

Where *r* you going? A typology of long-distance metathesis of liquids

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Abstract

This paper offers a typological analysis of the diachronic phenomena of long-distance metathesis of liquids that thrive in the history of several Romance languages. In particular, it explores metathesis of liquids from a non-initial consonant-liquid configuration towards the left periphery of the word, which may be accompanied by metathesis of post-vocalic liquids and be subject to locality restrictions, i.e. limitations with respect to the distance the migrating liquid may travel. Different combinations of the above possibilities yield four different typological categories, three of which are attested. Although existing models have offered insightful accounts of the phenomena at hand from a language-specific angle, a comprehensive understanding of the factors that determine the bigger typological picture is missing. The present proposal, couched within Property Theory (Alber & Prince 2015, in prep.), aims at generating all attested patterns and extracting the crucial ranking conditions that define the typology of long-distance metathesis. The cornerstones of the analysis are two ranking conditions that trigger/block metathesis from a post-consonantal and a post-vocalic environment, respectively, a

ranking condition imposing/lifting locality restrictions, and a ranking condition determining the least tolerated marked structure in a given language, choosing between a non-initial post-consonantal liquid and a post-vocalic one.

Keywords: Long-distance metathesis, liquids, Romance, typology, Property Theory.

1. Introduction

Long-distance metathesis (LDM) involving liquids and especially rhotics (henceforth collectively referred to as R)¹ is typical in the history of several Romance languages (Rohlf 1966) and in the Italiot Greek dialects (Rohlf 1950) (henceforth LDM languages). To exemplify, consider the cognates of Latin *capra* ‘goat’ (1a–b) and *capistru(m)* ‘halter’ (1c–d) in Sardinian (Lai 2013) and Judeo-Spanish (Lipski 1990) as well as the evolution of Medieval Greek *pikro* ‘bitter’ (1e) and *kapistri* ‘halter’ (1f) in Italiot Greek (Rohlf 1930).

(1) *LDM of R in Romance*

(a)	kápra	>	krápa	(Sardinian)
(b)	kápra	>	krába	(Judeo-Spanish)
(c)	kapístru(m)	>	krapístu	(Sardinian)
(d)	kapístru(m)	>	kabrésto	(Judeo-Spanish)
(e)	pikró	>	prikó	(Italiot Greek)
(f)	kapístri	>	krapísti	(Italiot Greek)

Although a substantial body of research has provided valuable insight into various aspects of LDM from a language-specific point of view (Coffman 2013, Torres-Tamarit et al. 2012, Lai 2013, 2015, Tifrit 2020; see also Chandlee 2014, Canfield 2015), the bigger typological picture of LDM remains unexplored. This paper aims at contributing to our understanding of LDM and its different manifestations across Romance languages from a typological point of view. In what follows, I present diachronic data from Romance that illustrate the phenomenon (section 2). Then, I review previous analyses of LDM phenomena in Romance and I highlight their shortcomings with respect to typological considerations (section 3). In section 4, I propose a novel analysis of the LDM landscape that relies on the identification of the ranking conditions that determine the typology, along the lines of Property Theory (Alber & Prince 2015, in prep.). Section 5 summarizes the conclusions.

¹ In many Romance languages, Latin /l/ and /r/ have been neutralized to /r/ (Wagner 1941, Pittau 1972, Viridis 1978, Frigeni 2005). In Italiot Greek, conflicting evidence prevents a generalization that both liquids are affected (Author 2020, in prep.; cf. Blevins & Garrett 2004, Coffman 2013). Gascon constitutes the only uncontroversial case where the lateral participates unchanged (see Coffman 2013 for data and references). In any case, it is indisputable that rhotics have the lion’s share in the phenomenon of LDM, hence the choice of the abbreviation.

2. LDM in Romance

LDM of Rs is abundantly attested in the diachrony of several Romance languages, among which all Sardinian varieties (Wagner 1941, Geisler 1994, Bolognesi 1998, Molinu 1999, Lai 2013, 2015), dialectal Italo-Romance (Rohlf's 1966), e.g. Neapolitan (Abete 2015) and Calabrian (Rohlf's 1966), Gascon (Grammont 1905, Rohlf's 1935, Duménil 1987, Blevins & Garrett 1998), Alguerese Catalan (Cabrera-Callís *et al.* 2010, Torres-Tamarit *et al.* 2012), Judeo-Spanish (Lipski 1990, Bradley 2006, 2007), as well as Italiot Greek (Rohlf's 1930, 1950, Karanastassis 1984–1992, 1997), presumably due to the centuries-long contact with Romance.² As a general rule, a non-initial complex onset consisting of a consonant followed by a liquid (CR) is “split” and a new CR is formed via leftward metathesis of the R. Two patterns are revealed according to the distance the migrating R travels: it either moves all the way from the onset of the second (O-2) or the third syllable (O-3) to the onset of the first syllable (O-1) of the word (2)³ or docks on the onset of the syllable that is adjacent to its point of departure (O-adj) (3). Notably, LDM is independent of stress: an R may leave a stressed syllable and land in an unstressed one (e.g. 2b, 3a), or vice versa (e.g. 3b), or even move from and to unstressed positions (e.g. 2a, 2c–e).

(2) *LDM to O-1*

(a)	conú(u)la	>	krannúya	‘distaff’	(Sardinian)
(b)	sapestráto	>	scrapestáto	‘loose-living’	(Neapolitan)
(c)	capéstro	>	crapésto	‘halter’	(Calabrian)
(d)	fenéstra	>	hriéste	‘window’	(Gascon)
(e)	kapístri	>	krapísti	‘halter’	(Italiot Greek)

(3) *LDM to O-adj*

(a)	catedrál	>	catredál	‘cathedral’	(Alguerese Catalan)
(b)	cabéstro	>	cabrésto	‘halter’	(Judeo-Spanish)

In a subset of the LDM languages, metathesis from CR was accompanied by metathesis from an internal coda position (RC) either to the O-1 (4)⁴ or the onset of the same syllable (O-same) (5)⁵ (cf. 6, where codas do not move):

² Unless stated otherwise, the data are taken from the following sources: Sardinian, Lai (2013); Neapolitan, Abete (2015); Calabrian, Rohlf's (1966); Gascon, Coffman (2013); Alguerese Catalan, Torres-Tamarit *et al.* (2012); Judeo-Spanish, Lipski (1990), based on input from Torres-Tamarit *et al.* (2012); Italiot Greek, Rohlf's (1930). To my knowledge, data of Sardinian, Judeo-Spanish, and Italiot Greek are given in phonetic transcription, whereas the words of the remaining languages are presented in the respective orthographic conventions.

³ More precisely, this type of metathesis seems to occur within the root at least in some varieties (Alber 2001 for Sardinian, Author 2020, in prep. for Italiot Greek). For the sake of simplicity, I avoid pursuing a detailed account of the morphological domain of metathesis in the present paper and I use the general term “word” instead.

⁴ Grammont (1905–1906) reports leftward metathesis from RC in Gascon, in certain phonological contexts. Here I follow Coffman (2013) in enlisting Gascon in type B (see Table 1).

⁵ Due to the scarcity of available examples providing positive evidence, I follow Cabrera-Callís *et al.* (2010) in classifying Alguerese Catalan among the languages displaying intersyllabic metathesis of coda rhotics.

(4) *Metathesis from RC to O-1*

- (a) fórfice > fróffice ‘scissors’ (Neapolitan)
 (b) cavalcáre > cravaccá ‘to ride’ (Neapolitan)
 (c) pórku > prókku ‘pig’ (Campidanese Sardinian)
 (d) coopertúra > kroβetúra ‘roof’ (Campidanese Sardinian,

Frigeni 2009: 144, fn. 13)

(5) *Metathesis from RC to O-same*

- (a) formént > fromént ‘wheat’ (Alguerese Catalan)
 (b) tabérna > taβréna ‘tavern’ (Judeo-Spanish)

(6) *Absence of metathesis from RC in LDM languages*

- (a) pérku *próku ‘pig’ (Nuorese Sardinian)
 (b) xórto *xróto ‘grass’ (Italiot Greek)

Based on, first, which configuration is affected by metathesis (i.e. none, only CR, or both CR and RC) and, second, whether or not locality restrictions are in effect, the languages at hand can be classified into four typological categories, dubbed as A, B, C, and D (Table 1). Type A includes non-metathetic languages, e.g. the old stages that later evolved into LDM languages of the type B, C, or D. Languages falling into type B manifest metathesis from CR to the O-1, but not metathesis from RC. Type C includes languages that exhibit metathesis from both complex onsets and codas, the only available landing site being the O-1. Finally, type D accommodates languages where metathesis targets both positions; however, all movements take place within a local domain.

Table 1: Typological classification of attested LDM languages

Attested languages		Metathesis		Locality restrictions
		from CR	from RC	
A	Latin, Medieval Greek	<i>no</i>	<i>no</i>	-
B	Gascon, Nuorese, Italiot Greek	<i>yes</i>	<i>no</i>	<i>no</i>
C	Sestu, Campanian, Calabrian	<i>yes</i>	<i>yes</i>	<i>no</i>
D	Judeo-Spanish, Alguerese	<i>yes</i>	<i>yes</i>	<i>yes</i>

Other combinations that yield LDM are logically possible, although, to my knowledge, unattested, such as local LDM from onset to onset, with the codas not moving (*yes–no–yes*). Another, more fine-grained possibility would be that onset Rs behave differently depending on the syllable they originate from; e.g. in the same language, R may exhibit LDM from the O-2 to the O-1 but metathesis from the O-3 to a coda or, vice versa, LDM from the O-3 to the O-2 and metathesis from the O-2 to a coda in the first syllable. Additionally, two language types including coda movement only can be distinguished, i.e. an unbounded one (*no–yes–no*) and a restricted one (*no–yes–yes*). These can again land

exclusively to pre-consonantal positions, be attracted only by onsets, or be insensitive to the target context. Among all these combinations, at least one, i.e. leftward intrasyllabic movement of codas, is found in the history of several languages, among which dialectal Spanish, e.g. *pedernal* > *pedrenal* ‘flint’ (Lipski 1990; Russell-Webb & Bradley 2009). It remains to be seen whether the rest of the logically possible patterns as well as rightward metathesis along the same lines (also affecting the first syllable), are plausible in natural languages and, secondarily, whether they will emerge in the future. In order to shed light on what language types are indeed possible, it is imperative that we first identify the driving forces of R metathesis. The following section offers an overview of previous works on LDM that have shed valuable light on several aspects of the process at hand. In addition, a critical review of these accounts is provided, with emphasis on their capacity to accommodate at least the three attested LDM language types.

3. Previous accounts

There is general consensus that the word-initial position is exceptionally strong and prominent (Beckman 1998, Zoll 1996, 1998, de Lacy 2001, Smith 2005). This assumption was the cornerstone of accounts within the framework of Optimality Theory (OT; Prince & Smolensky 1993/2004), which derived unbounded LDM through the interaction between a dominant positional markedness constraint requiring segments to be in the left periphery of the word, on the one hand, and a lower-ranked faithfulness constraint, on the other hand. The ground was laid by Alber’s (2001) OT analysis of synchronic metathesis of pre- and post-consonantal Rs in Sestu Sardinian, where she put forth that the O-1 attracts segmental material from non-initial positions, thus enhancing salience further. Alber takes the positional constraint COINCIDE-O-1 (‘all segments should be in the O-1’, Alber 2001: 4) to dominate LINEARITY, a faithfulness constraint that traditionally prohibits reordering of segments (McCarthy & Prince 1995, Hume 1998). Thus, she explains both the leftward directionality and the target environment, i.e. the first syllable. The proposal is readily applicable to the historical LDM manifested in the languages subsumed under type C and is briefly illustrated in Tableau 1 below (for the data see 1c):

Tableau 1: Metathesis from CR in Alber’s (2001) model

/kapistru/	COINCIDE-O-1	LINEARITY
a. kapistru	apistru!	
b. kapristu	apristu!	*
c. karpistu	arpistu!	*
☞ d. krapistu	apistu	*

Drawing on Alber (2001), Coffman (2013) investigates LDM in languages of type B, specifically Gascon, Italiot Greek, and Nuorese Sardinian, and argues that segmental material tends to accumulate in the first *syllable* (σ_1), rather than the first *onset*, thus he modifies the positional markedness constraint as COINCIDE- σ_1 , defined as ‘output segments are in the σ_1 ’ (2013: 116). Moreover, he emphasizes the observation that R originates from and lands in the same phonological environment, i.e. C_V, which minimizes perceptual invasiveness (Steriade 2001, Fleischhacker 2005, Zuraw 2007). In order to capture what he calls *cluster maintenance*, Coffman employs Zuraw’s (2007) *MAP constraint family and posits that the constraint penalizing the unfaithful mapping of a configuration CRV to a configuration CV and vice versa is ranked lower than constraints militating against more perceptually disruptive mappings, e.g. VRC to VC and vice versa. Along these lines, if Rs

originating from a post-consonantal position cannot retain their position due to the pressure exerted by COINCIDE- $\sigma 1$, as in Tableau 2, then they metathesize to a post-consonantal (output d) rather than a pre-consonantal position (output c), as the latter option incurs a violation of the dominant *MAP(VRC,VC). Notably, Rs may only metathesize all the way to the $\sigma 1$, as stopping at an intermediate station (e.g. output b) is equally dispreferred as not moving at all (output a) with respect to positional markedness. Given that the mapping VRC~VC is disallowed, metathesis from RC is by implication prohibited, as expected in type B.

Tableau 2: Metathesis from CR in Coffman’s (2013) model

/kapistru/	*MAP(VRC,VC)	COINCIDE- $\sigma 1$	*MAP(CRV,CV)
a. kapistru		pistru!	
b. kapristu		pristu!	(pi~pri), (tru~tu)
c. karpistu	(ap~arp)!	pistu	(tru~tu)
 d. krapistu		pistu	(ka~kra), (tru~tu)

Source: adapted from Coffman (2013: 120)

The OT analyses presented above have shed light on important aspects of LDM from a language-specific, or, rather, type-specific point of view, and they have contributed crucially to our understanding regarding the directionality of the process and the ideal landing site. Apart from the particular language type each proposal investigates, all can additionally generate the faithful type A by ranking all markedness constraints that give rise to metathesis below the faithfulness constraints. Nevertheless, when it comes to different patterns that compose the bigger typological picture of LDM, the suggested solutions encounter problems. Given the assumption that, if positional markedness dominates faithfulness, R has to end up in the O-1, and no intermediate landing site can be good enough, then these models inevitably predict only two out of the three types of LDM languages, i.e. B and C, and prove insufficient when it comes to capturing type D, where complying with certain locality restrictions may lead to a derived non-initial CR. More precisely, as shown in the Comparative Tableau (CT; Prince 2002), the input /kapistru/ has two possible outputs: the unmarked [krapistu] (types B, C), via the ranking POSITIONAL_MARKEDNESS >> FAITHFULNESS, and the faithful [kapistru] (type A), via the reversed ranking FAITHFULNESS >> POSITIONAL_MARKEDNESS. The candidate [kapristu], whereby metathesis has not resulted in a complex O-1 (type D), is not preferred by any constraint. Therefore, it is bound to lose every competition.

CT: Predicted winners according to Alber (2001) and Coffman (2013)

	<i>Input</i>	<i>Winner</i>	<i>Loser</i>	POSITIONAL_MARKEDNESS	FAITHFULNESS
a.	kapistru	krapistu	kapistru	W	L
b.	kapistru	krapistu	kapristu	W	e
c.	kapistru	kapistru	kapristu	W	W

Moreover, both models can only accommodate one type of unbounded LDM. An analysis in the spirit of Alber (2001) successfully captures type C, where every R moves to the O-1 regardless of its etymological position in the syllable. As nothing protects codas

from metathesizing, though, type B, where codas remain unaffected, is left unaccounted for. For instance, the Italiot Greek word *xorto* ‘grass’ (see 6b) is wrongly predicted to surface as *xroto*, where fewer segments are found outside the O-1 (Tableau 3).

Tableau 3: Metathesis from RC in type B according to Alber (2001)

/xorto/		COINCIDE-O-1	LINEAR
☹	a. xorto	orto!	
☹	b. xroto	oto	*!

On the other hand, Coffman’s (2013) type-B-oriented proposal fails to fully explain type C. In the *MAP model, a coda R in a non-initial syllable migrates to the O-1 as long as COINCIDE- σ 1 outranks the *MAP constraints. However, if RC is already in the σ 1, as in Latin *porcu* ‘pig’, no ranking can motivate intrasyllabic metathesis to the O-1, e.g. as in Campidanese Sardinian *prokku* (see 4c).⁶ As illustrated in Tableau 4, the faithful candidate (a) incurs an equal number of violations as candidate (b) with respect to COINCIDE- σ 1, and additionally wins against it with respect to both *MAP constraints. Thus, candidate (b) cannot be selected by any constraint hierarchy.

Tableau 4: Metathesis from RC in type C according to Coffman (2013) – σ 1

/porku/		COINCIDE- σ 1	*MAP(VRC,VC)	*MAP(CRV,CV)
☹	a. porku	*ku		
☹	b. proku	*ku	(ork~ok)!	(po~pro)

Apart from the above constraint-based models, noteworthy accounts of unbounded LDM have been couched within variations of Government Phonology (GP; Kaye et al. 1990, Kaye 1990) on the basis of the general assumption that R leaves a weak position and docks on a strong one. The first GP analysis of Sardinian LDM was offered by Lai (2013, 2015) within the Coda Mirror theory (Scheer 2004, Ségéral & Scheer 2005, Ziková & Scheer 2010). Simply put, Lai argues that metathesis is motivated due to lenition targeting *weak* positions, such as, primarily, intervocalic CR sequences (type B), and, secondarily, also codas (type C). R avoids being lenited by migrating to the strongest position available, which, in the case of Sardinian, is next to the initial consonant. The Coda Mirror analysis does not provide a comprehensive typological account either. Although it explains types A, B, and C, it faces the same problem other analyses of unbounded LDM encounter: it fails to capture type D. Since all word-internal intervocalic positions are taken to be weak, by implication, all non-initial intervocalic positions are disqualified as landing sites.

More recently, Tifrit (2020) investigates LDM in terms of GP2.0 (Pöchtrager 2006, Živanovič & Pöchtrager 2010) and posits that liquids in non-initial positions do not in fact move, but rather they percolate within the structure and transfer all of their content to the highest available onset projection; in simple terms, the O-1 (types B and C, depending on whether the process targets only CR or both CR and RC). Since Tifrit does not look at metathesis phenomena through a typological lens, the typological predictions of the model are not touched upon. Therefore, it is unclear whether Rs could climb towards the highest projection in a stepwise fashion, so that type D could also be accommodated.

Locality was addressed in Torres-Tamarit et al.’s (2012) account of restricted LDM in Algerese (see also Cabrera-Callís et al. 2010), framed within Harmonic Serialism (HS;

⁶ Cases of compensatory lengthening after coda metathesis are to be ignored in the present analysis.

McCarthy 2000, 2010, 2016). The central idea is that R does not travel long distances at all, but rather it moves stepwise towards the left edge of the stem, until it reaches the ideal position. The analysis uses a general LINEARITY constraint, that bans the reordering of segments altogether, and a less stringent LINEARITY_{non-local}, which penalizes only non-local metathesis, but allows the transposition of adjacent segments. Furthermore, markedness constraints are employed that prohibit R in pre-consonantal codas, i.e. *rC, and complex onsets in specific syllables of the stem, i.e. *CR/LEFT, *CR/MIDDLE, and *CR/RIGHT. The proposed ranking *CR/RIGHT, *LINEARITY_{non-local} >> *RC >> *LINEARITY, *CR/MID, *CR/LEFT forces R forming a complex onset in the rightmost syllable of the stem, e.g. *catedral* (see 3a), to move leftwards, first to the coda of the preceding syllable, i.e. *caterdal* (Tableau 5), and then intrasyllabically to the O-same, i.e. *catredal* (Tableau 6), where convergence is obtained (Tableau 7). In a similar fashion, a pre-consonantal R moves once, e.g. *taberna* → *tabrena* (metathesis to O-same) → *tabrena* (convergence). Crucially, the final docking site does not need to be the leftmost syllable of the stem: once the R has arrived in one onset to the left, derivation converges and further movement is blocked.

Tableau 5: Metathesis from CR in HS – Step 1

/catedral/	*CR/R	LINEAR _{non-loc}	*RC	LINEAR	*CR/M	*CR/L
a. catedral	*!					
☞ b. caterdal			*	*		
c. catredal		*!		*	*	
d. cratedal		*!		*		*

Source: adapted from Torres-Tamarit et al. (2012: 360)

Tableau 6: Metathesis from CR in HS – Step 2

/caterdal/	*CR/R	LINEAR _{non-loc}	*RC	LINEAR	*CR/M	*CR/L
a. caterdal			*!			
☞ b. catredal				*	*	
c. cratedal		*!		*		*

Source: adapted from Torres-Tamarit et al. (2012: 360)

Tableau 7: Metathesis from CR in HS – Convergence

/catredal/	*CR/R	LINEAR _{non-loc}	*RC	LINEAR	*CR/M	*CR/L
☞ a. catredal					*	
b. cartedal			*!	*		
c. cratedal		*!		*		*

Source: adapted from Torres-Tamarit et al. (2012: 360)

The serial analysis can also generate Type C, by means of the ranking CR/RIGHT, *CR/MIDDLE, LINEARITY_{non-local} >> *RC >> LINEARITY, *CR/LEFT, which renders the middle syllable of the stem an unsuitable host; therefore, R keeps moving towards the O-1. However, this approach proves less efficient in capturing type B, where metathesis does not affect codas. In essence, once a R migrating from a non-initial CR arrives in a coda position, derivation should converge, although the desired optimum should contain an initial CR instead. An anonymous reviewer suggests that the ranking CR/RIGHT, *CR/MIDDLE >> LINEARITY >> *RC >> LINEARITY_{non-local}, *CR/LEFT successfully blocks movement from etymological codas, while allowing for an onset R to travel long-distance to the O-1 already in the first round of evaluation. However, this solution faces a problem of theoretical nature:

due to the stringency relation between LINEARITY and LINEARITY_{non-local}, faithfulness returns two violations in total for every non-local movement. Crucially, though, HS posits that only one change, i.e. a single penalty with respect to faithfulness, is allowed per candidate during each step of evaluation. Thus, strictly, the candidates violating both LINEARITY constraints should not be available for evaluation.⁷ If the candidate involving non-local metathesis, e.g. candidate (c), Tableau 8, is not part of the GEN during the initial round, then R first moves locally to the coda of the adjacent syllable to the left (candidate b), and in the next step the derivation converges (Tableau 9). By the end of the loop, the faithful candidate (a) is incorrectly selected, whereas the attested candidate (b) is ruled out, as further movement, which is blocked by LINEARITY >> *RC.⁸

Tableau 8: Metathesis from CR in HS – Type B – Step 1

/pikro/	*CR/R	*CR/M	LINEAR	*RC	LINEAR _{non-loc}	*CR/L
a. pikro	*!					
☞ b. pirko			*	*		
✗ c. priko			*		*	*

Tableau 9: Metathesis from CR in HS – Type B – Convergence

/pirko/	*CR/R	*CR/M	LINEAR	*RC	LINEAR _{non-loc}	*CR/L
☛ a. pirko				*		
☹ b. priko			*!			*

Table 2 below summarizes how the existing models fare with respect to each LDM type.

Table 2: LDM in previous accounts

	COINCIDE-O-1	*MAP	GP	HS
A. No metathesis	✓	✓	✓	✓
B. Unbounded met. from CR	✗	✓	✓	✗
C. Unbound. met. from CR + RC	✓	✗	✓	✓
D. Local met. from CR + RC	✗	✗	✗	✓

4. Analysis of the LDM typology

The goal of this paper is to propose a typological account of LDM. I frame my analysis within Property Theory (Alber & Prince 2015, in prep., Alber et al. 2016, Alber &

⁷ In fact, this should also hold for candidates (c–d) in Tableau 5 and candidate (c) in Tableaux 6 and 7: they are not eliminated from the race due to a fatal violation, but rather they do not participate in the respective rounds of evaluation at all.

⁸ Another potential problem with Torres-Tamarit et al.'s analysis is that it predicts rightward metathesis under *CR/L >> *CR/R, which is not only unattested as a systematic process, but also unmotivated according to the assumption that R tends to move into more salient positions. I thank an anonymous reviewer for pointing this out.

Meneguzzo 2016, Merchant & Krämer 2017, DelBusso 2018, Bennett & DelBusso 2018), an OT-based model which aims at extracting the *properties*, i.e. the ranking conditions that generate every language of a typological system. Each property takes two values *a* and *b*, one being the logical opposite of the other, and is represented as $X < > Y$, where *X* and *Y* stand for (sets of) constraints ranked with respect to each other. Value *a* corresponds to the ranking $X \gg Y$ and value *b* to its logical opposite, i.e. $Y \gg X$. Finally, a property may be *moot* with respect to some language, i.e. not relevant in the particular language.

The proposed constraint system includes two markedness and two faithfulness constraints. In line with models that associate LDM with the enhancement of word-initial prominence, I assume that complex onsets preferably exist as close to the left edge of the word as possible, which is formalized by means of a positional markedness constraint ALIGN(Complex Onset, Left Edge) (ALIGN; see Zoll 1998), which penalizes non-initial complex onsets by counting the syllables between each illicit CR and the left edge. Furthermore, *R-CODA (*RC; McCarthy 1993, Orgun 2001, Torres-Tamarit et al. 2012) prevents R from being syllabified in a pre-consonantal coda.

Moreover, I use LINEARITY, which penalizes metathesis. For the purposes of this analysis, in the spirit of previous accounts (Alber 2001; Torres-Tamarit et al. 2012), LINEARITY (LINEAR) is violated in a Boolean manner, i.e. zero violations if the candidate is faithful vs. one violation if the precedence relations of the input are disrupted in the output (cf. Hume 1998, McCarthy 2003). Additionally, I posit LOCALITY (LOCAL), which controls the distance Rs may travel. Specifically, a local movement involves Rs skipping maximally one vowel/nucleus and, in this case, does not incur a violation.⁹ This means that the two nuclei by which an R is flanked in the input demarcate a local domain within which some freedom to move is granted: for instance, assuming leftward metathesis, R can move intra-syllabically from the coda to the onset, or from the onset of its original syllable to the onset of the previous syllable, but not, for example, to the onset of a syllable that is farther away. Simply put, LINEARITY penalizes *all* movements, whereas LOCAL penalizes *some* movements. The definitions of the constraints are given below:

(7) *Markedness constraints*

- (a) ALIGN(Complex Onset, Left Edge)
Complex onsets must be found at the left edge of the word – Assign a violation for each syllable that separates a complex onset from the left edge
- (b) *RC
Assign a violation for every R that is syllabified in a coda position

(8) *Faithfulness constraints*

- (a) LINEARITY
Assign a violation if the precedence relations in the input have not been preserved in the output
- (b) LOCALITY
Assign a violation if a segment in the output is relocated outside its local domain in the input, i.e. farther than one nucleus away from its original position

⁹ As an anonymous reviewer mentions, counting local distance in terms of nuclei makes more sense than counting syllable positions, if we assume that the input is not syllabified.

The interaction among these constraints yields the following factorial typology (FT) (“L” stands for language type). The candidates are given schematically as sequences of C, V, and R for the sake of abstraction and generalization. To enhance readability, the liquid is capitalized (R), while the other consonants and the vowels are given in lowercase (“c” and “v”, respectively).¹⁰

Table 3: FT

	1: /cvcRvcv/	2: /cvcvcRv/	3: /cvRvcv/	4: /cvcvRvcv/
L1 = A	cv.cRv.cv	cv.cv.cRv	cvR.cv.cv	cv.cvR.cv
L2	cv.cRv.cv	cv.cv.cRv	cRv.cv.cv	cRv.cv.cv
L3	cv.cRv.cv	cv.cv.cRv	cRv.cv.cv	cv.cRv.cv
L4 = B	cRv.cv.cv	cRv.cv.cv	cvRvcv	cv.cvR.cv
L5 = C	cRv.cv.cv	cRv.cv.cv	cRv.cv.cv	cRv.cv.cv
L6	cRv.cv.cv	cvR.cv.cv, cv.cvR.cv	cvR.cv.cv	cv.cvR.cv
L7	cRv.cv.cv	cvR.cv.cv, cv.cvR.cv	cRv.cv.cv	cv.cvR.cv
L8 = D	cRv.cv.cv	cv.cRv.cv	cRv.cv.cv	cv.cRv.cv

Before we move on to discussing the four attested LDM language types identified in section 2, a brief presentation of the entire typology is in order. The output mappings of the input /cvcRvcv/ (column 1) distinguishes between languages in which non-initial CR are not avoided (L1–3) and languages in which LDM takes place in order to repair the structures at hand (L4–8).¹¹ The second column, i.e. the output mappings of /cvcvcRv/, illustrates the further classification of the LDM languages into those in which metathesis is unbounded (L4–5), and those displaying local metathesis, which may be manifested via either movement of the R into a coda (L6–7)¹² or a non-initial complex onset (L8). As far as metathesis targeting codas is concerned, the candidates in column 3 classify the typology in languages which do metathesize from RC (L2–3, L5, L7–8) and those which do not (L1, L4, L6). Finally, column 4 sheds light on the distinction between unbounded (L2, L5) and local (L3, L7–8) metathesis of codas. Crucially, among the languages displaying local metathesis, the creation of derived non-initial complex onset, i.e. O-2, appears to be possible only in L3 and L8. Hence, in L7 pre-consonantal R in the second syllable does not move at all.

The four language types A (no metathesis), B (unbounded LDM), C (unbounded LDM and metathesis from RC), and D (local LDM and metathesis from RC) coincide with the L1, L4, L5, and L8, respectively. Among the remaining four languages, L6 and L7 also repair non-initial CR via local metathesis; in this case, though, LDM takes place only from

¹⁰ The FT, the VTs (see below), and the Property Analysis below (Table 4) were automatically calculated with the help of OTWorkplace (Prince et al. 2017).

¹¹ Although the relevant candidates were omitted in Table 3, it should be noted that, as expected also in previous OT accounts, /cRvcvcv/ always surfaces faithfully; in other words, metathesis does not target the O-1. This observation is consistent with the nature of the phenomenon under investigation, i.e. leftward metathesis that is arguably motivated by the licensing of marked structures such as complex onsets in prominent position, and not by the avoidance of CR in general (cf. e.g. Armenian, Zukoff 2012).

¹² A more nuanced analysis that would eliminate free variation could be achieved with the addition of another LOCALITY constraint, operating within a different domain. Further discussion exceeds the goals of the present paper.

the O-2 to the O-1, whereas R in the O-3 migrates to a coda position. In addition, L7 moves the coda of the first syllable to the O-1. In the final two languages that do not exhibit LDM, i.e. L2 and L3, RC clusters are eliminated by means of either unbounded metathesis to the first onset (L2) or local, intrasyllabic metathesis to the onset (L3; see dialectal Spanish, Lipski 1990; Russell-Webb & Bradley 2009). According to the proposed system, patterns not predicted to emerge at all include the creation of CR via rightward metathesis, e.g. /cvcRvcv/ → *[cv.cv.cRv], /cvRvcv/ → *[cv.cRv.cv], *[cv.cvR.cv], etc, displacement from and to coda, e.g. /cvcvRcv/ → *[cvR.cv.cv], and local LDM of onset Rs to the O-adj without metathesis from codas.

Let's return to the four languages under investigation. The Violation Tableaux below (VT1–2) demonstrate the violation profile of the candidates that are pertinent to the analysis. The rightmost column indicates the language types emerging according to the selection of the relevant candidate.

VT 1: Metathesis from CR

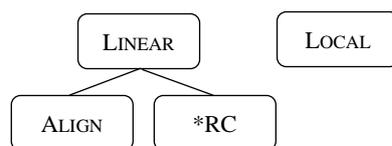
/cvcvRv/		LINEAR	LOCAL	ALIGN	*RC	
a.	cv.cv.cRv	0	0	2	0	= A
b.	cv.cRv.cv	1	0	1	0	= D
c.	cRv.cv.cv	1	1	0	0	= B, C

VT 2: Metathesis from RC

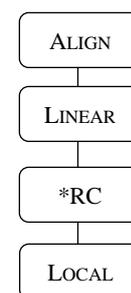
/cvcvRcv/		LINEAR	LOCAL	ALIGN	*RC	
a.	cv.cvR.cv	0	0	0	1	= A, B
b.	cv.cRv.cv	1	0	1	0	= D
c.	cRv.cv.cv	1	1	0	0	= C

The constraint hierarchies that generate each language type are presented in (9) as Hasse diagrams:

(9) A: No metathesis

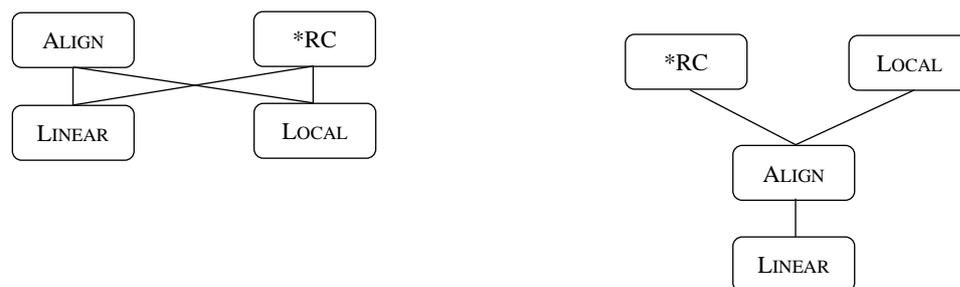


B: Unbounded metathesis from CR



C: Unbounded metathesis from CR and RC

D: Local metathesis from CR and RC



Certain rankings in these hierarchies are responsible for the emergence of a metathetic process in a language type. First, if LINEAR is ranked above a markedness constraint, then metathesis from the environment the particular constraint militates against is blocked. For instance, LINEAR >> ALIGN means that non-initial CRs, even though dispreferred, are not repaired by metathesis because the above-ranked LINEAR prohibits movement from CR. Likewise, LINEAR >> *RC blocks metathesis from RC. The reversed ranking, on the other hand, fuels metathesis from the relevant environment.

Similarly, if LOCAL dominates at least one markedness constraint, i.e. whichever of ALIGN and *RC (the class is denoted with { }.sub, see 10c) is subordinate, then locality restrictions are imposed at the expense of at least one marked structure that is penalized by a constraint that is ranked below LOCAL. The reversed ranking, i.e. both ALIGN and *RC dominating LOCAL, sidelines locality restrictions for the sake of an unmarked outcome of metathesis.

Finally, the ranking among the two markedness constraints determines which marked structure a language type may tolerate, and which one is strictly avoided. ALIGN >> *RC may allow for RC but not word-internal CR, whereas *RC >> ALIGN has the opposite effect.

The above crucial ranking conditions constitute the properties of the typological system, each of which comes with two values, given in (10):

(10) *Properties of the LDM system*

(a) METCR: *Metathesis from medial CR?*

ALIGN <> LINEAR

- METCR–yes: ALIGN >> LINEAR
- METCR–no: LINEAR >> ALIGN

(b) METRC: *Metathesis from RC?*

*RC <> LINEAR

- METRC–yes: *RC >> LINEAR
- METRC–no: LINEAR >> *RC

(c) LOCALMET: *Local metathesis?*

LOCAL <> {ALIGN, *RC}.sub

- LOCALMET–yes: LOCAL >> {ALIGN, *RC}.sub
- LOCALMET–no: {ALIGN, *RC}.sub >> LOCAL

(d) MARKED: *Most marked structure?*

ALIGN <> *RC

- MARKED–medCR: ALIGN >> *RC
- MARKED–RC: *RC >> ALIGN

The property values of the languages comprising the FT (Table 3) are demonstrated in Table 4 below. In what remains, I mainly elaborate on the property values of the four languages A–D identified in the previous sections (shaded in Table 4).

Table 4: Property Analysis

	METCR	METRC	LOCALMET	MARKED
L1 = A	<i>no</i>	<i>no</i>	<i>moot</i>	<i>moot</i>
L2	<i>no</i>	<i>yes</i>	<i>no</i>	<i>RC</i>
L3	<i>no</i>	<i>yes</i>	<i>yes</i>	<i>RC</i>
L4 = B	<i>yes</i>	<i>no</i>	<i>no</i>	<i>medCR</i>
L5 = C	<i>yes</i>	<i>yes</i>	<i>no</i>	<i>moot</i>
L6	<i>yes</i>	<i>no</i>	<i>yes</i>	<i>medCR</i>
L7	<i>yes</i>	<i>yes</i>	<i>yes</i>	<i>medCR</i>
L8 = D	<i>yes</i>	<i>yes</i>	<i>yes</i>	<i>RC</i>

METCR (ALIGN < > LINEAR) and METRC (*RC < > LINEAR), which determine whether metathesis from a certain environment is motivated, are relevant to all four languages A–D. Type A, where both properties are set to value *no*, includes languages that do not exhibit metathesis from neither CR nor RC (e.g. the languages from which the Romance LDM languages under investigation descended). Types B, C, and D, i.e. the attested types found in Romance, switched the value of METCR to *yes*, which signaled their evolution to languages that resort to LDM in order to repair non-initial CR. Among the LDM types, one, i.e. B, has retained value *no* of METRC and, hence, coda Rs, just like the ancestor type A. Types C and D, on the other hand, have changed the value of METRC, thus permitting the movement of a coda R.

The property LOCALMET (LOCAL < > {ALIGN, *RC}.sub) has narrower scope than the properties that act as triggers/blockers of metathesis. In order for locality restrictions to be relevant in a language, some type of metathesis must be active. In type A, where metathesis is blocked altogether, LOCALMET is moot. However, the property at hand plays a crucial role in distinguishing among the types with unbounded LDM, i.e. B and C, and type D where LDM is locally restricted. More specifically, in B and C, LOCAL is dominated by both markedness constraints (value *no*), thus any metathetic process may only result in an unmarked structure, i.e. an initial CR, even if this means movement outside the local domain. On the other hand, in D, LOCAL outranks ALIGN, which is subordinate to *RC (value *yes*). Therefore, the formation of a derived marked configuration CR in a non-initial syllable can be allowed if this means that LOCAL is satisfied. Indeed, in D we saw that, although R in the O-2 migrate to the O-1, R in the O-3 cannot travel this far; instead, they opt for the O-2, thus creating an environment that is otherwise avoided. However, the alternative, i.e. skipping the intervening syllable and landing in the O-1, would incur a fatal violation of LOCAL, hence it is ruled out.

The final property, MARKED (ALIGN < > *RC), decides whether non-initial CR or RC are considered worse. In most languages of our typology, among which type B, the value of MARKED is entailed via the values of other properties. For instance, as in type B ALIGN is ranked above LINEAR, and LINEAR dominates *RC, MARKED is by implication set to value *medCR*. In two language types, though, metathesis targets both positions and it is locally restricted, thus the outcome of metathesis cannot always be an unmarked initial CR. Therefore, it is required that MARKED determine whether it is preferable that the resolution

strategy creates non-initial CR (type D) or RC (L7). Regarding the other two attested types, A and C, mootness is observed with respect to MARKED. Recall that type A does not metathesize R from any configuration, which implies the absence of preference between the two structures. Moreover, type C eliminates all non-initial CR and RC via metathesis to the O-1. Therefore, both are, in practice, no longer found in the respective languages, which renders the comparison between them redundant.

Through the properties, it becomes clear why a coda position is not a suitable host for a metathesizing R in the three attested LDM languages (as opposed to L6–7 in the FT). Type B allows etymological RC by means of the property MetRC, which is set to value *no*, i.e. METRC. However, it bans derived RC: whereas a movement to the O-1 in order to avoid a non-initial CR would violate LINEAR, a movement *to* a coda position would additionally incur a violation of *RC. Even if the former option requires that the R cross the boundaries of its local domain, *RC outranks LOCAL (recall value *no* of property LOCALMET), thus the violation of *RC is fatal. Concerning types C and D, in both cases *RC is undominated (METRC–*no*; LOCALMET–*no*; MARKED–RC). This means, in simple terms, that there is always a better solution than creating a RC in types B–D.

Finally, although a thorough discussion of the diachronic evolutionary paths that led to the contemporary LDM languages falls beyond the scope of the present paper, a brief description of how property theory models minimal historical change is in order. Diachronic steps are taken to represent minimal switches of the property values (Alber 2015, Alber & Meneguzzo 2016, DelBusso 2018), i.e. a single change from *no* to *yes* (or vice versa) in each step (Author 2021). Along these lines, the historical stages between the non-metathetic ancestor languages (type A/L1, e.g. Latin and Medieval Greek) and the attested LDM languages should be reconstructed in terms of gradual resetting in the property values of METCR and, in addition, METRC. Subsequently, the need arises that property values of the properties that are moot with respect to type A be acquired, i.e. LOCALMET and MARKED. The change from one attested type to another may either be achieved via one value switch, e.g. A > B via resetting METCR from *no* to *yes*, as in the case of Medieval Greek > Italiot Greek, or proceed through intermediate stages, e.g. Latin (A) > Sardinian – Type B (through METCR–*no* to METCR–*yes*) > Sardinian – Type C (through METRC–*no* to METRC–*yes*) (see Lai 2013 for argumentation on the chronology of metathetic processes in Sardinian); Old Spanish (A) > dialectal Spanish (L3, through METRC–*no* to METRC–*yes*) > Judeo-Spanish (D, through METCR–*no* to METCR–*yes*) (Author in prep.; see Lipski 1990, Russell-Webb & Bradley 2009). Possibly, the unattested languages the analysis predicts could have also constituted inadequately documented transitional grammars between attested types.

5. Conclusions

Three well-documented LDM language types are identified in Romance: unbounded LDM of post-consonantal R (type B), unbounded LDM of post- and pre-consonantal R (type C), and locally restricted LDM of post- and pre-consonantal R (type D). Previous analyses of LDM adopt a language-specific perspective, or, to put it more accurately, take into consideration only groups of languages that are typologically similar. Consequently, despite having illuminated aspects of metathesis phenomena within particular languages, especially regarding the phonetic and perceptual biases that underlie metathesis of R, they nonetheless do not suffice to capture the full LDM landscape: in short, approaches of unbounded LDM are unable to explain restricted LDM and vice versa.

An alternative is offered within Property Theory that focuses on the building blocks of the LDM, i.e. those ranking conditions capable of generating all attested types. Two

properties are responsible for triggering or blocking metathesis: METCR (ALIGN <> LINEAR) triggers metathesis from non-initial CR and METRC (*RC <> LINEAR) motivates metathesis from RC. A third property LOCALMET (LOCAL <> {ALIGN, *RC}.sub) explains the existence or absence of locality restrictions. Finally, MARKED (ALIGN <> *RC) determines which marked structure is the lesser of the two evils. Free combination of the above ranking conditions generates a FT that contains all three LDM patterns that are found in Romance and the non-metathetic ancestors, e.g. Latin, as well as four languages exhibiting different metathesis patterns. Among the latter group, three are not reported to exist; however, they may have constituted undocumented previous stages of attested languages or they may be detected at a later point in the history of some language. The proposed analysis serves as a new lens for understanding metathesis and reconstructing the historical dimension of these phenomena and establishes important groundwork for future research, as it makes transparent the predictions regarding the typology of LDM. On this basis, follow-up studies can look for patterns that will confirm the predictions laid out in the present work or, in light of novel evidence, suggest modifications in the constraint system.

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