Constraints on the metathesis of sonorant consonants in Judeo-Spanish[1]

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Abstract

Judeo-Spanish denotes those varieties of Spanish preserved by the Sephardic Jews who were expelled from Spain in 1492 and have emigrated throughout Europe, North Africa, the Middle East, and the United States. This paper analyzes several types of sonorant consonant metathesis in Judeo-Spanish within the framework of Optimality Theory. Following Holt's (2004) account of Old Spanish, local metathesis of dl, dn, *and* nr *clusters is analyzed as a repair strategy for bad syllable contact. A novel analysis is proposed in which nasal place assimilation and positional faithfulness constraints account for the failure of* dm *metathesis in morphologically derived environments. Judeo-Spanish also has two types of innovative rhotic metathesis that cannot be explained in terms of syllable contact. The* rd $>$ dr *shift is analyzed as an effect of the Obligatory Contour Principle, whereby adjacent segments identical in place, manner, and voicing specifications are prohibited. The second type involves the displacement of* r *toward the left edge of a word, also frequently attested in popular Modern Spanish. A comprehensive account of rhotic metathesis is developed, following recent work on position-specific constraint evaluation (Riggle and Wilson 2005) and segmental adjacency constraints (Carpenter 2002).*

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The paper also considers alternative analyses, as well as some of the difficulties posed with respect to perceptually-based approaches (Blevins and Garrett 1998, 2004, Hume 2004).

1. Introduction

Judeo-Spanish (henceforth, JS) denotes those varieties of Spanish preserved by the Sephardic Jews who were expelled from Spain in 1492 and have emigrated throughout Europe, North Africa, the Middle East, and the United States. Despite its current status as an endangered language due to the lack of monolingual speakers and to the ever decreasing number of fluent speakers under the age of fifty-five (T. Harris 1994), modern JS remains underrepresented in recent work on Ibero-Romance phonetics and phonology and in general phonological theory. Previous descriptions of JS emphasize its conservative, archaic nature, highlighting its similarities to Old Spanish (henceforth, OS), while other research points up the novel characteristics that distinguish JS from both OS and other varieties of Modern Spanish (henceforth, MS). One phonological phenomenon of JS in which both retention and innovation can be observed is consonant metathesis. This paper develops an account of several types of consonant metathesis in JS within the constraint-based framework of Optimality Theory (McCarthy and Prince 1995, Prince and Smolensky 1993/2004).

Holt (2004) accounts for *dl* and *dn* metathesis in OS, e.g., *daldo* < *dadlo* 'give it', *dandos* < *dadnos* 'give us', as a strategy for repairing bad syllable contact, formalized in terms of interacting constraints on sonority and segmental ordering. Holt's analysis readily extends to modern JS, which has retained *dl* metathesis in imperative-clitic sequences. Also evident in OS and in some JS dialects is the metathesis of *nr* clusters in irregular future and conditional forms, e.g., *terné* 'I will have' < *tener* 'to have'. I show that *nr* metathesis receives a straightforward account in terms of syllable contact optimization. In OS, metathesis did not affect heteromorphemic *dm* clusters, and the same restriction is found in modern-day JS, e.g., *dadme* vs. **damde/dande* 'give me'. To explain the failure of *dm* metathesis across morpheme boundaries, I extend Holt's (2004) account through higher-ranking nasal place assimilation and positional faithfulness constraints. On this analysis, the bad syllable contact in *dm* is tolerated because it is better than the metathesized alternatives: *md* does not share place features, and *nd* changes the place of articulation of the morpheme-initial nasal.

Modern JS dialects also show two types of innovative rhotic metathesis. In the first type, heterosyllabic *rd* was transposed to tautosyllabic *dr* within and across morphemes, e.g., *tadre* < *tarde* 'late, afternoon', *par amodre de* < *par amor de* 'for the love of'. Unlike *dl* and *nr* metathesis, transposition of *rd*

does not result from syllable contact optimization. I analyze this innovation as an effect of the Obligatory Contour Principle (Leben 1973, McCarthy 1986), whereby adjacent segments identical in place, manner, and voicing specifications are prohibited. The second type involves displacement of *r* toward the left edge of a word, also frequently attested in popular MS. Following recent work on position-specific constraint evaluation (Riggle and Wilson 2005) and segmental adjacency constraints (Carpenter 2002), I develop a comprehensive account of both types of innovative rhotic metathesis.

This paper is organized as follows. Section 2 presents the nasal and lateral metathesis data and reviews the syllable-contact analysis of Holt (2004). Section 3 extends the analysis to account for the restriction involving *dm* clusters. Section 4 examines *rd* metathesis and develops an account in terms of the Obligatory Contour Principle. Section 5 considers additional innovations involving leftward rhotic metathesis and develops an analysis in terms of position-specific markedness and consonantal adjacency constraints. Section 6 examines some of the difficulties posed by the OS and JS data with respect to perceptually-based approaches to consonant metathesis. Section 7 concludes.

2. Nasal and lateral metathesis as optimization of syllable contact

Atonic vowel loss in Late Spoken Latin often created instances of "bad syllable contact" involving tautomorphemic *dn* and *dl* clusters, which were sometimes repaired in OS by metathesis, among other strategies not shown here.[2] The examples in (1a) and (1b) illustrate *dn* and *dl* metathesis, respectively (García de Diego 1970, Holt 2004, Lloyd 1987, Martínez-Gil 1991, 1994, 2003, Menéndez-Pidal 1941, Penny 2002, Pountain 2001). While variable forms are attested in OS, only the metathesized clusters are preserved in MS.

(1)		Latin	OS	MS	
	a.	CATENATU	*cadnado* ∼ *candado*	*candado*	'padlock'
		ANTENATU	*adnado* ∼ *andado*	*andado*	'stepchild'
				(cf. learnèd *antenado*)	
		LEGITIMU	*lidmo* ∼ *lindo*	*lindo*	'pretty'
		RETINA	*riedna* ∼ *rienda*	*rienda*	'rein'

2. Other attested strategies include dissimilation, palatalization, intrusive stop formation, deletion and strengthening. A particular word from Latin may show several variant forms in the written record from OS, e.g., ANTENATU > OS *adnado* ∼ *andado* ∼ *andrado* ∼ *alnado* ∼ *anado* ∼ *annado* 'stepchild' (see Holt 2004: 44, Fn. 1 and references cited therein).

b.	SPATULA	*espadla* ∼ *espalda*	*espalda*	'back'
	CAPITULU	*cabidlo* ∼ *cabildo*	*cabildo*	'town council'
	FOLIATILE	*hojadle* ∼ *hojaldre*	*hojaldre*	'puff pastry'
	TITULO	*tidle* ∼ *tilde*	*tilde*	'written accent'

Metathesis also variably affected heteromorphemic *dn* and *dl* in OS plural imperative-clitic sequences, as shown by the examples in (2a, b). Metathesis across the morpheme boundary no longer occurs in MS.

(2)		OS	MS	
	a.	*dadnos* ∼ *dandos*	*dadnos*	'give us'
		hazednos ∼ *hazendos*	*hacednos*	'do us'
	b.	*dadlo* ∼ *daldo*	*dadlo*	'give it'
		dezidlo ∼ *dezildo*	*decidlo*	'say it'

Like MS, JS has retained the lexicalized outcomes of morpheme-internal metathesis. Examples such as *lindo* 'pretty' and *espalda* 'back' are attested in Nehama's (1977) JS-French dictionary, based on the variety of JS spoken in Salonika. Unlike MS, however, JS still exhibits productive metathesis of *dl* in plural imperative-clitic sequences. The forms presented in (3) are documented in T. Harris (1994: 75), and similar examples and descriptions are found in Agard (1950: 207–208), Baruch (1930: 139), Crews (1935: 229), Luria (1930: 136), Subak (1906: 136–137), and Wagner (1914: 127–128).

(3)	JS	MS
	tomalda	*tomadla* 'take it'
	bushkalda	*buscadla* 'look for it'
	daldo	*dadlo* 'give it'
	metelda	*metedla* 'put it'
	traeldo	*traedlo* 'bring it'

Metathesis in OS verbal forms did not affect heterorganic *dm* clusters, as suggested by the lack of attested examples such as **damde/dande* for *dadme* 'give me' (Holt 2004: 51, Fn. 8). The first person plural pronoun *nos* 'us' in MS corresponds to *mos* 'us' in JS, the latter due to an independent and innovative change in the place of articulation of the nasal (Penny 1992: 137–138). To the best of my knowledge, there are no reports in the descriptive literature on JS of metathesis in forms such as **damde/dande* for *dadme* or **damdos/dandos* for *dadmos* 'give us'.

Drawing upon previous work on the role of sonority in syllable structure (Bat-El 1996, Clements 1990, Hooper 1976, Murray and Vennemann 1983, among many others), Holt (2004) develops an analysis in Optimality Theory (henceforth, OT) of metathesis as a repair strategy for avoiding bad syllable

contacts. Optimization of syllable contact is accounted for by the interaction among sonority constraints (4a, b, c), alignment (4d), and faithfulness (4e, f).

(4) a. MINIMAL DISTANCE IN SONORITY – MINDISTSON
There must be a minimum difference in sonority between members of a syllable onset.
b. SONORITY SEQUENCING PRINCIPLE – SSP
Between any member of a syllable and the syllable peak, only sounds of higher sonority rank are permitted.
c. SYLLABLE CONTACT LAW – SYLLCON
Sonority should not rise across a syllable boundary.
d. ALIGN
The elements of a morpheme should not extend beyond the stem boundary and should remain at the proper edge.
e. LINEARITY
The output is consistent with the precedence structure of the input and vice-versa.
f. MAXIMALITY
Input segments must have output correspondents.

To understand the role of syllable contact in OS metathesis, let us assume a sonority scale such as the one shown in (5). The sonority profiles of several different clusters are given in (6), where periods indicate syllable divisions. SYLLCON is violated by heterosyllabic *d.n* and *d.l* in (6a) because there is a rise in sonority across the syllable boundary. The opposite ordering of segments in (6b) satisfies the constraint because there is no sonority rise.

(5) Obstruents < Nasals < Liquids < Glides < Vowels (Clements 1990)
0 1 2 3 4

(6) a. * *d.n* 0 → 1 * *d.l* 0 → 2 ... violate SYLLCON
b. √ *n.d* 1 → 0 √ *l.d* 2 → 0 ... satisfy SYLLCON

The variability of metathesis results from a partially-ordered hierarchy in which the relationship between some of the constraints is in flux (see Anttila and Cho 1998, Anttila 2002). The tableaux in (7) illustrate the particular ranking of constraints that produces metathesis within morphemes and in imperative-clitic sequences.[3] High-ranking MAXIMALITY rules out candidates with

3. I assume that the input espad'la of the first tableau in (7) corresponds to the optimal output of the previous generation of speakers, following the historically prior loss of the intertonic vowel. In the second tableau, the input dad+lo arises synchronically in the morphological concatenation of the imperative and the clitic pronoun. The tableaux serve as a useful tool for describing sound changes that occur between language varieties and for laying out hypotheses

consonant deletion, which are not considered here. The apostrophe in the input of the first tableau reflects the historically prior loss of the atonic vowel. In the second tableau, brackets indicate morpheme boundaries in the output forms. For the moment, I abstract away from the continuancy alternation in Peninsular Hispano-Romance between stop [d] and approximant [ð] (although this difference will play a crucial role in the analysis of *rd* metathesis in JS proposed in Section 4). Heterosyllabic *d.l* in (7a) is a bad syllable contact, violating SyllCon. The remaining three candidates avoid the bad syllable contact, but not all are equally optimal. The onset clusters *.dl* and *.ld* in (7c, d) violate sonority conditions on onsets.[4] The low ranking of Linearity ensures that the problematic cluster is repaired by metathesis in (7b). The analysis is essentially the same for heteromorphemic verbal forms in the second tableau. In addition to Linearity, metathesis violates Align because the right edge of the verbal stem *dad* and the left edge of the clitic pronoun *lo* do not coincide in (7f, h).

(7) OS *espalda* 'back' and *daldo* 'give it'

espad'la	MinDistSon	SSP	SyllCon	Align	Linearity
a. es.pad.la			*!		
☞ b. es.pal.da					*
c. es.pa.dla	*!				
d. es.pa.lda	*!	*			*

dad+lo	MinDistSon	SSP	SyllCon	Align	Linearity
e. dad.][lo			*!		
☞ f. da[l.d]o				*	*
g. da.d][lo	*!				
h. da.[ld]o	*!	*		*	*

Holt attributes the lack of metathesis in MS plural imperative-clitic sequences to the external influence of the prescriptivist Real Academia Española, which would have favored maintaining the integrity of each component morpheme. As a result of this influence, MS has settled on the fixed ranking of

about how these changes occur. For more discussion of the status of inputs, lexicalization, and constraint re-ranking in language change, see the contributions assembled in Holt (2003).

4. In Spanish, complex onsets consist of an obstruent /p, t, k, b, d, g, f/ followed by a liquid /l/ or /ɾ/, but there are exceptions involving clusters of a coronal stop followed by the lateral. While /dl/ is not a permissible onset cluster in any dialect, onset /tl/ is allowed in some varieties such as Mexican Spanish (see J. Harris 1983: 13–14, 20–22, 31–35). Given the sonority scale in (5), MinDistSon actually predicts that stop-lateral onsets should be as well formed as stop-rhotic onsets, since both types present the same sonority distance. Additional constraints must be invoked to account for /tl/ and /dl/ clusters, but I do not address the issue in this paper. For further discussion and analysis of stop-lateral onsets, see Martínez-Gil (2001) and, more recently, Bradley (2006).

ALIGN ≫ SYLLCON, which disfavors productive metathesis across the morpheme boundary. Candidate (8e) wins under this ranking because alignment is respected at the expense of allowing a bad syllable contact. Once OS outputs like (7b) were optimized and lexicalized, there would have been no way for speakers to recover the etymological Latin form. Since prescriptivism could not undo the outcome of morpheme-internal metathesis, MS retains the *l.d* cluster in (8b).

(8) MS *espalda* 'back' vs. *dadlo* 'give it'

espalda	MINDISTSON	SSP	ALIGN	SYLLCON	LINEARITY
a. es.pad.la				*!	*
☞ b. es.pal.da					
c. es.pa.dla	*!				*
d. es.pa.lda	*!	*			

dad+lo	MINDISTSON	SSP	ALIGN	SYLLCON	LINEARITY
☞ e. dad.][lo				*	
f. da[l.d]o			*!		*
g. da.d][lo	*!				
h. da.[ld]o	*!	*	*		*

I argue that the absence of normative pressure in JS has resulted in the retention of productive *dl* metathesis in plural imperative-clitic sequences. In contrast to the fixed MS ranking and the variable OS ranking, JS now has the fixed ranking of SYLLCON ≫ ALIGN, which favors *daldo* (7f) over *dadlo* (7e). Like MS, JS has retained morpheme-internal metathesis, due to optimization and lexicalization of outputs like *espalda* in (7b).

The analysis presented thus far accounts for another type of metathesis in OS, not specifically treated by Holt (2004), which is retained in some modern JS dialects. In OS irregular future and conditional forms, deletion of the theme vowel of the infinitive often resulted in a nasal-rhotic cluster. Such derived clusters were variably resolved through metathesis, assimilation, and intrusive stop formation (Wanner 1989: 437). Baruch (1930: 139) and Lamouche (1907: 983) document synchronic alternations involving nasal-rhotic metathesis in modern JS irregular verbal forms, illustrated in (9). MS has retained the forms with intrusive stops, whereas the JS examples show metathesis.

	JS	MS		
(9)	*terné*	*tendré*	'I will have'	(cf. *tener* 'to have')
	verné	*vendré*	'I will come'	(cf. *venir* 'to come')

The fixed ranking of SYLLCON ≫ LINEARITY in modern JS accounts for *nr* metathesis in terms of syllable contact optimization, as in the case of *dl*

> *ld* discussed above. According to the sonority scale proposed in (5), the heterosyllabic *n.r* cluster in (10a) presents a sonority rise across the syllable boundary, violating SYLLCON, whereas the opposite ordering of segments in (10b) satisfies the constraint.

(10) a. * *n.r* 1 → 2 … violates SYLLCON
b. √ *r.n* 2 → 1 … satisfies SYLLCON

In tableau (11), the apostrophe in the input form reflects the deletion of the theme vowel of the infinitive. Heterosyllabic *n.r* in (11a) is eliminated for its bad syllable contact, and the *.nr* and *.rn* clusters in (11c, d) are ruled out for their violations of sonority conditions on onsets. The metathesis candidate (11b) is optimal because LINEARITY is low-ranking.[5]

(11) OS/JS *terné* 'I will have'

ten'ɾ+e	MINDISTSON	SSP	SYLLCON	ALIGN	LINEARITY
a. ten.ɾe			*!		
☞ b. teɾ.ne					*
c. te.nre	*!				
d. te.ɾne	*!	*			*

3. Nasal place alternations and the failure of *dm* metathesis

One prediction of the sonority-based account is that since *m* and *n* have the same sonority rank, *dm* should undergo metathesis as easily as *dn*. However, only homorganic *dn* underwent metathesis in OS imperatives, and forms such as **damde/dande* < *dadme* and **damdos/dandos* < *dadmos* remain unattested in JS. In contrast, the morpheme-internal cluster in the third example of (1a), LEGITIMU > *lidmo* ∼ *lindo,* did undergo metathesis and regressive nasal place assimilation, ultimately producing MS/JS *lindo* 'pretty'. More generally, assimilation took place when atonic vowel deletion in Late Spoken Latin placed a formerly prevocalic nasal consonant in contact with a following stop. As shown in (12), intervocalic stops first became voiced, and vowel loss then produced tautomorphemic nasal-stop clusters that were subject to regressive place assimilation (Penny 2002: 59, 87–88).

(12) a. COMITE > **comide* > **comde* > *conde* 'count'
LIMITARE > **limedar* > **limdar* > *lindar* 'to border upon'
SEMITA > **semida* > **semda* > *senda* 'path'

5. Furthermore, LINEARITY must rank below the faithfulness constraint penalizing consonant insertion, DEPENDENCY-C, in order to select outputs with *rn* metathesis over outputs with intrusive stops. For a more detailed OT analysis of consonant intrusion in OS and Old French, see Martínez-Gil (2003). For a feature-geometric account of OS, see Holt (2002: 93–94).

b.	BONITATE > **bonidade* > *bondad*	'goodness'
c.	MANICA > **manega* > *ma*[ŋ]*ga*	'sleeve, hose'
	DOMINICU > **dominigo* > *domi*[ŋ]*go*	'Sunday'

The final forms in (12a, c) show that homorganicity was achieved at the expense of sacrificing the original place features of the nasal. Place features of the following syllable-initial stop were maintained intact. In (12b), vowel deletion produced a homorganic cluster by default, as both the nasal and the stop were already coronal.

The generalization emerging here is that stop-nasal metathesis is permitted just in case the resulting syllable-final nasal can share the place features of the following stop. In the case of LEGITIMU > *lidmo* ∼ *lindo,* metathesis is licensed on independent grounds because nasals generally give up their place features to become homorganic with a following tautomorphemic stop, as seen in (12a, c). I would like to propose that *dm* metathesis is blocked in imperative-clitic forms because morpheme-initial nasals are protected by an additional faithfulness constraint on place features. This approach effectively limits metathesis to derived *dn* clusters because they automatically satisfy the homorganicity requirement. In the case of *dadnos* ∼ *dandos,* the resulting nasal-stop cluster is already coronal, in the same way that the cluster in *bondad* (12b) is already coronal. In contrast, derived *dm* is immune to reordering because homorganicity would require unfaithfulness to the input place specification of the clitic-initial nasal. I develop a formal account of these patterns involving nasal place assimilation and positional faithfulness constraints:

(13) a. NASALASSIMILATION – NASASSIM (Pater 2001: 175)[6]
A nasal must share place features with a following consonant.

b. IDENT(place) (McCarthy and Prince 1995)
Corresponding input and output segments have the same place features.

c. IDENTMORPHEME-INITIAL(place) – IDENTMI(place) (cf. Beckman 1997: 56, Casali 1996: 27)
Corresponding input and output segments in morpheme-initial position have the same place features.

d. Ranking: NASASSIM, IDENTMI(place) ≫ IDENT(place)

The markedness constraint in (13a) penalizes nasal-consonant clusters that do not share major place features, where place is a member of the set {LABIAL, CORONAL, PALATAL, DORSAL}. The context-free faithfulness constraint in (13b) is violated whenever an input segment undergoes a change in place features in

6. The insight behind this constraint can be attributed to the Coda Condition, originally proposed by Ito (1986).

its output correspondent. The positional faithfulness constraint in (13c) militates against a change in place features when the relevant segment is morpheme-initial (cf. Beckman 1997: 52–53 on the psycholinguistic motivation of root-initial positional faithfulness constraints).

When integrated within the analysis outlined in Section 2, the ranking in (13d) successfully accounts for the failure of *dm* clusters to undergo metathesis across a morpheme boundary. Although (14a) violates SyllCon, the violation is tolerated because the metathesis candidates fare worse on the higher-ranked constraints. The heterorganic cluster in (14b) violates NasAssim because the labial nasal does not share place features with the following coronal stop. The place-assimilated nasal in (14c) violates IdentMI(place) because the initial labial nasal of the input clitic changes to coronal in the output.[7] This analysis captures the fact that it is worse to create a heterorganic nasal-consonant cluster (14b) or to change place features of a morpheme-initial nasal (14c) than it is to tolerate a sonority rise across the syllable boundary (14a). In contrast, since the nasal of the input clitic in the second tableau is already coronal, metathesis in (14e) improves syllable contact without violating higher-ranked NasAssim. Gratuitous changes of the coronal nasal to any other place of articulation, such as labial in (14f), are ruled out by violations of NasAssim and the positional faithfulness constraint IdentMI(place).

(14) OS/JS *dadme* 'give me' vs. OS *dandos* 'give us'

dad+me	Nas Assim	IdentMI (place)	Syll Con	Ident (place)	Align	Linearity
☞ a. dad.][me			*			
b. da[m.d]e	*!				*	*
c. da[n.d]e		*!		*	*	*

dad+nos	Nas Assim	IdentMI (place)	Syll Con	Ident (place)	Align	Linearity
d. dad.][nos			*!			
☞ e. da[n.d]os					*	*
f. da[m.d]os	*!	*		*	*	*

7. A fourth potential candidate, *da*[m.b]*e*, would satisfy all three top-ranked constraints by sacrificing the place features of the input stop instead of the morpheme-initial nasal. Another positional faithfulness constraint, IdentOnset(place), is necessary in order to preserve the place features of the stop when syllabified in onset position (see Beckman 1997). Such a constraint is independently necessary to account for regressive place assimilation in morpheme-internal contexts in (12).

The same ranking would have allowed both metathesis and nasal place assimilation within the morpheme in OS, as illustrated in tableau (15). Given the ranking of SYLLCON above IDENT(place) and LINEARITY, the input labial nasal undergoes metathesis with and assimilates in place of articulation to the coronal stop, as in (15c). Since the nasal in this case is not morpheme-initial, IDENTMI(place) is irrelevant (cf. (14c)). A variable ranking of SYLLCON with respect to IDENT(place) can account for the variability between *lidmo* (15a) and *lindo* (15c) in OS.

(15) OS *lindo* 'pretty'

lid'mo	NAS ASSIM	IDENTMI (place)	SYLL CON	IDENT (place)	ALIGN	LINEARITY
a. lid.mo			*!			
b. lim.do	*!					*
☞ c. lin.do				*		*

In the positional faithfulness approach, nasal place alternations play a crucial role in limiting the range of consonant clusters that can be targeted by metathesis. Since SYLLCON dominates ALIGN, heteromorphemic stop-nasal clusters generally undergo metathesis to optimize syllable contact. Since NASASSIM and IDENTMI(place) rank even higher than SYLLCON, metathesis is licensed only if the homorganicity of the output cluster can be achieved without altering the input place features of the morpheme-initial nasal. Metathesis across the morpheme boundary targets homorganic *dn* but leaves heterorganic *dm* intact.

An anonymous reviewer asked whether there are any examples of historical change such as **CV+mVdV... > CV+m'dV...*, where vowel deletion places the morpheme-initial bilabial nasal before a coronal stop. If morpheme-initial nasals are protected by positional faithfulness, then this seems to predict that the nasal would fail to undergo place assimilation. I am unaware of any sound correspondences between OS and JS that meet the structural description of this example. However, the predicted failure of assimilation is correct only if IDENTMI(place) dominates NASASSIM, and the data examined thus far provide no evidence to motivate this ranking. Evidence for the opposite ranking comes from an independent change in JS. Word-initial /nwe/ was replaced by /mwe/ due to labialization of /n/ before the labiovelar glide /w/, e.g., *nueve* > *mueve* 'nine', *nuevo* > *muevo* 'new', *nuestro* > *muestro* 'our' (Penny 1992: 138). If NASASSIM is responsible for labialization, then this sound change points to a ranking of NASASSIM ≫ IDENTMI(place). This ranking predicts that the *m'd* cluster resulting from vowel deletion in hypothetical **CV+mVdV...* would be subject to regressive place assimilation. Importantly, the analysis in (14) and (15) remains unchanged. To account for the failure of *dm* metathesis across morpheme boundaries, NASASSIM and IDENTMI(place) must both dominate

SyllCon but need not be crucially ranked themselves. (14a) is optimal regardless of the relative ranking of assimilation and positional faithfulness constraints.

3.1. Excursus on obstruent-nasal metathesis in Sidamo

The opposite ranking of IdentMI(place) below SyllCon predicts a language in which input place features of the metathesized morpheme-initial nasal can be changed to achieve homorganicity. This pattern is attested in sychronic alternations in Sidamo, as well as other languages including Darasa, Gedeo, Hadiyya and Kambata (Hudson 1975, 1995, Hume 1998). The data from Sidamo in (16) show that suffix-initial /n/ is regularly transposed with a root-final obstruent, to which the nasal assimilates regressively in place.

(16)	a.	/hab+nemmo/	[hambemmo]	‘we forget’
	b.	/gud+nonni/	[gundonni]	‘they finished’
		/it+noommo/	[intoommo]	‘we have eaten’
		/has+nemmo/	[hansemmo]	‘we look for’
	c.	/duk+nanni/	[duŋkanni]	‘they carry’
		/ag+no/	[aŋgo]	‘let’s drink’

The output clusters in (16a, c) show that homorganicity is achieved by sacrificing input nasal place features, while the clusters in (16b) are homorganic by default.

The analysis of the Sidamo pattern is illustrated in (17). High-ranking SyllCon and NasAssim rule out the bad syllable contact in (17a) and the heterorganic cluster in (17b), respectively. In the optimal candidate (17c), the initial coronal nasal of the input suffix changes to labial in the output, but unfaithfulness is tolerated because IdentMI(place) is dominated by the top two markedness constraints. Unlike the OS/JS grammar in (14), the Sidamo ranking allows morpheme-initial nasal place features to be altered in order to satisfy the homorganicity requirement in metathesis contexts. The same ranking guarantees metathesis of input /dn/ clusters, as shown in (17e).[8]

8. An anonymous reviewer pointed out that although the analysis in (17) predicts metathesis both within and across morpheme boundaries, there are many languages that have metathesis occurring only in the latter context. This difference can be captured by a division of Linearity into two subconstraints, one that is context-free and one that is relativized to the morpheme-internal domain. Such a division has been proposed by Horwood (2002), who proposes Hom(omorphemic)Lin(earity) to rule out metathesis in underived contexts. In languages with metathesis occurring only at morpheme boundaries, HomLin dominates the markedness constraint responsible for triggering metathesis, which in turn dominates Linearity. Factorial typology may make different predictions depending on whether the analysis

(17) Sidamo metathesis and nasal assimilation

/hab+nemmo/	NAS ASSIM	SYLL CON	IDENTMI (place)	IDENT (place)	ALIGN	LINEAR-ITY
a. hab.][nemmo		*!				
b. ha[n.b]emmo	*!				*	*
☞ c. ha[m.b]emmo			*	*	*	*

/gud+nonni/	NAS ASSIM	SYLL CON	IDENTMI (place)	IDENT (place)	ALIGN	LINEAR-ITY
d. gud.][nonni		*!				
☞ e. gu[n.d]onni					*	*
f. gu[m.d]onni	*!		*	*	*	*

3.2. Comparison with a constraint conjunction approach

As a possible alternative to the positional faithfulness account developed above, the markedness constraint responsible for triggering metathesis could be made to target only the homorganic cluster, presumably due to the similarity of place features. Cross-linguistically, metathesis often affects adjacent segments that are acoustically or perceptually similar in some way. Based on the work of Kawasaki (1982) and Ohala (1990, 1993), Hume (1998: 303) argues that "sharper changes in the speech signal increase the salience of cues in the portion of the signal where the modulation ta kes place; the greater the magnitude of the modulation, the better the signal is detected." The greater susceptibility of homorganic *dn* (and *dl*) to undergo metathesis can thus be attributed to a reduced modulation of the speech signal.

Hume (1998, 2001) proposes a formal analysis of similarity effects in consonant metathesis in terms of constraint conjunction (Alderete 1997, Crowhurst and Hewitt 1997, Smolensky 1993, 1997). Specifically, the markedness constraint violated by the non-metathesized candidate is conjoined with an OCP

employs both HOMLIN and the ALIGN constraint in (4d), which refers specifically to morphological boundaries. A detailed discussion of the theoretical implications would lead us too far afield.

constraint targeting the particular feature shared by the adjacent segments.[9] Applying this approach to the OS data, let us assume the definition of Local Conjunction in (18a), as well as the OCP constraint in (18b), which targets CORONAL place:

(18) a. The Local Conjunction of C_1 and C_2 in domain D, $[C_1 \& C_2]_D$, is violated when there is some domain of type D in which both C_1 and C_2 are violated. (Smolensky 1993)
b. OCP(CORONAL)
Adjacent segments identical in CORONAL place are prohibited.
c. [OCP(COR) & SYLLCON]$_{AdjacentSegments}$

Local conjunction provides a way to limit metathesis to clusters of coronal consonants that exhibit a bad syllable contact. The conjoined constraint in (18c) is violated by an output candidate if and only if both of the simplex constraints are violated within the domain of adjacent segments.

The tableaux in (19) repeat those in (14), except that IDENTMI(place) is omitted and the conjoined constraint [OCP(COR) & SYLLCON]$_{AdjSeg}$ replaces the simplex constraint SYLLCON. The alternative analysis produces the correct results for heteromorphemic contexts. The cluster in (19a) does not violate the conjoined constraint because the simplex constraints SYLLCON and OCP(COR) are not simultaneously violated within the domain of adjacent segments. Although *d.m* violates SYLLCON, it satisfies OCP(COR) because the consonants are not both coronal. NASASSIM and IDENT(place) rule out the metathesis candidates in (19b,c), and the underlying segment order is preserved in the output. Since the cluster in (19d) violates both SYLLCON and OCP(COR), the conjoined constraint is also violated, and metathesis is optimal in (19e).

9. In Hume's (1998, 2001) formal analysis, consonant metathesis is triggered by a family of markedness constraints (AVOID C/X) that penalize the positioning of consonants in perceptually weak contexts. For consistency, I follow Holt's (2004) syllable-contact account and consider the implications of conjoining SYLLCON with the OCP. The difference in assumed markedness constraints should not affect the discussion pursued here. See Section 3.3 for discussion of a possible analysis based on Seo (2003, 2005, 2006), who also uses Hume's AVOID C/X constraints.

(19) Alternative analysis involving constraint conjunction

dad+me/	NAS ASSIM	[OCP(cor) & SYLLCON]$_{AdjSeg}$	IDENT (place)	ALIGN	LINEARITY
☞ a. dad.][me					
b. da[m.d]e	*!			*	*
c. da[n.d]e			*!	*	*

dad+me/	NAS ASSIM	[OCP(cor) & SYLLCON]$_{AdjSeg}$	IDENT (place)	ALIGN	LINEARITY
d. dad.][nos		*!			
☞ e. da[n.d]os				*	*
f. da[m.d]os	*!		*	*	*

While the local conjunction approach successfully distinguishes between *dm* and *dn* across morpheme boundaries, the account falls short in morpheme-internal contexts. A comparison of candidates (19a) and (20a) reveals that the conjoined constraint cannot distinguish between derived and non-derived *dm* clusters. In both cases, the same ranking of constraints selects the candidate that preserves the segmental ordering of the input. This is the wrong outcome for morpheme-internal clusters, which variably underwent metathesis and regressive nasal place assimilation. The leftward pointing hand '☜' means that (20c) should win but does not.

(20) Constraint conjunction analysis cannot produce morpheme-internal metathesis

lid'mo	NAS ASSIM	[OCP(cor) & SYLLCON]$_{AdjSeg}$	IDENT (place)	ALIGN	LINEARITY
☞ a. lid.mo					
b. lim.do	*!				*
☜ c. lin.do			*!		*

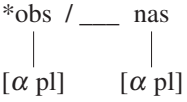
To save the local conjunction analysis, one might assume that the simplex constraint SYLLCON dominates IDENT(place), which would correctly favor (20c) over (20a). However, this ranking would overgenerate in derived contexts by favoring (19c) over (19a), and the account of the restriction on *dm* metathesis would be lost. Furthermore, changing the wording of the OCP in (18b) to refer to *tautomorphemic* segments does not save the analysis either. Although the *dm* cluster in (20a) is morpheme-internal, the OCP would be satisfied because the nasal consonant is not coronal. Even worse, the morphologically derived cluster in (19d) would no longer violate a tautomorphemic version of the OCP, nor its higher-ranked conjunction with SYLLCON. The account of *dn* metathesis in imperative-clitic sequences would be lost.

In contrast, the positional faithfulness analysis successfully distinguishes between derived and non-derived clusters. Since IDENTMI(place) is irrelevant when the nasal is not morpheme-initial, the ranking of NASASSIM and SYLLCON above IDENT(place) favors metathesis and nasal place assimilation in (15c). IDENTMI(place) becomes active in derived contexts, eliminating the metathesis/assimilation candidate in (14c).

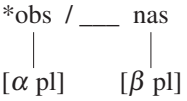
3.3. Comparison with a segment contact approach

Based on a typological survey of the patterning of sonorants in consonant clusters, Seo (2003, 2005, 2006) argues for segment contact constraints based on phonetic similarity and perceptibility, as formalized by Hume (1998, 2001). One problem for accounts that employ syllable contact is that no distinction is made between homorganic and heterorganic clusters. In obstruent-nasal sequences, phonological processes are more likely to apply if the consonants are homorganic than if they are heterorganic. As we have seen, the OS and JS data conform to this generalization in that morphologically derived *dn* is subject to metathesis but *dm* is not. Seo (2003: 87) proposes to incorporate reference to shared place features directly into the markedness constraints that give rise to phonological processes. Following this approach, let us consider an analysis based on the constraints in (21).

(21) a. *HOM OBS/NAS
Avoid positioning an obstruent before a homorganic nasal consonant.



b. *HET OBS/NAS
Avoid positioning an obstruent before a heterorganic nasal consonant.



c. *HOM OBS/NAS ≫ *HET OBS/NAS

(21a) is violated by an obstruent-nasal cluster in which the consonants have the same place feature, while (21b) is violated when place features are different. The universal ranking in (21c) expresses the generalization that homorganic obstruent-nasal sequences are more susceptible to phonological change than are heterorganic ones.

In the tableaux in (22), both NasAssim and *Hom obs/nas outrank Ident (place), which outranks *Het obs/nas. This analysis successfully distinguishes *dm* and *dn* clusters. (22b,c) are eliminated for their violations of NasAssim and Ident(place), respectively, and (22a) emerges as optimal despite its violation of low-ranking *Het obs/nas. In contrast, the *d.n* sequence in (22d) violates high-ranking *Hom obs/nas, and metathesis is optimal in (22e).

(22) Alternative analysis involving segment contact

dad+me/	Nas Assim	*Hom obs/nas	Ident (place)	*Het obs/nas	Align	Linear-ity
☞ a. dad.][me				*		
b. da[m.d]e	*!				*	*
c. da[n.d]e			*!		*	*

dad+nos	Nas Assim	*Hom obs/nas	Ident (place)	*Het obs/nas	Align	Linear-ity
d. dad.][nos		*!				
☞ e. da[n.d]os					*	*
f. da[m.d]os	*!		*		*	*

The segment contact account faces the same problem as the constraint conjunction account discussed in Section 3.2. Both approaches fail to distinguish between derived and non-derived *dm* clusters and, therefore, cannot account for variable metathesis and nasal place assimilation in morpheme-internal contexts. As illustrated in tableau (23), Ident(place) incorrectly rules out candidate (23c), and the *d.m* cluster emerges as optimal in (23a). Ranking *Het obs/nas above Ident(place) would select (23c) but would also overgenerate metathesis and place assimilation in derived contexts in (22c).

(23) Segment contact analysis cannot produce morpheme-internal metathesis

lid'mo	Nas Assim	*Hom obs/nas	Ident (place)	*Het obs/nas	Align	Linear-ity
☞ a. lid.mo				*		
b. lim.do	*!					*
☜ c. lin.do			*!			*

4. *rd* metathesis as a segmental OCP effect

In almost all varieties of JS except the northwest Balkans, inherited words that contained *rd* clusters in OS now have corresponding *dr*. Penny (1992: 138) states that since this feature is unattested in other varieties of Hispano-Romance, it should be included among the innovations of JS. The data in (24a) are from T. Harris (1994: 75), and similar examples are found in Agard (1950: 206), Crews (1935: 188), Luria (1930: 136), Nehama (1977), and Sala (1971: 51). Subak (1906: 171–172) documents the example in (24b) from Istanbul JS showing *rd* metathesis across the word boundary. Apparently, transposition of the original *rd* cluster led to lexicalization of the resulting blend *amodre*, thus requiring a second appearance of the preposition in the phrase *par amodre de* 'for the love of'.

(24) a.

JS	MS	
tadre	*tarde*	'late, afternoon'
sodro	*sordo*	'deaf'
pedron	*perdón*	'pardon'
godro	*gordo*	'fat'
pedrer	*perder*	'to lose'
vedra(d)	*verdad*	'truth'
kwedra	*cuerda*	'cord'
akodro	*acuerdo*	'agreement'
guadrar	*guardar*	'to keep'
vedre	*verde*	'green'

b. *par amodre de mi* 'for the love of me'
(< **par amodre* < *par amor de*)

What motivates *rd* metathesis? Syllable contact cannot be at issue because *r.d* already has a preferred sonority drop across the syllable boundary, i.e., 2 → 0 according to the sonority scale in (5). Blevins and Garrett (2004: 136) suggest in passing that the *rd* > *dr* shift in JS may be a consequence of coarticulatory effects: "[w]hen C_1C_2 gestural overlap results in nearly simultaneous closure, with C_1 released after C_2, a C_2C_1 cluster may be perceived." However, it remains to be explained why only *rd* clusters would have been subject to overlap but not other clusters containing a rhotic. For example, metathesis failed to affect *r* before noncoronal consonants in (25a). The absence of attested examples like (25b) reveals the directionality of metathesis, which transposed *rd* to *dr* but not vice-versa. Metathesis is also unattested in other rhotic-coronal clusters, as shown in (25c).

(25) a.

amargo	**amagro*	'bitter'
yerva	**yevra*	'grass'

b.	*kwadro*	**kwardo*	'frame'
	padre	**parde*	'father'[10]
c.	*arto*	**atro*	'full, fed up'
	karne	**kanre*	'meat'
	perla	**pelra*	'pearl'
	diverso	**divesro*	'diverse'

A brute-force markedness constraint such as **rd* ranked above LINEARITY and ALIGN would generate the patterns in (24a, b), respectively. However, such an approach merely stipulates *rd* as a target of metathesis without explaining why the clusters in (25) were unaffected. I propose that *rd* was targeted because *the adjacent consonants were maximally similar in place, manner, and voice features.* This explanation rests upon several claims about the phonetic realization of JS /ɾ/ and /d/ in different syllabic contexts. First, recent articulatory studies document syllable-position effects in several languages, whereby syllable-initial consonants tend to show more stable patterns of intrasegmental gestural coordination and greater degrees of constriction than the same consonants in syllable-final position (Kochetov 2006, Krakow 1999, and studies cited therein). A plausible hypothesis is that in JS, coda /ɾ/ came to be realized more frequently as an approximant (transcribed here as [ɾ̞] with the IPA lowering diacritic), while /ɾ/ associated to the syllable onset was realized with tighter constriction degrees (see Blecua 2001 for an acoustic description of approximant and stop-like realizations of /ɾ/ in modern Castilian Spanish). Second, in most JS varieties, the voiced obstruents /bdg/ show the same allophonic distribution as in Peninsular Hispano-Romance varieties, with approximant [βðɣ] appearing in most positions and stop [bdg] only after a pause or nasal, and also after a lateral in the case of /d/ (Penny 1992: 137). Third, Spanish approximants [βðɣ] involve less articulatory precision and do not have release bursts, in contrast to their plosive counterparts (Martínez-Celdrán 2004).

If correct, the hypothesis that *rd* in JS was realized phonetically as [ɾ̞.ð] makes it possible to analyze rhotic metathesis as an effect of the segmental Obligatory Contour Principal (henceforth, OCP). Leben (1973) first proposed the OCP in order to explain distributional regularities in lexical tone systems, and McCarthy (1986) subsequently modified the OCP to apply also to nonlinear segmental phonology. Some OT approaches to the segmental OCP have formulated the principle as a violable constraint taking different features as its arguments. I propose an analysis of *rd* metathesis involving the OCP constraint

10. Penny (1992: 138, Fn. 8) acknowledges the sporadic transposition of *dr* > *rd* in some MS dialects (e.g., Chicano Spanish *pierdas* < *piedras* 'stones', Louisiana Isleño Spanish *parde* < *padre* 'father') but views this as hypercorrection of earlier *rd* > *dr.* See Section 5 for further generalizations and analysis of leftward rhotic metathesis in JS and popular MS.

in (26), which operates over features such as the ones shown in (27) for coronal consonants.

(26) OCP(place, manner, voice) – OCP
Adjacent segments identical in place, manner, and voice features are prohibited.

(27)

	[ɾ̥]	[ð]	[ɾ]	[d]	[t]	[n]	[l][11]	[s]
CORONAL	√	√	√	√	√	√	√	√
[continuant]	+	+	−	−	−	−	−/+	+
[nasal]	−	−	−	−	−	+	−	−
[lateral]	−	−	−	−	−	−	+	−
[burst]	−	−	−	+	+	−	−	−
[voice]	+	+	+	+	−	+	+	−

Although arguably universally non-contrastive, the phonetic feature [burst] is included in (27) to distinguish between the noncontinuants [ɾ] and [d] (see Steriade 2000). The heterosyllabic sequence [ɾ̥.ð] violates (26) because the approximants [ɾ̥] and [ð] are identical in place, manner, and voice features. Heterosyllabic clusters of [ɾ̥] followed by coronal [t], [n], [l], or [s] are non-identical in manner and/or voice features and, therefore, do not violate the constraint. Since noncontinuant [ɾ], which surfaces *ex hypothesi* in onset position, differs from [ð] with respect to [continuant], tautosyllabic [.ðɾ] is also non-identical and immune from the OCP.

The tableaux in (28) illustrate the analysis of *rd* metathesis both word-internally and across word boundaries. The distribution of coda [ɾ̥] versus onset [ɾ] and the appearance of [ð] are controlled by other constraints not shown here. The ranking of OCP ≫ LINEARITY favors the [.ðɾ] onset cluster in (28b) over heterosyllabic [ɾ̥.ð] in (28a). Heterosyllabic [ð.ɾ] in (28c) violates SYLLCON because sonority rises across the syllable boundary. Tautosyllabic [.ɾð] in (28d) violates the SSP because sonority does not rise between the rhotic and the syllable peak (recall the constraint definition in (4b)). Optimal outputs like (28b) were eventually lexicalized in JS, thus giving rise to the metathesized forms observed in (24a). The analysis is the same for the phrase *amor de* in the second tableau, except that metathesis across the word boundary in (28f) also violates ALIGN. In contrast to the frequency of word-internal *rd* metathesis, the paucity of examples showing *rd* metathesis across the word boundary suggests

11. Following Holt (2002), I assume that laterals contain both primary and secondary place nodes that dominate different values of [continuant], although nothing in the present analysis hinges upon the distinction.

ALIGN ≫ OCP ≫ LINEARITY as a more appropriate ranking, with only sporadic inversion of the top two constraints producing occasional blends such as *amodre.*[12]

(28) *rd* metathesis in JS *tadre* 'late, afternoon' and *amodre* 'love (of)'

tarðe	MIN-DISTSON	SSP	SYLLCON	OCP	ALIGN	LINEARITY
a. taɾ̬.ðe				*!		
☞ b. ta.ðre						*
c. tað.ɾe			*!			*
d. ta.ɾðe		*!				

amoɾ ðe	MIN-DISTSON	SSP	SYLLCON	OCP	ALIGN	LINEARITY
e. a.moɾ̬.][ðe				*!		
☞ f. amo.[ðɾ]e					*	*
g. a.mo[ð.ɾ]e			*!		*	*
h. a.mo.ɾ][ðe		*!				

In the OCP account, *rd* metathesis is explained in terms of the similarity of [ɾ̬] and [ɾ], which is based on the hypothesis that coda /ɾ/ was pronounced more frequently as an approximant. *rd* metathesis is documented in JS texts as early as the sixteenth century and becomes most productive in Istanbul by the eighteenth century (Quintana 2006: 108). While the phonetic realization of coda /ɾ/ during that historical period is no longer directly verifiable, there is indirect evidence of the similarity between /ɾ/ and /d/ in coda position. Crews (1935: 194, N. 170) notes variation in the pronunciation of infinitive-clitic sequences in Bucharest JS, e.g., *dadvos* < *darvos* 'to give to you', in which /d/ replaces the final /ɾ/ of the infinitive.[13] At the time of Crews's observations in the early

12. The difference in the frequency of *dl* versus *rd* metathesis across morpheme boundaries could also be related to differences in prosodic representation. If enclitics are adjoined to the preceding prosodic word (PW) to form an outer PW, then the *dl* cluster of ((*dad*)$_{PW}$*lo*)$_{PW}$ falls within a PW domain. If prepositions are similarly adjoined to the following PW, then the *rd* cluster of (*amor*)$_{PW}$(*de*(*mi*)$_{PW}$)$_{PW}$ spans the boundary between two PWs. Given these representational assumptions, it may be possible to devise an account in which segmental reordering is more costly across the PW boundary than within a single PW domain.

13. Interestingly, just the opposite segmental change has arisen in some Peninsular varieties of MS, whereby /ɾ/ replaces the final /d/ of informal plural imperatives, e.g., *apagarla* < *apagadla* 'turn it off', *decirme* < *decidme* 'tell me' (Eddington 2004: 66–68). José Ignacio Hualde (personal communication) observes that a form such as *dadlo* 'give it' is only a reading pronunciation nowadays and that *darlo* is more characteristic of the spoken language. D. Eric Holt (personal communication) suggests that the *-r* imperative form is the result of a morphological change rather than rhotacism per se. Since Spanish allows *r*-final verbal infinitives to be used as imperatives when the recipient is unspecified, as in directions for household

1930s, [ð] had already disappeared as an allophone of /d/ in the Bucharest variety, leaving only the voiced stop realization. Quintana (2006: 88) agrees with Crews's suggestion that /d/ must have been pronounced at earlier stages as [ð], which is easily confused with the rhotic. The potential for confusability would have been greatest if coda /ɾ/ at that time was realized as an approximant [ɾ̬].

An additional piece of evidence supporting the OCP account of *rd* metathesis comes from the Bosnian variety of JS, which exhibits only stop allophones of /bdg/. As Baruch (1930) observes, "la *d* oclusiva es perceptible en posición intervocálica y precedida de *r, l, n: kada, modu, gordu, prenda, moldi*" (p. 138). Baruch goes on to note that *rd* metathesis is not found in Bosnia, where forms such as *vardi* 'green', *parder* 'to lose', and *gordu* 'fat' maintain the original *rd* clusters intact (p. 139). Assuming that coda /ɾ/ was realized as an approximant [ɾ̬], the lack of approximant [ð] in Bosnian JS suggests that *rd* clusters would have been realized phonetically as [ɾ̬.d]. Given the feature specifications in (27), this phonetic sequence would not have violated the OCP, and any deviation from the order of segments in the input would have been ruled out by violations of ALIGN and/or LINEARITY. The absence of approximant [ð] correlates with the absence of the *rd* > *dr* shift within the same JS dialect, which suggests that featural identity was a necessary condition for *rd* metathesis.[14]

5. Leftward rhotic metathesis in JS and popular MS

The transposition of *rd* clusters was an innovative and highly regular sound change in the majority of JS dialects. Although less regular than *rd* metathesis, leftward displacement of *r* is also attested and must be taken into account. Baruch (1930: 139), T. Harris (1994: 75), Luria (1930: 136), and Sala (1971: 154) document the following examples:

(29)		JS	MS	
	a.	*prisona*	*persona*	'person'
		prisigir	*perseguir*	'to pursue'
		treseru	*tercero*	'third'

items, recipes, etc., speakers may have co-opted the preexisting infinitival forms as informal plural imperatives via analogy (Eddington 1991).

14. Recall that Bucharest JS also lost the approximant allophone of /d/ but still shows evidence of *rd* metathesis (Crews 1935). Quintana (2006: 88) notes that (i) approximant allophones were lost from JS due to contact with Slavic languages, which lacked these sounds, and (ii) this change took place in Bosnia, Croatia, and Serbia more than a century before Bulgaria and Romania. This chronology suggests that in the western speech communities, the early loss of [ð] precluded the possibility of *rd* metathesis. In the eastern speech communities, *rd* metathesis was already underway before the loss of [ð] was complete.

b.	*impruviser*	*empobrecer*	'to impoverish'
	provi	*pobre*	'poor'
	krosta	*costra*	'scab'

A comparison of the JS forms with their MS counterparts shows that *r* has migrated leftward from coda position in (29a) and from the second position of a complex onset in (29b), ending up in the first complex onset of the word. Metathesis is intrasyllabic in the first group of examples but crosses a syllable boundary in the second group.

The leftward displacement of *r* is amply attested in popular MS speech. The following examples are from Lipski (1990: 92).[15] In (30), the coda rhotic has switched places with the preceding nuclear vowel and now forms a complex onset within the same syllable, as in JS (29a).

(30)	*abarcar* > *abracar*	'to cover, take on'
	Borgada > *Brugada*	(name)
	conturbiar > *controbiar*	'to disturb, bother'
	deperder > *depreder*	'to lose'
	deperdición > *depredición*	'loss'
	dormir > *drumir*	'to sleep'
	fortuna > *frutuna*	'fortune'
	garbanzo > *grabanzo*	'chickpea'
	intervalo > *intrevalo*	'interval'
	pedernal > *pedrenal*	'flint'
	percantar > *precantar*	(no gloss)
	perdonar > *predonar*	'to pardon'
	perfecto > *prefecto*	'perfect'
	permiso > *premiso*	'permission'
	persignar > *presi(g)nar*	'to make the symbol of the cross'
	persistir > *presistir*	'to persist'
	perspicaz > *prespicaz*	'perceptive, sharp'
	porfiar > *profiar*	'to insist'
	taberna > *tabrena*	'tavern'
	Torcuato > *Trocuato*	(name)
	turbio > *trubio*	'cloudy, muddy'

15. A similar and much more productive case of leftward rhotic metathesis is found in the Sardinian dialect of Sestu Campidanian (Bolognesi 1998, Frigeni 2005a,b). Some varieties of Sardinian also exhibit the *rd* > *dr* shift, but unlike JS, other rhotic-coronal clusters have undergone total assimilation. See Frigeni (2005a) for a comparison of the developments in Sardinian dialects and Frigeni (2005b) for an account of the conditions on coda rhotics in terms of representational contrast and featural similarity. See also Molinu (1999), who argues that the *rd* > *dr* shift in Sardinian is not a true case of segment metathesis but rather the leftward transfer of the laryngeal [voice] feature of the obstruent to the rhotic.

In (31), the rhotic has moved leftward from the second position of a complex onset to the same position in the immediately preceding syllable, as in JS (29b). The polysyllabic MS examples in (31b) show evidence of a one syllable limit on leftward movement. In each case, the rhotic is displaced by only one syllable from its original location, even though movement to the initial syllable would have created a well-formed cluster.

(31)	a.	*adientro* > *adriento*	'inside'
		dentro > *drento*	'inside'
		encabritado > *engravitao*	'angry'
		fábrica > *frábica*	'factory'
		Gabriel > *Grabiel*	(name)
		(h)ipocresía > *(h)iproquesía*	'hypocrisy'
		íntegra > *íntriga*	'integral'
		petral > *pretal*	'strap'
		petróleo > *pretolio*	'petroleum'
		postrero > *prostero*	'last one'
		postrimería > *prostimería*	'final period of time'
		quebrada > *crebada*	'broken'
		quebrar > *crebar*	'to break'
		resquebrajar > *rescrebajar*	'to crack'
		teatro > *treato*	'theater'
		temprano > *trempano*	'early'
		tigre > *trige*	'tiger'
	b.	*cabestro* > *cabresto*	'leading ox'
		catedral > *catredal*	'cathedral'
		dentífrico > *dentrífico*	'toothpaste'
		pedestre > *pedreste*	'pedestrian'

The following generalizations emerge from the Hispano-Romance patterns in (29) through (31):

(32) Rhotic metathesis ...

a. is triggered when *r* is adjacent to a consonant
b. favors the creation of *Cr* onset clusters
c. displaces *r* leftward from its original position
d. displaces *r* no more than one syllable from its original position

(32a) is motivated by the lack of attested examples involving word-final or intervocalic *r*, e.g., *perseguir* > *prisigir, *prisigri, *pirsigri* 'to pursue' (29a), *abarcar* > *abracar, *abracra, *abarcra* 'to cover, take on' (30), *postrimería* > *prostimería, *prostrimeía* 'final period of time' (31a). (32b) suggests that while both *rC* and *Cr* clusters trigger metathesis, *Cr* is an output of metathesis

more often than *rC* is. Lipski (1990: 90) proposes to explain (32c) as an effect of Latin phonotactic patterns, "which had the overall impact of promoting or retaining words in which the consonantal density (onset-initial and rhyme clusters) decreases from left to right." Finally, (32d) is motivated by examples like those in (31b). Lipski (1990: 100) points out that forms like **cratedal (< catedral)* are occasionally heard, but that displacement "appears to be at least partially subject to a constraint on distance of movement."

5.1. Position-specific markedness and leftward rhotic metathesis

This section develops an OT account of the generalizations about leftward rhotic metathesis in JS and popular MS. The default ranking of phonotactic constraints in (33) captures generalizations (32a,b). Both *rC* and *Cr* clusters are marked structures and potential metathesis triggers, and *Cr* is less marked than *rC.*

(33) *ɾC ≫ *Cɾ

The notion of position-specific constraint evaluation makes possible an account of the directionality and distance effects in rhotic metathesis. Recent work on local optionality in OT argues that constraints can be relativized to different positions within the word and that they can be variably ranked at each position-specific stratum in a constraint hierarchy (Riggle and Wilson 2005; see also Lubowicz 2005, McCarthy 2003a,b on the concept of *locus of violation* of constraints). I propose that the phonotactic constraints in (33) should be exploded into position-specific versions. Shown in both horizontal and vertical format, the hierarchy in (34a, b) expresses the basic ranking in (33) for a word that has three positions. The number after the '@' symbol denotes the position to which a constraint refers.

(34) a. *ɾC@3 ≫ *Cɾ@3, *ɾC@2 ≫ *Cɾ@2, *ɾC@1 ≫ *Cɾ@1

b. *ɾC@3

*ɾC@2 *Cɾ@3

*ɾC@1 *Cɾ@2

*Cɾ@1

This ranking is simply the combination of two subhierarchies of cluster constraints. In each subhierarchy, constraints that refer to positions closer to the initial syllable are ranked lower: *ɾC@3 ≫ *ɾC@2 ≫ *ɾC@1 and *Cɾ@3

≫ *Cr@2 ≫ *Cr@1. These fixed rankings formally express Lipski's observation that consonantal density decreases from left to right but in a way that pertains only to *rC* and *Cr* clusters. Instead of the variable ranking that accounts for local optionality, the hierarchy in (34) maintains the fixed, default ranking of *rC ≫ *Cr within each position-specific stratum.

Tableau (35) illustrates the effects of the hierarchy on a set of hypothetical CV.CV.CV forms that differ solely in the placement of *r*. (For consistency, I continue to assume that approximant [r̠] appears in coda position, as hypothesized in Section 4.) Constraints are linked to specific positions in output candidates by subscripts that correspond to the syllable containing the rhotic. Based on the markedness hierarchy alone, the word-initial *Cr* onset in (35d) is better than any *rC* or *Cr* cluster appearing farther to the right. The hierarchy thus captures generalization (32c). When *r* is displaced, it generally moves toward the part of the word where *rC* and *Cr* are less marked, i.e., leftward.

(35) Universal ranking of position-specific markedness constraints

		*rC@3	*Cr@3	*rC@2	*Cr@2	*rC@1	*Cr@1
a.	CV.CV**r̠$_2$.C**V			*!			
b.	CV.**Cr̠$_2$**V.CV				*!		
c.	CV**r̠$_1$.C**V.CV					*!	
☞ d.	**Cr̠$_1$**V.CV.CV						*

Let us assume a variable ranking of LINEARITY along the fixed hierarchy in (34). The position in which a cluster can trigger rhotic metathesis is determined by where LINEARITY happens to fall along the hierarchy in a given evaluation. When it falls at the top of the hierarchy, no metathesis takes place. Furthermore, LINEARITY is violated once for every segment that *r* passes over in an input-output mapping. The OT tenet of minimal constraint violation accounts for generalization (32d) regarding the distance constraint on rhotic displacement. In the absence of some higher-ranking constraint, a candidate with fewer LINEARITY violations is better than one with more violations. To put it another way, rhotic displacement must be minimal.

Tableau (36) gives an analysis of *CVr* > *CrV* metathesis in a trisyllabic word that contains coda *r* in the second syllable. In this particular evaluation, LINEARITY falls between *rC@2 and *Cr@2 in the markedness hierarchy. The fully faithful candidate (36a) has a preconsonantal *r* that belongs to the second syllable, which violates higher-ranking *rC@2. Candidates (36c, d) are ruled out by their multiple LINEARITY violations. The optimal candidate is (36b) because it involves a shorter distance of rhotic displacement.

(36) Popular MS *taberna* > *tabrena* 'tavern'

	taβerna	*ɾC@3	*Cɾ@3	*ɾC@2	LINEARITY	*Cɾ@2	*ɾC@1	*Cɾ@1
a.	ta.βe**ɾ̥$_2$.n**a			*!				
☞ b.	ta.**βɾ$_2$**e.na				*	*		
c.	ta**ɾ̥$_1$.β**e.na				**!		*	
d.	**tɾ$_1$**a.βe.na				**!*			*

The same ranking accounts for long-distance metathesis between adjacent *Cr* onsets, as shown in tableau (37). Candidates (37a, b) are eliminated by *Cɾ@3 and *ɾC@2, respectively. Candidate (37c) is optimal because it involves the shortest displacement.[16]

(37) Popular MS *catedral* > *catredal* 'cathedral'

	kateðral	*ɾC@3	*Cɾ@3	*ɾC@2	LINEARITY	*Cɾ@2	*ɾC@1	*Cɾ@1
a.	ka.te.**ðɾ$_3$**al		*!					
b.	ka.te**ɾ̥$_2$.ð**al			*!	*			
☞ c.	ka.**tɾ$_2$**e.ðal				**	*		
d.	ka**ɾ̥$_1$.t**e.ðal				***!		*	
e.	**kɾ$_1$**a.te.ðal				***!*			*

Lipski (1990) documents several counterexamples to generalizations (32b, c). The analysis developed thus far can accommodate these counterexamples in a way that reflects their more marked character. While rhotic metathesis usually favors the creation of *Cr* onset clusters, the examples in (38) show heterosyllabic *rC* as the favored outcome. In (38a), *r* is displaced rightward from an onset cluster to coda position within the initial syllable. In (38b), *r* is displaced leftward from an onset cluster in the second syllable to coda position in the first syllable.

16. Sardinian shows evidence of long-distance rhotic metathesis in which *r* has shifted two syllables leftward from its original position (see Frigeni 2005a for discussion). In the position-specific markedness approach developed here, longer distance displacement is predicted to be possible but less frequent, since LINEARITY has to be ranked farther down the hierarchy of position-specific markedness constraints.

(38)

a.	*brebaje* > *berbaje*	'beverage'
	brocal > *borcal*	'well cover'
	frito > *firto*	'fried'
	preferir > *perferir*	'to prefer'
	pretina > *pertina*	'belt'
	procurar > *porcurar*	'to try, get'
	profeta > *porfeta*	'prophet'
	profundina > *porfundina*	'bottom'
	promedio > *pormedio*	'average'
b.	*chacras* > *charcas*	'farm'
	lágrima > *lárguima*	'tear'
	madre > *marde*	'mother'
	matrimonio > *martimonio*	'marriage'
	padre > *parde*	'father'
	piedra > *pierda*	'stone'
	pudrir > *purdir*	'to go bad'

In all of the examples in (38), metathesis creates an *rC* cluster in which *r* appears in coda position of the initial syllable. To account for this outcome, the default ranking of *rC@1 ≫ *Cr@1 must be inverted, and *Cr@1 must also dominate LINEARITY. Tableau (39) gives an analysis of rightward metathesis in (38a). The fully faithful candidate (39a) is eliminated by *Cr@1. High-ranking *Cr@2 rules out the mapping in (39c), in which the rhotic moves to the following complex onset. The low ranking of *rC@1 allows (39b) to emerge as optimal.

(39) Popular MS *brocal* > *borcal* 'well cover'

	brokal	*rC@3	*Cr@3	*rC@2	*Cr@2	*Cr@1	LINEARITY	*rC@1
	a. **br$_1$**o.kal					*!		
☞	b. bo**r$_1$.k**al						*	*
	c. bo.**kr$_2$**al				*!		**	

The same ranking accounts for leftward metathesis in (38b). The fully faithful candidate (40a) is eliminated by *Cr@2. High-ranking *Cr@1 prevents rhotic displacement to the word-initial onset in (40c), and the low ranking of *rC@1 allows *r* to move to the coda of the initial syllable in (40b).

(40) Popular MS *padre* > *parde* 'father'

		paðre	*ɾC@3	*Cɾ@3	*ɾC@2	*Cɾ@2	*Cɾ@1	LINEARITY	*ɾC@1
	a.	pa.**ðɾ$_2$**e				*!			
☞	b.	pa**ɾ̪$_1$.ð**e						*	*
	c.	**pɾ$_2$**a.ðe					*!	**	

The position-specific markedness approach directly captures the exceptional nature of the metathesis data in (38). The default ranking of *ɾC ≫ *Cɾ correctly predicts that *Cr* is the favored outcome of metathesis in the majority of cases.[17] The sporadic creation of marked *rC* clusters requires that the default ranking be inverted, at least for word-initial position. Marked patterns of rhotic metathesis are thus predicted to be possible but less frequent because they involve a deviation from the default ranking.

5.2. Consonantal adjacency and the rd >dr *shift in JS*

We must now connect the analysis of leftward rhotic metathesis with the analysis of the *rd* > *dr* shift in JS developed in Section 4. There it was established that [ɾ̪.ð] clusters are marked because they violate an OCP constraint against

17. Vowel epenthesis phenomena seem to suggest that *Cr* is in fact a marked cluster, contrary to what the default ranking implies. First, it has long been noted in the Spanish phonetic literature that complex onsets containing /ɾ/ in second position typically show a vocalic element intervening between the rhotic and the preceding consonant (see, e.g., Navarro Tomás 1918: § 113). However, Bradley (2007, inter alia) argues that this element is not a true phonological vowel resulting from epenthesis in the synchronic grammar. Rather, it is the acoustic consequence of non-overlapping consonant gestures that are superimposed on the nuclear vowel. Second, Freitas (2003) documents the insertion of [i] in obstruent-liquid clusters in the L1 acquisition of European Portuguese, e.g., *cabra* [kabɨra] 'goat'. Rafael Núñez Cedeño (personal communication) points out that the same phenomenon occurs with child language in Dominican Spanish, e.g., *timbre* [timbere] 'stamp'. Assuming that examples such as these from L1 acquisition are in fact alternate strategies for resolving complex onsets and not simply the effects of gestural overlap, vowel epenthesis can be given a straightforward account in OT. Specifically, the correspondence constraint against vowel epenthesis (DEPENDENCY-V) must rank below both the relevant position-specific *Cr constraint and LINEARITY. Such a ranking predicts that *Cr* will be avoided by medial vowel epenthesis instead of rhotic metathesis. On the other hand, high-ranking DEPENDENCY-V prevents the insertion of a vowel in the *Cr* cluster.

adjacent segments identical in place, manner, and voice features. However, neither the OCP constraint nor LINEARITY says anything about the directionality of rhotic displacement. The markedness hierarchy in (34) incorrectly predicts that OCP-violating *rd* clusters will always be repaired by leftward metathesis of *r,* if a licit onset cluster can be created in the immediately preceding syllable.

Tableau (41) illustrates the problem. The fully faithful candidate (41a) violates the OCP constraint. The remaining two candidates avoid the OCP violation by transposing *r* with the following stop in (41b) and with the previous vowel in (41c). LINEARITY cannot distinguish between the two, so the lower ranked constraints of the markedness hierarchy get to determine the winner. Candidate (41b) is eliminated by its violation of *Cr@2, and (41c) wins. The leftward pointing hand '☜' means that (41b) should win but does not. No ranking of OCP and LINEARITY with respect to the markedness hierarchy is capable of selecting (41b), which is in fact optimal in JS.

(41) LINEARITY alone cannot account for *rd* transposition in JS

		perðon	OCP	LINEARITY	*Cr@2	*rC@1	*C@1
	a.	pe**ɾ̥₁.ð**on	*!			*	
☜	b.	pe.**ðɾ₂**on		*	*!		
☞	c.	**pɾ₁**e.ðon		*			*

There must be some other constraint that favors input-output mappings like those in (41b) over those in (41c). Carpenter (2002) extends the class of correspondence constraints to cover adjacency relations between segments. In Rotuman and Leti, there are processes of local, but not noncontiguous, metathesis which LINEARITY alone cannot account for. Carpenter proposes a family of adjacency constraints that prevent noncontiguous metathesis within a specified domain, which she assumes to be the syllable. For present purposes, I adopt the constraint in (42), whose domain is the consonantal tier.

(42) I-ADJACENCY$_{(C\text{-tier})}$ – I-ADJ$_{(CC)}$
If x is adjacent to y in the input, and x and y are positions on the consonantal tier, then x' must be adjacent to y' in the output.

This constraint requires the consonants of an input cluster to remain adjacent in the output. Carpenter proposes a general ranking scheme that rules out noncontiguous metathesis in languages that allow only local transposition of segments. An adjacency constraint must dominate some markedness or faithfulness constraint, which, in turn, dominates LINEARITY.

Tableau (43) shows how the ranking of I-ADJ$_{(CC)}$ ≫ OCP ≫ LINEARITY optimizes rightward metathesis in *rd* clusters. Candidate (43c) is eliminated because the *rd* cluster of the input is no longer adjacent in the output. The OCP constraint eliminates (43a), and the optimal candidate (43b) has a *dr* onset in the second syllable.

(43) *rd* metathesis in JS *pedron* 'pardon'

		perðon	I-ADJ$_{(CC)}$	OCP	LINEARITY	*Cr@2	*rC@1	*Cr@1
	a.	pe**ɾ̪.ð$_1$**on		*!			*	
☞	b.	pe.**ðr$_2$**on			*	*		
	c.	**pr$_1$**e.ðon	*!		*			*

To account for the leftward displacement of coda *r* in word-initial syllables in popular MS (30), both the adjacency constraint and LINEARITY must be ranked below the position-specific markedness constraints that trigger metathesis. In tableau (44), high-ranking phonotactic constraints eliminate both the fully faithful candidate (44a) and the *rf* > *fr* shift in candidate (44b). Since the adjacency constraint ranks below the two phonotactic constraints, the input *rf* cluster can now be broken apart by leftward rhotic metathesis in candidate (44c).

(44) Leftward metathesis in popular MS *prefecto* 'perfect'

		perfekto	*Cr@2	*rC@1	I-ADJ$_{(CC)}$	LINEARITY	OCP	*Cr@1
	a.	pe**ɾ̪$_1$.f**ek.to		*!				
	b.	pe.**fr$_2$**ek.to	*!			*		
☞	c.	**pr$_1$**e.fek.to			*	*		*

6. Alternative perceptual accounts

Recent work in phonological theory has approached the phenomenon of consonant metathesis from the perspective of listener-based sound change (Ohala 1993). According to Blevins and Garrett (1998, 2004), perceptual metathesis involves segments with acoustic features that can be realized over temporal domains spanning entire syllables or even strings of syllables (e.g., lowered F3 for rhotics and rhotic vowels, lateral formants for laterals and lateral vowels,

and spectral zero/nasal resonance for nasals and nasalized vocoids). Metathesis occurs when listeners reinterpret the elongated feature in a non-historical position.

The OS and JS data present several problems for this approach. First, Spanish /ɾ/ is typically described as having an extra-short acoustic duration of approximately 20 ms (Quilis 1993), which arguably makes it one of the shortest segments cross-linguistically. At least with respect to the long-distance metatheses in (29b) and (31), it seems difficult to reconcile the extreme brevity of /ɾ/ with the requirement that an acoustic feature extend over a sufficiently long domain in order for perceptual metathesis to occur. Second, temporal extension of acoustic features alone cannot explain the directionality of the *rd* > *dr* shift in (24), nor the failure of the clusters in (25a, c) to undergo transposition. Third, Blevins and Garrett predict that local metathesis should not affect stop-nasal clusters in any language, since there is no way for nasality to extend across the adjacent stop without directly affecting it. In a brief footnote, they suggest that the Spanish *tn* > *nd* sound change has been erroneously classified as metathesis and that the shift instead occurred via loan adaptation, although they provide no further discussion or evidence to support such a claim. However, it is clear from the written record that coronal stop-nasal metathesis was a productive, albeit variable, sound change internal to OS. The examples in (1a) are patrimonial lexical items inherited directly from Late Spoken Latin, while those in (2a) are morphologically complex forms created via productive cliticization. Furthermore, obstruent-nasal metathesis is a regular synchronic process in Sidamo, as seen in (16). The possibility of stop-nasal metathesis is correctly predicted by the interaction of markedness and faithfulness constraints in the OT account.

Hume (2004) proposes a model in which two conditions must obtain in order for metathesis to occur. First, the linear ordering of elements must exhibit indeterminacy, which is a function of both the listener's experience with those elements and the quality of information occurring in the speech signal. Second, the structure resulting from metathesis must be attested in the language. Word-medial *dn* and *dl* clusters are extremely rare in Spanish (see Eddington 2004: 67), and this no doubt would have led to indeterminacy regarding their linear order in OS due to the listener's inexperience with these clusters. Indeterminacy arises also in the temporal extension of "stretched out" acoustic features (Hume 2004: 219–220). Both the long-distance metathesis of /ɾ/ and the local metathesis of stop-nasal clusters are problematic for a perceptual account, as we have seen above in the discussion of Blevins and Garrett (2004). An anonymous reviewer pointed out, however, that "stretched out" features are not the only cause of indeterminacy. Perceptual similarity of adjacent segments may also lead to ambiguity in their linear ordering. In this respect, the formal OCP account of *rd* metathesis developed in Section 4 is consistent with Hume's per-

ceptibility account in which ambiguity/indeterminacy is a necessary condition for metathesis to occur.[18]

Finally, Hume (2004) argues that since stop release is favored prevocalically but perceptually masked in preconsonantal contexts, "the observation that a stop/consonant sequence is reordered so that the stop emerges instead before a vowel is thus to be expected" (p. 218). From this perspective, it is surprising that the *rd* > *dr* shift in JS consistently transposed the already prevocalic voiced coronal obstruent to preconsonantal position, where release cues are presumably less perceptible than before a vowel. In the OT analysis developed in Section 5, the locality of *rd* metathesis is accounted for by a high-ranking segmental adjacency constraint. As shown in tableau (43), the optimal candidate has a *dr* cluster, in which the adjacency of the two consonants in the input is maintained in the output.

7. Conclusion

While metathesis is typically described as an irregular and unpredictable sound change, Hock (1985) and others have noted that metathesis often serves to repair phonotactically illicit sequences or to bring about preferred syllable structures. Building upon Holt's (2004) syllable-contact account of OS metathesis, I have proposed a formal explanation of why heteromorphemic *dm* is immune from metathesis in both OS and JS. While the transposition of a coronal stop and a following nasal consonant is triggered by a constraint on syllable contact, the change is blocked by higher-ranking constraints governing nasal place alternations. I have also proposed to explain the *rd* > *dr* shift in JS as a dual effect of an OCP constraint against adjacent segments identical in place, manner, and voice features, and of a correspondence constraint requiring consonantal adjacency. Additional patterns of leftward rhotic metathesis in Hispano-Romance require a universal ranking of position-specific cluster markedness constraints. The theoretical relevance of these novel proposals is that they highlight the role of constraints on segmental features, which interact with sonority and other markedness constraints to generate the patterns of consonant metathesis attested in Hispano-Romance varieties.

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18. For theoretical discussion and comparison of segment contact and OCP constraints, see Seo (2003: 83–86).

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