

It is all downhill from here: A typological study of the role of Syllable Contact in Romance languages¹

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Abstract

The main purpose of this paper is to show that Syllable Contact is responsible for the application of an extensive set of processes drawn from Romance languages and to explore the nature and effects of this constraint within Optimality Theory (OT) on the basis of the analysis of these phenomena. All the processes under examination entail a change in manner of articulation and are the following: a) regressive manner assimilation in some varieties of Catalan and in Languedocian Occitan, b) alveolar fricative rhotacism in Majorcan Catalan, dialects of Sardinian and dialects of Galician and c) alveolar fricative gliding in Languedocian Occitan.

The analysis of these processes leads to two important theoretical implications. First, it provides strong empirical evidence that SYLLABLE CONTACT cannot be regarded as a single constraint which categorically bans coda-onset

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clusters with rising sonority, but rather should be broken down into a universal hierarchy of constraints targeting all possible sonority distances between adjacent heterosyllabic segments, as originally suggested by Murray and Vennemann (1983) and implemented within OT in Bat-El (1996), Gouskova (2001, 2002, 2004), Baertsch (2002) and Baertsch and Davis (2003, 2005, 2007) (see Pons 2004a, 2005a). Second, it sheds new light on the ordering within the sonority scale of certain classes of sounds, namely liquids and obstruents, whose positions have traditionally been controversial.

1. Introduction

It is a well-known fact that there is a cross-linguistic preference to avoid coda-onset clusters with sonority rise, a tendency known as the Syllable Contact Law after the work by Murray and Vennemann (1983) and Vennemann (1988). This law has been adduced to explain certain diachronic changes (Hooper 1976, Murray and Vennemann 1983, Vennemann 1988, Ham 1998, Martínez-Gil 2003, Holt 2004, Wheeler 2007, among others), but also synchronic phenomena such as epenthesis and epenthesis positioning (Bonet and Mascaró 1997, Rose 2000, Gouskova 2001), consonant strengthening (Colina 1995, Shin 1997, Bonet and Mascaró 1997, Jiménez 1997, 1999, Davis and Shin 1999, Gouskova 2002, 2004), syncope blocking (Urbanczyk 1996, Miglio 1998, Gouskova 2002), word order and subtraction regulation in blend formation (Bat-El 1996), allomorph selection (Hargus 1997, 2007), metathesis (Gouskova 2001), and regressive manner assimilation (Shin 1997, Davis and Shin 1999, Pons [2003] 2006, 2004a, 2007, Wheeler 2005).²

The main purpose of this paper is to show that Syllable Contact is responsible for the application of an extensive set of processes drawn from Romance languages and to explore the nature and effects of this constraint within Optimality Theory (OT) on the basis of the analysis of these phenomena. All the processes under examination entail a change in manner of articulation and are the following: (a) regressive manner assimilation in some varieties of Catalan and in Languedocian Occitan, (b) alveolar fricative rhotacism in Majorcan Catalan, dialects of Sardinian and dialects of Galician and (c) alveolar fricative gliding in Languedocian Occitan.

The analysis of these processes leads to two important theoretical implications. First, it provides strong empirical evidence that SYLLABLE CONTACT cannot be regarded as a single constraint which categorically bans coda-onset clus-

2. The literature devoted to SYLLABLE CONTACT is extremely profuse. Here, just certain symbolic studies, those especially relevant for the purpose of this paper, are referenced.

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This paper is organised as follows. Section 2 provides a short overview of the role of Syllable Contact in phonological theory with special reference to its implementation in OT (Section 2.1), sets out the assumed approach to the sonority scale in the paper (Section 2.2), as well as its basic tenets for features and faithfulness constraints (Section 2.3). In Section 3, processes which entail a change in manner of articulation of the consonants involved attributable to Syllable Contact are described and analysed. Section 3.1 addresses the process of regressive manner assimilation in Catalan and Occitan; Section 3.2 deals with the processes of rhotacism and gliding in Majorcan Catalan, Sardinian, Galician and Occitan. In Section 4, a comparison of the account built up in the paper with alternative interpretations is presented. Section 4.1 explores the proposal based on the local conjunction of the sonority margin hierarchies advocated in Baertsch (2002) and Baertsch and Davis (2003, 2005, 2007). Section 4.2 considers alternative reasons for the triggering of the processes based on perceptual optimisation in line with work by Côté (2000, 2004), Steriade (2004) and Wright (2004), among others, and, in the light of the patterns analysed, dismisses them. This section also briefly refers to the phonetic grounds of Syllable Contact. Section 5 summarises the main findings of the paper.

2. Theoretical background and assumptions

2.1. Syllable Contact in phonological theory

2.1.1. The origins of Syllable Contact. The cross-linguistic avoidance of rising sonority across syllable boundaries was originally reported in the studies framed within Natural (Generative) Phonology (Hooper 1976, Murray and Vennemann 1983, Vennemann 1988). In these studies, a law which promotes the consonantal strength of the onset and which demotes the consonantal strength of the coda in coda-onset transitions (1) is invoked to account for certain diachronic sound changes in languages such as German, Italian and Spanish (2). (Here and throughout the paper, the symbol ‘.’ is used to indicate a syllable break, following the IPA conventions. In (1), the symbol ‘\$’ also indicates a syllable break.)

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- (1) *Syllable Contact Law* (Vennemann 1988: 40)
 “A syllable contact $A^{\$}B$ is the more preferred, the less the consonantal strength of the offset A and the greater the consonantal strength of the onset B .”
- (2) *Some diachronic sound changes attributed to Syllable Contact*
- a. Onset strengthening in German and Italian (Vennemann 1988: 53)
var.we > *Far.be* ‘colour’ *val.jo* > *val.go* ‘I am valid’
swal.we > *Schwal.be* ‘swallow’ *dol.jo* > *dol.go* ‘I hurt’
 - b. Gemination in Italian (Vennemann 1988: 46)
 LAB.RUM > *lab.bro* ‘lip’ OC(U).LUM > *oc.chio* ‘eye’
 FEB.REM > *feb.bre* ‘fever’ SAP.IAT > *sap.pia* ‘(s/he) knows’
 - c. Regressive manner assimilation in Italian (Vennemann 1988: 54)
val+rà → *var.rà* *ven+rà* → *ver.rà*
 ‘(s/he) will be valid’ ‘(s/he) will come’
dol+ rà → *dor.rà* *dol+ rà* → *dor.rà*
 ‘(s/he) will feel pain’ ‘(s/he) will feel pain’
 - d. Metathesis in some Spanish dialects (Vennemann 1988: 55)
ven+rà → *ver.ná* ‘(s/he) will come’
pon+rà → *por.ná* ‘(s/he) will put’

In Murray and Vennemann (1983), a more concrete formulation that predicts different degrees of satisfaction of the law is stated (3). This formulation has been reinterpreted in terms of sonority in several studies devoted to syllable structure, such as the one by Clements (1990: 520) (4).

- (3) *Extended Syllable Contact Law* (Murray and Vennemann 1983: 520)
 “The preference for a syllabic structure $A.B$, where A and B are marginal segments and a and b are the Consonantal Strength values of A and B , respectively, increases with the value of b minus a .”
- (4) *Extended Syllable Contact Law* (Clements 1990: 520)
 “The preference for a syllabic structure $A.B$, where A and B are segments and a and b are the sonority values of A and B respectively, increases with the value of a minus b .”

2.1.2. *Syllable Contact within Optimality Theory.* Within OT, this law acquires the shape of a violable contextual markedness constraint (see, among others, Alderete 1995, Bat-El 1996, Urbanczyk 1996, Shin 1997, Ham 1998, Miglio 1998, Davis and Shin 1999, Rose 2000, and Holt 2004). The formulation of the constraint and its calculation, though, diverge from one author to another, basically depending on the behaviour of the language under study. Most of the aforementioned authors (Urbanczyk 1996, Shin 1997, Miglio 1998,

Davis and Shin 1999, Rose 2000, and Holt 2004) understand SYLLABLE CONTACT as a single and categorical constraint (5), along the lines of the general definition of the Syllable Contact Law (see 1).

- (5) SYLLABLE CONTACT
 “Sonority should not rise across a syllable boundary.”

Some other authors, however, have suggested different refinements of the constraint in order to account for the complexity of the data analysed. As defined in (5), SYLLABLE CONTACT categorically prohibits sonority rise across a syllable boundary. In some languages, however, although SYLLABLE CONTACT plays a role, a certain degree of sonority rise is tolerated. In other languages, moreover, this degree of sonority rise is permitted if specific consonants are involved. Yet, in some other languages, the sonority fall across a syllable boundary is also susceptible to improvement.

In Alderete (1995: 48), where epenthesis in Winnebago (Hocank) is considered, a constraint according to which sonority rise across a syllable boundary should not exceed one interval is invoked (6). The author is obliged to formulate the constraint thus because in this language a heterosyllabic sequence of a voiceless stop followed by a sonorant is forbidden (and avoided via epenthesis) (7a), whereas a heterosyllabic sequence of a voiced stop followed by a sonorant, with less sonority rise, is allowed (7b). The intuition behind this constraint is that “C2 may not be ‘too far above’ C1 in sonority” (Alderete 1995: 33).

- (6) *Particular version of SYLLABLE CONTACT* (Alderete 1995: 48)
- a. “C1 < C2 by no more than one sonority interval, where C1 and C2 are adjacent and C1 is syllable-final and C2 is syllable-initial”.
 - b. Assumed sonority scale: vowels > voiced fricatives, sonorants > voiced stops > voiceless obstruents.
- (7) *Winnebago (Hocank)*
- a. /hipres/ → epenthesis [hi.pe.res] ‘know’
 - b. /haracabra/ → no epenthesis [ha.ra.cabra] ‘the taste’

In Bat-El (1996), where blend formation in Modern Hebrew is treated, SYLLABLE CONTACT is broken down into two constraints: one which categorically prohibits sonority rise across a syllable boundary (8a), and another, less restrictive, which requires an enhancement of the sonority slope across a syllable boundary (8b), in line with the formulation of the Syllable Contact Law found in Murray and Vennemann (1983) (see 3).

- (8) *Particular version of SYLLABLE CONTACT* (Bat-El 1996: 304)
- a. “σCONT: The onset of a syllable must not be of greater sonority than the last segment.”

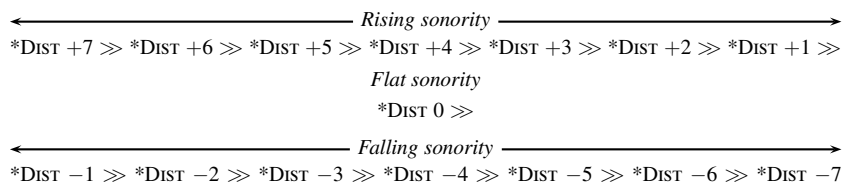
- b. “ σ CONTSLOPE: The greater the slope in sonority between the onset and the last segment in the immediately preceding syllable the better.”
- c. Assumed sonority scale: vowels > glides > liquids > nasals > fricatives > stops

Interestingly enough, σ CONTSLOPE is interpreted by Bat-El as a gradient constraint that evaluates the different degrees of sonority distance: the violations of this constraint are obtained by subtracting the sonority degree of the onset from that of the preceding segment, and the result is subtracted from the highest sonority degree. A salient aspect of this proposal is that not only sonority rise but also sonority drop is subject to improvement. That is why, for instance, a contact ‘r.d’ created through blending (i.e., / $\text{\textit{sxora}}$, $\text{\textit{blondinit}}$ / ‘black *fem. sing.*, blond *fem. sing.*’ → [$\text{\textit{sxor(a##blon).dinit}}$] ‘blond-dyed black *fem. sing.*’), appears to be more harmonic than a blending contact ‘n.d’ (i.e., [$\text{\textit{xo(ra##blo)n.dinit}}$]), which shows a sonority fall of -2 , and certainly more harmonic than a blending contact ‘n.r’, which shows a sonority rise of $+1$ (i.e., [$\text{\textit{blondin(it##xo)ra}}$]).

A more sophisticated formalisation of SYLLABLE CONTACT can be found in the work by Gouskova (2001, 2002, 2004), Baertsch and Davis (2003, 2005, 2007) and Baertsch (2002). In this section we focus on Gouskova’s approach to SYLLABLE CONTACT, which is the one we resort to in order to account for the data under analysis, and we leave Baertsch and Davis’ approach for closer evaluation in section 4.1.

According to Gouskova, SYLLABLE CONTACT is not a single constraint but a *relational hierarchy* of distinct markedness constraints targeting all possible sonority distances (positive, flat and negative) across syllable boundaries, like the one in (9).

(9) SYLLABLE CONTACT *as a relational hierarchy*
(Gouskova 2001, 2002, 2004)



In order to implement this proposal, Gouskova establishes a fixed matrix of consonant sonority distances (10), which is based on the sonority scale proposed by Jespersen (1904) and which recalls the one proposed by Clements (1990: 319). (For the sake of clarity, alternating cells are shaded here.)

(10) *Matrix of consonant contacts* (adapted from Gouskova 2001, 2002, 2004)

+7	+6	+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5	-6	-7
t.w	s.w	d.w	z.w	n.w	l.w	r.w	w.w	w.r	w.l	w.n	w.z	w.d	w.s	w.t
	t.r	s.r	d.r	z.r	n.r	l.r	r.r	r.l	r.n	r.z	r.d	r.s	r.t	
		t.l	s.l	d.l	z.l	n.l	l.l	l.n	l.z	l.d	l.s	l.t		
			t.n	s.n	d.n	z.n	n.n	n.z	n.d	n.s	n.t			
				t.z	s.z	d.z	z.z	z.d	z.s	z.t				
					t.d	s.d	d.d	d.s	d.t					
						s.t	s.s	t.s						
							t.t							

← less harmonic
→ more harmonic

(Assumed sonority scale (based on Jespersen 1904): glides > rhotics > laterals > nasals > voiced fricatives > voiced stops > voiceless fricatives > voiceless stops.)

The hierarchy in (9) is *relational* because it determines the well-formedness of a coda or onset not in isolation but in relation to the adjacent onset or coda, respectively; that is, “what an onset or a coda must look like depends on the adjacent consonant”. The relational nature of the SYLLABLE CONTACT hierarchy to a certain extent echoes Harmonic Alignment (Prince and Smolensky 1993 [2004]), insofar as it absorbs and combines two harmonic scales, the scale governing the sonority of the segments in coda position and the scale related to the sonority of the segments in onset position, into a single scale. In the light of this new approach, thus, the more marked the individual members in a relation, the more marked the overall relation: in other words, the more sonorous the consonant in onset position and the less sonorous the consonant in coda position, the more marked the relation or, inversely, the less sonorous the consonant in onset position and the more sonorous the consonant in coda position, the less marked the relation. Although this constraint hierarchy is extrinsically related to constraints which regulate the sonority of the coda and the sonority of the onset, the *DISTANCE constraints are independent of constraints on onsets and codas (contrarily to what is proposed in Baertsch and Davis 2003, 2005, 2007 and Baertsch 2002; see Section 4.1). In fact, the *DISTANCE constraints are “blind” to the type of consonant placed in onset and coda position (be it a stop, nasal, etc.); they are sensitive only to the sonority distance established between the adjacent consonants. That is why the combinations with the same sonority distance, regardless of the type of consonant placed in onset and in coda position, are predicted to be targeted the same way; they make up a stratum. For instance, in spite of being comprised by different segments, the sequences ‘l.w’, ‘n.r’, ‘z.l’, ‘d.n’, ‘s.z’, ‘t.d’ belong to the same stratum since they share the degree of sonority rise (i.e., +2), and therefore they are targeted by the same constraint (i.e., *DISTANCE +2) (see 9 and 10). The fact that combina-

tions with the same sonority distance are predicted to be targeted equally does not necessarily mean, however, that these combinations pattern the same way, given that the effects of the *DISTANCE constraints can be inhibited by other independently motivated constraints (i.e., faithfulness constraints of the type IDENT(nasal), IDENT(sibilant), etc. and other markedness constraints). This is what formally explains differences depending on the consonants involved as well as differences across linguistic varieties. See Section 3 for an account along these lines.

This proposal, and more specifically the hierarchy shown in (9), entails two interesting predictions. One is implicational, in the sense that a language that tolerates a sonority rise of +1 also tolerates a flat sonority and a decreasing sonority in the interval $[-1, -7]$; a language that permits a sonority rise of +2 also tolerates a rising sonority of +1, a flat sonority and a decreasing sonority in the interval $[-1, -7]$; and so on. This is, of course, a consequence of the fixed and unalterable nature of the hierarchy. The other is typological, in the sense that languages can differ with regard to the allowed intersyllabic sonority distance by selecting different cut-off points along the hierarchy. The languages studied in Gouskova (2004), indeed, vary with respect to the acceptable sonority distance: Icelandic tolerates a sonority distance of +6; Faroese, a distance of +5; Kazakh allows a flat, but not a rising sonority distance; and Sidamo and Kirghiz require sonority to drop, and to drop even to a minimum degree.

As already stated before, in Gouskova's approach *featural* discrepancies are ignored by the hierarchy, but *distance* discrepancies are not (see Section 4.1 for a discussion of Baertsch and Davis approach, which is sensitive to featural discrepancies). It may be the case, however, that in a particular linguistic variety not only featural discrepancies but also sonority distances are ignored. That is, different sonority distances (+1, +2, +3, etc.) are not used and the same phonological behaviour is therefore expected. Cases similar to these are explored in de Lacy (2002, 2004), who proposes, following Prince (1997a, 1997b), a theory in which contiguous markedness constraints traditionally organised in fixed universal scales (i.e., the vowel sonority hierarchy) can be conflated into a set of constraints which maintain a stringency relation and which are freely rankable (since each constraint contains the relative more marked elements). The author develops this proposal to account for the position of stress in Nganasan and Kiriwina. The relational alignment approach to SYLLABLE CONTACT advocated for in Gouskova refers indirectly to universal scales, and it can therefore be reformulated in a stringency form (11) along the lines of de Lacy's proposal (2002, 2004), in such a way that some distance distinctions – that is, some markedness distinctions – can be overlooked in a given language.

- (11) *Relational alignment hierarchy in a stringency form (based on 9)*
 *Dist +7
 *Dist +7, *Dist +6
 *Dist +7, *Dist +6, *Dist +5
 *Dist +7, *Dist +6, *Dist +5, *Dist +4
 *Dist +7, *Dist +6, *Dist +5, *Dist +4, *Dist +3
 *Dist +7, *Dist +6, *Dist +5, *Dist +4, *Dist +3, *Dist +2
 *Dist +7, *Dist +6, *Dist +5, *Dist +4, *Dist +3, *Dist +2, *Dist +1

Since the varieties analysed in this paper are “insensitive” not only to the type of consonants involved but also to some distance distinctions in that these can be conflated to just *two or three* relevant *strata* (see, for instance, Section 3.1 and Section 3.2), the stringency version of the relational alignment approach appears to be an even cleaner solution to account for the data.

2.2. *Assumptions for the sonority scale*

The sonority scale has proven to be a decisive parameter to account for syntagmatic relations between segments, such as their organisation within the syllable and across syllables: the principles invoked to justify this organisation, such as the Sonority Sequencing Principle, the Sonority Dispersion Principle or the Syllable Contact Law itself, which in OT have acquired the shape of contextual markedness constraints organised into universal hierarchies, undeniably rely on a specific distribution of segments within a scale according to their sonority.

Nevertheless, whereas there is tacit agreement about the relative sonority of some classes of segments, i.e., the hierarchy VOWELS > GLIDES > LIQUIDS > NASALS > OBSTRUENTS, there is a continued controversy about the relative sonority of the specific sounds which belong to these classes. This controversy mainly concerns the pairs laterals *vs.* rhotics, fricatives *vs.* stops, voiced obstruents *vs.* voiceless obstruents, and also stops *vs.* affricates *vs.* fricatives, and glottals (see Parker 2002 for extensive discussion about this topic). Indeed, the relative sonority of each of these sound classes varies from one study to another, basically depending on language-specific patterns. This procedure often leads to circular argumentations, since particular versions of the sonority scale are posited to account for specific language patterns, and these specific language patterns are adduced to justify the selection of these particular versions of the sonority scale (see, for instance, the criticisms of Walther 1993, Ohala 1990, 1992 and Clements 2006, on the circular reasoning of such approaches to the sonority of segments). Another traditional focus of debate is whether it is licit or not to resort to sonority confluations and reversals to justify differences across languages. Those who disagree with this view argue that the

sonority scale is universal, categorical (composed of discrete units) and invariable, and that discrepancies across languages must be derived exclusively from constraint reranking. There are other authors, though, who advocate a more *flexible* approach to the sonority scale and who claim that any attempt to obtain a universal and categorical sonority hierarchy will inevitably fall into arbitrariness.

This paper is couched within the latter view. Following the results in Parker (2002, 2008), indeed, I assume that sounds are organised in a continuum in the phonetic sonority scale, and that divergent phonological and categorical interpretations and exploitations of it across languages are available.³ Overall, the present paper takes as its starting point a very general, idealised, schematic and uncontroversial sonority scale (12), and refines it as phonological evidence for it is found. As we will see in Section 3, the refinements affect the position in the scale of those sounds typically ambiguous as far as sonority is concerned, namely of those included in the class of liquids and those included in the class of obstruents.

(12) *Assumed sonority scale (to be refined)*

OBSTRUENTS		SONORANTS			
stops, affricates	< fricatives	< nasals	< liquids	< glides	< vowels
1	2	3	4	5	6

2.3. *Assumptions for features and faithfulness constraints*

The relevant featural specifications assumed in the paper are presented in (13). Most of them do not merit any comment, as they coincide with traditional descriptions. Following Mascaró (1978), we assume that the flap is [–continuant] and that the trill is [+continuant], and, following Bonet and Lloret (1998), that laterals are specified as [–continuant]. Also labiodental fricatives are assumed

3. For an extensive discussion of this assumption, see Pons (2008, 2009). In these works it is suggested that the *phonetic* organisation of segments along the sonority scale should have a non-discrete, dense and gradient nature, in line with the work by Boersma and Hayes (2001). According to this proposal, segments would be organised in the sonority scale in such a way that each specific sound would cover a range of values, which would correspond to their phonetic properties. And this range, or part of it, may overlap the range allocated to another sound. In those cases where the range of values for different sounds overlap, a different phonological interpretation of the relative sonority of the sounds across languages (and, hence, a different phonologic sonority hierarchy) could be allowed and, indeed, expected. The consequence of this approach to the sonority scale is that the hierarchy of some sounds should be more fixed than that of others. And this would be the case of those segments that are cross-linguistically ambiguous as far as sonority is concerned, like liquids or obstruents.

to be [–continuant], a specification which is reinforced by the peculiar behaviour of these sounds across languages and, also, in Catalan (for valuable discussion in this respect, see Palmada 1994a and Bonet and Lloret 1998). (See also Section 3.2.4.3). Following Lloret (1992) and Bonet and Lloret (1998), affricates are assumed to be specified as [\pm continuant].

(13) *Featural assumptions*

Feature	Character	Faithfulness constraints	Affected segments
[+sonorant]	Binary	IDENT(+sonorant)	SONORANTS glides, laterals, rhotics, nasals
[–sonorant]	Binary	IDENT(–sonorant)	OBSTRUENTS stops, affricates, fricatives
[+continuant]	Binary	IDENT(+continuant)	NON-CONTINUANTS stops, non-sibilant fricatives, affricates, nasals, laterals, flap
[–continuant]	Binary	IDENT(–continuant)	CONTINUANTS glides, trill, sibilant fricatives, affricates
[sibilant]	Privative	IDENT(sibilant)	SIBILANTS
[nasal]	Privative	IDENT(nasal)	NASALS
[lateral]	Privative	IDENT(lateral)	LATERALS
[rhotic]	Privative	IDENT(rhotic)	RHOTICS
[coronal]	Privative	IDENT(cor)	CORONALS (dentals, alveolars, prepalatals, palatals)
[dorsal]	Privative	IDENT(dor)	DORSALS (velars, prepalatals, palatals)
[labial]	Privative	IDENT(lab)	LABIALS (bilabials, labiodentals)

Within Correspondence Theory, there are two possible approaches to features. Features as attributes of segments, which are typically regulated by the IDENT(F) constraints, and features as entities, independent of the segments to which are associated and typically regulated by MAX(F) constraints (see McCarthy 2008 for extensive discussion in this respect). We adopt the first approximation to features, and a particular version of IDENT(F) faithfulness constraints. Standard IDENT(F) constraints establish that correspondent segments must have the same specification for a given feature. The faithfulness relation is bidirectional in that the correspondence is checked both from the input correspondent to the output correspondent and from the output correspondent to the input correspondent; this is why, for instance, either the mapping /m/ \rightarrow [p] and the mapping /p/ \rightarrow [m] involve a violation of a constraint like IDENT(nasal),

according to which “correspondent segments must have the same specification for the feature [nasal]”. Here, we adopt a slightly different interpretation of the IDENT faithfulness constraints, in which a unidirectional relation is assumed, from the input to the output, in fact in accordance to the majority of faithfulness constraints (i.e., MAX-IO, DEP-IO), in which the scope of the correspondence is also unidirectional). This is a particular interpretation of IDENT faithfulness constraints, not in conflict with the general theory (see McCarthy 2008: 199), according to which a constraint such as IDENT(nasal) is defined as “Assign one violation mark for every nasal input segment whose output correspondent is not nasal”; therefore, only the mapping /m/ → [p] violates IDENT(nasal), but not the mapping /p/ → [m] (see Pater 1999, for a similar variation of IDENT(F) constraints, in this case framed within a strictly binary approach to features).

3. Manner alternations in Romance attributable to SYLLABLE CONTACT

In this section, a set of processes found in Romance varieties which entail a change in manner of articulation of the consonant in the coda in a situation of syllable contact are considered. Section 3.1 addresses regressive manner assimilation and Section 3.2 deals with rhotacism and gliding. Each of these sections attends to discrepant language patterns and includes a description of the data, an analysis of these data, and a final section summing up the main differences and similarities across varieties, and with an emphasis on the main theoretical implications of the patterns considered. The main arguments of this paper, namely the necessity of splitting SYLLABLE CONTACT, the desirability of resorting to a relational hierarchy in a stringency form, and the call for a more flexible approach to the sonority scale, are found in Section 3.1 and Section 3.2. Special attention is therefore given to these sections.

3.1. *Regressive manner assimilation*

3.1.1. *Majorcan and Minorcan Catalan.*⁴

3.1.1.1. *Data.* In Majorcan and Minorcan Catalan potentially rising sonority transitions across syllable boundaries are resolved through a process of total assimilation (14). Stops assimilate in manner (and also in place) of articulation

4. Majorcan and Minorcan are the dialects of Catalan spoken in the Balearic islands of Majorca and Minorca, situated in the Western Mediterranean. The Majorcan Catalan data are from Bibiloni (1993), Recasens ([1991] 1996), and Dols (1993), and have been checked with inquiries reported in Pons (2004a). The Minorcan Catalan data are entirely from Pons (2004a).

with the following consonant (14a). Alveolar sibilants assimilate in manner of articulation with the following lateral, rhotic or glide (14b). And nasals undergo manner (and also place) assimilation when followed by a lateral or a glide (14c). In all these cases, the process results in a geminate, applies word-internally and across words and independently of the morphological status of the words, and has no lexical exceptions. An optional process of total assimilation can also apply when a labiodental fricative is followed by a sonorant, especially in Majorcan Catalan (14d).

(14) *Regressive manner assimilation in potentially rising intersyllabic sonority clusters*

a. *Heterosyllabic clusters with a stop in coda position*

Stop + non-sibilant consonant

<i>cap fet</i>	/kap##fet/	[kaf.fét]	‘any fact’
<i>cap mos</i>	/kap##mɔs/	[kam.mós]	‘any bite’
<i>cap llit</i>	/kap##lit/	[ka.ł.łít]	‘any bed’
<i>cap riu</i>	/kap##riw/	[kar.ríw]	‘any river’
<i>cap iot</i>	/kap##jɔt/	[kaj.jót]	‘any yacht’

(Cf. *cap* /kap/ [káp] ‘any’; *cap hora* /kap##ɔrə/ [ka.pó.rə] ‘any hour’)

b. *Heterosyllabic clusters with an alveolar sibilant in coda position*

Alveolar sibilant + lateral, rhotic, glide

<i>dos llits</i>	/doz##litz/	[do.ł.łíts]	‘two beds’
<i>dos rius</i>	/doz##riwz/ ⁵	[dor.ríws]	‘two rivers’
<i>dos iots</i>	/doz##jɔtz/	[doj.jóts]	‘two yachts’

(Cf. *dos* /doz/ [dós] ‘two’; *dos anys* /doz##anjz/ [do.zájns] ‘two hours’)

c. *Heterosyllabic clusters with a nasal in coda position*

Non-palatal nasal + lateral, glide

<i>un llum</i>	/un#lum/	[u.ł.łúm]	‘one light’
<i>un iot</i>	/un#jɔt/	[uj.jót]	‘one yacht’

(Cf. *un* /un/ [un] ‘one’; *un animal* /un#əniməl/ [ù.nə.ni.mál] ‘one animal’)

5. According to *Richness of the Base* (Prince and Smolensky 1993 [2004]), there are no language-specific restrictions on underlying representations, so that for the surface form [r], in which there is no empirical evidence of the underlying specific manner specification, two representations should be posited, i.e., /r/ and /r/. The ranking constraint is ultimately responsible for the selection of the actual form in the language. This hypothesis is assumed throughout this paper and is consistent with the analysis given in it. For the sake of simplicity, however, the /r/ representation is used in the examples. This representation, on the other hand, is the one posited for all rhotics in well-established studies devoted to Catalan phonology (see, among others, Wheeler 1979, Bonet and Lloret 1998 and Wheeler 2005).

d. *Heterosyllabic clusters with a labiodental fricative in coda position*

Labiodental fricative + sonorant consonant

agaf mans /agaf##man+z/ [əjam.máns] ‘(I) take hands’*agaf llits* /agaf##lít+z/ [əja.ɫ.líts] ‘(I) take beds’*agaf rius* /agaf##riw+z/ [əjar.ríws] ‘(I) take rivers’*agaf iots* /agaf##jot+z/ [əja.jóts] ‘(I) take yachts’(Cf. *agaf* [əjáf] ‘(I) take’; *agaf ous* [ə.ja.fóws] ‘(I) take eggs’)

Flat or decreasing sonority transitions, on the contrary, are maintained as far as manner of articulation is concerned (15). Stops maintain their manner specification before another stop (15a), sibilants do so before a non-sibilant obstruent (15b), nasals do so when followed by an obstruent or a nasal (15c), and non-nasal sonorants systematically preserve their manner specification preceding another consonant (15d). As seen in (15a) and (15c), a process of regressive place assimilation applies when a stop or a nasal are followed by a heterorganic consonant.

(15) *Manner preservation in flat and decreasing intersyllabic sonority clusters*a. *Heterosyllabic clusters with a stop in coda position*

Stop + stop

pot caure /pɔd##kawɾ/ [pɔk.káw.rə] ‘(s/he) can fall down’*cap tros* /kap##trɔs/ [kat.trós] ‘any piece’b. *Heterosyllabic clusters with an alveolar sibilant in coda position*

Alveolar sibilant + non-sibilant obstruent

dos peus /doz##pɛwz/ [dos.péws] ‘two feet’*dos fils* /doz##fils/ [dos.fíls] ‘two threads’c. *Heterosyllabic clusters with a stop in coda position*

Non-palatal nasal + obstruent, nasal

un peu /un#pɛw/ [um.péw] ‘one foot’*un foc* /un#fɔg/ [um.fók] ‘one fire’*un mos* /un#mɔs/ [um.mós] ‘one bite’d. *Heterosyllabic clusters with a non-nasal sonorant in coda position*

Lateral + consonant

mal pas /mal##pas/ [mal.pás] ‘bad step’*mal ritme* /mal##ritm/ [mal.rím.mə] ‘bad rhythm’

Flap + consonant

per poc /pɛr##pɔk/ [pɛr.pók] ‘just barely’*per mi* /pɛr##mi/ [pɛr.mí] ‘in my opinion’

Trill + consonant

corr poc /korr##pɔk/ [kor.pók] '(I) don't run much'*corr* /korr##jardəz/ [kor.jár.ðəs] '(I) run yards'*iardes*

Glide + consonant

mai pot /maj##pɔd/ [maj.pót] '(s/he) never can'*mai riu* /maj##riw/ [maj.ríw] '(s/he) never smiles'

These are the general facts. Two exceptions arise to these generalisations. On the one hand, manner preservation in rising intersyllabic sonority clusters made up of a sibilant followed by a nasal (16a), a nasal followed by a rhotic (16b) and a liquid followed by a glide (16c). On the other hand, total assimilation in falling intersyllabic sonority clusters made up of a labiodental fricative followed by a stop (17).

(16) *Unexpected manner preservation in rising intersyllabic sonority clusters*a. *dos nius* /doz##niwz/ [doz.níws] 'two nests'b. *un riu* /un#riw/ [un.ríw] 'one river'c. *vol iogurts* /vɔl##juɣurz/ [vɔl.ju.ɣúrs] '(s/he) wants yogurts'(17) *Unexpected manner assimilation in falling intersyllabic sonority clusters*a. *agaf pans* /agaf##pan+z/[əjap.páns] '(I) take bread'b. *agaf cans* /agaf##kan+z/[əjac.cáns] '(I) take dogs'

Other important remarks about the data are the following. Manner assimilation does not apply when a stop is followed by a sibilant (e.g., *cap so* /kap##sɔn/ [kat.só] 'any sound') because, in these dialects, a sequence of two adjacent sibilants is avoided, for independent reasons, via manner dissimilation (cf. *dos sons* /doz##sɔnz/ [do.tsóns] 'two sounds').⁶ Alveolar sibilants can undergo an optional process of rhotacism when followed by a voiced obstruent, a nasal, or, more sporadically, when followed by a voiceless labiodental fricative.⁷ In the case of sibilants and nasals in coda position, finally, regressive manner assimilation

6. In Section 3.2.1.3, the interaction of this process of dissimilation and the processes considered in this paper (assimilation and rhotacism) is accounted for. See Palmada (1994a, b), for an analysis of these data within autosegmental phonology, and Pons (2004a, b), for a description and an analysis of these data within OT. For an analysis of sequences of adjacent sibilant segments in clitic forms in Central Catalan, see Bonet and Lloret (2002).

7. For a description and analysis of this process and the interaction of it with regressive manner assimilation, see Section 3.2.1, especially Section 3.2.1.3.

lation is circumscribed to alveolars and labials (see (14b) and (14c)), since the palatal counterparts undergo other processes when followed by a consonant.⁸

3.1.1.2. Interim descriptive generalisation. The emerging generalisation for Majorcan and Minorcan Catalan is that potentially rising sonority transitions across syllable boundaries are avoided by total assimilation (18a, b, c), whereas flat and decreasing sonority transitions are maintained (18h, i, j, k). As seen, three exceptions arise to this generalisation: sibilant preservation in sibilant-nasal heterosyllabic clusters, nasal preservation in nasal-rhotic heterosyllabic clusters, and liquid preservation in liquid-glide heterosyllabic clusters (see 18e, f, g).

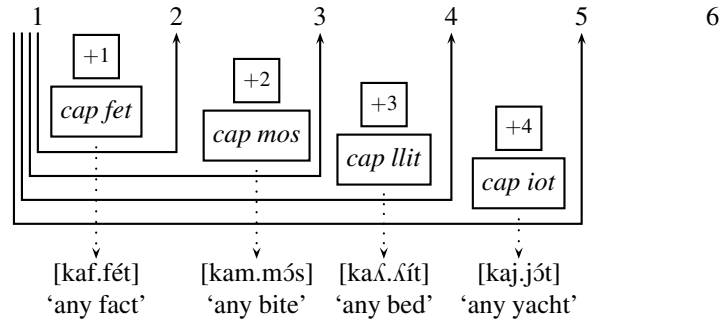
(18) *Manner assimilation and preservation in Majorcan and Minorcan Catalan*

Potentially rising intersyllabic sonority	→	Regressive manner assimilation
a. Stop + non-sibilant consonant		✗
b. Alveolar sibilant + lateral, rhotic, glide		✗
c. Nasal + lateral, glide		✗
d. Labiodental fricative + non-stop		✗ (optional)
e. alveolar sibilant + nasal		✗
f. nasal + rhotic		✗
g. liquid + glide		✗
Flat or falling intersyllabic sonority	→	Manner preservation
h. stop + stop		✓
i. alveolar sibilant + non-sibilant obstruent		✓
j. nasal + nasal, stop, fricative		✓
k. lateral, rhotic, glide + consonant		✓
l. labiodental fricative + stop		✗ (optional)

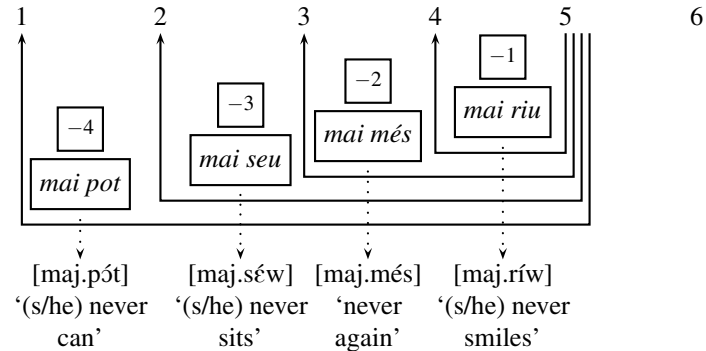
8. Prepalatal sibilants followed by a consonant undergo a process of gliding, independently motivated (e.g., *mateix dia* /mətɛj##diə/ [mətɛj.ðíə] '(the) same day'). For an analysis of this process within autosegmental phonology, see Palmada (1994a, 1996), and for an analysis of it within OT, see Pons (2004a, 2005c). Palatal nasals followed by a consonant undergo a process of split, also independently motivated (e.g., *any passat* /aɲ##pas+a+d/ [ájɲ.pəsát] '(the) last year'). For an analysis of this process within autosegmental phonology, see Mascaró (1986), Palmada (1994a, 1996), and for an analysis of it within OT, see Pons (2004a, 2005c).

3.1.1.3. Analysis. The process of regressive manner assimilation that is found in Majorcan and Minorcan Catalan clearly exemplifies the cross-linguistic tendency to avoid syllabic transitions with a sonority rise, and can therefore be attributed to either the Syllable Contact Law or the SYLLABLE CONTACT constraint (see Pons [2003] 2006, 2004a, Wheeler 2005). The effects of this law are especially obvious when the respective behaviours of stops and glides in coda position followed by another consonant are compared. The former are always involved in rising sonority transitions and consequently always undergo manner assimilation (19). The latter, by contrast, are always involved in falling sonority transitions and hence never undergo manner assimilation (20).

- (19) *Manner assimilation of stops*
 stops < fricatives < nasals < liquids < glides < vowels



- (20) *Manner preservation of glides*
 stops < fricatives < nasals < liquids < glides < vowels



An immediate analysis (to be revised), therefore, would say that regressive manner assimilation applies when the sonority between two heterosyllabic segments is potentially rising, that is, when the sonority of the consonant in coda position is lower than the sonority of the consonant in onset position. In OT terms, this behaviour could be formalised by ranking the SYLLABLE CONTACT

constraint above the relevant IDENT(Manner) faithfulness constraints (21) (see (22) and (23) for a definition of these constraints).

- (21) SYLLABLE CONTACT \gg IDENT(Manner)
- (22) SYLLABLE CONTACT (SYLLCONT):
Assign one violation mark for each syllabic transition with sonority rise.
- (23) IDENT(Manner) (IDENT(Man)):
Assign one violation mark for every output segment that differs from its input correspondent in manner of articulation.⁹

The same interpretation can be extended to most cases in which a nasal and a sibilant are followed by a consonant, in particular, to those cases in which a sibilant is followed by a non-nasal sonorant (24a) and to the sequences of a nasal followed by a lateral or a glide (24b).

- (24) *Manner assimilation of sibilants and nasals in rising sonority clusters*
- | | | | | |
|----|------------------|------------|-------------|--------------|
| a. | <i>dos llits</i> | /doz#łitz/ | [do.ł.łíts] | ‘two beds’ |
| | <i>dos rius</i> | /doz#riwz/ | [dor.ríws] | ‘two rivers’ |
| | <i>dos iots</i> | /doz#jotz/ | [doj.jóts] | ‘two yachts’ |
| b. | <i>un llum</i> | /un#łum/ | [u.ł.łúm] | ‘one light’ |
| | <i>un iot</i> | /un#jot/ | [uj.jót] | ‘one yacht’ |

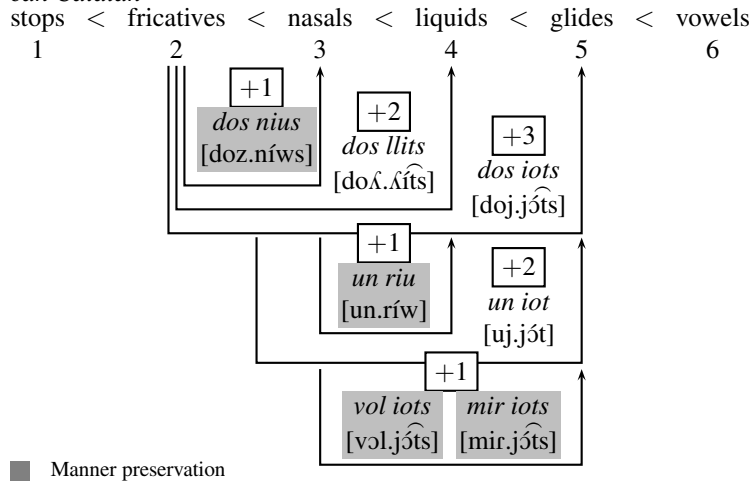
In these cases, as noted, regressive manner assimilation is triggered to avoid sonority rise across the syllable boundary. In other words, whenever SYLLABLE CONTACT is respected, the faithful candidates are selected; whenever SYLLABLE CONTACT is violated, the candidates with manner assimilation are the ones selected as optimal. However, sibilants and nasals, as well as all other sonorants, exhibit a behaviour that does not conform to the interpretation based on SYLLABLE CONTACT. As pointed out in Section 3.1.1.2, sibilants and sonorants do not always assimilate in manner of articulation with the following consonant in rising sonority transitions: in a sequence such as *dos nius* ‘two nests’, the sonority is rising from the coda to the onset but, even so, regressive manner assimilation does not apply ((25a); cf. (16a)). The same occurs with nasals followed by rhotics ((25b); cf. (16b)) or liquids followed by glides ((25c, d, e); cf. (16c)). In all these cases, contrary to the formulated prediction, the manner specification of the consonant in the coda is preserved even though the inter-syllabic sonority is rising.

9. This is a shorthand for the specific faithfulness constraints regulating featural changes according to their manner specification, which will be introduced later on (see 29, 30, 31).

- (25) *Sibilant and sonorant preservation in rising sonority clusters*
- a. *dos nius* /doz#niwz/ [doz.níws] ‘two nests’
 - b. *un riu* /un#riw/ [un.ríw] ‘one river’
 - c. *vol iots* /vɔl##jɔtz/ [vɔl.jóts] ‘two yachts’
 - d. *mir iots* /mir##jɔtz/ [mir.jóts] ‘(I) look at yachts’
 - e. *corr iardes* /korr##jardəz/ [kor.jár.ðəs] ‘(I) run yachts’

As illustrated in the figure in (26), the basic difference between the examples in (24) and the examples in (25) is that in the former the sonority distance exceeds one degree – except for the case of a nasal followed by a lateral¹⁰ – while in the latter the sonority distance is just one degree.

- (26) *Intersyllabic permitted and banned distances in Majorcan and Minorcan Catalan*



This behaviour leads to the conclusion that in Majorcan and Minorcan Catalan regressive manner assimilation of non-stop consonants only applies when the increasing sonority distance across a syllable contact is greater than one degree (see Pons [2003] 2006, 2004a, 2005a). Naturally, this behaviour cannot be accounted for by the mere interaction of a single markedness constraint banning sonority rise and the IDENT(Manner) faithfulness constraint, since the process of manner assimilation is sensitive to (a) the different degrees of sonority rise and (b) the manner of articulation of the consonants involved. The patterns in (26), indeed, support the extension of the Syllable Contact Law intended in Murray and Vennemann (1983), according to which the suitability of an intersyllabic contact depends on the sonority distance between adjacent segments

10. This case will be addressed below.

(see (4)), explicitly: the well-formedness of a syllabic contact A.B, where A and B are segments and a and b are their sonority values, increases at higher values of $a-b$, i.e., at lower values of $b-a$. According to this extension and following the sonority scale assumed thus far, a sequence such as *am.la* (with a sonority rise of +1) constitutes a less significant violation of this principle than a sequence such as *at.ja* (with a sonority rise of +4). Similarly, focusing on the case of sibilant and nasal segments in Majorcan and Minorcan Catalan, the sequences *dos nius* ‘two nests’ or *un riu* ‘one river’ (with a sonority rise of +1) make better contact than the sequences *dos llits* ‘two beds’, *un iot* ‘one yacht’ or *dos iots* ‘two yachts’ (with a sonority rise of +2 in the former cases, and of +3, in the last case).

All in all, it can be seen that it makes considerable sense to split the SYLLABLE CONTACT constraint into different markedness constraints that target all possible sonority distances, as established in Gouskova (2004), thus enabling the specific IDENT(Manner) constraints to interact with them.¹¹

In Majorcan and Minorcan Catalan, in which syllabic transitions with a positive distance of +1 are tolerated but syllabic transitions with a positive distance of +2 or higher are not, the constraint *DISTANCE +2, and also the constraints *DISTANCE +3, *DISTANCE +4, etc. (28), are ranked above the relevant IDENT(Manner) faithfulness constraints ((29), (30)). In other words, it is preferable to respect *DISTANCE +2, *DISTANCE +3, etc. than to preserve the sibilant or the nasal manner of articulation, and, on the other hand, it is preferable to respect IDENT(sibilant) and IDENT(nasal) than to satisfy *DISTANCE +1 (27).

(27) *Ranking for Majorcan and Minorcan Catalan*

... *DIST +3 >> *DIST +2 >>	IDENT(sib), IDENT(nas)... >>	*DIST +1 >> IDENT(-sont)
-----------------------------	------------------------------	--------------------------

- (28) *DIST ± n :
Assign one violation mark for every syllabic contact with a sonority distance of ± n .
- (29) IDENT(sibilant) [IDENT(sib)]:
Assign one violation mark for every sibilant input segment whose output correspondent is not sibilant. (See McCarthy and Prince 1995)

11. One could account for this behaviour by resorting to a markedness constraint prohibiting a sonority distance between heterosyllabic segments equal to or higher than +2: “*DIST ≥+2: Sonority distances between heterosyllabic adjacent consonants equal to or higher than +2 are prohibited.” (Pons [2003] 2006, 2004a). (See Prieto 1998, for a similar analysis in generative terms applied to Galician rhotacism). Although a constraint like this is useful to account for the Majorcan and Minorcan Catalan data, there is no evidence that it has a relevant role in other dialects or languages. This approach, however, resembles to some extent that adopted by de Lacy (2002, 2004) (see below).

- (30) IDENT(nasal) [IDENT(nas)]:
Assign one violation mark for every nasal input segment whose output correspondent is not nasal. (See McCarthy and Prince 1995)
- (31) IDENT(–sonorant) [IDENT(–sont)]:
Assign one violation mark for every [–sonorant] input segment whose output correspondent is not [–sonorant]. (See McCarthy and Prince 1995)

The introduction of this constraint hierarchy and a slight refinement of the sonority scale assumed so far leads to the desired results for the rest of the data for Majorcan and Minorcan Catalan. The cases of *un riu* ‘one river’ and *un llit* ‘one bed’, with preservation and assimilation, respectively, reveal that it is necessary to introduce this refinement in the sonority scale. In both cases, the sonority distance is +1, yet we see different behaviours: the nasal assimilates to the lateral but not to the rhotic. This is why we propose an adjustment of the sonority scale where the trills are placed between the rest of liquids and the nasals having its own slot:

- (32) *First refinement of the sonority scale* (to be refined; see 12)
- | | | | | | | | | | | | | |
|-------|---|------------|---|--------|---|--------------|---|---------|-----|--------|-----|--------|
| stops | < | fricatives | < | nasals | < | trill | < | liquids | < | glides | < | vowels |
| 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 |
| | | | | | | ↑ | | [r] | [r] | [l] | [ʎ] | |

This refinement, which is strongly supported cross-linguistically and functionally (see Section 3.1.4.3), increases the sonority distance between nasals and liquids (but not trills) (+1 → +2) and preserves the sonority distance assumed so far between nasals and trills (+1 → +1). Given the ranking in (27), this accounts for the fact that nasals undergo regressive manner assimilation when they precede a lateral but maintain their manner specification when followed by a trill. However, this modification in the sonority scale might complicate the explanation of sequences of a trill followed by a glide (*corr iardes* [kor.jár.ðəs] ‘(I) run yards’). These sequences should be resolved through manner assimilation, because the sonority distance between the segments is +2, according to the new scale. Yet this is not the behaviour of Majorcan and Minorcan Catalan, where manner assimilation never affects trill consonants. There are two possible solutions to the problem. A very simple one is to assume that the faithfulness constraint which protects the rhotic manner specification is undominated with respect to the constraint *DISTANCE +2 (33).

- (33) IDENT(rhotic) >> *DISTANCE +2

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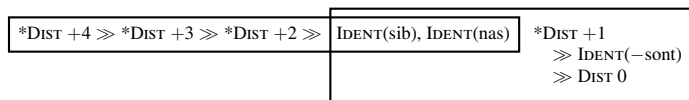
- (34) IDENT(rhotic) [IDENT(rhot)]:
Assign one violation mark for every rhotic input segment whose output correspondent is not rhotic. (See McCarthy and Prince 1995)

This would be the best solution if only the data concerning regressive manner assimilation were considered. However, as argued extensively in Section 3.1.4.3, Catalan shows a behaviour that supports another solution involving an additional refinement of the sonority scale, in which laterals and the flap occupy the same slot as glides in the scale.

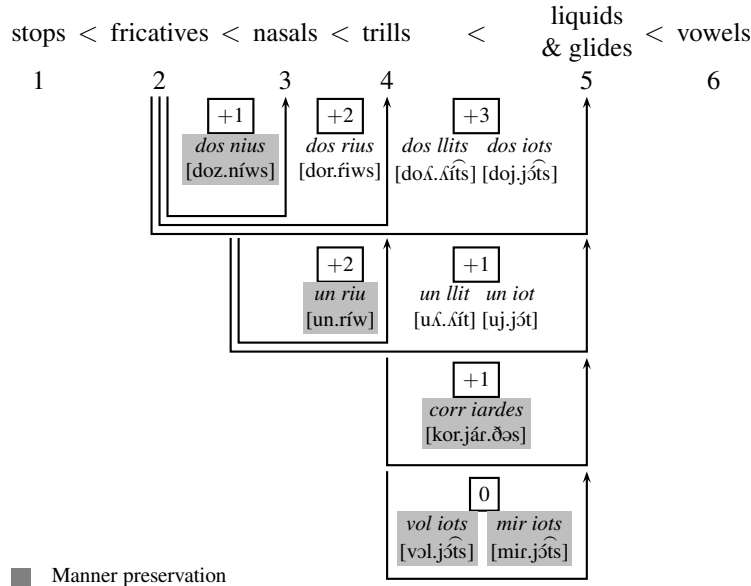
- (35) *Second refinement of the sonority scale* (see 32)
stops < fricatives < nasals < trill < **liquids & glides** < vowels
1 2 3 5 6

These two readjustments of the sonority scale determine the intersyllabic distances of (37), and insignificantly modify the sonority distances assumed so far for sibilants in coda position (see 37; cf. 27). Assuming the sonority scale in (35), the ranking established thus far (27, 36), indeed, makes the correct predictions for all cases. (In this ranking, DIST 0 has been introduced because it is relevant for sequences of two heterosyllabic distinct liquids or sequences of a liquid followed by a glide; see also Section 3.1.4.5.)

- (36) *Ranking for Majorcan and Minorcan Catalan (relational alignment form)*



(37) *Intersyllabic permitted and banned distances in Majorcan and Minorcan Catalan*



As Majorcan and Minorcan Catalan do not make any distinction between *DIST +4, *DIST +3, *DIST +2 (i.e., all these distances are equally banned regardless of the kind of consonant involved), but they do between { *DIST +4, *DIST +3, *DIST +2 } and { *DIST +1 } (i.e., just [-son] consonants are vulnerable to the latter constraint, and sibilants and nasals to the former),¹² the very same ranking shown in (36) can be reformulated in a stringency form, as shown in (38). The conflation of *DIST +4 >> *DIST +3 >> *DIST +2 into *DIST +4, +3, +2 thus accounts for the fact that these dialects do not exploit the markedness differences targeted by each of these constraints.

(38) *Ranking for Majorcan and Minorcan Catalan (stringency form)*
 *DIST +4, +3, +2 >> IDENT(sib), IDENT(nas) >> *DIST +4, +3, +2, +1 >> IDENT(-son) >> *DIST +4, +3, +2, +1, 0

Summing up, the analysis works as follows:

- a. Stops systematically assimilate in manner with the following consonant; the low ranking of the faithfulness constraint IDENT(-sonorant), below *DIST +n (equivalent to SYLLABLE CONTACT), justifies this behaviour.

12. See Footnote 10. { *DIST +4, *DIST +3, *DIST +2 } would be equivalent to *DIST ≥+2, advocated for by Pons [2003] 2006, 2004a.

- b. Sibilants and nasals only assimilate in manner with the following consonant when the syllable contact is higher than +1; as shown in (39) and (40), the ranking of IDENT(sib) and IDENT(nas) below *DIST +4, +3, +2 and above *DIST +4, +3, +2, +1 explains this behaviour: compare (39a), (39b) vs. (39c); also compare (40a) vs. (40b). (Note that geminates are invulnerable to *DISTANCE constraints and this is why the sonority distance is not indicated in these cases; see Section 3.1.4.5 for more discussion in this respect.)

(39) *Manner assimilation vs. manner preservation of sibilants in Majorcan and Minorcan*

	*DIST +4, +3, +2	IDENT(sib)	*DIST +4, +3, +2, +1
a. /doz##riwz/			
i. [doz.ríws] (+2)	*!		*
ii. [dor.ríws]		*	
b. /doz##jótz/			
i. [doz.jóts] (+3)	*!		*
ii. [doj.jóts]		*	
c. /doz##niwz/			
i. [doz.níws] (+1)			*
ii. [don.níws]		*!	

(40) *Manner assimilation vs. manner preservation of nasals in Majorcan and Minorcan*

	*DIST +4, +3, +2	IDENT(sib)	*DIST +4, +3, +2, +1
a. /son##kítz/			
i. [soŋ.kíts] (+2)	*!		*
ii. [soʎ.kíts]		*	
b. /son##riwz/			
i. [son.ríws] (+1)			*
ii. [sor.ríws]		*!	
iii. [son.ríws] (+2)	*!		*

- d. The remaining sonorants never assimilate in manner with the following consonant because they are never involved in sonority transitions higher than +1 (that is why the constraint *DIST +4, +3, +2, which is ranked at the same level as the faithfulness constraints which protect these consonants, is not exposed here; see (58a) for an explicit ranking). The ranking of IDENT(rhotic) above *DIST +4, +3, +2, +1 and the ranking of IDENT(lat) above *DIST +4, +3, +2, +1, 0 together account for this behaviour (41). (Note in the following tableau that *DIST +4, +3, +2, +1 dominates *DIST

+4, +3, +2, +1, 0 because of transitivity, in that IDENT(–sont) is dominated by the former and dominates the latter: the reason for this is that a sequence of two heterorganic stops, with an intersyllabic sonority distance of 0, is resolved through the preservation of the manner of articulation of the first consonant.)

- (41) *Manner preservation of non-nasal sonorants in Majorcan and Minorcan*

	IDENT(rhot) IDENT(lat)	*DIST +4, +3, +2	*DIST +4, +3, +2, +1, 0
a. /korɾ##jardəz/			
i. ☞ [kor.jár.ðəs] (+1)		*	*
ii. [koj.jár.ðəs]	*!		
b. /vəl##jotz/			
i. ☞ [vəl.jóts] (0)			*
ii. [vəj.jóts]	*!		

- c. As seen in Section 3.1.1.2, in Majorcan Catalan labiodental fricatives can undergo an optional process of regressive manner assimilation, not only in potentially rising syllabic transitions (*agaf mans* /agaf##man+z/ [əjam.máns] ‘(I) take hands’), which are explained by the activity of the same ranking that affects stops (see *a*, in this section), but also in falling syllabic transitions (*agaf cans* /agaf##kan+z/ [əjac.cáns] ‘(I) take dogs’). These cases will be addressed in Section 3.2, because they directly interact with the process of rhotacism.

3.1.2. Languedocian Occitan

3.1.2.1. Data. In Languedocian Occitan,¹³ final stops and affricates assimilate in manner of articulation with the following consonant, except when followed by a sibilant fricative (42). The process of regressive manner assimilation results in a geminate and is not sensitive to the place of articulation of the consonants involved or to the domain of application. All remaining consonants never undergo regressive manner assimilation (43).

13. Languedocian Occitan is the most conservative of Occitan dialects and is spoken in the south of France (in the region of Languedoc). The data for Occitan have been taken from Teulat (1972), Alibèrt (1976), Wheeler (1988), and Balaguer and Pojada (2005), and have been confirmed by Claudi Balaguer, Aitor Carrera, Anna Pineda, Patrick Sauzet and Rafèu Sichel.

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- (42) *Heterosyllabic clusters with an obstruent in coda position*
- | | | | |
|------------------------------------|------------------|------------------|------------------|
| <i>ròc mòl</i> | /rɔk##mɔl/ | [rɔm.mól] | ‘soft rock’ |
| (cf. <i>ròc</i> [rók] ‘rock’) | | | |
| <i>tot l’argent</i> | /tut##l#ardʒent/ | [tùl.lar.dʒén] | ‘all the silver’ |
| (cf. <i>tot</i> [tút] ‘all’) | | | |
| <i>estat normal</i> | /estat##nurmal/ | [es.tàn.nur.mál] | ‘normal state’ |
| (cf. <i>estat</i> [estát] ‘state’) | | | |
| <i>dètz minutas</i> | /dɛts##minytoz/ | [dèm.mi.ný.tos] | ‘ten minutes’ |
| (cf. <i>dètz</i> [dét̃s] ‘ten’) | | | |
| <i>mièg nud</i> | /mjɛdʒ##nyt/ | [mjɛn.nýt] | ‘half naked’ |
| (cf. <i>mièg</i> [mjét̃] ‘half’) | | | |
- (43) *Heterosyllabic clusters with a sonorant in coda position*
- | | | | |
|------------------------|--------------------|---------------------|-----------------------|
| <i>mòstran castèls</i> | /mɔstron##kastɛlz/ | [mɔs.troj.kas.téls] | ‘(they) show castles’ |
| <i>mòstran sacs</i> | /mɔstron##sakz/ | [mɔs.tron.sáts] | ‘(they) show bags’ |
| <i>mòstran rams</i> | /mɔstron##ranz/ | [mɔs.tron.ráns] | ‘(they) show bunches’ |
| <i>chaval san</i> | /tʃabal##san/ | [tʃa.βal.sá] | ‘healthy horse’ |
| <i>chaval rossèl</i> | /tʃabal##rɔsɛl/ | [tʃa.βàl.ru.sél] | ‘palomino horse’ |

Regressive manner assimilation does not apply when a stop is followed by a sibilant fricative (e.g., *jòc sabent* /ʒɔg##sabent/ [ʒò.ʦa.βén] ‘intelligent game’) because, in these dialects, as in Majorcan and Minorcan Catalan, a sequence of two adjacent sibilants is avoided, in this case with a general process of gliding which affects alveolar sibilants followed by specific consonants.

3.1.2.2. Interim descriptive generalisation. The emerging generalisation for Languedocian Occitan is that potentially rising sonority transitions across syllable boundaries are avoided by total assimilation, provided that this does not imply the loss of the manner of articulation of a non-stop consonant (44a, b). Falling or flat sonority transitions remain unaltered (44c) (see Pons 2005a, b).

(44) *Manner assimilation and manner preservation in Languedocian Occitan*

Potentially rising intersyllabic sonority	→	Regressive manner assimilation
a. stop + non-sibilant consonant		✓
b. all other contacts		✗
Flat or falling intersyllabic sonority	→	Manner preservation
c. consonant + consonant		✓

3.1.2.3. Analysis. The ranking of *DIST +4, +3, +2, +1 below the faithfulness constraints which protect sonorants and above IDENT(–sont) explains why assimilation applies exclusively when the rising transition involves a stop in coda position (46). Sibilants in the coda are not considered here because they are subject to a process of gliding, as seen in Section 3.1.2.1.

(45) *Assumed sonority scale* (see 35)
 stops < fricatives < nasals < trill < liquids, glides < vowels
 1 2 3 4 5 6

(46) *Manner assimilation vs. manner preservation in Languedocian Occitan*

	IDENT ₁ (nas)	*DIST +4, +3, +2	*DIST +4, +3, +2, +1	IDENT (–sont)
a. /rək##məl/				
i. [rɔg.məl] (+2)		*!	*	
ii. [rɔm.məl]				*
b. /mɔstron##ranz/				
i. [mɔs.tron.ráns] (+1)			*	
ii. [mɔs.tror.ráns]	*!			

3.1.3. *Dialects of Catalan*

3.1.3.1. Data. In most Catalan dialects (here illustrated with Central Catalan), stops undergo a process of regressive manner assimilation when followed by a homorganic nasal or lateral (47a).¹⁴ The process also affects dental stops

14. These data have been commonly described in the general studies devoted to Catalan phonology. See, for instance, Recasens ([1991] 1996) and Bonet and Lloret (1998).

followed by a labial nasal (47b). Otherwise, the manner of articulation of the stop is maintained (47c).¹⁵ All other consonants, on the other hand, never undergo regressive manner assimilation, even when involved in syllabic transitions with an increasing sonority (48).

(47) *Heterosyllabic clusters with a stop in coda position*

- a. Stop + homorganic nasal, lateral
cap mos /kap##mɔs/ [kam.mós] ‘any bite’
pot limitar /pɔd##limitar/ [pəl.li.mi.tá] ‘(s/he) can limit’
pot nedar /pɔd##nedar/ [pɔn.nə.ðá] ‘(s/he) can swim’
- b. Dental stop + labial nasal
pot mirar /pɔd##mirar/ [pɔm.mi.rá] ‘(s/he) can look’
- c. Stop + heterorganic nasal, lateral
cap nas /kap##nas/ [kab.nás] ‘any nose’
cap límit /kap##límit/ [kab.lí.mit] ‘any limit’

(48) *Heterosyllabic clusters with a non-stop in coda position*

- puf negre* /puf##nɛgr/ [puf.né.ɣrə] ‘black pouffe’
dos músics /doz##muzikz/ [doz.mú.ziks] ‘two musicians’
vol riure /bɔl##riwr/ [bɔl.ríw.rə] ‘(s/he) wants to laugh’
bar ianqui /bar##janki/ [bar.jáj.ki] ‘American bar’
mai riu /maj##riw/ [maj.ríw] ‘(s/he) never laughs’

3.1.3.2. Interim descriptive generalisation. In most Catalan dialects, any potential increase in sonority across a syllable boundary is levelled out by total assimilation or regressive manner assimilation (49a, b) provided that it does not imply the loss of the point of articulation of a non-coronal consonant or the manner of articulation of a non-stop consonant (49c). In contrast to what happens in Majorcan and Minorcan Catalan, the process of regressive manner assimilation is sensitive not only to sonority distances established between heterosyllabic segments, but rather to the type of manner and place implicated (see Pons 2004a, 2007).

15. Latin and Korean show a similar behaviour, which will be discussed in Section 4.2 (see, in this respect, Shin 1997, Davis and Shin 1999, and Steriade 2004).

It is all downhill from here 133

(49) *Manner assimilation and manner preservation in most Catalan dialects*

- | | | |
|---|---|--------------------------------|
| Potentially rising intersyllabic sonority | → | Regressive manner assimilation |
| a. stop + homorganic nasal, lateral | | ✓ |
| b. coronal stop + heterorganic nasal | | ✓ |
| c. all other contacts | | ✗ |
| Flat or falling intersyllabic sonority | → | Manner preservation |
| d. consonant + consonant | | ✓ |

3.1.3.3. Analysis. Regressive manner assimilation in Catalan is limited to homorganic sequences of a stop followed by a nasal or a lateral and to heterorganic sequences with a coronal stop in coda position. The fact that non-stop consonants are not affected by the process can be explained by ranking the faithfulness constraints that protect the manner of these consonants above the *DIST + constraints. This is illustrated in tableau (51). The ranking *DIST +4, +3, +2 >> *DIST +4, +3, +2, +1 is justified by the intervention of IDENT(-sont) in between, since stops are found in syllabic transitions of +1 (e.g., *cap fet* [kap.fét] ‘any fact’) (see Pons 2004a, 2007).

(50) *Assumed sonority scale* (see 45)

stops < fricatives < nasals < trill < liquids, glides < vowels
 1 2 3 4 5 6

(51) *Manner preservation in rising transitions with a non-stop in the coda in Catalan*

	IDENT (sib)	IDENT (nas)	*DIST +4, +3, +2	*DIST +4, +3, +2, +1
<i>/doz##niwz/</i>				
i. [doz.níws] (+1)				*
ii. [don.níws]	*!			
<i>/un##lít/</i>				
i. [un.lít] (+2)			*	*
ii. [u.lít]		*!		

The fact that the process only applies to homorganic sequences with a stop in the coda or to heterorganic sequences with a coronal stop in the coda can be attributed to a ranking in which *DIST +4, +3, +2 is ranked below IDENT(labial)

(52a) and IDENT(dorsal) (52b) and above IDENT(cor) (52c) and IDENT(−sont) (see (53), (54) vs. (55)) (see Pons 2004a). Indeed, the high ranking of IDENT (labial) and IDENT(dorsal) prevents manner assimilation when it implies the loss of the place of articulation of a non-coronal consonant (55). Note in (55) how crucial it is for the *DISTANCE constraints to conflate into *DIST +4, +3, +2 in order to discard a candidate with a change to a nasal (55iii), which according to the universal fixed hierarchy *DIST +4 >> *DIST +3 >> *DIST +2 would invariably be more harmonic than the actual candidate, with manner preservation (55i).

(52) *New constraints at play*

- a. IDENT(labial):
Assign one violation mark for every labial input segment whose output correspondent is not labial. (See McCarthy and Prince 1995)
- b. IDENT(dorsal):
Assign one violation mark for every dorsal input segment whose output correspondent is not dorsal. (See McCarthy and Prince 1995)
- c. IDENT(coronal):
Assign one violation mark for every coronal input segment whose output correspondent is not coronal. (See McCarthy and Prince 1995)

(53) *Manner assimilation in rising heterorganic transitions with a COR stop in the coda in Catalan*

/pɔd##mirar/	IDENT (lab)	*DIST +4, +3, +2	IDENT (−sont)!	IDENT(cor)
i. [pɔd.mi.rá] (+2)		*!		
ii. [☞] [pɔm.mi.rá]			*	*

(54) *Manner assimilation in rising homorganic transitions with a stop in the coda in Catalan*

	IDENT (lab)	*DIST +4, +3, +2	IDENT (−sont)!	IDENT(cor)
a. /kap##mɔs/				
i. [kab.mɔs] (+2)		*!		
ii. [☞] [kam.mɔs]			*	
b. /pɔd##limitar/				
i. [pɔd.li.mi.tá] (+4)		*!		
ii. [☞] [pɔl.li.mi.tá]			*	
iii. [pɔn.li.mi.tá] (+2)		*!	*	

- (55) *Manner preservation in rising heterorganic transitions with a stop in the coda in Catalan*

/kap##limit/	IDENT(lab)	*DIST +4, +3, +2	IDENT(-sont)
i. [kab.lí.mit] (+4)		*	
ii. [kal.lí.mit]	*!		*
iii. [kam.lí.mit] (+2)		*	*!

3.1.4. Summary and discussion

3.1.4.1. Similarities and differences across languages and dialects. Typological effects. In this section, three linguistic varieties that exhibit regressive manner assimilation have been considered. It has been seen Catalan (Section 3.1.3), a very restrictive one, in which the process may only affect stops, and even then only if it does not imply the loss of a non-coronal place specification. Languedocian Occitan (Section 3.1.2), on the other hand, is a less restrictive variety, in that the process affects stops, regardless of their place specification. Finally, Majorcan and Minorcan Catalan (Section 3.1.1) is the least restrictive of the three varieties, since the process affects stops systematically, nasals and sibilants less systematically, and the remaining sonorants not at all.

In all these varieties, then, stops are the consonants most prone to manner assimilation; this behaviour reproduces the cross-linguistically observed poor perceptibility of stops with respect to sibilants and sonorants in a weak position such as the coda, an asymmetry which has other consequences in the phonology of Catalan and other languages (see Steriade 2001b and Côté 2000, and, for Catalan, Recasens [1991] 1996, Jiménez 1997, 1999: 238–239, Pons 2004a: 405–406, and Lloret and Jiménez [2005, 2006] 2007: 8),¹⁶ and which

16. In these studies devoted to Catalan phonology, the poor perceptibility of stops in relation to other consonants is adduced as an argument to explain the process of deletion of the stop which occurs in Colloquial Catalan when a stop is placed in a internal complex cluster (e.g., *explicar* [əʃ.pli.á] ‘to explain’; *substituir* [sus.ti.tút] ‘substitute’), the process of deletion of the stop which occurs in Colloquial Valencian and in Meridional Valencian when a word-final stop is followed by a word with an initial consonant (e.g., *set cases* [se.ká.zes] ‘seven houses’; *tot bé* [to.βé] ‘all right’, see Jiménez 1997, 1999; Pons 2004a), the process of deletion of the stop phase of the final affricate followed by a word starting with a consonant in Colloquial Valencian Catalan, Southern Valencian Catalan, and also in Minorcan Catalan (e.g., *pots mirar* [pòs.mi.rá] ‘you can fall’; *caps quadrats* [kàs.kwa.ðráts] ‘squared heads’; see Jiménez 1997, 1999; Pons 2004a), as well as to explain the process of insertion of an epenthetic vowel in Alguerese Catalan when a stop, a voiceless labiodental fricative and an affricate are followed by a word with an initial consonant (e.g., *arrib tard* [arip i tárt] ‘(I) arrive late’, *escrif sempre* [askrif i sémpri] ‘I always write’, *desig feo* [dazitʃ i féo] ‘bad desire’, see Lloret 2002, Lloret and Jiménez [2005, 2006] 2007). (For a comprehensive analysis of the process of vowel in-

can be formalised through the ranking $\text{IDENT}(+\text{sonorant}), \text{IDENT}(\text{sibilant}) \gg \text{IDENT}(-\text{sonorant})$, *discontinuously* mediated by the relevant markedness constraints triggering manner assimilation (56c).

In all cases, moreover, manner assimilation is triggered when the faithful mapping consists of two heterosyllabic segments with sonority rise: the hypothesis that regressive manner assimilation is an effect of SYLLABLE CONTACT thus seems to be correct. This is corroborated interlinguistically and intralinguistically: (a) stops are the least sonorous consonants and are therefore always implicated in rising transitions; which is why they undergo manner assimilation in all varieties (56a); (b) in dialects such as Majorcan and Minorcan Catalan, with a wide range of assimilation patterns, the less sonorous the consonant in the coda, the greater the tendency to manner assimilation (see (56b)).

Manner assimilation can entail place assimilation, and it has been seen that in Catalan dialects it is blocked when a non-coronal segment is implicated, which also reproduces the cross-linguistic tendency to preserve labials and dorsals with respect to coronals (56b).

(56) *Tendency to manner assimilation interlinguistically and intralinguistically*

a. *Tendency to manner assimilation*

↑	Stops	→	all varieties
	Other consonants	→	Maj. and Min. Catalan

b. *Tendency to manner assimilation*

↑	Stops	↑	−sonorant → more
	(Sibilants)		
	Nasals		
	Other sonorants	↑	+sonorant → less

c. *(Universal) rankings at play*

- (i) $\text{IDENT}(+\text{sonorant}), \text{IDENT}(\text{sibilant}) \gg \text{IDENT}(-\text{sonorant})$ ¹⁷
- (ii) $\text{IDENT}(\text{lab}), \text{IDENT}(\text{dor}) \gg \text{IDENT}(\text{cor})$
- (iii) * $\text{DISTANCE} +4 \gg \text{DISTANCE} +3 \gg \text{DISTANCE} +2 \gg \text{DISTANCE} +1 \dots$

In (57) the rankings for Catalan and Languedocian Occitan are exposed (only the relevant constraints are indicated.)

section in terms of perceptual prominence, along the lines of Steriade 1999, 2001a, see Lloret and Jiménez [2005, 2006] 2007.)

17. $\text{IDENT}(+\text{sonorant})$ here is a shorthand for $\text{IDENT}(\text{rhotic}), \text{IDENT}(\text{lateral}), \text{IDENT}(\text{nasal})$.

- (57) *Rankings for regressive manner assimilation in Catalan and Languedocian Occitan*
- a. *Majorcan and Minorcan Catalan*
 $*\text{DIST } +4, +3, +2, \text{IDENT}(\text{lat}), \text{IDENT}(\text{rhot}) \gg \text{IDENT}(\text{nas}), \text{IDENT}(\text{sib}) \gg * \text{DIST } +4, +3, +2, +1 \gg \text{IDENT}(-\text{son}) \gg * \text{DIST } +4, +3, +2, +1, 0$
 - b. *Languedocian Occitan*
 $\text{IDENT}(\text{nas}), * \text{DIST } +4, +3, +2 \gg * \text{DIST } +4, +3, +2, +1 \gg \text{IDENT}(-\text{son}) \gg * \text{DIST } +4, +3, +2, +1, 0$
 - c. *Dialects of Catalan*
 $\text{IDENT}(\text{lab}), \text{IDENT}(\text{dor}), \text{IDENT}(\text{sib}), \text{IDENT}(\text{nas}) \gg * \text{DIST } +4, +3, +2 \gg \text{IDENT}(-\text{son}), \text{IDENT}(\text{cor}) \gg * \text{DIST } +4, +3, +2, +1, * \text{DIST } +4, +3, +2, +1, 0$

3.1.4.2. Theoretical implications of Syllable Contact. In Majorcan and Minorcan Catalan, rising sonority transitions are consistently avoided. However, a certain degree of sonority rise is permitted, mainly when specific consonants (i.e., sibilants, nasals and trills) are placed in coda position. This pattern undoubtedly corroborates the need for splitting SYLLABLE CONTACT into a hierarchy of constraints that target the permissible sonority distances across syllable boundaries, as advocated in Gouskova (2004), or, similarly, a hierarchy of constraints that target the permissible intersyllabic contacts according to their manner specification, as proposed in Baertsch and Davis 2003, 2005, 2007; Baertsch 2002. Only thus can the effects of SYLLABLE CONTACT be *discontinuously inhibited* by the intervention of the faithfulness constraints that regulate featural changes of manner. Gouskova's approach to SYLLABLE CONTACT based on *relational alignment* appears to be a satisfactory mechanism to account for regressive manner assimilation in Majorcan and Minorcan Catalan: certainly the process is sensitive to the absolute distance between heterosyllabic segments, independently of the type of consonants placed in coda and onset position, i.e., contacts with the same sonority distance make up a stratum (see (58a)) (see Pons 2004a: 206, 2005a, 2007: 143). However, an even more economical approach is to resort to Gouskova's hierarchy in a stringency form (à la de Lacy 2002), so that a stratum may be constituted by not only contacts with the same sonority distance but also contacts with a different sonority distance but with an equivalent assimilation pattern (see (58b)).

(58) *Permissible and impermissible contacts in Majorcan and Minorcan Catalan*

a. *Universal fixed hierarchy (5 rising strata) (after Gouskova)*

	Onset	6	5	4	3	2	1
Coda		V	G/L	T	N	F	S
6	V	0	-1	-2	-3	-4	-5
5	G/L	+1	0	-1	-2	-3	-4
4	T	+2	+1	0	-1	-2	-3
3	N	+3	+2	+1	0	-1	-2
2	F	+4	+3	+2	+1	0	-1
1	S	+5	+4	+3	+2	+1	0

V: vowels, G/L: glides / liquids, T: trill, N: nasals, F: fricatives, S: stops

■ Banned sonority distance for stops

■ Banned sonority distance for all the other consonants

b. *Stringency hierarchy (2 rising strata) (after de Lacy)*

	Onset	6	5	4	3	2	1
Coda		V	G/L	T	N	F	S
6	V	0	-1	-2	-3	-4	-5
5	G/L	+1	0	-1	-2	-3	-4
4	T	+2	+1	0	-1	-2	-3
3	N	+3	+2	+1	0	-1	-2
2	F	+4	+3	+2	+1	0	-1
1	S	+5	+4	+3	+2	+1	0

V: vowels, G/L: glides / liquids, T: trill, N: nasals, F: fricatives, S: stops

■ Banned sonority distance for stops

■ Banned sonority distance for all the other consonants

3.1.4.3. Theoretical implications of the sonority scale

Trills and other liquids. Liquids are often presented as a whole class in the sonority scale, but frequently they are broken down into two subclasses, laterals and rhotics, with the latter being more sonorous (see, among others, Jespersen 1904, Alderete 1995, Boersma 1998, and Gouskova 2004). However, the patterns observed in this paper as well as other studies devoted to Romance phonology prove that the direction *rhotics* > *laterals* is not always true, and that a clear distinction should be made between trills, on the one hand, and flaps and laterals, on the other. The asymmetric phonological behaviour of trills with respect to the other liquids as far as regressive manner assimilation is concerned leads, in fact, to interesting predictions about the exact position of these

sounds in the sonority scales of Majorcan and Minorcan Catalan and other Romance languages: trills are assumed to be less sonorous than other liquids, to the extent that they do not trigger manner assimilation of nasals, while laterals do. It is for this reason that a readjustment of the sonority scale to allow trills occupy their own position in the scale has been proposed. This readjustment is not *ad hoc*, though at first glance it may appear to be so. It is justified both from a typological and a phonetic point of view.

(a) Bonet and Mascaró (1997), for instance, attribute the distribution of rhotics in Romance languages such as Spanish, Catalan and Portuguese (59) to sonority dispersion effects on onsets and codas, and take as their starting point a radical separation of trills (located with obstruents) and flaps (located with glides) in the sonority scale (59).

(59) *Distribution of rhotics in Romance*
(after Bonet and Mascaró 1997: 104)

	Spanish	Portuguese	Catalan	0 OBSTRUENTS	TRILLS
a. word-initial position → trill	[rjézɣo]	[ríʃku]	[rísk]	1 NASALS	↓ FLAPS
b. onset position, after a C → trill	[onráðo]	[unráðu]	[unrát]	2 LATERALS	
c. second position of an onset → flap	[frío]	[fríu]	[frét]	3 GLIDES	
d. coda position → flap ~ trill	[mát/r]	[mát/R]	[már/r]	4 VOWELS	

(dialectal variation; free variation) (glosses in decreasing order: 'risk', 'honest', 'cold', 'sea')

(b) The same asymmetries between the trill and the flap are observed when Catalan apheresis and hypocoristic formation is considered (Bonet and Mascaró 1997: 120–121). In colloquial Catalan, a word initial unstressed schwa is commonly deleted ([ə]nar → nar 'to go'; [ə]gafar → gafar 'to take'), and this deletion is possible when the schwa is followed by a trill ([ə]rɪbar → [r]ɪbar 'to arrive') but not a flap ([ə]rɪnya → *[r]ɪnya 'spider'). Moreover, hypocoristics are formed in Catalan by isolating a trochee starting at the right edge of the word (*Josefina* → *Fina*; *Francisco* → *Cisco*, first names in Catalan), but, whereas truncation is possible when the resulting form starts with a trill (*Montserrat* → *Rat*), it is not when it would start with a flap. In these cases, the process is either blocked or another strategy is selected (cf. *Margarita* → *[r]ɪta, *Mita*; *Jeroni* → *[r]ɪni, *Noni*, first names in Catalan) (see Cabré 1993, for a complete picture of these truncation processes).

(c) The process of trilling which affects the future and the conditional morph(eme)s in some varieties of Catalan (*vendrà* /bɛn+ra/ [bən+.rál] '(s/he) will sell') can also be adduced as an argument to concede less sonority to trills

than to flaps. The idea is that the trill always means a more moderate sonority rise than the flap after a heterosyllabic consonant (see Pons 2005a, b, in preparation, for a comprehensive analysis of these cases in all Romance languages).

(d) Shin (1997: 169) proposes a variation of the sonority scale identical to the one in this section to account for the facts of Samosir Toba Batak, a language where the trill assimilates in manner of articulation with the following lateral (/marlaʝe/ [malláʝe] ‘to swim’), but the lateral does not assimilate in manner of articulation with the following trill (/tarsuŋgul##rohakku/ [tarsúŋgulrohakku] ‘my spirit awoke’)

(e) In Haddad (1984: 65–66), it is argued that the sonority of [l] is superior to the sonority of [r] in Lebanese Arabic. The evidence comes from the behaviour of the sequences of stem-final nasals followed by a liquid: the sequences of a nasal followed by lateral are more likely to be broken up via epenthesis (e.g., *[himl] [himil] ‘load’; *[ʔaml] [ʔamil] ‘lice’) than the sequences of a nasal followed by a trill, which are maintained.¹⁸

The sonority scale of (35), on the other hand, is consistent with the experimental results in Parker (2002, 2008). As far as intensity, pressure, F1, air flow and duration parameters in liquids are concerned, the author concludes:

// patterns as more sonorous than the flap /r/ 10 times, as equivalent 7 times, and as less sonorous in 3 cases. The flap /r/ in turn outranks the trill 9 times and ties with it only once. There is not a single instance in which the mean value for /r/ is significantly more ‘sonorous’ than that of /r/. I therefore posit that these three natural classes are universally ranked in the order laterals > flaps > trills.

(I am grateful to John J. McCarthy for indicating this point to me.) (See also Wheeler 2005.)

18. These are, on the whole, the general patterns, but opposite ones can also be found: in Italian, for instance, a diachronic process has affected laterals followed by a trill (e.g., *val+rà* [varrá] ‘(he/she) will be valid’, cf. *valere*; *dol+rà* [dorrá]; ‘(he/she) will feel pain’, cf. *dolere*), while clusters of a trill followed by a liquid have remained unaltered (*orlo* [órllo] ‘edge’ *Carlo* [kárllo] ‘Charles’) (see, also, the examples in 2); this suggests, thus, a higher sonority for trills than for laterals, and advocates, as argued in Section 2.2, a more flexible approximation to the sonority scale.

(60) Parker (2002: 233)

	onset position		coda position	
	males	females	males	females
intensity	l > r > r	l > r > r	l = r	l = r
pressure	l = r > r	l = r > r	l = r	l = r
F1	l = r > r	l > r > r	l = r	r = l
Flow	l > r > r	l > r = r	l = r	l = r
duration	r > l > r	r > l > r	l = r	l = r

Liquids and glides. The class of liquids and the class of glides also show ambiguous behaviour in terms of sonority. In this section, it has been proposed that they occupy the same slot in the sonority scale (see 35). This proposal is supported, again, by additional typological and phonetic evidence.

(a) In Catalan, intrasyllabic sequences of consonants with the same or increasing sonority are forbidden, the repair strategy being vowel epenthesis (*centre* /sentr/ [séntɾə] ‘centre’ cf. *centr-al* [səntɾál] ‘central’; *recte* /rɛkt/ [rɛktə] ‘agreement’; cf. *rect-itud* [rɛktitút] ‘rectitude’). When the intrasyllabic sonority is decreasing, epenthesis does not apply (*port* /pɔrt/ [pórt] ‘harbour’). Unexpectedly, though, in Catalan there are underlying consonant sequences with a decreasing sonority profile according to the traditional sonority scale that show epenthesis (*aire* /ajt/ [áj.rə] ‘air’; *retaula* /rətawl/ [rə.táw.lə] ‘altarpiece’). This is why Wheeler (1987) argues that the sonority of glides is lower than the sonority of liquids (i.e., liquids > glides), so that final sequences comprised by a glide followed by a liquid violate the Sonority Sequencing Principle and consequently undergo epenthesis. The insertion of this vowel is also justifiable if a sonority scale with liquids and glides having the same sonority is assumed. Under this assumption, vowel epenthesis is expected: it is inserted to avoid a sonority plateau, as in *recte*.

(b) In Majorcan Catalan, palatal nasals followed by a consonant undergo a process of splitting which results in a sequence of a glide followed by a nasal assimilated to the next consonant (e.g., *any passat* /aɲ##pasad/ [àjm.pə.sát] ‘last year’) and prepalatal sibilants undergo a process of gliding when followed by a consonant (e.g., *mateix dia* /mətɛj##diə/ [mə.tej.ðíə] ‘the same day’) (see Footnote 7). These processes reflect the tendency of the dialect to avoid (pre)palatal segments in preconsonantal position. This tendency, however, is not observed when a palatal lateral is followed by a consonant (e.g., *coll petit* /kɔl##pətit/ [kɔl.pə.tít] ‘small neck’). A possible explanation for this differentiated behaviour may be that splitting in this case would result in a coda comprised by a glide followed by an alveolar lateral, that is, a sequence of two tautosyllabic consonants that possess the same sonority according to the scale

proposed in (35) and therefore violate the Sonority Sequencing Principle (see Pons 2004a).

Again, the results in Parker (2002, 2008: 70) support this particular ordering. In fact, according to his results, glides in onset position are significantly out-ranked by laterals in sonority (laterals > glides) and less dramatically by flaps (flaps > glides), a behaviour that can be explained by the tendency of glides to harden in onset position:

Among the sonorants in particular, the glides /j w/ as a class have a lower mean sound level minimum than the liquids /l/ and /r/. As indicated at the bottom of the table, this sonority reversal is significant at the .05 level in the case of /l/ > /j w/ (p = .000) but not quite for /r/ > /j w/ (p = .055), whose mean sound levels are closer together (_6.3 vs. _7.6). A possible explanation for both of these outcomes is the well-documented tendency of Spanish approximants to harden and become more obstruent-like in onsets (Harris, 1969; Lavoie, 2000; Lozano, 1978). This would naturally lower their sound level values.

The refinements proposed in this paper, therefore, are robustly justified both from a typological and a functional point of view.

3.1.4.4. *Other strategies.* In this section, only manner assimilation has been considered as a strategy to satisfy the markedness constraints against rising sonority. There are, of course, many other available strategies (*i.e.* other possible candidates), such as (a) the deletion of one of the two consonants (e.g., *cap mort* /kap##mɔrt/ *[ka.mórt] ‘any dead’); (b) the insertion of an epenthetic vowel in between the consonants involved (e.g., /kap##mɔrt/ *[ka.pi.mórt] ‘any dead’); (c) the gemination of the consonant in coda position, in the cases of a stop followed by a lateral (e.g., /kap##limit/ *[kab.blí.mit] ‘any limit’); (d) the resyllabification of the first consonant into a complex onset in the cases of a stop followed by a flap (*i.e.*, *[ka.plí.mit] ‘any limit’); or, even, (e) changing the manner of articulation of the consonant in the onset. Consonant deletion and vowel insertion ((a), (b)) are blocked by the high ranking of MAX-IO and ALIGN-Words, according to which the right edge of the word must be aligned with the left edge of another word (see McCarthy and Prince 1993; Dols 2000, Bonet and Lloret 2002, and Pons 2004a, for Catalan). Gemination of the consonant in coda position (c) is not a legitimate strategy because of the activity of an output-output faithfulness constraint according to which the syllabic organisation of elements in a phonological phrase is the same as the syllabic organisation of the corresponding elements in a prosodic word (see Jiménez 1999, Wheeler 2005: 87). The same constraint is responsible for blocking the resyllabification of the consonant in coda position in a complex onset with the following consonant (d). Progressive manner assimilation or the hardening of the consonant in onset position (e), finally, are not available strategies

due to the specific positional faithfulness constraints which protect the features associated with the consonant situated in onset position (see, among others, Beckman 1998 [1999]).¹⁹

3.1.4.5. Important remarks. A very important observation about the manner assimilation account in this section refers to the interaction between the *DISTANCE constraints and the resulting consonant(s) in the process of regressive manner assimilation: this resulting consonant is necessarily a true geminate that is not evaluated by the *DISTANCE constraints, as proposed for Sidamo gemination in Gouskova (2004). This prevents strategies other than regressive manner assimilation (i.e., rhotacism) from applying when a non-sibilant is involved. Note that, otherwise, a sonority fall transition like the one in [ɪ.n] would always be better – unless the intervention of the relevant faithfulness constraints – than a sonority-flat transition like the one in [n.n] (see Pons 2005a, b). (For the interaction between the process of regressive manner assimilation and the process of rhotacism in Majorcan Catalan, see Section 3.2.1.3). Any geminate is thus *invulnerable* to the *DISTANCE constraints (see also Section 3.2.1, in which this assumption is crucial to account for the interaction between rhotacism and manner dissimilation). Another observation refers to the fact that regressive place assimilation applies both in rising and in flat and falling sonority transitions. In most cases of rising sonority, regressive place assimilation is motivated by the *DISTANCE constraints, since manner assimilation involves place assimilation. In falling and flat transitions, on the other hand, regressive place assimilation is motivated by the ranking AGREE(place) >> IDENT(place) (see Pons 2004a, for a justification of this ranking and its position in the general hierarchy of Balearic Catalan). In Section 3.1, sequences with a labiodental fricative have been omitted for expository reasons (see *d* in Section 3.1.1.3): they are also resolved through a process of regressive manner assimilation, not only when involved in rising transitions (e.g., *agaf mans* [əjam.máns] ‘(I) take blackberries’), but also in falling transitions (e.g., *agaf pans* [əjap.páns] ‘(I) take bread pieces’), especially in Colloquial Majorcan Catalan. The hierarchy *DISTANCE +4, +3, +2, +1 >> IDENT(–sont), adduced in Section 3.1.1.3, accounts for the sequences with rising sonority (e.g., *agaf mans* [əjam.máns]). In the next section, the reasons for the triggering of the process in falling transitions (e.g., *agaf pans* [əjap.páns]) will also be addressed (see Section 3.2.4.4).

19. The exact ranking of the constraints regulating these strategies and its justification can be found in Pons (2004a).

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3.2. *Rhotacism and gliding*

3.2.1. *Majorcan Catalan*

3.2.1.1. *Data.* In Majorcan Catalan, when an alveolar fricative is followed by a non-sibilant voiced obstruent or a nasal, it undergoes an *optional* process of rhotacism, which consists of replacing the sibilant manner of articulation for a rhotic approximant ([ɹ]) manner of articulation (61).²⁰ This process can also be triggered when the alveolar fricative is followed by a voiceless labiodental fricative, although this occurs less systematically. In all other contexts, alveolar fricatives undergo other processes: they undergo manner dissimilation before another sibilant (see Section 3.1.1 and footnote 5) and manner assimilation before a lateral, a rhotic or a glide (see also Section 3.1.1). Before a voiceless stop, the process never applies (62).

- (61) Alveolar sibilant + non-sibilant voiced obstruent, nasal or *f*
- | | | | |
|------------------|-------------|-----------------------------------|---------------|
| <i>dos bous</i> | /doz##bɔwz/ | [do.i.bɔws] | ‘two oxen’ |
| <i>dos dits</i> | /doz##ditz/ | [do.i.díts] | ‘two fingers’ |
| <i>dos gots</i> | /doz##gotz/ | [do.i.góts] | ‘two glasses’ |
| <i>dos vins</i> | /doz##vinz/ | [do.i.víns] | ‘two wines’ |
| <i>dos mesos</i> | /doz##mezz/ | [do.i.mé.zus] | ‘two months’ |
| <i>dos nius</i> | /doz##niwz/ | [do.i.níws] | ‘two nests’ |
| <i>dos focs</i> | /doz##fɔkz/ | [dos.fóks]~[dor.fóks]~[do.i.fóks] | ‘two fires’ |
- (62) Alveolar sibilant + voiceless stop
- | | | | |
|-----------------|--------------|------------|-----------------------|
| <i>dos pans</i> | /doz##panz/ | [dos.páns] | ‘two loaves of bread’ |
| <i>dos tocs</i> | /doz##tɔkz/ | [dos.tóts] | ‘two knocks’ |
| <i>dos cans</i> | /doz##kantz/ | [dos.káns] | ‘two dogs’ |

3.2.1.2. *Interim descriptive generalisation.* The emerging generalisation for the rhotacist varieties of Majorcan Catalan is that a decreasing or a flat sonority transition from the sibilant to the following consonant may be insufficient and may have to be augmented by increasing the sonority in the coda (64).

20. These data from Majorcan Catalan have mostly been taken from Moll (1934), Bibiloni (1983), Dols (1993) and Recasens ([1991] 1996), and have been checked with personal inquiries reported in Pons (2004a). Regarding the exact nature of the realisation of the consonant, Moll and Recasens report an approximant [ɹ] and Bibiloni refers to it as a relaxed [r]. Spectrographic analysis shows that the consonant tends to appear as the approximant [ɹ] in most contexts, unless followed by a voiceless labiodental fricative, in which case it tends to emerge as a flap. According to a recent electropalatographic (EPG) and acoustic study (Recasens 2007b), the process of rhotacism in Majorcan Catalan has a gradient character.

Rhotacism is the selected strategy to achieve this (63a; d–e). Potentially rising sonority transitions are also improved via rhotacism (63a). Three cases lie outside this generalisation: (a) manner assimilation when the sibilant is followed by a lateral or a glide (63b); (b) manner dissimilation, when the sibilant is followed by another sibilant (63c); and (c) preservation when the sibilant is followed by a voiceless stop (63f).

(63) *Manner assimilation, dissimilation and preservation in Majorcan Catalan*

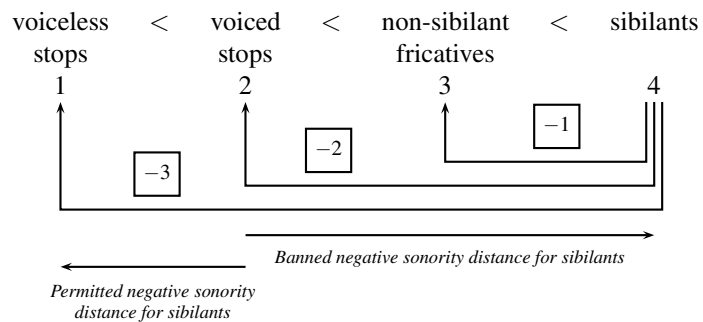
	Potentially rising intersyllabic sonority	→	Rhotacism	Other processes
a.	alveolar sibilant + nasal		✓	
b.	alveolar sibilant + lateral, glide		✗	Manner assimilation
c.	alveolar sibilant + sibilant		✗	Manner dissimilation
	Flat or falling intersyllabic sonority	→	Rhotacism	Other processes
d.	alveolar sibilant + labiodental fricative		✓	(also preservation)
e.	alveolar sibilant + voiced obstruent		✓	
f.	alveolar sibilant + voiceless stop		✗	Preservation

3.2.1.3. Analysis. Rhotacism applies not only in rising sonority transitions but also in flat and falling syllabic transitions. Provided that this pattern is analysed as a means to improve a syllable contact, it reinforces the hypothesis according to which SYLLABLE CONTACT is not a single constraint but rather a hierarchy of constraints banning not just positive but also flat and negative sonority distances across a syllable boundary (see Pons 2004a, 2005a). In these varieties, potentially flat and negative distances with an alveolar sibilant in the coda are also banned and incremented via rhotacism: the replacement of a sibilant manner specification with a rhotic approximant manner specification implies the augmentation of the sonority of the coda consonant, so that the falling sonority distance between this consonant and the following is increased (see 64b, for the position of the segment [ɾ] in the sonority scale; see also Parker 2002, 2008, and Pons 2005a, b). The fact that rhotacism applies before nasals, fricatives and *voiced stops*, but not before *voiceless stops* seems to indicate that the sonority of voiceless stops is lower than that of voiced stops (64a) (see Section 3.2.4.3 for a complete discussion of this new refinement of the sonority

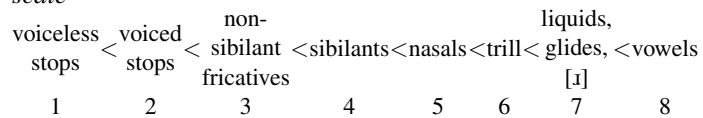
scale) (see also Pons 2005a, b, 2007). As there is additional evidence that sibilants show a greater sonority than other fricatives (see Section 3.2.4.3), these consonants are also split into two slots in the sonority scale (64b).

Given this new adjustment, in the linguistic varieties where rhotacism applies, negative sonority distances of -2 or higher are banned, whereas negative sonority distances of -3 or lower are permitted.²¹ This refinement maintains the sonority distance between sibilants and consonants of higher sonority, so that the analysis of regressive manner assimilation for sibilants in coda position is not affected; only stops are (insignificantly) affected in this respect, an issue which will be addressed in Section 3.2.4.4.

(64) a. *Third refinement of the sonority scale* (see 35)



b. *Incorporation of the rhotic approximant in the assumed sonority scale*



This behaviour can be formalised as a constraint hierarchy in which IDENT (sibilant) is ranked at the same level as *DISTANCE +4, +3, +2, +1, 0, -1, -2 and above *DISTANCE +4, +3, +2, +1, 0, -1, -2, -3, as shown in (66) and (67). This ranking rules out rhotacism when the negative sonority distance is -3 or lower and ensures rhotacism otherwise (compare, for instance, (66a) vs. (66b-c)). Note, on the other hand, that IDENT(cont) (65a) is responsible for both the blocking of regressive manner assimilation in those cases in which a

21. It could be interpreted that rhotacism does not apply before a voiceless stop as an effect of the contextual markedness constraint AGREE(voice) (Pons 2004a). This analysis, however, cannot account for sequences of an alveolar sibilant followed by a voiceless labiodental fricative (see Pons 2005a, b). Nonetheless, it should be noted that precisely rhotacism is not as systematic before a voiceless labiodental fricative as before a voiced stop.

non-continuant consonant follows (see candidates ii in 66), as well as for the blocking of lateralisation (see candidates iv in (66) and (67)) or the change to a flap (see candidates v in 66 and 67) (for the featural assumptions in the paper, see Section 2.3). The ranking *DISTANCE +4, +3, +2, +1 >> *DISTANCE +4, +3, +2, +1, 0, -1, -2 is crucial, as can be seen in (67ai, bi, ci), to discard candidates with manner preservation in potentially rising transitions. Note in (67a) how the tie between the candidate with manner assimilation and the candidate with rhotacism in sequences with a *nasal* in second position is solved in favor of the latter because of the activity of *GEMINATE NASAL. In sequences with a *liquid* in second position (67b), on the contrary, the competition between both candidates is solved in favor of the one showing manner assimilation because the one with rhotacism is discarded thanks to the activity of the constraint *DISTANCE +4, +3, +2, +1, 0, which rules out the sequence 'i.l'. The effects of the constraint *GEMINATE LIQUID, ranked above *GEMINATE NASAL (for a justification of this ranking, see Podesva 2002), are imperceptible because the candidate with rhotacism is discarded by the constraint *DISTANCE +4, +3, +2, +1, 0. The idea is the following: rhotacism is worthy in sequences with a nasal in second position, whereas it is not in sequences with a liquid, in that the falling transition is bigger in the former than in the latter. (Due to space reasons, in the following tableaux, just the relevant segmental sequences are presented.)

(65) *New constraints at play*

- a. IDENT(continuant):
Assign one violation mark for every continuant input segment whose output correspondent is not continuant. (See McCarthy and Prince 1995) (For the featural assumptions, see Section 2.3)
- b. *GEMINATE NASAL:
Assign one violation mark for every sequence of two adjacent nasals (see Podesva 2002).
- c. *GEMINATE LIQUID:
Assign one violation mark for every sequence of two adjacent liquids (see Podesva 2002).

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(66) *Preservation vs. rhotacism vs. manner assimilation in potentially falling and flat syllabic transitions in Majorcan Catalan*

	*DIST +4, +3, +2, +1, 0, -1, -2	IDENT (sib)	IDENT (cont)	*DIST +4, +3, +2, +1, 0, -1, -2, -3
a. /sp/				
i. [s.p] (-3)				*
ii. [p.p]		*	*!	
iii. [ɹ.p] (-6)		*!		
iv. [l.p] (-6)		*	*!	
v. [r.p] (-6)		*	*!	
b. /sd/				
i. [z.d] (-2)	*!			*
ii. [d.d]		*	*!	
iii. [ɹ.d] (-5)		*		
iv. [l.d] (-5)		*	*!	
v. [r.d] (-5)		*	*!	
c. /sf/				
i. [s.f] (-1)	*!			*
ii. [f.f]		*	*!	
iii. [ɹ.f] (-4)		*		
iv. [l.f] (-4)		*	*!	
v. [r.f] (-4)		*	*!	

(67) *Preservation vs. rhotacism vs. manner assimilation in potentially rising transitions in Majorcan Catalan*

	*DIST +4, +3, +2, +1	*DIST +4, +3, +2, +1, 0	*DIST +4, +3, +2, +1, 0, -1, -2	IDENT(sib)	IDENT(cont)	*GEMINATE LIQUID	*GEMINATE NASAL	*DIST +4, +3, +2, +1, 0, -1, -2, -3
a. /sn/								
i. [z.n] (+1)	*!		*					*
ii. [n.n]				*	*		*!	
iii. [ɹ.n] (-2)			*	*	*			*
iv. [l.n] (-2)			*	*	*!			*
v. [r.n] (-2)			*	*	*!			*

		*DIST +4, +3, +2, +1	*DIST +4, +3, +2, +1, 0	*DIST +4, +3, +2, +1, 0, -1, -2	IDENT(sib)	IDENT(cont)	*GEMINATE LIQUID	*GEMINATE NASAL	*DIST +4, +3, +2, +1, 0, -1, -2, -3
b.	/sl/								
i.	[z.l] (+3)	*!		*					*
ii.	[l.l]				*	*	*		
iii.	[ɹ.l] (0)		*!	*	*				*!
iv.	[r.l] (0)			*	*	*!			*
c.	/sr/								
i.	[z.r] (+2)	*!		*					*
ii.	[r.r]				*				
iii.	[ɹ.r] (-1)			*	*	*!			*
iv.	[l.r] (-1)			*	*!				*
v.	[r.r] (-1)			*	*!				*

Another available strategy not considered in these tableaux is the change of the sibilant to a glide ([j] or [w]), which would induce an equal sonority fall as the rhotic approximant: IDENT(place), although low-ranked in Majorcan Catalan, would outrank candidates with this strategy.

The basic difference between rhotacist and non-rhotacist varieties (see Section 3.1.1) is the position of IDENT(sibilant) in the ranking. In non-rhotacist varieties, IDENT(sibilant) is located at the same level as other faithfulness constraints regulating non-stop featural changes, below *DISTANCE +4, +3, +2 (68a), whereas, in rhotacist varieties, IDENT(sibilant) is located at the same level as *DISTANCE +4, +3, +2, +1, 0, -1, -2 (68b). (In (68a) and (68b), just the relevant constraints are exposed; and in (68c) the exhaustive ranking for Majorcan rhotacist varieties is exposed.)

(68) *Constraint ranking for rhotacist and non-rhotacist varieties of Majorcan Catalan*²²

- a. *Majorcan Catalan non-rhotacist varieties*
 *DISTANCE +4, +3, +2 >> IDENT(sib) >> *DISTANCE +4, +3, +2, +1 >> *DISTANCE +4, +3, +2, +1, 0, -1, -2 >> *DISTANCE +4, +3, +2, +1, 0, -1, -2, -3

22. All the constraints regulating positive sonority distances are added here, since they are relevant, as seen in Section 3.1, to account for regressive manner assimilation.

- b. *Majorcan Catalan rhotacist varieties*
 *DISTANCE +4, +3, +2 >> *DISTANCE +4, +3, +2, +1,
 *DISTANCE +4, +3, +2, +1, 0 >> *DISTANCE +4, +3, +2, +1,
 0, -1, -2, IDENT(sib) >> *DISTANCE +4, +3, +2, +1, 0, -1,
 -2, -3
- c. *Majorcan Catalan rhotacist varieties (exhaustive ranking)*
 *DISTANCE +4, +3, +2, +1, *DISTANCE +4, +3, +2, +1, 0 >>
 *DISTANCE +4, +3, +2, +1, 0, -1, -2, IDENT(sib), IDENT(cont)
 >> *GEMLIQ >> *GEMNAS >> *DISTANCE +4, +3, +2, +1, 0,
 -1, -2, -3

As pointed out in Section 3.1, in Majorcan and Minorcan Catalan, a sequence of two sibilants is avoided by means of a process of regressive manner dissimilation which gives as a result a geminate affricate sibilant.²³ This is a process completely unrelated to rhotacism and regressive manner assimilation, and it can be attributed to the constraint *GEMINATE SIBILANT (69a) (as defined in (69a), this constraint is not violated by a geminate affricate). This constraint is responsible not only for the process of manner dissimilation but also for the blocking of regressive manner assimilation when it would generate a geminate sibilant (e.g., *cap so* → [ka.ʎsó]; *[kas.só]; see also Section 3.1). The cross-linguistic tendency to avoid geminate sibilants is well known and has been demonstrated to be functionally motivated (see Boersma 1998; for Catalan, Pons 2004a: 227, Wheeler 2005: 15–33). Given the analysis above, however, one might reasonably expect that rhotacism, and not manner dissimilation, would apply in order to prevent a sequence of two adjacent sibilants: the competition between manner dissimilation and rhotacism is resolved in favour of the former process because the geminate affricate resulting from the process of dissimilation ([ʎs]) does not violate the *DISTANCE constraints (see Section 3.1.4.5), whereas [ɾ] does (compare, in this respect, candidates 70aiii and 70av). The actual candidate with a geminate affricate (70aiii) is preferred to a candidate with just dissimilation of the first consonant (70aii) or to a candidate with dissimilation and affrication of the second sibilant (70aiv), due to the unranked constraints *DIST +4, +3, +2, +1, 0, -1, -2, IDENT(sibilant), IDENT(continuant) (see Section 2.3 for the featural assumptions for affricates). A candidate not considered in this tableau is that with an affricate syllabified in onset position (*[ka.ʎs]). Given the fact that geminates are not sensitive to the *DISTANCE constraints, the syllable contact between a vowel and an affricate (with a falling sonority distance of -7, in that affricates are placed at the same

23. For a comprehensive analysis of this process within OT, see Pons 2004a: 226–296; Pons 2004b, Pons 2007: 169–238; for relevant discussion of the formation and lengthening of affricates in terms of syllable contact, see Jiménez 1996, and Wheeler 2005).

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level as stops in the sonority scale) would always be worse than a geminate, provided that *GEMINATE CONSONANT is ranked below the *DISTANCE constraint penalising such sonority fall; this would be a case of the emergence of the unmarked and here it is left for future research. To confirm the consistency of this approximation, in (70b) the ranking adduced for rhotacism is presented. A candidate not considered in (70b), $[\widehat{ddz}_{1,2}]$, homologous to the actual candidate resultant from the process of dissimilation (70a_{iii}), would be discarded by the positional faithfulness constraint IDENTONSET(cont) (69b).

(69) *New constraints at play*

- a. *GEMINATE SIBILANT:
Assign one violation mark for each sequence of two identical adjacent fricative sibilants (see Bonet and Lloret 2002; Pons 2004a, b; Wheeler 2005).
- b. IDENTONSET(cont):
Assign one violation mark for each continuant output segment syllabified in the onset position whose input correspondent is not continuant (see Beckman 1997, 1999)

(70) *Interaction between manner dissimilation and rhotacism in Majorcan Catalan*

		*GEMINATE SIBILANT	*DIST +4, +3, +2, +1, 0, -1, -2	IDENT(sib)	IDENT(cont)	*DIST +4, +3, +2, +1, 0, -1, -2, -3
a.	/s ₁ s ₂ /					
i.	[s ₁ .s ₂]	*!				
ii.	[t ₁ .s ₂] (+2)		*	*	*!	*
iii.	[ṭ ₁ .ṣ _{1,2}]					
iv.	[t ₁ .tṣ ₂] (0)		*	*	*!	*
v.	[ɹ ₁ .s ₂] (-3)			*		*!
b.	/s ₁ d ₂ /					
i.	[z ₁ .d ₂] (-2)		*			*
ii.	[d ₁ .d ₂]			*	*!	
iii.	[ɹ ₁ .d ₂] (-5)			*		
iv.	[l ₁ .d ₂] (-5)			*	*!	
v.	[r ₁ .d ₂] (-5)			*	*!	
vi.	[d ₁ .dẓ ₂] (0)			*	*!	

(To avoid ambiguity, in these tableaux, in which there are candidates with fusion, I use, following McCarthy and Prince 1995, Bonet and Lloret 2002, Pons 2004a, Pons 2004b, subindexes to point each implicated consonant)

3.2.2. *Sardinian, Galician and other Romance languages*

3.2.2.1. Data. In varieties of Sardinian like Nuorese,²⁴ the implosive *s* undergoes a process of rhotacism, similar to the one triggered in Majorcan Catalan, when followed by a voiced stop, a labial nasal, a glide, or a voiced fricative or affricate (71a). This process can also be triggered when the *s* precedes a voiceless labiodental fricative ([f]), but not when followed by any other voiceless obstruent (71b). The result of the process is a rhotic approximant, as well.²⁵ When the *s* is followed by an alveolar nasal, an alveolar lateral or an alveolar rhotic, that is, an alveolar sonorant, a process of regressive manner assimilation is triggered (71c).²⁶

(71) *Sardinian. Heterosyllabic cluster with an alveolar sibilant followed by a consonant*

a. Alveolar sibilant + voiced consonant (except for alveolar sonorant; see 72c) and *f*

<i>tres boes</i>	/tres##bœs/	[trɛi.bó.ɛs] ~ [trɛi.bó.ɛ.zɛ] ²⁷	'three oxen'
<i>tres domos</i>	/tres##dɔmɔs/	[trɛi.dó.mɔs] ~ [trɛi.dó.mɔ.zɔ]	'three houses'
<i>tres gattos</i>	/tres##gattɔs/	[trɛi.gát.tɔs] ~ [trɛi.gát.tɔ.zɔ]	'three cats'
<i>tres manos</i>	/tres##manɔs/	[trɛi.má.nɔs] ~ [trɛi.má.nɔ.zɔ]	'three hands'
<i>tres yannas</i>	/tres##jannas/	[trɛi.ján.nas] ~ [trɛi.ján.na.za]	'three doors'
<i>tres ziros</i>	/tres##ziɔs/	[trɛi.ðzí.rɔs] ~ [trɛi.ðzí.rɔ.zɔ]	'three turns'

24. Sardo-Nuorese is the dialect of Sardinian spoken in the province of Nuoro, situated in the north-east of Sardinia. The data from Sardo-Nuorese are taken from Pittau (1972: 33–34) and have been confirmed by Chiara Frigeni and Lucia Molinu. The voiced stops in (71a) can undergo a process of lenition (cf. [trɛi.βó.ɛs]). These alternative realisations are not inconsistent, however, with the analysis presented here.

25. The same patterns are found in prefixed forms and compounds (e.g., *disgrássia* /dis##grasja/ [dir.grás.sja] 'bad luck' vs. *dispiákere* /dis##pjakere/ [dis.pja.ké.re] 'to be disdainful'). I am grateful to Chiara Frigeni for providing me information about the exact realisation of the rhotic resulting from the process of rhotacism.

26. In Logudorese Sardinian, in the same contexts where *s* becomes [r], it can be realised as [l] (e.g., *tres manos* /tres##manɔs/ [trɛl.má.nɔs] ~ [trɛl.má.nɔ.zɔ] 'three hands'). (See, for instance, Pittau 1991 or Ladd & Scobbie 1998: 5.).

27. A final vowel which copies the quality of the preceding vowel is inserted in words ending in an alveolar fricative. See Section 3.2.5.4 for a discussion of the eventual implications of this process.

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	<i>tres tzeccos</i> /tres##zekos/	[trɛi.ðzék.kos] ~ [trɛi.ðzék.ko.zo]	‘three blinds’
	<i>tres zentes</i> /tres##zentɛs/	[trɛi.ðzén.tɛs] ~ [trɛi.ðzén.tɛ.zɛ]	‘three people’
	<i>tres fizos</i> /tres##fizos/	[trɛi.fí.ðzɔs] ~ [trɛi.fí.ðzɔ.zo]	‘three sons’
b.	Alveolar sibilant + voiceless obstruent (except for labiodental fricative; see 72a)		
	<i>tres panes</i> /tres##panɛs/	[trɛs.pá.nɛs] ~ [trɛs.pá.nɛ.zɛ]	‘three loaves of bread’
	<i>tres táulas</i> /tres##tawlas/	[trɛs.táw.las] ~ [trɛs.táw.la.za]	‘three tables’
	<i>tres canes</i> /tres##kanɛs/	[trɛs.á.nɛs] ~ [trɛs.á.nɛ.zɛ]	‘three dogs’
	<i>tres santos</i> /tres##santɔs/	[trɛs.sán.tɔs] ~ [trɛs.sán.tɔ.zo]	‘three saints’
	<i>tres sorres</i> /tres##sores/	[trɛs.sór.rɛs] ~ [trɛs.sór.rɛ.zɛ]	‘three sisters’
c.	Alveolar sibilant + alveolar sonorant		
	<i>tres nuces</i> /tres##nukɛs/	[trɛn.nú.kɛs] ~ [trɛn.nú.kɛ.zɛ]	‘three nuts’
	<i>tres litros</i> /tres##litɔs/	[trɛl.lít.trɔs] ~ [trɛl.lít.trɔ.zo]	‘three litres’
	<i>tres rosas</i> /tres##rɔsas/	[trɛr.ró.zas] ~ [trɛr.ró.za.za]	‘three roses’

In Galician, similarly, a process of rhotacism applies before a voiced consonant and before a non-sibilant fricative (72a). Before a voiceless stop, the *s* is maintained (72b).²⁸

28. Galician is a Romance language spoken in the north-west of Spain. Data from Galician are due to Dubert (1999), Frexeiro (1998), and have been checked with Sabela Labraña. According to Frexeiro (1998: 161), “É frecuente en boa parte do territorio galego, especialmente na zona suroriental, o fenómeno do rotacismo, consistente na realización do /s/ implosivo como [r] en posición interior de palabra ou por fonética sintáctica ante consonante sonora, o en menor medida perante as xordas /f/ e /θ/ ou mesmo /tʃ/.” [“It is common in much of Galicia, particularly in the south east, to encounter the phenomenon of rhotacism, which consists of the realisation of the implosive /s/ as [r] word-internal or across words when followed by a voiced consonant or more sporadically before the voiceless fricatives /f/ and /θ/ and also /tʃ/.”]. In Central Asturian Spanish, similarly, rhotacism applies before a voiced consonant and before an interdental or labiodental fricative (see Conde 1978: 96).

154 *Clàudia Pons-Moll*(72) *Galician. Heterosyllabic clusters with an alveolar sibilant followed by a consonant*

- a. Alveolar sibilant + voiced consonant, non-sibilant fricative
- | | | | |
|----------------------|-----------------|--------------------|-----------------|
| <i>estás mal</i> | /stas##mal/ | [es.taɪ.mál] | ‘you feel bad’ |
| <i>estás doente</i> | /stas##doente/ | [es.taɪ.do.én.te] | ‘you are ill’ |
| <i>estás facendo</i> | /stas##faθendo/ | [es.taɪ.fa.θén.do] | ‘you are doing’ |
| <i>dous cintos</i> | /dows##θintos/ | [dowɪ.θín.tos] | ‘two belts’ |
- b. Alveolar sibilant + voiceless stop
- | | | | |
|--------------------|---------------|-----------------|------------------|
| <i>estás parvo</i> | /stas##parbo/ | [es.tas.pár.βo] | ‘you are stupid’ |
| <i>estás tolo</i> | /stas##tolo/ | [es.tas.tó.lo] | ‘you are mad’ |

Alveolar fricative rhotacism is also found in other Romance languages and dialects, such as Picard, Asturian Spanish, Andalusian Spanish, South-American Spanish, etc. The contexts where the process applies are the same as those described above, that is, systematically before a voiced consonant and more sporadically before a voiceless labiodental fricative.²⁹

3.2.2.2. Interim descriptive generalisation. The emerging generalisation for Sardinian and Galician is that a decreasing or flat sonority transition from the sibilant to the following consonant may be insufficient and may have to be augmented by increasing the sonority in the coda. Rhotacism is the selected strategy to achieve this (71a, 72a). Potentially rising sonority transitions are also improved via rhotacism (71a, 72a) (see Pons 2005a, b). One case escapes this generalisation in both languages, namely manner preservation when the sibilant is followed by a voiceless stop (71b, 72b). There is an additional exception to this generalisation in Sardinian: the application of regressive manner assimilation in homorganic sequences with a sonorant in second position (71c).

3.2.2.3. Analysis. Sardinian and Galician show a very similar behaviour to Majorcan Catalan as far as rhotacism is concerned. As Galician shows the same behaviour as Majorcan Catalan, the same ranking of the relevant faithfulness constraints is at play (see the ranking in 68b; in this case, however, a ranking with IDENT(sibilant) in between *DISTANCE +4, +3, +2, +1, 0, -1, -2 and *DISTANCE +4, +3, +2, +1, 0, -1, -2, -3, as the one proposed for Sardinian, would also do the job). Note, however, that the dental fricative [θ] also triggers rhotacism (72a); this is in fact the expected behaviour since this consonant, not being sibilant, is placed with labiodental fricatives in the sonority scale; see

29. For a comprehensive description of rhotacism in Romance languages, see Lorenzo (1975).

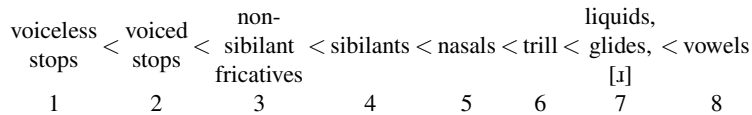
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64b). In Sardinian, the ranking of IDENT(sibilant) below *DISTANCE +4, +3, +2, +1, 0, -1, -2 and above *DISTANCE +4, +3, +2, +1, 0, -1, -2, -3 explains why rhotacism applies before all (non-coronal sonorant) consonants except voiceless stops (see ranking 73). The distribution between rhotacism and manner assimilation before a sonorant in Sardinian (see the data in 71a vs. the data in 71c) is determined by the crucial intervention of the constraint IDENT(place), since it prevents regressive manner assimilation when it would imply the loss of the place specification and ensures rhotacism in these cases (see the candidates in 73a). Otherwise, that is, when the place specification is not lost, regressive manner assimilation applies (see the candidates in 73b). The very same constraint is responsible for the selection of rhotacism and not gliding as a strategy to improve the syllabic contact. As in Majorcan Catalan (see Section 3.2.1.3), IDENT(cont) is especially relevant, since it blocks lateralisation, flapping and also regressive place assimilation when a non-continuant, non-sonorant, follows (see 73c). In Sardinian, on the other hand, a geminate sibilant is permitted (see 71b), because the constraint *GEMINATE SIBILANT is ranked below IDENT(sibilant) (see also Section 3.2.1.3).

(73) *Rhotacism in Sardinian*

	IDENT(place)	*DIST +4, +3, +2, +1	*DIST +4, +3, +2, +1, 0, -1, -2	IDENT(sib)	IDENT(cont)	*DIST +4, +3, +2, +1, 0, -1, -2, -3
a. /s##m/						
i. [z.m] (+1)		*!	*			*
ii. [ɹ.m] (-2)			*	*		*
iii. [m.m]	*!			*	*	
b. /s##n/						
i. [z.n] (+1)		*!				*
ii. [ɹ.n] (-2)			*!	*		*
iii. [n.n]				*	*	
c. /s##d/						
i. [z.d] (-1)			*!			*
ii. [ɹ.d] (-5)				*		*
iii. [d.d]				*	*!	

Cf. Assumed sonority scale



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3.2.3. *Languedocian Occitan*

3.2.3.1. *Data.* In Languedocian Occitan, a process of gliding of *s* applies when an alveolar fricative precedes a voiced obstruent, a voiceless labiodental fricative or a sonorant (74a). The process does not apply when the alveolar fricative precedes a voiceless stop (74b); in this context, an optional process of aspiration can apply (Patrick Sauzet, p.c.).³⁰

(74) *Heterosyllabic clusters with an alveolar sibilant followed by a consonant*

a.	Alveolar sibilant + voiced consonant or <i>f</i>		
	<i>las filhas</i>	/laz#fi.ʎoz/	[laj.fi.ʎos] ‘the daughters’
	<i>las femmas</i>	/laj##fennos/	[laj.fén.nos] ‘the women’
	<i>los buòus</i>	/luz#bjɔwz/	[luj.bjɔws] ‘the oxen’
	<i>bonis vins</i>	/bɔniz#binz/	[bɔnij.bíns] ‘good wines’
	<i>cos nud</i>	/kɔs#nyt/	[kɔj.nýt] ‘naked body’
	<i>es mòrt</i>	/es##mɔrt/	[ej.mórt] ‘(s/he) is dead’
b.	Alveolar fricative + voiceless consonant		
	<i>las claus</i>	/las#klaws/	[las.kláws] ‘the keys’
	<i>las pòrtas</i>	/las#pɔrtas/	[las.pór.tɔs] ‘the doors’
	<i>bonas</i>	/bɔnas#tawlas/	[bɔ.nos.táw.lɔs] ‘good tables’
	<i>taulas</i>		

3.2.3.2. *Interim descriptive generalisation.* The emerging generalisation for Languedocian Occitan is that a decreasing sonority value from the sibilant to the next consonant is not enough and it has to be augmented by increasing the sonority in the coda. Potentially rising sonority transitions are also avoided via gliding. The only case where gliding is not generated is before a voiceless stop (see Pons 2005a, b).

3.2.3.3. *Analysis.* The contexts for the application of gliding are the same as those for rhotacism in Majorcan Catalan, Galician and Sardinian. IDENT(sibilant), below *DISTANCE +4, +3, +2, +1, 0, -1, -2 and above *DISTANCE +4, +3, +2, +1, 0, -1, -2, -3 explains, again, why gliding applies before all consonants except voiceless stops. The fact that the process

30. In Majorcan Catalan, and less systematically in Minorcan Catalan, a process of gliding applies when a final prepalatal fricative is followed by a word starting with a consonant. The origin of this process might be the same as that which occurs in Occitan: a strategy to improve the syllable contact. For an autosegmental analysis of this process, see Mascaró (1986) and Palmada (1994a), and for an analysis of the process within OT terms, see Pons (2005c).

results in a glide and not in an approximant rhotic can be explained by the activity of a context-free markedness constraint penalising approximant rhotics (*[ɹ]), since in Languedocian Occitan these kinds of consonants are not documented (Rafèu Sichèl, pc.).

3.2.4. Summary and theoretical implications

3.2.4.1. Similarities and differences across languages and dialects. Typological effects. The patterns found in Majorcan Catalan, Sardinian, Galician and Languedocian Occitan are intriguingly similar. Indeed, rhotacism and gliding apply in the same contexts: before a voiced consonant or a voiceless labiodental fricative. As seen, the ranking *DISTANCE +4, +3, +2, +1, 0, -1, -2 (>>) IDENT(sibilant) >> *DISTANCE +4, +3, +2, +1, 0, -1, -2, -3 is responsible for the preservation of the alveolar sibilant before voiceless stops and for the change in manner of articulation of the sibilant before other consonants. This change in manner of articulation consists of increasing the sonority in the coda as much as possible, so that glides and liquids, with the higher sonority index (7) (see 64b), are the best available outcomes of the process. Among these consonants, the consonants which share most features with sibilants are the ones selected, that is, the approximant rhotic [ɹ], and the palatal glide [j]. As noted, IDENT(cont) blocks lateralisation and flapping in all varieties under study. Discrepancies across languages with respect to the consonant selected can be straightforwardly accounted for by the crucial intervention of various relevant constraints. IDENT(place) blocks gliding in Majorcan Catalan, Sardinian and Galician, and the context-free markedness constraint *[ɹ] prevents rhotacism in Languedocian Occitan. In Majorcan Catalan and Galician, IDENT(cont) is also responsible for blocking regressive manner assimilation as a strategy to satisfy *DISTANCE +4, +3, +2, +1, 0, -1, -2. In Sardinian, if a non-sonorant follows the sibilant, it is also IDENT(cont) that is responsible for blocking regressive manner assimilation; but, if a sonorant follows, IDENT(place) is the constraint which determines the triggering of rhotacism in heterorganic clusters and manner assimilation in homorganic clusters. Finally, it must be remembered that *DISTANCE +4, +3, +2, +1, outranking *DISTANCE +4, +3, +2, +1, 0, -1, -2, makes manner preservation impossible in all cases of intersyllabic distance greater than -2.

(75) *Constraint rankings for Majorcan Catalan, Galician, Sardinian and Languedocian Occitan (Simplified rankings)*

a. *Majorcan Catalan (& Galician)*

*DISTANCE +4, +3, +2, +1 >> IDENT(sib), *DISTANCE +4, +3, +2, +1, 0, -1, -2 >> *DISTANCE +4, +3, +2, +1, 0, -1, -2, -3 >> IDENT(place)

- b. *Sardinian*
 $\text{IDENT}(\text{place}), *DISTANCE +4, +3, +2, +1 \gg *DISTANCE +4, +3, +2, +1, 0, -1, -2 \gg \text{IDENT}(\text{sib}) \gg *DISTANCE +4, +3, +2, +1, 0, -1, -2, -3$
- c. *Occitan*
 $*DISTANCE +4, +3, +2, +1 \gg *[i] \gg *DISTANCE +4, +3, +2, +1, 0, -1, -2 \gg \text{IDENT}(\text{sib}) \gg *DISTANCE +4, +3, +2, +1, 0, -1, -2, -3 \gg \text{IDENT}(\text{place})$

3.2.4.2. Theoretical implications for SYLLABLE CONTACT. The theoretical consequences of these patterns are, like those related to regressive manner assimilation, especially relevant. The processes of rhotacism and gliding indicate that falling and flat sonority transitions are also susceptible to improvement: this fact supports the claim that SYLLABLE CONTACT is not a single constraint categorically banning rising sonority but a hierarchy of constraints targeting positive, flat or negative sonority distances across a syllable boundary. Indeed, in Majorcan Catalan, Sardinian, Occitan and Galician, negative sonority transitions of -3 or lower are permitted, but not of higher sonority (i.e., $-2, -1, 0, +1, +2$, etc.). Because just three (or four) strata are needed (see 76), the stringency version of the relational alignment hierarchy can account for it in a very simple way.

(76) *Permissible and impermissible sonority distances in Majorcan Catalan, Galician, Sardinian and Occitan* (specific language particularities are omitted here)

	Coda	Onset							
		8	7	6	5	4	3	2	1
		V	G/L	T	N	Sib	Fric	Vd St	VsSt
8	V	0	-1	-2	-3	-4	-5	-6	-7
7	G/L	+1	0	-1	-2	-3	-4	-5	-6
6	T	+2	+1	0	-1	-2	-3	-4	-5
5	N	+3	+2	+1	0	-1	-2	-3	-4
4	Sib	+4	+3	+2	+1	0	-1	-2	-3
3	Fric	+5	+4	+3	+2	+1	0	-1	-2
2	Vd St	+6	+5	+4	+3	+2	+1	0	-1
1	Vs St	+7	+6	+5	+4	+3	+2	+1	0

V: vowels, G/L: glides/liquids, T: trill, N: nasals, Sib: sibilants, F: fricatives, VdSt: voiced stops; VsSt: voiceless stops

■ Banned sonority distances for sibilants in the coda

3.2.4.3. Theoretical implications for the sonority scale.

Voiced and voiceless stops. The analysis of rhotacism and gliding, like the analysis of regressive manner assimilation, has important implications for the phonological organisation of voiced and voiceless stops in the sonority scale of Romance varieties. Indeed, the fact that rhotacism and gliding apply before sonorants, labiodental fricatives and voiced stops but not before voiceless stops seems to indicate that the sonority of voiceless stops is lower than the sonority of voiced stops, a pattern which is consistent with the phonetic results in Parker (2002, 2008). In fact, traditional studies in sonority have already detected this asymmetry. Blevins (1995), for instance, argues for the sonority scale shown in (77), which, according to the author, has not been counter-exemplified in the phonological and phonetic literature. The studies by Steriade (1982), Davis (1990), Alderete (1995) or Clements (2005) also support this division in the sonority scale.

- (77) Adapted from Blevins (1995: 211)
Voiceless stops < voiced stops

Labiodental fricatives and other non-sibilant fricatives. As seen in Section 3.2.1, among labiodental fricatives, voiceless fricatives are the ones least likely to trigger rhotacism, which suggests a lower sonority, similar to the voiceless stops, for these consonants. In fact, voiceless labiodental fricatives, like voiceless stops and unlike voiced fricatives and sibilants, can constitute, in most Romance languages, a complex onset with the following liquid (*plou* [plɔw] ‘it rains’, *flor* [flɔ] ‘flower’ vs. **slau* [sláu], **vlau* [láu]; see Bonet and Lloret 1998: 66–70). Another convincing argument in conferring similar sonority to voiceless stops and to voiceless labiodental fricatives is the fact that, together with stops and affricates, they trigger the insertion of an epenthetic vowel in Algherese Catalan when followed by a consonant (see an argumentation in this direction in Lloret and Jiménez [2005, 2006] 2007). One could argue for a sonority ordering like voiceless stops < voiceless labiodental fricatives < voiced stops < voiced labiodental fricatives < sibilants. As the results in Parker (2002, 2008) do not show differences in this respect, this ordering has been omitted from the present analysis and a less radical distribution that merely discriminates sibilants from non-sibilants, has been proposed (78):

- (78) Voiceless stops < voiced stops < non-sibilant fricatives < sibilants

Further research is needed, however, to shed light on the cross-linguistic special status of (voiceless) labiodental fricatives (see Lloret, Pons and Jiménez, in press).

3.2.4.4. Important remarks. The analysis in this section demands three remarks. The first one refers to the interpretation of the process of rhotacism in Sardinian. The process of rhotacism could simply be caused by a general prohibition in Sardinian against having an alveolar sibilant in the coda, an interpretation that would be consistent with the insertion of a vowel at the end of the phonological phrase (see all the examples in (71)). This would only be a plausible explanation as long as alveolar sibilants followed by a voiceless stop were not preserved (see (71b)) and as long as the insertion of this vowel did not apply after other consonants apart from alveolar sibilants (see *ándan*[a], *fínit*[i], *báttor*[o], etc., Pittau 1972: 17–18.). The second one refers to the behaviour of voiceless labiodental fricatives in Majorcan Catalan. As seen in Section 3.1.4.5, word-final labiodental fricatives also assimilate in manner of articulation with the following consonant, although less systematically than stops. The process, as said, applies not only to avoid rising syllabic transitions but also falling syllabic transitions (*agafpa* [gap.pá] ‘(I) take bread’). This behaviour is expected if it is assumed that, as sibilants, labiodental fricatives can not be involved in falling transitions equal or higher than -2 (*agafpa* *[gaf.pa]). IDENT(–son), then, should be ranked below *DISTANCE +4, +3, +2, +1, 0, -1 , -2 and above *DISTANCE +4, +3, +2, +1, 0, -1 , -2 , -3 . The consequences of this ranking for stops in coda position are irrelevant since they are never involved in syllabic transitions of lower sonority than 0, and they are never affected by the constraint penalising a flat sonority (0), because a sequence of two heterosyllabic stops is always resolved through a process of regressive place assimilation which gives as result a geminate stop, not sensitive, as seen in Section 3.1.4.5, to the *DISTANCE constraints.

4. Alternative analyses of the data and extensions of the proposal

4.1. Alternative analyses

In this section, we compare our proposal with two alternative formalizations and interpretations of regressive manner assimilation, rhotacism and gliding. A likewise syllabically driven one, based on the *Split Margin Hierarchy*, put forward by Baertsch (2002) and Baertsch and Davis (2003, 2005, 2007), and another one that regards the process as not being syllabically driven at all but phonetically grounded instead. (See also Section 3.2.4.4 for a rebuttal of an interpretation of rhotacism based on the prohibition of *s* in coda position.)

4.1.1. *The Split Margin Hierarchy.* Baertsch (2002) and Baertsch and Davis (2003, 2005, 2007) propose the *Split Margin Hierarchy*, in which SYLLABLE CONTACT is intrinsically connected to the independent preference for codas to

be as sonorous as possible and for onsets to be as unsonorous as possible. It is therefore based on the *Margin Harmony Scale* (79) and the subsequent *Margin Constraint Hierarchy* (80) proposed by Prince and Smolensky (1993 [2004]).

- (79) *Margin harmony scales* (Prince and Smolensky 1993 [2004]: 127–138)
- a. *Harmony scale for onsets*
 ONSET / voiceless stop > ONSET / voiceless fricative > ONSET / voiced stop > ONSET / voiced fricative > ONSET / nasal > ONSET / lateral > ONSET / rhotic > ONSET / glide
 - b. *Harmony scale for codas*
 CODA / glide > CODA / rhotic > CODA / lateral > CODA / nasal > CODA / voiced fricative > CODA / voiced stop > CODA / voiceless fricative > CODA / voiceless stop
- (80) *Margin Constraint Hierarchies* (Prince and Smolensky 1993 [2004]: 127–138)
- a. *Margin Constraint Hierarchy for onsets*
 * ONSET / glide >> * ONSET / rhotic >> * ONSET / lateral >> * ONSET / nasal >> * ONSET / voiced fricative >> * ONSET / voiced stop >> * ONSET / voiceless fricative >> * ONSET / voiceless stop
 - b. *Margin Constraint Hierarchy for codas*
 * CODA / voiceless stop >> *CODA / voiceless fricative >> *CODA / voiced stop >> *CODA / voiced fricative >> *CODA / nasal >> *CODA / lateral >> *CODA / rhotic >> *CODA / glide

The innovative element in this proposal is the addition to CON of a hierarchy of *local conjoined constraints* (81), those which regulate the sonority of the consonant in onset position (see (80a)) and those which regulate the sonority of the consonant(s) in coda position (see (80b)); and also the inclusion of the second member of the onset in each constraint. This hierarchy (see 81), in which M1 stands for the first element of an onset and M2 stands for the second element of a complex onset or for a coda, is responsible for both SYLLABLE CONTACT and onset sonority dispersion effects: a constraint like *M1 / glide & *M2 / voiceless stop, for instance, prohibits both a syllable contact with a voiceless stop followed by a glide, and a complex onset with a glide followed by a voiceless stop. Each of these conjoined constraints is predicted to apply within the domain of adjacent segments.

- (81) *Locally-conjoined constraint hierarchy*
 *M1 / glide & *M2 / voiceless stop]_{ADJSEG} >> *M1 / glide & *M2 / voiceless fricative]_{ADJSEG} >> *M1 / glide & *M2 / voiced stop]_{ADJSEG} >> *M1 / glide & *M2 / voiced fricative]_{ADJSEG} ...

Baertsch and Davis (2005) offer various arguments in support of this approach.

- (a) The first refers to the fact that a natural relation exists between the type of consonants permitted in a syllable contact and the type of consonants permitted in onset or coda position; for instance, languages like Lama do not allow an obstruent in coda position and also do not allow an obstruent in coda position in situations of syllable contact. It should be noted, however, that the relational hierarchy in Gouskova (2004) does not deny the existence of the margin hierarchy (and, thus, of a constraint such as *CODA / obstruent), so that the situations like the one described can also be accounted for by ranking the faithfulness constraints that protect obstruents below the *DISTANCE constraints and the constraint banning an obstruent in coda position (*CODA / obstruent). On the other hand, although these sorts of situations do exist, they cannot be considered a general pattern, and this is the case of the data dealt with in the present paper. In Section 3, especially in Section 3.1 and Section 3.2, we have seen that manner alternations of the coda consonant are *only* triggered when *followed* by specific consonants (cf. *cap mos* /kap##mɔs/ [kam.mós] ‘any bite’), but never *in isolation* (*cap* /kap/ [káp] ‘any’).
- (b) The second argument refers to the fact that there is a close connection between the consonants that appear across a syllable boundary and the two consonants that can appear in a complex onset; the consonants that appear in onset clusters are a subset of possible mirror-image clusters permitted in syllable contact. This is the case, for instance, of Campidanian Sardinian, where both a syllable contact constituted by a lateral followed by an obstruent and a complex onset composed of an obstruent followed by a lateral are forbidden; and that is why, according to the authors, the lateral in these sequences has undergone a diachronic process of rhotacism (e.g., ALBUS > *arba* **alba* ‘white’; PLUS > *prus* **plus* ‘more’). This is probably the most straightforward point of the proposal since the same constraint hierarchy answers for both syllable contact and onset sonority dispersion effects. At the same time, however, this argument is also the most uncertain, since in many languages there is not a direct correlation between the consonants permitted in a complex onset and the consonants permitted in a syllable contact. In Central Catalan, for instance, a complex onset of a stop followed by a nasal is banned and resolved via deletion (e.g., *pneumàtic* → [nəwmátik] ‘pneumatic’), but a syllable contact with the same consonants is allowed (e.g., *cap nas* → [kab.nás] ‘any nose’) (see Section 3.1.3). Usually, the constraints on sonority are more severe and frequent within syllables than across syllables, and this is not directly derived from Baertsch and Davis’ proposal. In fact, according to them, these situations must be accounted for by positing two locally conjoined constraints differing on the domain of application, so that the economy of the proposal is lost.

- (c) The third argument refers to the fact that some languages treat in different fashion heterosyllabic sequences with the same sonority distance but with different consonants: this is the case of Ponapean and Lama, where a sequence of two obstruents is banned whereas a sequence of two sonorants is not. This is not, of course, a real problem for the relational alignment approach, since pattern discrepancies that depend on the kind of consonants involved are accounted for by a different ranking of the faithfulness constraints advocating the preservation of certain features or by means of other independently motivated markedness constraints. See Section 3.1, for an analysis in this direction.

My major concern about this approach, related to this last point and also suggested by Gouskova (2004), has to do with the particular notion of *hierarchy* that it entails. Baertsch and Davis' approach takes as its starting point two fixed and unalterable universal hierarchies, one targeting the sonority of onsets and the other targeting the sonority of codas. The result of combining these two hierarchies into one is a *hybrid hierarchy*, with a fixed relation between constraints that target different distances but with an unfixed relation between constraints that target the same distances. This is because there are no criteria by which to calculate which constraint conjunction ends up being more or less marked – that is, ranked higher or lower – when the distance targeted by the conjunction is the same. In other words, must **M1/glide & *M2/lateral* (banning a sonority rise of +2) and **M1/rhotic & *M2/nasal* (also banning a sonority rise of +2) be ranked differently? **M1/glide & *M2/lateral* could be ranked higher than **M1/rhotic & *M2/nasal* because a lateral in the onset position is more marked than a nasal, but, inversely, **M1/rhotic & *M2/nasal* could be ranked higher because a rhotic in coda position is more marked than a glide. In fact, in Baertsch and Davis' approach, the constraints targeting the same distance are (freely) rankable to account for differences across languages and across types of segments (see c in this section).

Summing up, an important point that the relational alignment approach and the Split Margin Hierarchy have in common is the (almost always) fixed character of the proposed hierarchies, which confers on them an implicational character: if a language tolerates the structure targeted by a (locally-conjoined) constraint X, it will also tolerate the structure targeted by a (locally-conjoined) constraint ranked lower than X. An important point in which the two accounts differ is the way they treat syllable contacts with the same sonority distance: Gouskova's hierarchy makes no distinction between them, whereas Baertsch and Davis' can distinguish them or not. The (potential) degree of precision is thus superior in the local conjunction approach. In the following diagram, we summarize these formal discrepancies between the relational alignment approach and the local conjunction approach, both in a non-stringency and a stringency form.

(82) *Formal discrepancies between the different approaches to SYLLABLE CONTACT*

	(a) Relational alignment	(b) Local conjunction	(c) Relational alignment (stringency form)	(d) Local conjunction (stringency form)
Featural discrepancies	ignored	ignored or not	ignored	ignored or not
Distance discrepancies	not ignored	not ignored	ignored or not	ignored or not
Fixed character	yes	yes/no	no	no
	← <i>more restrictive</i>		→ <i>less restrictive</i>	
Precision	-	+		-

Whilst not denying the validity of the locally-conjoined constraint hierarchy approach to SYLLABLE CONTACT, in this paper we have proven that the relational alignment account is a good solution to cope with the complexity of the data analysed, as long as pattern discrepancies according to the type of segments involved can be accounted for with the crucial intervention of the relevant faithfulness constraints within the *DISTANCE hierarchy (see Section 3). As it has been shown, on the other hand, since the varieties analysed are “impassive” not only to the type of consonants involved but also to some distance distinctions in that these can be conflated to just *two*, *three* or *four* relevant *strata* (see, for instance, Section 3.1 and Section 3.2), the stringency version of the relational alignment approach has been proven to be an even cleaner solution.

4.1.2. *Phonetically grounded interpretations.*

4.1.2.1. Contrast effects? It is commonly accepted that the perception of consonants largely depends on the contrast (in manner, place, etc.) between adjacent segments. In Côté (2000, 2004), for instance, it is argued that cluster simplification is more prone to apply the more features the adjacent consonants have in common (i.e., the less contrast they exhibit), or, inversely, cluster simplification tends to be more strongly avoided when adjacent consonants have fewer features in common (i.e., the higher the contrast). This hypothesis can not be extended to account for regressive manner assimilation, since sequences with the same contrast behave differently depending on the syllabic position of

the consonants: whereas [m.p] is maintained, [p.m] is not, although the manner contrast is the same. Similarly to Côté, Steriade (2004) resorts to *place* syntagmatic contrast to explain the regressive manner assimilation patterns of Latin. In Latin, the heterosyllabic sequences [d.l], [n.l], [d.n] and [b.m] are resolved through regressive manner assimilation, whereas heterosyllabic sequences [g.l], [m.l], [d.m] and [b.n] are preserved. According to the author, the stop manner of articulation is preserved when it is sufficiently different from the following consonant and it is lost, due to specific stem-internal phonotactic constraints, when it is not. This interpretation is extensible to the behaviour of most Catalan dialects (and to Korean; see Davis and Shin 1998), where regressive manner assimilation is sensitive to the place similarity of the adjacent heterosyllabic consonants (but remember that it does not apply when the consonants of the cluster have a different place of articulation). However, it can not account for the behaviour of Majorcan and Minorcan Catalan or Languedocian Occitan, where regressive manner assimilation applies regardless of the place-similarity of the adjacent heterosyllabic consonants. As seen above, on the other hand, the simple activity of the universal hierarchy IDENT(labial), IDENT(dorsal) >> IDENT(coronal) is enough to account for the facts of Catalan and could be extended to the facts of Latin.

4.1.2.2. Is Syllable Contact phonetically grounded? It has often been claimed that if the laws and constraints regulating sonority distances (such as the SONORITY SEQUENCING PRINCIPLE, the SYLLABLE CONTACT LAW or the SONORITY DISPERSION PRINCIPLE) are just typologically motivated, they can not formally inspire typological patterns, because this ends up being a circular reasoning (Ohala 1990, 1992, Wright 2004), similar to that on which is grounded the sonority scale (see Section 2.2). This is the reason why Wright (2004) insinuates that the Syllable Contact Law might be “motivated by the optimisation of segments for *auditory advantages* and *recoverability in codas*: approximants > fricatives > nasals”. Yet, this is precisely what the SYLLABLE CONTACT hierarchy expresses and obtains in a formal way: the preference for increasing the sonority in the coda and for decreasing the sonority in the onset in order to guarantee the perception of the consonant in a weak structural position. The phonetic benefits of a pattern such as this one are twofold: (a) if the sonority in the coda consonant is raised, the perception of this consonant is more assured, as it would be in word final position; (b) if the sonority fall from the coda to the onset is raised, the perception of the consonant in the coda is even more assured due to the contrast established between the two consonants. Manner of articulation, contrarily to place of articulation (which depends on the acoustic cues of the flanking consonants), largely relies on the intrinsic cues of the involved consonant (see Wright 2004); in cases where there is a Syllable

Contact violation (i.e., 'p.m'), a competition between a consonant with strong internal cues in the onset position and a consonant with weak internal cues in the coda is established and it is resolved in favor of the former via regressive manner assimilation in that nothing (nor the internal cues or the syllabic position) assures the preception and preservation of the consonant; in cases where Syllable Contact is respected (i.e., 'm.p'), on the contrary, it is the syllabic position of the consonant with weak internal cues which prevents from progressive manner assimilation, despite of the intrinsic fragile nature of the consonant.

4.2. *Extensions of the proposal*

In this paper we have dealt with a reduced set of segmental processes which entail a change in the manner of articulation of the involved consonants. Our prediction, though, is that the analysis based on Syllable Contact as a relational hierarchy in a stringency form can be extended to superior set of phenomena, which also but not necessarily entail a change in manner of articulation, such as onset strengthening, word-internal epenthesis, strategy selection and allomorph selection in most Romance varieties, and many phonological processes across words, such as vowel epenthesis, consonant deletion, affricate simplification or gliding. (See Pons in preparation, for more details about some of these extensions.)

5. **Concluding remarks**

This paper has considered a set of apparently disparate and unrelated phenomena drawn from Romance languages that entail a manner alternation of the segments involved (i.e., regressive manner assimilation, rhotacism and gliding). We have confirmed that a common and well-recognised tendency lies behind these patterns: the cross-linguistic inclination to promote the sonority of the coda and to demote the sonority of the onset, namely the so-called Syllable Contact Law or the more recently coined SYLLABLE CONTACT constraint.

The existence of a correlation between these processes (especially regressive manner assimilation) and Syllable Contact has a longstanding reputation, having already been detected in the earliest studies devoted to this topic (see, for instance, Murray and Vennemann 1983 and Vennemann 1988). This paper, however, has provided significant empirical evidence that this law or its contextual markedness constraint equivalent cannot be regarded as a single instruction which categorically bans coda-onset clusters with rising sonority, but rather must be split into a universal hierarchy of constraints targeting all possible sonority distances (positive, flat and negative) between adjacent heterosyllabic segments, as originally suggested by Murray and Vennemann (1983)

and formally implemented within the OT machinery in Bat-El (1996) for the first time, and more recently in Gouskova (2001, 2002, 2004), in the form of a relational alignment hierarchy, and Baertsch and Davis (2003, 2005, 2007), in the form of a local conjunction hierarchy.

In this paper we have considered and discussed these two latter accounts of SYLLABLE CONTACT.

The local conjunction approach has been seen to have a wider range of applications than the relational alignment approach, but at the same time it involves a set of undesired empirical implications which do not fit with the data under analysis. The relational alignment approach, on the other hand, can be straightforwardly improved if it is formulated in a stringency form, along the lines of de Lacy (2002, 2004). Two main patterns have shown to be especially noteworthy in this respect.

When dealing with regressive manner assimilation in Majorcan and Minorcan Catalan, we have seen that rising sonority transitions are consistently avoided, although a certain degree of sonority rise is permitted, mainly when specific consonants (i.e., sibilants, nasals and trills) are located in the coda. This pattern undoubtedly corroborates the need for splitting SYLLABLE CONTACT into a hierarchy of constraints that target the permissible sonority distances across syllable boundaries, as advocated in Gouskova (2004), or, similarly, a hierarchy of constraints that target the permissible intersyllabic contacts according to their manner specification, as proposed in Baertsch and Davis (2003, 2005, 2007) and Baertsch (2002). Only thus can the effects of SYLLABLE CONTACT be discontinuously inhibited by the intervention of the faithfulness constraints that regulate featural changes of manner. Gouskova's approach to SYLLABLE CONTACT based on relational alignment appears to be a satisfactory mechanism to account for regressive manner assimilation in Majorcan and Minorcan Catalan, since the process is sensitive to the absolute distance between heterosyllabic segments, independently of the type of consonants located in coda and onset position. In other words, contacts with the same sonority distance make up a stratum, behave equally. Moreover, since the varieties analysed are "insensitive" not only to the type of consonants involved but also to certain distance distinctions in that these distance distinctions can be conflated to just *two or three* relevant *strata*, the stringency version of the relational alignment approach appears to be an even neater solution.

When dealing with rhotacism and gliding in Majorcan Catalan, Galician, Sardinian and Occitan, we have seen that not only potentially rising sonority syllabic transitions but also falling and flat sonority transitions are susceptible to improvement. Indeed, in all these varieties, when an alveolar sibilant is placed in the coda, negative sonority transitions of -3 or lower are permitted, but not of higher sonority, a circumstance which is avoided through the augmentation of the sonority of the coda via rhotacism or via gliding. This fact

supports the claim, yet again, that SYLLABLE CONTACT is not a single constraint categorically banning rising sonority but a hierarchy of constraints targeting positive and also flat and negative sonority distances across a syllable boundary. Again, as just *two or three* relevant *strata* are claimed to be needed to account for these facts, the stringency version of the relational alignment hierarchy can account for it in a very straightforward way.

This paper has also thrown new light on the ordering within the sonority scale of certain classes of sounds, namely liquids and obstruents, whose positions have traditionally been controversial. Along the lines of previous typological and phonetic studies, the facts related to regressive manner assimilation and onset trilling reinforce the assumption that, at least in most Romance varieties, trills have less sonority than other liquids, while by the same token liquids and glides show the same sonority. Also in line with previous typological and phonetic studies, the facts related to rhotacism and gliding reinforce the assumption that voiceless stops show a lower sonority than their voiced counterparts, while labiodental fricatives also show a lower sonority than sibilant fricatives.

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