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Muta cum liquida in the light of Tertenia Sardinian metathesis and compensatory lengthening Latin V̆tr > Old French Vrr

Tobias Scheer
Université de Nice-Sophia Antipolis, CNRS 6039

This article is designed to show that muta cum liquida (branching onsets) enclose an empty nucleus (in case they are bipositional). Arguments come from two data sets. A compensatory lengthening is studied that has occurred in the evolution from Latin to Old French *within* a muta cum liquida: *tr dr* > *rr*, i.e., the loss of *t d* is accompanied by the gemination of *r* iff the preceding vowel is short (*petra* > *pierre* vs. *paatre* > *père*). In Tertenia Sardinian, it is argued that metathesis of *r* from the right to the left of the *o* in /sesø døormendu/ → *sérø ðørɔmméndu; ndu* (with ensuing gemination of the m on the position vacated) occurs in order to circumscribe the second of two empty nuclei (ø) in a row.

1. Introduction

The goal of the pages below is to show that in those languages where muta cum liquida are bipositional (as opposed to monopositional TR clusters), they enclose an empty nucleus, i.e., TøR.[1] The presence of an empty nucleus in the midst of branching onsets is a genuine claim of the framework known as CVCV (or strict CV, e.g., Lowenstamm 1996; Scheer 2004; Szigetvári & Scheer 2005) in which this article is couched, and one that sets this theory apart from others. Two data sets are analyzed: a compensatory lengthening that occurred in the evolution from Latin to French in dental TR clusters, and a metathesis found in the Tertenia dialect of Sardinian.

1. T is shorthand for any obstruent, R for any sonorant.

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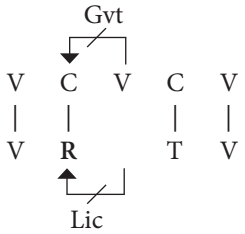
2. CVCV, the Coda Mirror and its muteness regarding branching onsets

The Coda Mirror (Ségéral & Scheer 2001, 2005, 2008; Scheer 2004: §110; Szigetvári 2008; Scheer & Ziková 2010) is a general theory of lenition and fortition that takes advantage of the tools of CVCV, a development of Government Phonology (Kaye et al. 1990; Kaye 1990). In this theory, syllabic constituency reduces to a strict sequence of non-branching onsets and non-branching nuclei. Rather than by arboreal structure, syllabic generalizations are expressed by lateral relations among constituents, government and licensing.

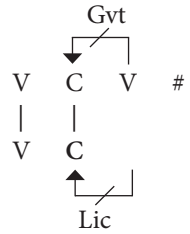
It may be seen under (1) that in this environment the coda context __{#,C} ('word-finally and before a heterosyllabic consonant') is reduced to a non-disjunctive statement that identifies as __ø ('before an empty nucleus').[2]

(1) Consonants in coda position are neither governed nor licensed; intervocalic consonants are governed (but unlicensed)

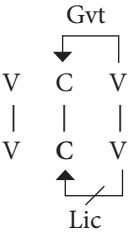
a. internal coda __C



b. final coda __#



c. V__V



Government and licensing are always regressive (they apply from right to left) and can only be headed by phonetically expressed nuclei. This is why coda consonants (which occur before empty nuclei: note that *only* coda consonants occur in this environment) are neither governed nor licensed. By contrast intervocalic consonants are governed: their nucleus is phonetically expressed and hence issues both government and licensing. Since no constituent may be governed and licensed at the same time, though, intervocalic consonants are only governed.

We know independently that government has a spoiling effect on its target. Licensing on the other hand enhances the segmental expression of its target (Scheer 2004: §125). Given furthermore that empty nuclei can only exist if they are governed, the second consonant of a (heterosyllabic) CC cluster will be licensed but escapes government since its nucleus is called to govern the empty nucleus to its left. This is the description of consonants in (word-internal) strong position: (2b) shows that they are licensed (that is, backed up) but ungoverned (i.e., unspoiled).

2. Note that the representations follow version 2 of the Coda Mirror (Scheer & Ziková 2010).

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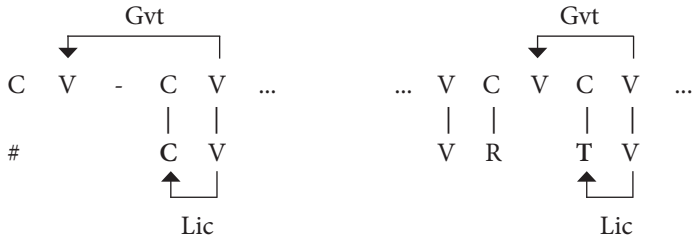
(2) Consonants in Strong Position: licensed but ungoverned

a. word-initial consonant #__ b. post-coda consonant C__



If post-consonantal consonants are characterized by the fact that they occur after an empty nucleus, this must also be the case for word-initial consonants: the Strong Position is precisely defined by the uniform behavior of these two positions in regard of lenition. This conclusion ties in with the proposal that Lowenstamm (1999) has made on the grounds of evidence that is unrelated to lenition: the phonological identity of the beginning of the word is an empty CV unit.[3] Under (2a) the initial CV appears to the left of the hyphen.

This is how the network of lateral relations and their inherent effect on targets define positional strength: the Strong Position disjunction {#,C}__ reduces to a uniform and unique context ('after an empty nucleus'). Its strength follows from the fact that it is licensed but ungoverned. Measured by the impact of lateral relations, the two weak positions are certainly weaker than the Strong Position: they identify, respectively, as unlicensed and ungoverned (the coda) and as governed (but unlicensed: the intervocalic position). The Coda Mirror is thus able to (1) reduce the two disjunctions (of the coda and the Strong Position) to single and unique phonological objects which (2) are symmetrical (ø__ vs. __ø) and (3) define, through the network of lateral relations, the hierarchy of positional strength that is indeed observed across languages. The Mirror effect, i.e., the double symmetry between the Strong Position and the coda regarding their structural description ({#,C}__ vs. __{#,C}) and the effect produced (strength vs. weakness) can hardly be accidental. The Coda Mirror accounts for this pattern by the pivotal role of empty nuclei: ø__ vs. __ø. Note that the Strong Position cannot be reduced to a non-disjunctive statement when traditional syllabic constituency is assumed (morae or onset, rhyme, nucleus, coda).

Let us now turn to branching onsets. In order to see how they fit into the Coda Mirror, we first need to know what they are made of. In CVCV, the standard analysis is that the solidarity between the two members of a (bipositional) TR cluster stems from a lateral relation that the two consonants contract at the melodic level: so-called Infrasegmental Government (IG) is responsible for their cohesion (Scheer 1999, 2004: §14).

3. A summary of work following this idea is available in Scheer (2012). Parametric variation regarding the initial CV is discussed in Scheer (2007, 2009, 2012), Seigneur-Froli (2003), Sanoudaki (2010).

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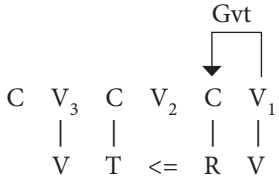
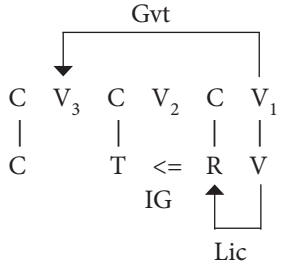
(3) Branching onset in CVCV: classical representation

a. in intervocalic position
e.g., lat. *petra*



b. in Strong Position {#,C}__
e.g., lat. *amplus*



Infrasegmental Government circumscribes the intervening empty nucleus and by this means is responsible for its phonetic muteness. When placed after a consonant as under (3b), a branching onset thus produces two empty nuclei in a row. The one that is enclosed within the TR cluster is mute because of IG, while the leftmost empty nucleus is governed by the vowel that follows the sonorant.

Given this structure, the situation of the R in regard of lenition is clear: it is governed (but unlicensed, hence intervocalic in terms of the Coda Mirror) when the TR cluster is intervocalic, but licensed and ungoverned in case the cluster stands in Strong Position (which is the description of a consonant in Strong Position). By contrast, the T is the target of no lateral relation at all, at least not of government or licensing. Rather, it is targeted by Infrasegmental Government, which however is known for not producing any segmental effect on its target (Scheer 2004: §149).

We are thus left without any hint at the relative positional strength of obstruents that occur in branching onsets. This kind of complete absence of indication is worse than a wrong prediction since it does not provide any clue that could allow for a revision of the structure. Reasons for this setback could be either that branching onsets are not the constructs depicted under (3), or that the Coda Mirror itself is flawed. The following section explores the former scenario.

3. Syntactic locality applied to branching onsets

In syntax, the extraction of items over so-called weak islands (quantifiers, subjects, heads) is governed by the principle of Relativized Minimality. That is, the extraction of any of the three categories mentioned over weak islands is possible unless an item is moved over another item of the same category (see Ross 1984; Rizzi 1990; Starke 2001; Szabolcsi 2006).

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Under (4b) for example, head movement shows that the result of moving a head (*could*) over a subject (*John and Mary*) is well formed (compare with 4a). By contrast, (4c) is ungrammatical because a head (*have*) is moved over another head (*could*).

(4) a. *John and Mary could have eaten.*
b. *Could John and Mary* $\_\__i$ *have eaten?*
c. **Have John and Mary could* $\_\__i$ *eaten?*

There would be much to dwell on from the syntactic point of view, but we do not need to go into any further detail, also in the interest of space restrictions. An informal description of locality that is sufficiently general in order to be able to be applied to phonology appears under (5) below.

(5) Locality Principle
Given a natural class A and its members $\{A_1, ...A_i...A_n\}$, a relation between A_1 and A_2 is local if and only if no other A_i intervenes.

This principle rules out (4c) since the relation between the source position of *have* and the position where it is pronounced is interrupted by another head. The same principle also invalidates the phonological structure under (3b) where two nuclei, V_1 and V_3, contract a relation over another nucleus, V_2. On this count, thus, the two categories that are subject to locality restrictions in phonology are onsets and nuclei. Note that branching onsets as under (3b) are the only structures in CVCV that violate locality.

It may be objected that there is no reason why a syntactic principle should also govern phonological representations. It may be interesting and desirable, however, that restrictions on syntactic and phonological structure converge. Under the header of structural analogy, this is the line of thought developed in Dependency Phonology (e.g., Anderson 2011, Vol.3), and also in Government Phonology (government in phonology is actually an import from syntax, see Kaye [1990]): grammar will have a stronger explanatory potential if the same principles can be shown to be active in distinct modules (such as syntax and phonology). This is also in line with current minimalist and biolinguistic thinking where so-called third factor explanations are sought: the motor of grammatical phenomena may be found in extra-grammatical, i.e., more general cognitive principles (see, e.g., Chomsky 2005).

If the violation of locality by branching onsets in Strong Position under (3b) is thus taken seriously, their representation needs to be amended. One thing is for sure: the empty nucleus to the left of the TR cluster must be governed, otherwise the entire structure is ill-formed. There are only two potential governors, though, and we know that considering V_1 as the governor of V_3 leads to the locality violation that we try to get rid of. The only alternative is thus to make V_2 the governor of V_3, as under (6) below.

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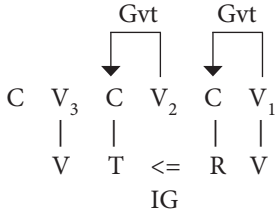
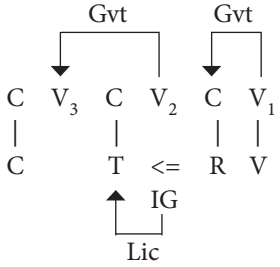
(6) branching onset in CVCV: revised representation

a. in intervocalic position
e.g., *petra*



b. in Strong Position {#,C}__
e.g., *amplus*



Beyond the source of the government relation that targets V_3 under (6b), there is no modification of the old structure: V_2 is still circumscribed by Infrasegmental Government and for that reason does not call for government from V_1.

On the other hand, the fact that V_2 is able to govern is incompatible with a basic principle of Government Phonology that was mentioned earlier: only nuclei that are phonetically expressed (plus eventually domain-final nuclei) are good lateral actors, i.e., can govern and/or license (Kaye 1990). Given (6b), this must be wrong. The amended representation of branching onsets thus enforces a view whereby the ability of nuclei to govern and license is defined by their phonological, rather than by their phonetic properties: nuclei are good lateral actors iff they are ungoverned, i.e., independently of whether or not they are pronounced. This evolution may be seen as a phonologization of phonology (or, perhaps more accurately, its dephoneticization) since it eliminates the last phonetic condition on a phonological potential (i.e., the ability to govern and license). The move from a non-local to a local representation of branching onsets is described at greater length in Scheer (2000a: 199ff, 2000b), where further consequences are discussed.

Regarding lenition, (6) shows that all of a sudden the Coda Mirror makes clear predictions: both members of the branching onset are now fully integrated into the network of lateral relations. Their respective positional strength is indicated under (7) below according to the position of the entire TR cluster, which may stand in intervocalic or in Strong Position (there are of course no branching onsets in coda position).

(7) Positional strength of T and R in a TR cluster that respects locality

a. TR in intervocalic position V__V
both T and R are governed (but unlicensed), that is in intervocalic position (cf. 1c)

b. TR in Strong Position {#,C}__
1. T is licensed but ungoverned, i.e., in strong position (cf. 2)
2. R is governed (but unlicensed), i.e., in intervocalic position (cf. 1c)

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In other words, for each member of the TR cluster and for each position in which the cluster occurs, the situation is exactly the one that would be encountered if the other member were not there. This is anything but an intuitive or trivial statement: there is every reason to believe that consonants will not behave alike when they occur in isolation or engage in a cluster.

Brun-Trigaud & Scheer (2010) have run this prediction against a number of data sets: the evolution of muta cum liquida in Celtic and from Latin to French, gorgia toscana (a spirantization found in the Tuscan dialect of Italian; Marotta [2008]) and the diatopic distribution of isoglosses in the ALF (*Atlas Linguistique de la France*, Gilliéron & Edmont 1902–1912) concerning T alone and T followed by a liquid. In all cases, the prediction was borne out: singleton Ts behaved just like Ts engaged in TR clusters, both in intervocalic and in Strong Position.

The concern of the present article is another aspect of the representation of muta cum liquida that was derived above, i.e., the presence of an empty nucleus in its midst. The remainder of the article tries to convince the reader that such an empty nucleus indeed exists, and that its phonological activity may be visible under certain circumstances. Note that to the best of my knowledge, CVCV is the only theory that supposes the existence of an empty nucleus in the midst of muta cum liquida: the demonstration below is thus highly discriminating.

4. *Petra* > *pierre*: Compensatory lengthening TR > RR in French[4]

In the evolution from Latin to French, intervocalic (primary and secondary) *tr dr* lose the *t d*. It is shown under (8) below that the gemination of *r* accompanies this evolution in some cases: *tr dr* > *(r)r*.[5]

(8)

		r does not geminate		*r* geminates	
tr	primary	*pa̲tre*	ofr. *père*	*pe̲tra*	ofr. *pierre*
	secondary	3SG *it(e)ra̲t*	ofr. *eire*	*it(e)ra̲a̲re*	ofr. *errer*
dr	primary	–	–	*quadra̲a̲tu*	ofr. *carré*
	secondary	**ri̲i̲d(e)re*	ofr. *rire*	FUT.3SG **riid(e)ra̲t*	ofr. *rirra*

4. This section is a piece of the *Grande Grammaire Historique du Français* (GGHF) whose chapter on the phonological evolution is written by Ségéral & Scheer (forthcoming).

5. Here and elsewhere in Section 4, data are from Fouché (1966–1973: 719ff), who concludes that the presence or absence of geminated *r* is predictable on the basis of stress, but introduces unnecessary subcategories and has no solution for diphthongs. Here and below, tonic vowels in Latin forms are underscored, and length is indicated by the repetition of the symbol.

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Since the gemination, in case it occurs, is a correlate of the elimination of the stop, we are facing a compensatory lengthening. Note that only dental muta cum liquida have something to compensate because only in dental TRs the obstruent is eliminated altogether: lenition in TR clusters affects labials and velars as well, which however subsist in either a voiced (*duplu* > *double*) or a voiced and spirantized (*capra* > *chèvre*) version, or reduce to yod (*lacrima* > ofr. *lairme*).

Compensatory lengthening has received a fair amount of attention in the literature, where a number of analyses in various frameworks are proposed, and cross-linguistic generalizations made: relevant voices include Chene & Anderson (1979), the articles in Wetzels & Sezer (1986), Gess (1998) and Kavitskaya (2002). The typical instantiation of the phenomenon occurs when a (coda) consonant is lost, and the (preceding) vowel lengthens. No doubt the case under (8) is a form of compensatory lengthening in the sense that the loss of a segment triggers the lengthening of a neighbor. But it has two peculiar properties: a consonant (rather than a vowel) lengthens upon the loss of a consonant, and the two consonants in question belong to the same branching onset. Namely the latter makes the phenomenon outstanding: I am not aware of other cases of the kind.

4.1 Gallo-Romance vowel length and the ban of super-heavy syllables: *VVC.C

In order to understand why the *r* sometimes does but at other times does not geminate, let us first look at the preceding vowel. A major feature of the evolution from Latin to Gallo-Romance is the transformation of the original contrast in vowel quantity into one of vowel quality: *ii*>*i*, *i ee*>*e*, *e*>ɛ, *a*>*a*, *uu*>*u*, *u oo*>*o*, *o*>ɔ (see, e.g., Bourciez & Bourciez 1967: 2). In further evolution, *all* vowels of the new system (except the extremes *ii*>*i* and *uu*>*u*) then show different behavior according to whether they stand in open or closed syllable. For example, lat. *i o* remain unchanged in ofr. in the latter context (*porta* > *porte*, *virga* > *verge*), but appear as diphthongs in open syllables (*mola* > *meule*, *pira* > *poire*) (see, e.g., Bourciez & Bourciez [1967: 35ff] for relevant detail).

What is important for the argument is the consensus regarding the reason why Gallo-Romance vowels show different behavior in closed and open syllables: vowel length. At the Gallo-Romance stage, we are sure that the Latin system of vowel quantity is not in power anymore: it was transformed into vowel quality.

There is a new length system genuine to Gallo-Romance, though, which is not (yet) phonologized and mechanically follows stress: tonic vowels in open syllables are long (while closed syllables preclude length).[6] Tonic Lengthening in open syllables is a well-known process that occurs, e.g., in Italian (see Chierchia 1986). In further

6. Compare, e.g., lat. *teela*, *feru*, *mola* > ofr. *teile* (>*toile*), *fier*, *muele* (>*meule*), where diphthongs are produced under stress, with the evolution of the same vowels in initial non-tonic position, i.e., lat. *feenuculu*, *fenestra*, *coolaare* > *fenouil*, *fenêtre*, *couler* where the result is non-diphthongal.

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development, then, short and long vowels show different evolution. The latter can only occur in open syllables and typically produce diphthongs (Fouché 1966–1973: 213f; Pope 1952: 224ff; Straka 1979: 194, 265).

The take-home message is the following generalization, which holds true for Gallo-Romance: *VVC.C, i.e., a ban on super-heavy syllables. In case a syllable bears a coda consonant, its vowel will be unable to lengthen, even if stress falls on it.

4.2 Gallo-Romance monophthongs: Compensatory lengthening blocked after long vowels

Let us now return to the *tr dr* > *(r)r* evolution. First consider Old French monophthongs. Only lat. stress, that is Gallo-Romance length, decides whether the following *r* does or does not geminate: a geminate is observed after unstressed, i.e., short vowels, while no gemination occurs if the preceding vowel is stressed, i.e., long.

(9)

g.-rom.		*r*		*rr*	
VV__	tr	*but(y)ru*	ofr. *bure*		
(= tonic)		*patre*	ofr. *pere*		
	dr	*occiid(e)re*	ofr. *ocire*		
V__	tr			**buut(y)raare*	ofr. *burrer*
(= unstressed)				*latroone*	ofr. *larron*
	dr			FUT.3SG **occiid(e)rat*	ofr. *ocirra*
				quadraatu	ofr. *carré*

Note that there is no distinction between primary and secondary clusters at all.[7] Also note that as expected Latin vowel length plays no role at all: gemination may be blocked after an originally long (*maatre* > ofr. *mere*) or short (*patre* > ofr. *père*) vowel, and it may go into effect in both contexts as well (VV__: **buut(y)raare* > ofr. *burrer*, V__: *latroone* > ofr. *larron*).[8]

Most examples under (9) oppose forms of the same verb where stress precedes or follows the TR, and gemination is blocked or observed accordingly. Fouché's (1966–1973: 719ff) complete data (23 items instantiating *tr dr* > *r*/VV__, 59 items illustrating *tr dr* > *rr*/V__) completed by a discussion of analogical activity are available in an online appendix to this article that could not be included due to space restrictions (www.unice.fr/scheer/papers.htm).

7. Good examples for primary *dr* preceded by a tonic vowel appear to lack.

8. The Latin diphthong *au* behaves just like the monophthongs under (9). This does not come as a surprise since its two parts have merged into *oo* at an early stage. Gemination is thus blocked after tonic *au* (*claud(e)re* > ofr. *clore*), but goes into effect after stressless *au* (FUT.3SG **claud(e)rat* > ofr. *clorra*).

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4.3 Gallo-Romance diphthongs have inherent and stress-independent length

The situation of Old French diphthongs is as follows. The language has three so-called unconditioned diphthongs (i.e., which arose without contribution of another segment), and one relevant conditioned diphthong (i.e., where a monophthong was combined with an external element, e.g., **mat(e)riaame* > ofr. *mairien* where the loss of *t* and the metathesis of yod created an *ai*). The four items are illustrated under (10) below.

(10)

kind of diphthong		lat.	ofr.	evolution in open syllable	
heavy	tonic	*i ee*	*ei* (>*oi*)	*creed(e)re*	ofr. *creire* (>*croire*)
	stressless		*ai*	**mat(e)riaame*	ofr. *mairien*
light	tonic	*e*	*ie*	*petra*	ofr. *pierre*
	tonic	*oo*	*ue* (>*eu*)	frk. **loobr*	ofr. *luerre* (>*leurre*)

Recall that (in open syllables) Gallo-Romance vowel length is co-extensive with (Latin) stress. Given the conditioning established in the preceding section, we thus expect tonic diphthongs to block gemination, while stressless diphthongs should produce *rr*. As a matter of fact, three out of four diphthongs misbehave: only tonic *ei* blocks gemination as expected. Tonic *ie* and *ue* also should, but do not, and stressless *ai* produces non-geminated results where gemination is awaited.

The question is thus what opposes (tonic) *ei* to (tonic) *ie ue*, and what unites tonic *ei* with non-tonic *ai*. The answer is the opposition between light (*ie ue*) and heavy (*ei ai*) diphthongs[9]: the former are inherently short, while the latter are inherently long. That is, diphthongs do not participate in the long-short pairing, i.e., *ie ue* have no long versions (even under stress), and *ei ai* have no short versions (even in non-tonic position). This is why gemination occurs after (tonic) *ie ue*, but is blocked after (non-tonic) *ai*.

4.4 The ban on super-heavy syllables blocks gemination

The empirical puzzle thus dissolves into a very simple generalization: the *r* of *tr dr* geminates iff the group is preceded by a short vowel (in Gallo-Romance), but gemination is blocked iff it occurs after a long vowel. Since the gemination is of a compensatory nature, the default is its going into effect. The question that needs to be asked is thus not why gemination occurs when it does, but rather why it does not occur when it does not. In other words, why is *r* unable to spread on the position of the lost dental when a long vowel precedes?

On the trivial assumption that geminates are coda-onset clusters, the output of gemination after long vowels is VVr.rV. We already know, however, that a ban on

9. The labels 'light' and 'heavy' are used with respect to aperture, which increases in the latter, but decreases in the former.

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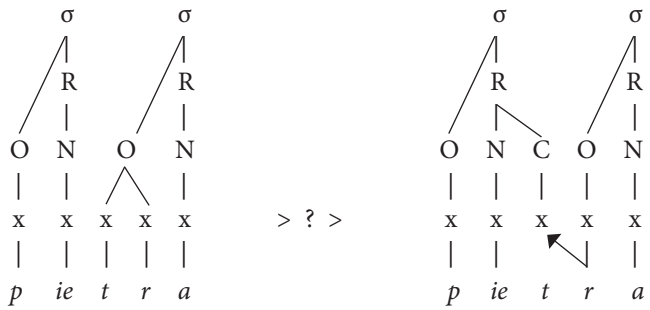
super-heavy rhymes *VVC.C governs the entire evolution of the vocalic system from Gallo-Romance to Old French (Section 4.1). It is thus obviously this same prohibition that blocks gemination after long vowels. The blocking effect of *VVC.C is visible on the vowel in case a diachronic modification 'wants to' lengthen a vowel in a closed syllable (Section 4.1), and it acts on a consonantal process when a diachronic event 'wants to' establish a coda in a syllable whose vowel is long (gemination blocked).

4.5 CVCV offers a plausible scenario, but no solution is in sight in traditional syllabic and moraic analysis

The critical fact that any analysis of the phenomenon needs to represent is the transformation of the timing unit of the first member of a branching onset (the T in V.TRV) into a coda (R_1 in $VR_1.R_2V$). Also note that the process at hand requires that the TR cluster be bipositional: the number of timing units is constant (the loss of the T is compensated by the gemination of the R), and the result is undoubtedly bipositional (a coda-onset sequence).

It is unclear how these analytic requirements could be satisfied with the classical inventory of syllabic constituents (onset, nucleus, rhyme, coda): as shown under (11) below, the loss of the T in a TR cluster would need to cause the vacated skeletal slot to be detached from the onset, to attach to the preceding rhyme in order to become a coda, and then to receive the melody spreading from the remaining onset slot.

(11)



It is hard to imagine a plausible story how the start- and the endpoint of this process could be related, and what the causality of the change of status of the skeletal slot could be.

Mora-based theory is also unable to describe the evolution as a compensatory lengthening. Its ambition is to account for all cases of this process where weight transfer is involved, but the evolution at hand precisely transforms a weightless position into one that has positional weight. Even if it were true that onsets are not universally weightless (Topintzi [2010], but see Goedemans [1996] for a refutation of alleged cases of onset weight), we know that at the relevant evolutionary stage in Gallo-Romance, onsets were weightless since stress assignment continues to work like in Latin (the same vowels are stressed, i.e., long). That is, stress placement takes into account codas (of

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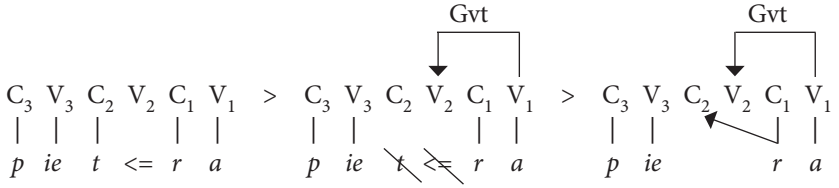
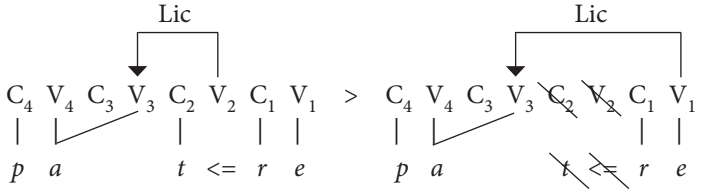
penultimate syllables), but ignores onsets. Moraic theory will therefore have to analyze the evolution of lat. p̲etra as a process where compensatory lengthening plays no role.

Contrasting with the situation in traditional syllabic and moraic environments, CVCV offers a plausible analysis where the loss of the T in fact *predicts* the transformation of its timing unit into a coda. The critical ingredient of this analysis is the empty nucleus that exists in the midst of the TR cluster, and which is automatically 'released' when the T is lost. Consider the two derivations under (12) below regarding a word with a short (*p̲etra*) and a long (*paatre*) vowel to the left of the TR cluster.

(12) a. *p̲etra* > **pietra* > *pierre*



b. *paatre* > *père* (***pèrre*, *parre*)



Recall from Section 2 that in CVCV the solidarity of a bipositional muta cum liquida is due to Infrasegmental Government (IG), a relationship between the two consonants that holds at the melodic level. IG is represented as '<=' under (12). When the T of the TR is lost, IG breaks down because, coming from the R, there is nothing that it can establish a relationship with anymore. Further recall from Section 3 that the empty nucleus enclosed within TRs, V_2 under (12a), enjoys full lateral actorship, i.e., is able to dispense government and licensing.

Now consider what happens when T is lost and IG breaks down: V_2 is not circumscribed by IG anymore and therefore needs to be governed in order to be able to remain unpronounced. In other words, it becomes visible for government, and V_1 now has governing duties (stage 2 of 12a). As an *automatic* consequence of the fact that V_2 is now governed, its onset C_2 acquires coda status: recall from Section 2 that in CVCV a consonant is a coda consonant iff it is followed by a governed empty nucleus.

C_2 having acquired coda status, the R in C_1 can spread on it if nothing withstands the existence of a geminate in this location. Under (12a), the putative geminate is preceded by a short vowel, and gemination can go into effect. Under (12b), however, the ban on super-heavy rhymes blocks the constitution of a geminate. How is the constraint against super-heavy rhymes expressed in an environment without rhymes? In CVCV, the second leg of long vowels needs to be licensed (Scheer 2004: §220). Therefore

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(alternating) long vowels cannot occur in closed syllables: the rightmost leg of V_xV_x in $V_xV_xCøCV$ would be followed by a governed empty nucleus, which by definition is unable to dispense licensing. Hence Tonic Lengthening in open syllables, and Closed Syllable Shortening in closed syllables.

The long vowel under (12b) thus needs a nucleus to its right that is able to license its second leg. V_2 can do that at stage one: being enclosed in a branching onset and therefore ungoverned, it is a good licensor. When T is lost and IG crashes, however, V_2 is in need of government and therefore, should it be governed by V_1, could not license V_3 anymore. In some other language, closed syllable shortening could occur, but this is not the parametric option taken by Gallo-Romance: here priority is given to the integrity of the long vowel, which means that the following nucleus must not be governed. The only way to assure that is to drop the CV unit of the original T (C_2V_2 under 12b) altogether. This is why there is no gemination under (12b), i.e., after long vowels.[10]

5. Metathesis in Tertenia Sardinian

Among other things, Sardinian is known for its (synchronically active) cases of metathesis. Descriptions (and analyses) are available for example in Wagner (1941), Contini (1987) Molinu (1998) and Bolognesi (1998). There are quite a number of different metatheses in Sardinian, which may well have different workings, and there is also a fair amount of diatopic variation. Below the focus is on one particular metathesis that is found in Tertenia (point of inquiry number 211 in Contini [1987]). Data and analysis are by Rosangela Lai, a native speaker of the dialect (see Lai 2013: 98ff, 2014).

5.1 Native vs. foreign vocabulary

Before considering the actual metathesis, it is useful to have a look at Tertenia lenition patterns that concern word-initial consonants. Two realizations in free variation are observed in case the preceding word is consonant-final: an epenthetic vowel may or

10. Dental clusters with laterals *tl dl* are examined in Ségéral & Scheer (forthcoming). Being notoriously (and universally) unable to form branching onsets, only secondary clusters occur, e.g., *rotu(u)lu* > ofr. *rolle* (>*rôle*), *modu(u)lu* > ofr. *molle* (>*moule*). After syncope and unlike secondary *t/d(v)r* which form solidary muta cum liquida (e.g., *it(e)raare* > **i.traa.re* > *errer*, *tl dl* remain thus heterosyllabic: *modu(u)lu* > *mod.lu*. Hence the reason for the loss of the *t d* in *tr dr* and *tl dl* is different: lenition in branching onsets in the former, elimination in coda position in the latter case. In the evolution *tl dl* > *ll*, no onset slot is transformed into a coda slot, and the loss of coda-*t/d* was compensated by the gemination of the lateral in all cases because *t d* have vacated a coda position (and hence the preceding vowel could not be long anyway).

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may not appear at the word boundary. This allows us to illustrate the behavior of the word-initial consonant in both weak (intervocalic) and strong (post-consonantal) position (see Lai 2009). Under (13) below, /paris pappendu/ "you seem eating" for example appears as *páris pappéndu* with no lenition in case the epenthetic *i* is absent, but as *párizi βappéndu* with lenited *β* when it is present. In the interest of space restrictions, the table below illustrates the divergent behavior of native and foreign vocabulary only for labials (the pattern is the same for dentals and velars).

(13) Lenition of word-initial labial stops in Tertenia Sardinian

	native vocabulary	foreign vocabulary
p	/paris pappendu/ "you seem eating"	/tenis puntʃas/ "you have (some) nails" (< Catalan *punxa*)
	párizi ***β****appéndu*	*ténizi* ***β****úntʃaza*
	páris ***p****appéndu*	*ténis* ***p****úntʃaza*
b	/paris bazendu/ "you seem kissing"	/paris bivendu/ "you seem living" (< Spanish *vivir*)
	párizi azéndu	*párizi* ***b****ivéndu*
	párir[11] ***β****azéndu*	*párir* ***b****ivéndu*

It may be seen that while voiceless stops in native and foreign vocabulary are treated alike in both strong (no mischief) and weak (voicing and spirantization) positions, the fate of voiced stops is remarkably distinct: while they experience no mischief in foreign vocabulary at all, they spirantize in strong and are lost altogether in weak position when occurring in native vocabulary.

The take-home information is that we hold in hands a diagnostic for the native vs. foreign character of words that begin with voiced stops. Visibly Tertenia divides lexical items into two categories, or strata, to which distinct phonological computation applies.

5.2 Tertenia metathesis: Description

On this backdrop, consider the data under (14) below where as before consonant-final words may or may not occur with an epenthetic vowel. Metathesis is triggered if no epenthesis occurs, i.e., in case the word-initial consonant is in strong position.

11. In coda position before voiced obstruents, /s/ appears as *r*.

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(14) Tertenia metathesis

	preceding V-final word		preceding C-final word	
a.	*dɔrmiri* "to sleep"			
	/sɔi/	*sɔi ɔrmέndu*	–	"(I) am sleeping"
	/sɛs/	*sézi ɔrmέndu*	*sέr ðrɔmmέndu*	"(you) are sleeping"
	/ɛst/	*ɛsti ɔrmέndu*	*ɛ ðrɔmmέndu*	"(s/he) is sleeping"
b.	*bɛntrɛ* "belly"			
	/pɔrtas/	*pɔ́rtaza έntri mánna*	*pɔ́rtar βrέnti mánna*	"(you) have a big belly"
	/pɔrtat/	*pɔ́rtaða έntri mánna*	*pɔ́rta βrέnti mánna*	"(he) has a big belly"

First, note some facts that are not of direct concern to the argument. In coda position, /s/ appears as *r* (only before voiced obstruents: /ses dormɛndu/ → *sέr ðrɔmmέndu*, compare with [15a]), and /-(s)t/ is unrealized on the surface (/pɔrta**t** bɛntri/ → *pɔ́rta βrέnti mánna*). Indication that the position of the /(s)t/ is present comes from the reaction of the following voiced obstruent, which behaves like if it stood in Strong Position (see [18c] below for the relevant representation); also, observe that the position of the /-t/ appears overtly under (15a–b), where the following *k b* expand on it. In intervocalic position, /s/ appears as *z*, and /t/ as *ð*. Also, there is compensatory lengthening of the metathesized *r* in case it originates in a coda: the m geminates in *sέr ðrɔmmέndu* (but nothing happens in *βrέnti*). Finally, note that the epenthetic vowel is in fact a copy of the preceding vowel: *a* under (14b), *i* under (14a) (/e/ surfaces as *i* in word-final position in Tertenia).

In the two words shown under (14), metathesis of *r* occurs when the preceding word is consonant-final, that is, when according to the pattern discussed in the previous section the word-initial voiced stop is realized on the surface (as a spirant) because it stands in Strong Position. In this case, an *r* that is engaged in a cluster moves to the right of the voiced stop and thereby creates a branching onset TR. In *dɔrmiri* the take-off position of the *r* is a coda, while in *bɛntrɛ* it is the second half of a muta cum liquida.

The variability of the take-off position is a first indication that the metathesis at hand is *not* driven by the unfavorable conditions of the liquid in its base position, as is often reported to be the case for metatheses. Rather, it looks like the future host of the liquid, i.e., the voiced stop, 'wants' to form a branching onset with another segment and attracts liquids, wherever they stand.

The next thing to note is that metathesis never occurs with words whose initial consonant is voiceless, or with foreign words (whatever the voice value of the initial consonant): a word-initial voiced consonant and the native character of the word are necessary conditions.

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(15) No metathesis with voiceless consonants and with foreign words

	preceding V-final word		preceding C-final word	
a.	*kɔrpus* "knock"			
	/piɣas/	*píɣaza ɣɔ́rpuzu*	*píɣas kɔ́rpuzu*	"(you) get knocks"
	/piɣat/	*píɣaða ɣɔ́rpuzu*	*píɣa kkɔ́rpuzu*	"(s/he) get knocks"
b.	*bardunfula* "whirligig" (< Catalan *baldufa*)			
	/tɛnis/	*tɛ́nizi bardúnfulaza*	*tɛ́nir bardúnfulaza*	"(you) have whirligigs"
	/tɛnit/	*tɛ́niði bardúnfulaza*	*tɛ́ni bbardúnfulaza*	"(s/he) have whirligigs"

Finally, consider the data under (16) below where no metathesis occurs even though the phonological circumstances are exactly identical with respect to (14).

(16) Absence of metathesis in native words with an initial voiced stop

	preceding V-final word		preceding C-final word	
a.	*barβa* "beard"			
	/pɔrtas/	*pɔ́rtaza árβa lɔ́ŋga*	*pɔ́rtar βárβa lɔ́ŋga*	"(you) have a long beard"
b.	*bɛrmis* "worm"			
	/pɔrtas/	*pɔ́rtaza érmizi*	*pɔ́rtar βérmizi*	"(you) have worms"
	/pɔrtat/	*pɔ́rtaða érmizi*	*pɔ́rta βérmizi*	"(s/he) has worms"
c.	*bɛrβɛi* "sheep"			
	/tɛnis/	*tɛ́nizi ɛrβɛ́izi*	*tɛ́nir βɛrβɛ́izi*	"(you) have sheep"
	/tɛnit/	*tɛ́niði ɛrβɛ́izi*	*tɛ́ni βɛrβɛ́izi*	"(s/he) has sheep"

The word-initial voiced stop behaves as expected (for native words), but the coda *r* that is present in the words does not move when the stop is pronounced in Strong Position. It must therefore be concluded that the difference between the words under (14) and (16) is *lexical*: either possesses some lexical property that the other does not have. Of course one can give in to the SPE-reflex and set up a diacritic feature [±metathesis]: *dɔrmiri* and *bɛntrɛ* will have it, while *barβa*, *bɛrmi* and *bɛrβɛi* will not. A related solution is to say that there are two distinct phonologies (cophonologies as in Anttila [2002], or indexed constraints as in Pater [2009]) applying to the two lexical sets, which are thus distinct by a lexical class marker: the lexical set marked A is computed by a metathesis-triggering phonology, while the lexical set marked B is computed by a non-metathesis phonology.

Finally, let us consider numbers: it so happens that the five words which are mentioned under (14) and (16) appear to represent the total lexical record of the language that displays the characteristics required for being a potential input to metathesis. This is due to the fact that in order to potentially undergo metathesis, lexical items need to be positive on three counts: (1) they must begin with a voiced stop, (2) they must be native, (3) they must bear a C*r* or an *r*C cluster after the first vowel. Crossing these

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three conditions shrinks the set of lexical items to five, two of which displaying metathesis, against three that do not. It may be readily argued that it is dangerous to base an analysis on only five words, and it is true that this is a serious obstacle. Below it is considered that the workings of Tertenia metathesis are nevertheless truly phonological.

5.3 Allomorphy is not an option in external sandhi

Another objection that may be raised against this conclusion is allomorphy: the two metathesizing roots could have two lexical recordings, one with the *r* in its original place and one with the *r* next to the word-initial consonant. This allomorphy would be phonologically conditioned, since allomorph selection will be done according to whether the preceding word is V- or C-final. What stands in the way of an allomorphic solution, though, is the fact that the phenomenon occurs in external sandhi: the trigger and the patient belong to two different words.

A cornerstone of generative thinking is cyclic derivation, i.e., the idea that phonological and semantic interpretation of morpho-syntactic structure is not done at one go, but rather piecemeal from the most to the least embedded chunk. Today this principle runs under the heading of phase theory (Chomsky 2000 and following) and is a key ingredient of current minimalist syntax.

Inside-out interpretation also supposes modularity: the morpho-syntactic computational system is necessarily distinct from the phonological computational system. Phonologically conditioned allomorphy, however, is a classical argument against the modular architecture that is namely made in OT quarters (e.g., McCarthy 2002: 154f): the fact that morphological computation is conditioned by phonological factors appears to be unexpected since allomorph selection is done before vocabulary insertion, i.e., before phonological information is available. Embick (2010: 81ff) provides an overview of the question and shows how phonologically conditioned allomorphy works in a modular environment: following the principles of inside-out interpretation, at stage X of a derivation the phonological information of all pieces that occur in phase/cycle X, and in all embedded phases/cycles therein, is available and may therefore be used by morphological computation (look-back). What the computation of allomorphy cannot use is phonological information of pieces that have not yet been concatenated (look-ahead).

As a result, in a modular environment and under inside-out interpretation, external sandhi phenomena can never be allomorphic since this would imply look-ahead. Therefore, if grammar is modular, Tertenia metathesis must have purely phonological and lexical workings.

5.4 Lexical conditioning makes traditional scenarios implausible

On the hypothesis that Tertenia metathesis (1) deserves a phonological analysis even though we are only talking about five roots and (2) has truly phonological, rather than

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allomorphic workings (3) on the basis of one single phonological computational system (no diacritic or class features), the first question to ask is *why* the liquid moves. Classical scenarios for metathesis are out of business because there is no general phonological circumstance that triggers liquid movement: rather, as was mentioned, it must be a *lexical* property of metathesizing roots that adds the sufficient condition to all those that are necessary anyway.

Typical motivations for metathesis that are found in the traditional and modern literature concern either the take-off or the landing site. That is, metathesis may be a repair when liquids come to be illegal in coda position. In the Tertenia case, however, nothing of the kind can be said since even in native vocabulary coda *r* occurs without any restriction: the three non-metathesizing roots do not react at all. Hence there is no general ban on coda *r* in the relevant computational system.

The same is true for explanations that are based on the landing site: consonants in strong, and especially in word-initial position, sometimes appear to 'attract' liquids. This may snatch away liquids from their original position[12] or even create liquids ex nihilo.[13] Again this will not work for Tertenia since liquids of non-metathesizing roots remain in situ: there is no general attraction of liquids to word-initial voiced stops in the language.

5.5 Empty nuclei are the motor

In order to get a handle on Tertenia metathesis, then, let us look at the trigger and its interpretation in Government Phonology. Metathesis occurs in metathesizing roots when the preceding word is consonant-final. In Government Phonology, word-final consonants are onsets of empty nuclei (while vowel-final words end in a contentful nucleus). This means that the presence of an empty nucleus to the left of the word-initial consonant provokes the reaction: the consonant in question somehow 'needs' a liquid in order to be able to stand a preceding empty nucleus. When the speaker chooses to insert an epenthetic vowel into the final empty nucleus of word 1, there is no sequence of two empty nuclei; therefore no metathesis occurs.

The analysis below builds on the triggering status of preceding empty nuclei: metathesis is triggered by an illegal sequence of two empty nuclei, whereby the presence

12. For example in the evolution of French where (unsystematically though) R involved in TR or RT clusters was attracted to the word-initial stop: (1) from post-coda TR as in *fimbria* > *frange*, *temp(e)raare* > *tremper*, (2) from intervocalic TR as in **bib(e)rat(i)cu* > *breuvage*, (3) from RT as in *torc(u)lu* > *treuil*, **berbice* > *brebis*). See, e.g., Bourciez & Bourciez (1967: 178, 180), Ségéral & Scheer (2005: 262) for discussion.

13. So-called parasitic *r* also occurs sporadically in the evolution of French next to stops in strong position: (1) word-initial as in *viticula* > *vrille*, *thesauru* > *trésor*, (2) post-coda as in *perdice* > *perdrix*, *regesta* > *registre*. See, e.g., Bourciez & Bourciez (1967: 178), Ségéral & Scheer (2005: 261) for discussion.

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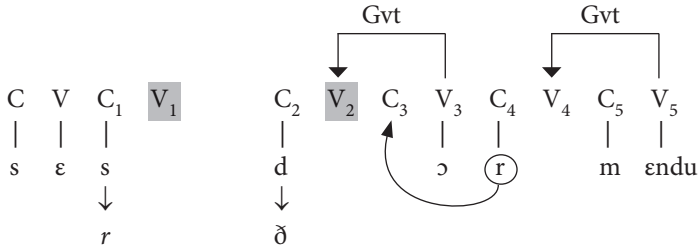
or absence of the second empty nucleus is the lexical property that distinguishes between metathesizing and non-metathesizing roots.

(17) a. In metathesizing roots, the nucleus of the word-initial consonant is empty.
b. In non-metathesizing roots, the nucleus of the word-initial consonant is contentful.

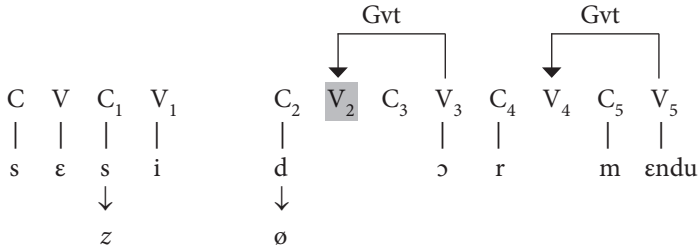
Given these ingredients, the situation of metathesizing roots is shown under (18), while non-metathesizing roots appear under (19).

(18) Metathesizing roots[14]

a. /sɛs dɔrmɛndu/ → sér ðrɔméndu

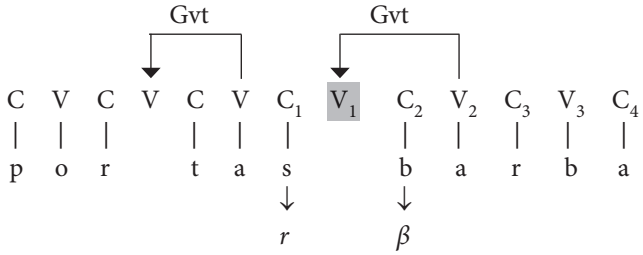


b. /sɛsi dɔrmɛndu/ → *sézi ɔrméndu*



(19) Non-metathesizing roots

a. /pɔrtas barba/ → *pórtar βárβa*



14. Segmental changes that are not the focus of the argument (see Section 5.2) are indicated. Note that under (18b) the word-initial /d/ is lost in coda, rather than in intervocalic position: it occurs before a governed empty nucleus (which is the definition of a coda consonant, see Section 2). The ban on coda obstruents is a surface-true generalization in Tertenia.

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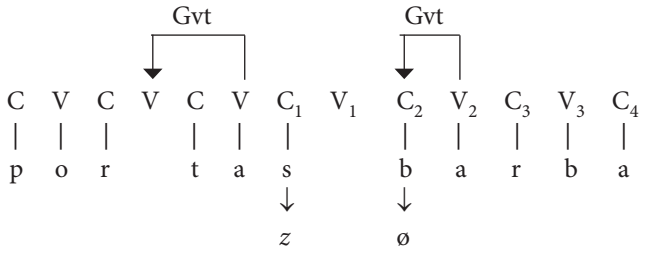
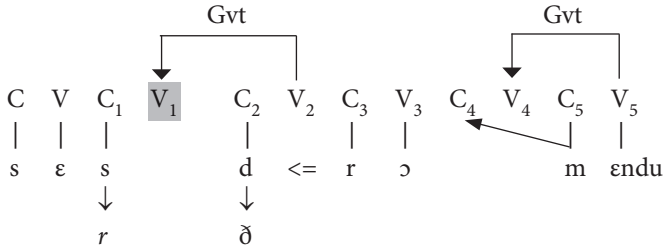
b. /pɔrtasa barba/ → *pórtaza árβa*



Under (18), the first nucleus of word 2, V_2, is empty, and an empty nucleus followed by an empty onset in fact separates the word-initial consonant and the vowel that follows on the surface. As a consequence, there are two empty nuclei in a row under (18a) (i.e., in case word 1 is C-final): V_1 and V_2 (grey-shaded). This is the motor of metathesis: V_3 can only govern V_2, to the effect that V_1 remains orphan (empty nuclei need to be governed or enclosed within a TR cluster) – the structure is ill-formed. This problem does not arise under (18b) since V_1 is filled by the epenthetic vowel. (20) below shows in which way the migration of the *r* to C_3 repairs the representation under (18a): the branching onset created makes it well-formed.

(20) /sɛs dɔrmɛndu/ → *sér ðrɔméndu*



There are still two empty nuclei in a row, V_1 and V_2, but the latter is now taken care of by virtue of being enclosed in a muta cum liquida. It does not require to be governed for that reason, and is able to dispense government itself (see Section 3): this is how V_1 is governed. In sum, what the creation of the branching onset through metathesis does is to circumscribe the empty V_2, which was in demand of government before, but is autonomous now.

For non-metathesizing roots under (19), the problem of two empty nuclei in a row does not arise in the first place since the lexical identity of these roots is precisely not to bear the extra empty nucleus to the right of the initial consonant. In absence of the trigger, there is no reason for metathesis to occur. Note that the /b/ is in Strong Position under (19a) (ungoverned but licensed) and therefore maintained in lenited guise. In (19b), however, it is lenited to zero due to its intervocalic position (governed).

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