**Prosodic strength in Campidanese Sardinian as Substance-Free Phonology**

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To be published in *Phonology*[1]. November 21, 2023.

**Abstract**

The ambition of this paper is to provide a phonological account of an intricate pattern of lenition and gemination in Campidanese Sardinian. The data show two things: that a model of phonology needs some way of showing strength and weakness as positional effects, and that neither can be reliably understood in phonetic terms. In this analysis, the discovery procedure does not depend on raw phonetic facts, but rather on a rich model of abstract phonological representations. These representations are of two kinds: melodic and prosodic—they allow for a substance-free phonological analysis of lenition and fortition in Campidanese that is not confronted by the difficulties inherent in surface-oriented approaches.

# 1 Introduction

Campidanese Sardinian[2], spoken throughout the southern portion of Sardinia (see Mensching & Remberger 2016 for a general overview of the linguistic situation in Sardinia), presents an intricate pattern of lenition and gemination. Descriptively, word-initial voiceless [p t ʧ k] and voiced [b d ʤ g] are realized as stops when in initial and post-consonantal position, while the voiceless class alternates with spirants [β ð ʒ ɣ] in intervocalic contexts. Complicating this description is the fact that [p t ʧ k] sometimes lengthen intervocalically, and [b d ʤ g] also sometimes spirantize.

The distribution of stops in Campidanese thus exhibits a dual patterning where both voiced and voiceless stops are subject to allophony, but the context and outcomes of that allophony seem to resist generalization. In very broad terms, stops are subject to a pattern of alternation, but the rule C[-cont] $\rightarrow$ C[+cont] / V_V does not make the correct predictions, since the surface intervocalic context can produce both spirants and geminates. This thorny problem has been a perennial issue in the literature (see Bolognesi 1998: 165 and Molinu 1999: 169) with some ejecting the pattern entirely from the remit of phonology (Katz 2021).

[1]I owe a profound debt of gratitude to Simone Pisano for his invaluable partnership in the field, as well as his generous and informed discussion of Campidanese phonology and morphology. I also want to thank Marco Antonio Pia for his time and help, as well as Roberta and the people of Genoni, Sardinia. This paper was greatly improved by the comments from three anonymous reviewers and the Editors of *Phonology*—any remaining mistakes or shortcomings are my own.

[2]Described previously in Wagner (1950 [1997]); Virdis (1978); Contini (1986); Jones (1988); Bolognesi (1998); Lai (2021b).

In this article I argue that the pattern of lenition and fortition in Campidanese is phonological. The key is an analytical approach which can generalize over patterns that are phonetically arbitrary and unnatural—an approach that reveals the perfectly orderly character of Campidanese lenition and fortition. In short, the intervocalic context is a superficial description that misses several important generalizations which come out only after careful inspection of the phonological system and the structure of Campidanese. This analysis shows that there are in fact two complementary intervocalic contexts, phonologically speaking, distinct in their prosodic structure (§4.2). While voiceless stops spirantize in prosodically weak positions and are thus subject to a true process of lenition, voiced stops only spirantize when there is an empty timing position to their left: a prosodically strong position that produces phonological gemination in both voiced and voiceless stops.

The analysis developed here shows that explanation for lenition and fortition in Campidanese can be provided if the representational account is adequate. This is in opposition to any surface-oriented view of strength and weakness, where the nature of the output is the final arbiter of what constitutes weakening and strengthening. In such views *any* spirant realization of a stop, for example, is weakening. In Campidanese, a surface-oriented view engenders a number of acute problems, given that describing all cases of *phonetic* spirantization as *phonological* lenition cannot do justice to the pattern observed. Campidanese thus presents an interesting case study for Substance-Free Phonology (SFP) (Hale & Reiss 2000a,b, 2008; Reiss 2003, 2008, 2018), since the output of weakening and strengthening in stops is partially neutralized to voiced fricatives, and phonetic cues are not reliable in the discovery procedure.

In the substance-free analysis developed here, explanation is derived through a theory of explicit representations, both melodic (segmental) and prosodic (suprasegmental). On the prosodic side, I use Strict CV phonology (Lowenstamm 1996; Scheer 2004b, 2012)—a development of Government Phonology (Charette 1990; Harris 1990; Kaye et al. 1990; Harris & Kaye 1990)—to provide a representational structure which explicitly defines contexts for both lenition and fortition. On the melodic side, I suggest that segmental representations in Campidanese are substance-free indexes of natural class-hood which contain no phonetic information but are available to phonological computation (see Dresher 2014; Odden 2022).

The article is organized as follows. First, in §2, I conduct a brief overview of definitions of strength and weakness that view each as being essentially reducible to surface properties of the output of fortition and lenition, respectively. In §3 I lay out the facts of obstruent distribution in Campidanese, highlighting a disjunctive pattern of lenition and of fortition. I show that the intervocalic context produces the same effect on target segments, meaning that an inspection of the phonetic facts cannot explain the pattern. Next, in §4 I show that the dual patterning of stops in Campidanese can be understood in phonological terms as a difference in representational structure on the prosodic tier. I then provide a substance-free account of the melodic content of segments in Campidanese, in order to show in §5 how these two domains interact with phonological computation and the interface between phonetics and phonology. The result is a straightforward account of both lenition and fortition in Campidanese.

# 2 Strength and weakness as properties of phonology

## 2.1 Substantive conceptions of strength

The vast majority of lenition[3] and fortition patterns are phonetically natural. For example, when a stop lenites, it typically is realized as a more sonorous allophone, while the reverse is true in cases of fortition. That is, there is an apparent lack of invariance between phonological processes of lenition and fortition and the phonetic cues of those processes. In the case of Campidanese, the assumption that this invariant relationship should hold contributes to the argument by Katz (2021) that lenition and fortition in Campidanese are not phonological, being instead phonetic effects produced by syntactically-determined prosodic domains and the influence these have on the expression of segments.

This is the logical endpoint for any surface-oriented view of lenition and fortition, where strength *qua* fortition depends on phonetic cues, including for example"duration, intensity, voicing, and degree of formant structure" (Lavoie 2001: 8). Surface-oriented views of strength have been argued for by Fougeron & Keating (1997: 3737) and Bybee & Easterday (2019: 270f.), among others. Likewise, weakness *qua* lenition is manifest as a reduction in articulatory effort (see Kaplan 2010 for an overview), a position which has been amply espoused in the literature (Bauer 1988; Bybee & Easterday 2019; Kirchner 1998, 2000; Kaplan 2010; Lavoie 2001). Lenition, in this light, is a deterministic, sequential process—operating diachronically or synchronically—which results in a reduction of articulatory effort (Bauer 1988). Voicing of intervocalic stops, for example, happens because devoicing in that context would require extra effort to stop the glottis from vibrating (Westbury & Keating 1986; Kingston & Diehl 1994).

Bauer (2008: 622) argues further that lenition can only be understood in terms of phonetic properties, as it is distinct and untethered from positional identifiers: if lenition is defined in uniquely environmental terms—such as V_V—a generalization is missed since there is a unity to processes of lenition in their "failure to reach a phonetically specified target". In this view, the substantive properties of lenition outweigh any positional effect. The most that can be hoped for is that position "can be seen as one of the influences on what phonetic changes are likely to occur" (Bauer 2008: 619).

However, phonological theory *qua* competence is not about what is likely or probable (cf. Newmeyer 2005: 104), and I argue that the pattern of alternation in Campidanese §3 shows two things:

[3] See Honeybone (2008) for an in depth review of the use and meaning of the term *lenition*, and Gurevich (2004) for a census of lenition processes, including intervocalic voicing.

1. A model of phonology needs some way of showing positional effects (syllabic effects) in patterns of lenition and fortition.

2. Positional effects cannot be reliably understood in phonetic terms.

That is, a non-phonological analysis of Campidanese strength and weakness entails a loss of generalization (see §3.2), but surface properties—articulatory or temporal—cannot be used to reliably identify strength and weakness: they can only be understood in phonological terms.

## 2.2 Strength and weakness in substance-free phonology

If a theory of lenition and fortition is viewed as more than just a catalog of phonetic correlates, it can potentially provide an explanatory connection between the effects of lenition and fortition and the contexts in which they are observed (Cyran 2008: 448). Following Szigetvári (2008: 124), this paper aims to meet three goals:

1. Provide a simple definition that enables the analyst to decide whether or not any phonological phenomenon is lenition.

2. Give a clearly defined set of contexts where what is categorized as lenition is "natural" to happen.

3. To correlate the change and the contexts, showing that it would be "unnatural" if lenition occurred elsewhere.

This approach is "substance-free" (Hale & Reiss 2000b, 2008; Reiss 2018) in that there is no primitive assumption made about how strength and weakness should be expressed phonetically. Indeed, I argue that it is impossible to make any conclusions about strength or weakness based solely on the phonetic properties of phonological output—the principal diagnostic tool is phonological behavior (Gussmann 2004; Kaye 2005; Odden 2013).

Put another way, lenition and fortition are always driven by position[4] (see also Honeybone 2012). In this view, strength and weakness are relative—strong

[4]The view of weakness as a structural rather than a substantive property has been argued for previously (Escure 1977; Foley 1977). Escure (1977: 57) argues that lenition must be a structural property since initial consonants do not lenite while medial consonants do, and proposes a hierarchy of the relative strength of consonants and their status as defined by major class and manner of articulation features. While Bauer (2008) shows that this hierarchy is empirically incorrect, Escure crucially argues for a hierarchy of positional strength where lenition is more likely to operate in some positions than in others. The hierarchy suggests there is a kind of relative strength between positions, with some positions more likely to host lenition processes than others. In turn, Foley (1977) argues that segments are defined by strength relations established between major classes of segments, with some segments being inherently stronger or weaker than others. While both Escure and Foley make reference to surface properties that determine a segment's relative strength or weakness, the structural view in which lenition is defined positionally marks a clear break from the substantive view, leading to a vision of weakening processes which are not directly related to the phonetic properties of segments.

items are strong only relative to an item in a weak position. How strong items are realized phonetically is determined at the interface, not by universal fortition scales. This substance-free approach makes predictions about what is weak and what is strong based on the position of each in prosodic structure.

Lenition is not, as such, a metaphorical term, but rather is a specific context in which a phonological process applies, resulting in a weaker segment in that the output contains fewer phonological primes than the input (see also Harris 1990, 1994; Harris & Lindsey 1995). In this view, lenition can have only one definition: any process which removes melodic primes in a phonologically weak position, regardless of its surface output. This characterization of weakness is phonological, since it says nothing about the phonetic exponence of lenition. This paper argues that the pattern of alternation in Campidanese between voiceless stops and spirantization entails the loss of melodic primes in specific prosodic positions, and is thus true lenition.

The representation of strength adopted here is equally phonological: it is defined by position and syllabic structure. Any segment which is associated to two positions on the skeletal tier is strong. Consequently, since doubly-associated voiced geminates are phonetically expressed as short, voiced spirants, surface-oriented correlates for strength are unavailable. The unexpected conclusion of this view is that the process of spirantization which targets voiced stops is a result of fortition (see also Lai 2021a: 85), where the melodic material associated to a single timing position becomes associated to two. This analysis reveals a surprising and novel fact: the outcome of fortition processes can result in an *increase* in sonority, meaning that surface-oriented views of phonological strength and weakness are inadequate.

# 3 Strength and weakness in Campidanese Sardinian

## 3.1 Some words on the data

The patterns described in this paper come principally from the description in Bolognesi (1998). They were confirmed as part of a fieldwork project conducted by the author and Simone Pisano in and around the village of Genoni, in the province of Sud Sardegna, located on the high plane of the Giara di Gesturi in south-central Sardinia in mid-February of 2020. Guided conversations were conducted with 23 inhabitants of Genoni, all of whom were born and raised in the village or nearby. The interviews were conducted in Sardinian by two native speakers. All participants were adults, between the ages of 36 and 91, and native speakers of Campidanese with a high level of competency and strong judgments about grammaticality, for whom many Campidanese is their first language though all are bilingual in Campidanese and Italian. All them regularly and reliably produced the patterns described below.

## 3.2 The empirical situation: Lenition and gemination

In external sandhi (cf. Bolognesi 1998: 36ff.), when morphology results in the voiceless stops [p t ʧ k] being realized intervocalically[5], the result is a surface spirant at the same place of articulation [β ð ʒ ɣ] as in (1), which shows citation forms as they would be realized in isolation or following a consonant-final word, along with the same forms in intervocalic contexts.

| | | | | |
|---|---|---|---|---|
| (1) | [puɖːa] | 'hen' | [sa βuɖːa] | 'the hen' |
| | [tɛrːa] | 'earth, soil' | [sa ðɛrːa] | 'the earth, the soil' |
| | [ʧivraʒu] | 'durum bread' | [su ʒivraʒu] | 'the durum bread' |
| | [kwatːru] | 'four' | [dɛ ɣwatːru] | 'of four' |

Where the voiceless stops are concerned, this pattern is systematic and invariable—it is predictable and has no exceptions. In this same intervocalic context, the behavior of voiced stops [b d ʤ g], there is a critical difference in behavior between the voiced and voiceless series. The most frequent outcome for voiced stops is simply to surface unaltered, though they may be dropped entirely (2):

| | | | | |
|---|---|---|---|---|
| (2) | [bentu] | 'wind' | [su entu] | 'the wind' |
| | [dominiɣu] | 'Sunday' | [su ominiɣu] | 'the Sunday' |
| | [ʤjara] | 'kind of hill' | [sa jara] | 'the hill' |
| | [gaŋga] | 'throat' | [saŋga] | 'the throat' |

Whether a voiced stop is realized as the zero form, however, is not predictable, since the alternations in (2) are optional and /su bentu/ may be realized as [su bentu] as well as [su entu] Elision of voiced stop drops depends on several things. First, it is subject to a register effect, being more likely in slower, careful speech (Bolognesi 1998: 36ff.). Critically, it is also subject to lexical exceptions (in particular borrowings, see Lai 2020), and some words never show elision of the voiced stop (3):

| | | | | |
|---|---|---|---|---|
| (3) | [barːĩã] | 'drill' | [sa barːĩã] | 'the drill' |
| | [dɔtːɔri] | 'doctor' | [su dɔtːɔri] | 'the doctor' |
| | [ʤovunu] | 'young man' | [su ʤovunu] | 'the young man' |

Even in northern varieties of Sardinian where elision is systematic, only words from the native lexicon undergo it; recent loanwords do not show any weakening (Lai 2021b). Since the pattern of voiced stop allomorphy depends on

[5]Here [su] and [sa] are the masculine and feminine noun-class determiners, derived from the Latin IPSUM and IPSAM, respectively (Jones 1988; Wagner 1950 [1997]). Frigeni (2005) uses /su/ and /sa/ to represent the article, while Bolognesi (1998) and Lai (2021b) provide arguments for positing /ssu/ and /ssa/, respectively. Since the difference between these two pairs of representations is not relevant to this discussion, I adopt Frigeni's convention for expository purposes.

morphological idiosyncrasies, it does not seem to be a property of the phonological grammar, and I do not treat it further here.

Complicating this pattern is the fact that there are intervocalic contexts in which voiced stops, like the voiceless stops, alternate with spirants (4):

| | | | | |
|---|---|---|---|---|
| (4) | [biɖːa] | 'village' | [a βiɖːa] | 'to the village' |
| | [dɔmu] | 'house' | [kusːa ðɔmuzu] | 'those houses' |
| | [gatːu] | 'cat' | [trɛ ɣatːuzu] | 'three cats' |

A further complication is the fact that voiceless consonants can be realized long on the surface rather than undergoing spirantization (5):

| | | | | |
|---|---|---|---|---|
| (5) | [piʃːi] | 'fish' | [bendia pːiʃːi] | 'sell-3SG.PST fish' |
| | [tɛmpuzu] | 'time' | [kustu tːɛmpuzu] | 'in those days' |
| | [kojai] | 'to marry' | [oʁia kːojai] | 'want-3SG.PST to marry' |

Voiceless stops thus exhibit a duality of patterning in the intervocalic context, spirantizing as in (1) but lengthening as in (5). In traditional terms, these two surface output patterns correspond to weakening and strengthening, respectively. In sum, the surface pattern of Campidanese stops presents several disjunctions, with voiced stops either surfacing faithfully, falling, or spirantizing, and with voiceless stops either spirantizing or lengthening, and all of this in the intervocalic context.

Simple observation of the conditioning environment of these alternations does not provide any explanation, indeed it obscures the generalization: there are two distinct phonological contexts in play. These contexts do not depend on surface properties, rather they are active at a more abstract level of structure (§4). The first environment triggers lenition of voiceless obstruents, it is the "true" intervocalic context, represented in structural terms as VCV. The second environment triggers lengthening of voiced stops and spirantization of voiced stops, it is the "false" intervocalic context because despite its surface properties it contains an abstract consonantal position, represented in structural terms as VCCV. Each context is entirely predictable, and each process is phonological.

### 3.2.1 Lenition

The pattern of allophony targeting voiceless obstruents in word-initial position in Campidanese is typically described as weakening or lenition (Wagner 1950 [1997]; Virdis 1978; Contini 1986; Bolognesi 1998; Mensching & Remberger 2016; Lai 2021b). Lenition is a descriptive term used to refer to the process which produces alternations of the kind in (1)—it does not as yet have any formal, theoretical status in this analysis. The primary ambition of this section is to lay out the facts concerning lenition in Campidanese, such that the disjunctions pointed out in §3.2 can be given a phonological explanation.

In (1), it was shown that lenition targets stem-initial voiceless stops in intervocalic contexts. The same position also triggers lenition of the fricatives /f s/, manifest as voicing (6):

(6) [foɣu] 'fire' [su voɣu] 'the fire'
[sɔʁi] 'sun' [su zɔʁi] 'the sun'

Lenition also operates on the first member of stop/sonorant clusters (7):

(7) [prũã] 'plum' [sa βrũã] 'the plum'
[trõũ] 'thunder' [su ðrõũ] 'the thunder'
[kroβu] 'crow' [su ɣroβu] 'the crow'
[fraði] 'brother' [su vraði] 'the brother'

In this same context, /l/ is also in an allophonic relationship with [ʁ], (or sometimes [ʕ], see Molinu 2009) (8):

(8) [luʒi] 'light' [sa ʁuʒi] 'the light'
[lũĩzi] 'Monday' [su ʁũĩzi] 'every Monday'
[leʤːu] 'ugly **msc.**' [omini ʁeʤːu] 'ugly man'

Since this alternation has the same structural description as those in (1) and (6), following arguments from Kisseberth (1970) concerning the functional unity of phonological rules, I will consider all these alternations to be the result of a singular process of LENITION, which must be given formal status (see §5.3). The categorical nature of the alternation's structural change, which affects both manner and place of articulation in a seemingly arbitrary way, requires an abstract phonological analysis that does not depend on phonetic facts (Chabot 2021; Scheer 2015).

### 3.2.2 LENITION in non-sandhi positions

The word-medial position merits some discussion regarding the effect of LENITION. In this position, there are no alternations, but the distributional facts show a preponderance of spirants and voiced fricatives: [zriβɔ̃ĩ] 'wild boar', [diðu] 'finger', [foɣu] 'fire'. Bolognesi (1998) and Lai (2015b, 2021b) argue that these are the result of lexicalized sound changes, and not the result of synchronic lenition as in (1). Lai (2015a: 275) provides the most explicit argument to this effect, suggesting that since word-medial obstruents in items such as [proku] 'pig' are not realized as spirants, it shows that by the time the diachronic process of metathesis which changed Latin PORCU > *ˈporku* > *ˈproku* was completed, any synchronic rule of lenition had already ceased to be productive.

Synchronically, this position introduces a number of difficulties. The first is that it establishes an active synchronic process which targets only word-initial onsets in intervocalic contexts, while word-medial onsets in the same context are spared. The second is that it introduces a number of phonemes, including /β ð ɣ/ which are distributionally limited to the intervocalic context, the very context which targets stops for spirantization and fricatives for voicing. This includes /z/, which is not a phoneme in Campidanese (Lai 2021b: 606), since per Bolognesi (1998: 28) it does not occur in absolute word initial position. Words such as [kazu] 'cheese' suggest that there is an underlying /s/ which is being voiced, thus an active process of lenition targeting intervocalic obstruents. The same is true of morphologically complex words such as 3SG in /pappa-t/ 'to eat 3-SG' or the plural /-s/ as in /faula-s/ 'lies', where the final morpheme of each form may surface with a following epenthetic copy-vowel, such that they appear as [papːaða] and [fauʁaza] respectively. Assuming that [z] and [ð] are not contrastive segments in Campidanese, their presence in these forms can be explained if they are the result of LENITION of /s/ and /t/, respectively.

A grammar which generalizes over the facts in §3.2 while ignoring word-medial intervocalic voiceless obstruents is significantly more complex, with a rule of lenition that distinguishes between external sandhi (V#.**C**V) and word internal intervocalic contexts (V.**C**V), along with an increase in the size of the phonemic inventory. If the rule that targets word-initial obstruents in external sandhi is also active in word-medial position, the rule itself is much simpler, and the distribution of spirants can be easily accounted for within the phonological grammar[6]. This is an application of the free-ride principle discussed by Zwicky (1970), where non-alternating forms are assumed to be subject to an active phonological process in a grammar (see Krämer 2012: 41f. for discussion). For this reason, this analysis considers LENITION to be active in word-medial positions. I will take up the case of [proku] and its representation in §3.2.4.

### 3.2.3 Non-targets of LENITION

LENITION does not target all obstruents in Campidanese. As discussed in §3.2 voiced stops may variably be reduced to zero in this context, but unlike for /p t ʧ k f s l/, which are always targeted by LENITION when in the proper context, voiced stop alternations are variable, with a number of lexical exceptions in which voiced stops never fall. Furthermore, the voiceless fricative /ʃː/ and the voiceless affricate /ʦː/ never undergo LENITION, even when in the proper context (Bolognesi 1998: 33), and the same is true of /ʤ/, /v/ and /ɖː/ (Bolognesi 1998: 39). The nasals, /n m ɲ/, never lenite in external sandhi: [su niu] 'the nest'. Word internally, /n/ does seem to lenite, but only when following the main stress-bearing vowel (Bolognesi 1998: 26). Given the essential role played by stress in the structural description of N-deletion and the fact that there are no alternations in intervocalic positions created by sandhi, this process is not the same as LENITION, and is not treated here.

### 3.2.4 Resistance to LENITION: Virtual Geminates

Recall that one of the arguments against synchronic word-medial LENITION is that words such as [proku] do not have word-internal spirants (Lai 2021b). I argued in §3.2.2 however that the same process of LENITION that targets word-initial obstruents in external sandhi is in fact active in word-medial position.

[6]For example, Celtic-consonant mutations resist a straight-forward phonological account in part precisely because the alternation is limited to initial positions (see Hannahs 2011)

In this section I argue that gemination is a manifestation of strength in that geminate stops *never* undergo LENITION.

In order to understand why LENITION does not target voiceless stops in words such as [proku], consider the data provided by Bolognesi (1998: 149) in (9), in which voiceless obstruents are realized in surface forms:

(9) ma[kː]u 'crazy'
tu[pː]a 'bush'
ma[tː]a 'tree
pu[tsː]u 'well'
bru[ʃː]a 'witch'

Immediately, what stands out in (9) is that all of the lenition-resisting objects are realized as phonetically long. However, in Campidanese, the status of phonemic geminates is uneven: only for the sonorants /r n l/ does phonetic length *always* correspond to an underlying contrast between geminates and singletons (Virdis 1978; Bolognesi 1998), other cases of phonetically long obstruents are variable and may be realized as short. For sonorants, Bolognesi (1998: 161) provides some near-minimal pairs, though the deletion of /n/ and its effect on vowels makes the contrast between 'hand' and 'big-MSC' less obvious (10):

(10) a. [mãũ] 'hand'
[karu] 'dear-MSC'
[pala] 'shovel'

b. [manːu] 'big-MSC'
[karːu] 'carriage'
[palːa] 'straw'

The contrasts in (10) suggest that geminate structure is active in the phonology of Campidanese. Lai (2015b, 2021b) notes, however, that for all other obstruents in Campidanese—as in (9)—phonetic duration is not contrastive. Even for words such as those in (9), geminates may be realized as phonetically short, meaning that duration is not a reliable correlate for geminancy in Campidanese (Bolognesi 1998; De Iacovo & Romano 2015).

While it seems obvious that an increase in phonological timing should result in an increase in phonetic duration, phonological timing is above all a matter of phonological representations (see Davis 2011 for discussion), and many factors related to performance can impact the manifestation of timing as duration (Clements 1986: 39). In Italian, for example, length is not always the primary phonetic correlate of gemination (Payne 2005, 2006). Geminates which are not expressed as phonetically long are what Ségéral & Scheer (2001a: 311ff.) refer to as *virtual geminates*, objects whose surface realization is identical to a corresponding singleton, but which is doubly associated to positions on the skeleton without entailing an increase in phonetic duration[7].

[7]See, among others, Lowenstamm (1991); Faust (2014); Faust & Lampitelli (2020) and Ulfsb-

With no phonetic correlate on the consonant itself available for identifying phonolgoical geminates, they can only be identified through phonological behavior. The principal characteristic of geminates is that they *never* lenite (see Jones 1988: 321 and Bolognesi 1998: 33)[8]. Geminate resistance to LENITION is a manifestation of *inalterability of geminates* (Hayes 1986), a structural property inherent in geminates which protects them from LENITION. Since words such as [makːu] 'crazy' never undergo LENITION, regardless of the phonetic length of the medial consonant, they must be geminate (see also Barillot & Ségégral 2005; Barillot et al. 2018 for a comparable case in Somali). Whether a voiceless stop is realized as long or short does not affect its phonological status: speakers perceive them as the same object.

This suggests that any word such as [proku] which does not manifest surface length but which resists LENITION is a virtual geminate, which must be discoverable by language learners. In the case of [proku] for example, the resistance to lenition of word-medial stops is enough for learners to recover geminate structure—the underlying form /prokku/[9]. The result is a phonological geminate which is not realized with phonetic length, recoverable through its resistance to LENITION.

### 3.2.5 Fortition

As shown in (2), in the intervocalic configuration which triggers spirantization of voiceless stops, voiced stops never spirantize. However, (4) exhibits a pattern of alternation in which voiced stops do in fact spirantize. This is what Bolognesi (1998) calls "pseudo-lenition" and what Katz (2021: 657f.) refers to simply as lenition.

I argue that spirantization of voiced stops is not lenition in the phonological sense, but rather is the result of a process which targets voiceless stops as well, for which I will provisionally adopt the term FORTITION. The effect of FORTITION is most apparent where voiceless stops are concerned since they are generally realized with phonetic length. Ultimately, I will argue that FORTITION affects voiced stops, as well as voiceless stops, fricatives, and sonorants, though only members of the latter *must* be realized with phonetic duration. Unexpectedly, voiced stops are realized as spirants when subject to FORTITION. This will be shown through the examination of three related contexts in which FORTITION in Campidanese is active. What unifies the three contexts is that in each, there is an empty timing position to the left of the targeted segment.

The first context to consider is word-initial following a final stop in a preceding word, such as the plural marker /-s/ or the 3SG verbal marker /-t/. In such cases, the final obstruent does not surface as a coda, and instead triggers either

jorninn (2021) for examples of phonologically long vowels which do not surface as phonetically long.

[8] See Ladd & Scobbie 2003, for whom "geminate" is equivalent to "not-lenited" in Logudorese.

[9] In this work I will indicate phonological geminates as /CC/ and phonetic length as [Cː], although it should be kept in mind that phonetic length is variable and phonological geminates /CC/ can be realized without phonetic length as [C].

the insertion of a paragogic copy-vowel if realized, or subsequent lengthening of the word-initial stop if elided (Contini 1986; Jones 1988; Molinu & Pisano 2016; Lai 2021b). In the description given by Jones (1988: 322), in such circumstances initial consonants are "reinforced" or given a "geminate pronunciation". Indeed, Bolognesi (1998: 190) sees this as a fortition manifest as surface gemination, and provides the following examples (11):

(11) a. /bendia-t piʃʃi/ 'sold-3SG fish'
[bendia pːiʃːi]

b. /nomɛna-t fattu fattu/ 'mention-3SG every now and then'
[nomɛna fːatːuvatːu]

c. /ia-t defendiu/ 'had-3SG defended'
[ia ðefendiu]

The examples in (11) represent a sub-case of FORTITION, which I will refer to as *compensatory lengthening*. Lai (2021b) calls this a synchronic process of fortition, by which an obstruent /p/ is realized with increased length, [pː] as in (11a). The same is true of fricatives, as in (11b).

When a voiced stop is realized in parallel contexts, the result is a spirant, as shown in (11c). What (11) and (4) show is an interesting dual pattern: in compensatory lengthening contexts, voiceless stops geminate while voiced stops spirantize.

The second context of FORTITION in Campidanese is fed by a process of metathesis. Diachronically, metathesis characterizes the evolution of Latin to Sardinian generally (Molinu 1999), but its effect was particularly salient in Campidanese (Virdis 1978). Lai (2013, 2014, 2015a) identifies three kinds of metathesis, each of which affects the rhotic phoneme /r/:

(12) (i) Long-Distance Metathesis: the liquid moves from a word-medial branching onset to a word-initial branching onset CVCrV → CrVCV

(ii) Local Metathesis: the liquid moves from a branching onset to a coda CVCrV → CVrCV

(iii) South-Western Metathesis: the liquid moves from a coda to a branching onset CVrCV → CrVCV

While (12i) and (12ii) are diachronic processes, (12iii) is active *synchronically* in words that begin with a vowel and are disyllabic: VrCV (Bolognesi 1998: 419). This process is key for understanding how FORTITION works in Campidanese, and for what it tells us about prosodic structure and the synchronic lenition process (13):

(13) a. /su arku/ → [srakːu] ‘the bow’
/su orku/ → [srokːu] ‘the ogre’
/su ortu/ → [srotːu] ‘the garden’

b. /kusta ɛrba/ → [kustrɛβa] ‘this grass’
/su orʤu/ → [sroʒu] ‘the barley’
/su argu/ → [sraɣu] ‘the sour one’

As /r/ moves into the branching onsets shown in (13), it suppresses the realization of the initial vowel in the article, and triggers lengthening of following voiceless stops (13a) and spirantization of following voiced stops (13b); a dual patterning which parallels (11).

The third context of FORTITION occurs after certain vowel-final prepositions and connectives which have lost an etymological final consonant in diachrony (Jones 1988): e.g. /a/ (<AD or AUT) “to/at”, /ɛ/ (<ET) “and”, /nɛ/ (<NEC), and a handful of others. Lengthening is thus triggered by unstressed monosyllables with etymological coda consonants (Bolognesi 1998; Lai 2021b). The etymological lost-consonant is what Bolognesi (1998) refers to as a *ghost consonant*, since it appears to mark the context for a certain subset of FORTITION processes. As in some other languages of Italy, this appears to be a kind of Raddoppiamento Fonosintattico (RF)[10]. That is, following Fanciullo (1986: 67), an initial consonant is realized as geminate if immediately preceded by an item specified in the lexicon to trigger RF, as in (14):

(14) a. [prẽũ] ‘full’ [ɛ pːrẽũ] ‘and full of’
[ti] ‘you’ [nɔ tːi] ‘not you’
[ʧeʁu] ‘heaven’ [a ʧːeʁu] ‘to heaven’

b. [boɣizi] ‘put out’ [nɔ βoɣizi] ‘don’t put out’
[dɔmo] ‘house’ [a ðɔmu] ‘to the house’
[graðesːu] ‘satisfaction’ [a ɣraðesːu] ‘to have-3SG satisfaction’

RF is common to all varieties of Sardinian and represents a kind of strengthening (Contini 1986). In RF, as in compensatory lengthening, there is a dual pattern: voiceless consonants are realized as geminate (14a), while voiced consonants are realized as spirants (14b)[11].

### 3.2.6 Summary of the empirical situation in Campidanese Sardinian

To summarize, Campidanese is characterized by a process, LENITION, which spirantizes voiceless stops but does not target voiced stops. There are three processes, however, which do produce spirantized voiced-stop realizations: compensatory lengthening triggered by the loss of a preceding word-final consonant

[10] See Loporcaro 1997; Passino 2013, and Russo 2013 for an overview of RF, and Fanciullo 1997 for RF in central and southern Italian languages.

[11] In contrast, in Logudorese voiced stops are realized as surface geminates as a result of RF (see Ladd & Scobbie 2003). In some southern varieties of Sardinian there is variation where voiced stops are realized as geminates in this context (Lai 2021a; Molinu & Pisano 2016).

(11c), compensatory lengthening induced by metathesis (13b), and RF (14b). In addition, these latter three processes all result in lengthening of voiceless stops, and so I refer to all three processes as FORTITION. The pattern of lenition and gemination is schematized in Table 1.

Table 1: A summary of spirantization and lengthening patterns in Campidanese Sardinian.

| Context | /p t ʧ k/ | /b d ʤ g/ |
|---|---|---|
| Left edge intervocalic (1) (2) | [β ð ʒ ɣ] | [b d ʤ g] |
| Word-medial intervocalic (§3.2.2) | [β ð ʒ ɣ] | [b d ʤ g] |
| Compensatory lengthening (11) | [pː tː ʧː kː] | [β ð ʒ ɣ] |
| Metathesis induced CL (13) | [pː tː ʧː kː] | [β ð ʒ ɣ] |
| RF (14) | [pː tː ʧː kː] | [β ð ʒ ɣ] |

Considering the distribution of spirants and stops in Table 1, there is a direct link between the context of lengthening in voiceless stops and spirantization in voiced stops. FORTITION, then, is a process which results in /p t ʧ k/ being realized as geminate just as for /b d ʤ g/, also geminates despite their phonetic identity as spirants. To suppose otherwise is to interpret as an accident the fact that RF, compensatory lengthening, and metathesis induced compensatory lengthening all have complementary scope over voiceless and voiced stops. I argue they are the result of a singular process of strengthening which is reflected in prosodic structure (§4.2).

In a surface-based approach (cf. Katz 2021), this conclusion is surprising, since spirantization is a classic case of lenition—Kirchner (2000: 510) suggests that spirant realizations of geminates are suboptimal and violate constraints which select output candidates for articulatory ease as well as perceptual faithfulness, and therefore can never be selected by a grammar[12]. This is no doubt what leads Bolognesi (1998: 165) to argue that voiced stops spirantize precisely because "they cannot give rise to geminate structure", as voiced post-lexical geminate structures are ill-formed. In order to prevent the grammar from producing such structures, Molinu (1999: 169) imposes a constraint on the grammar which blocks voiced geminates in post-lexical phonology, arguing that the RF process which produces geminates in Lugodorese instead gives rise to "variantes non-géminées et spirantisées" in Campidanese. That is, a spirant is explicitly not a geminate, since a constraint in the grammar interdicts the gemination of voiced obstruents.

[12]Kirchner (2000: 513) argues that spirant outputs of geminates are possible so long as the geminate segment first degeminates. This leaves room for some ambiguity of interpretation. On the one hand, Campidanese represents a counter example to the universal generalization made, since phonologically it does not degeminate. On the other, it does not represent a counter example since the phonetic output is not accompanied by a durational increase. This ambiguity is a consequence of the scrambling trope (Scheer 2010), and threatens Kirchner's claims with empirical vacuity.

I argue that this is a classic case of "substance abuse" (Hale & Reiss 2000b, 2008)—a misuse of the phonetic facts in the building of the analysis. This has two unfortunate results in Campidanese. The first is the loss of generalization entailed by analyzing spirantization and gemination in a disjunctive way as a function of the output. The second is the bloating of the synchronic grammar in order to prevent voiced stops from geminating. The solution to these problems, I argue, is to recognize that compensatory lengthening, metathesis-induced compensatory lengthening, and RF produce geminate structures from all stop inputs, voiceless and voiced alike. The correct view is to analyze all three FORTITION processes as a singular, unified process that results in a phonological geminate, resistant to LENITION as revealed by voiceless stops and surfacing as spirants in the case of voiced stops. This conclusion discards entirely the phonetic properties of the segments in question, and emerges only from consideration of phonological structure and behavior.

Following a general principle established by Hyman (1970), the advantage of positing such abstract structures is the explanatory value they provide[13]: patterns of spirantization and gemination are the result of two prosodic effects, one of LENITION and one of FORTITION. LENITION is a *melodic* process that targets voiceless stops in a weak prosodic position, triggering the loss of melodic material. FORTITION is a *prosodic* effect that spreads melodic material and results in phonological gemination *in all cases*. The result is a unified analysis of strength and weakness in Campidanese, summarized in Table 2. In this view, both weakening and strengthening are still metaphorical notions—their formal status is in their prosodic representations, and how each process falls out from prosodic structure (§4).

Table 2: A summary of positional effects in Campidanese Sardinian.

| | /p t ʧ k/ | /b d ʤ g/ |
|---|---|---|
| LENITION | [β ð ʒ ɣ] | [b d ʤ g] |
| FORTITION | [pː tː ʧː kː] | [β ð ʒ ɣ] |

The facts in Campidanese suggest some notion of phonological *weakness* inherent in the context that conditions obstruent lenition, and *strength* inherent in the context that resists the lenition process. That is, weak contexts allow lenition, and strong contexts produce geminate structure. The observation that segments which resist LENITION are geminate does not in and of itself constitute an explanation for their exceptional status, it merely recapitulates the distribution of stops and spirant allophones; nor does it satisfy the requirements for a theory of lenition (see §2.2). To do these things, an adequate theory of phonological representations and computations is required.

[13]Further examples of the explanatory power of virtual geminates in Campidanese can be found in Lai (2015b,a), where it is shown that they allow for a deeper understanding of the behavior of certain word-initial obstruents, and a process of vowel epenthesis which occurs preceding s+C clusters and virtual geminates.

# 4 Representational structure in Campidanese Sardinian

## 4.1 The representation of timing positions

The examination of the empirical situation in Campidanese (§3) reveals an intricate pattern of spirantization, lengthening, and resistance to spirantization. In this section, I will elaborate an analysis of the prosodic structure of Campidanese which shows this pattern can be understood to fall out from the effects of phonological computation in different phonological configurations. I argue that there are two processes at work, which I have called LENITION and FORTITION. LENITION is a phonological process that works on melodic representations, but which crucially depends on the prosodic structure as a part of its structural description. FORTITION is a phonological process which spreads melodic material by associating it to two timing positions, producing geminate structure.

Here, singletons are represented as a single melodic segment associated to a single timing position (15a) while geminates are represented as a single melodic segment associated to two timing positions, as in (15b):

(15) a. S b. S

X X X

Any autosegmental theory (Archangeli & Pulleyblank 1994; Clements 1986; Clements & Keyser 1983; Goldsmith 1976, 1990; Lowenstamm & Kaye 1985) with a skeleton can build structures like those in (15). The objective here is to make a connection between the structural associations of segments to timing positions in the skeleton and how phonological computation is influenced by them, thus satisfying the second requirement for a theory of lenition discussed in §2.2, as well as providing an explanation for the facts in §3.2. The basic intuition is one based on phonological strength and weakness, where a segment being associated with two timing positions results in prosodic strength through FORTITION, and is thus immune to LENITION.

The analysis thus presents two levels of phonological representation, one prosodic and one melodic. I will begin by outlining the level of prosodic representation, with a particular emphasis on how prosodic structure interacts with LENITION and FORTITION, staying entirely within a phonology that is agnostic to phonetic substance.

## 4.2 Prosodic representations

To show this, let us first consider what kind of syllabic positional strength effects are attested cross-linguistically. Ségéral & Scheer (2008b: 135) provide a schematic view of the various configurations of consonant and vowel sequences and their characteristic positional strengths, reproduced in Table 3, which suggests that three different positions need to be distinguished. The first is the

Table 3: Five positions of strength and weakness (Ségéral & Scheer 2008b: 135).

| POSITION | | USUAL NAME | | |
|---|---|---|---|---|
| a. | #_V | word-initial | strong position | |
| b. | VC._V | post-Coda | strong position | |
| c. | V_.CV | internal Coda | Coda | weak positions |
| d. | V_# | final Coda | Coda | weak positions |
| e. | V_V | intervocalic | | weak positions |

word-initial and post-Coda position, which is a position of strength. In Campidanese this strength is manifest in the power to license the realization of the full set of phonemic obstruents, as well as resistance to LENITION, as seen in all citation forms in §3.2. This protected position, {C,#}_, has been dubbed the *Coda Mirror* (Ségéral & Scheer 2001b; Scheer 2004a; Ségéral & Scheer 2008a; Scheer 2012).

The second is the internal Coda and final Coda position, a position of weakness. Coda weakness is manifest in Campidanese as severe restrictions on what segments are licensed[14] in that position. In lexical forms, the full set of possible Codas is /r s t/, a nasal consonant homorganic for place with a following consonant, and the first element of a geminate (Jones 1988; Bolognesi 1998; Molinu 1999; Lai 2021b). Generally, /s/ and /t/ codas are the result of morphology, as in for example PLURAL nouns or 3SG verb endings. On the surface, however, /s/ and /t/ trigger either the epenthesis of a copy vowel identical to the final vowel in the stem, as in /kanna-s/ [kan:a-z(a)] 'reeds', or are deleted in final position, as in (11). In turn, /r/ is subject to a number of processes of metathesis which means its distribution as Coda is restricted to word-medial position in a limited number of lexical items, as in the examples in (13). This leaves the set of surface Codas limited to word-medial /r/, /s/ in s+C clusters, homorganic nasals[15] and the first element of geminates.

The third position is the intervocalic position. Weakness in this position is manifest in it being a target of LENITION. These three positions in Campidanese conform with the observations made by Ségéral & Scheer (2008b: 135) that there are two ways of being weak—pervasive generalizations which should be reflected in theory. Looking at synchronic patterns in Campidanese, we can establish three positional effects:

1. Strong—the Coda mirror, host to the entire consonantal inventory, and where LENITION is inert
2. Weak—Coda, where licensing power is severely restricted
3. Weak—Intervocalic, the target of LENITION

[14]See Itô (1986, 1989) for the notion of *coda licensing.*

[15]Two words in the native lexicon end in /N/, the prepositions *in* 'in' and *kun* 'with'. In both cases, the nasal is realized homorganic with a following C, or as a nasal vowel if the following word begins with a vowel.

The different effects correspond to the intuition that weakness is a manifestation of loss or erosion of melodic material, while strength is resistance to such processes. The three effects also require a theory of prosodic structure sensitive to each position. A hierarchical syllable with an onset and coda can distinguish between strong onsets and weak codas, but it cannot isolate the intervocalic position, which is typically viewed as an onset despite its distinct phonological behavior that contrasts with onsets in the strong position. A further desideratum of the theory is to explain geminate inalterability—rather than stipulating in the grammar that geminates are immune to LENITION, geminate inalterability should fall-out naturally from basic principles of the formal system.

### 4.2.1 The analytic tool: Strict CV phonology

In order to capture the three distinct prosodic positions, this analysis makes use of the basic machinery of Strict CV phonology (Lowenstamm 1996; Scheer 2004b, 2012), a development of the Government Phonology program (Charette 1990; Harris 1990; Kaye et al. 1990; Harris & Kaye 1990). In Strict CV phonology, prosodic structure is built not out of hierarchical arborescent structures, but out of *lateral relationships* between constituents on a CV tier. This means that the three different positions of strength and weakness are distinguished by the different configurations of lateral relations between members of the CV tier[16].

In Strict CV, the skeletal tier is built from an invariant alternation between C and V positions[17]. Relations between C and V positions are defined by two lateral forces: *government* and *licensing*, and the difference between C and V lies in their distinct licensing powers. Co-occurrence restrictions between adjacent segments are not due to hierarchical syllabic structure, but due to lateral relations between the segments; "branching onsets" or "onset and coda", for example, are not in a relationship derived from an arboreal hierarchy, but one derived strictly in terms of the lateral relationships between them (Kaye et al. 1990). Syllabic structure then is not a phonological primitive *per se*, but a derived property of adjacency relations.

Roughly speaking, *government* is a force which serves to weaken or inhibit melodic material, while *licensing* reinforces it. Both originate at the right edges of words, propagating back—V positions with melodic material may govern and license constituents to their left. There is a hierarchical relationship between governing and licensing: they cannot both exert influence on the same segment (Scheer 2012). If a segment is potentially subject to both lateral forces, it will

[16] For Strict CV analyses of comparable phenomena in Italian, see Lampitelli (2017); Passino (2013), as well as Scheer (2012: 208 ff.) for Corsican, Russo & Ulfsbjorninn (2020) for Neapolitan, and Lai (2013, 2014, 2015b,a) for different effects in Sardinian.

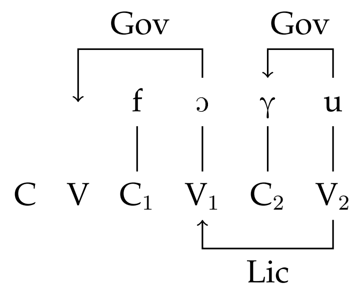
[17] Here, C and V are substance free: they do not have any direct articulatory correlates, since they contain, in principle, no melodic material themselves. Features such as Consonantal and Vocalic do not have a single measurable property which can be used to distinguish between them (Vennemann & Ladefoged 1973: 62). Thus, following Clements & Keyser (1983), neither C nor V can be characterized in phonetic terms since neither has invariant phonetic correlates; instead they represent primitives whose justification rests on theory-internal principles and make a set of significant generalizations.

be subject to government. In turn, licensing will influence the next available segment. When a CV unit is full of melodic material, the V position will contract a relationship of licensing from any following licenser, while the C position will contract one of government.

In Strict CV, all morphological boundary information—information which communicates with the interfaces and is translated from morphology—must be in the form of CV units, meaning that representations contain an empty initial CV at the left edge of words. The difference between a CV unit and a conventional # is that a CV unit is a true phonological object through which morphology is translated into phonology, while # is an arbitrary diacritic whose only function is to mark morpho-syntactic boundaries. This initial CV may enter into a lawful lateral relationship just like any other CV position (Lahrouchi 2018; Lowenstamm 1999; Scheer 2009, 2012). As such, it exerts an influence on the structure of lateral relationships in phonology.

The nature of the strict ordering of CV elements in lateral phonology, along with CV-interpreted morphosyntactic information, means that there is potential in any representation for a number of empty C or V positions—positions with no associated melody. Empty V positions are known as *empty Nuclei*. All languages impose restrictions on the number of empty Nuclei in a given prosodic representation. In order to remain unexpressed, empty Nuclei must contract a relationship of government, which they get from any filled V position that follows. Consider the representation (16)[18], which shows the interaction between the forces of government, licensing, and the empty positions in the initial CV:

(16) /fɔku/ → [foɣu] 'fire'




In (16), $C_2$ contains lexically-specified melodic material, and contracts a relationship of government from the following vowel, $V_2$, which in turn licenses $V_1$, since the latter also contains lexically-specified melodic material. $V_1$, on the other hand, must govern the empty V position of the initial CV, and thus licenses $C_1$. This means that $C_1$ is in the position of the Coda Mirror; being [+Lic], it is not subject to lenition. Thus, [+Lic] is a formal configuration of prosodic structure that reinforces and does not diminish melodic primes; in Campidanese, this lateral configuration is phonologically stable. The position of the intervocalic $C_2$ is an onset like $C_1$, but has a distinct status in this representation, since it is governed,

[18]Note that in (16) and all representations in this analysis, C and V positions are numbered only for expository purposes, such indexing has no status in the formal theory itself.

but not licensed. This position, [+Gov], is where LENITION occurs—here /k/ is realized as [ɣ].

Since filled V positions license and govern, and Codas are followed by empty V positions, they do not enter into any lateral relationship. The result is a position, [-Lic -Gov], with reducing power to license melodic primes. This weak position is subject to severe cooccurrence restrictions, with only /r/, homorganic nasals, or the first part of a geminate being allowed to surface as a Coda in Campidanese. For example, a word such as /fatat/ 'do-3SG' has the following underlying representation (17):

(17) /fatat/

```
        f  a  t  a  t
        |  |  |  |  |
  C  V  C  V  C  V  C  V
```

The representation in (17) has an empty final V position. If an empty Nucleus cannot contract a lateral relationship, it must be expressed[19]. In Campidanese this restriction results either in the deletion of the Coda or in the realization of a paragogic copy-vowel identical to the stem-final vowel in ungoverned empty V positions. The representation in (18) is the surface realization of (17):

(18) [faðaða]

```
       Gov      Gov   Gov
        f  a  ð  a  ð  a
        |  |  |  |  |  |
  C  V  C  V  C  V  C  V
          Lic  Lic   Lic
```

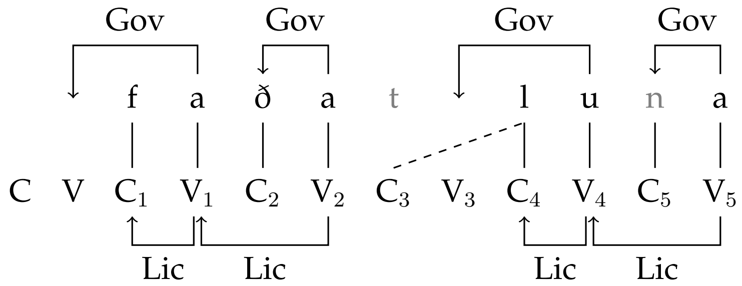
As such, lateral relations not only effect phonological computation, but they also define the well-formedness of a string (Scheer 2012: 145). In order to remain unexpressed, a $V_1$ must be governed by a following $V_2$; if $V_2$ is empty, it cannot govern $V_1$. This predicts that there may not be a sequence of two consecutive empty Nuclei: an empty $V_2$ cannot govern a preceding $V_1$, which thus cannot remain empty and must be phonetically expressed. In classical terms, the result is epenthesis, as when the post-consonantal copy vowel surfaces in Campidenese. In this way, well-formedness does not come from outside of phonology in the form of arbitrary constraints—rather it is the result of lateral relations (see Lai 2015a,b for a discussion of other similar effects elsewhere in Sardinian).

The second solution for the problem presented by /fatat/ is to delete the final consonant. This solution is available when there is a following C-initial

[19] This appears to be another parametric choice—in some languages final empty nuclei can remain empty or even exert an effect on prosodic structure by being good licensers, see Scheer (2012) and Cavirani (2022) for discussion.

word, since final and internal codas do not have the same status in Campidanese. The latter precede a governed Nucleus, which thus cannot be expressed and so cannot contract any kind of lateral relationship with any final consonant. The association between this consonant and its position on the CV tier then moves to the following consonant, resulting in compensatory lengthening (represented by the dashed association line), as for /fatat luna/ 'the moon is shining', represented in (19):

(19) /fatat luna/ → [faða lːũã] 'the moon is shining'




In (19), government and licensing proceed as normal from the right edge. The /l/ in i $C_4$ s normally subject to LENITION, but is protected here since it is licensed. The empty position at $V_3$ attracts government from $V_4$, remaining empty, and consequently $C_3$ is the coda position, a position which imposes severe distributional restrictions on segmental material in Campidanese, as mentioned above. Since the stop in $C_3$ cannot be associated to the timing tier, the association it projects moves to $C_4$, resulting in geminate structure. $V_2$ contracts lateral relationships as normal, and $V_1$ governs the V position in the initial CV instead of $C_1$, resulting in another strong position.

What is the content of this restriction on Coda licensing? Harris (1990) and Cyran (2008, 2010) argue that the amount of melodic material in a segment corresponds to its *substantive complexity*; the more melodic material in a segment, the more complex it is. Cyran (2010) argues that substantive complexity has consequences for prosodic structure, since the more melodic material a segment has, the more licensing strength it requires. Such *complexity scales* mean that positions which are not licensed cannot host as much melodic material as those which are. In Campidanese, positions which contract no lateral relationships—Codas—are weak, licensing only minimally complex segments. In particular, Codas may license nasal segment homorganic for place and the first part of geminates, structures which have in common the "sharing" of melodic material with following segments. In these cases the strength of the structures is reflected by the sharing of segmental material that would otherwise be prohibited in [-Lic -Gov] positions (Honeybone 2005b).

In sum, lateral relations define the three positions of prosodic strength, with each receiving a unique prosodic identity. Importantly, they define the Coda Mirror as [+Lic], making it formally distinct from the intervocalic position, which is [+Gov]. Finally, since Codas do not contract any lateral relationships, being [-Lic -Gov], their power to license contrasts is reduced. The three positions are summarized in Table 4.

Table 4: The lateral relations of the three positions of strength in Campidanese.

| | Strength | Governed | Licensed |
|---|---|---|---|
| The Coda Mirror | strong | no | yes |
| Intervocalic | weakest | yes | no |
| The Coda | weak | no | no |

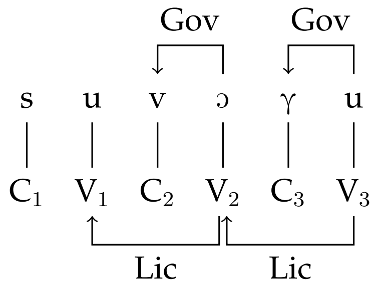
Distinguishing between the three positions means that the context of LENITION in Campidanese can be given a unified context: [+Gov]. Only segments with this lateral configuration can be targeted by LENITION, any other configuration is spared from its effects.

### 4.2.2 Prosodic position and geminate inalterability

We are now in a position to see how prosodic position interacts with LENITION, FORTITION, and gives rise to geminate inalterability—and how the notions of *strength* and *weakness* may be understood in in a substance-free approach.

First, let us consider the case of LENITION, which targets intervocalic obstruents (20)[20]:

(20) /su foku/ → [su voγu] 'the fire'




In (20), $V_3$ licenses $V_2$ , which in turn licenses $V_1$ , resulting in both $C_3$ and $C_2$ being [+Gov]—weak positions. Since those positions are filled by segments subject to LENITION, each is realized on the surface as its corresponding weak allophone.

One prediction made by this theory is that intervocalic positions which are word medial, such as $C_3$, are also [+Gov], and thus potential targets for LENITION. While I presented conceptual arguments for considering spirants in this position to be the result of lenition in §3.2.1, to those arguments can now be added a theoretical one—this position is weak by virtue of its prosodic structure; any potential target in this position will be subject to LENITION. This

[20]The initial CV is not represented in (20), since the melodic material in the clitic has filled it (see Lahrouchi 2018). For expository purposes, I do not represent any lateral relations at the left edge of clitics.

is exactly how a learner is able to recover singletons in this position, since any surface stop in a word-medial position is a geminate, any surface spirant is a singleton[21]. Thus, the simplifications to the grammar that come from assuming LENITION is active in this position fall s out from the lateral relations of intervocalic consonants.

In Strict CV, the relationship which characterizes obstruent sonorant clusters (TR) is known as *infrasegmental government* (see Scheer 2004b, 2012). Infrasegmental government (formalized as T<=R) is a specific kind of government which holds between constituents of branching onsets, and has the effect of suppressing exponence of the V position between the two members, which remains empty. In contrast to other empty V positions the empty V positions in TR clusters are good lateral actors, and may contract government and licensing relationships with other CV positions.

In (21), we see that the $V_2$ is circumscribed by infrasegmental government and thus a good lateral actor, governing $C_2$, and triggering lenition at that position:

(21) /su krɔpu/ → [su γrɔβu] 'the crow'

Gov Gov Gov

s u γ <= r o β u

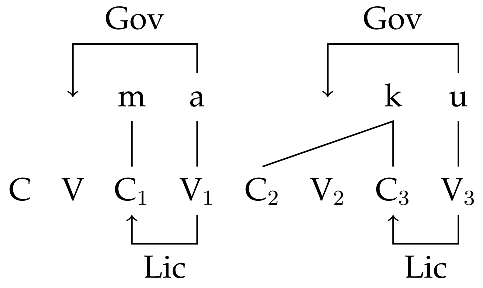
$C_1$ $V_1$ $C_2$ $V_2$ $C_3$ $V_3$ $C_3$ $V_3$

Lic Lic Lic

This brings us back to geminate inalterability. As argued in §3.2.4, in Campidanese, phonetic duration is not a correlate of phonological geminates—rather it is resistance to LENITION that is the defining characteristic of phonological geminates. Infrasegmental government means that the empty V position between two consonants in a tautosyllabic TR cluster does not act like an empty V position between heterosyllabic consonants. Strict CV predicts that any C position which is [+Gov] is weak, and since geminates are not a target of LENITION, they must have a different lateral configuration, corresponding to prosodic strength. In all geminates, there is an empty V position between two C positions. This empty V must be governed to remain empty, as we can see for lexical geminates, as in *makku* 'crazy' (22):

[21] Since voiced geminates and voiceless singletons are neutralized to spirants, one question is if the underlying representation of word-medial surface spirants could ever be a voiced geminate and how a learner would ever know. It is hypothesized that when confronted with cases of absolute neutralization, learners make the simplest assumptions possible regarding underlying representations. In this case, faced with the choice between a singleton/p/ and a geminate /bb/, learners assume the singleton is the underlying representation.

(22) /makku/ → [makːu] ‘crazy’



In (22), $V_3$ governs the empty position $V_2$ and licenses $C_3$, leaving $C_3$ in the strong position, [+Lic], and protecting it from LENITION. $C_2$, in turn, contracts no lateral relationship, leaving it in the Coda [-Lic -Gov], which is also immune to lenition. Since in the case of (22) the Coda is the first element of a geminate, the weak position $C_2$ is able to license the melodic material inherited from $C_3$. This gives us a formal representation of *strength* inherent in lateral relations: their interaction with multiply-associated segments determines where LENITION is active and where it is not.

## 4.3 Melodic representations

Before coming to an examination of the computational wing of Campidanese, I will introduce a system of formal representations and their organization of the consonantal system is in order. I do not address the vocalic system because their representational content is not relevant to LENITION or FORTITION, but a full analysis of Campidanese phonology would require such an analysis. The principal ambition of this section is to show how LENITION modifies melodic structure.

Table 5 is a phonological schema of the phonemic consonants in Campidanese. A few precisions are in order. The segments /ʥ/, /v/ and /ɲ/ are exceedingly rare, and found only in recent loan-words from Italian (Lai 2021b). The retroflex /ɖ/ is only ever encountered as a geminate, and with the exception of the object proclitics [ɖːa(s)] , [ɖːu(s)], [ɖːis], is only found word-medially. All other consonants in Table 5 are phonemic word initially.

The organization of Table 5 deserves some discussion. In substance-free theories, melodic representations do not contain phonetic information. They are abstract, purely symbolic counters which index natural class-hood and mark contrast. That is, labels such as [dental] or [nasal] are not claims about the substantive content of features, they are merely useful shorthand used by linguists to refer to contrastive features or to natural classes (see Chabot 2022 for discussion). The organization of Table 5 is not substantive, it is phonological. For example, the position of the coronal stops /t d ʦ ʥ/ shows each pair at distinct places of articulation. This follows from a principle that views affricates as phonological singletons—simple stops with no continuant element or friction (Clements 1999; Scheer 2003). Affricates rarely have a corresponding plosive at the same place of articulation, while they frequently share a place of articulation with fricatives

Table 5: The consonantal segments in Campidanese Sardinian.

| | STOPS | FRICATIVES | LIQUIDS | NASALS |
|---|---|---|---|---|
| LABIAL | p b | | | m |
| LABIODENTAL | | f v | | |
| DENTAL | t d | | | |
| ALVEOLAR | ʦ ʥ | s | l r | n |
| POSTALVEOLAR | ʧ ʤ | ʃ | | ɲ |
| RETROFLEX | ɖ | | | |
| VELAR | k g | | | |

(Berns 2008: 102). Though the articulatory configuration of affricates is much like that of fricatives, phonologically they pattern with stops (LaCharité 1993; Berns 2008). Kehrein (2002: 5) is explicit on this point, arguing that nothing in their underlying representations allows for stops to be distinguished from affricates, which he terms the *Generalized Stop Approach*. Indeed, in Campidanese, when /ʧ/ geminates, it is the stop portion which becomes long, as in [fratʧi] 'sickle' and [kruttsu] 'short'.

The place distribution of affricates is dependent on the distribution of stops, and affricates and stops are in complementary distribution with respect to place of articulation; what LaCharité (1993: 75ff) refers to as the *stop-affricate dependency*. Where stops and affricates occur at the same place of articulation, and where they are contrastive, there must be a feature distinguishing the class of stops from the class of affricates. Thus, for LaCharité (1993); Clements (1999) and Kehrein (2002), the difference between affricated and non-affricated stops is one of place. To distinguish between /t d/ on the one hand and /ʦ ʥ/ on the other, each pair is assigned a distinct *phonological* place of articulation.

An additional comment can be made on the distribution of stops, fricatives, and liquids, especially where each contains a voiced and voiceless member. There is a voluminous literature on how voicing contrasts are represented in phonology and implemented phonetically (Halle & Stevens 1971; Keating 1984; Iverson & Salmons 1995, 2006, 2011; Lombardi 1995; Avery & Idsardi 2001; Honeybone 2005a; Cyran 2014). What is important here is that, with the exception of /ʦ/—which is always a geminate—each place of articulation has a leniting member (on the left), and a non-leniting member (on the right). Each segment on the left in Table 5 is a member of the exact class targeted by LENITION. However, the target of LENITION cannot be voiceless segments, since it also targets /l/. I suggest that the distinction between voiceless and voiced obstruents in Campidanese can be profitable conceived as being one of fortis and lenis, respectively (see also Bolognesi 1998: 163, Lai 2021a: 82ff., Virdis 1978: 91).

Here, applied to Campidanese, fortis and lenis are labels of convenience, based on the observation that the articulation of /p t ʧ k f s l/ is stable throughout the process of FORTITION, while that of /b d ʤ g/ is not, resulting in spirants. Conversely, /p t ʧ k f s l/ are realized with phonetic voicing after

LENITION, a property of lenis articulations. The contrast between fortis and lenis in Campidanese is not expressed phonetically the way it is in Germanic, but as true voicing as is typical in Romance (cf. Cyran 2014 for Polish, Iosad 2012 for Friulian, and Iosad 2017 for Bothoa Breton, where it is argued that the relationship between phonetic voicing and phonological voicing is arbitrary).

In Campidanese, lenis is realized with active closure voicing, and fortis realizations are not realized with aspiration (Keating 1984). Consequently, the target of LENITION is the set of fortis segments: /p t ʧ k f s l/ which are marked by a substance-free feature: [fortis]. Those segments which are not marked by [fortis] do not undergo LENITION. The same is true of those segments such as /ɖ/ and /ʃ/ which are always represented as lexical geminates (see Lai 2015b for discussion).

# 5 Phonological computation in Campidanese Sardinian

## 5.1 Two computational domains and an interface

I have identified two phonological processes in Campidanese, which I have referred to as FORTITION and LENITION. This section will provide an analysis of how both computational processes operate in Campidanese. It shows that FORTITION is a process which operates at the prosodic level, associating melodic material with additional timing positions, while LENITION is a process which operates at the melodic tier, active in a particular prosodic context, [+Gov], and resulting in the loss of melodic material.

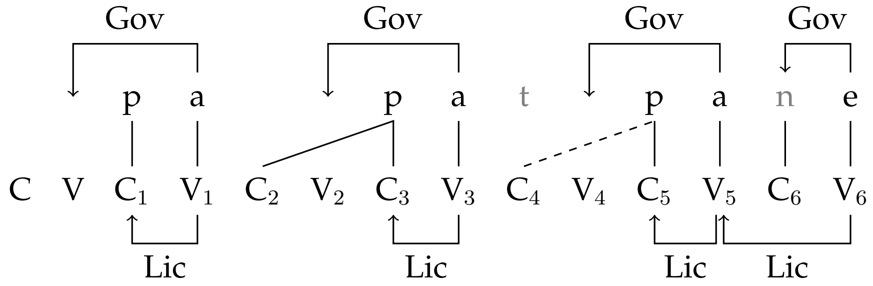
Some form of an interface between phonology and the phonetic module is a necessary property of any substance-free theory of phonology (see Scobbie 2007; Boersma & Hamann 2008; Hamann 2011; Scheer 2014; Kingston 2019 for proposals of interface models). A one-to-one mapping between phonological features and phonetic exponence cannot always be assumed (Keating 1988), as phonological features and phonetic properties do not map back to each other invariably (see for example Hamann 2004 for retroflexivity, Kingston & Diehl 1994 and Honeybone 2005a for voicing, and Clements 1990 for sonority). Phonetic realizations of phonological objects are not only learned, but they may vary in unexpected and unpredictable ways (Chabot 2019).

In the model I use here, *post-phonological spell-out*, the mapping between phonetic realizations and phonological objects is a look-up function (Scheer 2014). Spell-out is a lexicon of instructions that map from underlying forms to surface forms; as such it works like a dictionary and each entry must be learned during acquisition—as is true for morphosyntax, mappings are not innate. While phonological computation works over phonological features, it is in spell-out that features are imbued with phonetic substance. Spell-out functions once all phonological computation has been carried out; it is purely translational and performs no computation itself. Thus it cannot, for example, insert or remove features or change association lines or prosodic structure. I will show how this arbitrary spell-out produces spirant outputs of voiced stops that undergo FORTITION in the following section.

## 5.2 A formal account of FORTITION

First, let us examine FORTITION through the lens of the prosodic structures established in §4.2. In §3.2.5, it was shown that the loss of a final consonant preceding a voiceless consonant triggered a process of compensatory lengthening by which the voiceless consonant is both exempt from LENITION and realized with phonetic duration as in *pappat pani* 'eat-3SG bread' (23):

(23) /pappat pane/ → [pap:a p:ãĩ] 'eats-3SG bread'




In (23), $C_4$ is [-Lic, -Gov], and thus subject to strict licensing requirements. Since /t/ does not meet those requirements in Campidanese, it is not associated to the prosodic position, and cannot surface. However, the melodic material associated to $C_5$ is [+Lic], and associated with $C_4$ by FORTITION—marked with a dashed line. The difference between post-lexical geminates and lexical geminates is inherent in the structure in $C_4C_5$ which represents double association derived through FORTITION and $C_2C_3$, in which the double association is part of the lexical representation.

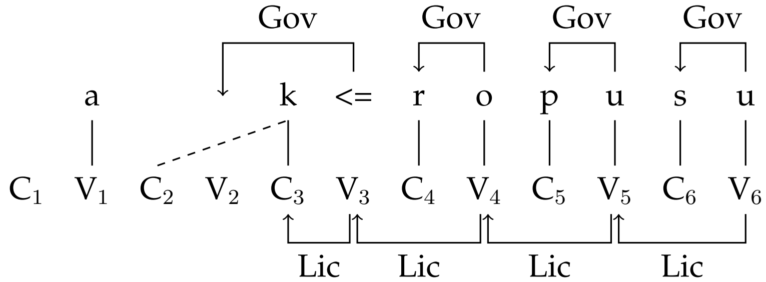
This brings us to the second kind of FORTITION discussed in §3.2.5, that of RF. On the surface, the positional description of RF is intervocalic, yet LENITION is never triggered. Recall that in RF a closed class of lexical objects triggers gemination of a following consonant. Representations for this set of lexical object contain an empty CV in their underlying representations (Chierchia 1986; Larsen 1998; Passino 2013). In this way, they are representationally distinguished from non-RF triggering lexical-objects (24):

(24) a. Non-RF triggering b. RF triggering


The empty C positions in RF-triggering morphemes explains why they result in geminate structure, as consonantal material is associated to the available empty C position. One point of precision is due concerning the representation in (24b), which contains an association line with no melody. An empty C position alone is clearly not enough to trigger FORTITION, since the initial CV does not trigger lengthening of initial consonants in Campidanese, as seen in (23) for example. Passino (2013: 337f.) argues that RF-triggering morphemes are more than just empty C positions: they also contain an association line in their underlying representations. This explains why consonants spread to empty C positions—when such an association line is not available, spreading cannot happen.

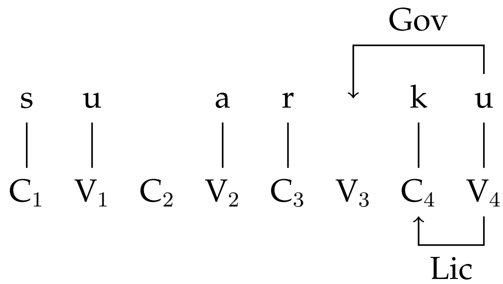
The effect of the empty CV position and its association line can be seen in (25), where the association line inherent in the representaiton of $C_2$ shifts to the melody of $C_3$, resulting in a geminate structure.

(25) /a krɔpus/ → [a kːroβuzu] 'to crows'



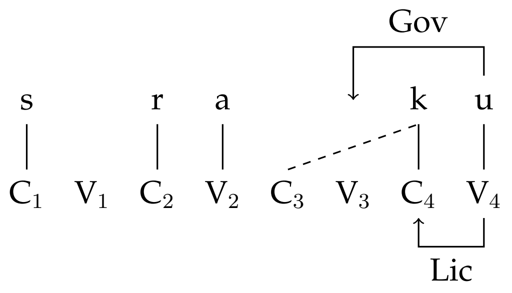

This brings us to the third and final kind of FORTITION discussed in §3.2.5, metathesis-induced compensatory lengthening. Consider the representation in (26):

(26) /su arku/ 'the bow'



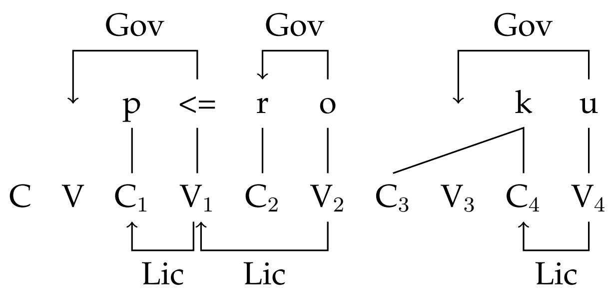

In (26), there is a lexical /r/ associated with $C_3$. When metathesis causes /r/ to move into $C_2$, this vacates the Coda position. The resulting empty C position is associated with the melodic material of the following $C_4$, resulting in a geminate (27):

(27) [srakːu] ‘the bow’



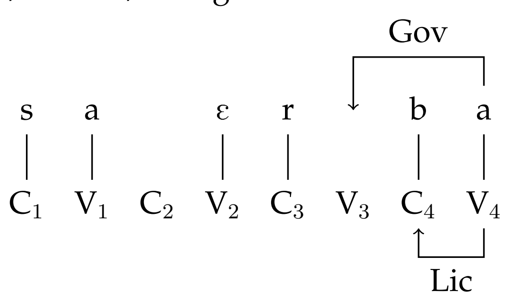

This account of FORTITION explains why objects such as *proku* ‘pig’ resist LENITION, without stipulating that LENITION is inactive in word-medial position: the word-medial consonant is geminate. It is possible that diachronically, this gemination was a result of FORTITION, but synchronically, in the absence of metathesis-based alternations, it has been reanalyzed as a lexical geminate.

(28) /prɔkku/ → [prokːu] ‘pig’



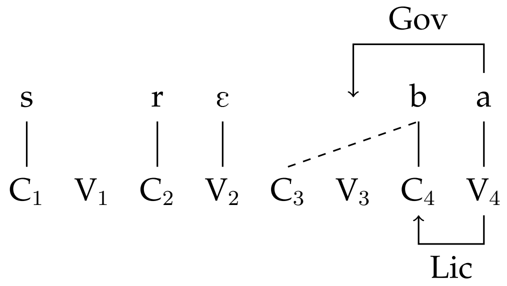

Finally, this account demonstrates that voiced stops are also geminated by FORTITION, despite their surprising phonetic exponence as spirants. While increased timing units can result in increased duration on the surface, the ultimate phonetic expression of a phonological object is impacted by non-phonological factors (Clements 1986: 39), which potentially obscure any expression of phonological length. Consider for example the process of metathesis, where a coda /r/ moves out of its lexically-specified position in the correct morphophonological contexts. The representation in (29) shows the underlying form of a metathesis context:

(29) /sa ɛrba/ ‘the grass’



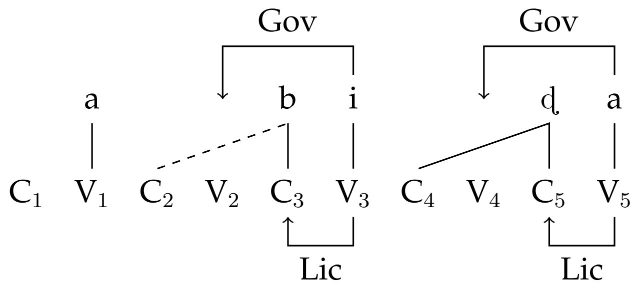
In (29), the lexical /r/ associated with the $C_3$ moves to $C_2$, vacating the Coda position. Just as in (27), the resulting empty C position is associated with the melodic material of the following C, resulting in a geminate (30):

(30) [srɛβa] 'the grass'




In RF, the same FORTITION effect can be seen (31) for voiced stops, just as in (25) for voiceless stops:

(31) /a biɖɖa/ → [a βiɖːa] 'to the village'

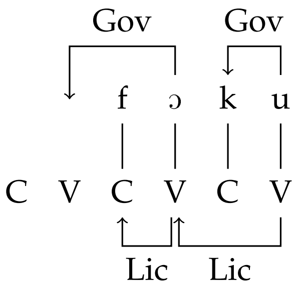



In (31) FORTITION associates the lexical /b/ of $C_3$ to $C_2$, thereby creating geminate structure, belied by its expression as the spirant [β].

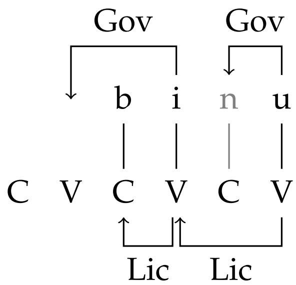
Lateral relations in Campidanese and their affect on LENITION and FORTITION are shown in (32), where the distinct contexts of each are made explicit in their structural representations.

(32) a. *Isolation form*

[foɣu] 'fire'




[bĩũ] 'wine'




b. LENITION context

[su voγu] 'the fire'

Gov Gov

s u f ɔ k u

C V C V C V

Lic Lic

[su bĩũ] 'the wine'

Gov Gov

s u b i n u

C V C V C V

Lic Lic

c. FORTITION context

[ɛ fːoγu] 'and fire'

Gov Gov

ɛ f ɔ k u

C V C V C V C V

Lic Lic

[ɛ βĩũ] 'and wine'

Gov Gov

ɛ b i n u

C V C V C V C V

Lic Lic

### 5.2.1 FORTITION and the interface

The realization of geminate /b d ʤ g/ as spirants is a surprising conclusion in any theory where phonological structure is recapitulated in phonetic substance. In the substance-free view adopted here, though, this is not relevant to phonology *qua* computation, rather it is an example of the realization of phonological structure being shaped by third-factor phenomena (Chomsky 2005). In particular, this is an effect of the physical exigencies of voicing, which requires air to flow through the vocal cords, which accumulates in the oral cavity (Ohala 1997).

During stop production, all exit valves are closed, as air flowing through the glottis (a necessary condition for moving vocal chords) builds up in the buccal cavity, oral pressure nears subglottal pressure (Ohala 1983: 194ff.). When this happens, the air flow through the glottis is diminished and voicing is no longer possible. The longer the stop is held, the greater the likelihood for voicing to be extinguished. This results in a strong tendency for long voiced stops—geminates—to become voiceless.

However, Ohala (1983) notes that the tension between voicing and stops can be relieved in other ways, notably by "unstopping" the stop—by changing it to a voiced fricative or approximant. This third-factor effect would have been an actor on voiced geminates at a diachronic stage when voiced geminates were realized with increased duration, as they are synchronically in Logudorese (Ladd & Scobbie 2003). If spirantization is an effect of increased buccal cavity pressure and release that has been phonologized (see Hyman 1976, 2008), then it will produce a synchronic pattern such as the one in Campidanese.

Melodic content is interpreted in spell-out through a mapping between underlying representations and surface forms. Since spell-out is sensitive to prosodic structure, and since each mapping is a look-up function, it can interpret singletons (33a) and geminates (33b) in phonetically disparate ways.

(33) a. $\begin{array}{c}\begin{bmatrix}\text{-fortis}\\ \text{+labial}\\ \dots\end{bmatrix}\\ |\\ \text{C}\end{array} \leftrightarrow \text{b}$ b. $\begin{array}{c}\begin{bmatrix}\text{-fortis}\\ \text{+labial}\\ \dots\end{bmatrix}\\ \\ \text{C V C}\end{array} \leftrightarrow \beta$

Something the representations in (33) make clear is that FORTITION produces a geminate from voiceless obstruents, without effecting any change to the melodic representation of the underlying input segment. This follows from geminate inalterability: geminates are immune to such feature changing operations in Campidanese. Put another way, the phonetic expression of geminate voiced stops as spirants is not a fact about phonological computation *senso strictu*, rather it is an effect of the interface. It is irrelevant to the formal computational theory since the only phonological process in voiced stop gemination is the process that constructs association lines between the melodic material of voiced stops and the empty C positions; their realization as spirants is a fact about interpretation at the interface, not about phonological computation changing any melodic representation. This is in contrast to the process of LENITION which targets voiceless stops. Since LENITION actually changes melodic material through phonological computation, it is part of the phonological grammar, not an interface effect.

## 5.3 A formal account of LENITION

### 5.3.1 LENITION of voiceless stops

While FORTITION operates on the prosodic tier, LENITION operates over the melodic tier, targeting /p t ʧ k f s l/ when they are in a [+Gov] prosodic context. Though /p t ʧ k f s l/ share no obvious phonetic properties that would suggest they constitute a natural class, the fact that LENITION can be given a singular structural description suggests there is a single rule underlying LENITION in Campidanese, effecting a single structural change. The first objective of the computational analysis is to define the structural change that results in /p t ʧ k f s l/ being realized as [β ð ʒ ɣ v z ʁ].

As noted by Katz (2021: 652), the alternation between voiceless stops /p t ʧ k/ and voiced fricatives [β ð ʒ ɣ] has posed serious obstacles for output-oriented phonology; such alternations are an example of a *saltation*, a structural change where a category B is "jumped" over on the way from A → C (Lass 1997; Minkova 1993). Hayes & White (2015: 267) define saltation in featural terms: for every segment A, B, and C, when some feature is shared by all three, but A alternates with C while B remains invariant.

I suggest that the attention placed on saltatory alternations is misguided, and that they do not pose any particular difficulties for synchronic phonological computation. In part, the attention paid to saltatory alternations is based on a conceptual argument, reflected in the intuitions of many phonologists, that a change A to C is somehow more extreme than a change A to B. Given an alternation /p/ → [β], the assumption that this is a saltation is made with no evidence that this particular structural change actually involves more than a single change of feature, such that /p/ → [b] involves a single change but /p/ → [β] involves more than one. The assumption seems to be based on the description of /p/ and /b/ in phonetic terms, but not in phonological ones. The definition of saltation used changes depending on the feature system used; though in substance-free approaches which assume no single, universal feature system (Dresher 2014; Odden 2022), there is no reason to assume that the structural change that maps /p/ → [β] is more than a single feature. The explanation for the relative rarity of saltatory alternations is found in diachrony: saltation is never the result of a single sound change (Minkova 1993; Lass 1997), but rather the result of a cumulative rule telescoping (Wang 1968; Hyman 1975; Kenstowicz & Kisseberth 1977). The saltation pattern of Campidanese has similarly been attributed to an effect of diachrony and contact, rather than a one-step sound change (Lai 2020: 251).

### 5.3.2 The lateral

As discussed in §3.2.1, the alternation between the lateral and its uvular or pharyngeal allophone must also be viewed as part of the larger pattern of LENITION. It is of particular interest because of its phonetically arbitrary nature: nothing in the structural description or the phonetic identity of /l/ explains why it should be realized as an uvular or pharyngeal fricative (Chabot 2021; Scheer 2015) .

There is some diatopic variation between the uvular and pharyngeal realizations of the output segment, though Contini (1986: 521) describes the output as a distinct pharyngeal fricative. This alternation is present in many, but not all, varieties of Campidanese (see Virdis 1978; Contini 1986; Molinu 2009). In Genoni, speakers are very aware of this alternation and their production of an uvular or pharyngeal phone, and consider it to be one of the distinctive markers of their dialect of Campidanese (34):

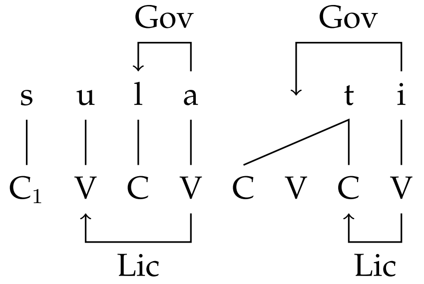
| | | | | |
|---|---|---|---|---|
| (34) | [l]atːi | 'milk' | su [ʁ]atːi | 'the milk' |
| | [l]ebiu | 'mild' | lebiu [ʁ]ebiu | 'very mild' |
| | [l]ũã | 'moon' | sa [ʁ]ũã | 'the moon' |
| | [l]imõĩ | 'lemon' | su [ʁ]imõĩ | 'the lemon' |

Molinu (2009) also provides examples of this alternation in data from her fieldwork in Genoni (35):

| | | | | |
|---|---|---|---|---|
| (35) | [l]aðru | 'bacon' | su [ʁ]aðru | 'the bacon' |
| | [l]ɔŋga | 'long' | braβa [ʁ]ɔŋga | 'long beard' |
| | [l]imɔ̃ĩ | 'lemon' | binti [ʁ]iˈmɔ̃izi | 'twenty lemons' |
| | [l]ampaðaza | 'June' | ɛkːomint͡sau [ʁ]ampaðaza | 'June just started' |

Given that this alternation takes place in external sandhi at word boundaries, is categorical in nature, and not explainable through recourse to phonetic functionalism, any argument against it being an extra-phonological effect seems doomed to fail. It must be a grammatical effect since it is arbitrary in phonetic terms, and it must be a phonological process since it occurs in external sandhi and has well-defined phonological context: intervocalic positions subject to government (36):

(36) /su latti/ → [su ʁatːi] 'the milk'




In short, the alternation in (34) and (35) is the product of phonological computation that takes place in the context of [+Gov] positions, a process formalized as (37):

(37) $\mathrm{l} \rightarrow \left\{ \begin{array}{c} \text{ʁ} \\ \text{ʕ} \end{array} \right.$ / +Gov

The alternation between /l/ and [ʁ] or [ʕ] is phonetically unnatural, since the structural change seems to have no plausible explanation in the triggering context. This computational change is a demonstration of the power of the computational system, which operates in a way that is insensitive to phonetic constraints—it is substance free.

### 5.3.3 The phonological rule of LENITION

The regularity of the pattern exhibited in §3.2.1, the fact that it is triggered in external sandhi, and its well-defined phonological context all militate for its status as a phonological rule; any theory of phonology must be able to treat it as such. What is required is an explicit statement of the general computational properties at work. I have already suggested that LENITION is a process that occurs in positionally weak contexts, resulting in the loss of melodic material from segments which undergo it. This accords well with the diachronic observation that lenition follows a clear and well recognized trajectory towards the eventual disappearance of segments, as expressed in the famous personal communication from

Theo Vennemann reported by Hyman (1975: 165), which provides a teleological definition of lenition as a segment's progression towards zero (see discussion in Honeybone 2008: 13f.). In the final step of this progression, when the segment is reduced to zero, there is a clear loss of melodic material. To account for this erosion of melodic material, Harris (1990, 1994); Harris & Lindsey (1995) propose that lenition is *always* the loss of melodic material.

Thus, a segment which finds itself in a [+Gov] context is subject to licensing restrictions: melodic material is removed in this position. The formal definition of LENITION in Campidanese can now be given (38):

(38) Formal definition of Campidanese LENITION
[fortis] $\rightarrow \varnothing$ / [+Gov]

This rule says that the feature [fortis] is deleted when it is [+Gov]. In the Campidanese system, then, the loss of a single feature causes three distinct structural changes: /p t ʧ k/ are voiced and fricativized, /f s/ are voiced, and /l/ is realized as an uvular or pharyngeal fricative.

## 5.4 Conclusion

In this paper I set out to give a phonological account of strength and weakness in Campidanese. I argued that neither notion can be understood in phonetic terms, since voiced stops are realized as spirants when in the context of FORTITION. I proposed an account that relies critically on representations. In this account, the effects of LENITION and FORTITION are shown to be sensitive to their respective phonological contexts. The former relies on the lateral configuration between segments, and the latter depends on the presence of an empty object to the left of the target.

More generally, I have sought to account for the pattern in Campidanese through a substance-free lens. To this end, in §2.2 I stated three analytical goals for a theory of lenition (Szigetvári 2008: 124). I have shown that LENITION and FORTITION are the loss of melody in [+Gov] contexts and the association of melodic material to more than one timing position, respectively. Thus, the analysis here shows that the Campidanese data is amenable to these three goals, provided the proper representational tools are used. To wit:

1. I provide a simple definition of lenition as loss of melodic material and of fortition as multiply-associated structure on the skeletal tier.

2. I provide a natural context for each one of these processes, to wit [+Gov] for the former, and an empty position on the skeletal tier which associates to the melody of another position in a geminate structure for the latter.

3. I correlate the change and the contexts, thereby showing that LENITION would be "unnatural" if it occurred in a [+Lic] context, for example, while FORTITION would be "unnatural" if it occurred in a [+Gov] context.

This analysis reveals that both weakness and strength are positional effects in Campidanese which cannot be directly read-off their phonetic correlates. It shows that voiced stops are spirantized after phonological fortition. This is a surprising fact in surface-oriented theories of phonology, where lenition trajectories are always phonetically defined; a change /b/→[β] goes down the lenition scale. In Campidanese, though, this change is in fact a manifestation of strength.

But the consequence for phonological theory is not just another argument that phonetic inspection is inadequate as a discovery procedure. Strength and weakness in Campidanese also show the intricate way in which computation, melodic representations, and prosodic representations can all interact to give rise to surface patterns. To approach explanatory adequacy, a theory of phonology must have an explicit definition of each—it cannot rely entirely on computation or entirely on representations (cf. Anderson 1985: 350).

# References


Anderson, Stephen R. 1985. *Phonology in the twentieth century*. Chicago & London: The University of Chicago Press.

Archangeli, Diana & Douglas Pulleyblank. 1994. *Grounded phonology*. Cambridge, Massachusetts & London: The MIT Press.

Avery, Peter & William J. Idsardi. 2001. Laryngeal dimensions, completion, & enhancement. In T.A. Hall (ed.), *Distinctive feature theory*, 41–71. Berlin: De Gruyter Mouton.

Barillot, Xavier, Sabrina Bendjaballah & Nicola Lampitelli. 2018. Verbal classes in Somali: Allomorphy has no classificatory function. *Journal of Linguistics* 54(1). 3–43.

Barillot, Xavier & Phillippe Ségégral. 2005. On phonological processes in the '3rd' conjugation in Somali. *Folia Orientalia* 41. 115–131.

Bauer, Laurie. 1988. What is lenition? *Journal of Linguistics* 24. 381–392.

Bauer, Laurie. 2008. Lenition revisited. *Journal of Linguistics* 44. 695–624.

Berns, Janine. 2008. *Friction between phonetics and phonology: The status of affricates*. Nijmegen: Radboud Universiteit dissertation.

Boersma, Paul & Silke Hamann. 2008. The evolution of auditory dispersion in bidirectional constriant grammars. *Phonology* 25. 217–270.

Bolognesi, Roberto. 1998. *The phonology of Campidanian Sardinian*. Dordrecht: HIL.

Bybee, Joan & Shelece Easterday. 2019. Consonant strengthening: A crosslinguistic survey and articulatory proposal. *Linguistic Typology* 23(2). 263–302.

Cavirani, Edoardo. 2022. Silent lateral actors: the role of unpronounced nuclei in morpho-phonological analyses. *The Linguistic Review* 39(4). 615–653.

Chabot, Alex. 2019. What's wrong with being a rhotic? *Glossa: a journal of general linguistics* 4(1): 38. 1–24.

Chabot, Alex. 2021. *Possible and impossible languages: Naturalness, third factors, and substance-free phonology in the light of crazy rules*. Nice: Univeristé Côte d'Azur dissertation.

Chabot, Alex. 2022. On substance and Substance-Free Phonology: Where we are at and where we are going. *The Canadian Journal of Linguistics* 67(4). 429–443.

Charette, Monik. 1990. Licence to govern. *Phonology* 7. 233–253.

Chierchia, Gennaro. 1986. Length, syllabification, and the phonological cycle in Italian. *Journal of Italian Linguistics* 8. 5–34.

Chomsky, Noam. 2005. Three factors in language design. *Linguistic Inquiry* 36(1). 1–22.

Clements, G. Nick & Samuel J. Keyser. 1983. *CV phonology: A generative theory of the syllable*. Cambridge Massachussetts: MIT Press.

Clements, George N. 1986. Compensatory lengthening and consonant gemination in LuGanda. In Leo Wetzels & Engin Sezer (eds.), *Studies in compensatory lengthening*, 37–78. Dordrecht: Foris Publications.

Clements, George N. 1990. The role of the sonority cycle in core syllabification. In John Kingston & Mary E. Beckman (eds.), *Papers in Laboratory Phonology I: Between the grammar and physics of speech*, 283–333. Cambridge: Cambridge University Press.

Clements, George N. 1999. Affricates as noncontoured stops. In Osamu Fujimura, Brian D. Joseph & Palek Bohumil (eds.), *Proceedings of LP '98: Item order in language and speech*, 271–299. Prague: The Karolinum Press.

Contini, Michel. 1986. Les phénomènes de sandhi dans le domaine sarde. In Henning Andersen (ed.), *Sandhi phenomena in the languages of Europe*, 519–550. Berlin, New York, & Amsterdam: De Gruyter Mouton.

Cyran, Eugeniusz. 2008. Consonant clusters in strong and weak positions. In Joaquim Brandão de Carvalho, Tobias Scheer & Philippe Ségéral (eds.), *Lenition and fortition*, 447–481. Berlin & New York: De Gruyter Mouton.

Cyran, Eugeniusz. 2010. *Complexity scales and licensing in phonology*. Berlin & New York: De Gruyter Mouton.

Cyran, Eugeniusz. 2014. *Between phonology and phonetics: Polish voicing*. Berlin & New York: De Gruyter Mouton.

Davis, Stuart. 2011. Geminates. In Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume & Keren Rice (eds.), *The Blackwell companion to phonology*, 837–897. Oxford: Wiley-Blackwell.

De Iacovo, Valentina & Antonio Romano. 2015. Durations of voiceless stops in a Sardinian variety. *Proceedings of the 18th International Congress of Phonetic Sciences* ICPhS XVIII. 1–4.

Dresher, B. Elan. 2014. The arch not the stones: Universal feature theory without universal features. *Nordlyd* 41(2). 165–181.

Escure, Geneviève. 1977. Hierarchies and phonological weakening. *Lingua* 43. 55–64.

Fanciullo, Franco. 1986. Syntactic reduplication and the Italian dialects of the Centre-South. *Journal of Italian Linguistics* 8. 67–104.

Fanciullo, Franco. 1997. *Raddoppiamento sintattico e ricostruzione linguistica nel Sud italiano*. Pisa: Edizioni ETS.

Faust, Noam. 2014. Templatic metathesis in Tigre imperatives. *Phonology* 31(2). 209–227.

Faust, Noam & Nicola Lampitelli. 2020. Virtual length and the two *I*'s of Qaraqosh neo-Aramaic. *Journal of Semitic Studies* 65(1). 35–60.

Foley, James. 1977. *Foundations of theoretical phonology*. Cambridge, London, New York, & Melbourne: Cambridge University Press.

Fougeron, Cécile & Patricia A. Keating. 1997. Articulatory strengthening at edges of prosodic domains. *The Journal of the Acoustical Society of America* 101. 3728–3740.

Frigeni, Chiara. 2005. The development of liquids from Latin to Campidanian Sardinian: The role of contrast and structural similarity. *Toronto Working Papers in Linguistics* 24. 15–30.

Goldsmith, John. 1976. *Autosegmental phonology*: Massachusetts Institute of Technology dissertation.

Goldsmith, John. 1990. *Autosegmental and metrical phonology*. Oxford: Basil Blackwell.

Gurevich, Naomi. 2004. *Lenition and contrast: The functional consequences of certain phonetically conditioned sound changes*. New York & London: Routledge.

Gussmann, Edmund. 2004. The irrelevance of phonetics: The Polish palatalisation of velars. *Corpus* 3. 1–28.

Hale, Mark & Charles Reiss. 2000a. Phonology as cognition. In Noel Burton-Roberts, Philip Carr & Gerard Docherty (eds.), *Phonological knowledge: Conceptual and empirical issues*, 161–184. Oxford: Oxford University Press.

Hale, Mark & Charles Reiss. 2000b. "Substance abuse" and "dysfunctionalism": Current trends in phonology. *Linguistic Inquiry* 31(1). 157–169.

Hale, Mark & Charles Reiss. 2008. *The phonological enterprise*. Oxford: Oxford University Press.

Halle, Morris & Kenneth Stevens. 1971. A note on laryngeal features. *MIT Quarterly Progress Report* 101. 198–213.

Hamann, Silke. 2004. Retroflex fricatives in Slavic languages. *Journal of the International Phonetic Association* 34(1). 53–67.

Hamann, Silke. 2011. The phonetics-phonology interface. In Nancy Kula, Bert Botma & Kuniya Nasukawa (eds.), *The Continuum companion to phonology*, 202–224. London: Continuum.

Hannahs, S.J. 2011. Celtic mutations. In Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume & Keren Rice (eds.), *The Blackwell companion to phonology*, 2807–2830. Oxford: Wiley-Blackwell.

Harris, John. 1990. Segmental complexity and phonological government. *Phonology* 7. 255–300.

Harris, John. 1994. *English sound structure*. Oxford: Blackwell.

Harris, John & Johnathan Kaye. 1990. A tale of two cities: London glottalling and New York City tapping. *Linguistic Review* 7. 251–274.

Harris, John & Geoff Lindsey. 1995. The elements of phonological representation. In Jacques Durand & Francis Katamba (eds.), *Frontiers of phonology*, 34–79. London & New York: Routledge.

Hayes, Bruce. 1986. Inalterability in CV Phonology. *Language* 62(2). 321–351.

Hayes, Bruce & James White. 2015. Saltation and the P-map. *Phonology* 32. 267–302.

Honeybone, Patrick. 2005a. Diachronic evidence in segmental phonology: The case of laryngeal specifications. In Marc van Oostendorp & Jeroen van de Weijer (eds.), *The internal organization of phonological segments*, 319–354. Berlin: De Gruyter Mouton.

Honeybone, Patrick. 2005b. Sharing makes us stronger: process inhibition and segmental structure. In Philip Carr, Jacques Durand & Colin J. Ewen (eds.), *Headhood, elements, specification and contrastivity: Phonological papers in honour of John Anderson*, 167–192. Amsterdam: John Benjamins.

Honeybone, Patrick. 2008. Lenition, weakening and consonantal strength: Tracing concepts through the history of phonology. In Joaquim Brandão de Carvalho, Tobias Scheer & Philippe Ségéral (eds.), *Lenition and fortition*, 9–93. Berlin: De Gruyter Mouton.

Honeybone, Patrick. 2012. Lenition in English. In Terttu Nevalainen & Elizabeth Closs Traugott (eds.), *The Oxford handbook of the history of English*, 773–787. Oxford: Oxford University Press.

Hyman, Larry M. 1970. How concrete is phonology? *Language* 46(1). 58–76.

Hyman, Larry M. 1975. *Phonology: Theory and analysis*. New York: Holt, Rinehart and Winston.

Hyman, Larry M. 1976. Phonologization. In Alphonse Juilland (ed.), *Linguistic studies presented to Joseph H. Greenberg*, 407–418. Saratoga, California: Anma Libri.

Hyman, Larry M. 2008. Enlarging the scope of phonologization. *UC Berkeley Phonology Lab Annual Report* 302–408.

Iosad, Pavel. 2012. Final devoicing and vowel lengthening in Friulian: A representational approach. *Lingua* 122(8). 922–951.

Iosad, Pavel. 2017. *A substance-free framework for phonology: An analysis of the Breton dialect of Bothoa.* Edinburgh: Edinburgh University Press.

Itô, Junko. 1986. *Syllable theory in Prosodic Phonology*. Amherst: University of Massachusetts dissertation.

Itô, Junko. 1989. A prosodic theory of epenthesis. *Natural Language and Linguistic Theory* 7. 217–259.

Iverson, Gregory K. & Joseph C. Salmons. 1995. Aspiration and laryngeal representation in Germanic. *Phonology* 12. 369–396.

Iverson, Gregory K. & Joseph C. Salmons. 2006. On the typology of final laryngeal neutralization: Evolutionary Phonology and laryngeal realism. *Theoretical linguistics* 32(2). 205–216.

Iverson, Gregory K. & Joseph C. Salmons. 2011. Final devoicing and final laryngeal neutralization. In Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume & Keren Rice (eds.), *The Blackwell companion to phonology*, 1622–1643. Oxford: Wiley-Blackwell.

Jones, Michael. 1988. Sardinian. In Martin Harris & Nigel Vincent (eds.), *Romance languages*, 314–350. London & New York: Routledge.

Kaplan, Abby. 2010. *Phonology shaped by phonetics: The case of intervocalic lenition*. Santa Cruz: University of California, Santa Cruz dissertation.

Katz, Jonah. 2021. Intervocalic lenition is not phonological: evidence from Campidanese Sardinian. *Phonology* 38. 651–692.

Kaye, Jonathan. 2005. GP, I'll have to put your flat feet on the ground. In Hans Broekhuis, Norbert Corver, Riny Huybregts, Ursula Kleinhenz & Jan Koster (eds.), *Organizing grammar. studies in honor of Henk van Riemsdijk*, 383–288. Berlin: De Gruyter Mouton.

Kaye, Jonathan, Jean Lowenstamm & Jean-Roger Vergnaud. 1990. Constituent structure and government in phonology. *Phonology* 7. 193–231.

Keating, Patricia A. 1984. Phonetic and phonological representation of stop consonant voicing. *Language* 60(2). 286–319.

Keating, Patricia A. 1988. The phonology-phonetics interface. In Frederick J. Newmeyer (ed.), *Linguistics: The Cambridge survey volume 1*, 281–302. Cambridge: Cambridge University Press.

Kehrein, Wolfgang. 2002. *Phonological representation and phonetic phasing. Affricates and laryngeals*. Tübingen: Niemeyer.

Kenstowicz, Michael & Charles Kisseberth. 1977. *Topics in phonological theory*. New York: Academic Press.

Kingston, John. 2019. The interface between phonetics and phonology. In William F. Katz & Peter F. Assmann (eds.), *The Routledge handbook of phonetics*, 359–400. London & New York: Routledge.

Kingston, John & Randy L. Diehl. 1994. Phonetic knowledge. *Language* 70(3). 419–454.

Kirchner, Robert. 1998. *An effort-based approach to consonant lenition*. Los Angeles: University of California, Los Angeles dissertation.

Kirchner, Robert. 2000. Geminate inalterability and lenition. *Language* 76(3). 509–545.

Kisseberth, Charles W. 1970. On the functional unity of phonological rules. *Linguistic Inquiry* 1(3). 291–306.

Krämer, Martin. 2012. *Underlying representations*. Cambridge: Cambridge University Press.

LaCharité, Darlene. 1993. *The internal structure of affricates*. Ottawa: University of Ottawa dissertation.

Ladd, Robert D. & James M. Scobbie. 2003. External sandhi as gestural overlap? Counter-evidence from Sardinian. In John Local, Richard Ogden & Rosalind Temple (eds.), *Papers in Laboratory Phonology VI: Phonetic interpretation*, 162–180. Cambridge: Cambridge University Press.

Lahrouchi, Mohamed. 2018. The left edge of the word in the Berber derivational morphology. *Glossa: a journal of general linguistics* 3(1). 30.

Lai, Rosangela. 2013. *Positional effects in Sardinian muta cum liquida: Lenition, metathesis, and liquid deletion*. Alessandria: Edizioni dell'Orso.

Lai, Rosangela. 2014. Positional factors in the evolution of Sardinian *muta cum liquida*: A case study. *L'Italia Dialettale: Rivista di Dialettologia Italiana* 75. 149–160.

Lai, Rosangela. 2015a. Lateral relations in Sardinian metathesis: A unified account. In Domenico Russo (ed.), *The notion of syllable across history, theories and analysis*, 254–293. Newcastle upon Tyne: Cambridge Scholars Publishing.

Lai, Rosangela. 2015b. Word-initial geminates in Sardinian. *Quaderni di Linguistica e Studi Orientali* 1. 37–60.

Lai, Rosangela. 2020. Divergent phonological behaviour in heritage speakers of sardinian. *Quaderni di Linguistica e Studi Orientali* 6. 241–255.

Lai, Rosangela. 2021a. Il Raddoppiamento Fonosintattico nel sardo medievale. *Studi e Saggi Linguistici* LIX(1). 75–115.

Lai, Rosangela. 2021b. Sardinian. In Christoph Gabriel, Randall Gess & Trudel Meisenburg (eds.), *Manual of Romance phonetics and phonology*, 597–627. Berlin & Boston: De Gruyter Mouton.

Lampitelli, Nicola. 2017. A morphophonological analysis of the velar insert in Italian verbs. *Glossa: a journal of general linguistics* 2(1). 47.

Larsen, Bergeton Uffe. 1998. Vowel length, *raddoppiamento sintattico* and the selection of the definite article in Italian. In Patrick Sauzet (ed.), *Langues et grammaire II-III, phonologie*, 87–102. Paris: Université Paris 8.

Lass, Roger. 1997. *Historical linguistics and language change*. Cambridge: Cambridge University Press.

Lavoie, Lisa M. 2001. *Consonant strength: Phonological patterns and phonetic manifestations*. New York & London: Garland Publishing, Inc.

Lombardi, Linda. 1995. Laryngeal features and privativity. *The Linguistic Review* 12. 35–59.

Loporcaro, Michele. 1997. *L'origine del raddoppiamento fonosintattico: Saggio di fonologia diacronica romanza*. Basil & Tüebingen: Francke Verlag.

Lowenstamm, Jean. 1991. Vocalic length and centralization in two branches of Semitic (Ethiopic and Arabic). In Alan S. Kaye (ed.), *Semitic studies in honor of Wolf Leslau on the occasion of his 85th birthday*, 949–965. Wiesbaden: Harrassowitz.

Lowenstamm, Jean. 1996. CV as the only syllable type. In Jacques Durand & Bernard Laks (eds.), *Current trends in phonology: Models and methods*, 419–441. Manchester, U.K.: European Studies Research Institute.

Lowenstamm, Jean. 1999. The beginning of the word. In John R. Rennison & Klaus Kühnhammer (eds.), *Phonologica 1996: Syllables!?*, 153–166. The Hague: Thesus.

Lowenstamm, Jean & Jonathan Kaye. 1985. Compensatory lengthening in Tiberian Hebrew. In Leo Wetzels & Engin Sezer (eds.), *Studies in compensatory lengthening*, 97–132. Dodrecht: Foris.

Mensching, Guido & Eva-Maria Remberger. 2016. Sardinian. In Adam Ledgeway & Martin Maiden (eds.), *The Oxford guide to the Romance languages*, 270–291. Oxford: Oxford University Press.

Minkova, Donka. 1993. On leapfrogging in historical phonology. In Jaap van Marle (ed.), *Historical linguistics 1991: Papers from the 10th International Conference on Historical Linguistics, Amsterdam, August 12-16, 1991*, 211–228. Amsterdam: Benjamins.

Molinu, Lucia. 1999. Métathèse et variation en sarde. *Cahiers de Grammaire* 24. 153–181.

Molinu, Lucia. 2009. La latérale intervocalique non géminée en sarde méridional. *Vox Romantica* 68. 129–155.

Molinu, Lucia & Simone Pisano. 2016. Riflessioni sulle realizzazioni di -/s/ in alcune paralte sarde confronate con quelle di altre varietà romanze. In Franz Rainer, Michela Russo & Fernando Sánchez Miret (eds.), *Actes du XXVIIe Congrès international de linguistique et de philologie romanes (Nancy, 15-20 juillet 2013). Section 3 : Phonétque, phonologie, morphophonologie et morphologie*, 129–139. Nancy: ATILF/SLR.

Newmeyer, Frederick J. 2005. *Possible and probable languages: A generative perspective on linguistic typology*. Oxford: Oxford University Press.

Odden, David. 2013. Formal phonology. *Nordlyd* 40(1). 249–273.

Odden, David. 2022. Radical substance-free phonology and feature learning. *The Canadian Journal of Linguistics* 67(4). 500–551.

Ohala, John. 1983. The origin of sound patterns in vocal tract constraints. In Peter F. MacNeilage (ed.), *The production of speech*, 189–216. New York: Springer-Verlag.

Ohala, John. 1997. Aerodynamics of phonology. *Proceedings of the 4th Seoul International Conference on Linguistics* 92–97.

Passino, Diana. 2013. A unified account of consonant gemination in external *sandhi* in Italian: *Raddoppiamento sintattico* and related phenomena. *The Linguistic Review* 30(2). 313–346.

Payne, Elinor M. 2005. Phonetic variaiton in Italian consonant gemination. *Journal of the International Phonetic Association* 35(2). 153–181.

Payne, Elinor M. 2006. Non-durational indices in Italian geminate consonants. *Journal of the International Phonetic Association* 35(2). 83–95.

Reiss, Charles. 2003. Quantification in structural descriptions: Attested and unattested patterns. *The Linguistic Review* 20. 305–338.

Reiss, Charles. 2008. Constraining the learning path without constraints, or the OCP and NoBanana. In Bert Vaux & Andrew Nevins (eds.), *Rules, constraints, and phonological phenomena*, 252–301. Oxford: Oxford University Press.

Reiss, Charles. 2018. Substance free phonology. In S.J. Hannahs & Anna R.K. Bosch (eds.), *The Routledge handbook of phonological theory*, 425–452. London & New York: Routledge.

Russo, Michela. 2013. Il raddoppiamento sintattico dell'italiano. Tratti prosodici e struttura fonologica. In Fernando Sánchez Miret & Daniel Recasens (eds.), *Studies in phonetics, phonology and sound change in Romance*, 145–178. München: Lincom Europa.

Russo, Michela & Shanti Ulfsbjorninn. 2020. Initial lenition and strength alternations (v/b) in Neapolitan: A laryngeal branchingness condition. *Glossa: A Journal of General Linguistics* 5(1): 11. 1–27.

Scheer, Tobias. 2003. On spirantisation and affricates. In Stefan Ploch (ed.), *Living on the edge: 28 papers in honour of Jonathan Kaye*, 283–301. Berlin & New York: De Gruyter Mouton.

Scheer, Tobias. 2004a. How minimal is phonological change? *Folia Linguistica Historica* 25. 69–114.

Scheer, Tobias. 2004b. *A lateral theory of phonology: What is CVCV, and what should it be?* Berlin & New York: De Gruyter Mouton.

Scheer, Tobias. 2009. External sandhi: What the initial CV is initial of. *Studi e Saggi Linguistici* 47. 43–82.

Scheer, Tobias. 2010. What OT is, and what it is not. *Journal of Linguistics* 46. 193–218.

Scheer, Tobias. 2012. *Direct interface and one-channel translation: A non-diacritic theory of the morphosyntax-phonology interface*. Berlin & New York: De Gruyter Mouton.

Scheer, Tobias. 2014. Spell-out, post-phonological. In Eugeniusz Cyran & Jolanta Szpyra-Kozłowska (eds.), *Crossing phonetics-phonology lines*, 255–275. Newcastle upon Tyne: Cambridge Scholars Publishing.

Scheer, Tobias. 2015. How diachronic is synchronic grammar? In Patrick Honeybone & Joseph C. Salmons (eds.), *The Oxford handbook of historical phonology*, 313–336. Oxford: Oxford University Press.

Scobbie, James M. 2007. Interface and overlap in phonetics and phonology. In Gillian Ramchand & Charles Reiss (eds.), *The Oxford handbook of linguistic interfaces*, 17–52. Oxford: Oxford University Press.

Ségéral, Philippe & Tobias Scheer. 2001a. Abstractness in phonology: the case of virtual geminates. In Katarzyna Dziubalska-Kołacyk (ed.), *Constraints and preferences*, 311–337. Berlin & New York: De Gruyter Mouton.

Ségéral, Philippe & Tobias Scheer. 2001b. La Coda-Mirroir. *Bulletin de la Société de Liguistique de Paris* 96. 107–152.

Ségéral, Philippe & Tobias Scheer. 2008a. The Coda Mirror, stress and positional factors. In Joaquim Brandão de Carvalho, Tobias Scheer & Philippe Ségéral (eds.), *Lenition and fortition*, 483–518. Berlin & New York: De Gruyter Mouton.

Ségéral, Philippe & Tobias Scheer. 2008b. Positional factors in lenition and fortition. In Joaquim Brandão de Carvalho, Tobias Scheer & Philippe Ségéral (eds.), *Lenition and fortition*, 131–172. Berlin & New York: De Gruyter Mouton.

Szigetvári, Péter. 2008. What and where? In Joaquim Brandão de Carvalho, Tobias Scheer & Philippe Ségéral (eds.), *Lenition and fortition*, 93–129. Berlin & New York: De Gruyter Mouton.

Ulfsbjorninn, Shanti. 2021. Lenition and metathesis in Hawu: A quantity-sensitive language. *SOAS Working Papers in Linguistics* 20. 1–25.

Vennemann, Theo & Peter Ladefoged. 1973. Phonetic features and phonological features. *Lingua* 32. 61–74.

Virdis, Maurizio. 1978. *Fonetica del dialetto sardo campidanese*. Cagliari: Della Torre.

Wagner, Max Leopold. 1950 [1997]. *La lingua sarda*. Nuoro: Ilisso.

Wang, William S-Y. 1968. Vowel features, paired variables, and the English vowel shift. *Language* 44(4). 695–708.

Westbury, John R. & Patricia A. Keating. 1986. On the naturalness of stop consonant voicing. *Journal of Linguistics* 22(1). 145–166.

Zwicky, Arnold M. 1970. The Free-Ride Principle and two rules of compelte assimilation in English. *CLS* 6. 579–588.