mechanisms – that is, to sound intensity increasing inside prosodic constituents, but decreasing at their edges. For recent discussion of lenition/fortition, cf. also Ségéral/Scheer (2008); Honeybone (2008); Kirchner (1998); Gurevich (2003).

palatalized labial and a palatal consonant [ptʃ bdʒ mdʒ] (cf. Table 3a–b: OOc. [ˈsaptʃa] ‘know$_{3SG.SUBJV}$ < SAPIAT’, OOc. [ˈrobdʒe] ‘red’ < RUBEU(M); Egd. [vinˈdemdʒa] ‘grape harvest’ < VINDEMIA(M)) or simply to palato-alveolar consonants (cf. Table 3a–b: Sic. [ˈsattʃu], Fr. [saʃ] ‘know$_{3SG.SUBJV}$ < SAPIAT’; Sic. [ˈgaddʒa] ‘cage’ < CAVEA(M), Fr. [ʁaʒ] ‘anger’ < RABIA(M); Oc. [venˈdemɲa], Lig. [venˈdeɲa] ‘grape harvest’ < VINDEMIA(M)). This type of process can be accounted for by the independent rule in Figure 24, where only terminal features are spread in assimilation processes (in line with Halle 1995).

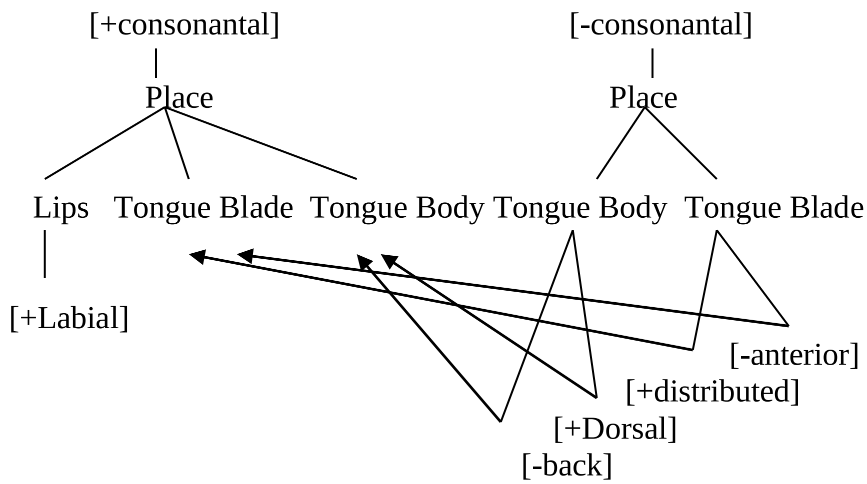


Figure 24: Assimilation process of the terminal nodes of the Tongue Body and Tongue Blade nodes. All Tongue Body and Tongue Blade features spread back to the preceding consonant.

Thus, the palatalization of labials generates quite complex segments involving labial and dorsal primary articulations, and a coronal secondary articulation, as shown in Figure 25.

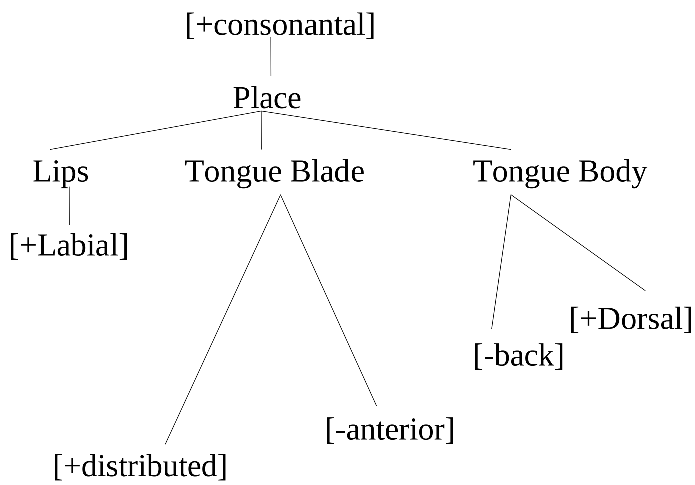


Figure 25: AT configuration of palatalized labials.

The fact that in many Romance varieties labials do not undergo a change of place of articulation can be explained by assuming that the application of the assimilation rule in Figure 24 is blocked by the grammar having an active constraint against such complex segments. Varieties in which labials do instead undergo palatalization may display two different outcomes. In some varieties, this constraint is not active and therefore the rule in Figure 24 applies; the coronal component of the complex segment then undergoes the coronal raising rule in Figure 11, and affrication thus generates complex outcomes such as [ptʃ bdʒ mdʒ]: e.g., Egd. [vinˈdemdʒa] ‘grape harvest’ < VINDEMIA(M). In other varieties, the constraint is active. The assimilation rule (Figure 24) applies, but its output is repaired by delinking the [+Labial] articulator. Subsequently, the derived palato-alveolar segment undergoes the same changes discussed above and surfaces as [tʃ dʒ ɲ]: e.g., Lig. [venˈdeɲa] ‘grape harvest’ < VINDEMIA(M).

Let us now turn to voiced plosives. Unlike voiceless plosives, in palatalization processes voiced plosives are often neutralized with high front glides, thus surfacing as [j] (cf. Table 2a–c: Cal. [ˈraju] ‘ray’ < RADIU(M), Friul. [koˈrɛ(j)a] ‘strap’ < CORRIGIA(M), Cal. [ˈmaju] ‘May’ < MAIU(M); cf. Table 5: Sp. [ˈjerno] ‘son-in-law’ < GENERU(M)); for example:

(8.) Sicilian

a.	[ˈfuju] ‘flee$_{1SG}$’	<	FUGIO
b.	[ˈoji] ‘today’	<	HODIE

c. [ˈjoku] ‘game’ < IOCU(M)
d. [ˈpɛju] ‘bad$_{CMP}$’ < PEIORE(M)

We can account for this fact by assuming the following rule, in which [+consonantal] is changed into [-consonantal] in the structure in Figure 26.

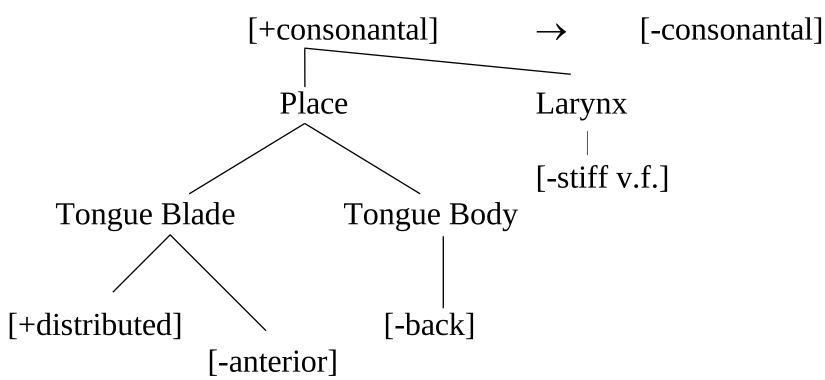


Figure 26: Neutralization rule. Palatalized plosives become glides before front vowels, thus switching from [+consonantal] to [-consonantal].

The outcomes [ʤ z dz ʒ ɟ s ʃ] (cf. Table 2a–b: It. [ˈraddʒo], Rm. [ˈrazə] ‘ray’ < RADIU(M), Cors. [ˈmeddzu] ‘half’ < MEDIU(M), Cors. [ˈoɟi] ‘today’ < HODIE; Tusc. [koˈreddʒa], Sur. [kuˈredza], Sut. [kuˈreʒa]/[kuˈreɟa], Sal. [kuˈreʃa] ‘strap’ < CORRIGIA(M); cf. Table 5: It. [ˈʤenero], Ven. [ˈdzenero], Cors. [ˈɟenaru], Fr. [ʒɑ̃dʁ] ‘son-in-law’ < GENERU(M)) are due to further processes of fortition applying to the neutralized [j]; some examples follow.[24]

(9.) Salentino
a. [ˈfuʃu] ‘flee$_{1SG}$’ < FUGIO
b. [ˈoʃe] ‘today’ < HODIE
c. [ˈʃweku] ‘game’ < IOCU(M)
d. [ˈpeʃu] ‘bad$_{CMP}$’ < PEIORE(M)

(10.) Italian
a. OIt. [ˈfuddʒa] ‘flee$_{3SG.SBJV}$’ < FUGIAT
b. It. [ˈoddʒi] ‘today’ < HODIE

[24] Sonorant consonants may also be affected by a change like in Figure 24 (with subsequent loss of laterality or nasality ([ʎ] → [j], [ɲ] → [j] Table 4b).

c.	It.	[ˈʤɔko] ‘game’	<	IOCU(M)
d.	It.	[ˈpɛdʤo] ‘bad$_{CMP}$’	<	PEIORE(M)

5 Recent OT-based analyses of palatalization

In the previous section, we have seen how Calabrese’s (2005) rule-and-constraint based model can account for the wide spectrum of micro- and macro-variation in Romance palatalization. In this section, we turn to discuss two recent accounts of palatalization that have been proposed within the Optimality Theory (OT) framework, the current leading phonological theory: Rubach’s (1984/2011; 2003) and Bateman’s (2007; 2010; 2011). We do this as a chance to make a meta-theoretical evaluation of opposing phonological frameworks, while setting aside their ideological beliefs.

However, before proceeding we need to address the well-known difficulty of evaluating OT-based proposals. This difficulty is due to the complex nature of the theory that allows the OT practitioner to always be able to come up with a new constraint – a violable one, and therefore one that is not testable insofar as its effects can be somehow always overridden by another violable, and not directly testable, constraint. The consequence is that often the analysis, and the evaluation of it, appears to be an exercise in excluding the possible unattested candidates, an exercise which is just governed by good luck, as Clements (2000) noticed, since no one can ever be sure that all the possible options were clearly considered. For this reason, a thorough evaluation of these accounts in the context of this chapter cannot be done unless the OT-theoretical complexity is reduced so that the actual predictions of the analysis can be evaluated. In particular, in this section we will set aside the theoretical complexity that faithfulness constraints bring about.

In OT (Prince/Smolensky 1993/2004, McCarthy/Prince 1995), rules are rejected as devices for phonological processes. Rather, phonological processes are interpreted as a way to solve language-specific phonological constraints. In this spirit, for example, epenthesis is seen as a way of repairing violations to well-formedness constraints on complex syllable structures. A grammar in Optimality Theory (OT) involves a language-particular ranking of universal constraints (Prince/Smolensky 1993/2004) which come in two types: *markedness constraints* prohibit certain output configurations, whereas *faithfulness constraints* block certain input-to-output mappings. Phonological generalizations are expressed by the interaction, through ranking, of these constraints. Thus, in OT a process A→B / C__D is characterized in the following way (McCarthy 2000):

(11.) a. Some markedness constraint *CAD dominates any faithfulness constraint F (A↛B) that would block the A→B mapping;

b. No markedness constraint that CBD violates is ranked above *CAD; and

c. For all X≠B, there is some faithfulness constraint F (A↛X) or some markedness constraint *CXD that dominates F (A↛B).

OT proponents claim that, by the complex decomposition of the notion of a phonological process as in (14), deeper levels of explanatory adequacy can be reached in phonology (Prince/Smolensky 1993/2004; cf. Roca 1997; McCarthy 2008). In particular, OT is claimed to be able to (i) account for conspiracies and (ii) provide a direct formal framework for representing universality and markedness, because the constraints are assumed to be universal and related to markedness. As discussed in Calabrese (2005; 2009; 2019), (i) and (ii) are not an OT prerogative, rather they are achieved in other models too. What remains is OT complexity.[25] On one side, OT wildly overgenerates. For example, consider the phonological process defined in (14). In order for it to be dealt with in OT, it needs to be decomposed into at least four constraints – the two markedness constraints *CAD, *CXD; and the two faithfulness constraints F(A↛B), F(A↛X).[26] These four constraints can be freely ranked. This results in 4! = 24 possible ranking permutations. Each process is part of a factorial typology including the other 23 members. Thus, each process must be included in a large conspiracy with many related processes. There are simply too many solutions to a given phonotactic constraint, whereas the number of known conspiracies seems to be limited (the 'too-many-solution problem'; cf. Steriade 2009).[27] On the other side,

[25] There are also other problems OT faces such as its failing to account for opaque process interactions (Vaux 2008) and for morpho-phonological and language-specific idiosyncratic processes, whose existence is in fact clearly incompatible with the idea that phonological processes revolve around phonological optimization (Paster 2006; Bye 2008). Such problems are irrelevant in the context of this chapter.

[26] The number of constraints considered in (14) depends on the logic interpretation of the logical connective *or* in (14c). In our discussion, we interpreted it exclusively (□), so to consider the minimal number of constraints (and therefore ranking permutations); if *or* were to be interpreted inclusively ((), the number of constraints would go up to 5, along with the permutations (5!=120).

[27] We can name the most important ones: the hiatus conspiracy; conspiracies involving syllabic configurations such as those against complex onsets or complex codas; conspiracies dealing with prosodic structures; conspiracies involving marked segments such the front rounded

there is also an internal architectural redundancy of OT. Like other constraint-and-repair models (Calabrese 1988; 1995; 2005; Paradis 1988), OT also has repairs, i.e. operations changing input strings that violate some markedness constraint. They are implemented by GEN, although hidden in this component. So, consider a repair such as A→B implemented by GEN. This repair, as all other GEN operations, is punished by a faithfulness constraint, (A↛B) in this case – faithfulness constraints are always the negative mirror image of GEN's operations. So, the same operation is essentially referred to twice in the grammar, although its first instance is hidden in GEN. Thus, there is a pervasive hidden duplication between the operations GEN can perform and faithfulness constraints at the base of OT, violating any reasonable principle of economy. Accordingly, one could consider only the operations that GEN implements in response to markedness constraints and disregard the action of the faithfulness constraints.[28]

For these reasons, in the following review of OT-based analyses of palatalization we will try to reduce OT-theoretical complexity by putting aside faithfulness constraints, and instead focusing only on the fundamental core of the framework: the markedness constraints and the repairs they trigger.

5.1 Rubach's analysis

Rubach's (1984/2011) investigation deals with palatalization in Slavic languages. Despite the many similarities between the historical palatalization processes in the Slavic and Romance languages, a thorough discussion of Slavic palatalization is not possible here. We will, instead, focus on Rubach's analysis of velar coronalization before front vowels, which is the most problematic palatalization process (cf. 4.1).

(15) k → tʃ /__ i, e

Rubach (1984/2011) proposes the following markedness constraints (cf. also Rubach 2003) and Rubach/Booj 2001):

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vowels or [-ATR] high vowels; conspiracies involving the OCP; conspiracies involving the distribution of features in strings.

[28] Note that according to the same general principle of economy, a repair triggered by the violation of a constraint implements the minimal change that fixes the violation. This would prevent OT's overgeneration.

(16) a. PALATALIZATION-e (PAL-e): A consonant and a following mid vowel agree in backness.
b. AFFRICATION (AFF): *[Coronal, -back, -strident]
c. POSTERIORITY (POST): *[Coronal, +anterior, -back]
d. *SOFTDORSAL (*SOFTDOR): Don't be a [-back] dorsal.

Rubach assumes that palatalization is triggered by the constraint PAL-e (16a). PAL-e forces the sequence /ke/ to agree in the feature [-back]; thus, via (16a) the velar is fronted: /ke/→/k'e/. However, the candidate /k'e/ violates the constraint *SOFTDOR (16d). At this point, the dorsal /k/ changes its place of articulation into coronal by Prince and Smolensky's (1993/2004) universal ranking in (17), in which *LABIAL (don't be a labial) is ranked higher than (>>) *CORONAL (don't be a coronal). Assuming that the coronal candidate preserves the feature [-back], the constraints AFF (16b) and POST (16c) ensure that the desired output from /ke/ is a [-anterior, +strident] coronal, namely a post-alveolar affricate [tʃ].

(17) *Labial >> *Coronal

In some respects, Rubach's analysis is quite close to what we have proposed in the preceding pages. In particular, the constraints POST (16c) and AFF (16b), although quite stipulative in themselves, are equipollent to the correlation in (4). It is to observe, however, that in Rubach's analysis, the coronal articulator is selected as default only because of the ranking in (17). Although theoretically possible in OT, this formulation fails, however, to account for the assimilatory nature of the process. Furthermore, the analysis must assume that the ranking in (17) is fixed and may not vary across languages. If *LABIAL >> *CORONAL could be reranked, insertion of a labial articulator could be implemented, so that one would expect labialization as one of the outcomes of palatalization, which is obviously contrary to the facts.[29] Note that pharyngealization and glottalization should also be excluded as possible repairs in addition to labialization. So, one needs to assume that constraints such as *TONGUEROOT (No pharyngeals) and *LARYNX (No laryngeals) are ranked higher than *CORONAL, on a par with *LABIAL:

(18) *Labial, *TongueRoot, *Larynx >> *Coronal

---

[29] Assuming OT, $\text{DEP}_{[+\text{strident}]}$ and $\text{DEP}_{[-\text{anterior}]}$ must always be very low. In fact, if $\text{DEP}_{[+\text{strident}]}$ and $\text{DEP}_{[-\text{anterior}]}$ were ranked higher than AFF (26b) and POST (26c), one would expect labialization as one of the outcomes of palatalization.

It follows that (18) would need to be fixed across all languages. This prediction, however, does not seem to be borne out. In many languages, coronal plosives become glottal plosives (e.g. t→ʔ/__# in English), which would, however, be impossible to account for if (18) could indeed be reranked in the first place. Therefore, the possibility that (17) and (18) are cross-linguistically constant cannot be true. In order to prevent pharyngealization and glottalization from occurring in palatalization processes, Rubach's theory would need to add new (potentially ad-hoc) constraints, which would not only complicate an already very complex analysis, but also resort to unmotivated auxiliary hypotheses.

5.2 Bateman's analysis

Bateman's (2007; 2010; 2011) analysis uses articulatory phonology within the OT framework, along the lines of Gafos (2002) and Davidson (2003; 2004). Bateman bases her analysis of palatalization on the notion of gestural blending (Browman/Goldstein 1992) as in Recasens (2011), discussed in 3.2. Recall that gestural blending occurs because the gestures using the same tract variable are attempting to force it to perform two tasks (namely achieve two targets) simultaneously; it is therefore impossible for this to happen without the gestures perturbing each other's movements. If the overlap is greater than minimal, the constriction is undershot. The result is (a) a shift in the *location* of the constriction to some place between the two coordinating gestures; and (b) a change in the *degree* of the constriction (Bateman 2007, 202). Bateman accounts for the blending interaction between tongue blade and tongue body (namely the trigger of palatalization processes) on the basis of two assumptions. First, she assumes that gestural blending occurs when the interacting gestures are produced with the same major articulator; second, she assumes that the tongue blade and tongue body are sub-articulators of a single major articulator: the tongue. This close connection between the tongue sub-articulators is the main reason behind coronal and dorsal consonants undergoing palatalization more easily and freely across language (either independently of each other or together in the same language).

In her analysis, Bateman follows Gafos (2002) in accounting for the interactions between consonantal and vocalic gestures through the interaction between *gestural landmarks* (instead of Browman/Goldstein's (1992) gestural score; cf. 3.2). Each gesture has five temporal landmarks shown in Figure 27: the *onset* of the movement, reached at the beginning of the gestural movement; the *target* location, reached at the maximal constriction; the *center* point of the constriction; the *release* of the constrictions; finally, the *release offset*, reached at the end of the gestural movement. The *gestural* plateau is the portion of time (between target and release) during which the constriction is held; the *c-center* (which stands for constriction center) is the mid-point of the gestural plateau.

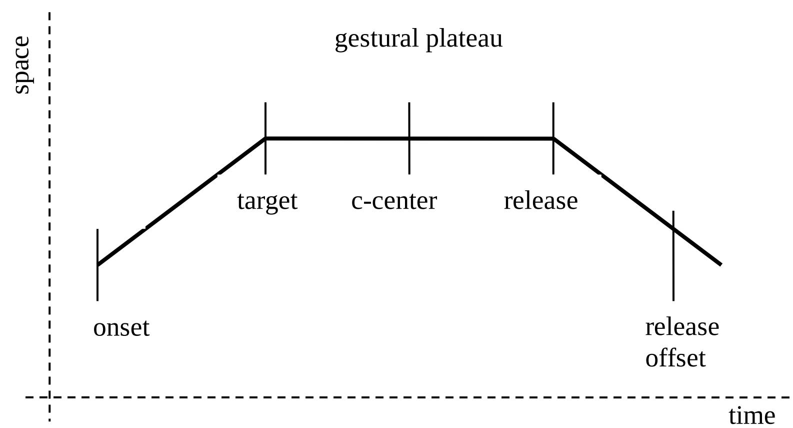

Figure 27: Gestural landmarks (from Bateman 2007, 193). The bold line represents the articulator moving through space and time.

Gestural coordination is implemented in the grammar by a markedness constraint that favors coordination of consonantal and vocalic gestures. Following Gafos (2002) and Davidson (2004), Bateman (2007) uses COORDINATION and ALIGNMENT constraints for that purpose. These constraints force selection of candidates that have the landmarks (namely onset, target, c-center, release, release offset) of consonantal and vocalic gestures aligned with one another. For full palatalization processes, she argues for a CV-COORDINATION constraint that controls the tongue gestures of a consonant (C) and a vocoid (V). This constraint states that all the consonants in an onset have a coordination relationship with the nucleus vowel.

(19) CV-COORDINATION-CENTER (tongue): CV-COORD-C (Tongue)
Align c-center landmark of tongue-gesture with onset landmark of V-gesture.

When a consonant occurs before a front vowel, (19) requires the c-center landmark of the consonant to be synchronized with the onset landmark of the following front vowel. This is done as shown in Figure 28: the c-center of tongue-gesture (solid line) is aligned with the onset of V-gesture (dotted line). For example, when the consonant

/t/ precedes the front vowel [i], the c-center landmark of the former is synchronized with the onset landmark of the latter by (19). A greater overlap between the two movements then comes about, which ultimately results in realization of the affricate [ʧ], which combines features of the two elements: [t] is [alveolar, closed] and [i] is [palatal, narrow], and they blend together in [tʃ], which is [palato-alveolar, closed-critical] (where [critical] is a blend of the [closed] and [narrow] values of the consonant and the vowel, respectively).

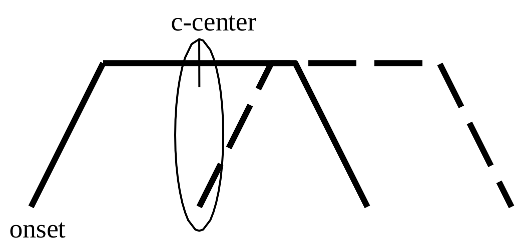

Figure 28: Gestural overlap between the articulation of a consonant (solid line) and the articulation of a front vowel (dotted line).

This system works fairly well for palatalization of coronals because the ultimate outcome is alveo-palatal (which is precisely a blending of coronal and dorsal gestures). However, this is not the case in the coronalization of dorsal consonants. In this case, in fact, the input constriction location of the tongue body is changed from velar to palato-alveolar: e.g. /ke/ → [tʃ], so that the change leads to an involvement of the tongue blade. If a velar plosive has a [velar] constriction location, and the palatalization trigger has a [palatal] constriction location – for example, when the trigger is [e] which is simply [palatal, mid], with no tongue blade involvement – it is unclear why these segments blend to produce a [palato-alveolar] gesture as in [tʃ], in a way overshooting both targets. The obvious outcome of the gesture blending in this case should instead simply be a fronted velar, or perhaps a palatal plosive. Here, we essentially have the same problem we noted in the case of Recasens's analysis in so far as there is the unexpected appearance of a tongue blade gesture in violation of the no-tampering condition.

Bateman tries to solve the problem by following Lee (2000), who proposes that palatal plosives, e.g. [c], require a great articulatory effort, since the front part of the tongue body must make contact with the entire palatal region.[30] Lee (2000, 423–424) proposes that in the case of this consonant, an easier articulation is an affricate, [tʃ] even though it overshoots the palatal region.[31] The problem remains, however, of how tongue blade involvement emerges in this process. The articulatory effort due to the fact that the front part of the tongue body must make contact with the palatal region could simply be solved by changing the closure to [critical], i.e. by producing a palatal fricative. It is unclear why we need to insert a tongue blade gesture. There is simply no intrinsic motivation for such insertion, and its appearance in Lee's account is nothing more than a stipulation. It is also to observe that by adopting Lee's proposal, dorsal coronalization is no longer assimilatory in nature, which is a fundamentally counterintuitive move.

Bateman's analysis faces other two problems. First it wrongly predicts that all front vowel gestures affect the preceding consonant regardless of whether this is coronal or dorsal. In this way, however, Bateman also misses the important generalization that (a) coronals are mostly affected by front glides and high vowels, and not by non-high front vowels; and (b) dorsals are affected by all front vowels (that is, close, mid, and open vowels) and glides (Bhat 1978; cf. also Bateman 2011, 597). In Calabrese's (2005) analysis, this generalization is naturally explained as an effect of coronal raising (cf. Figure 11) and velar fronting (cf. Figure 12): the former is triggered by the coronal features [-anterior, +distributed], which are found only in high front vowels and glides; the latter is triggered by the feature [-back] found in all front vowels.

Secondly, and most importantly, the constraint in (19) imposes alignment and coordination of the consonantal and vocalic gestures independently of whether the vowel is front or back. Insofar as the tongue blade and the tongue body are sub-articulators of the same major articulator (the tongue), gestural blending should therefore occur in both cases and, in the case of back vowels, should trigger velarization of coronal consonants – namely anti-palatalization processes as exemplified in (20), which would be expected to be at least as common as

[30] In fact, the palatal stop [c], which has active tongue blade involvement, is not the most probable outcome of velar fronting. Rather, a fronted velar is the common and unproblematic allophonic outcome. We put aside this problem here.
[31] Bateman also postulates that this change is helped by the fact that [c] and the affricate [tʃ] share acoustic properties which make them similar.

palatalization, or even coexistent with it. As far as we know, such processes are unattested – and surely they do not co-occur with palatalization.[32]

(20) a. tʃ → tx/ __ u
b. tʃ → k / __ u
c. t → k/ __ u etc.

A possible solution for this problem is restricting (19) to front vowel gestures. However, the motivations behind (19) being restricted to front vowels would be articulatory and phonologically unclear. It seems to lack independent motivation, thus appearing highly stipulative.[33]

In conclusion, we believe that the theoretical infrastructure of rule-based models such as SPE and more recent constraint-and-repair models (Calabrese 2005; cf. also Paradis 1988) can deal with palatalization in a more cohesive, less stipulative way. Rules are not only restricted insofar as they can only insert or delete nodes in well-grounded phonological representations; but also, they operate on the phonological representations directly, without the intricate roundabout of constraints that OT entails. A model containing rules (or rule-like devices like repairs) is, therefore, much more parsimonious, and constrained, and therefore to be preferred to a model such as OT.

6 Conclusions

Romance palatalization is a complex phonological phenomenon. In our overview, we compared a number of analyses that have so far been proposed. Calabrese's (2005) analysis of palatalization seems to be able to account for the wide spectrum of micro- and macro-variation in Romance, as compared to the other competing accounts, which instead need a number of ad-hoc stipulative assumptions. In this account, palatalization is seen as a two-step process. First, when preceding a front vocoid,

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[32] It is to observe that given the constraint in (19), if tongue body fronting has an effect on the preceding consonant gesture, tongue body lowering should also have one. And this should also be found in the case of Tongue Root dislocations. As far as we know, such interactions are not part of "palatalization" processes.

[33] The other solution OT provides is resorting to some faithfulness constraints that forbid all possible (and unwelcome) changes. The ranking of these faithfulness constraints would have to be universally fixed, so to exclude all unattested processes – again, an unmotivated stipulation.

consonants undergo complex phonological processes (*step 1*; 4.1). Coronal consonants are raised (*coronal raising*) and velar consonants are fronted (*velar fronting*), which eventually brings about promotion of a secondary corono-laminal articulation to primary status (*coronalization*). Coronalization creates complex phonological configurations whereby a wide portion of the tongue body is involved in a primary occlusion of the vocal tract. We have shown that such complex articulations may be repaired in a number of ways, and each variety has its own (*steps 2–3*; cf. 4.2–4.3). In particular, we have seen that some varieties have chosen to apply fission, thus leading to affrication while some others have chosen to delete one of the features involved, thus leading to fricativization. The hope is to have shown how these repair procedures account for the changes in manner of articulation characterizing palatalization processes in a simple and straightforward way, under the starting assumption that the repair operations proposed formalize articulatory aspects of palatalization which may otherwise seem beyond the control of the speaker; this perspective seems compatible with the idea that the speaker has a role in this type of change as proposed in Gess (2013).

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