It is all downhill from here: a typological study of the role of Syllable Contact in Romance languages*

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 & Vennemann (1983) and Vennemann (1988). This law has been adduced to explain certain diachronic changes (Hooper 1976, Murray & 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 & Mascaró 1997, Rose 2000, Gouskova 2001), consonant strengthening (Colina 1995, Shin 1997, Bonet & Mascaró 1997, Jiménez 1997, 1999, Davis & 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 & Shin 1999, the author 2003 [2006], Wheeler 2005).[1]

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. The processes under examination are the following: *a*) regressive manner assimilation in some varieties of Catalan and in Languedocian Occitan, *b*) onset strengthening and epenthesis in Catalan, *c*) alveolar fricative rhotacism in Majorcan Catalan, dialects of Sardinian and dialects of Galician, *d*) alveolar fricative gliding in Languedocian Occitan, *e*) strategy selection in word-initial consonant clusters which violate the minimum sonority distance constraints in Catalan, and, finally, *f*) allomorph selection in Catalan and Spanish.

The analysis of these processes, indeed, leads to some important theoretical implications. On the one hand, this paper provides strong empirical evidence that SYLLABLE CONTACT cannot be regarded as a single constraint which categorically bans coda-onset 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 & Vennemann (1983) and implemented within the OT machinery in Bat-El (1996), Gouskova (2001, 2002, 2004), Baertsch (2002) and Baertsch & Davis (2003, 2005, 2007). (See the author 2004a, 2005a.) In addition, two of the existing formal accounts of SYLLABLE CONTACT are considered and discussed, namely the relational alignment approach, developed by Gouskova, and the local conjunction approach, formulated by Baertsch & Davis; it is demonstrated that the first is powerful enough to account for the data under analysis, although it can be straightforwardly improved if it is formulated in a stringency form, along the lines of de Lacy (2002, 2004). In addition, the paper 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. Finally, in the light of recent experimental results on the sonority of sounds (Parker 2002, 2008), a novel notion of the sonority scale, different from traditional ones, is proposed and assumed thereafter throughout the paper.

This paper is organised as follows. Section 2 provides a critical overview and discussion of the role of Syllable Contact (§ 2.1) and the sonority scale (§ 2.2) in phonological theory with special reference to their implementation into OT. This section includes a justification of the theoretical framework adopted to account for the data considered in the paper, discusses the universal character of the sonority scale, and introduces a particular notion of the sonority scale built upon the results in Parker (2002, 2008). In section 3, the processes which entail a change in manner of articulation of

* ACKNOWLEDGMENTS. (All the references to the author's work are indicated as "the author (year)"; they do not appear in the references section.)

[1] 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.

the consonants involved 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. Section 4 concentrates on the phonetic grounds of Syllable Contact, and considers alternative reasons for the triggering of the processes based on perceptual optimisation in line with work by Hume (1998, 2000), Steriade (1999a, 1999b, 2001a,b 2004), and Wright (2004), among others, and, in the light of the patterns analysed, dismisses them. Section 5 introduces additional data (onset strengthening, epenthesis, allomorph and strategy selection in Catalan and Spanish) which provide definitive support for the hypothesis defended in the paper, and section 6 summarises its main findings.

2 Theoretical background and assumptions

2.1 Syllable Contact in phonological theory

The cross-linguistic avoidance of rising sonority across syllable boundaries was originally reported in the studies framed within (Generative) Natural Phonology (Hooper 1976, Murray & 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.)

(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	>	*Shwal.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	→	*va.rrà*	'(s/he) will be valid'	*ven+rà*	→	*ve.rrà*	'(s/he) will come'
dol+ rà	→	*do.rrà*	'(s/he) will feel pain'	*dol+ rà*	→	*dor.rà*	'(s/he) will feel pain'

d. Metathesis in some Spanish dialects (Vennemann 1988: 55)

ven+rá	→	*ver.ná*	'(s/he) will come'
pon+rá	→	*por.ná*	'(s/he) will put'

In Murray & 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 the one by Clements (1990: 520) (4).

(3) *Extended Syllable Contact Law* (Murray & 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*."

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 & 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 & Shin 1999, Rose 2000, and Holt 2004) understand SYLLABLE CONTACT as a single and categorical constraint, 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 sophistications 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).[2]

(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.<u>pe.r</u>es]	'know'
b.	/haracabra/	→	no epenthesis	[ha.ra.ca<u>b.r</u>a]	'the taste'

In Bat-El (1996), where blend formation in Modern Hebrew is accounted for, 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

[2] See a different interpretation of these data in Baertsch & Davis (2007).

slope across a syllable boundary (8b), in line with the formulation of the Syllable Contact Law found in Murray & 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. "σContSlope: 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, σContSlope 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, given the input /šxora, blondinit/ ('black *fem. sing.*, blond *fem. sing.*'), a blend such as [šxor<a##blon>.dinit] ('blond-dyed black *fem. sing.*'), in which the created contact 'r.d' shows a sonority fall of –3, appears to be more harmonic than a blend such as [šxo<ra##blo>n.dinit>], in which the created contact 'n.d' shows a sonority fall of –2, and certainly more harmonic than a blend such as [blondin.<it##šxo>ra], in which the created contact 'n.r' shows a sonority rise of +1.

A more sophisticated formalisation of Syllable Contact can be found in the work by Gouskova (2001, 2002, 2004), Baertsch & Davis (2003, 2005, 2007) and Baertsch (2002).

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 (9).

(9) *Syllable contact as a relational hierarchy* (Gouskova 2001, 2002, 2004)[3]

← *Rising sonority* →

*Dist +7 >> *Dist +6 >> *Dist +5 >> *Dist +4 >> *Dist +3 >> *Dist +2 >> *Dist +1 >>

Flat sonority

*Dist 0 >>

← *Falling sonority* →

*Dist –1 >> *Dist –2 >> *Dist –3 >> *Dist –4 >> *Dist –5 >> *Dist –6 >> *Dist –7

The hierarchy 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 & 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

[3] In Gouskova (2001, 2002, 2004), rising sonority transitions are represented by a positive value (*i.e.* '+'), while decreasing sonority transitions are represented by a negative value (*i.e.* '–'). In Clements's (1990) formulation, by contrast, '–' is used for rising sonority and '+' for decreasing sonority. Gouskova's notation is used throughout this paper.

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 & Davis 2003, 2005, 2007 and Baertsch 2002; see below). 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). The fact that combinations 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 across the consonants involved as well as differences across linguistic varieties. (See § 3 for an approximation in this direction.)

In order to implement the 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) (11). (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: glides > rhotics > laterals > nasals > voiced fricatives > voiced stops > voiceless fricatives > voiceless stops.)

(11) *Matrix of consonant contacts* (Clements 1990: 319)

	V	G	L	N	O	
V	V.V	V.G	V.L	V.N	V.O	↑ *more harmonic*
G	G.V	G.G	SV.L	SV.N	SV.O	
L	L.V	L.SV	L.L	L.N	L.O	
N	N.V	N.SV	N.L	N.N	N.O	
O	O.V	O.SV	O.L	O.N	O.O	*less harmonic*

less harmonic → *more harmonic*

(Assumed sonority scale: vowels > glides > liquids > nasals > obstruents)

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,–6]; 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,–6]; 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.

Another thorough and even more powerful proposal is that put forward by Baertsch (2002) and Baertsch & Davis (2003, 2005, 2007). The authors 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* (12) and the subsequent *Margin Constraint Hierarchy* (13) proposed by Prince & Smolensky (1993 [2004]).

(12) *Margin harmony scales* (Prince & 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

(13) *Margin Constraint Hierarchies* (Prince & 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*, those which regulate the sonority of the consonant in coda position (13a) and those which regulate the sonority of the consonant(s) in onset position (13b); and also the inclusion of the second member of the onset in each constraint. This hierarchy (see 14), 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.

(14) *Locally-conjoined constraint hierarchy*

*M1 / glide & *M2 / voiceless stop]$_{\text{ADJSEG}}$ >> *M1 / glide & *M2 / voiceless fricative]$_{\text{ADJSEG}}$ >> *M1 / glide & *M2 / voiced stop]$_{\text{ADJSEG}}$ >> *M1 / glide & *M2 / voiced fricative]$_{\text{ADJSEG}}$ …

Because of stringency, the conjoined constraints are supposed to be ranked above the unconjoined ones. Baertsch (2002) and, especially, Baertsch & Davis (2005) offer various arguments in support of this approach.

a) The first one 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 § 3, especially in § 3.1 and § 3.2, we will see that manner alternations of the coda consonant are *only* triggered when *followed* by specific consonants, but never *in isolation*.

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 (*e.g. pneumàtic* → [nəwmátik] 'pneumatic'), but a syllable contact with the same consonants is allowed (*e.g. cap nas* → [kab.nás] 'any nose') (see § 3.1.3 and § 5.3). Usually, the constraints on sonority are more severe and frequent within syllables than across syllables, and this is not directly derived from Baertsch & 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 § 3.1, for an analysis in this direction.

My major concern about this approach, related to this last point and also suggested by Gouskova, has to do with the particular notion of *hierarchy* that it entails. Baertsch & 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 be *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 & 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 both accounts 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 (16a), whereas Baertsch & Davis' can distinguish them or not (16b). The degree of precision is thus superior in the local conjunction approach (see 16).

In Gouskova's approach, *featural* discrepancies are ignored by the hierarchy, but *distance* discrepancies are not. 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 like these are explored in de Lacy (2002, 2004), who proposes a theory in which contiguous markedness constraints traditionally organised in fixed universal scales (*i.e.* the vowel sonority hierarchy) can be conflated in a stringency form which allows them to be *freely ranked* (since each constraint starts with the most marked element of the hierarchy and is thus enclosed within all constraints). Both the relational alignment and the locally-conjoined constraint hierarchy refer directly or indirectly to universal scales, and they can therefore be reformulated in a stringency form (see, for instance, 15, where the relational alignment hierarchy is presented in a stringency form), in such a way that some distance distinctions can be overlooked in a given language.

(15) *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

(16) *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

more restrictive ← → *less restrictive*

– ← *precision* → –
+

Whilst not denying the validity of the locally-conjoined constraint hierarchy approach to SYLLABLE CONTACT, in this paper it is proven that the relational alignment account is powerful enough 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 § 3). As will be 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 or three* relevant *strata* (see, for instance, § 3.1 and § 3.2), the stringency version of the relational alignment approach appears to be an even cleaner solution.

2.2 The sonority scale in phonological theory

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 and Ohala 1990, 1992, 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 conflations 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* and *gradient* approach to the sonority scale and who claim that any attempt to obtain a universal and categorical sonority hierarchy will inevitably fall into arbitrariness. They base this view on the following arguments. *a*) The specific phonetic properties of each sound and class of sounds can fluctuate from one language to another, even if the given label coincides. An eloquent example of this is the class of rhotic sounds, which covers a wide range of variants, each with its own particular articulatory and perceptual attributes (in Ladefoged & Maddieson 1996: 216, for instance, eight different rhotic sounds are identified). One may expect, consequently, a slightly different relative sonority in each case (see, in this respect, § 3.1.4.3). *b*) The specific phonetic features of each sound, and therefore of its relative sonority, can vary depending on the structural position that it occupies. This is the case, again, of rhotics, and also of laterals, whose particular articulatory and acoustic properties can differ significantly depending on their syllabic position, as several studies have noted (see, for Catalan, Recasens & Espinosa 2007a or Recasens 2005). *c*) The relative sonority of sounds can diverge depending on the phonetic context: Larson (1993), for instance, proposes a model in which sonority is considered to be not absolute, but rather the result of a mutual (bidirectional) excitation between adjacent segments (see Parker (2002) for discussion about this proposal). *d*) The relative sonority of sounds can oscillate depending on the physiological properties of the speakers (in Parker 2002, slight sound sonority differences are detected in males and females.).

It is also reasonable to think about different sonority distances between different pairs of segments; that is, unlike what is tacitly assumed in traditional approaches to the sonority scale, *e*) the sonority distance between each pair of categories does not necessarily have to be the same. By the same token, *f*) it is obvious that as languages do not share the same segment inventories, the relative sonority distances between sounds across languages may be expected to be different; and that *g*) languages can make a similar or a different phonological use of the same physical properties of speech sounds. It is worth mentioning here Selkirk's (1984: 121) observations: "…the values are purely relational: the distance between each niche in the hierarchy has the same value. It is not unlikely that this is the wrong approach, and that the sonority distances between segments of lesser sonority are smaller than those between segments of greater sonority, that is, that there are *significant discontinuities in the sonority hierarchy*.” In this line, in Wheeler (2005), a discontinuous sonority scale is advocated for.

Probably, the most comprehensive —and the least phonologically biased— study on sonority thus far is the one by Parker (2002, 2008). Parker explores the hypothesis that phonological sonority has concrete quantifiable physical correlates. He measures five potential acoustic and aerodynamic correlates of sonority for (Peruvian) Spanish and English: intensity, peak intraoral air pressure, first formant values, peak air flow, and total duration, and concludes that *intensity* is the most reliable correlate of phonological sonority while duration is the *weakest* one. These results are quite consistent with those of Ladefoged (1993), according to whom “The sonority of a sound is its *loudness* relative to that of other sounds with the same length, stress and pitch.”. The author compares the results of the application of these measurements to the sounds of Spanish with the typologically grounded scale of (17) and detects, as expected, a higher sonority in sonorants than in obstruents. But he also identifies some interesting reversals: *a*) in onset position, glides as a class have a lower sonority than the liquid /l/ and, less significantly, than the liquid /ɾ/; *b*) also in onset position, nasals as a class show a higher sonority than the trill; *c*) in coda position, nasals show a higher sonority than laterals (18).

(17) *Typologically grounded scale* (Parker 2002, 2008)
glides > rhotic approximants > flaps > laterals > trills > nasals > voices fricatives > voiced affricates > voiced stops > voiceless fricatives > voiceless affricates > voiceless stops

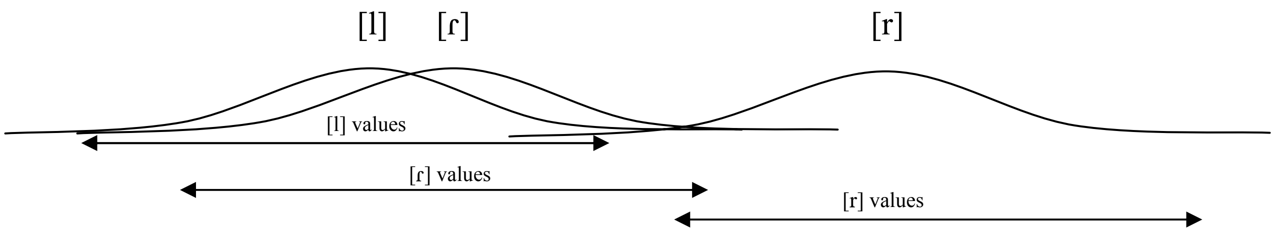
(18) *Some phonetic reversals* (Parker 2002, 2008)
laterals, flaps > glides nasals > trill nasals > laterals

In a very recent study (Jany, Gordon, Nash & Takara 2007), the intensity of sounds was calculated following Parker (2002, 2008) for four genetically diverse languages: Egyptian Arabic, Hindi, Mongolian and Malayalam. Interestingly enough, they found out that disputed sonority contrasts, such as the contrast between laterals and rhotics, follow language-specific patterns (19), whereas undisputed contrasts, such as sonorants > obstruents, are cross-linguistically consistent in their acoustic patterns (a very simplified account of the phonetic results of this study is exposed here).

(19) *Some cross-linguistic phonetic discrepancies* (Jany, Gordon, Nash & Takara 2007)
a. Egyptian Arabic: laterals > nasals > rhotics
b. Hindi: laterals > rhotics > nasals
c. Mongolian: rhotics > nasals > laterals
d. Malayalam: laterals > rhotics > nasals

With the aim of reaching a compromise between the phonetic and phonological facts while at the same time avoiding a circular interpretation of them, in this paper we suggest that the *phonetic* organisation of segments along the sonority scale and therefore the organisation of constraints related to sonority into hierarchies should have a non-discrete, dense and gradient nature, in line with the work by Boersma & Hayes (2001). This proposal could be adapted to the organisation of segments in the sonority scale in such a way that each specific sound would cover a range of values in the sonority scale, 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. This would be the case, as illustrated in (20), of those segments that are cross-linguistically ambiguous as far as sonority is concerned, like liquids. This account, as expressed in (21), would allow one to make typological predictions about the cross-linguistic frequency of each hierarchy.

(20) *Gradient sonority scale*



(21) *Cross-linguistic frequency of each hierarchy* (according to 20)

1. [l] > [ɾ] > [r] (most likely), 2. [ɾ] > [l] > [r] (less likely), 3. [l] > [r] > [ɾ] (less likely)
4. [ɾ] > [r] > [l] (less likely), 5. [r] > [l] > [ɾ] (less likely), 6. [r] > [ɾ] > [l] (least likely)

This would be the formal answer to Parker's conclusions: "Most languages in fact conflate the scale in the sense that they do not systematically exploit all the intervals. This is because they either lack the respective phoneme(s) entirely, or else they collapse together two or more adjacent ranks and thus do not distinguish them in terms of their phonological processes." (Parker 2002: 240)

In the absence of a complete cross-linguistic study of the sonority values of all sounds, an accurate and realistic formalisation of this intuition is beyond the scope of this paper. However, 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. Overall, the present paper takes as its starting point a very general, idealised, schematic and uncontroversial sonority scale (22), and refines it as phonological evidence for it is found.

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

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

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 § 3.1 and § 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, stops assimilate in manner (and also in place) of articulation with the following consonant (23a), except when they are followed by a sibilant

[4] Majorcan and Minorcan are the dialects of Catalan spoken in the Balearic islands of Majorca and Minorca, situated in the Western Mediterranean (see the map 2 in the Appendix I). The Majorcan Catalan data are from Bibiloni (1993), Recasens ([1991] 1996), and Dols (1993), and have been checked with inquiries reported in the author (2004a). The Minorcan Catalan data are entirely from the author (2004a).

segment, in which case they undergo only regressive place assimilation.[5] The process results in a geminate, is not sensitive to the place of articulation of the consonants involved,[6] and has no exceptions. Sequences of two heterorganic stops are resolved through a process of regressive place assimilation (23b).[7]

(23) *Heterosyllabic clusters with a stop in coda position*[8]

a. Stop + non-sibilant consonant

cap fet	/kap##fet/	[kaf.fét]	'any fact'
cap mos	/kap##mɔs/	[kam.mɔ́s]	'any bite'
cap llit	/kap##ʎit/	[kaʎ.ʎít]	'any bed'
cap riu	/kap##ɾiw/	[kar.ríw]	'any river'[9]
cap iot	/kap##jɔt/	[kaj.jɔ́t]	'any yacht'

(Cf. *cap* /kap/ [káp] 'any'; *cap hora* /kap##ɔɾə/ [ka.pɔ́.ɾə] 'any hour')

b. Stop + heterorganic stop

pot caure	/pɔd##kawɾ/	[pɔk.káw.ɾə]	'(s/he) can fall down'
cap tros	/kap##tɾɔs/	[kat.tɾɔ́s]	'any piece'

Alveolar sibilants[10] assimilate in manner of articulation with the following lateral, rhotic or glide (24a) and undergo a process of manner dissimilation when followed by another sibilant (see footnote 5). In the other contexts, that is, before other obstruents and nasals, they are preserved (24b).

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[5] Manner assimilation does not apply when a stop is followed by a sibilant (*e.g. cap so* /kap##sɔn/ [kat͡.tsɔ́] 'any sound') because, in these dialects, a sequence of two adjacent sibilants is avoided via manner dissimilation (cf. *dos sons* /doz##sɔnz/ [dot͡.tsɔ́ns] 'two sounds') (see the author 2003b, 2004a,b; following Jiménez 1996, the resultant geminate character of the consonant is interpreted in these studies as a strategy to improve the syllable contact.) See Palmada (1994a,b), for an analysis of these data within autosegmental phonology, and the author (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 & Lloret (2002). In § 3.2.1.3, the interaction of this process of dissimilation and the processes considered in this paper (assimilation and rhotacism) are accounted for.

[6] Regressive manner assimilation in most Catalan dialects is limited to homorganic sequences of a stop followed by a lateral and a nasal; therefore, the place of articulation is relevant in this particular case (see § 3.1.3).

[7] All the examples in (23-26) involve function words, and, according to one reviewer, this could explain why manner assimilation applies. The morphological status of the involved words, however, is not decisive for the resolution of the cluster: assimilation applies no matter what the morphological category is (see, for instance: *llop negre* [ʎon.né.ɣɾə] 'black wolf'). Nor is the domain of application relevant for the resolution of these sequences: the very same patterns are found in prefixed forms, compounds and within words. The symbol '##' indicates a word boundary.

[8] Final labiodental fricatives also undergo regressive manner assimilation when followed by a consonant, although less systematically. These cases will be addressed in § 3.1.4.5 and in § 3.2.4.4.

[9] According to *Richness of the Base* (Prince & 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.* /ɾ/ 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 /ɾ/ 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 & Lloret 1998 and Wheeler 2005).

[10] Prepalatal sibilants followed by a consonant undergo a process of gliding, independently motivated, that affects these consonants in preconsonantal position (*e.g. mateix dia* /mateʃ##diə/ [mə.tej.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 the author (2004a, 2005b). The *s*, on the other hand, can undergo an optional process of rhotacism when followed by a nasal, a voiced obstruent or, more sporadically, when followed by a voiceless labiodental fricative. For a description and analysis of this process and the interaction of it with regressive manner assimilation, see § 3.2.1, especially § 3.2.1.3.

(24) *Heterosyllabic clusters with a sibilant in coda position*

a. Alveolar sibilant + lateral, rhotic, glide

dos llits	/doz##ʎitz/	[doʎ.ʎít͡s]	'two beds'
dos rius	/doz##ɾiwz/	[dor.ríws]	'two rivers'
dos iots	/doz##jɔtz/	[doj.jɔ́t͡s]	'two yachts'

b. Alveolar sibilant + stop, non-sibilant fricative, nasal

dos peus	/doz##pɛwz/	[dos.pɛ́ws]	'two feet'
dos fils	/doz##filz/	[dos.fíls]	'two threads'
dos nius	/doz##niwz/	[doz.níws]	'two nests'

(Cf. *dos* /doz/ [dós] 'two'; *dos anys* /doz##aɲz/ [do.zájns] 'two hours')

Nasal segments undergo manner (and place) assimilation when followed by a lateral or a glide (25a); otherwise, they maintain their manner specification (but not their place specification) (25b). The place of articulation of the nasal is irrelevant for the resolution of the process.[11]

(25) *Heterosyllabic clusters with a nasal in coda position*

a. Nasal + lateral, glide

un llum	/un#ʎum/	[uʎ.ʎúm]	'one light'[12]
un iot	/un#jɔt/	[uj.jɔ́t]	'one yacht'

b. Nasal + stop, fricative, rhotic

un peu	/un#pɛw/	[um.pɛ́w]	'one foot'
un foc	/un#fɔg/	[uɱ.fɔ́k]	'one fire'
un mos	/un#mɔs/	[um.mɔ́s]	'one bite'
un riu	/un#ɾiw/	[un.ríw]	'one river'

(Cf. *un* /un/ [un] 'one'; *un animal* /un#ənimal/ [ù.nə.ni.mál] 'one animal')

Except for some unproductive cases, lateral, rhotic and glide segments never undergo regressive manner assimilation (26).

(26) *Heterosyllabic clusters with a non-nasal sonorant in coda position*

a. Lateral + consonant

mal pas	/mal##pas/	[mal.pás]	'bad step'
mal ritme	/mal##ɾitm/	[mal.rím.mə]	'bad rhythm'
mal iot	/mal##jɔt/	[mal.jɔ́t]	'bad yacht'

b. Flap + consonant[13]

per poc	/pəɾ##pɔk/	[pəɾ.pɔ́k]	'just barely'

---

[11] Word-final palatal nasals, however, undergo an independent process of split when followed by a word initial consonant (*e.g. any passat* /aɲ##pasad/ [àjm.pə.sát] 'last year'). For an analysis of this process within autosegmental phonology, see Mascaró (1986b) and Palmada (1996), and for an analysis within OT, see the author (2005b).

[12] Recasens ([1991] 1996: 258) also reports a nasalised realisation of the lateral resulting from the process of regressive manner assimilation.

[13] The [ɾ] corresponding to the infinitive tense morph totally assimilates in manner of articulation with the following consonant when followed by a pronominal clitic (*comprar-me* /konpraɾ#m/ [komprəmmə́] 'to buy (for me)'; *comprar-te* /konpraɾ#t/ [komprəttə́] 'to buy (for you)', etc.). In Mascaró (2007), these cases are interpreted as instances of overassimilation and are accounted for by resorting to the allomorphy of the infinitive tense morph.

per mi	/pəɾ##mi/	[pəɾ.mî]	‘in my opinion’
per iots	/pəɾ##jɔtz/	[pəɾ.jɔ́t͡s]	‘for yachts’

c. Trill + consonant

corr poc	/koɾɾ##pɔk/	[kor.pɔ́k]	‘(I) don’t run much’
corr iardes	/koɾɾ##jardəz/	[kor.jár.ðəs]	‘(I) run yards’

d. Glide + consonant

mai pot	/maj##pɔd/	[maj.pɔ́t]	‘(s/he) never can’
mai riu	/maj##ɾiw/	[maj.ríw]	‘(s/he) never smiles’

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 (28a,b,c), whereas decreasing sonority transitions are maintained (28g,h,i). However, three exceptions arise to this generalisation: sibilant preservation in sibilant-nasal heterosyllabic clusters (*e.g. dos nius* /doz##niwz/ [doz.níws] ‘two nests’), nasal preservation in nasal-rhotic heterosyllabic clusters (*e.g. un riu* /un#ɾiw/ [un.ríw] ‘one river’), and liquid preservation in liquid-glide heterosyllabic clusters (*e.g. vol iogurts* /vɔl##juɣuɾz/ [vɔ̀l.ju.ɣúɾs] ‘(s/he) wants yogurts’) (see 28d,e,f).

(27) *Assumed sonority scale (to be refined)* (see 22)

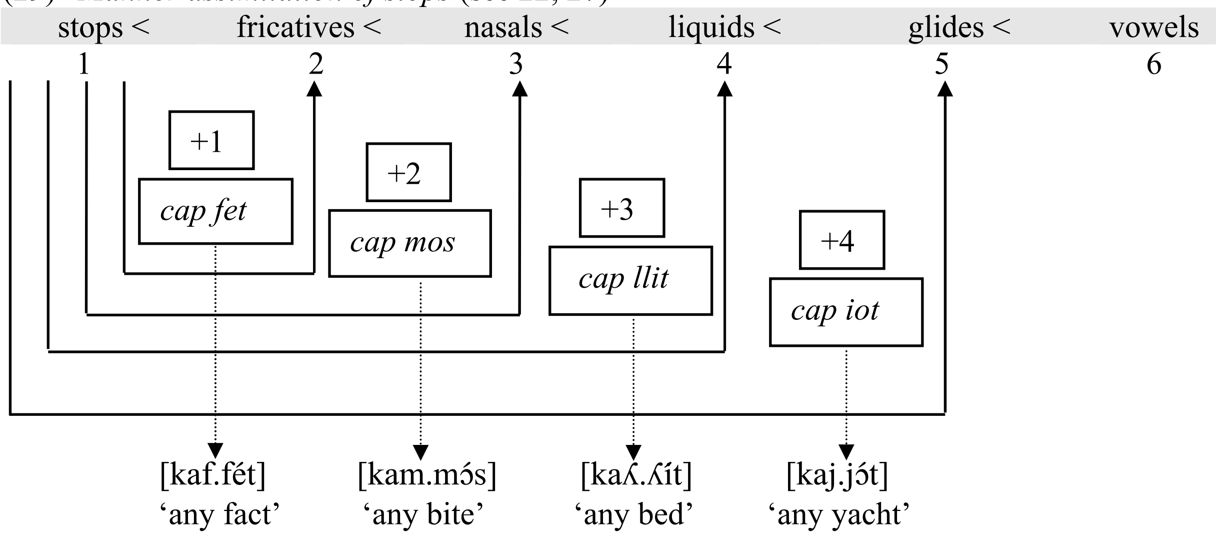
OBSTRUENTS		SONORANTS			
stops, affricates <	fricatives <	nasals <	liquids <	glides <	vowels
1	2	3	4	5	6

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

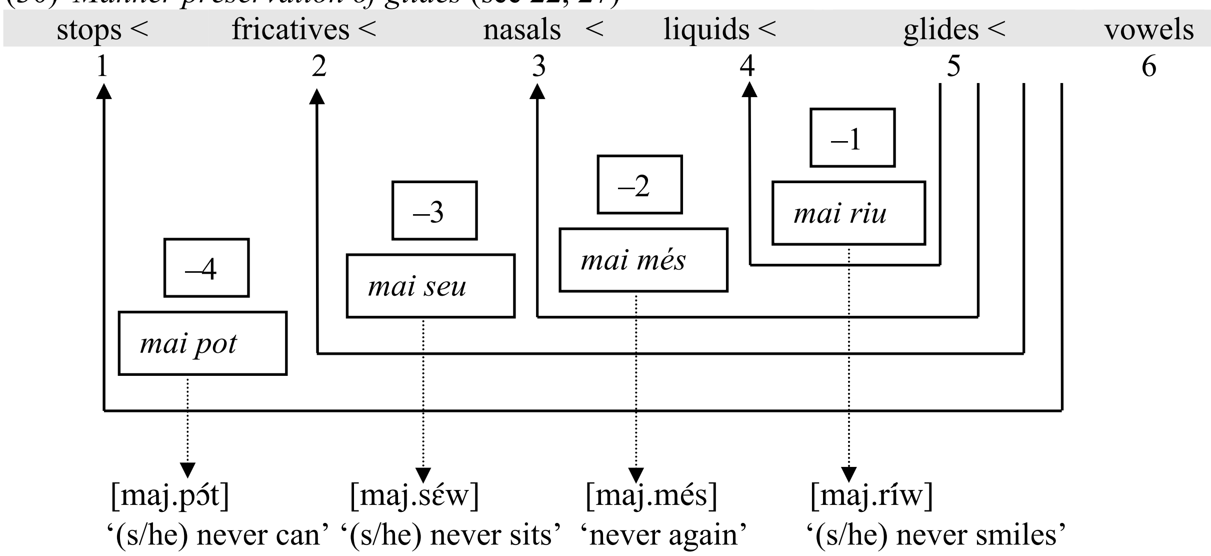
Potentially rising intersyllabic sonority	→	Regressive manner assimilation
a. stop + non-sibilant consonant b. alveolar sibilant + lateral, rhotic, glide c. nasal + lateral, glide		✓ ✓ ✓
d. alveolar sibilant + nasal e. nasal + rhotic f. liquid + glide		✗ ✗ ✗
Flat or falling intersyllabic sonority	→	Manner preservation
g. Stop + stop h. Nasal + nasal, stop, fricative i. Lateral, rhotic, glide + consonant		✓ ✓ ✓

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 the author [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 (29). The latter, by contrast, are always involved in falling sonority transitions and hence never undergo manner assimilation (30).

(29) *Manner assimilation of stops* (see 22, 27)



(30) *Manner preservation of glides* (see 22, 27)



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 (31).

(31) SYLLABLE CONTACT >> IDENT(Manner)

(32) SYLLABLE CONTACT (SYLLCONT): Assign one violation mark for each syllabic transition with sonority rise.

(33) IDENT(Manner) (IDENT(Man)): Assign one violation mark for every output segment that differs from its input correspondent in manner of articulation.[14]

As the tableau in (34a) exemplifies, a candidate with sonority rise (34*ai*) incurs in a violation of SYLLABLE CONTACT, and is therefore ruled out, whereas a candidate with a flat sonority resulting from a process of regressive manner assimilation (34*aii*), which respects SYLLABLE CONTACT, is

[14] This is a shorthand for the specific faithfulness constraints regulating featural changes according to their manner specification, which will be introduced later on (see 42, 43, 44). For the featural assumptions in the paper, see Appendix II.

selected as the optimal candidate. As shown in (34*bi*), on the other hand, a candidate with sonority fall is preferred to a candidate with regressive manner assimilation (34*bii*), since the latter unnecessarily involves an unfaithful mapping.

(34) *Manner assimilation in rising transitions vs. manner preservation in falling transitions*

a. *cap mos* /kap##mɔs/ [kam.mɔ́s]

/kap##mɔs/	SYLLCONT	IDENT(Man)
i. [kap.mɔ́s]	*!	
ii. ☞ [kam.mɔ́s]		*

b. *mai més* /maj##mes/ [maj.més]

/maj##mes/	SYLLCONT	IDENT(Man)
i. ☞ [maj.més]		
ii. [mam.més]		*!

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 (35a) and to the sequences of a nasal followed by a lateral or a glide (35b). 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 (36a,b); whenever SYLLABLE CONTACT is violated, the candidates with manner assimilation are the ones selected as optimal (37a,b).

(35) *Manner assimilation of sibilants and nasals in rising sonority clusters*

a. *dos llits*	/doz#ʎitz/	[doʎ.ʎí͡ts]	'two beds'	b. *un llum*	/un#ʎum/	[uʎ.ʎúm]	'one light'
dos rius	/doz#ɾiwz/	[dor.ríws]	'two rivers'	*un iot*	/un#jɔt/	[uj.jɔ́t]	'one yacht'
dos iots	/doz#jɔtz/	[doj.jɔ́͡ts]	'two yachts'				

(36) *Manner preservation in falling syllabic transitions*

a. *dos peus* /doz#pɛwz/ [dos.pɛ́ws] 'two feet'

/doz##pɛwz/	SYLLCONT	IDENT(Man)
i. ☞ [dos.pɛ́ws]		
ii. [dop.pɛ́ws]		*!

b. *un peu* /un#pɛw/ [um.pɛ́w] 'one foot'

/un#pɛw/	SYLLCONT	IDENT(Man)
i.☞ [um.pɛ́w]		
ii. [up.pɛ́w]		*!

(37) *Manner assimilation in potentially rising syllabic transitions*

a. *dos llits* /doz#ʎitz/ [doʎ.ʎí͡ts] 'two beds'

/doz##ʎitz/	SYLLCONT	IDENT(Man)
i. [doz.ʎí͡ts]	*!	
ii. ☞ [doʎ.ʎí͡ts]		*

b. *un llum* /un#ʎum/ [uʎ.ʎúm] 'one light'

/un#ʎum/	SYLLCONT	IDENT(Man)
i. [uɲ.ʎúm]	*!	
ii. ☞ [uʎ.ʎúm]		*

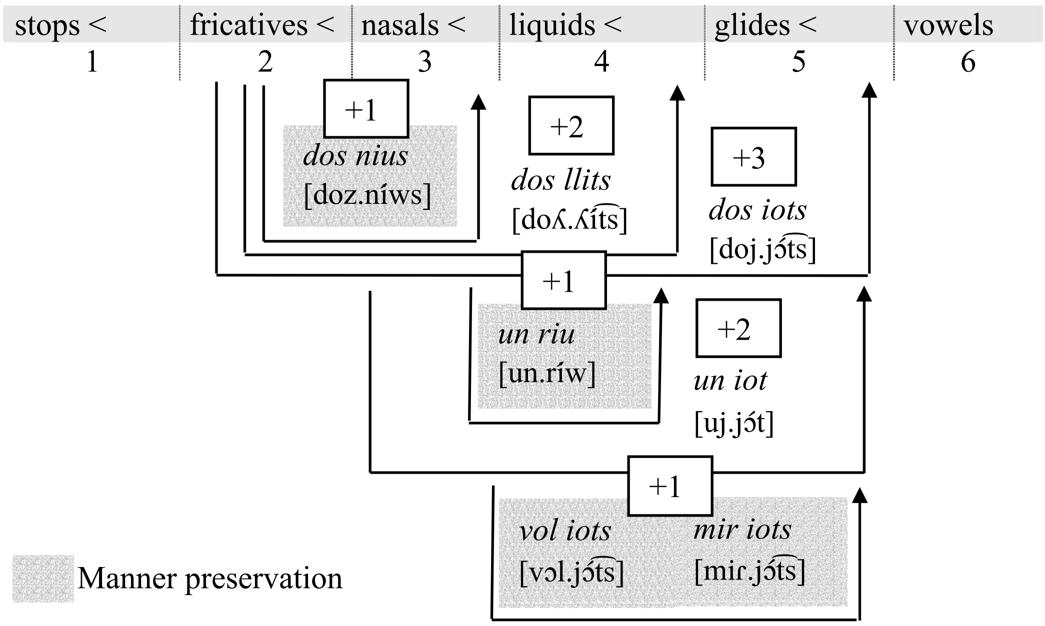
However, sibilants and nasals, as well as all other sonorants, exhibit a behaviour that does not conform to the interpretation based on SYLLABLE CONTACT. As pointed out in § 3.1.1.2, sibilants do not always assimilate in manner of articulation with the following consonant in rising sonority transitions: 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 (38a). The same occurs with nasals followed by rhotics (38b) or liquids followed by glides (38c,d,e). In all these cases, contrary to the formulated prediction, the manner specification of the consonant in the coda is preserved even though the intersyllabic sonority is rising.

(38) *Sibilant and sonorant preservation in rising sonority clusters*

a. *dos nius*	/doz#niwz/	[doz.níws]	‘two nests’
b. *un riu*	/un#ɾiw/	[un.ríw]	‘one river’
c. *vol iots*	/vɔl##jɔtz/	[vɔl.jɔ́t͡s]	‘two yachts’
d. *mir iots*	/miɾ##jɔtz/	[miɾ.jɔ́t͡s]	‘(I) look at yachts’
e. *corr iardes*	/koɾɾ##jaɾdəz/	[kor.jáɾ.ðəs]	‘(I) run yachts’

As illustrated in the figure in (39), the basic difference between the examples in (35) and the examples in (38) is that in the former the sonority distance exceeds one degree —except for the case of a nasal followed by a lateral—[15] while in the latter the sonority distance is just one degree.

(39) *Sibilant and sonorant preservation / assimilation (to be revised)* (see 22, 27)



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 the author [2003] 2006, 2004a, 2005a).[16] 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 (39), indeed, support the extension of the Syllable Contact Law intended in Murray & Vennemann (1983), according to which the suitability of an intersyllabic contact depends on the sonority distance between adjacent segments (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

[15] This case will be addressed below.

[16] 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.” (the author [2003] 2006, 2004a). (See Prieto 1998, for a similar analysis in generative terms applied to Galician rhotacism; see 85.). 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).

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.

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., are ranked above the relevant IDENT(Manner) faithfulness constraints (42, 43). 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 (40).

(40) *Ranking for Majorcan and Minorcan Catalan*

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

(41) *DIST ± *n*: Assign one violation mark for every syllabic contact with a sonority distance of ± *n*.

(42) IDENT(sibilant) [IDENT(sib)]: Assign one violation mark for every sibilant input segment whose output correspondent is not sibilant. (See McCarthy & Prince 1995)

(43) IDENT(nasal) [IDENT(nas)]: Assign one violation mark for every nasal input segment whose output correspondent is not nasal. (See McCarthy & Prince 1995)

(44) IDENT(–sonorant) [IDENT(–sont)]: Assign one violation mark for every [–sonorant] input segment whose output correspondent is not [–sonorant].[17] (See McCarthy & 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 (as they are not considered in the analysis, affricates are omitted in the following scale):

(45) *First refinement of the sonority scale (to be refined)* (see 22, 27)

stops <	fricatives <	nasals <	**trill <**	liquids <	glides <	vowels
				[r] [ɾ] [l] [ʎ]		
1	2	3	**4**	5	6	7

This refinement, which is strongly supported cross-linguistically and functionally (see § 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 (40),

[17] For the featural assumptions in this paper, see Appendix II.

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 (46).

(46) IDENT(rhotic) >> *DISTANCE +2

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

This would be the best solution if only the data concerning regressive manner assimilation were considered. However, as argued extensively in § 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.

(48) *Second refinement of the sonority scale* (see 22, 27, 45)

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

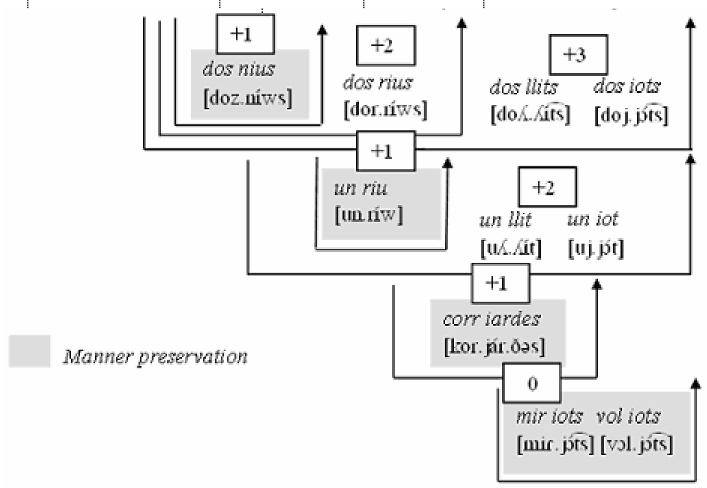
These two readjustments of the sonority scale determine the intersyllabic distances of (50), and insignificantly modify the sonority distances assumed so far for sibilants in coda position (see 50; *cf*. 39). Assuming the sonority scale in (48), the ranking established thus far (40, 49), indeed, makes 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 § 3.1.4.5.)

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

*DIST +4 >> *DIST +3 >> *DIST +2 >>	IDENT(sib), IDENT(nas), IDENT(lat)…	*DIST +1 >> IDENT(–sont) >> DIST 0

(50) *Intersyllabic permitted and banned distances*

stops <	fricatives <	nasals <	trills <	liquids & glides <	vowels
1	2	3	4	5	6



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 [–sont] consonants are vulnerable to this last constraint), the very same ranking shown in (49) can be reformulated in a stringency form, as shown in (51). 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.

(51) *Ranking for Majorcan and Minorcan Catalan (stringency form)*

*DIST +4, +3, +2 >> IDENT(sib), IDENT(nas), IDENT(lat) >> *DIST +4, +3, +2, +1 >> IDENT(–sont) >> *DIST +4, +3, +2, +1, 0

Summing up, the definitive 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 +4, +3, +2, +1 (equivalent to SYLLABLE CONTACT; see 31, 34), justifies this behaviour.

b) Sibilants and nasals only assimilate in manner with the following consonant when the syllable contact is higher than +1; as shown in (52) and (53), the ranking of IDENT(sib) and IDENT(nas) below *DIST +4, +3, +2 and above *DIST +4, +3, +2, +1 explains this behaviour: compare 52a, 52b *vs*. 52c; also compare 53a *vs*. 53b.

(52) *Manner assimilation vs. manner preservation of sibilants*

a. /doz##ɾiwz/	*DIST +4, +3, +2	IDENT(sib)	*DIST +4, +3, +2, +1
i. [doz.ɾíws] (+2)	*!		*
ii. ☞ [dor.ɾíws]		*	
b. /doz##jɔtz/	*DIST +4, +3, +2	IDENT(sib)	*DIST +4, +3, +2, +1
i. [doz.jɔ́t͡s] (+3)	*!		*
ii. ☞ [doj.jɔ́t͡s]		*	
c. /doz##niwz/	*DIST +4, +3, +2	IDENT(sib)	*DIST +4, +3, +2, +1
i. ☞ [doz.níws] (+1)			*
ii. [don.níws]		*!	

(53) *Manner assimilation vs. manner preservation of nasals*

a. /son##ʎitz/	*DIST +4, +3, +2	IDENT(nas)	*DIST +4, +3, +2, +1
i. [soɲ.ʎít͡s] (+2)	*!		*
ii. ☞ [soʎ.ʎít͡s]		*	
b. /son##ɾiwz/	*DIST +4, +3, +2	IDENT(nas)	*DIST +4, +3, +2, +1
i. ☞ [son.ɾíws] (+1)			*
ii. [sor.ɾíws]		*!	
iii. [son.ɾíws] (+2)	*!		

c) 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 is not exposed here). 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 (54).

(54) *Manner preservation of non-nasal sonorants*

a. /korr##jardəz/	IDENT(rhot)	*DIST +4, +3, +2, +1	*DIST +4, +3, +2, +1, 0
i. ☞ [kor.jár.ðəs] (–1)			
ii. [koj.jár.ðəs]	*!		
b. /vɔl##jɔtz/	IDENT(lat)	*DIST +4, +3, +2, +1	*DIST +4, +3, +2, +1, 0
i. ☞ [vɔl.jɔ́t͡s] (0)			*
ii. [vɔj.jɔ́t͡s]	*!		

In the preceding tableaux (52, 53, 54), additional featural changes and thus faithfulness constraints are involved. For the sake of simplicity, only the relevant ones (nasal, sibilant, lateral, rhotic) are included (see Appendix II for the featural assumptions in the paper).

3.1.2 *Languedocian Occitan*

3.1.2.1 *Data*. In Languedocian Occitan,[18] final stops and affricates assimilate in manner of articulation with the following consonant, except when followed by a sibilant fricative.[19] The process of regressive manner assimilation results in a geminate and is not sensitive to the place of articulation of the consonants involved (55). All remaining consonants never undergo regressive manner assimilation (56).[20]

(55) *Heterosyllabic clusters with an obstruent in coda position*

ròc mòl	/ɾɔk##mɔl/	[rɔm.mɔ́l]	'soft rock'	(cf. *ròc* [rɔ́k] 'rock')
tot l'argent	/tut##l#aɾd͡ʒent/	[tùl.laɾ.d͡ʒén]	'all the silver'	(cf. *tot* [tút] 'all')
estat normal	/estat##nuɾmal/	[es.tàn.nur.mál]	'normal state'	(cf. *estat* [estát] 'state')
dètz minutas	/dɛts##minytoz/	[dɛ̀m.mi.ný.tos]	'ten minutes'	(cf. *dètz* [dɛ́t͡s] 'ten')
mièg nud	/mjɛdʒ##nyt/	[mjɛn.nýt]	'half naked'	(cf. *mièg* [mjɛ́t͡ʃ] 'half')

(56) *Heterosyllabic clusters with a sonorant in coda position*

mòstran castèls	/mɔstɾon##kastɛlz/	[mɔ̀s.tɾoŋ.kas.tɛ́ls]	'(they) show castles'
mòstran sacs	/mɔstɾon##sakz/	[mɔ̀s.tɾon.sát͡s]	'(they) show bags'
mòstran rams	/mɔstɾon##ɾanz/	[mɔ̀s.tɾon.ráns]	'(they) show bunches'
chaval san	/tʃabal##san/	[t͡ʃa.βal.sá]	'healthy horse'
chaval rossèl	/tʃabal##rɔsɛl/	[t͡ʃa.βàl.ru.sɛ́l]	'palomino horse'

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 (57a,b). Falling or flat sonority transitions remain unaltered (57c) (see the author 2005a).

[18] Languedocian Occitan is the most conservative of Occitan dialects and is spoken in the south of France (in the region of Languedoc) (see the map 3 in Appendix I). The data for Occitan have been taken from Teulat (1972), Alibèrt (1976), Wheeler (1988), and Balaguer & Pojada (2005), and have been confirmed by Claudi Balaguer, Aitor Carrera, Anna Pineda, Patrick Sauzet and Rafèu Sichel.

[19] Regressive manner assimilation does not apply when a stop is followed by a sibilant fricative (*e.g. jòc sabent* /ʒɔg##sabent/ [ʒɔ̀.t͡sa.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.

[20] The domain of application is not relevant for the resolution of these sequences: the patterns are found in prefixed forms, compounds and within words (see, for instance, *tecnica* /tekniko/ ~ /tenniko/ [ten.ní.ko] 'technique').

(57) *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 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 (59). Sibilants in the coda are not considered here because they are subject to a process of gliding, as seen in § 3.2.3.1; for coherence with the ranking established for Majorcan and Minorcan Catalan, *DIST +4, +3, +2 has been added in the tableau of (59).

(58) *Assumed sonority scale* (see 22, 27, 45, 48)

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

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

a. /ɾɔk##mɔl/	IDENT(nas)	*DIST +4, +3, +2	*DIST +4, +3, +2, +1	IDENT(–sont)
i. [rɔg.mɔ́l] (+2)		*!	*	
ii. ☞ [rɔm.mɔ́l]				*
b. /mɔstɾon##ɾanz/				
i. ☞ [mɔ̀s.tɾon.ráns] (+1)			*	
ii. [mɔ̀s.tɾor.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 (60a).[21] The process also affects dental stops followed by a labial nasal (60b). Otherwise, the manner of articulation of the stop is maintained (60c).[22] All other consonants, on the other hand, never undergo regressive manner assimilation, even when involved in syllabic transitions with an increasing sonority (61).

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

a. Stop + homorganic nasal, lateral

cap mos	/kap##mɔs/	[kam.mɔ́s]	'any bite'
pot limitar	/pɔd##limitaɾ/	[pɔ̀l.li.mi.tá]	'(s/he) can limit'
pot nedar	/pɔd##nedaɾ/	[pɔ̀n.nə.ðá]	'(s/he) can swim'

[21] These data have been commonly described in the general studies devoted to Catalan phonology. See, for instance, Recasens ([1991] 1996) and Bonet & Lloret (1998).
[22] Latin and Korean show a similar behaviour, which will be discussed in § 4.2 (see, in this respect, Shin 1997, Davis & Shin 1999, and Steriade 2004).

b. Dental stop + labial nasal

pot mirar	/pɔd##miɾaɾ/	[pɔ̀m.mi.ɾá]	'(s/he) can look'

c. Stop + heterorganic nasal, lateral

cap nas	/kap##nas/	[kab.nás]	'any nose'
cap límit	/kap##limit/	[kab.lí.mit]	'any limit'

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

puf negre	/puf##nɛgɾ/	[puv.nɛ́.ɣɾə]	'black pouffe'
dos músics	/doz##muzikz/	[doz.mú.ziks]	'two musicians'
vol riure	/bɔl##ɾiwɾ/	[bɔl.ɾíw.ɾə]	'(s/he) wants to laugh'
bar ianqui	/baɾ##janki/	[bar.jáŋ.ki]	'American bar'
mai riu	/maj##ɾiw/	[maj.ɾíw]	'(s/he) never laughs'

3.1.3.2 *Interim descriptive generalisation*. In most Catalan dialects, any potentially increase in sonority across a syllable boundary is levelled out by total assimilation or regressive manner assimilation (62a,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 (62c). In contrast to what happens in Majorcan and Minorcan Catalan, the process of regressive manner assimilation is sensitive not to sonority distances established between heterosyllabic segments, but rather to the type of manner and place implicated (see the author 2004a, 2007).

(62) *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 (64). 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 the author 2004a, 2007).

(63) *Assumed sonority scale* (see 22, 27, 45, 48, 58)

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

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

/doz##niwz/	IDENT(sib)	IDENT(nas)	*DIST +4, +3, +2	*DIST +4, +3, +2, +1
i. ☞ [doz.níws] (+1)				*
ii. [don.níws]	*!			
/un##ʎit/				
i. ☞ [uɲ.ʎít] (+2)			*	*
ii. [uʎ.ʎít]		*!		

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 are ranked below IDENT(labial) (65a) and IDENT(dorsal) (65b) and above IDENT(cor) (65c) and IDENT(–sont) (see 66, 67 *vs.* 68) (see the author 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 (66). Note in (68) 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 (68*iii*), 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 (68*i*).

(65) *New constraints at play*

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

(66) *Manner assimilation in rising heterorganic transitions with a coronal stop in the coda*

/pɔd##miɾaɾ/	IDENT(lab)	*DIST +4, + 3, +2	IDENT(–sont)	IDENT(cor)
i. [pɔ̀d.mi.ɾá] (+2)		*!		
ii. ☞ [pɔ̀m.mi.ɾá]			*	*

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

a. /kap##mɔs/	IDENT(lab)	*DIST +4, + 3, +2	IDENT(–sont)	IDENT(cor)
i. [kab.mɔ́s] (+2)		*!		
ii. ☞ [kam.mɔ́s]			*	
b. /pɔd##limitaɾ/				
i. [pɔ̀d.li.mi.tá] (+4)		*!		
ii .☞ [pɔ̀l.li.mi.tá]			*	
iii. [pɔ̀n.li.mi.tá] (+2)		*!	*	

(68) *Manner preservation in rising heterorganic transitions with a stop in the coda*

/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 (§ 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 (§ 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 (§ 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, 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, the author 2004a: 405-406, and Lloret & Jiménez [2005, 2006] 2007: 8),[23] and which can be formalised through the universal ranking IDENT(+sonorant), IDENT(sibilant) >> IDENT(–sonorant), *discontinuously* mediated by the relevant markedness constraints triggering manner assimilation.

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 (69a); *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 69b).

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 (69c).

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

a. *Tendency to manner assimilation*

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

b. *Tendency to manner assimilation*

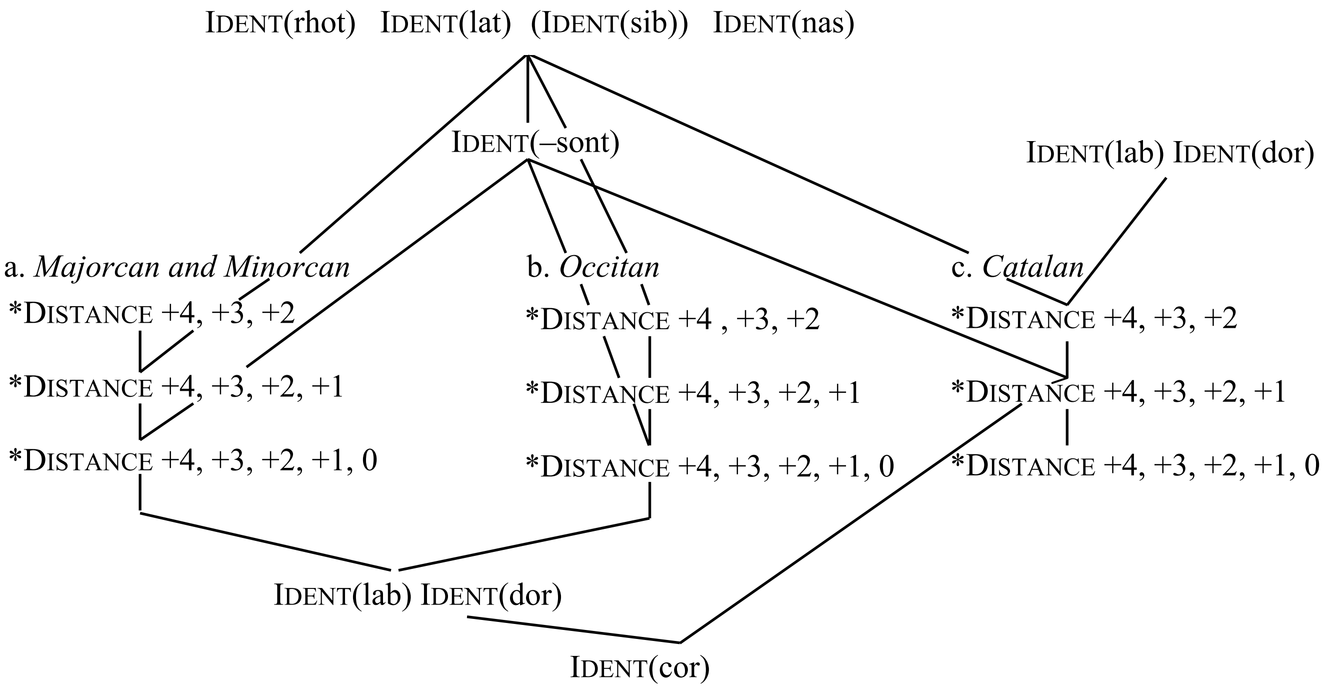
↑ Stops ↑ –sonorant → more
{Sibilants, Nasals}
Other sonorants +sonorant → less

[23] 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* [əs.pli.ká] ‘to explain’; *substitut* [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* [sɛ.ká.zes] ‘seven houses’; *tot bé* [to.βé] ‘all right’, see Jiménez 1997, 1999; the author 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* [pɔ̀s.mi.ɾá] ‘you can fall’; *caps quadrats* [kàs.kwa.ðráts] ‘squared heads’; see Jiménez 1997, 1999; the author 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 tá̯lt] ‘(I) arrive late’, *escrif sempre* [askɾif i sémpɾa] ‘I always write’, *desig feo* [dazit͡ʃ i féo] ‘bad desire’, see Lloret 2002, Lloret & Jiménez [2005, 2006] 2007). (For a comprehensive analysis of the process of vowel insertion in terms of perceptual prominence, along the lines of Steriade 1999, 2001a, see Lloret & Jiménez [2005, 2006] 2007.)

c. *Universal rankings at play*

a. IDENT(+sonorant), IDENT(sibilant) >> IDENT(–sonorant)[24]
b. IDENT(lab), IDENT(dor) >> IDENT(cor)
c. *DISTANCE +4 >> DISTANCE +3 >> DISTANCE +2 >> DISTANCE +1…

(70) *Rankings for regressive manner assimilation in Catalan and Languedocian Occitan*



(For expository reasons, IDENT(labial) and IDENT(dorsal) are repeated here. The position of these constraints in Majorcan Catalan and in Languedocian Occitan is, in fact, below *DISTANCE +4, +3, +2, +1, 0, –1, –2, –3, as will be seen in § 3.2.4.1; see, especially, 89).

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 & 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 71a, § 2.1) (see the author 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 71b; § 2.1).

[24] IDENT(+sonorant) here is a shorthand for IDENT(rhotic), IDENT(lateral), IDENT(nasal).

(71) *Permissible and impermissible contacts in Majorcan and Minorcan*

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

Coda \ Onset		6 V	5 G/L	4 T	3 N	2 F	1 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

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

Coda \ Onset		6 V	5 G/L	4 T	3 N	2 F	1 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

a. Banned sonority distance for stops
Banned sonority distance for the all other consonants

b. Banned sonority distance for stops
Banned sonority distance for the all other consonants

3.1.4.3 *Theoretical implications of the sonority scale*.

— *Trills*. 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 & Mascaró (1997), for instance, attribute the distribution of rhotics in Romance languages such as Spanish, Catalan and Portuguese (72) to sonority dispersion effects on onsets and codas, and take as their starting point a radical separation of trills and flaps in the sonority scale.

(72) *Distribution of rhotics in Romance* (after Bonet & Mascaró 1997: 104)

	Spanish	*Portuguese*	*Catalan*	0 OBSTRUENTS	TRILLS
a) word-initial position → trill	[rjézɣo]	[ʀíʃku]	[rísk]	1 NASALS	↓
b) onset position, after a C → trill	[onráðo]	[unʀáðu]	[unrát]	2 LATERALS	↓
c) second position of an onset → flap	[frío]	[fʀíu]	[frɛ́t]	3 GLIDES	FLAPS
d) coda position → flap ~ trill	[máɾ/r]	[máɾ/ʀ]	[már/ɾ]	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 & 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 ([ər]*ibar* → [r]*ibar* 'to arrive') but not a flap ([əɾ]*anya* → *[ɾ]*anya* '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* → *[ɾ]*ita*, *Mita*; *Jeroni* → *[ɾ]*oni*, *Noni*, first names in Catalan) (see Cabré 1993, for a complete picture of these truncation processes).

c) As will be shown in § 5.1, the process of trilling which affects the future and the conditional morph(eme)s in some varieties of Catalan (*vendrà* /bɛn+ɾa/ [bən̺.rá] '(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.

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 (/marlaŋe/ [malláŋe] '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.* *[ħiml] [ħimil] 'load'; *[ʔaml] [ʔamil] 'lice') than the sequences of a nasal followed by a trill, which are maintained.[25]

The sonority scale of (48), on the other hand, is consistent with the experimental results in Parker (2002, 2008) (see § 2.2). As far as intensity, pressure, F1, air flow and duration parameters in liquids are concerned, the author concludes: "/l/ patterns as more sonorous than the flap /ɾ/ 10 times, as equivalent 7 times, and as less sonorous in 3 cases. The flap /ɾ/ 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 /ɾ/. I therefore posit that these three natural classes are universally ranked in the order laterals > flaps > trills." (I am grateful to J.J.M for indicating me this point.) (See also Wheeler 2005).

(73) Parker (2002: 233)

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

— *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

[25] 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* [órlo] 'edge' *Carlo* [kárlo] 'Charles') (see, also, the examples in 2); this suggests, thus, a higher sonority for trills than for laterals, and advocates, as argued in § 2.2, a more flexible approximation to the sonority scale.

sonority scale (see 48). 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* /sentɾ/ [séntɾə] 'centre' cf. *centr-al* [sən̪tɾál] 'central'; *recte* /rɛkt/ [rɛ́ktə] 'agreement'; cf. *rect-itud* [rəktitút] 'rectitude'). When the intrasyllabic sonority is decreasing, epenthesis does not apply (*port* /pɔrt/ [pɔ́rt] 'harbour'). Unexpectedly, though, in Catalan there are underlying consonant sequences with a decreasing sonority profile according to the traditional sonority scale (see § 2.2) that show epenthesis (*aire* /ajɾ/ [áj.ɾə] 'air'; *retaule* /rətawl/ [rə.táw.lə] 'altarpiece'). This is why Wheeler (1987) argues that the sonority of glides is lower than the sonority of liquids (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.

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* /mateʃ##diə/ [mə.tej.ðíə] 'the same day'). 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* /kɔʎ##pətit/ [kɔ̀ʎ.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 homosyllabic consonants that possess the same sonority according to the scale proposed in (48) and therefore violate the Sonority Sequencing Principle (see the author 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 outranked 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 /ɾ/. 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 /ɾ/ > /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.mɔ́rt] 'any dead'); *b*) the insertion of an epenthetic vowel in between the consonants involved (*e.g.* /kap##mɔrt/ *[ka.pi.mɔ́rt] '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 & Prince 1993b;

Dols 2000, Bonet & Lloret 2002, and the author 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]).[26]

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 [ɹ.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 the author 2005a). (For the interaction between the process of regressive manner assimilation and the process of rhotacism in Majorcan Catalan, see § 3.2.1). Any geminate is thus invulnerable to the *DISTANCE constraints (see also § 3.2.1, especially 83, 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 the author 2004a, for a justification of this ranking and its position in the general hierarchy of Balearic Catalan). In § 3.1, sequences with a labiodental fricative have been omitted for expository reasons (see footnote 8): they are also resolved through a process of regressive manner assimilation, not only when involved in rising transitions (*e.g. agaf móres* [gam.mórəs] '(I) take blackberries'), but also in falling transitions (*e.g. agaf pomes* [gap.pó.məs] '(I) take apples'), especially in Colloquial Majorcan Catalan. The hierarchy *DISTANCE +4, +3, +2, +1 >> IDENT (–sont), adduced in § 3.1.1.3, accounts for the sequences with rising sonority. In the next section, the reasons for the triggering of the process in falling transitions will also be addressed (see § 3.2.4.4).

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 (74).[27] This

[26] The exact ranking of the constraints regulating these strategies and its justification can be found in the author (2004a).

[27] 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 the author (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]. According to Recasens (1991 [1996]), rhotacism is an idiolectal feature that could have been motivated by an erroneous perception of the s in implosive position. The author also adduces as a possible origin of the phenomenon the historical contact of this dialect with Occitan and Sardinian (see, in this respect, § 3.2.3 and § 3.2.2). Spectrographic

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 § 3.1.1 and footnote 5) and manner assimilation before a lateral, a rhotic or a glide (see also § 3.1.1). Before a voiceless stop, the process never applies (75).

(74) Alveolar sibilant + non-sibilant voiced obstruent, nasal or *f*

dos bous	/doz##bɔwz/	[doɹ.bɔ́ws]	'two oxen'
dos dits	/doz##ditz/	[doɹ.dí͡ts]	'two fingers'
dos gots	/doz##gɔtz/	[doɹ.gɔ́͡ts]	'two glasses'
dos vins	/doz##vinz/	[doɹ.víns]	'two wines'
dos mesos	/doz##mezz/	[doɹ.mé.zus]	'two months'
dos nius	/doz##niwz/	[doɹ.níws]	'two nests'
dos focs	/doz##fɔkz/	[dos.fɔ́ks]~[doɾ.fɔ́ks]~[doɹ.fɔ́ks]	'two fires'

(75) Alveolar sibilant + voiceless stop

dos pans	/doz##panz/	[dos.páns]	'two loaves of bread'
dos tocs	/doz##tɔkz/	[dos.tɔ́͡ts]	'two knocks'
dos cans	/doz##kanz/	[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. Rhotacism is the selected strategy to achieve this. Potentially rising sonority transitions are also improved via rhotacism. Three cases lie outside this generalisation: *a*) manner assimilation when the sibilant is followed by a lateral or a glide (76b); *b*) manner dissimilation, when the sibilant is followed by another sibilant (76c); and *c*) manner preservation when the sibilant is followed by a voiceless stop (76f).

(76) *Manner assimilation, dissimilation and preservation in Majorcan and Minorcan 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	
d. alveolar sibilant + labiodental fricative		✓	(also preservation)
e. alveolar sibilant + voiced obstruent		✓	
f. alveolar sibilant + voiceless stop		✗	Preservation

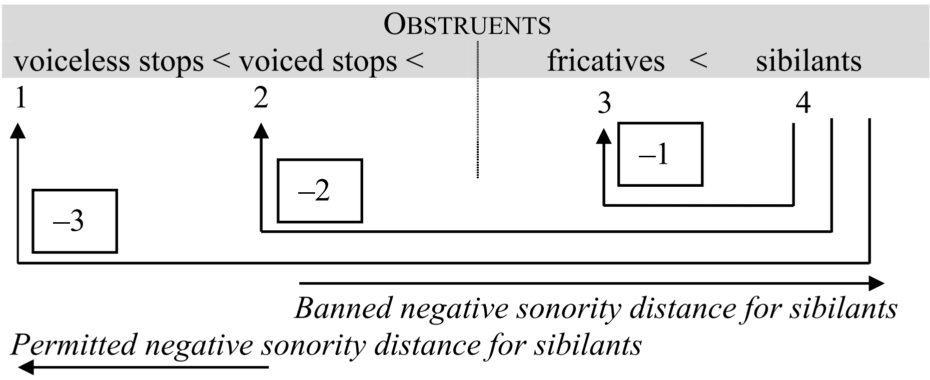
3.2.1.3. *Analysis*. Rhotacism applies not only in rising sonority transitions but also in flat and falling syllabic transitions. Provided that this pattern is analysed as a means to improve a syllable contact, it reinforces the hypothesis according to which SYLLABLE CONTACT is not a single constraint but rather a hierarchy of constraints banning not just positive but also flat and negative sonority distances across a syllable boundary (see the author 2004a, 2005a). In these varieties, potentially flat and negative distances with an alveolar sibilant in the coda are also banned and

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.

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 77b, for the position of the segment [ɹ] in the sonority scale; see also Parker 2002, 2008, and the author 2005a). 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 (see § 3.2.4.3 for a complete discussion of this new refinement of the sonority scale) (77a) (see also the author 2005a, 2007). As there is additional evidence that in Romance sibilants show a greater sonority than other fricatives (see also § 3.2.4.3), these consonants are also split into two slots in the sonority scale (77a). 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.[28] (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 § 3.2.4.4)

(77)

a. Third refinement of the sonority scale (see 22, 27, 45, 48, 58)



b. Incorporation of the rhotic approximant in the assumed sonority scale (see 22, 27, 45, 48, 58)

voicess stops <	voiced stops <	non-sibilant fricatives <	sibilants <	nasals <	trill <	liquids, glides, [ɹ] <	vowels
1	2	3	4	5	6	7	8

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 (79) and (80). This ranking rules out rhotacism when the negative sonority distance is –3 or lower (compare, for instance, 79*a vs.* 79*b-c*) and ensures rhotacism otherwise. Note, on the other hand, that IDENT(cont) (78)[29] is responsible for both the blocking of regressive manner assimilation in those cases in which a non-continuant consonant follows (see candidates *ii* in 79 and 80), as well as for the blocking of lateralisation (see candidates *iv* in 79 and 80) or the change to a flap (see candidates *v* in 79 and 80). (In the following tableaux, just the relevant segmental sequences are presented.)

[28] It could be interpreted that rhotacism does not apply before a voiceless stop as an effect of the contextual markedness constraint AGREE(voice) (the author 2004a). This analysis, however, cannot account for sequences of an alveolar sibilant followed by a voiceless labiodental fricative (see the author 2005a). Nonetheless, it should be noted that precisely rhotacism is not as systematic before a voiceless labiodental fricative as before a voiced stop.
[29] For the featural assumptions adopted in this paper, see Appendix II.

(78) a. IDENT(continuant): Assign one violation mark for every continuant input segment whose output correspondent is not continuant.[30] (See McCarthy & Prince 1995)
b. *GEMINATE NASAL: Assign one violation mark for every sequence of two adjacent nasals.

(79) *Preservation* vs. *rhotacism* vs. *manner assimilation in potentially falling and flat transitions*

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

(80) *Preservation* vs. *rhotacism* vs. *manner assimilation in potentially rising transitions*

a. /sn/ [ɹ.n]	*DIST +4, +3, +2, +1	*DIST +4, +3, +2, +1, 0, –1, –2	IDENT (sib)	IDENT (cont)	*GEM NASAL	*DIST +4, +3, +2, +1, 0, –1, –2, –3
i. [z.n] (+1)	*!	*				*
ii. [n.n]			*	*	*!	
☞ iii. [ɹ.n] (–2)		*	*			*
iv. [l.n] (–2)		*	*	*!		*
v. [ɾ.n] (–2)		*	*	*!		
b. /sl/ [l.l]						
i. [z.l] (+3)	*!	*				*
☞ ii. [l.l]			*	*		
iii. [ɹ.l] (0)		*	*			*!
iv. [ɾ.l] (0)		*	*	*!		*

[30] Following Mascaró (1978), it is assumed that the flap is [–continuant], and following Bonet & Lloret (1998), it is assumed that laterals are specified as [–continuant]. Also labiodental fricatives are assumed to be [–continuant], a specfication 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 & Lloret 1998). (See also § 3.2.4.3). Following Lloret 1992 and Bonet & Lloret 1998, affricates are assumed to be specified as [± continuant].

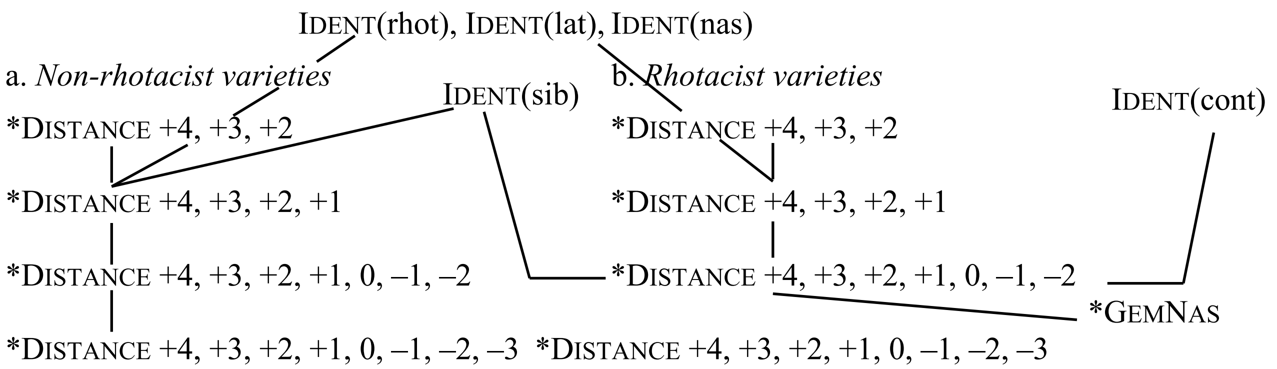
c. /sr/ [r.r]						
i. [z.r] (+2)	*!	*				*
☞ ii. [r.r]			*			
iii. [ɹ.r] (–1)		*	*	*!		*
iv. [l.r] (–1)		*	*!			*
v. [ɾ.r] (–1)		*	*!			*

(In the case of unranked constraints, the exclamation mark is located at the last unranked constraint, in order to formally reproduce the ambiguity about which constraint is responsible to discard the candidate.)

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 other constraints with this strategy. The ranking *DISTANCE +4, +3, +2, +1 >> *DISTANCE +4, +3, +2, +1, 0, –1, –2 is crucial, as seen in (80a*i*,b*i*,c*i*), to discard candidates with manner preservation in potentially rising transitions. Finally, for the sequence /sn/, regressive manner assimilation is not possible due to the constraint *GEMINATE NASAL, strategically ranked below *DISTANCE +4, +3, +2, +1, 0, –1, –2, IDENT(sib), IDENT(cont).

The basic difference between rhotacist and non-rhotacist varieties (see § 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 (81a), whereas, in rhotacist varieties, IDENT(sibilant) is located at the same level as *DISTANCE +4, +3, +2, +1, 0, –1, –2 (81b).

(81) *Constraint ranking for rhotacist and non-rhotacist varieties of Majorcan Catalan*[31]



As pointed out in § 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 (see also footnote 5; for a comprehensive analysis of this process within OT, see the author 2004a: 226-296; the author 2004b, the author 2007: 169-238; for relevant discussion about the formation and lengthening of affricates in terms of syllable contact, see Jiménez 1996, and Wheeler 2005). This is a process completely unrelated to rhotacism and regressive manner assimilation, and it can be attributed to the constraint *GEMINATE SIBILANT (82a) (as defined in 82a, 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* → [kat͡.t͡sɔ́]; *[kassɔ́]; see also § 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, the author 2004a: 227, Wheeler 2005: 15-

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

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 ([t͡tts]) does not violate the *DISTANCE constraints (see § 3.1.4.5), whereas [ɹ] does (compare, in this respect, candidates 83*aiii* and 83*av*). The actual candidate with a geminate affricate (83*aiii*) is preferred to a candidate with just dissimilation of the first consonant (83*aii*) or to a candidate with dissimilation and affrication of the second sibilant (83*aiv*), due to the unranked constraints *DIST +4, +3, +2, +1, 0, –1, –2, IDENT(sibilant), IDENT(continuant) (see footnote 30, for the featural assumptions for affricates). A candidate not considered in this tableau is that with an affricate syllabified in onset position (*[ka.t͡sɔ́]). 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; see 77b and 22, in which it is shown that affricates are placed at the same 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 (83b) the ranking adduced for rhotacism is presented. A candidate not considered in (83b), [d͡dz$_{1,2}$], homologous to the actual candidate resultant from the process of dissimilation (83a*iii*), would be discarded by the positional faithfulness constraint IDENTONSET(cont) (82b).

(82) *New constraints at play*

a. *GEMINATE SIBILANT: Assign one violation mark for each sequence of two identical adjacent fricative sibilants (see Bonet & Lloret 2002; the author 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)

(83) *Interaction between manner dissimilation and rhotacism*

a. /s$_1$s$_2$/ [t͡.ts]	GEMINATE SIBILANT	*DIST +4, +3, +2, +1, 0, –1, –2	IDENT (sib)	IDENT (cont)	*DIST +4, +3, +2, +1, 0, –1, –2, –3
i. [s$_1$.s$_2$]	*!				
ii. [t$_1$.s$_2$] (+2)		*	*	*!	*
☞ iii. [t͡.ts$_{1,2}$]					
iv. [t$_1$.t͡s$_2$]		*	*	*!	*
v. [ɹ$_1$.s$_2$] (–3)			*		*!
b. /s$_1$d$_2$/ [ɹ.d]	GEMINATE SIBILANT	*DIST +4, +3, +2, +1, 0, –1, –2	IDENT (sib)	IDENT (cont)	*DIST +4, +3, +2, +1, 0, –1, –2, –3
i. [z$_1$.d$_2$] (–2)		*			*
ii. [d$_1$.d$_2$]			*	*!	
☞ iii. [ɹ$_1$.d$_2$] (–5)			*		
iv. [l$_1$.d$_2$] (–5)			*	*!	
v. [ɾ$_1$.d$_2$] (–5)			*	*!	
vi. [d$_1$.d͡z$_2$] (0)			*	*!	

(To avoid ambiguity, in these tableaux, in which there are candidates with fusion, I use, following Bonet & Lloret 2002, the author 2004a, the author 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,[32] 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 (84a). This process can also be triggered when the *s* precedes a voiceless labiodental fricative ([f]), but not when followed by any other voiceless obstruent (84b). The result of the process is a rhotic approximant, as well.[33] When the *s* is followed by an alveolar nasal, an alveolar lateral or an alveolar rhotic, a process of regressive manner assimilation is triggered (84c).[34]

(84) *Heterosyllabic cluster with an alveolar sibilant followed by a consonant*

a. Alveolar sibilant + voiced consonant (except for alveolar sonorant; see 84c) and *f*

tres boes	/trɛs##bɔɛs/	[trɛɹ.bɔ́.ɛs]~[trɛɹ.bɔ́.ɛ.zɛ][35]	'three oxen'
tres domos	/trɛs##dɔmɔs/	[trɛɹ.dɔ́.mɔs]~[trɛɹ.dɔ́.mɔ.zɔ]	'three houses'
tres gattos	/trɛs##gattɔs/	[trɛɹ.gát.tɔs]~[trɛɹ.gát.tɔ.zɔ]	'three cats'
tres manos	/trɛs##manɔs/	[trɛɹ.má.nɔs]~[trɛɹ.má.nɔ.zɔ]	'three hands'
tres yannas	/trɛs##jannas/	[trɛɹ.ján.nas]~[trɛɹ.ján.na.za]	'three doors'
tres ziros	/trɛs##ziɾɔs/	[trɛɹ.d͡zí.ɾɔs]~[trɛɹ.d͡zí.ɾɔ.zɔ]	'three turns'
tres tzeccos	/trɛs##zɛkɔs/	[trɛɹ.d͡zɛ́k.kɔs]~[trɛɹ.d͡zɛ́k.kɔ.zɔ]	'three blinds'
tres zentes	/trɛs##zɛntɛs/	[trɛɹ.d͡zɛ́n.tɛs]~[trɛɹ.d͡zɛ́n.tɛ.zɛ]	'three people'
tres fizos	/trɛs##fizɔs/	[trɛɹ.fí.d͡zɔs]~[trɛɹ.fí.d͡zɔ.zɔ]	'three sons'

b. Alveolar sibilant + voiceless obstruent (except for labiodental fricative; see 84a)

tres panes	/trɛs##panɛs/	[trɛs.pá.nɛs]~[trɛs.pá.nɛ.zɛ]	'three loaves of bread'
tres táulas	/trɛs##tawlas/	[trɛs.táw.las]~[trɛs.táw.la.za]	'three tables'
tres canes	/trɛs##kanɛs/	[trɛs.ká.nɛs]~[trɛs.ká.nɛ.zɛ]	'three dogs'
tres santos	/trɛs##santɔs/	[trɛs.sán.tɔs]~[trɛs.sán.tɔ.zɔ]	'three saints'
tres sorres	/trɛs##sorɛs/	[trɛs.sɔ́r.rɛs]~[trɛs.sɔ́r.rɛ.zɛ]	'three sisters'

c. Alveolar sibilant + alveolar sonorant

tres nuces	/trɛs##nukɛs/	[trɛn.nú.kɛs]~[trɛn.nú.kɛ.zɛ]	'three nuts'
tres litros	/trɛs##litrɔs/	[trɛl.lít.trɔs]~[trɛl.lít.trɔ.zɔ]	'three litres'
tres rosas	/trɛs##rɔsas/	[trɛr.rɔ́.zas]~[trɛr.rɔ́.za.za]	'three roses'

[32] Sardo-Nuorese is the dialect of Sardinian spoken in the province of Nuoro, situated in the north-east of Sardinia. See Map 4 in Appendix I. 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 (84a) can undergo a process of lenition (cf. [trɛɹ.βɔ́.ɛs]). These alternative realisations are not inconsistent, however, with the analysis presented here.

[33] The same patterns are found in prefixed forms and compounds (*e.g. disgrássia* /dis##grasja/ [dir.grás.sja] 'bad luck' *vs. dispiákere* /dis##pjakerɛ/ [dis.pja.kɛ́.ɾɛ] '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.

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

[35] A final vowel which copies the quality of the preceding vowel is inserted in words ending in an alveolar fricative. See § 3.2.3.4 for a discussion of the eventual implications of this process.

In Galician, similarly, a process of rhotacism applies before a voiced consonant and before a non-sibilant fricative (85a). Before a voiceless stop, the *s* is maintained (85b).[36]

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

a. Alveolar sibilant + voiced consonant, non-sibilant fricative

estás mal	/stas##mal/	[es.taɹ.mál]	'you feel bad'
estás doente	/stas##doente/	[es.taɹ.do.én.te]	'you are ill'
estás facendo	/stas##faθendo/	[es.taɹ.fa.θén.do]	'you are doing'
dous cintos	/dows##θintos/	[dowɹ.θín.tos]	'two belts'

b. Alveolar sibilant + voiceless stop

estás parvo	/stas##paɾbo/	[es.tas.páɾ.βo]	'you are stupid'
estás tolo	/stas##tolo/	[es.tas.tɔ́.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.[37]

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 may be insufficient and may have to be augmented by increasing the sonority in the coda. Rhotacism is the selected strategy to achieve this. Potentially rising sonority transitions are also improved via rhotacism (see the author 2005a). One case escapes this generalisation in both languages, namely manner preservation when the sibilant is followed by a voiceless stop. 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.

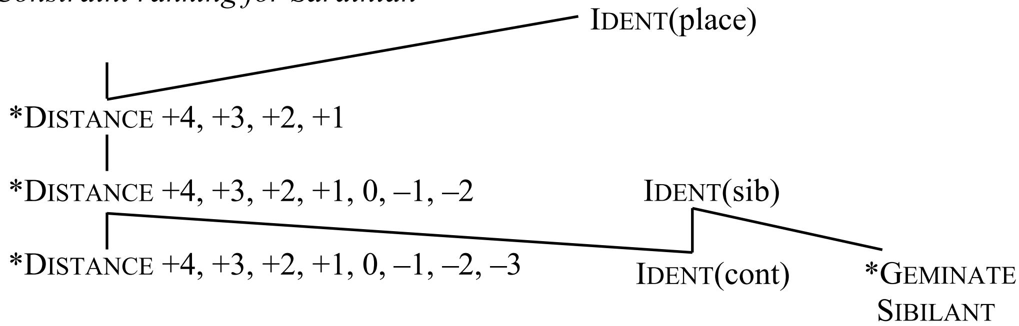
3.2.2.3. *Analysis*. Sardinian and Galician show a very similar behaviour to Majorcan Catalan as far as rhotacism is concerned. As Galician shows the same behaviour as Majorcan Catalan, the same ranking of the relevant faithfulness constraints is at play (see the ranking in 81b; in this case, however, 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 (85a); this is in fact the expected behaviour since this consonant, not being sibilant, is placed with labiodental fricatives in the sonority scale; see 77b). 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 the ranking in 86 and its effects in 87). The distribution between manner assimilation and rhotacism before a sonorant in Sardinian (see the data in 84a *vs.* the data in 84c) 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 87a). Otherwise, that

[36] 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/ implosive como [ɾ] en posición interior de palabra ou por fonética sintactica ante consonante sonora, o en menor medida perante as xordas /f/ e /θ/ ou mesmo /t͡ʃ/." ["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 [ɾ] word-internal or across words when followed by a voiced consonant or more sporadically before the voiceless fricatives /f/ and /θ/ and also /t͡ʃ/."]

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

is, when the place specification is not lost, regressive manner assimilation applies (see the candidates in 87b). 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 § 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 the candidates in 87c). In Sardinian, on the other hand, a geminate sibilant is permitted (see 84b), because the constraint *GEMINATE SIBILANT is ranked below IDENT(sibilant) (see also § 3.2.1.3).

(86) *Constraint ranking for Sardinian*



(87) *Sardinian. Effects of the constraint ranking in (86)*

a. /s##m/	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
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

voicess stops <	voiced stops <	non-sibilant fricatives <	sibilants <	nasals <	trill <	liquids, glides, [ɹ] <	vowels
1	2	3	4	5	6	7	8

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 (88a). The process does not apply when the alveolar fricative precedes a voiceless stop (88b); in this context, an optional process of aspiration can apply (Patrick Sauzet, p.c.).[38]

[38] 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 (1986b) and Palmada (1994a), and for an analysis of the process within OT terms, see the author (2005b).

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

a. Alveolar sibilant + voiced consonant or *f*

las filhas	/laz#fiʎoz/	[laj.fí.ʎos]	'the daughters'
las femmas	/laj##fennos/	[laj.fén.nos]	'the women'
los buòus	/luz#bjɔwz/	[luj.bjɔ́ws]	'the oxen'
bonis vins	/bɔniz#binz/	[bɔnij.bíns]	'good wines'
cos nud	/kɔs#nyt/	[kɔj.nýt]	'naked body'
es mòrt	/es##mɔɾt/	[ej.mɔ́ɾt]	'(s/he) is dead'

b. Alveolar fricative + voiceless consonant

las claus	/las#klaws/	[las.kláws]	'the keys'
las pòrtas	/las#pɔɾtas/	[las.pɔ́ɾ.tɔs]	'the doors'
bonas taulas	/bɔnas#tawlas/	[bɔ.nos.táw.lɔs]	'good tables'

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 the author 2005a).

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 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 the 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 77b), 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.

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

a. *Majorcan Catalan (& Galician)* b. *Sardinian*

IDENT(sib) IDENT(place)

*DISTANCE +4, +3, +2, +1 *DISTANCE +4, +3, +2, +1

*DISTANCE +4, +3, +2, +1, 0, –1, –2 *DISTANCE +4, +3, +2, +1, 0, –1, –2

*DISTANCE +4, +3, +2, +1, 0, –1, –2, –3 *DISTANCE +4, +3, +2, +1, 0, –1, –2, –3

c. *Occitan*

*DISTANCE +4, +3, +2, +1 *[ɹ]

*DISTANCE +4, +3, +2, +1, 0, –1, –2

*DISTANCE +4, +3, +2, +1, 0, –1, –2, –3

(*Simplified rankings*)

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 strata are needed (see 89), the stringency version of the relational alignment hierarchy can account for it in a very simple way (90).

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

	Onset	8	7	6	5	4	3	2	1
Coda		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*. 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 (91), which, according to the author, has not been counter-exemplified in the phonological and phonetic literature. The studies by Steriade (1982), Davis (1990) and Alderete (1995) (see also § 2.1) also support this division in the sonority scale.

(91) Adapted from Blevins (1995: 211)
voiceless stops < voiced stops

As seen in § 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* [plɔ́w] 'it rains', *flor* [flɔ́] 'flower' *vs.* **slau* [sláu], **vlau* [vláw]; see Bonet & 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 Alguerese Catalan when followed by a consonant (see an argumentation in this direction in Lloret & Jiménez [2005, 2006] 2007). One could argue for a sonority ordering like voiceless stops < voiceless labiodental fricative < voiced stop < voiced labiodental fricatives < sibilants. (I am grateful to an anonymous reviewer for highlighting this topic.)

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 (92):

(92) 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.

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. Two anonymous reviewers have suggested that 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 84). This would be a plausible explanation as long as alveolar sibilants followed by a voiceless stop where not preserved (see 84b) 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 § 3.1.4.5 (see also footnote 8), 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 (*agaf pa* [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 (*agaf pa* *[gaf.pa]). IDENT(–sont), 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 § 3.1.4.5, to the *DISTANCE constraints.

4 The phonetic basis of Syllable Contact

Other interpretations of regressive manner assimilation, rhotacism and gliding could be adduced, such as the one that regards the process as not being syllabically driven at all but phonetically grounded instead. In this section, some alternatives and reflections in this direction are briefly considered.

4.1. *Prominence effects?* It is commonly accepted that the perception of consonants largely relies on the acoustic cues of the following segments: in this respect, it has been claimed that the more sonorous the second consonant of a cluster, the more likely it is that the first consonant of the cluster is perceived (see, among others, Steriade 1999a, b, 2001a,b; Côté 2000). The patterns related to regressive manner assimilation, however, ignore this tendency and, in fact, challenge it, in that it applies precisely when the sonority of the second consonant exceeds the first and it fails to apply when the sonority of the first consonant exceeds the second. In other words, from a perceptual point of view, regressive manner assimilation applies in prominent contexts, whereas manner preservation is found in non-prominent contexts. The same can be said for rhotacism and gliding, since the likelihood of the application of these processes increases with the sonority of the second consonant of the cluster. Why, indeed, should the sibilant change its manner of articulation in an optimal perceptual environment? Perhaps this can be taken as evidence that the perceptual scale proposed by Steriade should refer only to homosyllabic sequences and should not affect heterosyllabic ones? It should be said, on the other hand, that markedness constraints like *WEAK-CUES, used in these kinds of studies, are uncertain in nature because they do not target a specific structure, since it has to be defined outside CON. Which consonants provide favourable perceptual cues? In which structural contexts? Is the preceding consonant the one which enhances the perceptibility of a consonant or is it the following? On the other hand, these constraints are also hybrid in nature in that they have to some extent the attributes of markedness constraints and faithfulness constraints (*i.e.* they prohibit a segment in a particular context); they are in fact *positional markedness* constraints. One thus detects a certain redundancy between these markedness constraints and the faithfulness constraints regulating featural changes (*i.e.* IDENT(F), MAX(F)). Why not resort, therefore, to positional faithfulness constraints, instead (*i.e.* IDENT(F) / Context A; IDENT(F) / Context B)?

4.2. *Contrast effects?* It is also 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 & 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 in general and could be extended to the facts of Latin.

4.3. *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 § 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 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. This interpretation in fact largely conforms to the hypothesis put forward in § 4.2.

5 Further evidence

The processes studied in § 3 entail a change in the manner of articulation of the consonant in coda position which always consists of an augmentation of the sonority of the coda consonant. In this section, other strategies to improve the syllable contact in Romance are considered: onset strengthening in Catalan (§ 5.1), epenthesis in Catalan (§ 5.2), strategy selection in Catalan (§ 5.3) and allomorph selection in Catalan and Spanish (§ 5.4). The analysis of these processes further supports the hypotheses defended in this paper.[39]

5.1 Onset strengthening in Catalan

A common and well-recognised strategy to improve the syllable contact is onset strengthening, that is, the demotion of the sonority of the onset consonant (see, among many others, Vennemann 1988, and, for Romance languages, Colina 1995, Bonet & Mascaró 1997, Jiménez 1996, 1997, 1999, Holt 2004). This strategy is also found in Catalan dialects. *a*) In Catalan in general, a process of trilling applies when flaps are preceded by a nasal or a lateral in morpheme-internal position (*e.g. honrat* /onɾ+a+d/ [un.rát] 'honest'; *folrar* /folɾ+a+ɾ/ [ful.rá] 'to line'; see Bonet & Mascaró 1997, Jiménez 1997, 1999). *b*) In a few north-eastern Catalan varieties, flaps corresponding to the infinitive, future or conditional morph(emes) undergo the very same process of trilling when preceded by a stem ending in a non-glide or a non-stop consonant (*e.g. vendrà* /bɛn+ɾa/ [bən̪.rá]; '(s/he) will sell'; *vendria* /bɛn+ɾiə/ [bən.ríə] '(s/he) would sell'; cf. *venia* [bəníə] 's/he sold'; see Lloret 2002); when preceded by a stem ending in a glide or a stop consonant, the flaps corresponding to these tense

[39] This section accounts for the facts of Catalan dialects in general; therefore, the constraint ranking used here is the one proposed in § 3.1.3 ("Dialects of Catalan").

morph(eme)s are maintained as such (*e.g. caurà* /kaw+ɾa/ [kəw.ɾá] '(s/he) will fall'; *rompré* /ɾonp+ɾe/ [rum.pɾé] '(I) will break'; see Lloret 2002).

In all these cases, potentially rising or flat sonority across syllable boundaries (*[un.ɾát], *[ful.ɾá]) is avoided through onset strengthening (for an analysis in similar terms, see Wheeler 2005: 256-257, and also the author [2003] 2006, 2004a). Strengthening within the morpheme (see *a*) is motivated by the ranking CONTIGUITY-IO, CONTIGUITY-OI >> IDENT(nasal), IDENT(lateral), IDENT(rhotic) >> *DISTANCE +4, +3, +2 >> *DISTANCE +4, +3, +2, +1 >> *DISTANCE +4, +3, +2, +1, 0 >> IDENT(continuant).[40] CONTIGUITY-IO / CONTIGUITY-OI and IDENT(nasal) / IDENT(lateral) block epenthesis / deletion within the word and regressive manner assimilation, respectively. The high ranking of IDENT(rhotic) ensures the rhotic manner preservation, while the low ranking of IDENT(continuant) ensures trilling (*e.g.* [un.rát]) to satisfy the *DISTANCE constraints, that is, to improve the syllable contact. Strengthening across morphemes (*i.e.* /bɛn+ɾiə/) is preferred to epenthesis due to the same constraint ranking and also to the activity of the high-ranked constraint ALIGN-Morph(eme)s, with the same effects as CONTIGUITY but across morph(eme)s. When the intersyllabic sonority created by the stem-final consonant and the tense morph(eme)s is falling (*e.g.* /kaw+ɾa/), trilling is also unnecessary and thus fails to apply (*e.g.* [kəw.ɾá]); when the contact between the stem-final consonant and the flap belonging to the tense morph(eme) constitutes a legal onset (*e.g.* /ɾonp+ɾe/), trilling is also unnecessary and thus fails to apply (*e.g.* [rum.pɾé]).[41]

5.2 Epenthesis in Catalan

Another well-known strategy to optimise the intersyllabic contact is epenthesis (see, among many others, Vennemann 1988, and, for Romance languages, Bonet & Mascaró 1997, Holt 2004), as occurs in the verbal morphology of most Catalan dialects in the same contexts described above, that is, between a stem ending in a non-glide or non-stop consonant and the infinitive, future or conditional morph(emes) (see Mascaró 1986a and Lloret 2002). When the stem ends in a coronal consonant, a dental voiced stop consonant is inserted (*e.g. vendria* /bɛn+ɾiə/ [bən̪.dɾíə] '(s/he) would sell'), whereas when the stem ends in a non-coronal consonant or a consonant cluster, a vowel is inserted (*e.g. venceré* /bɛns+ɾe/ [bən.sə.ɾé] '(I) will win'; *temeré* /tem+ɾe/ [tə.mə.ɾé] '(I) will be afraid'). Some dialects of Catalan (those spoken in the north-east of Catalonia), though, insert a consonant in these cases (*e.g. temeré* /tem+ɾe/ [təm.bɾé] '(I) will be afraid'; see Lloret 2002).[42]

In all these examples, potentially rising or flat sonority across syllable boundaries is avoided via epenthesis. The same ranking adduced above, but, of course, with ALIGN-MORPH(eme)s low-ranked (*i.e.* IDENT(nasal), IDENT(lateral), IDENT(rhotic) >> *DISTANCE +4, +3, +2 >> *DISTANCE +4, +3, +2, +1 >> *DISTANCE +4, +3, +2, +1, 0 >> IDENT(continuant) >> ALIGN-MORPH(eme)s) explains

[40] The ranking IDENT(nasal), IDENT(lateral), IDENT(rhotic) >> *DISTANCE +4, +3, +2 >> *DISTANCE +4, +3, +2, +1 >> *DISTANCE +4, +3, +2, +1, 0 is justified in § 3.1.3.3 (see 70), devoted to Catalan varieties in general.

[41] The new constraints at play in this ranking state as follows: *a*) CONTIGUITY-IO: Assign one violation mark for each portion of S1 which does not constitute the same contiguous string as the corresponding portion in S2. *b*) CONTIGUITY-OI: Assign one violation mark for each portion of S2 which does not constitute the same contiguous string as the corresponding portion in S1 (See McCarthy & Prince 1995). *c*) ALIGN-Morph(eme)s: Assign one violation mark for each edge of a given morph(eme) which is not aligned with the edge of another morpheme. (See McCarthy & Prince 1993b).

[42] A reviewer suggests that these cases could be interpreted as instances of allomorphy, resulting from a historical process of epenthesis. In this case, two verbal stems should be posited: one without the final consonant or vowel (*e.g.* /bɛn/ ~ /tem/) and another with it (*e.g.* /bɛnd/ ~ /temə/); the former would be the stems selected by default, and the latter, the stems selected in order to prevent a bad syllable contact, that is, when the stem is followed by the infinitive, future or conditional morph(eme)s. This is, of course, a licit interpretation of the facts, but it unnecessarily overloads the lexicon, in that two different allomorphs must be posited for each verbal form. The same reviewer suggests that the schwa could be considered a theme vowel morpheme, which is implausible, since the only occasions when it appears would be in these particular verbal forms of the second and third conjugation (*cf. caurà* /kaw+ɾa/ [kəw.ɾá] '(s/he) will fall'; *rompré* /ɾonp+ɾe/ [rum.pɾé] '(I) will break'; see also Mascaró 1986a, for discussion on this subject).

the insertion of epenthesis to improve the syllable contact. The distribution between vowel / consonant epenthesis and the quality of the latter is a consequence of the activity of the universal hierarchy of context-free markedness constraints *DORSAL >> *LABIAL >> *CORONAL, and also, as pointed out in descriptive terms in Lloret (2002), of the activity of the contextual markedness constraints AGREE(place), AGREE(voice) and *INTERNAL COMPLEX CODA.[43] The idea is that a dental stop (the unmarked segment, determined by the universal ranking *DORSAL >> *LABIAL >> *CORONAL) is inserted if it does not imply a violation of the contextual markedness constraints AGREE(place) (*[təm.dré], *[pləɲ.dré]) and *INTERNAL COMPLEX CODA (*[bənz.ðré]). AGREE(voice), on the other hand, ensures the voiced character of the inserted stop. (See the author 2005a.)

5.3 Strategy selection in Catalan

In Catalan, word-initial onsets violating the sonority sequencing principle are repaired via epenthesis (*e.g. sputnik* /sputnik/ [əspúnnik] 'Sputnik'), whereas word-initial onsets respecting it are maintained (*e.g. plata* /platə/ [plátə] 'silver'). The consonants which comprise the onset, however, must respect a minimum sonority distance. When this minimum sonority distance is not satisfied, two strategies emerge: epenthesis and deletion. The former is selected when the stem has a sibilant in first position (*e.g. eslau* /slaw/ [əz.láw] 'Slav'). The latter is selected when the insertion of an epenthetic vowel would imply an illicit syllable contact (*e.g. psicologia* /psikuluʒiə/ [sikuluʒíə], *[əp.sikuluʒíə] 'psychology'; *pneumatic* /pnəwmatik/ [nəwmátik], *[əp.nəwmátik]; see Bonet & Lloret 1998). Epenthesis, and not deletion, applies in the first case because sibilant segments show a strong resistance to deletion due to their perceptual prominence; the ranking of MAX(sibilant) above the *DISTANCE+ constraints explains this behaviour. The poor perceptual prominence of stops, in contrast, explains their deletion due to the *DISTANCE+ constraints (see § 3.1.4.1). It is important to note that the process of deletion applies even when it entails the loss of a consonant which contrasts with the following consonant as far as place of articulation is concerned (see, in this respect, § 3.1.3).

5.4 Allomorph selection in Catalan and Spanish

Catalan —and other Romance languages, such as Spanish— shows a case of allomorph selection which affects the prefix *–in* that is clearly motivated by the *DISTANCE hierarchy. This prefix surfaces as such (*i.e.* [in]) before a stem with an initial vowel (*e.g. inesperat ~ inesperado* [inəspərát] ~ [inesperáðo] 'unexpected'; *inhumà ~ inhumano* [inumá] ~ [inumáno] 'inhuman') or an initial alveolar obstruent (*e.g. insolidaritat ~ insolidaridad* [insuliðaritát] ~ [insoliðáriðað] 'non-solidarity'); before other non-liquid consonants the prefix also surfaces as such but the nasal acquires the place configuration of the consonant that follows (*e.g. imparitat ~ imparidad* [impəritát] ~ [impariðáð] 'imparity'; *incongruent ~ incongruente* [iŋkuŋgruén] ~ [iŋkoŋgruén̪te] 'incongruous'). When the prefix precedes a liquid, however, it surfaces as [i]: (*e.g. il·limitat ~ ilimitado* [ilimitát] ~ [ilimitáðo]; *irreprensible* [irəprənsíbblə] ~ [ireprensíβle] 'non-punishable').

Following the proposal in Mascaró (1996a, b; 2007) and Bonet & Mascaró & Lloret (2007), it can be stated that the prefix *–in* has two allomorphs which are lexically ordered. Given the lexical

[43] The new constraints at play in this ranking state as follows: *a*) *DORSAL: Assign one violation mark for each segment with a dorsal place specification (See Prince & Smolensky 1993 [2004]); *b*) *LABIAL: Assign one violation mark for each segment with a labial place specification (See Prince & Smolensky 1993 [2004]); *c*) *CORONAL: Assign one violation mark for each segment with a coronal place specification (See Prince & Smolensky 1993 [2004]); *d*) AGREE(place): Assign one violation mark for each sequence of adjacent segments with different place specifications (See Prince & Smolensky 1993 [2004]); *e*) AGREE(voice): Assign one violation mark for each sequence of adjacent segments with different voice specifications (See Prince & Smolensky 1993 [2004]).

ordering $_1$/in/ and $_2$/i/, and the ranking IDENT(nasal) >> *DISTANCE +4, +3, +2 >> *DISTANCE +4, +3, +2, +1 >> PRIORITY, /in/ would be the *unmarked*, *defective* and *priority option*, selected in cases of sonority fall, and /i/ would be the selected option to avoid sonority rise or flat sonority across syllable boundaries. The featural mapping of the nasal when followed by a heterorganic consonant is explained by the fact that the AGREE(place) constraint outranks IDENT(coronal). Remind that a syllable contact comprised by a nasal and a trill is permitted in Catalan (see § 3.1.3); the very same contact, however, is banned in these prefixed forms (*e.g. irreprensible* [irəprənsíbblə] ~ [ireprensíβle]). This discrepant behaviour is explained by the ranking IDENT(nasal) >> *DISTANCE +4, +3, +2 >> *DISTANCE +4, +3, +2, +1 >> PRIORITY, which ensures the selection of the allomorph resulting in a unmarked phonological structure, since in these particular cases the faithfulness constraint IDENT(nasal) does not intervene, given the immediate selection of the prefix allomorph without the nasal (*i.e.* [i]).[44]

5.5 Theoretical consequences

The behaviour depicted in this section is relevant both for the sonority scale and for SYLLABLE CONTACT. As seen in these sections, a split version of SYLLABLE CONTACT is necessary to account for the process of onset strengthening (§ 5.1), epenthesis (§ 5.2), and strategy and allomorph selection (§ 5.3, § 5.4), since these are strategies triggered not only to avoid a rising sonority but also a flat sonority. The fact that a trill is preferred to the flap after a heterosyllabic consonant, again, suggests a lower sonority in the former consonant than in the latter in that it apparently constitutes a more moderate sonority rise than the flap (*i.e.* [ónrə] (+1) *vs*. *[ónɾə] (+2)) or a sonority fall and not a sonority plateau ([mulré] (–1) *vs*. *[mulɾé] (0)). As seen, allomorph and strategy selection also demand a split version of the SYLLABLE CONTACT constraint, in that it is triggered not only to avoid sonority rise but also flat sonority.

6. Conclusions

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, coda rhotacism and gliding, and onset strengthening), the insertion of epenthetic elements, and the specific distribution and selection of certain (morpho)phonological structures and processes according to the resultant manner configuration.

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 onset strengthening) and Syllable Contact has a longstanding reputation, having already been detected in the earliest studies devoted to this topic (see, for instance, Murray &

[44] Grimalt (in preparation) adduces another interesting case of allomorph selection in Majorcan Catalan, which could also be syllabically driven. The Majorcan Catalan imperative forms of some second conjugation verbs display different stem allomorphs (with a final consonant or with a final vowel) when they appear as free forms and when they appear followed by clitic pronouns. When they appear as free forms, they surface without a final vowel (*e.g. beu* /bəw/ [bə́w] 'drink!; *mou* /mɔw/ [mɔ́w] 'move!'; *rep* /rəb/ [rə́p] 'receive!'; *mol* /mɔl/ [mɔ́l] 'grind!'). Similarly, verbs whose stem ends in a glide neither show a final vowel in the stem when followed by a clitic (e.g. *beu-ne* /bəw#nə/ [bəw.nə́] 'drink some!'). By contrast, those verbs whose stem ends in a non-glide consonant, do show a final vowel (e.g. *ven* /vən/ [və́n] 'sell!'; *ven-la* /vənə#l+ə/ [və.nə́.lə] 'sell it (fem.)!', cf. *[vən.lə́]; *mol* /mɔl/ [mɔ́l] 'grind!'; *mol-la* /mɔlə#lə/ [mo.lə́.lə] 'grind it (fem.)!', cf. *[mɔl.lə́]). According to the analysis presented in this paper, however, while allomorphy would be expected in cases such as *ven-la* (to avoid a sonority rise of +2), it would not be in cases such as *mol-la*, since geminates are not sensitive to the *DISTANCE constraints (see § 3.1.4.5).

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 & 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 & 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 be more powerful and precise than the relational alignment approach, but the latter is robust enough to account for the data under analysis. Nevertheless, it 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 & 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 "impassive" 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 proven to be needed to account for these facts, the stringency version of the relational alignment hierarchy can account for it in a very simple 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.

Finally, in order to reach a compromise between the phonetic and the phonological facts and with the aim of avoiding circular procedures in assuming discrepant sonority scales exclusively based on specific language patterns, we have suggested a novel interpretation of the notion of the sonority scale based on the proposal of Boersma & Hayes (2001). According to this new approximation, the *phonetic* organisation of segments along the sonority scale and, therefore, the organisation of constraints related to sonority into hierarchies should have a non-discrete, dense, gradient and probabilistic nature: each specific sound would cover a range of values in the sonority scale, 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. This would be the case of those segments that are cross-linguistically ambiguous as far as sonority is concerned, like liquids or obstruents, as seen in this paper. This account would allow one to make typological predictions about the cross-linguistic frequency of each hierarchy. On the whole, in the absence of a complete cross-linguistic study of the sonority values of all sounds, an accurate and realistic formalisation of this intuition must be left for future research.

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