Modelling phonologization

Vowel reduction and epenthesis in Lunigiana dialects

Modelling phonologization

Vowel reduction and epenthesis in Lunigiana dialects

PROEFSCHRIFT

ter verkrijging van
de graad van Doctor aan de Universiteit Leiden,
op gezag van de Rector Magnificus, prof.mr. C.J.J.M. Stolker,
volgens besluit van het College voor Promoties
te verdedigen op dinsdag 24 maart 2015
klokke 15:00 uur

door

Edoardo Cavirani

Geboren te La Spezia, Italië
in 1983

Modelling phonologization

Vowel reduction and epenthesis in Lunigiana dialects

TESI

per il conseguimento
del titolo di Dottore di Ricerca presso l'Università di Pisa,
conferito dal Magnifico Rettore
su proposta della Scuola di Dottorato in Discipline Umanistiche,
Programma di Ricerca in Linguistica
difesa martedí 24 marzo 2015
ore 15:00

da

Edoardo Cavirani

Nato a La Spezia, Italia
nel 1983

Promotiecommissie

Promotoren: Prof.dr. M. Van Oostendorp
Prof.dr. G. Marotta
Prof.dr. R. D'Alessandro

Overige leden: Prof. dr. E. Carpitelli (Université Stendhal-Grenoble 3)
Dr. S.R. Hamann (Universiteit van Amsterdam)
Prof. dr. F.L.M.P. Hinskens (Meertens Instituut, KNAW; Vrije Universiteit)

Table of Contents

Acknowledgments

Speaking of which, also for ‘diachronic’ reasons, I should mention Alessandro Lenci first. It was thanks to his classes that I’ve been fascinated by the formalization of the linguistic knowledge a human needs to generate and understand language. A few years before meeting him, I was walked to the University of Pisa by Dostoevsky. Well, more prosaically, it was his novels, whose characters I was dreaming to hear the ‘real voice’ of. So I started studying Russian at the Faculty of Foreign Languages and Literatures. Russian, in turn, led me to other exciting literatures and languages and, unexpectedly, to computational linguistics, i.e. to Alessandro. What he was teaching us, and because of the way he was doing it, sounded like a possible way to satisfy the curiosity in understanding a few of the deepest mechanisms that, by combining together tiny primitive elements, made it possible to create the magnificent masterpieces that lead me till there. Besides to computational and formal linguistics, he introduced me to Optimality Theory and, as a consequence, to phonology and its Pisan ‘correlate’: Giovanna Marotta. If Alessandro’s classes were my linguistic birthplace, Giovanna’s words have been the trellis I climbed up along. Her familiarity with both phonetics and phonology, but most of all her iron determination and multi-coloured enthusiasm, made of her the right teacher and an enjoyable travel companion. She managed to pass down to me some of this determination and enthusism and, also because of this, I owe her a lot. For instance, if I’m here writing the acknowledgments of a PhD dissertation in phonology, it’s because, since my MA, she put my first linguistic steps on a phonological path, walking me till its last word.

Along the same path, more precisely in an EGG summer school in Constanta, Romania, I had other crucial meetings. There I found a friend, Jonathan Bucci, the italo-nicoise *maudit* phonologist with whom I shared wine, more or less scientific illusions, walks in the *vieux Nice* and other existential steps. At the same crossroads I met Tobias Scheer and Marc Van Oostendorp. By listening to them, I discovered how exciting the enterprise can be to figure out the theories that can be argued to underlie linguistic models and, ultimately, human linguistic knowledge. In Constanta I’ve also run into the volcanic Roberta D’Alessandro, which gave a decisive boost to my gait: together with Marc, she made it possible for my road to turn toward the Netherlands.

The first milestone was Leiden University, LUCL, where I lived for six months. Here I basked in an inspiring place for a phonologist, packed with great linguists and, above all, with amazing persons, such as Bahar Soohani, Borana Lushaj, Christian Rapold, Enrico Boone, Jessie Nixon, Kate Bellamy, Laura Migliori, Margarita Gulian, Marieke Meelen, Martin Kohlberger, Nikos Koutsoukos, Orsat Ligorio, Piotr Pisarek, Rebecca Voll and Stanly Oomen. With some of them I spent quite a few hours pleasantly feeding our stomachs and rehabilitating our jaws and tongues between a working/writing session and the next. Others took me to climb (of course, indoor), hike and explore the Netherlands and its pubs. Others, such as Martin and Piotrek, with their brilliant and deep conversations and their (well, actually, Piotrek’s) amazing cooking represented a safe and pleasant shelter from more than one storm. But, more importantly, in some of them I found a friend. Giuseppe Torcolacci, Linda Badan, Gaetano Fiorin, Simone Marian e Sara Lusini substantially contributed, and still contribute, to the fascination and the *gezelligheid* of this place. All of them gave me (more than) a roof more than once, and two of them, Sara and Simone (together with their hairy fellows Ernesto and Ruspa), have even been a family to me for the six months of my second Dutch stop. If I managed to go through the final stages of the writing phase without flipping out has been also thanks to them, to the warm dinner they got me used to find on the table every night, to the freshly sliced fruit that every morning was waiting for me in the bowl, and to much much more.

During this second Dutch visit I had the possibility to spend a considerable amount of time at the Meertens Instituut, *het Bureau*, where I've been remembered about how fun and exciting can linguistics be. Ana Vogeley, Ben Hermans, Eric Tjong Kim Sang, Etske Ooijevaar, Francesc (Xico) Torres-Tamarit, Frans Hinskens, Kathrin Linke, Lotte Hendriks, Nina Ouddeken, Sjef Barbiers and Varun De Castro-Arrazola have been amazing colleagues and friends, always ready to smile out the grey of some cloudy moment and cast some light on the dark corners of my linguisitics knowledge. But, crucially, I had Marc in the office in front of mine. Grown up along Giovanna's trellis, Marc's office was the studio I refined my ideas into, a place I was dragged to by a doubt, or pushed by some wild solution, always finding a key to dismantle the former and domesticate (or set free) the latter. With his fresh, sharp and ironic mind, he has been to me a constant source of inspiration, the giant whose height I've been (and still am) striving to reach. As obvious for everyone who knows him, the height I'm referring to is not limited to linguistics.

The PhonoLAM meetings organized by Nina, then, allowed me to meet the amazing Silke Hamann, who played a substantial role for the 'cleaning' and enriching process of my analyses. Before knowing to be part of my reading committee, indeed, she carefully read several drafts of my phonological analyses, providing every time enlightening comments.

Other 'contributors' to this dissertation have been Allison Kirk and Marijn van 't Veer. Indeed, the former painstackingly went through it revising and definitely improving my English writing. In other words, if this dissertation sounds readable enough is, for a big part, thanks to her. To Marijn, instead, I owe both the readability of the *samenvatting* and, thanks to his dissertation (van t' Veer 2015), part of what I know about OT (feature co-occurrence) constraints.

Between the first and the second Dutch stops I had another crucial meeting. It was in Nice, where, wandering throughout Lunigiana, beside Jonathan, I met Elisabetta Carpitelli. Together with Jean-Pierre Lai, and beyond being a deep *connoisseur* of Luinigiana dialects and culture, she simply represents one of the best persons I've ever met. The reasons I'd have to thank her for go far beyond dialectolgy, her merits making of her one of those companions or, better, of those masters, that you would always wish to find at your side.

On the very same side, I've been so lucky to have other great persons. Even if, or maybe partially because, they are quite far from my work, they substantially contributed to its success, making of the life flowing outside of my computer a very fun and interesting place to wake up in every once in a while (remember the "flipping out" I hinted at above). They are Francesca Strik Lievers, whom I also due this book's cover to, Gianluca Lebani and Lucia Passaro, who shared with me much more than liters of coffee in via S. Maria 36, Hara & Marghe, who I shared almost all of the best moments of my whole life with, Giannuzzo, with whom I grew up since he was trying to patent a way to get a flu in five minutes just to escape an oral exam at the middle school, Spitirquí, who is still here, and Viola, who simply represents a part of myself.

Finally, the travel I just tried to sketch out couldn't even get started without my Carrarese and Pontremolese informants: Alma Cordiviola, Alberto Morelli, Antonietta Merli, Armando Salvini, Bruno Dell'Amico, Daniele Canali, Danilo Pinotti, Enzo De Fazio, Giancarlo Bellotti, Luciano Bertocchi, Marco Mori, Maria Grazia Morelli, Mario Laquidara, Michela Viti, Renzo Cantarelli and Riccardo Solari. More importantly, the biggest journey, the one my PhD represented only a little leg of, would have simply never begun without Agostino, Oriana, Saverio, Leonardo and Ilario. Grazie!

1 Introduction

1.1 Diatopy, diachrony and phonologization

In the last decades of XIX AD, Schuchardt (1868-1870) and Schmidt (1872) developed the wave model (*Wellentheorie*). This model was meant to account for linguistic similarities that were difficult to understand by means of the schleicherian tree model: in the case that the presence of a given linguistic feature within a set of languages cannot be explained by their genetic relationship, it can be described as a consequence of their geographical adjacency (Campbell 1998). Indeed, a change is argued to spread within a given linguistic *continuum* similarly to the concentric, progressively expanding and weakening waves produced by throwing a stone on a water surface:

> "a given linguistic innovation radiates outward from a central or focal area, in which the change is usually carried through to completion. From there, the change proceeds to a transitional area, in which the change occurs in varying degrees of completion, depending on the distance from the focal point of change." (Wolfram & Schilling-Estes 2003:721)

The wave model, hence, explicitly recognizes the relationship between diachronic change and diatopic variation. Interestingly, the distribution of the two phonological phenomena under concern, i.e. unstressed vowel reduction and non-etymological vowel insertion, within the Romance linguistic *continuum* can be described along similar lines.

Proto-Romance unstressed vowel reduction, for instance, can be argued to radiate from France towards the rest of the Western Romance speaking world. While this process has been "carried through to completion" in French, the more we move toward the peripheral regions of the relevant linguistic *continuum*, the milder the outcome of such a process (Chapter 3). Namely, while unstressed vowels have been deleted in French, peripheral varieties such as the southern-most Northern Italian dialects still show some trace of them (Loporcaro 2005-2006). Interestingly, a detailed synchronic picture of this kind of 'peripheral delay' can be observed in Lunigiana (Section 2.1), i.e. in the area where the two dialects under concern, Pontremolese (Section 2.2) and Carrarese (Section 2.3), are spoken. Within this geographical area, indeed, the bundle of isoglosses splitting Western from Eastern Romance (collectively known as La Spezia-Rimini or Carrara-Fano isogloss; Pellegrini 1977) fans out (Fig. 2.2). Furthermore, notice that while north of these isoglosses unstressed vowels have been categorically deleted, south of them they are still preserved. In other words, Lunigiana constitutes a transitional area displaying the full range of phonetic/phonological nouances ranging from the unstressed vowel deletion of Emilian to the preservation thereof of Tuscan. Within this area, Carrarese and Pontremolese have been selected for the analysis inasmuch as they constitute the two major varieties spoken close to Lunigiana borders. Indeed, Carrara and Pontremoli are the biggest centres of, respectively, the northern and southern Lunigiana. As a consequence, among Lunigiana dialects, Carrarese and Pontremolese constitute the varieties that are both geographically and linguistically closer to, respectively, the (Tuscan) varieties preserving unstressed vowels and the (Emilian) varieties deleting them. As far as unstressed vowel reduction is concerned, the transitional nature of Lunigiana linguistic area has been already noticed by Giannarelli (1913) and Luciani (1999: 82):

> "(pre-tonic and post-tonic) unstressed vowel deletion, which is a permanent feature in the Emilian dialect, is (almost) normal in Higher Magra Valley (Pontremoli) […], while the more you descend the valley, the more deletion alternates with reduction to the undistinguished vowel [*schwa*, E.C.], which is quite regular in a lot of Lower Lunigiana dialects. As a result, at the beginning of this century [XX, E.C.] some scholars, as Giannarelli, have been induced to consider the presence of undistinguished vowel 'the joining link' between unstressed vowel persistence of the Tuscan dialect and the constant deletion of the Emilian one."[1] [EC]

The nonetymological vowel insertion process occurring in a subset of the same Western Romance varieties can be described along similar lines.

The nonetymological vocoid first broke the tautosyllabic consonant clusters of the dialect (Pontremolese) that earlier and completely underwent unstressed vowel reduction. Then, 'growing older', the phonetic content of this vocoid was gradually enhanced (i.e. lengthened) and, eventually, considered a cue of a phonological segment belonging to the Pontremolese vowel inventory (Section 7.4). On the other hand, the nonetymological vocoid occurring in the more peripheral variety (Carrarese) displays nowadays the phonetic characteristics that the Pontremolese one showed before being phonologized. Namely, it can be optionally and gradually enhanced, but it doesn't cue any vocalic segment (Section 7.3).

As claimed above, the diffusion of these two phonological processes within Western Romance fits with the wave model. More recently, discussing the life cycle of phonological rules, Bermúdez-Otero (in press) claims that

> "[the] connection between rule generalization and geographical space arises because sound change originates in a focal area […], from which it propagates outwards in line with […] wave theory."

---

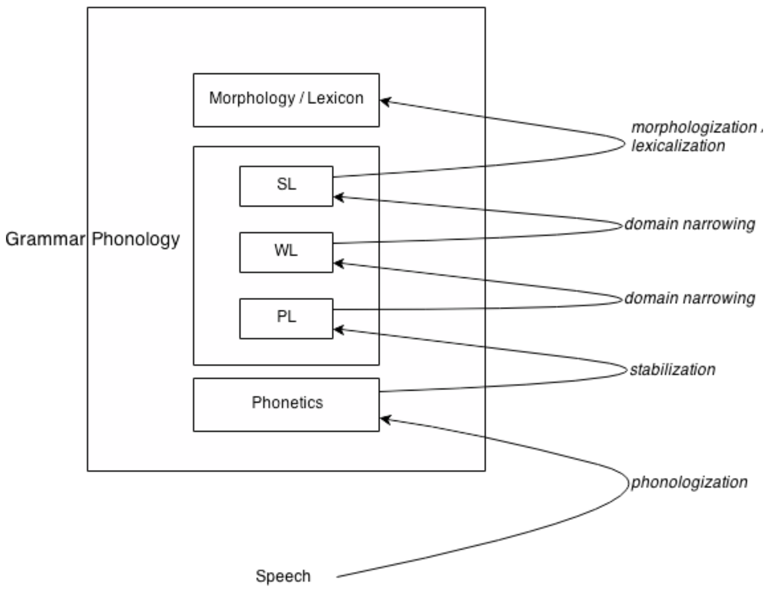
[1] "[il] dileguo delle vocali atone (protoniche e postoniche) che è costante nell'emiliano, è di norma o quasi nell'Alta Val di Magra (Pontremoli) […], mentre man mano che si scende lungo la valle al fenomeno del dileguo si alterna sempre di più quello della riduzione alla vocale indistinta che diventa quasi la regola in molti dialetti della Bassa Lunigiana sì che già ai primi di questo secolo alcuni studiosi come il Giannarelli sono stati indotti a vedere nella presenza della vocale indistinta 'l'anello di congiunzione' fra la persistenza delle vocali atone proprie del toscano e il dileguo costante proprio dell'emiliano." (Luciani 1999: 82)

This means that while in the centre a given process synchronically displays a systematic and categorical behavior, the more we approach the periphery, the less systematically and categorically it applies. In other words, in the first case the process reached (at least) a phonological status, while retaining its primigenial phonetic status in the second. Indeed, assuming a modular architecture of the grammar (Fodor 1983; Bermúdez-Otero 2012; Section 6.3),

> "[in] the course of this life cycle, a phonetic phenomenon that is at first exhaustively determined by extragrammatical factors (physics and physiology) becomes ever more deeply embedded in the grammar of a language, first as a language-specific gradient process of phonetic implementation, later as a categorical phonological rule applying in increasingly narrow morphosyntactic domains, until it eventually escapes phonological control altogether." (Bermúdez-Otero in press)

A phonological process is hence assumed to climb up along the path represented in Fig. 1.1:

Fig. 1.1 The life cycle of phonological processes (Bermúdez-Otero & Trousdale 2012: 700)



As already noticed above, in mimicking diachronic change, diatopic variation may give us a synchronic picture of the phonologization process. This means that, by analyzing the geographical micro-variation of a given phonetic/phonological pattern, we can test which grammatical level the pattern reached in a given linguistic community and, crucially, what those speakers know about it, how this knowledge is represented in their mind. We can thus deepen our understanding of how a physical world object, such as a sound, enters the speaker's symbolic system of knowledge, i.e. how something gradient and continuous starts being represented and computed as something categorical and discrete. Or, resorting to Hyman's words, how

> "a perhaps unavoidable universal phonetic property [first] takes on a language-specific form which cannot be said to be strictly automatic or mechanical [and then] becomes phonological in the traditional sense, i.e. structured, categorical." (Hyman 2013: 7)

To sum up, the close examination of the geographical micro-variation of a given phonological process allow us to a) define the internal borders of a linguistic *continuum*, thereby improving dialects' classification, b) reconstruct the spread of a diachronic change which shaped such a *continuum*, together with its various stages and, crucially, c) get some more insight into the phonetics-phonology interface.

Together with a formal account of phonologization, the present work constitutes an attempt to 'reduce' the (phonetic) variation of the chomskian E-language to a set of I-language (phonological) universals or, as in our case, an attempt to

> "understand the smallest differences between dialects as manifestations of universal principles underlying the organization of language systems; the smallest difference (at the level of language as a system shared by the members of a community […]) is thus explained on the basis of the highest common devisor (I-language, language as a cognitive commodity). Thus dialect features are […] explained as different instantiations of language universals or as instantiations of different language universals." (Hinskens, Hermans & Van Oostendorp 2014: 2)

The present work, hence, can be of some interest for both variationist and theoretical/formal phonologists. Indeed, the phonological analysis presented in Chapter 7 resorts to a set of theoretical 'tools' developed within the generative/rationalist (as opposed to empiricist) approach to phonology (Chapter 6). As a consequence, it rests on

> "a set of assumptions that constitutes a serious attempt at an overarching conception of the nature of human language and human cognitive structure." (Carr 2000: 85)

At the same time, generative phonologists seem not to take into adequate consideration the data the variationist approach builds its analyses on. Indeed, generative phonologists ground their analyses on phonetic transcriptions that are supposed to represent the speech of some *ideal* speaker of a given linguistic community. In other words, they *idealize* "specific, spatiotemporally unique utterances" (Carr 2000: 79). On the other hand, variationists "appear[s] to lack an overarching conception of the nature of human language" (Carr 2000: 58).

Because of this, the phonological analysis presented in Chapter 7 is grounded on a detailed phonetic account (Chapter 5) of the patterns of unstressed vowel reduction and vowel insertion characterizing Carrarese and Pontremolese. By taking into consideration both the formal side and the phonetic details of the variation under concern, an approach is therefore here pursued that

> "places variation and laboratory work at the heart of phonological enquiry, but at the same time rests on a properly articulated overall conception of the nature of human language, human cognition, and the structure of human languages." Carr 2000: 85)

As for the formalization technology, in Generative Phonology, diachronic changes such as the ones under analysis have been described as the addition, removal or reordering of rules in a speaker's grammar (Halle 1962; Kiparsky 1968; King 1969). As a consequence, the generations involved in the change display slightly different grammars: they are the same, except for the order in which some rules apply. These kinds of rule usually describe the transformation undergone by a class of segments (defined by the *structural change* side of the rule) in a given context (defined by the *structural description* side of the rule). In other words, they give a formalized account of the way a phoneme (or a class thereof) changed in the passage from one generation to the other. However, they do not actually say anything about the phonological process nor about the linguistic knowledge of the generations involved in the change at hand, and should rather be considered as descriptions of "a lexical restructuring that might take place from one generation to another" (Hamann 2014: 255).

However, even if the addition of rules is not the most adequate way to account for the linguistic knowledge underlying phonological changes, the idea that the generations involved in the change have different grammars is still widely accepted. Under this view, hence, a change is initiated when the learning child builds a grammar that differs from the one of her parents. To better understand, rather than just describe, the initiation of a phonological change, a model thus needs to be built of the learner's grammar. Namely, as far as the phenomena under analysis in the present work are concerned, grammars need to be modelled that determine the reduction of post-tonic unstressed vowels and the related process of vowel insertion (Chapter 7). Resorting to these grammars, hence, a detailed account can be given of the reduction-to-deletion and intrusion-to-epenthesis changes underwent by, respectively, unstressed vowels and nonetymological vocoids. As shown in Chapter 6, these grammars are couched within the Bidirectional Phonetics and Phonology model (henceforth BiPhon; Boersma 2007, 2009, 2011), i.e. within an optimality-theoretic approach that assumes a modular architecture of the language faculty (and, more generally, of cognition; Section 6.3). Within this model, the properties of both the representations and the way they are mapped onto each other are defined in terms of constraints (Section 6.2).

Before starting this formal travel through time, it's useful to introduce the two terms we've just resorted to in order to differentiate the two different typologies of nonetymological vocoids: intrusion and epenthesis.

1.2 Intrusive and epenthetic vowels

Carrarese and Pontremolese acoustic data show that, while the slightly more central dialect (Pontremolese) shows a regular (phonological) epenthesis (Section 5.3.2), Carrarese optionally shows the (phonetic) forerunner of such a process (Section 5.3.1). This follows from the wave model mechanics introduced in the preceding section and from the related hypothesis according to which epenthesis, namely a systematic and categorical process, is the phonologization of a process that is initially articulatorily/perceptually-driven. The phonetic conditions triggering this process, in turn, result from the completion of the unstressed vowel reduction process: once the deletion stage has been reached with a sufficient amount of systematicity and categoricity, nonetymological vocoids start their life cycle.

In other words, starting from a proto-Romance stage x, where the two dialects do not undergo any (relevant) process, we expect Pontremolese to start reducing the unstressed vowels in stage x+1, and Carrarese to remain displaying them. Then, in x+2, the reduction is assumed to be complete in Pontremolese and still ongoing in Carrarese. Once the deletion stage is reached, Pontremolese starts showing the epenthetic vowel's forerunner in x+3, and Carrarese simultaneously completes the reduction process. Finally, in stage x+4 (namely nowadays) the epenthesis is argued to be systematic in Pontremolese, with Carrarese presenting instead its forerunner[2].

In order to make explicit the difference in the grammatical status of the inserted vocoids, the terminology and, above all, the diagnostics proposed by Hall (2006), turn out to be extremely useful.

Hall (2006) distinguishes between intrusive and epenthetic vowels and lists a set of properties that helps in indentifying what the grammatical status of the vocoid a language inserts is:

Tab. 1.1 Intrusive vs. epenthetic vowel (Hall 2006: 5)

Properties of phonologically invisible inserted vowels (intrusive vowels)

a. the vowel's quality is either schwa, a copy of a nearby vowel, or influenced by the place of the surrounding consonants
b. if the vowel copies the quality of another vowel over an intervening consonant, that consonant is a sonorant or guttural
c. the vowel generally occurs in heterorganic clusters

---

[2] The chronological ordering just referred to constitutes an *idealization*. Indeed, it is here assumed (without any evidence) that the processes at hand proceed in the two dialects at the same speed. This idealization rests on the *scientific realism* characterizing, according to Popper's view, the nature of scientific knowledge. As stressed by Carr (2000), since we cannot achieve a "completely certain scientific knowledge", we can only formulate hypotheses that are supposed to be "our best approximations as to the way reality is". As a consequence, we need to "factor out […] certain aspects of reality in order to arrive at a better comprehension of other aspects and the interaction between those different aspects". In order to focus on the interaction of the two processes (and because of the lack of useful data), the speed of their diffusion within the two dialects has been factored out.

d. the vowel is likely to be optional, have a highly variable duration, or disappear at fast speech rates
e. the vowel does not seem to have the function of repairing illicit structures. The consonant clusters in which the vowel occurs may be less marked, in terms of sonority sequencing, than clusters which surface without vowel insertion in the same language

Properties of phonologically visible inserted vowels (epenthetic vowels)

a. the vowel's quality may be fixed or copied from a neighbouring vowel. A fixed quality epenthetic vowel does not have to be schwa
b. if the vowel's quality is copied, there are no restrictions as to which consonants may be copied over
c. the vowel's presence is not dependent on speech rate
d. the vowel repairs a structure that is marked, in the sense of being cross-linguistically rare. The same structure is also likely to be avoided by means of other processes within the same language

As argued by Hall (2006, 2011), the main phonological difference between the intrusive and the epenthetic vowel is the "phonological transparency" of the former. This means that, while the epenthetic vowel is phonologically similar to every other lexical vowel, being able, for instance, to constitute a syllabic nucleus, the intrusive one is an articulation/perception-driven phonetic by-product of the consonantal gestures' timing, a kind of "open transition" (Bloomfield 1933) or "excrescent vowel" (Levin 1987) which, despite its vocalic quality, doesn't constitute a syllabic nucleus (Pearce 2004; Hall 2011). Interestingly, Hall (2006: 35) explicitly claims that an intrusive vowel, "like other phonetic processes, […] may become phonologised. A vowel sound that originated as intrusive may be reanalysed over time as a segmental vowel, either epenthetic or underlying." Furthermore, as already observed in Saami (Engstrand 1987), Finnish (Harms 1976), Irish Gaelic (Greene 1952), Scots Gaelic (Dorian 1965) and Dutch (Booij (1995), "[s]ometimes intrusive vowels in one dialect of a language correspond to segmental vowels in another dialect" (Hall 2006: 36).

As shown by the data presented in Chapters 5 and 7, this picture fits pretty well with the situation observable within Lunigiana, the south-westernmost corner of the Northern-Italian dialects speaking area. Indeed, as pointed out in the previous section, vowel epenthesis occurs in its complete, categorical form only in the dialect which is closer to the irradiation centre, namely in Pontremolese. In this dialect Latin unstressed vowels have been completely deleted and a nonetymological segment is realized which satisfies the requirements for it to be classified as an epenthetic vowel (Tab. 1.1): it has a fixed acoustic quality ([ɐ] and [u]) which differs from the schwa's; its presence does not depend on the speech rate; also, it can be described as having a phonotactic ill-formedness repairing function, occurring indeed only in word-final consonant clusters that otherwise show a raising sonority contour (Sections 5.3.2 and 7.4). On the other hand, in the more peripheral dialect, i.e. Carrarese, non-etymological vocoid insertion does not show the same categorical nature of Pontremolese epenthesis. Indeed, this vocoid fits with the intrusive vowel category proposed by Hall (2006): it is acoustically a schwa; its place of articulation is heavily conditioned by the adjacent consonants; it is optional and extremely variable in duration; its presence and duration depend on the speech rate; and it doesn't have any repairing function (Section 5.3.1).

As a matter of fact, schwa-like vocalic releases can be found in both dialects. Indeed, when syncope and apocope generate a word-final consonant cluster with an even or falling sonority contour, both Carrarese and Pontremolese speakers variably realize a word-final schwa-like vocoid whose presence and duration are conditioned by the phonosyntactic context (it's more likely present and long if the relevant cluster is followed by a consonant-initial word than by a pause), by the speech rate (the faster the less likely it is realized) and by 'emphatic conditioning' (Restori 1892; Savoia 1983; Carpitelli 1995)[3]. It can hence be considered a vowel-like release that can be enhanced because of articulatory reasons or to meet some extra-linguistic requirements[4]. However, even if, as far as apocope is concerned, Carrarese and Pontremolese seem to be alike, some differences can still be found. The word-final vocoid of Carrarese, for instance, is slightly shorter than that of Pontremolese and is realized in phrase-final position much less frequently in the former than in the latter. As for syncope, the etymologically word-medial vowel of proparoxitones doesn't show any vocalic counterpart in Pontremolese, a schwa-like vocoid being instead optionally realized by Carrarese speakers.

In order to account for these seemingly 'superficial' differences, a formal account has to be developed of both the phonological side and the phonetics-phonology mapping of Carrarese and Pontremolese. Indeed, an explicit formalization of these two related issues can cast some light on the 'depth' of the differences just hinted at. This, in turn, allows us to define the grammar level reached by the two processes under concern and, as a consequence, the degree and the modality of the interaction among phonetic and phonological requirements.

[3] Similar conditionings on the realization of a word-final schwa-like vocoid (*e muet*) are reported for French by Schmid (in press). Together with the 'emphatic' one, he mentions 'stylistic factors' ("formal discourse is more likely to contain schwas, whose occurrence may even be mandatory in poems and song texts for metrical reasons") and 'phonosyntactic' constraints ("final schwa is not retained in the citation forms of nouns such as *porte* […] but the orthoepic norm prescribes the insertion of an *e muet* in those phonosyntactic contexts where otherwise a string of three consonants would arise"). Crucially, he argues that *e muet* is absent from the relevant phonological representations.

[4] Interestingly, D'Arcy (in press) claims that feedback and sociolinguistic incrementation may amplify this effect further. This may be the case for the word-final vocoid of the Pontremolese variety spoken in the Piagnaro neighbourhood, where its amplification ([^{ə}]>[ø]) is perceived by the speakers of the surrounding Pontremolese area as a distinctive (and maybe grotesque) feature of the town-centre speakers.

PART I: DIALECTOLOGICAL OVERVIEW

2 The two dialects

2.1 Introduction

Carrarese and Pontremolese are two Northern Italian dialects (Rohlfs 1966; Maffei Bellucci 1977; Loporcaro 2009) spoken in Lunigiana. Within this group, historical and geographical conditions fostered the development of the linguistic variability that allows us to classify Lunigiana dialects as peripheral varieties (Bertoni & Bartoli 1925; Andersen 1988)[5], namely as varieties where it is "likely to see the development of elaborate phonetic norms and the proliferation of low-level pronunciation rules" (Trudgill 1992: 206). The extreme variability of Lunigiana dialects has already been observed by Giannarelli (1913), who claims that

> "probably, no other region of the Peninsula can present the scholar with so many phonetic varieties in such a small area, as Lunigiana does; here the phonetic laws of a village differ, often fundamentally, from the ones of nearby villages. The origin of this endless variation can be found, without any doubt, in the encounter within this region of Tuscan, Ligurian and Emilian: indeed, it can be said that Lunigiana dialects represent the joining link between the above mentioned dialects, whose elements continuously clash against each other, the victory smiling alternatively to one or the other. Variability, then, together with the melting of different elements, constitutes the peculiar character of Lunigiana dialects […]."[6] [EC]

Lunigiana's linguistic heterogeneity is mimicked by its politically fragmentary nature. Its northwestern borders nowadays include some Ligurian districts, such as Calice al Cornoviglio, Bolano, Vezzano Ligure, Santo Stefano Magra, Arcola, Sarzana, Lerici, Ameglia, Castelnuovo Magra and Ortonovo. As for its northern and

---

[5] "It may be tempting to take 'central' and 'peripheral' as purely spatial terms, but to be of any value in historical dialectology these terms should be used to characterize dialects from the point of view of their socio-spatial function, as suggested by Jakobson […]. As such these are purely empirical, descriptive notions, and they correlate with the density and orientation of networks of communication, peripheral dialects being characterized by a lower density and more clearly defined orientation of lines of inter-community communication than central dialects." (Andersen 1988: 74)

[6] "[n]essuna regione della Penisola forse può presentare allo studioso tante varietà fonetiche in così piccolo territorio, come presenta la Lunigiana; dove le leggi fonetiche di un paese differiscono spesso fondamentalmente da quelle di un paese vicino. L'origine di questa infinita varietà è da ricercarsi senza dubbio nell'incontro, in questa regione, del Toscano, del Ligure, dell'Emiliano: anzi si può dire che i dialetti della Lunigiana rappresentano l'anello di congiunzione fra le tre unità dialettali sopra ricordate, i cui elementi cozzano in questa regione di continuo fra loro, ed ora la vittoria arride agli uni, ora agli altri. La varietà dunque e la fusione di elementi diversi costituiscono il carattere peculiare dei dialetti Lunigianesi […]." (Giannarelli 1913: 261)

eastern borders, they coincide with the Tuscan border, including Zeri and Pontremoli districts in the north, and Filattiera, Bagnone, Licciana Nardi, Comano, Fivizzano and Casola in Lunigiana districs in the east. Finally, Lunigiana's southern border crosses the Massa-Carrara district, including only Carrara. This is shown in Fig. 2.1, where the borders of Lunigiana and its districts are represented (in the map, only Carrara, Pontremoli and Ortonovo districts have been shaded).

Fig. 2.1 Lunigiana's political and linguistic borders

From a geographical point of view, this region is closed on the western, northwestern, eastern and southeastern sides by a crown of mountains (respectively, the southernmost side of the Ligurian Apennines, the western side of the Tusco-Emilian Apennines and the northwestern side of the Apuan Alps) and on the southwestern side by the Tyrrhenian Sea. This is shown in Fig. 2.2, where Lunigiana's geographical conformation is shown together with its position with respect to Italian borders and, in the bottom-right circle, to the La Spezia-Rimini bundle of isoglosses.

Fig. 2.2 Lunigiana's geographical positioning

Notwithstanding the apparently closed setting of this half-moon, different populations met and clashed within this region, the *limes* periodically moving and dividing ancient Ligurians from Etrurians (VI-V BC) and Romans (II BC), Byzantines from Langobards (VI-VII AD), Maritime Republics of Genoa from the one of Pisa (XI AD) and from Milan (XV AD), Florence from Modena and Parma (XVI-XVIII AD), the Kingdom of Sardinia form Modena and Parma (XIX-XX AD) and, nowadays, Tuscany from Liguria and Emilia (Pistarino 1986). One of the reasons for the political instability of this region is its having always been a stopover along the north-south track (Ambrosi 1967). Indeed, this area was cut through by important commercial and pilgrim routes such as the pre-Roman path from the modern-day Lucca to Piacenza, the Via Aurelia (Rome - Arles), the Via Francigena (Rome - Canterbury) and a pair of routes from Luni, one of the most important Roman harbours (nowadays in Ortonovo district), to Emilian centres (Banti 1932; Ambrosi 1967). Along these routes, hence, together with money, marble and swords, different languages met and crossed for many centuries, making Lunigiana a transition area between the Northern Italian varieties of Ligurian and Emilian, and the Tuscan in the south. As a consequence, a lot of variation can be found within the whole area, the influence of the surrounding varieties increasing the more close close to the natural boundaries we get. As hinted at in the opening quote, the transitional nature of Lunigiana varieties is particularly evident in more 'superficial' linguistic component, such as lexicon, phonetics and phonology (Maffei Bellucci 1977).

As an example of this great variation, it suffices to have a look at Carrara district. Indeed, within this small area (71,01 km^2), etymologically Ligurian, Emilian and Tuscan lexical entries can be found, each with its proper 'phonetic dress'.

Interestingly, their percentage varies depending of the part of the district that is taken into account. For instance, while in the variety spoken in the centre of Carrara the syncopated Emilian forms are the majority, as soon as we get closer to the sea-side (Avenza), the percentage of Ligurian words (which display a lower degree of vowel reduction) increases, as does the percentage of Tuscan forms in the southeastern villages of Colonnata, Bedizzano and Bergiola Foscalina (in these areas, for instance, long consonants resisted the elsewhere regular degemination). The form used for 'to lean', for instance, is [arəmˈbarə] (see Genovese *arembare*) in Avenza, but [aponˈtar] in Carrara, while the form for 'anaesthesia' is [alˈlɔpːjə] in Colonnata, Bedizzano and Bergiola Foscalina, but [ˈdɔrma] in Carrara.

Similarly, in the whole of Lunigiana, different groups of dialects have been identified depending on the quantity of features shared with the Tuscan, Ligurian and Emilian dialects. One of the first proposals in this direction has been made by Giannarelli (1913), who divides the area into the three groups presented in Tab. 2.1:

Tab. 2.1 Lunigiana dialects classification (adapted from Giannarelli 1913)

a. *Tusco-Ligurian* dialects

spoken between the lower part of the Magra river (northwest), the sea (southeast), the Frigido (east) and the Apuan Alps (north), with two offshoots along the upper part of the Aulella river (up to Casola and Regnano) and its affluent (the Lucido river, up to Gragnola)

b. *Tusco-Emilian* dialects

spoken along the lower part of the Aulella and Rosaro rivers (east), the Taverone river up to the Apennines (west) and the Magra river up to Villafranca and Bagnone (north)

c. *Liguro-Emilian* dialects

spoken in the upper part of the Magra river (north of Villafranca), up to the Apennines

Notwithstanding the validity of this partition, according to which Carrarese and Pontremolese belong, respectively, to b) and c), it has to be pointed out that the linguistic borders between these three sub-groups of varieties are obviously not so sharp. Indeed, Ligurian features progressively decrease from west and northwest to southeast, where they increasingly melt with Tuscan features. Similarly, Emilian features progressively decrease from north to south and southeast, increasingly melting with Tuscan features (Bottiglioni 1911; Giannarelli 1913; Ambrosi 1956; Maffei Bellucci 1977; Luciani 1999, 2002). Because of the variety and the gradualness of these linguistic dimensions, other partitions have been proposed, such as the one suggested by Maffei Bellucci (1977), who identifies seven main groups (with a set of sub-groups) centred on the (historically) more important towns of the area: Pontremoli, Zeri, Filattiera, Bagnone, Sarzana, Carrara and Lerici. To side with one or the other of the different partition proposals is a matter of deciding which features are considered more or less relevant in this respect[7].

It is interesting to point out that, among the various phonetic/phonological characteristics contributing to this kind of *sfumato* picture of Lunigiana dialects, one of the firstly recognized features is the variability of the unstressed vowel outcome. Indeed, Giannarelli (1913) considers the "vocali indistinte", namely the "faint", reduced central vowels, as the joining link between the unstressed vowels' persistence in Tuscan and their constant deletion in Emilian:

> "And this is an extremely natural thing; that a vowel which tends to disappear is first obscured and then, little by little, disappears: actually, the fact that on the Emilian border the phenomenon is very rare, while it is more frequent in Fivizzano and extremely frequent, almost constant, in Lower Lunigiana […] leads us to maintain that Lunigiana dialect's faint vowel, in place of the unstressed vowels that tend to disappear, is the joining link between their persistence in Tuscan, and their disappearance in Emilian."[8] [EC]

Interestingly, Giannarelli (1913) introduces the parallelism between the diatopic and the diachronic variation, claiming that the graduality characterizing the diachronic dimension of the change under concern can be synchronically mimicked by the diatopic distribution of unstressed vowel outcomes within this peripheral area:

> "the quantity of the cases of [ə] persistence is inversely proportional to the distance that divides the villages of this area from Tuscany, and directly proportional to the distance that divides them from Emilia."[9] [EC]

The data supporting this claim will be extensively presented and discussed in Chapters 5 and 7, where the difference between Carrarese and Pontremolese with respect to the "faint vowel" is made evident.

As already hinted at above, though, notwithstanding this difference, the two dialects under concern belong to a pretty homogeneous group of varieties sharing a wide set of features. Indeed, since this area comprises all the southern isoglosses

[7] Given that in the present work we are considering the phonological systems of the varieties spoken in Carrara and Pontremoli, and that these varieties are classified as belonging to different groups in every proposed partition, we do not take any particular side. What matters here is that they display a significantly different behaviour with respect to the phonological processes under concern.

[8] "E questa è cosa naturalissima; che una vocale tendente al dileguo prima si oscuri e poi dilegui del tutto a poco a poco: anzi il fatto che sul confine Emiliano […] il fenomeno è molto raro, mentre si fa più frequente a Fivizzano e frequentissimo, fino a diventar costante, nella Lunigiana inferiore […] ci induce ad asserire che la vocale indistinta dei dialetti della Lunigiana, al posto delle vocali atone che tendono al dileguo, è l'anello di congiunzione fra la persistenza di esse vocali, propria del toscano, e il dileguo costante dell'Emiliano." (Giannarelli 1913: 278)

[9] "il numero dei casi di persistenza [of [ə], EC] è inversamente proporzionale alla distanza che separa i paesi di questa zona dalla Toscana, e direttamente proporzionale alla distanza che li separa dall'Emilia." (Giannarelli 1913: 278)

characterizing Northern Italian varieties (Fig. 2.2 and Fig. 3.1), Lunigiana dialects can be included within this dialectal group.

Together with Northern Italian dialects, Lunigiana varieties share the features presented in Tab. 2.2[10] (the dialect of Ortonovo has been included as representative of the Tusco-Ligurian group presented in Tab. 2.1):

Tab. 2.2 Phonological features shared among Lunigiana and Northern Italian dialects

a. Degemination

SEPTE(M) ‘seven’ > Carr., Pontr. and Ort. [sɛt] vs. It. [ˈsɛtːe]

b. CL- > [kʲ] > [tʃ] and GL- > [gʲ] > [dʒ]

CLĀVE(M) ‘key’ > Carr., Pontr. [ˈtʃava], Ort. [ˈkʲawa] vs. It. [ˈkjaːve]
GLĂCIĒ(M) ‘ice’ > Carr. [dʒats], Pontr. [dʒas], Ort. [ˈgʲatʃo] vs. It. [ˈgjatːʃo]

c. (-)$C^{e/i}$- > [tʃ] > [ts] > [s] and (-)$G^{e/i}$- > [dʒ] > [dz] > [z] (see also Section 3.1.1)

CENTU(M) ‘hundred’ > Carr. [tseŋt], Pontr. [sent], Ort. [ˈtʃento] vs. It. [ˈtʃɛnto]
GĔLŪ(M) ‘freeze’ > Carr. [dzel], Pontr. [zel], Ort, [ˈdʒelo] vs. It. [ˈdʒɛːlo]

d. SKJ-, STJ-, $SK^{e/i}$- > /s/

BESTIA(M) ‘beast’ > Carr., Pontr. [bis] ‘snake’, Ort. [ˈbiʃo] vs. It. [ˈbiʃːa]

e. /n/ > [ŋ] in etymological and derived Cd position

CĀNE(M) ‘dog’ > Carr., Pontr., Ort. [kaŋ] vs. It. [ˈkaːne]

f. voicing of intervocalic voiceless plosives and /s/

CUTICA(M) ‘rind, turf’ > Carr., Ort. [ˈkod$^{(ə)}$ga], Pontr. [ˈkudga] vs. It. [ˈkoˑtica]

---

10 See also Section 3.1, where a picture is given of the features characterizing Western Romance.

g. -RJ- > /r/

FURNĀRĬU(M) 'baker' > Carr., Ort. [forˈnar], Pontr. [furˈnar] vs. It. [forˈnaːjo]

h. Ŏ, Ĕ > [o](/[u]), [e](/[œ]) in open syllables and in closed syllables if followed by a nasal

BŎNU(M) 'good' > Carr., Ort. [boŋ], Pontr. [buŋ] vs. It. [ˈbwɔːno]
DĔNTE(M) 'tooth' > Carr. [dent], Ort. [ˈdento], Pontr. [dønt])

Besides these phonological features, Lunigiana and Northern Italian dialects share some morphosyntactic feature, such as the ones presented in Tab. 2.3 (Maffei Bellucci 1977; Luciani 1999):

Tab. 2.3 Lunigiana and Northern Italian dialects' morphosyntactic features

a. I-III feminine declension /-a/ metaplasm

CARNĔ(M) 'meat' > Carr., Ort., Pontr. [ˈkarna] vs. It. [ˈkarne]

b. confluence of II and III masculine declension

PISCĔ(M) 'fish' > Carr., Pontr. [ˈpes], Ort. [ˈpeʃo] vs. It. [ˈpeʃːe]

c. /-i/ PL.MASC morpheme instead of /-a/ PL.N morpheme

BRĀCHĬA 'arms' > Carr. [ˈbratsi], Ort. [bratʃi], Pontr. [brasi] vs. It. [ˈbratːʃa]

d. augmentative by adjective-participle juxtaposition

It. [ˈnwɔːvo di ˈdzekːa] 'brand new' vs. Carr. [ˈnov ts$^{(ə)}$ˈkent], Pontr. [ˈnøu̯ tʃœˈkant], Ort. [ˈnoo[11] ts$^{(ə)}$ˈkento]

e. obligatory proclitic subject

It. [ˈdiːtʃi] '(you) say' vs. Carr. [t ˈdits], [t ˈditʃa], Pontr. [t ˈdiz]

[11] Notice that this form is bisyllabic. As a consequence, the two rounded vowels of the transcribed form constitute two different nuclei. Phonetically, this is made evident by a tonal break occurring between the two acoustically identical vowels.

f. past perfect instead of preterite

It. [lo ˈfeːtʃi] 'I did it' vs. Carr. [a ɖ ɔ ˈfat], Pontr. [a l ɔ ˈfat], Ort. [a ɖ ɔ ˈfato]

Now that the features contributing to the characterization of Lunigiana dialects as Northern Italian varieties have been presented, in the next two sections a sketch is given of the phonological features singularly characterizing Pontremolese (Section 2.2) and Carrarese (Section 2.3).

2.2 Pontremolese

2.2.1 Consonant system

Pontremolese is spoken over an area of 182.48 km^2, with a population of 7,524 inhabitants[12]. As far as social mobility is concerned, the main (economical and educational) centre of attraction is represented by the Emilian town of Parma. This is a consequence of the XIX century political unification of Pontremoli and the surrounding villages (Zeri, Mulazzo, Filattiera, Bagnone and Villafranca) into a single administrative district that, after the Congress of Vienna (1815), has been assigned to Parma's Borbon family (Maffei Bellucci 1977 and references therein). From this moment, the road running along the Cisa mountain pass, i.e. the road that links Lunigiana to Parma, progressively gained importance.

As for the dialect, the knowledge of Pontremolese is more and more exclusively passive (see also Section 4.1). Younger generations, indeed, rarely exhibit an active competence: the regional variety of Italian is nowadays their mother tongue.

As reported by Maffei Bellucci (1977) and Restori (1892), Pontremolese displays a 19-segment consonant system:

Tab. 2.4 Pontremolese consonant system (adapted from Maffei Bellucci 1977: 34)

	Bilab.	Labiodent.	Alv.	Postalv.	Retrofl.	Pal.	Velar
Stop	p b		t d				k g
Affricate				tʃ dʒ			
Fricative		f v	s z				
Nasal	m		n			ɲ	(ŋ)
Lateral			l				
Rhotic			r				
Glide						j	w

[12] Data relative to 31st December 2013 (ISTAT).

While Pontremolese stops and fricatives do not display any particular characteristic[13], it is interesting to point out that, as in the majority of Northern Italian dialects (Tuttle 1991), the alveolar nasal is neutralized to its velar counterpart in word-final position (see also Tab. 2.2e). Together with the labiodental nasal occurring before labiodental stops (see fn. 13 for an example), the velar nasal should hence be considered an allophone of the alveolar one.

Another segment displaying an interesting behaviour is the lateral. Indeed, when followed by another consonant, /l/ can be neutralized either to /u̯/ or to /r/: [myl] < MŪLU(M) 'mule' vs. [mur] < MŪRU(M) 'wall', but [kau̯d] < CĂLĬDU(M) 'hot' vs. [kurp] < CŎLĂPHU(M) 'strike'. Moreover, it can be also deleted: [dus] < DŪLCE(M) 'sweet', [sɔd] < SŎLDU(M) 'money'). Finally, another context triggering a change in the etymological lateral is the presence of a following front glide/vowel: [ˈfɔdʒa] 'leaf' vs. It. [ˈfɔʎːa] 'leaf' < FŎLĬA).

As can be noticed by these examples, the lateral is consistently reduced when occurring in coda position, i.e. in a prosodically weak position. Interestingly, the fact that in forms such as [myl] ('mule') the lateral is not reduced, suggests that word-final consonants should not be considered coda segments. Indeed, they are considered onsets of a syllable projected by a following nucleus lacking any phonological content (Section 6.3.1.1.2). It should also be noted that when reduction occurs, its direction depends on the content of the following onset and, partially, on that of the preceding nucleus: as reported by Maffei Bellucci (1977), if the lateral is followed by dental or palatal consonants, then /l/ is reduced to [u̯]. Furthermore, if the preceding vowel is back, then the lateral can also be dropped. If, instead, the following onset is a labial or velar consonant, then it is reduced to [r] (see Section 7.4, fn. 140, for a tentative phonological account of the [u̯] ~ [r] alternation).

The behaviour of the lateral in coda position described above is displayed by other Northern Italian dialects as well (Loporcaro 2009). Similarly, Pontremolese shares with these varieties the voicing of intervocalic voiceless consonants (see Tab. 2.2f). Indeed, few forms can be found which resisted this assimilative process: [buˈkal] 'chamber pot', [ˈgutʃa] 'needle', [gyˈsuŋ] 'dry chestnut', but [furˈmiga] 'ant' (It. [forˈmiːka]), [ˈreza] 'root' (It. raˈdiːtʃe), [muˈruza] 'girlfriend' (It. moˈroːza) (Maffei Bellucci 1977: 36-37).

Another phonological characteristic that deserves to be mentioned is the outcome of Latin velar and alveolar stops when followed by the front glide/vowel: $G^{e,i}$, GJ and DJ are reduced to the fricative [z] ([zel] 'freeze' vs. It. [ˈdʒɛːlo], [dzyŋ] 'fasting' vs. It. [diˈdʒuːno]), and $C^{e/i}$, TJ and STJ to [s] ([bras] 'arm' vs. It. [ˈbratːʃo], [ˈvisi] 'vice' vs. It. [ˈvitːtsjo]). Interestingly, as can be grasped from the examples just given (see also Tab. 2.2b and Tab. 2.2c), Pontremolese outcomes constitute a further argument supporting the hypothesis according to which this dialect represents a diachronic stage that follows the Carrarese one: while Standard Italian preserves the post-alveolar affricate outcomes of proto-Romance, Carrarese shows their alveolar

[13] They behave similarly to the corresponding Standard Italian segments: they are always distinctive, except from the set of sibilants. Indeed, the voicing contrast of this subset of fricatives is neutralized in preconsonantal position, where the sibilant assimilates to the voicing specification of the following consonant ([skrit] 'written' vs. [zguɱfjar] 'to deflate'). The same holds for Carrarese.

counterparts and Pontremolese, crucially, their fricative cognates. In other words, Standard Italian, Carrarese and Pontremolese seem to be arranged along a diachronic *continuum* whereby the relevant consonant's place of articulation is gradually assimilated to that of the following front segment. Similarly, these segments seem to gradually lose their consonantal strength: they start as stops (Latin), develop into affricates (Standard Italian and Carrarese) and end up as fricatives (Pontremolese and other Northern Italian dialects; Loporcaro 2009).

2.2.2 Vowel system

The Pontremolese vowel system is made up of the eight segments presented in Tab. 2.5, where the right-hand segments of the front series represent the rounded counterparts of the left-side vowels, and the brackets the dubious phonological status of the relevant vocoid (see below):

Tab. 2.5 Pontremolese vowel system (adapted from Maffei Bellucci 1977: 34)

	Stressed vowels			Unstressed vowels		
	Front	Central	Back	Front	Central	Back
High	i y		u	i		(u)
High-mid	e ø					
Low-mid	ɛ (œ)		ɔ			
Low		a			a	

The first things worthy of attention are the front/back asymmetry of the stressed vowel subsystem and the presence of front rounded vowels.

As for the front rounded vowel class, it has to be pointed out that it constitutes one of the major arguments in favour of the classification of Pontremolese as belonging to the Liguro-Emilian group (Tab. 2.1). Furthermore, these vowels have been resorted to by Maffei Bellucci (1977) as evidence for the linguistic influence exerted on Pontremolese by Lombard dialects such as Piacentino (Maffei Bellucci 1977: 22-24). Indeed, both Ligurian and Lombard display front rounded vowels, which, in Lunigiana, are only present in Pontremolese and in the two related sub-varieties spoken in Zeri and Filattiera.

As a matter of fact, the phonological status of one of these rounded vowels, namely of the front low-mid vowel that Maffei Bellucci (1977) transcribes as [œ], is uncertain. Similarly to what happens in Turin dialect (Berruto 1974), the [ø] ~ [œ] opposition does not display a great functional load. Indeed, these two vocoids could be considered two allophones (Restori 1892; Savoia 1983), but, since they do not seem to occur in complementary distribution, they have been considered by Maffei Bellucci (1977) to have a phonological, distinctive status. However, as explicitly claimed by Maffei Bellucci (1977: 47, fn. 103), she lacks experimental evidence to substantiate the acoustic difference between these two vocoids. Moreover, as pointed out by Carpitelli (1995: 80), Maffei Bellucci (1977) grounds the alleged absence of complementary distribution on etymological considerations. Maffei Bellucci (1977), indeed, maintains that, while [ø] developed either from Ŏ in open syllables ([ˈsøla] < SŎLĔA 'sole') or as a result of an assimilation process (to a following labial consonant: [ˈfømna] < FĒMĬNA 'female'), [œ] developed either from Ĕ in preconsonantal position ([dœnt] < DĔNTE(M) 'tooth'), or from Ē/Ĭ in etymologically closed syllables ([ˈfœta] < *fetta 'slice', [vœrd] < VIR(Ĭ)DE(M) 'green'). To solve the issue about the phonological status and the actual acoustic content of [ø] and [œ], Carpitelli (1995) analyses the vocoids under concern in the relevant phonological contexts and shows that as far as their formant structure is concerned, these sounds do not show any significant difference. This finding rebuts the [ø]/[œ] distinction proposed by Maffei Bellucci (1977) for Pontremolese and supports instead the impressionistic/auditory-grounded proposals of Restori (1892) and Savoia (1983), according to which these two phonetic labels refer to a single acoustic, and phonological, object: [ø] /ø/. This is the reason why the lower front rounded vowel has been represented within brackets in Tab. 2.5.

As for the front/back vowel asymmetry, Tab. 2.5 shows that while the front series displays three segments, the back one lays out only two vowels: the proto-Romance [o] has not been preserved. Indeed, the vowels that have been reduced to [o] in proto-Romance (Calabrese 2003), namely Ō and Ŭ (It. [aˈmoːre] < AMŌRE(M) 'love'; It. [ˈdoltʃe] < DŬLCE(M) 'sweet'), developed into [u] ([aˈmur] 'love'; [dus] 'sweet') in Pontremolese. Furthermore, notice that [u] can be the outcome of Ŏ as well, i.e. of a vowel that in proto-Romance developed into [ɔ] (It. [ˈbwɔːno] < BŎNU(M) 'good'). Indeed, if followed by a nasal, Ŏ developed into a back high vowel ([buŋ] 'good'; as shown in Tab. 2.2f, a similar raising affected the corresponding front vowel: Ĕ > [ø]). This also happened to Ŏ in syllables closed by a liquid or a nasal ([kurp] < CŎL(Ă)PHU(M) 'strike'; [ˈstumg$^{(ə)}$] < STOMĂCHUS 'stomach'). Together with the 'regular' outcome (OCŬLU(M) 'eye' > It. [ˈɔkːjo], Pontr. [ɔtʃ]) then, Ŏ displays a further development: [ø]. In this case, the triggering context is the open syllable: [ˈsøla] < SŎLĔA 'sole'.

Latin Ū, instead, developed into [y]: LŪNA(M) 'moon' > Pontr. [ˈlyna] vs. It. [ˈluːna].

As for the front vowels, they do not display any difference with respect to the proto-Romance developments: Ē and Ĭ gave [e] (CĂTĒNA(M) 'chain' > Pontr. [kaˈdena], It. [kaˈteːna]; SĬTI(M) 'thirst' > Pontr. [ˈseda], It. [ˈseːte]), Ī gave [i] (AMĪCU(M) 'friend' > Pontr. [aˈmig], It. [aˈmiːko]) and, if not occurring in an open syllable or in a syllable closed by a nasal (see Tab. 2.2f), Ĕ gave [ɛ] (MĔDĬU(M) 'half' > Pont. [mɛz], It. [ˈmɛdːdzo]).

Another development characterizing the stressed vowel system is the palatalization of the low vowel (Maffei Bellucci 1977; Restori 1892). However, this process seems to be limited to the infinitive morpheme of the first conjugation and to the outcome of the Latin suffix -ARIUS. Even in these cases, though, this process does not apply regularly: [aˈmar] ~ [aˈmɛr] < AMĀRE 'to love', [tlar] ~ [tlɛr] < TĒL-ARIU(M) 'loom'.

As far as the unstressed vowel system is concerned, we should distinguish between pre- and post-tonic context. Indeed, similarly to what happens in Western Romance (see Sections 3.2.2 and 3.2.3), while unstressed vowels have been systematically deleted when occurring in post-tonic position, in pre-tonic position they display a higher resistance.

The behaviour of the post-tonic unstressed vowels is extensively discussed, both from a phonetic and a phonological point of view, in Sections 5.2 and 7.2. As just hinted at, all the unstressed vowels occurring after stressed syllables undergo deletion, except when they represent the SG.FEM ([a]) or the PL.MASC ([i]) morpheme. However, in the case that the PL.MASC is preceded by a nasal, it is deleted as well (Pontr. [kaŋ] 'dog/dogs' vs. It. [ˈkaːne] 'dog' ~ [ˈkaːni] 'dogs').

In pre-tonic position, instead, unstressed vowels can be retained. The low vowel, for instance, generally undergoes apheresis ([ˈgutʃa] < ACŬCŬLA(M) 'needle'), but not necessarily ([kaˈval] < CĂBALLUS(M) 'horse'). The same happens to proto-Romance /i/ ([fnir] < FĪNĪRE 'to finish', but [ziˈrar] < GȲRĀRE 'to turn'), /o/ ([vrer] < *VOLERE 'to want', but [uˈnur] < HŎNŌRE(M) 'honour') and /u/ ([byˈter] < BŪTȲRU(M) 'butter').

The reader is referred to Sections 5.2 and 7.2 for a more detailed discussion of the unstressed vowels' fate in Pontremolese. However, before tackling these sections, the features characterizing Carrarese phonology with respect to Pontremolese must be presented. This is the topic of the next section.

2.3 Carrarese

2.3.1 Consonant system

Carrarese is spoken over an area of 71,01 km^2, with a population of 64.234 inhabitants[14]. In contrast with Pontremoli, Carrara constantly represented a pole of attraction for the surrounding area. Indeed, the need for manpower to employ in the marble quarries periodically attracted migrants from the areas that were politically related to Carrara. Because of the political instability of Lunigiana (see Section 2.1), migrants came from Pisa, Florence, Siena and Genoa (about 14th-15th century), or from small villages in Emilian and Reggian Appennines[15]. The same political instability, together with the peculiar attitude of Carrara inhabitants with respect to authority[16], can possibly be considered a factor contributing to their political and

[14] Data relative to 31st December 2013 (ISTAT).

[15] Notice that marble extraction started very early: the first mention of Carrara's marble can be found in Pliny the Elder (*Naturalis Historia* XXXVI, 7), who claims that in 48 BC Mamurra, Julius Caesar's *praefectus fabrum*, used this marble for his villa in Celio. (At least) since that time, marble extraction has never stopped, becoming particularly intense in the Roman Augustean and Imperial ages, then again during Renaissance humanism and as a consequence of technological developments, in 19th and 20th century.

[16] After the First International (1864), anarchism rapidly spread in Carrara's area, where, because of the hard working conditions of quarry workers, anarco-syndacalism found fertile ground (also notice that, since the Roman period, quarry workers were mainly slaves and convicts, although the working conditions of later 'free' workers were not so different from slavehood). In the last part of 19th century, hence, several uprisings occurred and various secret organizations were constituted (such as the "Spartana", a kind of First International

social identity. If asked whether they felt “more Tuscan” or “more Ligurian”, the majority of Carrara inhabitants would refuse both identities in favor of the local Carrara identity.

As in the case of Pontremolese, knowledge of Carrarese is almost exclusively passive (see also Section 4.1), the regional variety of Standard Italian being the mother tongue of younger generations. This is made explicit by Luciani (Carrara, 1923-2004), who explicitly claims to

> “belong […] to a generation of Carraresi, maybe the last, that in its childhood, within the family, heard relatives (parents, uncles, grandaparents, etc.) chatting with friends […] in dialect, while addressing us (sons and nephews) in Italian.”[17] [EC]

Even if the Carrarese consonant system shares many features with almost all Lunigiana dialects (Tab. 2.2), it differs from other varieties, and mainly from Pontremolese, in some features (Bottiglioni 1911; Maffei Bellucci 1977; Luciani 1999, 2002). Its consonant system is represented in Tab. 2.6:

Tab. 2.6 Carrarese consonant system

	Bilab.	Labiodent.	Alv.	Postalv.	Retrofl.	Pal.	Velar
Stop	p b		t d		ɖ		k g
Affricate			ts dz	tʃ dʒ			
Fricative		f v	s z				
Nasal	m		n			ɲ	(ŋ)[18]
Lateral			l				
Rhotic			r				
Glide						j	w

The Carrarese consonant system displays the alveolar affricates /ts/ and /dz/, which come respectively from CJ and C followed by front vowels ([brats] ‘arm’ vs. It. [ˈbratːtʃo]; [diˈtsembra] ‘December’ vs. It. [diˈtʃembre), and from J, DJ, Gj and G followed by front vowels ([dzov] < ‘yoke’ vs. It. [ˈdʒoːgo]; [ˈɔdzi] ‘today’ vs. It. [ˈɔdːdʒi]). As discussed in Section 2.2.1 and 3.1.1, these affricates occur as fricatives in Pontremolese.

Another difference is the Carrarese preservation of the pre-consonantal lateral (Carr. [alt] vs. Pontr. [au̯t] ‘high’; Carr. [kolp] vs. Pontr. [kurp] ‘strike’). If, instead,

offspring particularly interested in armed struggle) in order to improve workers conditions. These organizations then merged into an Anarchist Federation, which in turn flew into the Italian Anarchist Union (UAI, 1920). Then, after Mussolini banned UAI (1926), in a congress held at Carrara in 1945, Italian anarchists constituted the Italian Anarchist Federation (FAI), which still keeps its seat in Carrara (Fedeli 2004).

[17] “Appartengo […] ad una generazione di Carraresi, forse l’ultima, che nell’infanzia, nella vita di famiglia, sentiva i parenti (genitori, zii, nonni, ecc.) e i loro amici e conoscenti conversare fra loro in dialetto e rivolgersi a noi (figli e nipoti) in italiano.” (Luciani 1999: 42)

[18] As in Pontremolese, the alveolar nasal is neutralized to its velar counterpart in word-final position, which should hence be considered an allophone.

the post-lateral segment is a palatal glide, while Pontremolese transforms the lateral into a post-alveolar affricate, Carrarese deletes it (Pontr. [adʒ] vs. Carr. [ai̯] < ALIU(M) 'garlic'). The more interesting characteristic of Carrarese liquids, though, is the outcome of the etymologically geminate /l/. Indeed, while single intervocalic laterals underwent no change, geminate laterals developed into single voiced retroflex stops ([ˈpaɖa] < Long. *palla 'ball' vs. [ˈpala] < PĀLA(M) 'shovel'; [ɖ] < ILLU(M)/ILLA(M) 'the SG.MASC/FEM'). This feature characterizes, within Northern Italian dialects, all (and only) the dialects spoken around the Apuan Alps (Ambrosi 1956; Savoia 1980; Luciani 1999, 2002) and has been traced back to a pre-Latin Mediterranean substrate (Bottiglioni 1955, Merlo 1956a, 1956b). However, as for many other phonological structures of Romance varieties that were absent from the Latin inventory, retroflex segments are nowadays better explained as later innovations (Savoia 1980; Caracausi 1986; Loporcaro 2011b). It has to be noticed, though, that this retroflex stop is undergoing a further change. Indeed, while it is commonly found in varieties spoken in the small villages surrounding Carrara (for instance, in Ortonovo), in Carrarese it is often reduced to the correspondent alveolar stop (Luciani 1999, 2002). The above mentioned [ˈpaɖa], for instance, is often pronounced as [ˈpada][19].

Finally, with respect to Pontremolese, Carrarese lacks intervocalic stop voicing. It should be pointed out, however, that a set of ancient forms, often referring to traditional and popular elements, shows the voiced outcome of an etymological voiceless stop. This happens especially if that stop is velar ([fuˈgatsa] < *FOCACIA, a typical Carrarese cake; [a ˈdig] < DĪCO 'I say'; [pɔg] < PAUCU(M) 'few, little'), but also, even if less often, with alveolar and bilabial stops ([ˈkod⁽ᵊ⁾ga] < CUTICA(M) 'rind, turf'; [kaˈvest⁽ᵊ⁾r] < CAPISTRU(M) 'noose'). Furthermore, the

[19] Lateral, retroflex and alveolar consonants can be all referred to as coronal sounds. From an elemental point of view (Section 6.3.1.1.1), the homogeneity of this class is formalized as the inclusion of |A| in these consonants' phonological representation. Indeed, if unheaded, |A| is argued to represent the alveolar resonance (of [l] and [d]), while, if headed, it represents the retroflex resonance (of [ɖ]). The phonological link between the alveolar and the retroflex segment is shown, for instance, by Wambaya. Indeed, in this Non-Pama-Nyungan West Barkly Australian language, these two consonants alternate in word-medial position ([ˈguɖa] 'to be sick' vs. [ˈguda] 'stone'), but are neutralized in favour of the retroflex in word-initial position, i.e. in a prosodically strong position. In other words, the element occurring unheaded in a prosodically weaker position surfaces as headed in the prosodically strongest position. As an example, consider the reduplication process of a form such as [ɖididʲa] 'to carry'. The word-initial consonant of this form is retroflex. However, when reduplication occurs, this consonant surfaces as alveolar, while the first segment of the reduplicant, being word-initial, is retroflex: [ɖi-dididʲa] 'carry (dur.)'. In other words, the underlyingly alveolar segment ([d] = |ʔLA|) is 'enhanced' ([ɖ] = |ʔL<u>A</u>|) when occurring in word-initial position (but see Hamann 2003 for other Australian languages displaying the opposite neutralization pattern). Under this approach, the Carrarese [ɖ] to [d] diachronic change could hence be considered a weaking process (occurring in intervocalic position), which could have been enhanced by the contact with Standard Italian, which crucially lacks retroflex sounds. Furthermore, it is interesting to point out that the similarity between alveolars and retroflexes rests on acoustic grounding as well. Indeed, they both present an energy peak in the central region of the spectrum, the difference being in the slightly lower values of F3 in the case of the retroflex (Backley 2012: 94).

more we move away from the city of Carrara toward smaller villages in the countryside, the more this voicing is generalized (Ort. [faˈdiga] vs. Carr. [faˈtika] ‘effort’; Ort. [kuˈɲad] vs. Carr. [kuˈɲat] ‘brother-in-law’). However, notice that the Carrarese forms that underwent voicing underwent voicing in North Western Tuscan as well, where voicing arrived in the medieval period from the north (through Lucca) and has never been generalized (Savoia 1980; Castellani 2000). Moreover, the southern isogloss of intervocalic stop voicing has been argued to coincide with the Po river up to 8th century (Politzer & Politzer 1953). As a consequence, Carrarese voiced forms should be analysed in the same way as Tuscan forms, namely as the result of a lexical diffusion phenomenon (Loporcaro 2009).

2.3.2 Vowel system

Like the consonant system, the vowel system of Carrarese also displays some differences with respect to the Pontremolese one.

As far as the stressed vowel system is concerned, Carrarese differs from Pontremolese in a) the lack of front rounded vowels (Carr. [pu] vs. Pontr. [py] ‘more’; Carr. [ˈfora] vs. Pontr. [ˈføra] ‘outside’); b) the lack of palatalization of the Latin low vowel in open syllables (AMĀRE > Carr. [aˈmar] vs. Pontr. [aˈmɛr] ‘to love’); c) the presence of the high-mid ~ low-mid vowel opposition (Carr. [ˈbota] ‘barrel’ vs. [ˈbɔta] ‘knock’; Pontr. [i ˈkøz] ‘he cooks’ vs. [kɔz] ‘things’; Carr. [ˈora] ‘hours’ vs. [ɔr] ‘gold’; Pontr. [ur] ‘hours’ vs. [ɔr] ‘gold’). The other stressed vowels do not display any particular difference with respect to Pontremolese developments (Section 2.2.2 and Tab. 2.2).

As for the unstressed vowel system, it doesn’t show relevant differences with respect to the Pontremolese one: unstressed vowels have been generally deleted in post-tonic position (Section 5.2 and 7.2), showing instead some more resistance in pretonic position (as discussed in Sections 3.2.2 and 3.2.3, this generalization holds in the whole Western Romance domain). Maffei Bellucci (1977), for example, reports instances of forms where back vowels either resist reduction or, if followed by a high stressed vowel, reduce to [u]: [porˈtoŋ] ‘front door’ ~ [purtunˈtsiŋ] ‘small front door’. Few forms can be found where the front and back high vowels also resist deletion: [vriˈta][20] < VĒRĬTĀTE(M) ‘truth’; [uˈnir] < ŪNĪRE ‘to join’. Letting aside these few exceptions, she claims that, both in pretonic and post-tonic position, unstressed vowels are generally reduced to schwa. However, as she explicitly states, her analysis of Carrarese is not supported by direct evidence: it is based on the data reported by Luciani (1999, 2002), which, in turn, relies on an impressionistic/auditory analysis. As discussed in Chapters 5 and 7, the schwas they report as outcomes of the reduction process should rather be considered as articulatory driven intrusive vowels, and not as ‘reduced’ versions of the corresponding etymological vowels. In other words, Carrarese schwa is a phonetic by-product lacking any underlying vocalic correlate. As a consequence, it should not be inserted in the vocalic segment inventory presented in Tab. 2.7 (where the vowels

[20] Notice that this form’s etymologically first vowel has been deleted.

that can exceptionally occur in unstressed position are in brackets). As can be noticed from the few exemples just given, the two front vowels and the low one regularly occur in unstressed position as well. However, this happens only in the case that they represent SG.FEM ([a]), PL.FEM ([e])[21] and PL.MASC ([i]) morphemes (Chapters 5 and 7). As in the case of Pontremolese, if PL.MASC [i] if preceded by a nasal, then it is deleted as well (Carr., Pontr. [kaŋ] 'dog/dogs' vs. It. [ˈkaːne] 'dog' ~ [ˈkaːni] 'dogs').

Tab. 2.7 Carrarese vowel system

	Stressed vowels			Unstressed vowels		
	Front	Central	Back	Front	Central	Back
High	i		u	i		(u)
High-mid	e		o	e		(o)
Low-mid	ɛ		ɔ			
Low		a			a	

Finally, as far as the length feature is concerned, while in surrounding (Ligurian and Emilian) dialects it has a distinctive value (Loporcaro 2009, 2011b), in Carrarese, as in the other Lunigiana dialects, it does not (Barbera 2008; Loporcaro 2009).

[21] Recall that, in Pontremolese, the PL.FEM ([e]) also undergoes deletion.

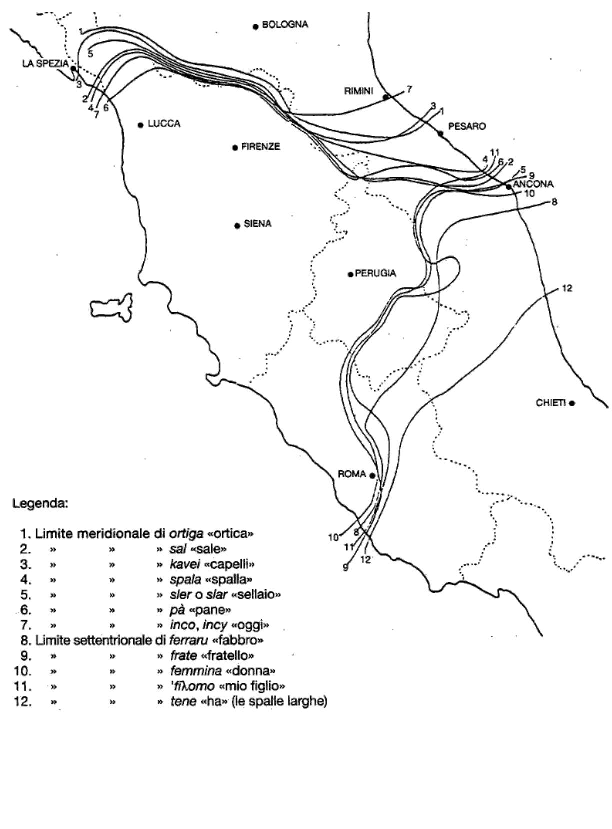
3 Diachronic background

3.1 A wide shot of Western Romance diachronic phonology

3.1.1 Some shared outcomes

In Section 3.2 a description of the processes that affected the unstressed vowel system in the transition from Latin to Northern Italian dialects is presented. This way, a set of tendencies can be identified that reshaped the phonological system in such a way that, within Italian borders, Northern Italian varieties today sound extremely different from the varieties spoken below the Carrara-Fano isogloss (Pellegrini 1977). As shown in the upper side of the map in Fig. 3.1, the isoglosses identifying the southern limit of the vowel reduction processes (isogloss 2 for apocope and 5 for syncope) are just some of the ones that constitute the bundle of isoglosses splitting the Romance-speaking *continuum* into the two different groups known as Western and Eastern Romance.

Fig. 3.1 Italian dialects' main isoglosses (Rohlfs 1937: 10)



Indeed, the same bundle of isoglosses splits the Romance varieties between the ones where the etymological length and strength of consonants have been preserved (Eastern Romance), and the ones where consonants underwent some weakening process (Western Romance)[22]. From UACCA(M) 'cow', for instance, we have Sp. *vaca*, Fr. *vache* vs. It. *vacca* (Loporcaro 2011b); from VĪTA 'life' we have Ro. *vită* and It. *vita* vs. Cat., Pt. and Sp. *vida* and Fr. *vie* (Rohlfs 1966). Furthermore, the Western Romance varieties keep the Latin -S ending in both the nominal (It. *gli amici* vs. Sp. *los amigos*, Sard. *sos amigos* 'the friend PL') and the verbal system (Sp. *llegas* 'arrive PRES.2SG', *llegamos* 'arrive PRES.1PL', *llegáis* 'arrive PRES.2PL' vs. It. *pieghi* 'fold PRES.2SG', *pieghiamo* 'fold PRES.1PL', *piegate* 'fold PRES.2PL'; Sard. *istímas* 'love PRES.2SG', *istimá(m)us* 'love PRES.1PL', *istimáis* 'love PRES.2PL' vs. It. *stimi* 'esteem PRES.2SG', *stimiamo* 'esteem PRES.1PL', *stimate* 'esteem PRES.2PL'; Fanciullo 2007).

Three other characteristics have been identified that are shared by Western Romance varieties (Pellegrini 1992: 286): the preservation of CL clusters, as in CLAVE(M) 'key' > Fr. *clef*, Pt. and Sp. *clave*, Liv. *claf* (Rohlfs 1966), and the palatalization of CA- and GA- in open stressed syllables, as in CAPRA(M) 'goat' > Fr. *chèvre*, Lad. *chiavra* (Rohlfs 1966), and of Ū (> [y]) in both stressed and unstressed syllables, as in LŪNA(M) 'moon' > Fr. *lune*, Mil. *lüna* (Rohlfs 1966)[23]. However, while this characterizes in a first stage all the varieties spoken north of the Carrara-Fano line, these features were then covered by subsequent developments that affected only Northern Italian dialects, and can thus be found only in some peripheral variety thereof. The CL cluster, for instance, was subsequently palatalized (Tab. 2.2b). Interestingly, the various stages of the diachronic evolution are mimicked by the diatopic variation. Beside the peripheral conservative outcomes just hinted at, in (more) central varieties such as the ones spoken in Lombardy and Piedmont, CL turns into [tʃ] (CLAVE(M) > [tʃaːf]). Furthermore, in some peripheral areas it's possible to find the intermediate diachronic stage(s) as well. Indeed, in Collagna (prov. of Reggio) and Ortonovo (prov. of La Spezia) the outcome of CLAVE(M) is respectively [ˈcaːva] (Loporcaro 2009: 85) and [ˈcawa]. A similar fate hit Latin velar plosives (both voiceless and voiced) if followed by a front vowel. The more you move from peripheral areas to the centre, the closer they are to [s]: CENTU(M) 'hundred' > Ort. [ˈtʃɛnto], Carr. [tseŋt], Pontr. [sent], Ven. [ˈsento].

[22] As pointed out by Marotta (in press), the Latin consonants' fate do not actually support a sharp distinction between Western and Eastern Romance. For instance, Sardinian displays both the -S plural ending (Sard. *sos amigos* 'the friend PL') and gemination (Sard. *fattə* 'done P.PART.SG.MASC), i.e. respectively, a Western and Eastern Romance feature.

[23] The last two features correspond to the 'acutissime spie celtiche' proposed by Ascoli (1882-5), who resorted to the concept of substratum to explain the similarities shared by the varieties spoken in the regions previously occupied by Celtic communities. The substratum-oriented explanations, though, are nowadays generally discredited by scholars. It has been shown, for instance, that the two 'spie' don't meet the three requirements put forward by Ascoli himself: the chorographic, intrinsic and extrinsic requirements. Indeed, these 'spie' are neither uniformly present in all the areas inhabited by Celts, nor attested in other Celtic languages or other areas occupied by Celts. A different explanation for these varieties' similarity has been proposed that interprets them as the outcome of a proto-Romance convergence (Pellegrini 1977).

Another feature characterizing Northern Italian dialects (that does not cross the Alps[24]) is vowel length contrast phonologization, which has been considered a byproduct of the interaction of degemination and the pan-Romance stressed open syllable lengthening (Loporcaro 2005, 2011a; Filipponio 2012; Marotta 2014)[25]. Indeed, the (allophonic) proto-Romance open syllable vowel lengthening (see below) creates a set of long vowels whose length, as a consequence of the later loss of consonantal length distinctiveness, is then phonologized. Consider, for instance, a Northern Italian dialect such as Milanese, which displays the following oppositions: [naːz] 'nose' vs. [nas] 'I'm born' but [søːl] 'alone SG.MASC' vs. [ˈsøːla] 'alone SG.FEM' (Loporcaro 2011a: 70). Here the long vowel corresponds to the stressed vowel of a Latin open syllable (NĀSU(M) 'nose', SŌLU(M) 'alone SG.MASC' and SŌLA(M) 'alone SG.FEM'), and the short one to the vowel of a closed syllable (NASCO(R) 'born PRES.1SG'). These few examples show that the lengthening occurred only in etymologically open syllables, i.e. before apocope applied. If the two processes had applied in the opposite order, we would instead have the attested [ˈsøːla] 'alone SG.FEM' vs. the unattested *[søl] 'alone SG.MASC'. On the other hand, oppositions such as Mil. [fyːz] 'spindle' vs. [fys] 'be PRES.3SG' show how the contrastive function of consonant length has been replaced by that of the vowel. This becomes evident if we consider the Standard Italian cognates of the Milanese forms just mentioned, [ˈfuːzo] and [ˈfosːe]: Standard Italian did not undergo degemination and consonant length preserves its distinctive power, vowel lengthening being predictable from the syllabic template (Marotta 1985). In other words, from a Latin form such as ˈCVCV we have the proto-Romance ˈCVːCV because of open syllable lengthening, while the vowel of a form such as ˈCVCCV does not undergo any change: since its stressed vowel occurs in a closed syllable, no vowel lengthening applies. Up to this stage, stressed vowel lengthening is still allophonically determined. Afterward, in the case the CC sequence is a geminate, the degemination process turns ˈCVCCV into ˈCVCV. As a consequence, the two forms under concern can only be distinguished by the stressed vowel length, which is thus phonologized: /ˈCVːCV/ vs. /ˈCVCV/[26].

---

[24] A transalpine instance of the contrastive vowel length is represented by the Franco-provencal variety of Haute-Ville (Savoy) (Martinet 1956: 75). See also Morin (2006) for an historical account of the distinctive vowel length in French.

[25] Different accounts of vowel length phonologization have been proposed that consider the trigger to be either apocope (Repetti 1992), the loss of word-final consonant voicing (Baroni & Vanelli 2000), a Strong Rhyme Constraint requiring the bimoraicity (and hence the lengthening) of a stressed vowel (Montreuil 1991) or the high ranking of a FOOT-BINARITY constraint (Prieto 1993). However, these accounts undo the link between the old (Latin) and the new (Northern Italian) vowel length contrast and, more importantly, cannot account for dialects displaying both the vowel length contrast and the word-final vowel (Loporcaro 2011a: 71).

[26] It has to be pointed out that vowel length is not distinctive in Venetian (which should be considered apart from the other Northern Italian dialects) nor in any other peripheral variety, such as Catalan and, crucially, Carrarese (Barbera 2008) and Pontremolese (Maffei Bellucci 1977). Assuming that open syllable lengthening applies to the whole Latin speaking area (as evidenced by the different outcomes of stressed vowels in open vs. closed syllables; see Tab. 3.1), the lack of distinctive vowel length in some Western-Romance varieties can be

Finally, Northern Italian dialects share a property with Gallo Romance, with the dialects spoken in the high-southern part of the Adriatic area and with Standard Italian (which, however, displays different outcomes), namely the distinction between the stressed vowels occurring in open syllables and the ones occurring instead in closed syllables (Loporcaro 2005, 2011b, Filipponio 2012). This is shown in Tab. 3.1:

Tab. 3.1 Differences in the tonic vowel outcome in open vs. closed syllable in Northern Italian dialects

Open syllables		Closed syllables	
PĔTRA(M)	It. [ˈpjɛtra]	LĔCTU(M)	It. [ˈlɛtːo]
‘stone’	Bol. [ˈpreːda]	‘bed’	Mil. [lɛtʃ]
NŎVU(M)	It. [ˈnwɔvo]	NŎCTE(M)	It. [ˈnɔtːe]
‘new’	Bol. [noːv]	‘night’	Mil. [nɔtʃ]
LĂCU(M)	It. [ˈlaːgo]	ANNU(M)	It. [ˈanːo]
‘lake’	Mod. [lɛːg]	‘year’	Mil. [ˈan]

As shown by Tab. 3.1, the difference between Northern Italian dialects and Standard Italian is particularly evident in open syllables. In this context, north from the Carrara-Fano isogloss, high-mid vowels are preferred to (diphthongs containing) low-mid vowels and, even if just in few varieties, low-mid vowels are preferred to the low ones (Mod. [lɛːg] vs. It. [ˈlaːgo]) and falling diphthong to high-mid vowels (Romagn. [ˈnei̯f] vs. It. [ˈneːve]). A difference can also be noticed in closed syllables, where Ĭ gives [e] in Italian but [ɛ] in some Northern Italian dialects (ĔPISCŎPU(M) ‘bishop’ > Lig. *v*[ɛ]*sku*, Lom. *v*[ɛ]*skuf*, Em. *v*[ɛ]*škof*; Rohlfs 1966).

The high-mid vowels occurring in Northern Italian dialects are considered by Loporcaro (2011a) to be the outcome of the proto-Romance forms, which are still retained by Standard Italian. Proto-Northern Italian dialects should have shown therefore the rising diphthongs occurring nowadays in Standard Italian. A process can thus been assumed for these dialects that spreads the [high] feature of a glide towards the following vowel. The glide, then, is deleted. For the two forms displaying in Tab. 3.1 a high-mid vowel, we can thus propose the following paths: *[ˈpɛːtra] > *[ˈpjɛtra] > *[ˈpjetra] > Bol. [ˈpreːda] and *[ˈnɔːvo] > *[ˈnwɔvo] > *[ˈnwovo] > Bol. [noːv] (Loporcaro 2011a). This hypothesis rests upon the proposal made by Schürr (1970), according to which the originally metaphonetic rising diphthong spread very early from Northern France and has been subsequently generalized in non-metaphonizing varieties also, together with the open syllable lengthening process (Marotta in press).

interpreted as the effect of a process which applies after degemination and neutralizes the vowel length distinction (Loporcaro 2011a).

Summarizing, in the transition from Latin to Northern Italian dialects, the phonological system underwent the set of changes in consonant, stressed vowel and unstressed vowel sub-systems listed in Tab. 3.2:

Tab. 3.2 Main phonological changes from Latin to Northern Italian dialects

Consonant sub-system

a. intervocalic consonant lenition
b. degemination

Stressed vowel sub-system

c. difference between vowel outcomes in open vs. closed syllable
d. new vowel length contrast

Unstressed vowel sub-system

e. syncope
d. apocope

Leaving aside the changes in the consonant sub-system (see Loporcaro 2011b and Schmid to appear for a detailed overview), the general tendencies are presented below that affect the vowel sub-system in the transition from Latin to Northern Italian dialects. The processes undergone by unstressed vowels, namely syncope and apocope, are considered in more detail in Sections 3.2.2 and 3.2.3 respectively. As for the other features characterizing Northern Italian and, particularly, Lunigiana dialects, see Section 2.1.

3.1.2 Zooming into the vowel system diachrony

The phonological system of Latin contrasts ten vocalic segments. Indeed, together with the height and frontness dimensions, the vowels also contrast along the length dimension, as shown by the minimal pairs in Tab. 3.3:

Tab. 3.3 Vowel length contrast in Latin

MĀLUM	'bad'	MALUM	'apple'
LĒVIS	'smooth'	LEVIS	'light'
LĪBER	'free'	LIBER	'book'
PŌPULUS	'poplar tree'	POPULUS	'people'
FŪGIT	'run away 3SG.PRES'	FUGIT	'run away 3SG.PERF'

As well as for its distinctive value, vowel length shows its relevance within the Latin prosodic module by entering the stress assignment algorithm: given a word with more than two syllables[27], the Latin metrical system assigns the stress to the penultimate syllable, if heavy, or to the antepenult if the penult is light. A syllable, in turn, is heavy if it contains a falling diphthong, a short vowel followed by a coda segment or, crucially, a long vowel. The stress is therefore assigned to the penultimate syllable in forms like CON.TAC.TUS 'contact' and A.MĪ.CUS 'friend', but to the antepenult one in forms like IN.TĔ.GER 'intact' and A.NĬ.MUS 'soul'. The stress, then, is subordinate to (the penultimate syllable's) rhyme weight and, as a consequence, to vowel length.

Vowel length, on the contrary, is not subordinate to stress: long vowels appear in stressed as well as in unstressed syllables. Furthermore, unstressed long vowels can occur in open as well as closed syllables. Hence, Latin displays the syllable structure typology presented in Tab. 3.4:

Tab. 3.4 Syllable structure typology

Stressed syllables			Unstressed syllables		
ˈCV	ˈPĂ.LŪS	'pole'	CV	ˈRO.SĂ	'rose' nom.
ˈCV:	ˈPĀ.LUS	'swamp'	CV:	ˈRO.SĀ	'rose' abl.
ˈCVC	ˈMĬT.TO	'I send'	CVC	ˈHA.BĔT	'he has'
ˈCV:C	ˈMĪL.LE[28]	'thousand'	CV:C	ˈHA.BĒS	'you have'

Latin thus allows light (V = one mora), heavy (VC/V: = two moras) and superheavy (V:C = three moras) rhymes (Marotta 1999; Lehmann 2005).

This notwithstanding, it has to be pointed out that, since its archaic period (VII BC-75 BC; Weiss 2009), Latin has shown a set of processes that partially subordinates vowel length to stress. Such processes include a) *correptio iambica*, whereby word-final unstressed vowels shortened after a light syllable (BĔNĔ < *dwĕnēd 'well'), and b) the shortening undergone by unstressed vowels preceding a word-final consonant (except for /-s/, as in AMĂT 'love PRES.3SG' vs. AMĀS 'love PRES.2SG', AMŎR 'love NOM' vs. AMŌRIS 'love GEN')[29]. As a consequence, the

[27] In bisyllabic words, the stress is regularly assigned to the first syllable, as in CAE.LŌ 'sky', CA.NIS 'dog'. Letting aside some exceptional forms such as IL.LŪC 'there', final stressed syllables are allowed in monosyllabic words only, as in RES 'thing' (Marotta 1999).

[28] As noticed by Giannini & Marotta (1989), the laterals represent the consonant class more often occurring as geminate, and the one that shows the highest functional load: the minimal pairs involving short vs. long laterals are the most widespread.

[29] The tendency to shorten unstressed syllable rhymes can be fulfilled by the alternative strategy of word-final consonant deletion, a process that could be motivated by the 'preference' for a less marked (i.e. coda-less) syllable structure (Kiss 1971; Giannini & Marotta 1989, but see Section 3.2.1 for a slightly different approach). As a consequence, in the diachronic development from Latin to proto-Romance, the forms displaying word-final consonants are heavily reduced. Similarly to what happens in unstressed vowel reduction before word-final consonants, the only segment that resists the alternative Rhyme-simplifying process, i.e. the word-final consonant deletion, is /-s/. Indeed, as hinted at above, this consonant is retained as the plural ending in the nominal system of some Western Romance varieties. However, as shown in Section 3.2, in the varieties spoken north of the Carrara-Fano

length distinction has been increasingly limited to stressed syllables (Herman 1990): the bases have been set for the reduction of its independence from stress and for the later loss of vowel length distinctiveness in Romance languages. As a matter of fact, in these varieties, the stress-to-weight dependency relation has been definitively reversed[30]. According to Loporcaro (2011a) the open syllable stressed vowel lengthening is directly connected with the loss of the vowel length distinctiveness (Calabrese 2003) which, from Roman Africa, apparently spread to the whole Latin-speaking world (Herman 1968, 1990): as evidenced by a set of metalinguistic observations contained in the writings of Augustine (354-430) and Consentius (5th century), Latin speakers from Africa did not distinguish the phonological length of vowels[31], showing at the same time a tendency to lengthen the vowels occurring in open stressed syllables[32]. From this moment on, vowel length became an allophonic feature determined by the shape of the stressed syllable, which must hence be heavy, i.e. [ˈCVː] or [ˈCVC].

By the beginning of 5th century[33], then, the stress position is lexically determined and the "inherited contrastive V[owel]Q[uantity] plays no further role, either for stress assignment or for other aspects of the phonology: the proto-Romance system has arisen" (Loporcaro 2011a: 57).

Before zooming into the fate of Romance unstressed vowels, it is possibly interesting to spend a few words on the factors that could be taken into account to better understand the reasons behind the prosodic changes under concern. For instance, the intimate relationship between the processes targeting vowel length and stress seems to depend on the language-specific main phonetic correlate of prosodic prominence.

Even if the identification of the exact phonetic nature of a dead language's stress obviously cannot be confirmed by acoustic analyses, the diachronic processes whose action can be observed throughout all of Latin history, together with the typological survey of accentual systems, allow us to consider intensity as the main phonetic

---

isogloss, unstressed vowel reduction processes (syncope and apocope) create a vast number of new codas. This, in turn, means that the 'preference' for open syllables cannot be considered the only 'force' shaping the word structure.

[30] In Standard Italian, for instance, stress position is distinctive, and vowels lengthen if they occur in open stressed syllables ([ˈkaːne] 'dog' vs. [ˈkanːe] 'canes'). More precisely, vowel lengthening regularly applies to stressed penultimate syllables and, partially (Canalis & Garrapa 2012), to antepenultimate syllables, being instead blocked word-finally (Marotta 1985; Kaye 1992; Loporcaro & Bertinetto 2005).

[31] In his *De doctrina Christiana* (IV, 10, 24), for example, Augustine claims that it should be preferable to use the allotrope OSSUM, instead of ŎS 'bone', because the African Latin speakers could easily confuse it with ŌS 'mouth' (Loporcaro 2011a: 55).

[32] In his *Ars de barbarismis et metaplasmis* (V, 392 Keil), for instance, Consentius claims that African Latin speakers pronounce PIPER ([ˈpiper]) 'pepper' as [ˈpiːper], and PICES ([ˈpikeːs]) 'pitch' as [ˈpiːkes] (Loporcaro 2011a: 55).

[33] See Väänänen (1963), Pulgram (1975), Vineis (1984), Giannini & Marotta (1989) for different chronological and sociolinguistic accounts that date back the collapse of phonological vowel length.

correlate of Latin stress[34] (Allen 1973; Vineis 1997; Marotta 2006; Fortson IV 2011). Indeed, vowel reduction processes, as well as the lack of melodic accentual systems within the Romance world, typically characterize dynamic accentual systems (as opposed to melodic ones; Schmid 2012). As shown by *correptio iambica* and by the shortening of preconsonantal word-final unstressed vowels, as well as by the vowel reduction processes analysed in the next sections, vowel length is reduced in prosodically non-prominent position throughout a great part of Latin history (Section 3.2.1), being instead maintained under stress. However, due to the fact that length can be considered a correlate of intensity, the reduction (also orthographically registered; see Herman 1968, 1990) of the former can be considered a byproduct of the reduction of the latter (Crosswhite 2004). This can be noticed by comparing the relation between the intrinsic duration of different vowel qualities. Lehiste (1970), for instance, (articulatorily) correlates intensity with length in accounting for the recurrent asymmetries observable within the vocalic space of different languages: the lower the vowel, the more long and intense it is. Something similar is reported by Crosswhite (2004), who claims that "the more open the vocal tract is, the more sound can escape, thus increasing intensity". This has been observed at least since Fairbanks (1950), who describes an extremely robust positive correlation between a vowel's 'power' (i.e. intensity) and the size of jaw opening: the more open a vowel, the more intense it is. Obviously, this correlates with an increase in duration: the more open the vowel, the more time needed to reach the relevant vocalic (articulatory) configuration. As a consequence, if prosodic prominence has to be expressed by means of an increase in intensity, stressed vowels tend to be also lengthened. On the other hand, the opposite decrease in intensity of an unstressed vowel correlates with a decrease in duration. The duration reduction of unstressed vowels in both pre-Classical Latin and proto-Romance can thus be seen as a byproduct of the enhancement of the intensity asymmetry between stressed and unstressed vowels. It is interesting to point out that, as claimed by Crosswhite (2004), the decrease in duration just hinted at can also result in vowel undershoot:

> "prominence-reducing vowel reduction is a phenomenon in which relatively long vowels are replaced in unstressed position with shorter vowels of a similar quality. As such, prominence-reducing vowel reduction is somewhat similar […] to the phonetic phenomenon of vowel undershoot." (Crosswhite 2004: 224)

Thus, the centralization undergone by Western Romance unstressed vowels (Section 3.2) can be considered a further confirmation of the intensity nature of these varieties' prominence. Notice that, as discussed in the next section, this pattern also supports a view according to which pre-Classical Latin (and possibly, as

[34] Alongside typology and diachronic processes, a passage from Sextus Pompeius Festus (V, 126,31-127,11 GLK) gives us a clue about the nature of Latin accentuation: "illa syllaba plus sonat in toto verbo, quae accentum habet. Ergo illa syllaba, quae accentum habet, plus sonat, quasi ipsa habet maiorem potestatem." ["the more sonorous syllable within the whole word is the stressed one. Hence, the stressed syllable is the most sonorous, as if it had more power". EC].

suggested by Fortson IV 2011, all stages of Latin) tends toward the stress-timing pole of the syllable/stress-timing dichotomy (Pike 1945; Abercrombie 1967).

After this brief discussion of the phonological tendencies characterizing the transition from Latin to Western Romance, the next section reviews the two processes that affected unstressed vowels: syncope and apocope.

3.2 Vowel reduction and epenthesis in diachrony

3.2.1 Introduction

Unstressed vowel reduction processes are one of the main features of the 'second prosodic revolution' (Loporcaro 2011a), which turns the Latin phonological system into the different systems of Romance languages. More precisely, while the collapse of Latin vowel length contrast signals the transition from Latin to proto-Romance, syncope and apocope contribute to the split between Eastern and Western Romance, with unstressed vowels undergoing the reduction processes to a greater extent in the second group of languages. In turn, within Western Romance, Gallo Romance varieties underwent these processes earlier and more 'drastically'. Indeed, these segmental processes changed the prosodic structure of words: as a consequence of syncope and apocope, the complexity of syllable margins has been considerably increased (Marotta 2014). This way, the commonly held view according to which Romance shows a preference for open syllables (Lausberg 1967) cannot be maintained any more, at least not as the unique force driving the change of the prosodic structure of words (see also fn. 29): while widely attested processes such as word-final consonant deletion (Giannini & Marotta 1989) and its forerunner (Fanciullo 1997)[35], coda-weakening (Marotta 1995; Loporcaro 2011a)[36] tend to

---

[35] Fanciullo (1997) shows that the assumed tendency of late Latin to delete word-final codas must instead be considered a weakening process that removes phonological place features from coda segments. This process triggers the spreading of features from the following segment and results in the partial or total assimilation of the coda to the following onset. Indeed, he points out that the Pompeian Latin distich, "quisquis ama valia, peria qui nosci amare / bis [t]anti peria, quisquis amare vota" (C. Lat. AMAT, UALEAT, PEREAT, UOTAT) would be metrically ill-formed if we assume -T deletion. If, instead, we assume a process of gemination applying after third person verbs (still present in Sardinian and Souther-Italian varieties spoken in 'Lausberg's area'), we have something like "quisquis ama [bː]alia, [pː]eria [kː]uisquis amare vota", namely a metrically perfect structure. This gemination process, hence, must be considered to be the total assimilation of the (etymological) coda-onset sequence.

[36] This process accounts for the deletion of the non-homorganic segment in tri-consonantal clusters such as the one in SANCTUS > It. *santo*, Ro. *sânt* 'holy' (Marotta 1995), for the development of new geminate consonants in the C. Lat. to Italian evolution (Giannini & Marotta 1989) and for the synchronic constraints on possible coda segments in Italian (which, if not liquid or sibilant, receive their place feature specification from the following consonant).

simplify codas, other processes can be found within the Romance-speaking area that seem to aim for the opposite target. Indeed, the tendency to delete word-final consonants has been counterbalanced by the effect of apocope, which considerably increases the set of consonants occurring in Western Romance varieties in word-final position. More generally, syncope and apocope may increase the overall complexity of all the consonantal syllabic constituents. Indeed, together with the increase in complexity of codas resulting from apocope, syncope creates previously unknown onset clusters, as in Pian. [ˈsptsaːvnə] 'they were breaking', [ˈvdiːvnə] 'see IMP.3PL', [ˈʃcɛlːə] 'small bucket', [ˈfcøtːa] 'little old woman' (Loporcaro 2011a).

However, both tendencies just hinted at can be interpreted as epiphenomena of a more general diachronic drift in rhythmic structure. Indeed, their outcomes match the properties that contribute to the classification of a language as belonging to the "compensation" pole (Bertinetto & Bertini 2008) of the isochrony *continuum*[37], namely to the set of languages showing a great amount of coarticulation effects, such as the sometimes drastic compression of the segments occurring in prosodically weak positions (Schmid 2012). From the late Latin/proto-Romance stage, where syllabic isochrony was achieved by the leveling of stressed syllables' weight (ˈCVː=ˈCVC), the rhythmic structure of Western Romance drifts towards the opposite pole through a progressive process of unstressed vowel reduction. Actually, throughout the whole history of Latin, it is possible to find evidence that allows us to interpret its diachronic development as a pendulum-like movement from one pole to the other. Indeed, as pointed out above, in its archaic stage Latin a) is affected by syncope, b) shortens distinctively long vowels if unstressed and c) shows some clues of heterosyllabic *muta cum liquida* resyllabification (Loporcaro 2011a)[38]. Therefore, pre-Classical Latin can be understood as drifting towards the compensation pole. In the Classical period, instead, vowel length is preserved and *muta cum liquida* clusters become tautosyllabic. This can be interpreted as a move towards the opposite 'control' pole. In Western Romance, then, this tendency seems to have

[37] The one about isochrony is a long debated issue: since Lloyd James (1940), who described the rhythm of Spanish as a machine gun and that of English as a Morse code, languages have been split in two big categories. According to this view, there are syllable-timed languages, i.e. the languages whose syllables show the same duration, and stress-timed languages, where isochrony refers to inter-stress intervals (Pike 1945; Abercrombie 1967). A third rhythmic class was then added by Ladefoged (1975), who shows how languages such as Japanese display isochrony at the mora level. Henceforth, languages have been known to differ based on the constituent considered to be the minimal unit to build their rhythm on: mora, syllable or foot. However, these differences have been repeatedly questioned: the physical traces of isochrony are absent from the acoustic signal, and the rhythmic class of the various languages have been rather considered as an epiphenomenon of autonomous and interacting phonological processes/properties (Dauer 1983; Nespor 1990; Rasmus *et al* 1999; Schmid 2012). Therefore, isochrony is no longer considered a rigid rhythmic parameter, and languages are no longer classified as belonging to one of these three classes. They are rather considered as showing a tendency towards one of them.

[38] The same resyllabification process seems to come back on the scene in the Latin-to-Romance transition. Loporcaro (2011a), for instance, resorts to it to account for the change of stress position in words displaying *muta cum liquida* clusters, as in Sp. *entero*, Pt. *enteiro*, Fr. *entier*, It. *int(i)ero*, Log. *intreu*, where the penultimate stress position does not correspond to the Lat. antepenultimate stress on INTĔGRU(M) 'entire'.

turned once more towards the compensation pole (and once more again, quite recently, as evidenced by the control rhythmic nature of the currently spoken French; Matte 1982).

As for the causes of the pendulum-like movement of rhythmic structures, a possible explanation could be found in the intensive nature of the stress of Latin and of all its daughter languages (Section 3.1.2), which exerts an attractive force over the surrounding prosodically weak segments (Recasens 2014): the higher intensity and duration values of stressed vowels foster the loss of acoustic prominence of prosodically weak vowels, which therefore become shorter and less intense[39]. Once the prosodically weak segments have been reduced and eventually deleted, the compressing process stops, and the language starts in this way to move back towards the opposite (syllable-timing/control) pole. According to Loporcaro (2011a), it seems therefore that the 'motor' of this pendulum-like movement is partly language-internal. Indeed, describing French, he claims that

> "the very shift back to syllable-timing was the endpoint of the segmental reductions in prosodically weak positions typical of a stress-timed language: once, say, DOMINĬCAM or OFFICĪNAM, through several steps, were restructured as [diˈmɑ̃ʃ] 'Sunday', [yˈzin] 'factory', there was subsequently little left for reduction to apply to synchronically, and syllable-timing was restored." (Loporcaro 2011a: 106)

Beside this language-internal explanation, another 'motor' of the shift in rhythmic organization could be found in sub- or ad-strata conditioning: prosody is indeed one of the phonetic/phonological aspects that are first and more strongly influenced by a foreign accent (Trouvain & Gutt 2007). However, letting aside the 'quest' for the 'pendulum's motor', it here suffices to notice that the phonological characteristics just described are clear symptoms of the position reached by the pendulum in a given diachronic stage.

Like the other Northern Italian dialects, Carrarese and Pontremolese can be classified as compensation varieties. However, given their peripheral position with respect to the alleged centre of irradiation of the changes that contributed to moving the pendulum towards the compensation pole, it is useful to describe the relative chronology and geography of these changes' diffusion.

[39] Prince & Smolensky (1993) offer an optimality-theoretic formalization of this mechanism by means of a set of Alignment constraints favouring the coincidence of prosodically prominent positions with phonetically prominent segments.

3.2.2 Syncope

As recognized by Vineis (1997), syncope is a "structural permanent feature" of Latin and it is hence impossible to identify the starting point of this phonological process. According to Leumann (1977), Pensado Ruiz (1984) and Loporcaro (2011a) syncope has been active "from prehistoric times [of Latin history] down to the formation of the Romance languages" (Leumann 1977: 95): before the 4th century BC, i.e. before the generalization of the Latin stress assignment algorithm, short vowels occurring after the stress are either deleted (if the resulting consonant cluster can be correctly resyllabified: PARS < *parti-s 'part'; MORS < *morti-s 'death') or reduced/raised (FĀCIO 'do PRES.1SG' ~ CONFĬCIO vs. *CONFCIO 'produce PRES.1SG'). Vowel deletion and vowel reduction of archaic Latin can therefore be considered two different stages of the same process, the Sonority Sequencing Generalization (henceforth SSG; Sievers 1881; Jespersen 1904; Blevins 1995) operating as a blocking condition for the most 'dramatic' outcome production. As already hinted at in the previous section, this process was probably determined by the intensive nature of Latin stress:

> "in the classical period, the dynamic strength was somewhat relaxed, at least in the acrolectal varieties reflected in the literary language (and in classical metrics, possibly under Greek influence), to crop up again in the late Empire when, for socio-political reasons, the standard progressively lost its force. This historical development perfectly accounts for the relationship and continuity between early and late syncope, which is essential to the comprehension of later Romance evolution." (Loporcaro 2011a: 62)

The 'permanence' of syncope is evidenced by the *Appendix Probi*, which testifies the presence of this process in a late stage (about 5th century) of Latin (*calda* < CALIDA(M) 'hot f.s.'; *virdis* < UIRIDI(S) 'green'; *oclus* < OCULUS 'eye'). As shown in Tab. 3.5, the deletion of post-tonic unstressed vowels of proparoxitones affects all Romance languages:

Tab. 3.5 Syncope in Romance languages

CALIDA(M)	'hot'	Fr. *chaude*, It. *calda*, Log. *kalda*, Ro. *caldă*
UIRIDE(M)	'green'	Fr. *vert*, It. *verde*, Log. *bilde*, Ro. *verde*
HEDERA(M)	'ivy'	Sp. *hiedra*, Pt. *hera*, Cat. *eura*, Prov. *elra*, Fr. *lierre* vs. It. *edera*, Ro. *iederă*

In general, a tendency can be found for syncope to occur more pervasively as we move from Eastern to Western Romance, and to Gallo Romance in particular. In French, for instance, all Latin proparoxitones have been shortened by collapsing the post-tonic syllabic nucleus. This way, the scope of the stress has been reduced: oxitones and paroxitones are the only possible word-level prosodic structures.

Beside the second vowel of the proparoxitones, the vowels that occur between a secondary and primary stress are extensively deleted (CIUITATE(M) 'city' > O. Fr. *citet*, Sp. *ciudad*, It. *città*, Ro. *cetate*). However, as in the post-tonic context, pretonic syncope affects Romance varieties to slightly different degrees, showing, as expected, its maximal application in Western Romance. SEPTIMĀNA(M) 'week', for instance, became Sp. *semana*, Cat., Prov. *setmana*, Fr. *semaine* but It. *settimana*, Ro. *săptămână*. Secondary stress, hence, protects vowels from deletion, as does the pretonic position in tri-syllabic paroxitones (NEPŌTE(M) 'nephew' > Fr. *neveu*, It. *nipote*, Ro. *nepot*). However, these shelters have been overwhelmed in the Northern Italian dialects of Lombardy, Piedmont, Emilia-Romagna[40] and, crucially, also in Lunigiana. In these areas, indeed, pretonic mid vowels occurring in open syllables (primary or secondary via degemination) do not resist deletion[41]: for example, while the first (secondary-stressed) vowel of SEPTIMĀNA(M) 'week' resists deletion in some Western Romance varieties such as French[42], Spanish, Portuguese and Catalan, it is deleted in Northern Italian dialects such as Bol. (['stmɛːna]), Lomb. ([stmana]), Ort. (['ʃtmana]) and Pied. (['smana]). Similarly, vowels undergo syncope also in tri-syllabic paroxitones: while Lat. NEPŌTE(M) 'nephew' gives Fr. *neveu*, we have Pied. *əmvut* and Romagn. *ənvut* (Rohlfs 1966). Furthermore, these dialects tolerate syncope outcomes even if the resulting clusters violate SSG. Rohlfs (1966: 169), for instance, reports forms such as Bol. *pca* 'pity' (It. *peccato*) and *bca* 'butcher' (It. *beccaio*) with an even sonority contour, and Romagn. *mdor* 'harvester' (It. *mietitore*) with a falling sonority contour[43].

However, Northern Italian dialects can display a higher resistance to syncope with respect to French. In Fiorenzuola, for instance, we have both syncopated (['kudga] 'rind' < *CUTICA(M), ['laŋda] 'lamp' < LAMPADA(M) and un-syncopated (['semula] 'bran (flour)' < SIMULA(M)) etymologically proparoxitonic forms. On the other hand, in other varieties, such as Bol. (['lɛːgr(u)ma] 'tear' < LACRIMA(M), ['vep(e)ra] 'viper' < UIPERA(M)) or Lunigiana dialects (Carr. ['stom(ə)k], Ort. ['stomko] 'stomach' < STOMĂCHU(M), Carr. ['man(ə)ka], Ort. ['manka] 'sleeve' < MĂNĬCA(M)), forms can be found where reduction alternates with the deletion of the post-tonic unstressed vowel in, respectively, slow vs. allegro speech, as is the case for the syncope/reduction alternation in other languages (Coco 1970; Gsell 1996; Kager 1997; Harris 2011; Loporcaro 2011a).

---

[40] Rohlfs (1966), for instance, reports Pied. [tlɛ], Em. and Romang. [tlɛr] (< *TELARIU(M)). Within these varieties /a i u/ resist deletion (Loporcaro 2011a).

[41] The ban on pretonic mid vowel deletion in closed syllables, however, which is active in Emilian dialects (Loporcaro 2011a: 60), can be violated in Lunigiana varieties such as Ortonovese, where a vowel can be deleted if followed by a (etymologically coda) nasal consonant. In this case, the nasal is vocalized, thereby becoming a syllabic nucleus (Nov. [teŋ'pesta] vs. Ort. [tŋ̍'pɛsta]).

[42] It should be pointed out that in French it can actually be pronounced as either [sə'mɛn] or [smɛn]. The etymologically secondary stressed vowel can thus undergo deletion (Bürki et al. 2011).

[43] Actually, these dialects widely resort to prosthesis as a process to enhance consonant clusters' well-formedness, as in Em. *aldam* 'manure' (It. *letame*), Bol. *arveina* 'ruin' (It. *rovina*).

As already hinted at, French is the Romance variety which underwent syncope to a greater extent and earlier than other varieties, and can be considered the spreading centre of this process: while, in Gaul, its phonologization cannot precede the end of the 7th century, varieties such as Spanish (DOMINICU(M) > *domingo* 'Sunday') or Northern Italian dialects (Fior. *CUTICA(M) > [ˈkudga] 'rind') underwent syncope generalization after intervocalic voicing, i.e. after the end of the 11th century (Menéndez Pidal 1968).

Summarizing, the "structurally permanent feature" (Vineis 1997) of syncope, active along the whole Latin history, blows over in the transition from proto-Romance to Eastern Romance but continues to exert its effect on Western Romance, where it modifies the word structure of single varieties to a different extent: as far as the Northern Italian dialects are concerned, it applies much more in Piedmont, Emilia and Romagna than in Lombardy.

After word-medial vowels, the same reduction/deletion process affected the word-final vowels.

3.2.3 Apocope

In the transition from Latin to Western Romance, unstressed word-final vowels underwent reduction processes similar to the ones that affected word-internal vowels, with a first stage of generalized length neutralization[44], followed by a second one where different varieties undergo different degrees of reduction (Loporcaro 2011a). As a result, the five-vowel system(s) of proto-Romance result(s) in further reduced systems. Tuscan (along with Standard Italian), for instance, displays a four-vowel system where /u/ merges with /o/ ([ˈluːpo] < LŬPU(M) 'wolf'; [ˈkanto] < CANTO 'sing PRES.1SG'), while other varieties reduce the number of word-final unstressed vowels to three (Pt.: /ə/ < Ī Ĭ Ē Ĕ, /ɐ/ < A and /u/ < Ŏ Ō Ŭ Ū; Sp.: /e/ < Ī Ĭ Ē Ĕ, /a/ < A and /o/ < Ŏ Ō Ŭ Ū), two (Cat.: Ø < Ī Ĭ Ē Ĕ, /ə/ < A and /o/ < Ŏ Ō Ŭ Ū) and one (Occitan: Ø < Ī Ĭ Ē Ĕ, /a/ < A, Ø < Ŏ Ō Ŭ Ū; Surselvan: Ø < Ī Ĭ Ē Ĕ, /ɐ/ < A, Ø < Ŏ Ō Ŭ Ū; Fr. Ø < Ī Ĭ Ē Ĕ, /ə/ < A, Ø < Ŏ Ō Ŭ Ū). A rich variety can thus be observed in the degree of vowel reduction processes (i.e. reduction vs. deletion), but also in the strategies adopted (i.e. peripheralization vs. centralization) along both the diatopic and the diachronic[45] dimensions.

As in the case of syncope, Gallo Romance varieties are the ones that underwent the word-final syllable reduction process earlier and to the maximum extent. In

[44] As stated above, starting from the 3rd century BC, word-final unstressed vowels are progressively reduced (*correptio iambica*). In the 4th century AD, for example, -Ŏ (< Ō) was the prescribed standard PL.1 ending of verbs (Allen 1973). This process of length neutralization followed two different paths, whereby high short vowels were merged either with high long vowels, as in Sardinian (Ī, Ĭ > /i/; Ū, Ŭ > /u/), or with the long mid ones, as in the rest of the Romance world (Ĭ, Ē > /e/; Ŭ, Ō > /o/).

[45] It has to be pointed out that this process seems to be reversible (Loporcaro 2011a). In Castilian, for instance, between the 10th and the 12th century, final /e/ is variably deleted after coronals, but it has been restored during the second half of the 13th century because of the loosening of French and Catalan cultural influence (NĬVE(S) > *nieve/nief* > [ˈnje.βe] 'snow').

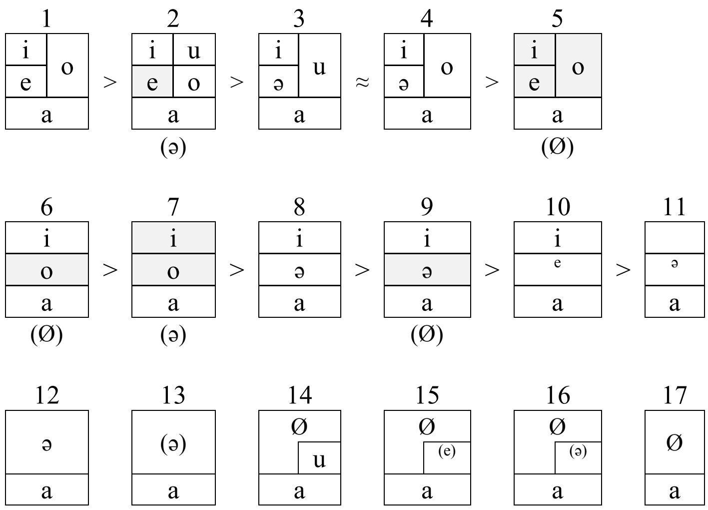
French, for instance, non-low vowels were first centralized and then, by the end of the 6th century, were eventually deleted, leaving /ə/ (< A) as the only unstressed word-final vocalic outcome. A similar pattern occurs in most Northern Italian dialects (except for Ligurian and Veneto varieties, which display a four-vowel system), where the non-low vowels underwent apocope (Mil. [ˈnœːf] < NOUU(M) 'new SG.MASC' vs. [ˈnœva] < NOUA(M) 'new SG.FEM')[46]. Interestingly, in Northern Italian peripheral areas such as the Modena province, a reduction pattern can still be found that corresponds to the centralization stage of O. Fr. (Pian. [ˈpɛvːrə] < PIPERE(M) 'pepper', [mi a ˈkãːtə] < CANTO 'sing PRES.1SG', [ti t ˈkãːtə] < *canti < CANTAS 'sing PRES.2SG', [ˈkarːə] < CARRU(M) 'cart'). Furthermore, non-low final vowels can be found in pre-pausal position in other peripheral dialects, such as that of Pianaccio (province of Bologna), being instead deleted in connected speech ([e ˈskrisːe] 'write PRES.3SG.MASC' vs. [e ˈskris na ˈletːra] 'write PRES.3SG.MASC a letter'). The same holds for the old stages of the dialects that currently display apocope's effect, such as Milanese (Contini 1935). Furthermore, even if in imperative forms such as Fior. [ˈbaːza] 'kiss IMP.2SG' the low vowel is preserved, the final /a/ cannot resist the prosodically required deletion: in order to avoid a proparoxitone resulting from cliticization, /a/ is deleted ([ˈbaːzla] vs. *[ˈbaːzala] 'kiss IMP.2SG her'), unless an unsyllabifiable consonant cluster is otherwise created ([ˈbazamla][47] vs. *[ˈbazmla] 'kiss IMP.2SG her for me'). The variation in apocope application occurring in Northern Italy's dialects gives us a synchronic picture of the diachrony of this process. In Tab. 3.6, for instance, a sample is presented of the different word endings allowed in the Northern Italian varieties spoken in a peripheral area such as the Tosco-Emilian Apennines, an area which comprises, crucially, Higher Lunigiana (vowels in grey boxes are neutralized to [ə] or Ø when they do not occur in phonological-phrase final position):

[46] As already hinted at, in Lunigiana the masculine plural morpheme /i/ resists deletion after non-nasal consonants. For instance, the Carrarese and Pontremolese cognates of It. *uomo* 'man' are, respectively, [ˈɔm] and [ˈɔm(uŋ)], the plural being [ˈɔmi] in both the dialects (It. *uomini*). In Carrarese, also PL.FEM /e/ resists deletion.

[47] The shortening of this stressed vowel is accounted for by a synchronic process of prosodic compensation (Marotta 1985): if, within a foot, some phonetic material is added to the right of a stressed vowel, the otherwise stressed long vowel is shortened.

Tab. 3.6 Apocope in Tosco-Emilian Apennines (from Loporcaro 2005-2006)

1 Aulla (MS); 2 Falcinello (SP); 3 Borgotaro (PR); 4 Fivizzano (MS), Terrarossa (MS); 5 Camporaghena (MS), Riolunato (MO), Lizzano (BO); 6 Sassalbo (MS), Comano (MS); 7 Gorfigliano (LU); 8 Licciana (MS); 9 Giuncugnano (LU); 10 Roggio (LU); 11 Pontremoli (MS); Sillano (LU), Gombitelli (LU); 13 Piandelagotti (MO); 14 Piacenza, Busseto (PR); 15 Casola (MS); 16 Travacò (PV); 17 common Northern Italian.



The varieties in Tab. 3.6 are arranged in three different rows: the first five dialects display the full range of possible vowels in phonological-phrase final position (showing a possible neutralizing effect elsewhere) and represent a pretty conservative situation. In the second row the dialects are presented which display a reduced vowel system. These varieties, spoken in Lunigiana and Garfagnana, allow only three vowels in phonological phrase-final position and show a tendency towards the reduction to schwa of mid vowels. Finally, the third row represents the dialects that go further in the word-final reduction process and should hence be considered the more innovative varieties: they heavily reduce the number of word-final vowels and show no difference between the vowel outcomes in different phrasal positions. This suggests that, while in the more conservative dialects the vowels are still present in the underlying representations of the words (they are still pronounced in phonological-phrase final position), in the more innovative ones the vowels are completely deleted from the underlying representations and cannot be retrieved. As shown in Chapter 5, as for the phonological phrase-final position, Carrarese system seems to coincide pretty well with that of Pontremolese (Tab. 3.6, number 11). Indeed, letting aside plural suffixes, they both delete word-final mid vowels (Luciani 2002; Maffei Bellucci 1977; Carpitelli 1995). However, to be more precise, Pontremolese is more likely to present in the same position a schwa-like vocoid which, under 'emphasis condition' can be lengthened and slightly rounded (Restori 1892; Giannarelli 1913; Carpitelli 1995; Savoia 1983). As shown in Chapters 5 and 7, these vocoids should be considered to be an articulatory/perception driven (enhanced) vowel-like release.

Summarizing, apocope follows syncope and, starting from France, where it can be considered complete by the end of the 8th century, it spreads to the rest of the Western Romance-speaking world, where it affects vowels with a different chronology and to a different extent. From this moment on, mutual intelligibility of former Late Latin speakers was increasingly threatened[48].

3.2.4 Epenthesis

While a considerable amount of work has been done on unstressed vowel reduction diachrony, the literature about the diachrony of epenthesis in Romance languages is not so plentiful. Some brief hints about it can only be found relative to its presence in Classical Latin, where it was "not regularly productive" (Lehmann 2005: 144), and to its diachronic development in Emilian dialects such as Modenese. As reported by Passino (2013), some descriptions have only been given in the first years of the last century by Bertoni (1905, 1925), who claims that syllabic consonants occurred in word-initial position as a consequence of syncope (*n̩vod* 'nephew', *r̩mnar* 'to number'), before developing a prosthetic vowel (*anvod* 'nephew', *armnar* 'to number') between the 14th and the 16th century. The lack of literature notwithstanding, it is hence reasonable to assume that the insertion of a nonetymological vocalic segment followed the processes which, by deleting unstressed vowels, generated consonant clusters that violate language-specific and/or universal sonority-related phonotactic constraints. Indeed, epenthesis has been interpreted as a synchronic repair strategy to solve some phonotactic ill-formedness (Repetti 1995; Loporcaro 1998; Hall 2011). Alternatively, it has been considered to be triggered by the need to abide by the template conditions of a given language (for instance fulfilling its minimum word size requirements; Olson 2003), or to enhance adjacent consonants' (place of articulation) discrimination (Hall 2006). Summarizing, hence, it helps to improve the well-formedness of a given phonological structure.

Furthermore, as shown by the phonetic data presented in Chapter 5 and by the phonological analysis in Chapter 7, this synchronic process represents the arrival point of a phonologization path that builds on phonetic conditions resulting from the adjacency of particular consonants, whose acoustic vowel-like properties (such as stops' release and sonorants' intrinsic formant structure) have been gradually enhanced and/or reinterpreted by listeners as cues for a vocalic segment. Crucially, these necessary (but non-sufficient if not complemented by some phonological principle) conditions are supplied by the completion of the vowel reduction

[48] Given that the Council of Tours (813) advised the use of "rustica Romana linguam" for sermons, by the mid-8th century it seems that uneducated people were no longer able to understand priests' Latin.

processes: the phonologization process can only start once syncope and apocope become regular phonological processes of a given language.

After reaching this stage, the phonologization process can go on and the epenthetic vowel can be eventually lexicalized (Bermúdez-Otero in press). This is what happened in Emilian dialects, the Northern Italian varieties that earlier and hence more drastically underwent the effect of unstressed vowel reduction. As argued by Passino (2013: 27), Emilian speakers display a set of non-etymological vowels that should be considered "mobile, alternating vowels whose melody is recorded in the lexicon but not linked to a skeletal position"[49]. Indeed, she claims that their quality cannot be predicted either by the adjacent consonants' quality, nor by that of the closest stressed vowel, as shown by the data from Bolognese presented in Tab. 3.7:

Tab. 3.7 Bolognese non-etymological vowels (adapted from Passino 2013: 16)

a̲l ˈgaːl	'the cock'	*te e̲t ˈstɛː*	'you SUBJ.2.SG stay'
æ̲l gaˈlen	'the hen PL'	*t a̲t ˈftess*	'you SUBJ.2.SG REFL.2.SG dress'

As can be noticed, the non-etymological (underlined) vowels show different qualities even if followed by the same consonant. She claims, therefore, that they cannot be accounted for by a synchronic epenthetic process, which would either insert a fixed-quality vowel, or a vowel whose quality is spread from some adjacent 'donor'. Their melody should hence be considered to be stored in the lexical representation of those words. Until we have a more detailed analysis of both the phonological and phonetic properties of these non-etymological vowels, it is interesting to point out that Bolognese displays forms in which the presence of the (formerly) epenthetic vowel does not alternate with its absence. This means that these non-etymological vowels' presence in the phonetic string is not triggered by the need to solve a phonotactically illicit sequence. This is shown, for instance, by the forms presented in Tab. 3.8:

Tab. 3.8 Lexicalized prosthetic vowel

a̲lˈdaːm	'manure'	*i a̲lˈdaːmi*	'manure PL.'

In this case, the prosthetic vowel of the singular form is also kept in the plural, even if the presence of the article would allow for the correct application of the syllabification algorithm to the cluster resulting from the syncope of Lat.

[49] Assuming a CVCV phonological approach (Scheer 2004), the linking of these floating vowels to the correct skeletal slots is determined by the need to avoid a sequence of two empty nuclei or, in clitic/verb compounds, by the ill-formedness of particular consonant sequences.

LÆTĀMĔN. The absence of alternation, hence, constitutes a strong argument for the lexical status of some non-etymological, formerly epenthetic vowel[50].

[50] As reported by Daniele Vitali (pc), nonetymological lexicalized vowels can also be found throughout some verbal paradigms.

PART II: PHONETICS

4 Fieldwork

"Magari la füs vera che cun l'Autostrada
a s'cambiësë la facia dl'intera cuntrada.
A nü vrës ch'la dvëntës, a n'al digh gnanc tant fort,
Un bèl nàstar négar d'na curùna da mort!"[51]

L'autostrada, Michelotti (2005)

In the following sections the reader is provided with the results of the experimental work carried out in order to substantiate both the mostly auditory-based descriptions presented by Restori (1892), Maffei Bellucci (1977) and Luciani (1999, 2002), and, crucially, the phonological analysis presented in Chapter 7. An account is hence given of the fieldwork performed in Carrara and Pontremoli, the results of which are acoustically and statistically analysed in Chapter 5.

4.1 Introduction

A means to enhance the political unification of a nation has often been the pursuit of cultural and, crucially, linguistic homogenization. The relative delay of Italy in this respect (it was politically unified in the 1861), together with the high degree of illiteracy (in 1861 it was about 78%), allowed the Italian linguistic variation to be well preserved until quite recently (De Mauro 2002). This notwithstanding, the knowledge and use of dialects have been increasingly undermined: Standard Italian, formerly used in a linguistically diglossic system, has been gradually substituted to the dialects, its context of use progressively widening (Loporcaro 2009: 174). Hence, after a stage of bilingualism, a significant percentage of Italian speakers currently shows only a passive competence of the dialect spoken by the preceding generation (see Manzini & Savoia 2005, I: 29-34 for some quantitative data). All of this has, of course, a kind of macabre outcome: we're attending the not-so-gradual demise, the 'gradual language death' (Wolfram 2002), of several dialects and cultures, a demise which the last speakers of the dialects under concern in the present work can describe, and feel the progress of. It's at the same time interesting and sad to listen to those speakers' stories of feeling ashamed to speak in their mother tongue, and about the sometimes scrappy manners their parents resorted to to convince them to forget their mother tongue and culture for the

[51] "If only were it true that the highway/ could change the face of this whole area./I wish it won't become – and I am not saying it out loud -/a beautiful black ribbon on a funeral wreath".

sake of progress; a progress which then, by means of an infrastructural and media revolution (Pasolini 1973)[52], accomplished the postunitarian political intent[53].

The same infrastructural revolution, however, made the travel side of the fieldwork quite easy. Indeed, even if in the first decades of the last century the dialectological and anthropological surveys were carried out by bike (Bottiglioni 1911) or by donkey (Caselli 1933[2010]), Carrara and Pontremoli are nowadays extremely easy to reach by car or public transport. As pointed out in Chapter 2, these two towns are situated extremely close by (Carrara) or alongside (Pontremoli) some important commercial and pilgrim routes, such as the pre-Roman path from the modern Lucca to Piacenza, the Via Aurelia (Rome - Arles), the Via Francigena (Rome - Canterbury) and a pair of routes from Luni (one of the most important Roman harbours, nowadays in the Ortonovo district) to the Emilian main centres. Well, as a consequence of the ‘infrastructural’ revolution Pasolini referred to, a consistent part of these routes has been covered by tarmac, significantly reducing the time needed to move from one centre to the next. This ease of movement, together with the proximity of the author’s village (Ortonovo), made it possible to carry out several rounds of interviews, which turned out to be extremely helpful in fine-tuning the questionnaire presented in the following section.

4.2 The questionnaire

Given the purpose of the present work, to provide a description of the interplay between the phonetic/phonological processes of unstressed vowel reduction and

[52] “Oggi […] l’adesione ai modelli imposti dal Centro, è totale ed incondizionata. I modelli culturali sono rinnegati. L’abiura è compiuta […] Come si è potuta esercitare tale repressione? Attraverso due rivoluzioni […]: la rivoluzione delle infrastrutture e la rivoluzione del sistema d’informazioni. Le strade, la motorizzazione ecc. hanno ormai strettamente unito la periferia al Centro, abolendo ogni distanza materiale. Ma la rivoluzione del sistema d’informazioni è stata ancora più radicale e decisiva. Per mezzo della televisione, il Centro ha assimilato a sé l’intero paese, che era così storicamente differenziato e ricco di culture originali. Ha cominciato un’opera di omologazione distruttrice di ogni autenticità e concretezza.” (“Today […] people’s adherence to centrally-imposed models is total and unconditioned. Cultural models have been repudiated. Abjuration has been committed. […] How could such repression be imposed? Through two revolutions […]: the revolution of infrastructures and the revolution of media. Roads and the wide availability of cars have now closely connected the suburbs to the center and overcome the actual geographical distances. However, the revolution of media has been even more radical and decisive. Through television, the center assimilated the whole country, which was historically diverse and included many original cultures. It started a wave of homologation that destroys any authenticity and concreteness.” [EC])

[53] As for for the role of television in language change, see Stuart-Smith, Pryce, Timmins & Gunter (2013), where they show how broadcast media can contribute to the acceleration of an ongoing language change. However, they explicitly claim that “this role is neither necessary nor sufficient for ‘causing’ these changes […], since they appear to have been underway for decades. Nor is there any reason to assume that media should be essential for linguistic diffusion.” (Stuart-Smith, Pryce, Timmins & Gunter 2013: 531)

epenthesis with respect to the phonologization issue, a questionnaire (Section 9) has been drawn up which aims at the elicitation of a set of forms in which the deletion of the unstressed vowels generates etymologically unattested clusters, both abiding by and violating SSG. Furthermore, in order to evaluate the relevance of both the word- and phonological phrase-final contexts and to test in this way the hypothesis about the trajectory the phonological change is assumed to advance along over time (Bermùdez-Otero in press), special attention has been paid to forms that undergo reduction/deletion in post-tonic contexts[54].

To select the relevant forms, the available literature on the two dialects was used, namely Restori (1982), Bottiglioni (1911), Giannarelli (1913), Maffei Bellucci (1977), Savoia (1983), Carpitelli (1995), Luciani (1999, 2002) and Barbera (2008). This made it possible to pick up forms belonging to the lexicon of the two dialects, as well as to check the consistency of the collected data with the descriptions already available.

Given their relevance for the triggering of epenthesis of both the unstressed vowel reduction/deletion processes and the relative sonority degree of the consonants that cluster up, forms were selected that belong to the two categories presented in Tab. 4.1, namely to the Latin classes of paroxitonic and proparoxitonic words. In Tab. 4.1 the brackets indicate the optionality of the consonant and ‘=’, ‘>’ and ‘<’ specify, respectively, that the first consonant is identical, higher and lower with respect to the second consonant in terms of sonority (Parker 2011). Under the templates, the Standard Italian (in italic) and Latin (in capital letters) forms whose dialectal outcomes have been considered for the phonetic and phonological analysis are presented. The upper-left box is shadowed because no Carrarese or Pontremolese form dispays a word-final consonant cluster with a sonority plateau: as a consequenc of degemination, geminates have been reduced to singletons.

Tab. 4.1 Selected forms’ template

Paroxitones	Proparoxitones
	ˈσ.C_1V.C_2(C)V ($C_1=C_2$)
	selvatico SILVĀTĬCU(M) ‘wild SG.MASC’
	tiepido TĔPĬDU(M) ‘lukewarm SG.MASC’
ˈ(C)(C)(C)VC.CV	ˈσ.C_1V.C_2(C)V ($C_1>C_2$)
colpo CŎL(Ă)PHU(M) ‘stroke’	*stomaco* STŎMĂCHU(M) ‘stomach’
forno FURNU(M) ‘oven’	*manico* *MĂNĬCU(M) ‘handle’
merlo MĔRŬLU(M) ‘blackbird’	
ˈ(C)(C)(C)V(C).CCV	ˈσ.C_1V.C_2(C)V ($C_1<C_2$)
libro LĬBRU(M) ‘book’	*giovane* IŬVĔNE(M) ‘young SG.MASC’
magro MĂCRU(M) ‘thin SG.MASC’	*libero* LĪBĔRU(M) ‘free SG.MASC’
quattro QUATŬŎR ‘four’	*tenero* TĔNĔRU(M) ‘tender SG.MASC’
	asino ĂSĬNU(M) ‘donkey’

54 The final draft of this questionnaire is partly the result of a repeated discussion thereof with Giovanna Marotta.

The forms listed in Tab. 4.1 were inserted in a set of carrier sentences that were structured in the most suitable way possible to be as fitting as possible to the everyday cultural and social context of the speakers. Furthermore, as shown in Tab. 4.2, in order to evaluate both the *sandhi* effects and the phonologization's direction, the same form is followed in different sentences by a phonological phrase boundary, a consonant-initial word, a vocalic suffix and a vowel-initial word. The suspension full stops indicate that the written sentence actually belongs to a larger one: during the interview, the first 'half' sentences, namely those followed here by the suspension full stops, have been read (by the interviewer) and uttered (by the informant) together with their second 'half', namely with those preceded here by the suspension full stops.

Tab. 4.2 Some example of the carrier sentences

a. *colpo* CŎL(Ă)PHU(M) 'strike'

i. Gli è venuto un *colpo*
'He had a stroke'
ii. Stai attento a non prendere un *colpo* di sole
'Be careful not to get sunstroke'
iii. Gli ho dato un paio di *colpi*
'I hit him a couple of times'
iv. Gli ho dato un *colpo* o due
'I hit him one or two times'

b. *libro* LĬBRU(M) 'book'

i. Mi sono comprato un bel *libro*
'I bought a nice book'
ii. E' un *libro* nuovo nuovo
'It's a really new book'
iii. Ho comprato un paio di *libri*
'I bought a couple of books'
iv. Ho trovato un bel *libro* antico
'I found a nice ancient book'

c. *selvatico/-a* SILVĀTĬCU(M) 'wild SG.MASC/FEM'

i. Questa carne sa di *selvatico*…
'This meat tastes like wild (animal)…'
ii. …ma di *selvatico* buono
'…but like tasty wild (animal)'
iii. No, non è *selvatica*
'No, it's not wild (f.)'
iv. Allora? Sa di *selvatico* o no?
'So? Does it taste like wild (animal) or not?'

d. *stomaco* STŎMĂCHU(M) ‘stomach’

i. Mi è venuto un bel bruciore di *stomaco*
‘I got strong heartburn’
ii. A forza di bere vino ho tutto lo *stomaco* rovinato
‘Because of my heavy wine drinking, my stomach is all damaged’
iii. Per fare la trippa non vanno bene tutti gli *stomaci*: ci vuole quello bovino
‘To make tripe, not any stomach is suitable: you need the bovine one’
iv. A forza di bere così tanto ho tutto lo *stomaco* annacquato.
‘Because I’ve been drinking so much, my stomach is all watered-down’

e. *giovane* IŬVĔNE(M) ‘young’

i. Luigi è ancora troppo *giovane*
‘Luigi is still too young’
ii. Lui è *giovane* davvero…
‘He is really young…’
iii. …lei invece non è così *giovane*
‘…she’s not that young instead’
iv. *Giovane* e un po’ scemo
‘Young and a little silly’

As a result, 42 sentences were made up, which were then read to the informants in Italian. They were asked to translate the sentences in their own dialect at a self-controlled normal speech rate.

Before the submission of the questionnaire, all speakers were asked to introduce themselves in their own dialect, and special attention was paid to the description of the place where they were born and raised, of their parents, of the school they attended and of the places where they may have moved for a job. Furthermore, during this preliminary part the interviewer spoke in his own dialect (Ortonovese; see Section 2.1). This allowed the interviews to occur in the most informal register possible, thereby removing the conditioning of Standard Italian on speakers’ dialectal production. At the same time, together with biographical data about the speakers (which were also collected by means of a dedicated form), a set of spontaneous speech linguistic data were collected for comparison with the elicited data. Furthermore, before beginning the recording session, the informants were asked to sign a form consenting to the use of the recordings for our scientific purpose.

It should be pointed out that some months before the actual recording, the same questionnaire had been submitted by email to ED and LB (see Section 4.3), two speakers who regularly write poems in Carrarese and Pontremolese, respectively. They had been requested to translate the sentences, transcribe them as accurately as possible and send them back to the author. Even if they don’t have probative value from the phonetic point of view[55], these kinds of data can be considered to provide a clue about the speaker's phonological awareness of the reduced and epenthetic vowels. Indeed, in the case that the spectrographic analysis displayed a weak vowel-like periodic structure which is supposed to be intrusive, the speakers' transcriptions, together with tests where speakers are asked to choose between two different spellings, can help us to understand whether the periodic structure under concern is perceived and interpreted by the speaker as a syllabic nucleus or rather as a vowel-like release/intrusive vowel (Hall 2006), namely as a non-phonologized phonetic (by-)product (Silverman 2011). Hall (2011), for example, reports that if asked to transcribe their colloquial pronunciations, her Lebanese Arabic informants write the epenthetic vowels. This fact has been interpreted as a sign of these speakers' awareness of the epenthesized segments' (phonological) presence. If, instead, the non-etymological vowel were not part of the relevant phonological representation, then the speakers would be expected not to write it down. Similarly, turning to the perception side, a speaker who's not phonologically aware of an epenthetic segment's presence is expected to prefer forms where that segment is absent. A piece of evidence pointing in this direction has been put forward by Pearce (2004). She presents a set of Kera[56] speakers with two different spellings for some 'acoustically CVCVCV words' whose second V has been analysed as epenthetic. In this case the speakers preferred the CVCCV spelling (discarding the CVCVCV one). This can be interpreted as evidence of the fact that, while the epenthetic vowel is part of the Lebanese Arabic speakers' phonological representation, it is not part of the Kera speakers'.

Turning back to our dialectal data, if the epenthetic vocoid were phonologically represented, it would be reasonable to assume that we would find it in the transcriptions, and that it would be absent if it were not phonologically there. In other words, in the first case it would be phonologically similar to the etymological vowels, whereas it would more likely be a 'non-phonologized phonetic (by-)product' in the second. The transcriptions produced by ED and LB were then compared with the uttered versions produced by the same speakers to check the distance between the two modality-dependent productions. What emerged was a transcription consistent with the acoustic characteristics of the data.

With the same aim, the recorded data were compared with the poetic literary productions the author has been able to find (Michelotti 2005; Bertocchi 2006 and Borgioli 2008). Also in this case, the graphical presence vs. absence of the alleged epenthetic vocoid was considered to be a likely reflex of its phonological presence vs. absence. Acknowledging the risk of resorting to an artificial language such as poetic language for dialectological purposes, the metrical and rhythmical competence of these poets, who are more used to oral than to written means, together with the lack of a shared writing norm, can indeed be considered a subsidiary tool for the study of the phonological competence of these dialects' speakers.

[55] However, as claimed by Montgomery (1999: 25), "unconventional spellings almost always turn out [...] to be phonetically based in whole or in part".

[56] Kera is an East Chadic language that, crucially, lacks a writing tradition.

4.3 The speakers

Because of the unstoppable process hinted at in Section 4.1, the recruitment of informants who still consider the dialect their mother tongue, who still use it in their everyday life (at least in a 'diglossic' way) and who are at the same time willing to be recorded turned out not to be such an easy endeavour. The inexorability of this process notwithstanding, or maybe thanks to it, literary contests and web pages have been organized which aim at the preservation of the two dialects. Using these has made it possible to reach the speakers who, according to the promoters of these cultural efforts, are the ones who best know and speak the two dialects[57]. Several speakers per dialect were then interviewed. However, due to the sub-optimal recording conditions and to some inadequacies of the speakers' speech, only five speakers per dialect were selected for the present work. The complete list of speakers and the relative sociolinguistic information can be found in Section 10.

As can be verified in Section 10, all of the interviewed speakers claim to use the dialect in ordinary conversations, as their primary language, resorting to Italian in more formal contexts. In other words, they use their dialect as the 'low variety' of a diglossic system, Italian constituting the 'high variety' (Berruto 1987). Regarding place of birth, they were all born either in Carrara or in Pontremoli, where they spent the majority of their lives. A slightly lower degree of homogeneity can be found in terms of the place of birth of their parents; in 2 cases (ED and GB), one of the parents came from a place other than Carrara or Pontremoli. There is some more variation concerning age and level of education, the speakers ranging, respectively, between 59 (MV f.) to 85 (AM m.) and between the first years of elementary school (AM) and a master's degree (LB). Finally, while for Carrarese it was possible to interview two female and three male speakers, we managed to find only male Pontremolese speakers. However, as pointed out in Section 5.1.2, the problem of the asymmetrical gender distribution for a graphical representation of the data has been solved by means of a formant normalization procedure. As for the other sociolinguistic variables, the tiny differences that have just been mentioned (parents' places of birth and level of education) turned out not to influence the phonetic data we're interested in.

4.4 The recording

The sentences uttered by the informants were recorded with a solid state recorder Marantz PDM671 and a microphone Sennheiser MKE 1 (levalier omnidirectional condensator) preamplified by a Sennheiser MZA 900P-4, the speech being low-pass filtered and digitized at a sampling rate of 22,050 Hz.

---

[57] Special thanks for the retrival of Pontremolese speakers go to Elisabetta Carpitelli, whose deep knowledge of Higher Lunigiana allowed the author to choose the right informants.

All of the speakers were individually recorded in their own houses, in recording sessions of about one hour and a half long. During these sessions, close attention was paid to reduction of the background noise and echo by choosing furnished rooms and, in the event that the outside noise could threaten the recording quality, by closing the shutters.

It was possible to collect about 10 hours of speech in this manner, which was then acoustically analysed by means of the PRAAT speech processing software (Boersma & Weenink 2013). This software made it possible to perform an analysis of the segments' spectral content on the basis of both a wide-band spectrogram and the wave-form windows.

All aspects of the acoustic analysis were carried out in the Laboratory of Phonetics of the University of Pisa under the supervision of the professor Giovanna Marotta. The results of this analysis are presented in the next section.

5 Acoustic and statistical analyses

5.1 Introduction

In the present section, the results of the analysis of the data collected in the fieldwork described in Chapter 4 are presented. After a brief description of the methodology (Section 5.1.1) and normalization method (Section 5.1.2), the reduced vowels (Section 5.2) of the penultimate stressed words (Section 5.2.1) of both Carrarese (Section 5.2.1.1) and Pontremolese (Section 5.2.1.2) are discussed. Similarly, the reduced vowels of the antepenultimate stressed words (Section 5.2.2) are presented in Carrarese (Section 5.2.2.1) and Pontremolese (Section 5.2.2.2). A section then follows where the intrusive/epenthetic vowels are described (Section 5.3) for Carrarese (Section 5.3.1) and Pontremolse (Section 5.3.2).

5.1.1 The acoustic analysis

As already mentioned in the previous section, the data were acoustically analysed with PRAAT (Boersma & Weenink 2013). By means of both the (wide-band) spectrogram and the wave-form windows, it was possible to isolate the relevant segments and measure their formant structure and length.

As for the formant structure, the default settings (which identify five formants up to 5,000 Hz) of the built-in LPC algorithm turned out to be sufficiently accurate for most of the data. However, in order to find out the exact frequency values, it was sometimes necessary to increase the number of formants because of both the tendency of F1 and F2 to merge in the back vowels and the coarticulation effects characterizing certain speakers' speech. The accuracy of the frequency values returned by the LPC algorithm was checked by means of a close visual examination of the spectrogram window representation. On the other hand, since the aim of the formant analysis was to measure the first two formants, it was not necessary to increase the frequency span of the spectrogram window beyond the default of 5,000 Hz. Indeed, since Fant (1968), it has been repeatedly shown that F1 frequency corresponds to both the articulatory and perceptual dimensions of vowel height, while F2 frequency corresponds to the front/back dimension, and crucially, that these two formants occur below 2,500 Hz. Together, F1 (roughly 200 to 800 Hz) and F2 (roughly 600 to 2,200 Hz) suffice to determine the quality of the vowels under analysis. Furthermore, the first two formants were found to better resist conditioning due to a low quality recoding (Ferrari Disner 1983) and, in this respect, constitute a significant indication for vowel identification.

As for the selection of the vowel interval to measure the F1 and F2 frequency of, the large amount of coarticulation effects just hinted at, together with the reduced duration (and intensity) of the unstressed vowels under analysis, didn't allow for the selection of the same time interval for every vowel token. Indeed, depending on both the shortness and the consonantal context the analysed vowel occurs in, the formant transitions can be distributed along a fairly large vowel interval in its initial as well as final parts (Harrington 2010). As a consequence, the mean frequency values were calculated of the longer steady state intervals of F1 and F2, which are considered the acoustic by-product of the target configuration the articulators aim at in producing a vowel. The length of the selected steady state intervals shows a great degree of variation, ranging from a maximum of about 200 ms in the longest stressed vowels to the minimum found in some schwa-like unstressed vocoids. In this case, the F1 and F2 frequencies were calculated at the point where F1 displayed the highest frequency value (Harrington 2010).

As for the vowel length measuring, close examination of both the spectrogram and the wave-form representations allowed us to pinpoint the vowel boundaries, which were identified through the co-occurrence of a drastic change in the amplitude of the waveform, in the energy of the formants (particularly of F2) and in the periodicity of the signal (Stevens 2000).

The methodology just described was applied to both unstressed and stressed vocoids. As for the latter, the values were calculated of the cardinal vowels occurring in the forms whose unstressed vocoid values are taken into account for the analysis. This made it possible to define the main acoustic coordinates of Carrarese and Pontremolese vocalic space contours that, in turn, are resorted to to arrange, respectively, the unstressed and intrusive vocoids under concern. Furthermore, the recording of stressed vowel acoustic values allowed us to perform the statistical analyses concerning the ustressed/stress vowel duration ratio (Sections 5.2 and 5.3).

Since the carrier sentences were uttered by every speaker only once, every target form is presented just once per context. Hence, the methodology just described was applied to single tokens, the results displayed in Sections 5.2 and 5.3 being therefore absolute values.

The results of the analyses just described were afterwards organized according to the metrical structure of the word (paroxitones vs. proparoxitones) in which the vowels were analysed, to its phonological context of occurrence (before a consonant-initial word vs. before a pause) and to the dialect where the word comes from. To improve the readability, the data were then integrated in a set of tables. Furthermore, the vocalic tokens under analysis were plotted together with the stressed vowels of the relevant dialect. However, given the lack of homogeneity in speakers' age and gender, the vocalic tokens represented in the plots were first normalized.

5.1.2 The normalization

As stated by Flynn (2011),

> "no two speakers' vowel tracts share the same dimensions. As a consequence, the 'same' phonological vowel uttered by different speakers will show formants at different frequencies due to the different sizes of the speakers' vocal tracts. […] It can be difficult, then, when comparing the positioning of

vowels within speakers' vowel spaces, to identify whether differences in formant values are due to a linguistic change in the vowel system, or are merely due to the anatomical and physiological differences between speakers. It has been acknowledged that the raw Hertz formant frequencies of different speakers are not directly comparable, and that it is not ideal to plot formant values in Hertz from different speakers on the same formant chart […] The solution is, in principle, to remove as much of the inter-speaker formant value differences due to biological differences as possible. This would leave quantities unaffected by the size of a speaker's vocal tract, and so would be directly comparable." (Flynn 2011: 1)

Since the aim of the present work requires close examination of the distribution within the vowel space of two adjacent vowel clouds ([ɐ] and [ə]), and because of the biological (age and gender) differences of the recorded speakers, the solution Flynn (2011) hints at above turns out to be extremely relevant for the correct comparison of the row frequency values collected by the acoustic analysis of the present data. For this reason, a process of vowel formant normalization has been applied to the Carrarese and Pontremolese data. Among the various normalization methods available on NORM (Thomas & Kendall 2007), both the Lobanov z-score and the Watt & Fabricius modified S-centroid procedures were tested on the recorded data. The former turned out to be preferable because of the 'skewing' problems the latter has with respect to the low vowels (Flynn 2011; Fabricius et al. 2009). Since one of the epenthetic vowels of Pontremolese occupies a low portion of the vowel space, the 'skewing' problem of the Watt & Fabricius modified method turns out to be serious enough to avoid this method and opt instead for the Lobanov z-score procedure, which is generally presented as the best one by the relevant publications about normalization methods (Adank et al. 2004; Flynn 2011; Fabricius et al. 2009). The Lobanov z-score procedure is a vowel-extrinsic, formant-intrinsic and speaker-intrinsic method, which means that in order to normalize a vowel formant, it takes into account (the means and the standard deviations of) the correspondent formant values (formant-intrinsic) of all of the vowels (vowel-extrinsic) that make up the phonological vowel system of a single speaker (speaker-intrinsic).

Thanks to this procedure, it has been possible to correctly compare and plot together the different phonetic realizations of the same phonological segment as uttered by the various speakers of each dialect, thereby nullifying the conditioning of the speakers' biological differences in frequency values of the vocalic segments under concern. The plotting and the statistical analysis of the data were performed by means of the SYSTAT 13 software (Wilkinson 2009). As shown in the following sections, the vowel tokens were clustered together in a set of clouds, according to the (phonological) vowel type they are the realization of. Furthermore, Gaussian bivariate confidence ellipses were drawn for every vowel cloud. These ellipses are centred on the sample means of F1 and F2, their major axes being calculated on the basis of the two formants' standard deviations and their orientation on the covariance between F1 and F2. The size of the ellipses was chosen by setting the probability value to the default value of 0.6837, which means that the probability for a vowel token represented on the plots to occur inside of the ellipses is about 68%.

In the next sections, the Carrarese and Pontremolese data for which the analysis methodology has just been discussed are presented both in their row acoustic (tables) and normalized version (plots). Following the presentation of the data relative to the unstressed vowel reduction processes (Section 5.2), the description of the data concerning the epenthetic/intrusive vowels are displayed (Section 5.3).

5.2 The reduced vowels

As discussed in Chapter 2, Carrarese and Pontremolese are two Gallo Italic dialects belonging to the Western Romance family, namely to the Romance languages that underwent the phonological process which gradually reduced unstressed vowels. The resort to the ‘gradualness’ concept implies that variation can be found within the relevant geographical domain as far as the degree of unstressed vowel reduction is concerned (Section 3.2). Therefore, in the following sections, the data resulting from the fieldwork and their acoustic and statistical analyses are presented in order to substantiate the diatopic micro-variation observed in this geographical area.

5.2.1 Paroxitones

As reported by relatively recent dialectological literature on the two dialects (Luciani 2002; Maffei Bellucci 1977), both Carrarese and Pontremolese underwent a phonological process that categorically deleted word-final mid vowels[58]. However, it has also been claimed that it is possible to perceive a word-final short vocoid (Restori 1892; Giannarelli 1913; Maffei Bellucci 1977; Savoia 1983), a kind of vowel-like release whose presence can be noticed also in the acoustic representation (Carpitelli 1995). The same authors claim that its phonetic realization is (functionally) conditioned by the need to ease the pronunciation of the otherwise ‘difficult’ consonant clusters. Indeed, while no trace of it is usually found in the forms ending with a single consonant (It. [ˈtutːo] ‘all m.’, [ˈnaːzo] ‘nose’, [ˈkaːne] ‘dog’, [ˈmuːro] ‘wall’ vs. Carr. and Pontr. [tut], [naz], [kaŋ], Carr. [mur], Pontr. [myr]), it can occur when the word ends with a primary or secondary consonant cluster, namely as the outcome of both apocope and its interaction with syncope. In any case, when this sound occurs, its acoustic characteristics make it different from the other vowel. Indeed, Restori (1982) explicitly claims that

> “the word-final voiceless -ö is so hardly distinguishable that, not to give it […] the same relevance of the other sounds, I had to resort to a special

[58] An indication of the speakers’ awareness of the outcome of this process can also be found in the literary production of both the dialects (Michelotti 2005; Bertocchi 2006; Borgioli 2008), where the etymologically word-final vowels are constantly dropped.

orthographic notation, -°. The quality of this sound is so indistinguishable that, rather than a real sound, I would define it a buccal resonance." [59] [EC]

In the following sections, the forms are presented which etymologically showed a penultimate stressed syllable, and which therefore display a word-final consonant cluster as a result of apocope.

5.2.1.1 Carrarese

In Tab. 5.1 a selection of Carrarese penultimate stressed forms is presented. As can be noticed, the result of the acoustic analysis is shown for the 5 speakers (AC, BD, ED, MV and AM) whose recording have been taken into account. For each of them, three forms are presented which, after the apocope, show either a decreasing (*colpo* 'stroke' and *forno* 'oven') or an even (*merlo* 'blackbird') sonority contour. Their Italian cognate[60] occurs in the second column and their phonetic (large) transcription in the columns with the 'Transcr.' tag. In this last column, the symbol 'ᵊ' represents the schwa vocoid in the case that its duration is less than 50% of the stressed vowel's. The numerical values correspond, from left to right, to the row (namely pre-normalization) F1 and F2 frequency Hertz values, to the absolute duration of the unstressed ('v ms') and stressed ('V ms') vowels expressed in milliseconds, and to the relative duration ('v/V') of the unstressed vowel with respect to the stressed one (when the unstressed vowel does not occur, the relative length column obviously displays a '0'). Furthermore, the vowel's acoustic values were calculated if the words in which they occur are followed either by a consonant initial word ('ˈσ.CCv] C') or by a phonological phrase-final boundary ('ˈσ.CCv] #'). 'N' has been inserted in the table whenever the recording of the corresponding word is not good enough to allow for accurate measurement of the acoustic values.

[59] "la finale sorda -*ö* [i.e. [ø], EC] è così a malapena distinguibile che, per non darle […] importanza pari agli altri suoni, m'ha costretto ad una notazione ortografica speciale -*°*. […] la qualità del suono [-°] è talmente indistinta che più che un vero suono lo direi una risonanza buccale." (Restori 1982: 7-8)

[60] See Loporcaro (2011a) on the possibility of considering the Standard Italian forms a valid approximation of the etymological ones, at least as far as the presence vs. absence of the etymological vowels is concerned.

Tab. 5.1 Carrarese paroxitones - decreasing/even sonority contour

Forms	ˈσ.CCv] C						ˈσ.CCv] #					
	F1	F2	v ms	V ms	v/V	Transcr.	F1	F2	v ms	V ms	v/V	Transcr.
AC												
colpo	461	1632	69	61	113%	[ˈkolpə]	0	0	0	192	0	[ˈkolp]
forno	369	1664	56	64	88%	[ˈfornə]	0	0	0	189	0	[ˈforn]
merlo	507	1589	57	148	38%	[ˈmɛrlᵊ]	0	0	0	169	0	[ˈmɛrl]
BD												
colpo	451	1694	38	56	67%	[ˈkolpə]	0	0	0	108	0	[ˈkolp]
forno	508	1700	44	146	30%	[ˈfornᵊ]	0	0	0	189	0	[ˈforn]
merlo	518	1891	53	155	34%	[ˈmɛrlᵊ]	0	0	0	185	0	[ˈmɛrl]
ED												
colpo	372	1239	44	63	70%	[ˈkolpə]	0	0	0	131	0	[ˈkolp]
forno	494	1336	74	43	172%	[ˈfornə]	546	1427	94	156	60%	[ˈfornə]
merlo	0	0	0	101	0	[ˈmɛrl]	0	0	0	180	0	[ˈmɛrl]
MV												
colpo	455	1376	54	76	71%	[ˈkolpə]	0	0	0	200	0	[ˈkolp]
forno	510	1536	41	66	62%	[ˈfornə]	0	0	0	176	0	[ˈforn]
merlo	546	1391	39	123	32%	[ˈmɛrlᵊ]	746	1642	84	188	45%	[ˈmɛrlᵊ]
AM												
colpo	N	N	N	N	N	N	0	0	0	113	0	[ˈkolp]
forno	N	N	N	N	N	N	0	0	0	162	0	[ˈforn]
merlo	439	1357	73	68	107%	[ˈmɛrlə]	440	1435	120	207	58%	[ˈmɛrlə]

As can be noticed by observing the formant frequency columns of Tab. 5.1, the F1 and F2 values are fairly close to the ones that characterize the ‘ideal’ schwa (500 Hz and 1,500 Hz; Silverman 2011).

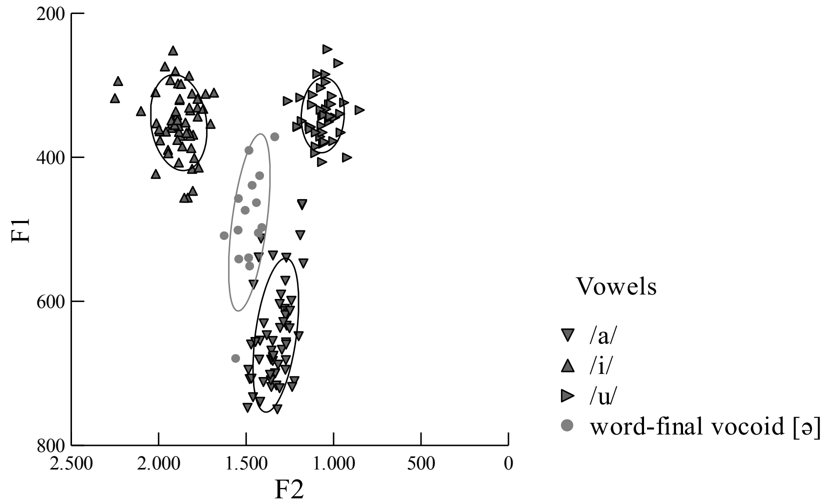
Indeed, as shown in Tab. 5.2, the mean frequency values of the entire set of word-final vocoids are 491 Hz for F1 and 1,527 Hz for F2, with a standard deviation of, respectively, 89 Hz and 179 Hz (displayed in the cells under the ‘Total’ tag).

Tab. 5.2 Carrarese paroxitones - decreasing/even sonority contour - mean values

Carrarese	F1	F2	v ms	V ms	v/V
ˈσ.CCv] C					
mean	469	1534	54	89	74%
SD	56	194	13	41	42%
ˈσ.CCv] #					
mean	577	1501	99	184	54%
SD	156	122	19	26	8%
Total					
mean	491	1527	63	108	70%
SD	89	179	23	54	38%

Furthermore, no really significant difference between the mean formant values of the vowels belonging to the two phrasal contexts can be found. A departure from the mean frequency values can be found only in the F1 of the word-final vocoid occurring in pre-pausal forms. However, given the low number of the pre-pausal words where this vocoid is realized, the relative mean values are not statistically significant. In Fig. 5.1 the normalized vocoids of Tab. 5.2 have been plotted together with the normalized cardinal vowels.

Fig. 5.1 Carrarese word-final vocoids - paroxitones



It is quite clear from the plot that the word-final vocoids of Carrarese's paroxitones occupy the centre of the vocalic space, namely the one where the schwa typically occurs (Silverman 2011).

As far as the duration parameter is concerned, the mean values summarized on the right side of Tab. 5.2 show that the paroxitone-final vocoid's duration is 70% of the stressed vowel's. Interestingly, a significant difference can be noticed between the pre-pausal and pre-consonantal vocoids: even if the absolute duration of the former is nearly double (99 ms) that of the latter (54 ms), the mean value of the pre-pausal vocoid's relative duration is significantly lower (54%) than that of the pre-consonantal one (74%). The greater absolute duration of the pre-pausal tokens can be easily accounted for by the universal physiologically-based lengthening of the phonological-phrase final part (Scott 1982). Indeed, the stressed vowel that occurs in this phrasal context is significantly longer (184 ms) than its phrase-medial counterpart (89 ms). As has already been said, the low number of pre-pausal vocoid tokens casts some doubt on the statistical significance of these types of mean results. However, while this is true for the formant analysis, in the case of the duration parameter the low number of words displaying the word-final vocoid can be taken into account to interpret the numerical data. Indeed, the relative shortness (which also shows an extremely low standard deviation) of the paroxitone-final vocoids in the phrase-final context, together with the low frequency of their realization (3 cases out of 15, namely 20%)[61], can be interpreted as a clue to the categorical absence of the word-final vowels from the phonological representation of the words (a more detailed discussion of the phonological interpretation of the data will be presented in Chapter 7). Furthermore, Loporcaro (2005-2006) implicitly suggests that in Northern-Italian dialects, the phrase-final and phrase-medial word-final vowels can enter an implicational relationship. It has been observed, indeed, that in the peripheral varieties of the Northern-Italian group, the deletion of word-final vowels occurring in phrase-medial position diachronically precedes that of the word-final vowels occurring instead in phrase-final position, and that this diachronic variation can synchronically be observed in diatopic variation: the dialects that show a word-final vocoid in phrase-final position can realize the same vowel in phrase-medial position or not, but the ones that drop it in phrase-final position delete it phrase-medially as well. In Carrarese the word-final vowel is constantly deleted both in phrase-final and phrase-medial position if the relevant form is followed by another word starting with a vowel[62] (It. [uŋ ˈkolpo o ˈdue] 'one or two strokes' vs. Carr. [uŋ ˈkolp o ˈdo]; It. [um ˈmɛrlo aranˈtʃoːne] 'an orange blackbird' vs. Carr. [um ˈmɛrl aranˈtsoŋ]). Similarly, as can be noticed from the transcription column in Tab. 5.1, the word-final vocoid in phrase-medial position can display an extremely short duration (up to 30% of the stressed vowel's duration), or can be completely deleted[63].

---

[61] As will be shown later, similar results can be found for the pre-pausal context throughout all the Carrarese data.

[62] In this last phrasal context, no exception has been found in the analysed data: all the etymologically word-final vowels are constantly dropped, and the resulting consonant cluster is resyllabified.

[63] Again, another piece of evidence can be found in the literary production of Carrara's poets (Borgioli 2008), who never write down the word-final vowels.

Hence, considering the implicational relationship just hinted at, it seems to be quite safe to claim that the word-final vowels are categorically absent from the words' phonological representations, with the realization of the vocoid being more likely functionally and articulatorily interpretable as a vowel-like release whose size is increased (and hence perceived as a vocoid) in order to enhance the perception of the consonant's place of articulation in tri-consonantal clusters. Indeed, as stated by Hall (2006),

> "[w]hen two consonant gestures are produced with a low degree of overlap, there is an acoustic release between them, which may be interpreted by the listener as a vowel. If the tongue body is in a fairly neutral position, or this period is short in duration, the perceived vowel will sound like a schwa." (Hall 2006: 388)

As for the relevance of the role of perception, she explicitly claims that

> "the perceptibility of the adjacent consonants is increased if there is a release burst between them. The release burst can carry some articulatory information about the consonant. A burst that is voiced and has vocalic characteristics - i.e. an intrusive vowel – should be particularly suited to convey articulatory information about the adjacent consonant." (Hall 2006: 408)

Leaving an in-depth phonological analysis of these observations to Section 7.2 the next section is devoted to the description of Pontremolese penultimate stressed forms.

5.2.1.2 Pontremolese

Tab. 5.3 presents a selection of Pontremolese penultimate stressed forms. Again, the recordings of 5 speakers were chosen (DP, MM, LB, AS and GB). The selected forms are the same as those of Carrarese: two with an after-apocope decreasing sonority contour (*colpo* 'stroke' and *forno* 'oven') and one with an even one (*merlo* 'blackbird'). In the first column, the corresponding Italian cognate can be found, while the phonetic transcription is shown in the 'Transcr.' column, where the symbol 'ᵊ' represents the schwa vocoid in the case that it is shorter than 50% of the stressed vowel's duration. In the 'F1' and 'F2' columns, the frequency values of the relative formants can be found, and in 'v ms', 'V ms' and 'v/V', the duration of the unstressed and stressed vowels and the proportion between them, respectively, are displayed. As in the preceding tables, the vowels' acoustic values have been calculated in the case that the relevant words are followed by a consonant initial word ('ˈσ.CCv] C') or by a pause ('ˈσ.CCv] #').

Tab. 5.3 Pontremolese paroxitones - decreasing/even sonority contour

Forms	ˈσ.CCv] C						ˈσ.CCv] #					
	F1	F2	v ms	V ms	v/V	Transcr.	F1	F2	v ms	V ms	v/V	Transcr.
DP												
colpo	393	1244	49	87	56%	[ˈkurpə]	0	0	0	167	0	[ˈkurp]
forno	511	1292	135	111	121%	[ˈfurnə]	0	0	0	179	0	[ˈfurn]
merlo	486	1179	94	165	57%	[ˈmørlə]	0	0	0	211	0	[ˈmørl]
MM												
colpo	371	1506	41	37	111%	[ˈkurpə]	369	1450	93	126	74%	[ˈkurpə]
forno	419	1362	70	46	152%	[ˈfurnə]	350	1493	100	143	70%	[ˈfurnə]
merlo	446	1520	58	93	62%	[ˈmørlə]	411	1451	37	80	46%	[ˈmørlᵊ]
LB												
colpo	356	1392	33	71	47%	[ˈkurpᵊ]	425	1471	91	125	73%	[ˈkurpə]
forno	357	1457	52	42	125%	[ˈfurnə]	377	1594	59	118	50%	[ˈfurnə]
merlo	429	1945	56	62	90%	[ˈmørlə]	0	0	0	176	0	[ˈmørl]
AS												
colpo	400	1440	51	70	73%	[ˈkurpə]	0	0	0	159	0	[ˈkurp]
forno	477	1575	54	66	82%	[ˈfurnə]	533	1525	71	120	59%	[ˈfurnə]
merlo	425	1390	85	190	45%	[ˈmørlᵊ]	450	1548	137	131	105%	[ˈmørlə]
GB												
colpo	444	1557	57	46	125%	[ˈkurpə]	472	1392	122	101	121%	[ˈkurpə]
forno	518	1569	68	63	108%	[ˈfurnə]	542	1429	94	122	77%	[ˈfurnə]
merlo	453	1291	69	138	50%	[ˈmørlə]	503	1564	100	143	70%	[ˈmørlə]

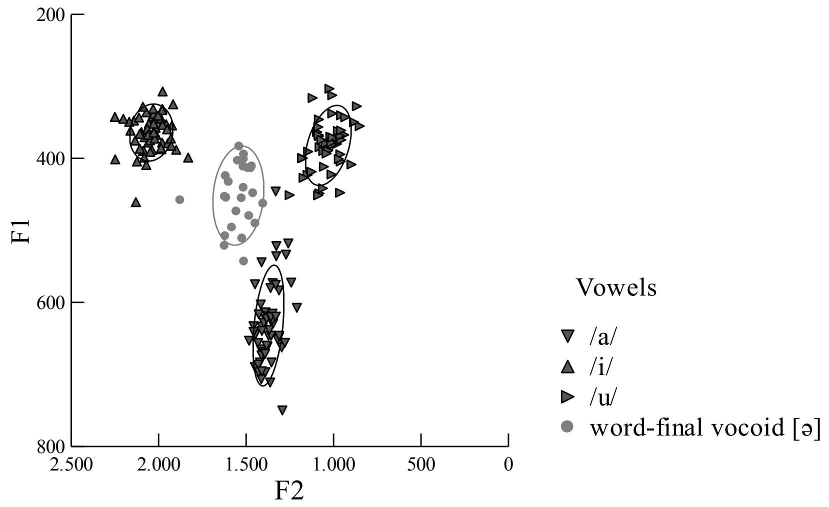
The acoustic mean values of the Pontremolese paroxitones are summarized in Tab. 5.4:

Tab. 5.4 Pontremolese paroxitones - decreasing/even sonority contour - mean values

Pontremol.	F1	F2	v ms	V ms	v/V
ˈσ.CCv] C					
mean	432	1448	65	86	87%
SD	52	184	25	46	35%
ˈσ.CCv] #					
mean	443	1492	90	184	74%
SD	69	65	29	19	23%
Total					
mean	437	1465	75	100	82%
SD	58	148	29	41	31%

Pontremolese word-final vocoids, like their Carrarese counterparts, show the same F1 and F2 frequencies of the schwa: namely 437 Hz for F1 and 1,465 for F2[64]. Furthermore, no significant difference can be found among their realizations in the pre-consonantal and pre-pausal contexts. In contrast to the Carrarese case, the higher number of occurrences of the tokens under consideration suggests that the mean results can be considered statistically significant. The word-final vocoids of Pontremolese can thus be qualitatively considered the same object, namely a schwa, regardless of their context of occurrence. Indeed, as shown in Fig. 5.2, where they have been plotted together with the stressed normalized cardinal vowels, they occupy the centre of the Pontremolese vocalic space.

Fig. 5.2 Pontremolese word-final vocoids - paroxitones



As for the duration parameter, the values summarized in Tab. 5.4 show that the mean relative durations of the word-final vocoids occurring in the two different phrasal contexts are slightly different: 87% of the stressed vowel's duration for the pre-consonantal vocoid and 74% for the pre-pausal one.

Furthermore, similarly to what happens in Carrarese, lengthening of both the word-final vocoid and the stressed vowel also occurs in Pontremolese. While the relevant pre-consonantal mean values are 65 ms (SD 25) and 86 ms (SD 46) for the

---

64 As for F3, whose tokens value has been omitted from Tab. 5.3, its mean value is 2,439 Hz (SD 214 Hz), no significant difference having been noticed among the pre-consonantal (mean 2,460 Hz, SD 201 Hz) and the pre-pausal (mean 2,408 Hz, SD 240 Hz) contexts. Carrarese, instead, displays an F3 mean value of 2,670 Hz (SD 143 Hz). Even if the Pontremolese values turn out to be slightly different from the one calculated by Carpitelli (1995), their lower values with respect to the Carrarese values are consistent with the 'more rounded' quality that has been proposed for their Pontremolese realization. Indeed, the rounding of the lips lowers the F3 values (Stevens 2000).

word-final vocoid and the stressed vowel values, respectively, the same objects' durations are 90 ms (SD 29) and 184 ms (SD 19) if they occur in pre-pausal position. This is consistent with the phrase-final lengthening already discussed in Section 5.2.1.1.

Coming back to Tab. 5.3, a difference can be noticed regarding the possibility of omitting the word-final vocoid in the two different phrasal contexts: while it is constantly realized in the pre-consonantal context, it can be optionally (LB and AS speakers) or regularly (DP) dropped in the pre-pausal one. Even if differences in the deletion frequency can be found between Carrarese (which deletes more frequently) and Pontremolese, the Pontremolese data just presented seem to point in the same direction, namely towards a categorical absence of the etymological word-final vowel from the word's phonological representation. Further pieces of evidence in favour of this interpretation can be found in the literature on this dialect (Restori 1982; Giannarelli 1913; Maffei Bellucci 1977), which, as already pointed out in Section 5.2.1, describe the apocope as a regularly applying process. Indeed, no word-final vocoid can be found if the word ends with a single consonant, and it is constantly dropped even in words ending in a consonant cluster if followed by a vowel-initial form[65] (It. [uŋ ˈkolpo o ˈdue] 'one or two strokes' vs. Pontr. [uŋ ˈkurp o ˈdui]; It. [um ˈmɛrlo inˈdjaːno] 'an indian blackbird' vs. Pontr. [um ˈmørl inˈdjaŋ]). Furthermore, similarly again to what happens in Carrarese, the literary production supports the hypothesis of the absence of this object from the mental representations of the Pontremolese speakers[66]. Hence, an explanation can be proposed for word-final vocoid realizations that resorts to the same perceptual/articulatory motivations borrowed from Hall (2006) to account for the Carrarese pattern.

[65] As in Carrarese, the pre-vocalic context admits no exception: all the etymologically word-final vowels are dropped and the consonant (cluster) is resyllabified.

[66] As an example, see the third line of the poem excerpt in the opening of Section 4.1, where the poet writes "[…] *gnanc tant fort*" 'not too loud'. Acknowledging the problems in deriving an underlying representation from the written data, what has been said so far makes the following a fairly likely phonological representation of the line excerpt just quoted: /ˈɲank tant ˈfɔrt/.

5.2.2 Proparoxitones

As in the case of the paroxitones, Carrarese and Pontremolese show some (phonetic) difference in the degree to which this process applies to antepenultimate stressed words. To be more precise, while apocope applies in the two dialects more or less to the same degree, syncope, namely the reduction of the word-medial post-tonic vowels, more drastically changed the prosodic shape of Pontremolese proparoxitones. The Carrarese data are presented first and the Pontremolese in Section 5.2.2.2.

5.2.2.1 Carrarese

In Tab. 5.5 the antepenultimate stressed forms as uttered by the same five speakers of Carrarese are presented. For each of them, seven forms are considered, which, after apocope and syncope, show a decreasing (*stomaco* 'stomach' and *manico* 'handle'), even (*tiepido* 'lukewarm SG.MASC', *selvatico* 'wild SG.MASC') or increasing (*tenero* 'tender SG.MASC', *giovane* 'young SG.MASC' and *libero* 'free SG.MASC') sonority contour. As for the paroxitones, their Italian cognates can be found in the second column and their phonetic transcriptions under 'Transcr.' The symbol '^{ə}' represents the schwa vocoid in the case that it is less than half the length of the stressed vowel. 'F1', 'F2', 'Duration' and 'v/V' columns respectively display the row F1 and F2 frequency Hertz values, the absolute duration of the unstressed and stressed vowels (in milliseconds) and the relative duration of the unstressed vowels with respect to the stressed ones. All of these values have been calculated for the etymologically word-medial ('v_1') and word-final ('v_2') vowels. In this table the vowel acoustic values have been calculated in the case that the words in which they occur are followed either by a consonant initial word ('$ˈ\sigma.Cv_1Cv_2$] C') or by a pause ('$ˈ\sigma.Cv_1Cv_2$] #'). The vocoid's values of the same forms occurring in a pre-vocalic context are presented below in a dedicated table. 'N' means that the recording of the corresponding word is not good enough to accurately measure the acoustic values, and 'Nc' that the relevant value has not been calculated.

Tab. 5.5 Carrarese proparoxitones

Forms	ˈσ.Cv$_1$Cv$_2$] C										ˈσ.Cv$_1$Cv$_2$] #									
	F1		F2		Duration			v/V		Transcr.	F1		F2		Duration			v/V		Transcr.
	v$_1$	v$_2$	v$_1$	v$_2$	v$_1$	v$_2$	V	v$_1$	v$_2$		v$_1$	v$_2$	v$_1$	v$_2$	v$_1$	v$_2$	V	v$_1$	v$_2$	
AC																				
tiepido	350	453	1827	1627	64	120	153	42%	79%	[ˈtepᵊdə]	464	491	1683	1584	83	85	186	45%	46%	[ˈtepᵊdᵊ]
selvatico	662	404	1691	1490	51	48	76	67%	64%	[səlˈvatəkə]	329	477	1152	1596	46	54	148	31%	36%	[səlˈvatᵊkᵊ]
stomaco	461	424	1127	1380	43	39	57	76%	69%	[ˈstoməkə]	0	0	0	0	0	0	Nc	0	0	[ˈstomk]
manico	599	440	1035	1667	43	50	103	42%	48%	[ˈmanəkᵊ]	0	0	0	0	0	0	Nc	0	0	[ˈmank]
tenero	456	0	1807	0	59	0	92	64%	0	[ˈtenər]	445	0	1663	0	86	0	157	55%	0	[ˈtenər]
giovane	369	0	1477	0	64	0	61	105%	0	[ˈdzovən]	429	359	1552	1653	43	68	193	22%	36%	[ˈdzovᵊnᵊ]
libero	446	0	1545	0	41	0	122	34%	0	[ˈlibər]	490	0	1649	0	32	0	110	29%	0	[ˈlibᵊr]
BD																				
tiepido	0	0	0	0	0	0	Nc	0	0	[ˈtepd]	0	0	0	0	0	0	Nc	0	0	[ˈtepd]
selvatico	665	449	1438	1554	41	39	88	46%	44%	[səlˈvatəkᵊ]	612	0	1691	0	75	0	143	52%	0	[səlˈvatək]
stomaco	N	N	N	N	N	N	N	N	N	N	0	0	0	0	0	0	Nc	0	0	[ˈstomk]
manico	616	565	1948	1671	32	51	81	39%	64%	[ˈmanᵊkə]	490	0	1475	0	32	0	152	21%	0	[ˈmanᵊk]
tenero	494	0	1992	0	47	0	141	33%	0	[ˈtenᵊr]	501	0	2196	0	43	0	144	30%	0	[ˈtenᵊr]
giovane	490	0	1286	0	59	0	122	48%	0	[ˈdzovᵊn]	0	0	0	0	0	0	88	0	0	[ˈdzovn]
libero	0	0	0	0	0	0	N	0	0	[ˈlibr]	0	0	0	0	0	0	Nc	0	0	[ˈlibr]
ED																				
tiepido	413	433	1461	1557	50	67	189	27%	36%	[ˈtepᵊdᵊ]	539	513	1482	1498	39	98	142	27%	68%	[ˈtepᵊdə]
selvatico	349	563	1919	1375	37	44	93	40%	47%	[səlˈvatᵊkᵊ]	0	543	0	1556	0	61	149	0	41%	[səlˈvatkᵊ]
stomaco	492	495	1180	1223	34	62	60	56%	104%	[ˈstoməkə]	504	486	1208	1553	69	43	97	71%	45%	[ˈstoməkᵊ]
manico	406	539	1351	1633	31	42	76	41%	55%	[ˈmanᵊkə]	343	0	1675	0	63	0	130	49%	0	[ˈmanᵊk]
tenero	506	514	1518	1433	49	81	64	77%	128%	[ˈtenərə]	N	N	N	N	N	N	N	N	N	N
giovane	476	0	1266	0	63	0	57	110%	0	[ˈdzovən]	548	466	1396	1396	32	50	173	18%	29%	[ˈdzovᵊnᵊ]
libero	452	0	1455	0	63	0	50	127%	0	[ˈlibər]	440	0	1478	0	44	0	124	35%	0	[ˈlibᵊr]
MV																				
tiepido	452	432	1063	1247	24	22	101	24%	22%	[ˈtepᵊdᵊ]	0	0	0	0	0	0	Nc	0	0	[ˈtepd]
selvatico	320	444	1605	1135	33	39	68	48%	58%	[səlˈvatᵊkə]	442	0	1989	0	50	0	106	47%	0	[səlˈvatᵊk]
stomaco	620	0	1140	0	27	0	31	88%	0	[ˈstomək]	476	0	1134	0	44	0	97	45%	0	[ˈstomᵊk]
manico	457	464	1451	1315	37	36	66	56%	54%	[ˈmanəkə]	600	494	1476	1450	62	59	155	40%	56%	[ˈmanᵊkə]
tenero	566	0	1444	0	39	0	131	30%	0	[ˈtenᵊr]	550	0	1977	0	151	0	193	78%	0	[ˈtenər]
giovane	0	0	0	0	0	0	Nc	0	0	[ˈdzovn]	514	441	1348	821	57	71	130	44%	55%	[ˈdzovᵊnə]
libero	0	0	0	0	0	0	Nc	0	0	[ˈlibr]	0	0	0	0	0	0	Nc	0	0	[ˈlibr]
AM																				
tiepido	375	436	1310	1322	70	67	81	86%	83%	[ˈtepədə]	433	407	1397	1551	65	87	149	44%	58%	[ˈtepᵊdə]
selvatico	327	393	1450	1411	58	43	100	58%	44%	[səlˈvatəkᵊ]	320	401	1433	1390	81	108	156	52%	69%	[səlˈvatəkə]
stomaco	0	415	0	1077	0	21	56	0	37%	[ˈstomkᵊ]	0	0	0	0	0	0	Nc	0	0	[ˈstomk]
manico	N	N	N	N	N	N	N	N	N	N	320	0	2239	0	57	0	173	33%	0	[ˈmanᵊk]
tenero	440	0	1506	0	89	0	62	143%	0	[ˈtenər]	415	0	1538	0	62	0	187	33%	0	[ˈtenᵊr]
giovane	385	0	1191	0	63	0	95	66%	0	[ˈdzovən]	409	440	1334	1438	69	106	181	38%	59%	[ˈdzovᵊn]
libero	453	407	1327	1338	50	69	166	30%	42%	[ˈlibᵊrᵊ]	421	426	1246	1287	68	89	105	65%	83%	[ˈlibərə]

The acoustic mean values of the Carrarese proparoxitones are summarized in Tab. 5.6:

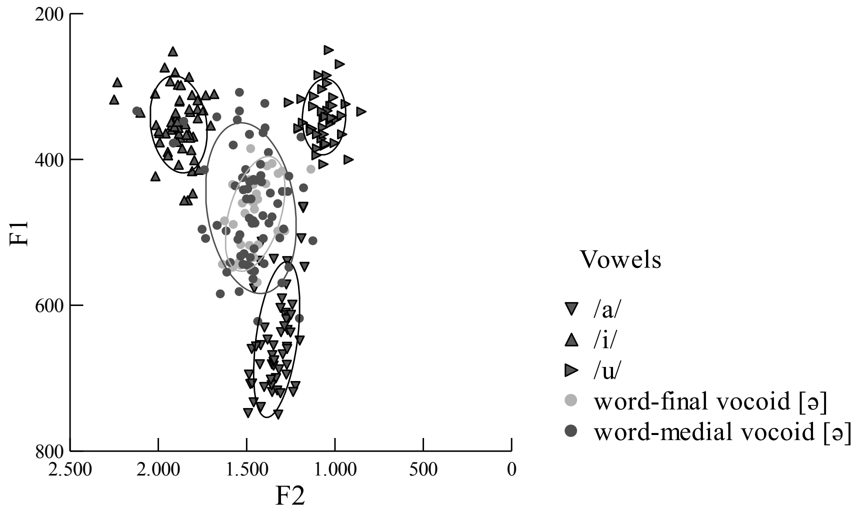
Tab. 5.6 Carrarese proparoxitones - mean values

Carrarese	F1		F2		Duration			v/V	
	v_1	v_2	v_1	v_2	v_1	v_2	V	v_1	v_2
ˈσ.Cv_1Cv_2] C									
mean	468	459	1458	1414	49	52	91	61%	60%
SD	97	54	265	180	15	23	38	31%	26%
ˈσ.Cv_1Cv_2] #									
mean	460	457	1559	1444	61	75	145	42%	52%
SD	81	51	299	213	25	22	31	15%	16%
Total									
mean	464	459	1504	1427	54	62	117	52%	57%
SD	90	52	283	192	21	25	44	27%	22%

As in the case of paroxitones, the F1 and F2 frequency values of the proparoxitone-final vocoids illustrate their schwa quality, with mean values of, respectively, 459 Hz and 1,414 Hz in phrase-medial position and 457 Hz and 1,444 Hz in phrase-final. The same holds for word-medial vocoids, their F1 and F2 mean frequency values being 468 Hz and 1,458 Hz in phrase-medial position and 460 Hz and 1,559 Hz in the phrase-final.

This notwithstanding, F2 shows a considerable standard deviation in every context, with a tendency to be larger in word-medial vocoids. Indeed, while the F1 standard deviation never exceeds 100 Hz, that of F2 ranges between 192 Hz for the word-final vocoid class and 283 Hz for the word-medial class. The difference between the vocoids belonging to the two lexical contexts can be graphically visualized in Fig. 5.3, where they have been plotted together with the normalized stressed cardinal vowels: while the word-final vocoids are concentrated in the very centre of the Carrarese vocalic space, the word-medial ones are still centrally distributed, but they’re also more scattered.

Fig. 5.3 Carrarese word-medial and -final vocoids - proparoxitones



A closer examination of the tokens' values seems to show a tendency for the word-medial F2 to be slightly higher when the etymological vowel is front high and/or when it is adjacent to an alveolar consonant. AC's word-medial vocoids, for example, display an F2 of 1,827 Hz and 1,629 Hz in *tiepido* and *selvatico*, whereas the word-final F2 values of the same forms are 1,627 Hz and 1,490 Hz. At the same time, however, AC's F2 value of the word-medial vocoid of *manico*, namely a form with an etymologically high vowel preceded by an alveolar consonant, is lower than that of the schwa (1,035 Hz). Even if the analysed vocoids do not show a consonantal context of occurrence varied enough to definitively side with one of the two possible sources of F2 variation, it is interesting to point out that tokens can be found in which the F2 of an etymologically non-high vocoid is higher than that of an etymologically high one. Crucially, these tokens are adjacent to an alveolar consonant. This is the case, for example, of the word-medial vocoids of *tenero* as uttered both in phrase-medial and phrase-final position by AC (1,807 Hz and 1,663 Hz), BD (1,992 Hz and 2,196 Hz), MV (1,444 Hz and 1,977 Hz) and AM (1,506 Hz and 1,538 Hz). In all of these cases, the F2 values are higher than those of the schwa and, crucially, as high as (or even higher than) the forms with an etymologically high vowel, uttered by the same speakers. These facts, along with the shortness of these vocoids, seem to suggest that the observed F2 variation is more likely to be due to a coarticulatory effect[67] than to a conditioning of the etymological quality of

[67] Interestingly, Flemming (2007) describe a very similar situation for the English word-medial schwa, which shows greater F2 variation with respect to the word-final one. In his study, the greater F2 variation is due to the articulatory conditioning of the consonantal environment of the word-medial schwa, which in turn is argued to be a consequence of both its lack of contrastive load and, crucially, its shortness. Flemming & Johnson (2007) averaged this schwa duration at 64 ms. Given that the word-medial schwa mean durations of both Carrarese and Pontremolese tend to show about the same length as the English one, and that

which this vocoid is the outcome. Indeed, it is quite plausible to assume that the tongue fronting needed to produce the alveolar consonant has already started (or is coming back to the central/neutral position) when the schwa is pronounced. Since the advanced tongue position is the articulatory correlate of a high F2 frequency, the high F2 values recorded for the vocoid under consideration are possibly explained in this way (Flemming 2007; Flemming & Johnson 2007; Silverman 2011). For all of these reasons, the object under consideration is considered here to be phonetically a schwa, in both word-medial and word-final position.

In Tab. 5.7 the relative and absolute durations of the word-medial and word-final vocoids occurring in both phrase-medial and phrase-final proparoxitones are repeated. As in the preceding tables, the absolute duration of the stressed vowels used to calculate the means are displayed as well.

Tab. 5.7 Carrarese proparoxitone - medial and final vocoid duration

		v_1		v_2		V
		ms	v/V	ms	v/V	ms
$v]_w$ C	mean	49	61%	52	60%	91
	SD	15	31%	23	26%	38
$v]_w$ #	mean	61	42%	75	52%	145
	SD	25	15%	22	16%	31
Total	mean	54	52%	62	57%	117
	SD	21	27%	25	22%	44

The phrase-final lengthening effect is also evident in this case: both the stressed vowels and the word-medial and word-final vocoids occurring in phrase-final forms are longer than the ones occurring phrase-medially, at least as far as the absolute duration is concerned. Indeed, as already noted for the paroxitones, a look at the relative durations suggests that actually, all of the vocoids occurring in phrase-final words are proportionally more reduced than the ones occurring in phrase-medial forms. Tab. 5.7 also suggests that in the phrase-final context the word-final vocoid is longer (52%) than the word-medial one (42%). This statistical observation should, however, be rectified. As can be noticed in Tab. 5.5, even if these word-final vocoids can be longer than the word-medial ones occurring in the same word, they are dropped far more frequently: out of 34 phrase-final forms, 21 tokens (62%) show no word-final vocoid, and only 10 (29%) show no word-medial vocoid.

It is also interesting to observe that, leaving aside one token (i.e. *selvatico* as uttered by ED), whenever the vocoid is absent word-medially, it is absent from word-final position as well, however, the opposite is not true. In other words, deletion of the word-medial vocoid implies deletion of the word-final one.

---

these segments do not bear any contrastive load, the articulatory explanation of the F2 variation proposed by Flemming (2007) can easily account for the present data.

Summarizing, even if it is frequently unrealized, when the word-final vocoid of a phrase-final form is present, it tends to be slightly longer than the word-medial one. This fact can be interpreted as an optional, maybe emphatically conditioned (Restori 1892; Savoia 1983), lengthening of the release of the (phonologically) word-final plosive[68]. Indeed, comparing the first four forms of every speaker with the last three, i.e. the ones ending with a plosive and the ones ending with a sonorant, it can be noticed that the word-final vocoid is realized 8 times (24%) in the first class and 5 (15%) in the second one. This difference in frequency of post-plosive and post-sonorant vocoid realization is still more drastic in the phrase-medial forms. In these words, the post-plosive is realized 16 times (48%), but only twice (6%) after a word-final sonorant.

Focusing now on the phrase-medial forms, Tab. 5.7 shows that the word-medial and the word-final vocoids share the same length. They are both approximately 60% of the stressed vowels' length. As in the phrase-final words, a preference for word-final vocoid deletion can also be observed phrase-medially. As just noted, however, the difference between the plosive-final and the sonorant-final vocoids is more drastic here: out of 15 tokens where the word-final vocoid is not realized, only two show a plosive in final position. Since the words occurring in phrase-medial position are followed by a consonant-initial word, the general tendency toward a more frequent realization of the word-final vocoid (18 times against 13 times in the phrase-final words), and the specific tendency for it to be realized after a plosive, could be due to the same articulatory and perceptual principles already put forward for the word-final vocoids of the phrase-medial Carrarese paroxitones. Indeed, the high variability of their F2 (see above), the frequency of their realization and their short length suggest that these vocoids can be considered the acoustic by-product of the low degree of overlap of two consonantal gestures: the release of the first consonant is slightly enhanced to convey information about the consonant's place of articulation, and therefore sounds acoustically similar to a short schwa whose F2 value is conditioned by flanking consonants (Hall 2006; Flemming 2007).

As for the word-medial vocoids occurring in phrase-medial position, a preference can be observed for them to be realized more often than the word-final ones in the same phrasal context, and slightly more (28 tokens out of 33: 85%) than the word-medial ones occurring in phrase-final words (24 tokens out of 34: 71%).

In Tab. 5.8 the values are shown of the vocoids occurring in proparoxitones that either end with a vocalic suffix (*-a* and *-e* for the singular and plural feminine forms or *-i* for the plural masculines if not preceded by a nasal consonant) or are followed by a vowel-initial word.

---

[68] Interestingly, the same 'emphatic conditioning' is reported for French by Schmid (in press), who explicitly claims that in "*merde alors!* [ˈmɛʀd aˈlɔːʀə] 'blimey', […] the paragogic schwa is not part of the underlying representation".

Tab. 5.8 Carrarese pre-vocalic proparoxitones

ˈσ.CvC (]) V						
Forms	F1	F2	Duration		v/V	Transcr.
	v	v	v	V	v	
AC						
tiepido	435	1734	57	157	36%	[ˈtep^{ə}d-]
selvatico	0	0	0	130	0	[səlˈvatk-]
stomaco	0	0	0	Nc	0	[ˈstomk-]
manico	471	1284	50	70	71%	[ˈmanək-]
tenero	0	0	0	Nc	0	[ˈtenr-]
giovane	0	0	0	Nc	0	[ˈdzovn-]
libero	0	0	0	Nc	0	[ˈlibr-]
BD						
tiepido	0	0	0	Nc	0	[ˈtepd-]
selvatico	332	1551	60	120	50%	[səlˈvatək-]
stomaco	0	0	0	Nc	0	[ˈstomk-]
manico	0	0	0	Nc	0	[ˈmank-]
tenero	0	0	0	Nc	0	[ˈtenr-]
giovane	0	0	0	Nc	0	[ˈdzovn-]
libero	0	0	0	Nc	0	[ˈlibr-]
ED						
tiepido	481	1406	25	73	34%	[ˈtep^{ə}d-]
selvatico	378	1997	57	87	66%	[səlˈvatək-]
stomaco	611	1063	57	86	66%	[ˈstomək-]
manico	364	1332	70	49	143%	[ˈmanək-]
tenero	530	1427	75	74	101%	[ˈtenər-]
giovane	543	1141	31	154	20%	[ˈdzov^{ə}n-]
libero	542	1427	57	96	59%	[ˈlibər-]
MV						
tiepido	603	1744	32	72	44%	[ˈtep^{ə}d-]
selvatico	376	1324	32	177	18%	[səlˈvat^{ə}k-]
stomaco	495	1185	46	59	78%	[ˈstomək-]
manico	518	1497	46	62	75%	[ˈmanək-]
tenero	0	0	0	Nc	0	[ˈtenr-]
giovane	0	0	0	Nc	0	[ˈdzovn-]
libero	0	0	0	Nc	0	[ˈlibr-]
AM						
tiepido	435	1424	69	149	46%	[ˈtep^{ə}d-]
selvatico	314	1234	71	116	61%	[səlˈvatək-]
stomaco	0	0	0	Nc	0	[ˈstomk-]
manico	N	N	N	N	N	N
tenero	418	1430	81	107	76%	[ˈtenər-]
giovane	0	0	0	Nc	0	[ˈdzovn-]
libero	441	1240	44	127	35%	[ˈlib^{ə}r-]

In Tab. 5.9 the mean values of the acoustic data presented in Tab. 5.8 are displayed:

Tab. 5.9 Carrarese pre-vocalic proparoxitones - mean values

Carrarese	F1	F2	Duration		v/V
	v	v	v	V	v
ˈσ.CvC (]) V					
mean	460	1413	53	102	60%
SD	88	233	16	38	30%

When these proparoxitones are followed by a vowel, whether it belongs to the same word or to the following one, the word-medial etymological vowel shows, as usual, the same formant frequency values as the schwa: 460 Hz for F1 and 1,413 Hz for F2. As in the vocoids of the words occurring in the other phrasal contexts, a great deal of variation can be observed as far as the F2 values are concerned. Indeed, while the F1 standard deviation is 88 Hz, that of F2 is 233 Hz. It can thus be argued that this variation is also due to the coarticulatory effect. Given the substantial similarity with the vocoids occurring in the other phrasal contexts, the normalized vocoids occurring in the pre-vocalic words have been plotted together with the word-medial ones in Fig. 5.3.

As for the duration parameter, their relative mean value and standard deviation (mean 60%, SD 30%) are similar to those of the same vocoids occurring in the phrase-medial words (61%, SD 31%). The only difference between these two groups concerns the frequency of realization of the vocoid: while in the pre-consonantal words it is realized in 28 of 32 tokens (87%), in the pre-vocalic ones it occurs in 18 of 34 tokens (53%). It has to be noted, however, that seven of these 18 occurrences are found in tokens uttered by the same speaker, namely ED, and they also display the longest durations. For all of the other speakers, there is a preference for the vocoid's absence, and in the case that it is realized, for it to be relatively short.

As suggested in the opening of Section 5.2.2, while syncope applied in a 'milder' way in Carrarese, in Pontremolese the unstressed vowel reduction resulted in its complete deletion. This is shown in the next section.

5.2.2.2 Pontremolese

Tab. 5.10 shows the data of the proparoxitones uttered by five Pontremolese speakers (DP, MM, LB, AS, GB) in the usual pre-consonantal and pre-pausal contexts. In this table, the words have been included which, as a consequence of syncope and apocope, show either a decreasing (*stomaco* 'stomach', *manico* 'handle') or an even (*tiepido* 'lukewarm m.', *selvatico* 'wild m.') sonority contour.

The words that instead show an increasing sonority contour are presented in a dedicated table where Pontremolese forms displaying an epenthetic vowel are described (Section 5.3.2).

Tab. 5.10 Pontremolese proparoxitones - decreasing/even sonority contour

Forms	ˈσ.Cv$_1$Cv$_2$] C										ˈσ.Cv$_1$Cv$_2$] #									
	F1		F2		Duration			v/V		Transcr.	F1		F2		Duration			v/V		Transcr.
	v$_1$	v$_2$	v$_1$	v$_2$	v$_1$	v$_2$	V	v$_1$	v$_2$		v$_1$	v$_2$	v$_1$	v$_2$	v$_1$	v$_2$	V	v$_1$	v$_2$	
DP																				
tiepido	297	389	877	1024	94	101	155	60%	65%	[ˈteʋdə]	345	379	920	1514	125	62	151	83%	41%	[ˈteud^{ə}]
selvatico	0	391	0	1207	0	74	98	0	76%	[sarˈvadgə]	0	386	0	1878	0	53	176	0	30%	[sarˈvadg^{ə}]
stomaco	0	411	0	1227	0	123	81	0	152%	[ˈstumgə]	0	415	0	1566	0	129	109	0	119%	[ˈstumgə]
manico	0	466	0	1469	0	93	105	0	88%	[ˈmankə]	0	416	0	1748	0	79	122	0	65%	[ˈmankə]
MM																				
tiepido	0	412	0	1593	0	88	81	0	108%	[ˈtevdə]	0	413	0	1584	0	85	85	0	100%	[ˈtevdə]
selvatico	0	345	0	1365	0	56	70	0	79%	[sarˈvadgə]	0	364	0	1561	0	47	139	0	34%	[sarˈvadg^{ə}]
stomaco	0	364	0	1330	0	48	61	0	78%	[ˈstumgə]	0	347	0	1573	0	101	134	0	75%	[ˈstumgə]
manico	0	380	0	1596	0	61	53	0	116%	[ˈmangə]	0	389	0	1552	0	75	149	0	50%	[ˈmangə]
LB																				
tiepido	0	420	0	1707	0	49	87	0	56%	[ˈtevdə]	0	365	0	1854	0	69	101	0	69%	[ˈtevdə]
selvatico	0	343	0	1457	0	51	81	0	63%	[sarˈvadgə]	0	391	0	1503	0	86	118	0	73%	[sarˈvadgə]
stomaco	0	375	0	1480	0	75	60	0	124%	[ˈstumgə]	0	409	0	1421	0	69	109	0	63%	[ˈstumgə]
manico	0	331	0	1587	0	11	17	0	65%	[ˈmangə]	0	380	0	1540	0	64	119	0	54%	[ˈmangə]
AS																				
tiepido	0	410	0	1707	0	88	112	0	79%	[ˈtevdə]	0	429	0	1600	0	113	88	0	129%	[ˈtevdə]
selvatico	0	381	0	1269	0	62	78	0	80%	[sarˈvadgə]	0	438	0	1547	0	112	159	0	70%	[sarˈvadgə]
stomaco	0	456	0	1399	0	82	104	0	79%	[ˈstumgə]	0	470	0	1360	0	101	111	0	91%	[ˈstumgə]
manico	0	461	0	1732	0	77	83	0	93%	[ˈmangə]	0	448	0	1462	0	190	151	0	126%	[ˈmangə]
GB																				
tiepido	0	440	0	1644	0	82	127	0	64%	[ˈtevdə]	0	468	0	1636	0	76	110	0	69%	[ˈtevdə]
selvatico	0	425	0	1677	0	62	89	0	70%	[sarˈvadgə]	0	467	0	1504	0	101	115	0	88%	[sarˈvadgə]
stomaco	0	437	0	1587	0	83	105	0	79%	[ˈstumgə]	0	499	0	1441	0	77	60	0	128%	[ˈstumgə]
manico	0	480	0	1866	0	68	64	0	105%	[ˈmangə]	0	384	0	1675	0	62	109	0	57%	[ˈmangə]

As already hinted at, syncope changed the Pontremolese prosodic word structure to a greater extent that it did in Carrarese. Indeed, as shown in Tab. 5.10, the etymological word-medial vowels were regularly deleted by all of the speakers. The only exception is DP, who ‘goes a little further’, changing the labio-dental fricative into the corresponding labio-dental approximant [ʋ] (whose frequency values are displayed here).

The regular deletion of the word-medial unstressed vowel obviously applies also in the forms occurring before a vowel. In these cases, the presence of the full vowel, regardless of whether it belongs to the same or to the following word, prevents the creation of a consonant cluster and nullifies any perceptual reason for the schwa-like vocoid to be realized. As already discussed in the previous sections, before a consonant-initial word or a pause, a word-final consonant cluster can display a schwa-like release which can be interpreted both as a means of perceiving the place of articulation of the preceding consonant and as a by-product of the consonantal gesture phasing (Hall 2006). A word such as /sarˈvadg/ ‘wild SG.MASC’, for example, displays a word-final schwa-like vocoid (see Tab. 5.10). On the other hand, in forms such as *selvatica* /sarˈvadga/ ‘wild f.’ and *selvatico o no* /sarˈvadg o no/ ‘wild m. or not’ the formant transitions that help to identify the /g/ place of articulation can be ‘read’ in the formant structure of the vowels that follow it, namely the feminine ending *-a* and the disjunctive conjunction *o*. Therefore, no perceptual reason can be found which could either block the word-medial vowel deletion or favour the presence of the word-final schwa-like vocoid. Since no exception has been found to the absence of this pre-vocalic schwa-like vocoid a dedicated table would be redundant and is hence not presented here.

In Tab. 5.11 the mean values of the acoustic data presented in Tab. 5.10 are displayed:

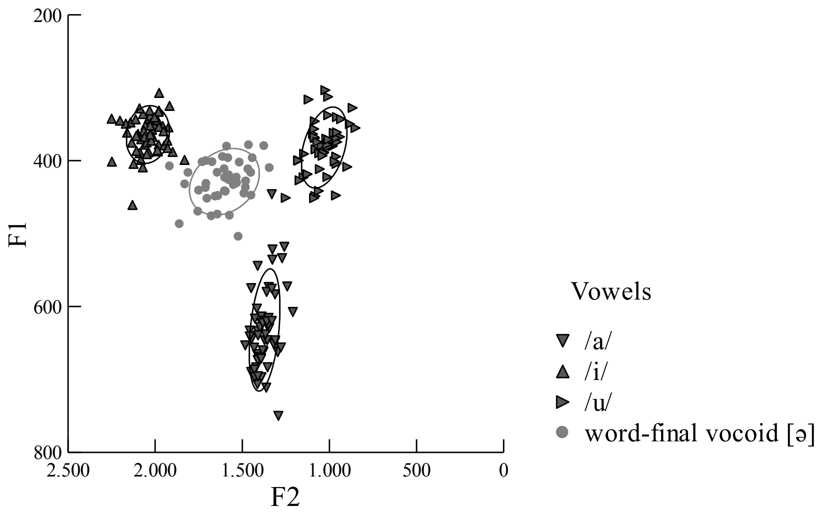
Tab. 5.11 Pontremolese proparoxitones - decreasing/even sonority contour - mean values

Pontremol.	F1		F2		Duration			v/V	
	v_1	v_2	v_1	v_2	v_1	v_2	V	v_1	v_2
ˈσ.Cv_1Cv_2] C									
mean	0	406	0	1496	0	72	86	0	86%
SD	0	43	0	213	0	24	29	0	24%
ˈσ.Cv_1Cv_2] #									
mean	0	413	0	1576	0	88	121	0	76%
SD	0	41	0	132	0	32	28	0	31%
Total									
mean	0	409	0	1536	0	80	103	0	81%
SD	0	42	0	179	0	29	33	0	28%

As for the word-final vocoid, it is realized in all the forms, showing a slightly greater relative duration (mean 86%, SD 24%) in the pre-consonantal context than in the pre-pausal one (mean 76%, SD 31%). The absolute durations of both the word-final vocoids and the stressed vowels again show the phrase-final lengthening effect. In the phrase-medial words, the vocoid and the stressed mean absolute values are, respectively, 72 ms (SD 24 ms) and 86 ms (SD 29 ms), against the 88 ms (SD 32 ms) and 121 ms (SD 28 ms) of the words occurring in the phrase-final forms. Hence, from both the point of view of the frequency of occurrence and of duration, the word-final vocoids occurring in the two phrasal contexts can be considered phonetically the same object.

No significant difference can be found as far as the formant frequency values are concerned either, and the normalized corresponding tokens have hence been plotted in Fig. 5.4 without distinguishing their phrasal context. As can be seen, the word-final vocoids occur in the centre of the Pontremolese vocalic space, nearly perfectly overlapping with the same dialect’s paroxitone-final vocoids plotted in Fig. 5.2.

Fig. 5.4 Pontremolese word-final vocoids - proparoxitones - decreasing/even sonority contour



In both the phrasal contexts, they display similar F1 and F2 mean frequencies, namely 406 Hz (SD 43 Hz) and 1,496 Hz (SD 213 Hz) in the phrase-medial words and 413 Hz (SD 41 Hz) and 1.576 Hz (SD 132 Hz) in the phrase-final. As already observed for the forms discussed in the preceding sections, more variation can be found in F2 values, the standard deviations of F1 being about 40 Hz in the words occurring in both the phrasal contexts, but 213 Hz and 132 Hz in phrase-medial and phrase-final forms. The same articulatory and perceptual explanations already proposed for the greater variation of F2 with respect to F1 can be applied to these vocoids as well. As a consequence, comparing the vocoid F2 standard deviations of the words occurring in the two phrasal contexts, it's not surprising to find a greater variation when the vocoid is followed by a consonant-initial word (213 Hz) than when followed by a pause (132 Hz). Indeed, in the first case the vocoid's F2 can be conditioned by the two flanking consonants. Similarly, given that the word-medial vocoids are regularly absent in the phrase-final words also, the word-final ones can be interpreted as a means of enabling the perception of the (phonologically) word-final consonant.

Now that the description of the fate of the etymologically unstressed vowels in the two dialects has been accomplished, let us turn to the intrusive/epenthetic vowels.

5.3 The intrusive/epenthetic vocoids

In the following sections, a description of the vocoids that can show up as a consequence of the etymologically unstressed vowel deletion is offered. As in the case of the reduced vowels just described, a subtle variation can be observed in the way these vocoids behave in the two dialects. To underline this difference, these vocoids are labelled as ‘intrusive’ (I) in Carrarese and ‘epenthetic’ (E) in Pontremolese (see also Section 1.2).

5.3.1 Carrarese

In Tab. 5.12 the data are presented of the penultimate stressed words that, as a consequence of apocope, show a word final consonant cluster with an increasing sonority contour (*muta cum liquida*).

Tab. 5.12 Carrarese paroxitones - increasing sonority contour

Forms	ˈσ.CIC] C						ˈσ.CIC] #					
	F1	F2	v ms	V ms	v/V	Transcr.	F1	F2	v ms	V ms	v/V	Transcr.
AC												
libro	442	1470	58	49	118%	[ˈlibər]	0	0	0	138	0	[ˈlibr]
magro	467	1767	50	97	52%	[ˈmagər]	0	0	0	189	0	[ˈmagr]
quattro	580	1744	49	99	50%	[ˈkwatər]	0	0	0	165	0	[ˈkwatr]
BD												
libro	524	1444	93	109	85%	[ˈlibər]	0	0	0	174	0	[ˈlibr]
magro	0	0	0	120	0	[ˈmagr]	0	0	0	168	0	[ˈmagr]
quattro	0	0	0	190	0	[ˈkwatr]	0	0	0	94	0	[ˈkwatr]
ED												
libro	471	1251	60	57	104%	[ˈlibər]	0	0	0	114	0	[ˈlibr]
magro	436	1421	53	96	55%	[ˈmagər]	488	1420	59	218	27%	[ˈmag^{ə}r]
quattro	0	0	0	88	0	[ˈkwatr]	423	1463	60	134	45%	[ˈkwat^{ə}r]
MV												
libro	508	1360	54	99	55%	[ˈlibər]	0	0	0	135	0	[ˈlibr]
magro	0	0	0	94	0	[ˈmagr]	0	0	0	171	0	[ˈmagr]
quattro	0	0	0	74	0	[ˈkwatr]	0	0	0	195	0	[ˈkwatr]
AM												
libro	425	1207	143	76	189%	[ˈlibər]	426	1324	75	124	60%	[ˈlibər]
magro	426	1516	54	112	48%	[ˈmag^{ə}r]	427	1481	58	225	26%	[ˈmag^{ə}r]
quattro	444	1402	39	128	31%	[ˈkwat^{ə}r]	426	1359	46	118	39%	[ˈkwat^{ə}r]

These forms are *libro* ‘book’, *magro* ‘thin’ m. and *quattro* ‘four’. The reader should already be familiar with the column tags of the following table, the only difference being that here, the pre-consonantal (ˈσ.CIC] C) and pre-pausal (ˈσ.CIC] #) contexts are the ones in which the word (optionally) displays an intrusive vowel (‘I’).

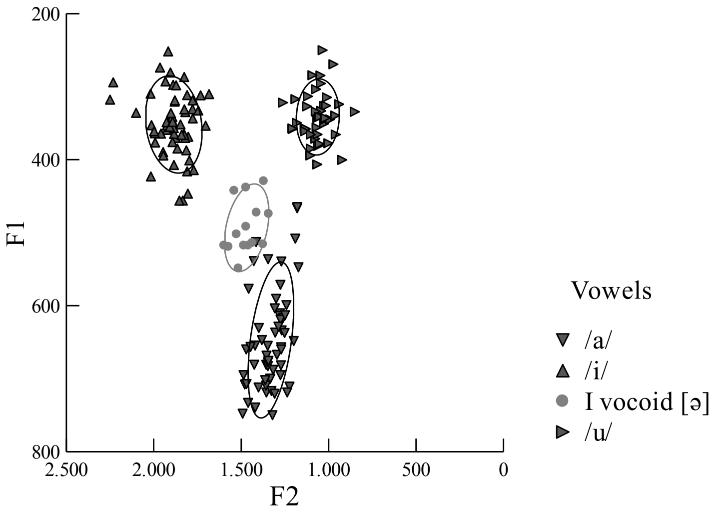
The relative mean values can be found in Tab. 5.13:

Tab. 5.13 Carrarese paroxitones - increasing sonority contour - mean values

Carrarese	F1	F2	v ms	V ms	v/V
ˈσ.CIC] C					
mean	472	1458	65	99	79%
SD	51	183	31	33	48%
ˈσ.CIC] #					
mean	438	1409	60	157	39%
SD	28	67	10	39	14%
Total					
mean	461	1442	63	128	66%
SD	46	153	25	46	43%

It is immediately clear that the intrusive vocoid of Carrarese shows the same mean F1 and F2 frequencies of the schwa in both phrasal contexts, namely 472 Hz (SD 51 Hz) and 1,458 Hz (SD 183 Hz) in the pre-consonantal word and 438 Hz (SD 28 Hz) and 1,409 Hz (SD 67 Hz) in the pre-pausal one. It can also be noticed that, as far as F2 and F1 are concerned, the variation observed in the intrusive vocoid is lower than the one characterizing the vocoid occurring in the contexts described in the previous sections. However, since the F2 frequency values of schwa-like vocoids are assumed to be conditioned by the quality of the adjacent consonants (Flemming 2007; Flemming & Johnson 2007 and Silverman 2011), and given that the intrusive vocoids acoustically analysed occur in very similar consonantal contexts, the I vocoids of Carrarese should be considered qualitatively similar to the other vocoids analysed so far. Indeed, as shown in Fig. 5.5, they occupy the same central area of the Carrarese vocalic space.

Fig. 5.5 Carrarese I vocoids - paroxitones



As for the duration parameter, the data summarized in Tab. 5.13 show that the phrase-final lengthening applies also in this case, but interestingly only to the stressed vowels. While in the previously examined vocoids, the absolute duration augments proportionally to that of the stressed vowel, the I vocoid goes in the opposite direction, its duration being shorter in phrase-final words than in phrase-medial ones. Indeed, as shown by the table, in phrase-medial forms, the mean durations of the I vocoid and the stressed vowel are, respectively, 65 ms (SD 31 ms) and 99 ms (SD 33), against the 60 ms (SD 10 ms) and 157 ms (SD 39 ms) of phrase-final forms. Furthermore, while phrase-finally the I vocoid is realized in only in five tokens out of 15, phrase-medially it occurs in 10 out of 15. These data seem to suggest that the I vocoid is transparent to the phrase-final lengthening, and that Carrarese speakers 'easily' pronounce word-final bi-consonantal clusters with both an even (Section 5.2.2.1) and an increasing sonority contour[69]. To be more precise, they also seem to 'prefer' the word-final increasing sonority contours to the even ones. Indeed, as shown in Tab. 5.12, while they produce only five tokens out of 34 (15%) showing an even sonority contour (namely the forms in Tab. 5.5 where both apocope and syncope are 'drastically' applied), they produce 10 out of 15 (67%) tokens showing an increasing sonority contour. However, from the acoustic/perceptual point of view, this is hardly surprising as it has been argued that the monovibrant rhotics[70] contain "two vocalic elements, one on each side of [the]

[69] It is also interesting to note that cases can be found where the vowel reduction processes neutralize some opposition, such as the one between *libero* 'free' and *libro* 'book', both pronounced as [ˈlibr] (see for example the relevant pre-consonantal and pre-pausal forms as pronounced by BD and MV in Tab. 5.5 and the pre-pausal ones produced by the same speakers in Tab. 5.12).

[70] The spectrographic analysis of Carrarese and Pontremolese rhotics shows that, similarly to those of Northern Italian varieties (Romano 2013), they are phonetically flaps.

constricted interval" (Savu 2013: 145). As a consequence, the need for a formantic structure conveying the articulatory information of the preceding stop is fulfilled by the 'vocalic elements' of the following rhotic. The phonetic considerations just discussed call for a description of the I vocoid as a kind of enhancement of the first 'vocalic element' of the post-consonantal rhotic.

In the next section, the differences between the intrusive vocoid just described and the epenthetic vocoid of Pontremolese will be phonetically substantiated by the presentation of the latter's data.

5.3.2 Pontremolese

In Tab. 5.14 the acoustic data are presented of the Pontremolese penultimate stressed words showing an increasing sonority contour after the application of apocope. The tags in the table are the same as those already described for Tab. 5.12, the only difference being the use of 'E' to indicate the epenthetic vocoid instead of the 'I' used for the Carrarese intrusive vocoid.

Tab. 5.14 Pontremolese paroxitones - increasing sonority contour

Forms	ˈσ.CEC] C						ˈσ.CEC] #					
	F1	F2	v ms	V ms	v/V	Transcr.	F1	F2	v ms	V ms	v/V	Transcr.
DP												
libro	564	880	91	160	57%	[ˈlibɐr]	571	1033	105	137	77%	[ˈlibɐr]
magro	616	1253	95	123	77%	[ˈmagɐr]	628	1429	153	170	90%	[ˈmagɐr]
quattro	541	1375	45	102	44%	[ˈkwat^{ɐ}r]	581	1390	83	154	54%	[ˈkwatɐr]
MM												
libro	522	1412	72	75	96%	[ˈlibɐr]	576	1294	83	111	75%	[ˈlibɐr]
magro	548	1496	69	96	72%	[ˈmagɐr]	552	1355	71	132	54%	[ˈmagɐr]
quattro	501	1441	40	77	52%	[ˈkwatɐr]	430	1591	55	145	38%	[ˈkwat^{ɐ}r]
LB												
libro	489	1291	57	57	101%	[ˈlibɐr]	545	1381	106	118	90%	[ˈlibɐr]
magro	476	1355	65	100	65%	[ˈmagɐr]	554	1468	81	119	68%	[ˈmagɐr]
quattro	494	1335	45	76	59%	[ˈkwatɐr]	579	1487	64	149	43%	[ˈkwat^{ɐ}r]
AS												
libro	591	1346	86	68	126%	[ˈlibɐr]	615	1401	142	118	120%	[ˈlibɐr]
magro	622	1692	69	88	79%	[ˈmagɐr]	622	1576	108	162	67%	[ˈmagɐr]
quattro	596	1529	50	62	81%	[ˈkwatɐr]	607	1418	124	170	73%	[ˈkwatɐr]
GB												
libro	601	1331	88	101	87%	[ˈlibɐr]	592	1412	65	100	65%	[ˈlibɐr]
magro	490	1642	76	93	82%	[ˈmagɐr]	500	1534	84	126	67%	[ˈmagɐr]
quattro	584	1415	59	78	76%	[ˈkwatɐr]	504	1450	50	122	41%	[ˈkwat^{ɐ}r]

In Tab. 5.15 the mean values are presented of the Pontremolese epenthetic vocoid acoustic data:

Tab. 5.15 Pontremolese paroxitones - increasing sonority contour - mean values

Pontremol.	F1	F2	v ms	V ms	v/V
ˈσ.CEC] C					
mean	549	1386	67	90	77%
SD	51	187	18	26	21%
ˈσ.CEC] #					
mean	564	1415	92	184	68%
SD	53	133	31	22	22%
Total					
mean	556	1400	79	113	72%
SD	52	160	28	33	21%

To facilitate comparison between the intrusive/epenthetic vocoids, in Tab. 5.16 the frequency and length mean values of the Carrarese intrusive vocoid are illustrated here.

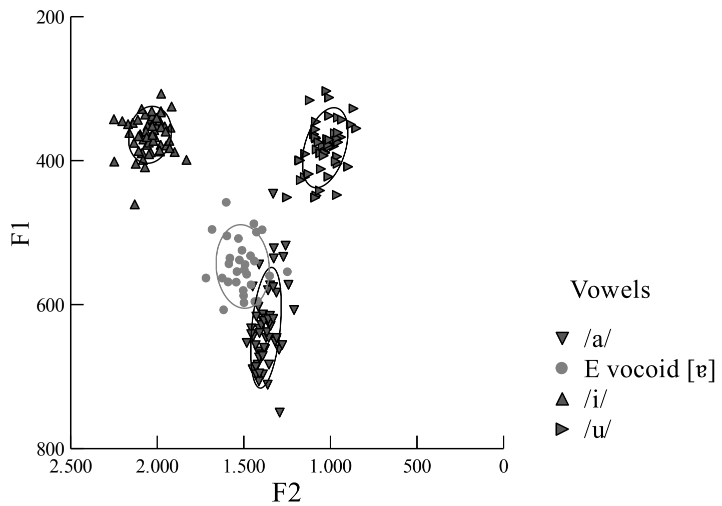
Tab. 5.16 Carrarese intrusive vocoids mean values

Carrarese	F1	F2	v ms	V ms	v/V
ˈσ.CIC] C					
mean	472	1458	65	99	79%
SD	51	183	31	33	48%
ˈσ.CIC] #					
mean	438	1409	60	157	39%
SD	28	67	10	39	14%
Total					
mean	461	1442	63	128	66%
SD	46	153	25	46	43%

As can be noticed by having a look at the means from the two dialects presented in Tab. 5.15 and Tab. 5.16, while the Carrarese I vocoid shows an F1 mean value similar to that of the schwa, the Pontremolese E vocoid F1 displays higher frequency values in the forms occurring in both phrasal contexts. Since the F1 frequency value is inversely correlated with the height of the vowel, the Pontremolese E vocoid turns out to be lower than the Carrarese I vocoid. As for the F2, the mean values of the two vocoids occurring in the phrase-final words are pretty similar (1,409 Hz for I vs.

1,415 for E), but show a significant difference as far as the standard deviation is concerned: the Pontremolese E vocoid shows a higher value (67 Hz for I vs. 133 Hz for E). On the other hand, in the phrase-medial words, the Pontremolese E vocoid displays a lower F2 mean value (1,386 Hz) than the Carrarese I vocoid (1,458 Hz), the standard deviations being, in this case, quite similar (187 Hz for E vs. 183 Hz for I). While F1 is related to the vowel height, the F2 frequency value is related to the vowel frontness: the lower the F2, the more back the vowel is. Hence, the F2 values of the Pontremolese E vocoid suggest that it is less central than the Carrarese I vocoid (as shown by the E mean value of the phrase-medial forms) and that it can be produced with a greater amount of variation along the front-back dimension (as indicated by the higher E SD value of the phrase-final forms). Summarizing, the mean F1 and F2 E frequency values characterize a vocoid which is slightly more low and back than a schwa, which has hence been transcribed as [ɐ] and plotted in Fig. 5.6 together with the normalized stressed cardinal vowels.

Fig. 5.6 Pontremolese E vocoid ([ɐ]) - paroxitones



Another difference between I and E vocoids can be found both in their mean durations and in their frequency of realization in the phrase-final forms. Indeed, while I vocoids of Carrarese average at 60 ms, 39% of the stressed vowel length, Pontremolese E vocoids average at 92 ms, that is, 68% of the stressed vowel length. Furthermore, while the phrase-final I is far shorter than the phrase-medial one (which is 79% of the stressed vowel length), the relative lengths of the phrase-final and phrase-medial Pontremolese E are very similar (68% vs. 77%). Hence, while Carrarese I seems to be transparent to the phrase-final lengthening (Section 5.3.1), the same cannot be argued for the Pontremolese E vocoid, which behaves as every other vowel.

Furthermore, while Carrarese I is frequently dropped (10 times phrase-finally and five phrase-medially out of 15), Pontremolese E is always realized in both of the phrasal contexts.

The acoustic, durational and distributional differences just described suggest a phonological difference between I and E. However, before going through it (Chapter 7), Pontremolese proparoxitones showing a post-syncope/apocope increasing sonority contour need to be described. Indeed, as shown in Tab. 5.17, proparoxitones are interesting not only because they confirm the distributional difference between I and E, but also because they display the back E vocoid. In order to display the acoustic differences between the two E vocoids, the usual *tenero*, *libero* and *giovane* are presented together with *asino* ‘donkey’. As can be noticed in the table, while *tenero* and *libero* show the low E, *giovane* and *asino* show the back one (henceforth respectively aE and uE).

Tab. 5.17 Pontremolese proparoxitones - increasing sonority contour

	ˈσ.CEC] C										ˈσ.CEC] #									
Forms	F1		F2		Duration			v/V		Transcr.	F1		F2		Duration			v/V		Transcr.
	v1	v2	v1	v2	v1	v2	V	v1	v2		v1	v2	v1	v2	v1	v2	V	v1	v2	
DP																				
tenero	567	0	1219	0	56	0	87	64%	0	[ˈtenɐr]	660	0	1286	0	69	0	140	49%	0	[ˈtenɐr]
libero	547	0	1062	0	109	0	148	74%	0	[ˈlibɐr]	624	0	1225	0	107	0	121	88%	0	[ˈlibɐr]
giovane	423	0	690	0	140	0	171	82%	0	[ˈzuʊŋ]	420	0	692	0	166	0	145	115%	0	[ˈzuʊŋ]
asino	303	0	629	0	105	0	139	76%	0	[ˈazʊŋ]	345	0	745	0	81	0	178	45%	0	[ˈaz^{ʊ}ŋ]
MM																				
tenero	N	N	N	N	N	N	N	N	N	N	530	0	1487	0	70	0	145	48%	0	[ˈtenɐr]
libero	542	0	1383	0	50	0	88	57%	0	[ˈlibɐr]	524	0	1278	0	93	0	97	96%	0	[ˈlibɐr]
giovane	308	0	690	0	63	0	90	70%	0	[ˈzuʊŋ]	377	0	843	0	57	0	94	60%	0	[ˈzuʊŋ]
asino	397	0	637	0	109	0	168	65%	0	[ˈazʊŋ]	338	0	736	0	90	0	188	48%	0	[ˈaz^{ʊ}ŋ]
LB																				
tenero	695	0	1593	0	51	0	72	71%	0	[ˈtenɐr]	706	0	1555	0	93	0	112	83%	0	[ˈtenɐr]
libero	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
giovane	N	N	N	N	N	N	N	N	N	N	283	365	702	1368	102	95	81	126%	117%	[ˈzuʊŋə]
asino	297	0	733	0	106	0	113	94%	0	[ˈazʊŋ]	301	0	837	0	87	0	184	47%	0	[ˈaz^{ʊ}ŋ]
AS																				
tenero	619	0	1513	0	68	0	100	68%	0	[ˈtenɐr]	716	0	1541	0	134	0	137	98%	0	[ˈtenɐr]
libero	594	0	1302	0	81	0	75	108%	0	[ˈlibɐr]	602	0	1357	0	117	0	87	135%	0	[ˈlibɐr]
giovane	442	0	904	0	40	0	87	46%	0	[ˈzu^{ʊ}ŋ]	288	0	706	0	209	0	143	146%	0	[ˈzuʊŋ]
asino	344	0	740	0	77	0	154	50%	0	[ˈazʊŋ]	282	0	1169	0	94	0	184	51%	0	[ˈazʊŋ]
GB																				
tenero	532	438	1571	1608	44	53	81	54%	65%	[ˈtenɐrə]	569	0	1610	0	91	0	105	86%	0	[ˈtenɐr]
libero	613	0	1329	0	108	0	118	91%	0	[ˈlibɐr]	513	0	1391	0	65	0	90	72%	0	[ˈlibɐr]
giovane	269	0	813	0	84	0	95	89%	0	[ˈzuʊŋ]	347	0	780	0	111	0	102	109%	0	[ˈzuʊŋ]
asino	349	0	1020	0	67	0	120	56%	0	[ˈazʊŋ]	217	0	632	0	93	0	157	59%	0	[ˈazʊŋ]

Tab. 5.17 shows that, while the Pontremolese proparoxitones with an even or decreasing sonority contour resulting from the combination of syncope and apocope do not display any cluster-breaking vocalic segment, if the word-final cluster is a *muta cum liquida* then an aE vocoid appears. The only thing that can be observed in the even/decreasing sonority contour cases (see Tab. 5.10) is the regular realization of a schwa-like vocoid after the last consonant of the cluster, both phrase-medially and phrase-finally. This word-final vocoid is instead unrealized in Pontremolese increasing sonority contour proparoxitones. It should be noted that it actually

appears in two cases: in *tenero* as pronounced by GB in phrase-medial position and in *giovane* as pronounced by LB in phrase-final position. In both of these cases, the F1 and F2 values indicate that this vocoid is qualitatively a schwa. The fact that GB produces the same form without this vocoid in the other phrasal context and that all of the other forms produced by LB lack this vocoid render these two tokens exceptions to a fairly regular generalization.

In Tab. 5.18 the mean values are displayed of the acoustic data just presented. The table shows the mean values of the low epenthetic vocoid (aE) on the left and those of the back epenthetic vocoid (uE) on the right.

Tab. 5.18 Pontremolese proparoxitones - increasing sonority contour - mean values

Pontremol.	aE									uE								
	F1		F2		Duration			v/V		F1		F2		Duration			v/V	
	aE	v_2	aE	v_2	aE	v_2	V	aE	v_2	uE	v_2	uE	v_2	uE	v_2	V	uE	v_2
	ˈσ.CEC] C									ˈσ.CEC] C								
mean	589	0	1371	0	71	0	96	73%	0	348	0	762	0	88	0	126	70%	0
SD	54	0	183	0	26	0	26	18%	0	61	0	130	0	30	0	33	17%	0
	ˈσ.CEC] #									ˈσ.CEC] #								
mean	605	0	1414	0	93	0	115	84%	0	320	0	784	0	109	0	146	81%	0
SD	77	0	139	0	23	0	22	26%	0	57	0	150	0	45	0	40	39%	0
	Total									Total								
mean	597	0	1394	0	83	0	106	79%	0	333	0	774	0	99	0	137	75%	0
SD	66	0	157	0	26	0	25	23%	0	59	0	137	0	39	0	37	30%	0

As for the F1 and F2 frequencies, the proparoxitonic aE vocoids display pretty much the same mean values as their paroxitonic equivalents: in the phrase-medial forms, the F1 and F2 mean values are, respectively, 589 Hz and 1,371 Hz (versus 549 Hz and 1,386 Hz in the paroxitones), and 605 Hz and 1,414 Hz in the phrase-final ones (versus 564 Hz and 1,415 Hz in the paroxitones). The similarity between the paroxitonic and proparoxitonic aE formant values is confirmed by the similarity of the relative standard deviations, which, as usual, show the highest values for F2 in both phrasal contexts. The paroxitones' and proparoxitones' aE vocoids must hence be phonetically considered the same object.

A substantial difference can instead be found when the word-final consonant of a cluster is a nasal (as in the outcome of *giovane* and *asino*). In this phonological context, the Pontremolese speakers realize an epenthetic vocoid that displays the formant frequency values of a high back vowel. It has, as shown in Tab. 5.18, an F1 mean of 333 Hz (SD 59 Hz) and an F2 mean of 774 Hz (SD 137 Hz). It is interesting to note that its quality can be argued to be conditioned by the following consonantal articulation. Indeed, uE occurs before a word-final nasal that, crucially, in Pontremolese is always velar[71]. In other words, the uE shares some articulatory

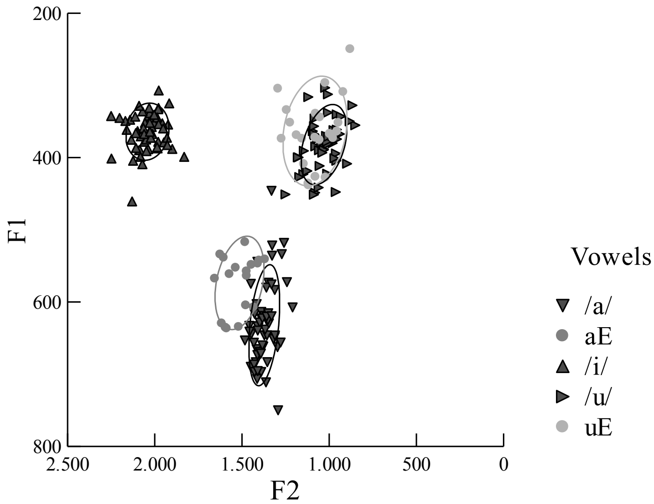
[71] Interestingly, even if Carrarese word-final nasals are velar, they do not spread their acoustic (or phonological) features toward the preceding vocoid, which in Carrarese keeps its own schwa-like quality (Pontr. [ˈazʊŋ] vs. Carr. [ˈazəŋ] 'donkey').

configuration with the following consonant, namely the backness of the tongue body of the velar nasal.

As for the duration parameter, the back and the low epenthetic vocoids do not show any difference: they are both slightly less than the 80% of the stressed vowel duration.

In order to better visualize the numerical data presented so far about the formant frequencies of these vocoids, aE and uE have been plotted in Fig. 5.7 together with the Pontremolese stressed cardinal vowels.

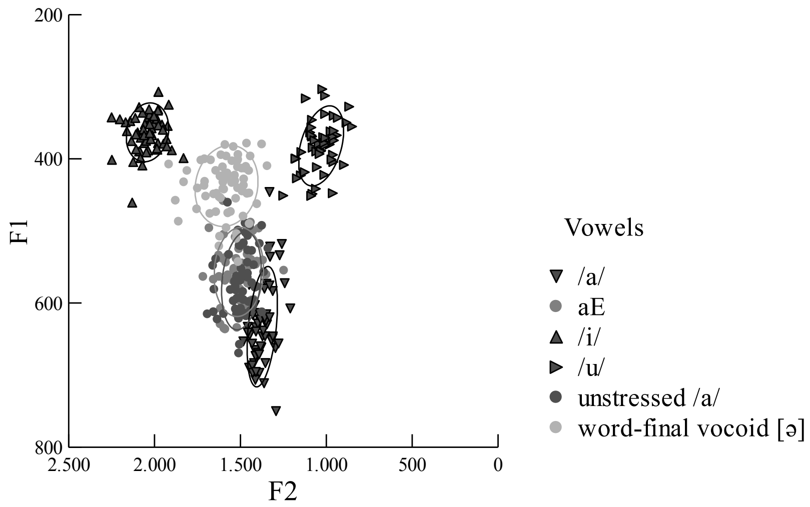
Fig. 5.7 Pontremolese aE and uE vocoids - proparoxitones



As already shown by the numerical data, the aE cloud is a little more low and back with respect to that of the schwa-like vocoid realized in word-final position, which occupies a more central and high position. This can be visually checked in Fig. 5.8, where aE[72] has been plotted together with the stressed cardinal vowels and, crucially, with the unstressed /a/ (which occurs word-finally to mark the singular feminine) and the schwa-like vocoid, which can be realized word-finally.

[72] Given their phonetic and phonological similarity, the paroxitonic and proparoxitonic aE vocoids have been collapsed together here.

Fig. 5.8 Pontremolese aE, unstressed /a/ and schwa-like word-final vocoids



As can be noticed in the figure above, the aE probability ellipsis almost perfectly overlaps with that of the unstressed /a/. This means that the two objects share the same frequency values, which in turn means that they are perceived as the same by Pontremolese speakers as well. As for the other epenthetic vocoid, the uE cloud overlaps considerably with the stressed high-back vowels (Fig. 5.7), showing just a little more dispersion. As claimed for aE, this means that the Pontremolese speakers may interpret uE and /u/ as the same object. Furthermore, as pointed out above, the fact that, differently from the Carrarese I, the Pontremolese E undergoes the phrase-final lengthening, can be considered another clue to the phonetic and phonological identity of aE and uE with respect to /a/ and /u/. Namely, from both the phonetic and phonological points of view, there seems to be no difference between the Pontremolese epenthetic vocoids and full vowels.

Therefore, even if what is written down by the poets can be considered neither a phonetic nor a phonological transcription of their strophe, it might be no coincidence that they use the <a> and <u> graphemes for the aE and uE vocoids just described.

PART III: PHONOLOGY

6 The theoretical toolkit

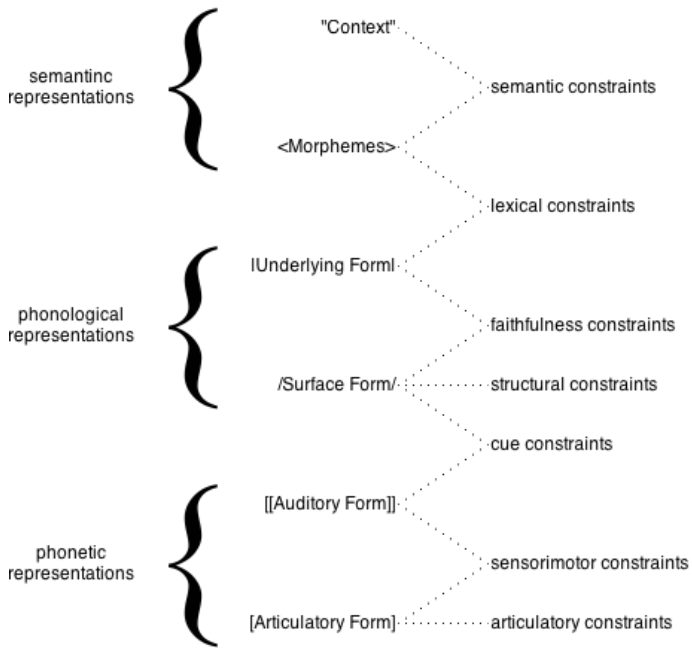
Należy fonetykę od fonologii odróżniać, ale nie należy ich oddzielać.
Phonetics and phonology should be told apart, but not taken apart.
(Stieber 1955: 73 [Cyran 2012])

6.1 Introduction

In this chapter, the theoretical tools resorted to for the phonological analysis (Chapter 7) of the data presented in Chapter 5 are introduced.

As hinted at in Section 1.1, the phonological analysis of the processes under consideration assumes a modular architecture of human cognition (Fodor 1983; Scheer 2014) and, particularly, of the language module (Bermúdez-Otero 2012; in press), for the formalization of which we resort to the BiPhon model (Fig. 6.1). The basic properties of this model's architecture are given in Section 6.3, where the phonetic (Section 6.3.1.2) and phonological (Section 6.3.1.1) levels of representation are described. As for the structures belonging to the phonological level, we resort to an autosegmental representational approach, and an account is therefore given of the way phonological information is structured both below (Section 6.3.1.1.1) and above (Section 6.3.1.1.2) the skeleton. Notice that, since we resort to BiPhon, i.e. to an optimality-theoretic model, the structural properties of the various levels of representation, as well the way levels are mapped onto each other, are defined in terms of constraints interaction. These constraints, therefore, constitute the building blocks of our phonological analysis, and are hence presented first (Section 6.2). In particular, the constraints are introduced starting from the bottom side of the BiPhon grammar architecture represented in Fig. 6.1. Articulatory and sensorimotor constraints (Section 6.2.1) are therefore described first. They are followed by the cue constraints (Section 6.2.2), the structural constraints (Section 6.2.3) and, differently from BiPhon, by the phonological recoverability constraints (Section 6.2.4).

Fig. 6.1 BiPhon grammar (Boersma 2011)



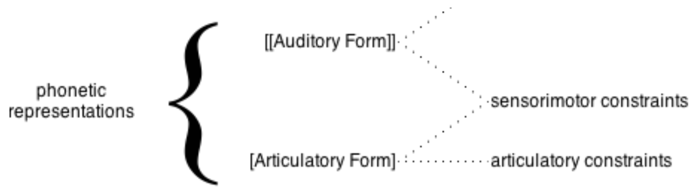
Furthermore, notice that, since our analysis does not refer to any semantic representation, the constraints concerning BiPhon's highest representational level are not considered. Similarly, because of the (coloured) containment underlying-surface representation relationship (Section 6.3.1.1.3), the faithfulness constraints linking them within BiPhon are ruled out.

6.2 Constraints

6.2.1 Articulatory and sensorimotor constraints

As shown in Fig. 6.2, the phonetic module assumed by BiPhon consists of an acoustic and an articulatory representational level. These two levels are mapped onto each other by a set of sensorimotor constraints, a set of articulatory constraints instead evaluating only the articulatory forms (Boersma 1998; Kirchner 1998).

Fig. 6.2 BiPhon phonetic module (adapted from Boersma 2011)



As discussed in Section 6.3.1.2, though, while the acoustic representational level can be included within the linguistic module (see also Section 6.3.1.1.1), the linguistic status of articulatory representations is not so clear. This is mirrored by the set of constraints referring to it. For instance, the sensorimotor and articulatory constraint rankings can hardly be considered language-specific (Hamann 2011): if not universal (because humans share similar anatomical and physiological characteristics), their ranking needs to be considered speaker-specific (because we are slightly different from each other anyway) and fixed (Boersma 2011). It sounds a little outlandish, indeed, to admit that a given language conditions the (re)ranking of constraints that refer to the vocal tract's anatomical and physiological properties. The only ranking change that can be thought of with respect to these constraints regards the articulatory ones. It can be assumed, for instance, that in fast and/or casual speech they are moved, in block, at the top of the hierarchy, resulting in a more blurry and economical speech (Silke Hamann pc). In fact, as shown in Chapter 7, this mechanism is resorted to in order to formalize the very first stage of vowel reduction (Section 7.2) and coarticulation (Section 7.3). More generally, we could assume that the phonetics' intrinsic variability, i.e. the "fuel" of phonological changes (Kiparsky 1995)[73], is mimicked in BiPhon by the ranking of the articulatory constraints. These constraints need, therefore, to be defined.

In Tab. 6.1, the sensorimotor constraints we resort to in the phonological analysis of Chapter 7 are presented. They

> "express the language user's knowledge of the relation between articulation and sound; with them, the speaker knows how to articulate a given sound and can predict what a certain articulatory gesture will sound like." (Boersma 2009: 60)

Basically, these constraints work similarly to the 'traditional' OT faithfulness constraints: they evaluate the similarity between two representations that are assumed to be related.

Following the notational convention proposed by Boersma (2011), we represent acoustic forms between double squared brackets and articulatory forms between single squared brackets.

[73] "In the domain of sound change, the analog of genetic mutations that fuel the process is phonetic variation, and the analog to natural selection is the inherently selective process of transmission that incorporates them into the linguistic system" (Kiparsky 1995: 657).

Tab. 6.1 Sensorimotor constraints

a. Formant structure sensorimotor constraints

a_i. General constraint (template)

[[x Hz]] [x]: an acoustic x-like formant structure is produced by an articulatory configuration x

a_{ii}. Specific constraints

[[ə Hz]] [ə]: an acoustic schwa-like formant structure is produced by tongue and lips in rest/neutral position

[[u Hz]] [u]: an acoustic u-like formant structure is produced by tongue in back position and rounded lips

b. Durational sensorimotor constraints

b_i. General constraint (template)

[[x ms]] [x ms]: an acoustic (periodic) structure of a given duration is produced by a (vocalic) gesture of the same duration

b_{ii}. Specific constraints

[[xː]] [xː]: a long acoustic (periodic) structure is produced by a long (vocalic) gesture

[[xˑ]] [xˑ]: a half-long acoustic (periodic) structure is produced by a half-long (vocalic) gesture

[[x]] [x]: a short acoustic (periodic) structure is produced by a short (vocalic) gesture

[[^{x}]] [^{x}]: an extra-short acoustic (periodic) structure is produced by an extra-short (vocalic) gesture

As can be noticed, sensorimotor constraints have been formalized which refer either to the formant characteristics (Tab. 6.1a) or to the duration (Tab. 6.1b) of a given phonetic object. As for the first set, [[x Hz]] represents the F1 and F2 acoustic properties, while [x] is a shorthand for the articulatory instructions a speaker needs to send to the peripheral system to produce the acoustic target [[x]][74]. As for the durational sensorimotor constraints, they specify on one side the acoustic duration of a given phonetic object ([[x ms]]), and on the other the duration of the gesture producing it ([x ms]).

It has to be stressed, however, that the acoustic values these constraints refer to are 'slightly more abstract' than the actual ones. Indeed, they are argued to represent the values the speaker/listener draws as a consequence of a normalization process that levels inter-speaker biologically driven formant and duration differences, as well as the differences due to speech rate variation. For instance, the durational sensorimotor constraints formalize (and normalize) the relative difference among long (e.g. a stressed |X|), short (e.g. an unstressed |X|) and extra-short (e.g. a reduced |X|) instances of a given phonetic object[75]: the speaker knows that a long acoustic duration ([[x:]]) is reached by holding the relative vocalic gesture longer ([x:]) than what is needed to articulate a short ([[x]]) or extra-short ([[^{x}]]) acoustic duration.

As for these constraints' relative ranking, they are argued to tie on the same hierarchy level: there is no reason to assume that a speaker has a better knowledge of the way, for instance, a low vowel, as opposed to a high one, can be articulated[76]. Furthermore, given the results of, for instance, bite-block experiments, these constraints are assumed to sit in a relatively low hierarchy level: in the case that a

[74] The actual content of the articulatory side ([x]) of these constraints is not defined because of its irrelevance with respect to the aim of the present work. However, a possible formalization could refer, for instance, to the three articulatory dimensions already suggested by Stevens & House (1955: 486): "(1) the distance d_0 from the glottis to a point of maximum constriction of the tube, (2) the radius r_0 of the tube at that constriction, and (3) the ratio of the average cross-sectional area to the length for that portion of the tube that is more than 14.5 cm from the glottis. Each of these three numbers varies between a range of values: 4 to 13 cm for d_0, 0.3 to 1.2 cm for r_0, and 0.1 to 20 cm for the *A/l* ratio of the mouth opening". Interestingly, they describe some asymmetries as far as the acoustic/articulatory properties are concerned. They show, for instance, that /i/ is "relatively insensitive to mouth opening changes, but it is sensitive to variation in tongue position and height, i.e. place and degree of constriction", while "the production of /u/ is dependent largely on mouth opening characteristics" (Stevens & House (1955: 493). A possible formalization of the sensorimotor constraint could thus refer to articulatory dimensions such as the ones just mentioned, namely to those that mostly affect the F1 and F2 profile. For a possible, more recent, formalization, the reader is referred to Boersma (1998) and Kirchner (1998).

[75] Since we are describing processes that, in their very first stages (e.g. Proto-Romance), applied in languages whose acoustic forms cannot be empirically analysed, the duration values displayed in the constraints in Tab. 6.1b simply state that a given vocoid comes in different durational 'sizes'. Given the normalization process hinted at above, the assumption is that, notwithstanding its actual duration, the speaker/listener articulates/perceives the same vocoid as long ([[x:]]), half-long ([[x·]]), short ([[x]]) or extra-short ([[^{x}]]). As pointed out in Section 3.1.2, a difference in duration can be considered a cue for the prosodic prominence of a given vocoid (Crosswhite 2004; Gendrot & Adda 2006). This means, in turn, that duration is relevant also for the phonetics-phonology interface. Indeed, as shown in Chapter 7, cue constraints must refer to this acoustic dimension as well.

[76] However, as suggested by Boersma (2011), the sensorimotor knowledge of a given sound articulation can be conditioned by the vowel system of the language under concern. Indeed, it is likely that a speaker has poorer knowledge of the acoustic/articulatory space that is not used.

speaker's articulation is somehow impeded, she tries her best to reach the acoustic target she knows to be associated with a given phonological element, no matter how she manages to do it. This suggests that sensorimotor constraints are, at least, universally lower than cue constraints (Section 6.2.2).

Before moving to the articulatory constraints' description, it has to be noticed that, in our analysis, we only resort to the two specific formant sensorimotor constraints presented in Tab. 6.1a_{ii}. Sensorimotor constraints referring to other phonetic objects can be modelled, though, on the template presented in Tab. 6.1a_i. On the other hand, the specific duration constraints of Tab. 6.1b_{ii} are not resorted to in the analysis. Indeed, if violations are assigned increasingly[77], the general duration constraint of Tab. 6.1b_i does the same job of the specific constraints and, at the same time, slims the tableaux. Finally, notice that, given that the processes under analysis affect vocalic segments, only the constraints referring to them appear in the tableaux in Chapter 7.

Articulatory constraints are presented in Tab. 6.2, where the cover constraint (Tab. 6.2b) synthetizing the specific constraints of Tab. 6.2a is shown together with the violation marks it assigns to vocoids displaying different articulatory characteristics (Tab. 6.2c; notice that in this table the labels occurring between the brackets refer to the articulatory properties of vowels). Finally, an articulatory constraint favouring coarticulation is presented in Tab. 6.2d.

Tab. 6.2 Articulatory constraints

a. Specific constraint

[TENSE]&[xː]:	do not produce a stiff and long (vocalic) gesture
[TENSE]&[xˑ]:	do not produce a stiff and half-long (vocalic) gesture
[TENSE]&[x]:	do not produce a stiff and short (vocalic) gesture
[TENSE]&[ˣ]:	do not produce a stiff and extra-short (vocalic) gesture
[LAX]&[xː]:	do not produce a loose and long (vocalic) gesture
[LAX]&[xˑ]:	do not produce a loose and half-long (vocalic) gesture

[77] Namely, a violation mark is assigned for every reduction 'step' differentiating the output from the input. For instance, a form displaying a (acoustically) long vowel ([[xː]]) incurs a violation mark if its vowel surfaces (i.e. is articulated) as half-long ([[xˑ]]), two marks if it surfaces as short ([[x]]) or three if extra-short ([[ˣ]]).

[LAX]&[x]: do not produce a loose and short (vocalic) gesture

[LAX]&[^{x}]: do not produce a loose and extra-short (vocalic) gesture

b. Cover constraint

*ART: minimize gestures stiffness and duration

c. Violations

[Tense]&[xː]: *****

[Tense]&[xˑ], [Lax]&[xː]: ****

[Tense]&[x], [Lax]&[xˑ]: ***

[Tense]&[^{x}], [Lax]&[x]: **

[Lax]&[^{x}]: *

d. Coarticulatory constraint

CO-ART: overlap adjacent articulations

Since the processes under analysis are argued to start as undershoot (Sections 3.1.2, 3.2.1 and 7.2), these articulatory constraints can be considered as a rough formalization of this process (Flemming 1995; Gendrot & Adda 2006; Recasens 2014)[78]: they express the preference for gestures' reduction, namely for the least stiff and long gestures as possible. The co-occurrence of gestures' stiffness and duration reduction characterizing undershoot is here formalized by the conjunction (&) of constraints referring to the duration parameter (*[xː], *[xˑ], *[x] and *[^{x}]) and constraints referring instead to gestural stiffness (*[TENSE] and *[LAX]).

As for the "preference for gestures' reduction", this is expressed by the fixed, universal ranking given in Tab. 6.3, where the constraints are ordered in such a way as to express an increasing preference for the more lax and short vocalic gestures.

[78] They could also be seen as formalizations of the tendency towards the minimum effort, or as instances of the *power constraint* proposed by Lindblom (1983: 231), who claims that "[g]eneralizing from the physics of the spring-mass system to speech, we find that speech production appears to operate as if physiological processes were governed by a *power constraint* limiting energy expenditure per unit time". Alternatively, they could be considered instances of the LAZY constraint family (Kirchner 1998). Regarding Kirchner's (1998) formalization, though, see Marotta (2006a), who casts some doubt on the accuracy of the articulatory effort estimate and on the assignment of the numerical values quantifying it for the various outputs.

The assumption is that the more long and tense/peripheral a vowel is, the more effortful is its production (Lindblom 1983).

Tab. 6.3 Universal articulatory constraints hierarchy

[TENSE]&[xː] >> *[TENSE]&*[xˑ], *[LAX]&*[xː]* >> [TENSE]&*[x], [LAX]&*[xˑ] >> *[TENSE]&*[^{x}], *[LAX]&*[x] >> *[LAX]&*[^{x}]

As in the case of duration sensorimotor constraints, however, in the analysis presented in Chapter 7 the specific articulatory constraints are 'synthesized' by the cover constraint *ART, which, when sitting on the top of the hierarchy, formalizes the reduction pressure undergone by all the vowels of a given form.

Similarly, the top ranking of the CO-ART formalizes the process whereby the speaker overlaps adjacent articulations (Ladefoged 1975; Recasens 2014).

The ones just presented complete the set of constraints operating within the phonetic module. The set of constraints needs now to be presented that manages the phonetics-phonology interface, i.e. that associates the acoustic to the surface phonological representations.

6.2.2 Cue constraints

Cue constraints were introduced by Boersma (1998) and Escudero & Boersma (2003). They "express the language user's knowledge of cues […] i.e. the relation between auditory form and phonological surface form" (Boersma 2009: 60). In other words, they manage the mapping of acoustic objects, viz. cues, onto phonological subsegmental primitives, viz. elements (Section 6.3.1.1.1), and can thus be considered a crucial component for the phonetics-phonology interface (Sections 6.3 and 6.3.1.1.1; Boersma 2009, 2011; Hamann 2011).

As shown in Tab. 6.4, these constraints formally consist of an element (on the left side) and an acoustic object (on the right side). The acoustic side, in turn, refers either to duration (Tab. 6.4a), or to formant structure (Tab. 6.4b). Furthermore, notice that specific formant cue constraints referring to other elements can be constructed taking the general one as a model, and that, as expected given elements compositionality, 'complex' vowels are cued by 'complex' acoustic structures (Section 6.3.1.1.1).

Tab. 6.4 Cue constraints

a. Duration cue constraint

|X| [[x ms]]:	an element has (at least) a short acoustic periodic structure

b. Formant cue constraints

b_i. General constraint (template)

|X| [[x Hz]]:	|X| has an [x]-like formant structure

b_{ii}. Specific constraints

|A| [[ə Hz]]:	|A| has an [ə]-like formant structure (F1:F2 ≈ F2:F3)
|U̲| [[u Hz]]:	|U̲| has an [u]-like formant structure (F0 ≈ F1 ≈ F2)
|H| [[ə Hz]]:	|H| has an acoustic [ə]-like formant structure (C's release)

It has to be pointed out that, as in the case of the sensorimotor constraints, the acoustic values occurring on the right side of the cue constraints represent normalized values. This possibility has been already put forward by Hamann (2009: 124), who claims that the use of "relative" values instead of the actual one (of Boersma 1998) "reduces the number of constraints considerably and implies that some kind of speaker normalization has taken place". Similarly, Boersma (2009: 58) claims that "the Auditory Form may turn out to have to be divided into a representation 'before' speaker normalization and a representation 'after' speaker normalization".

As for the durational cue constraint, [[x ms]] represents, as in the case of the durational sensorimotor constraints, the normalized duration value of a short vowel. In other words, this constraint defines the minimal (normalized) duration a periodic acoustic structure must have for it to be a cue for a vocalic element.

In the formant constraints of Tab. 6.4b, instead, the normalization effect is represented with reference to the relative distances among the fundamental frequency (F0), the first (F1), the second (F2) and the third (F3) formant. |A| [[ə Hz]], for instance, formalizes the fact that, for a given speaker, |A| is cued by a periodic acoustic structure whose first three formants are evenly spaced (F1:F2 ≈ F2:F3), i.e. by a schwa-like vocoid (Flemming 2009). In the case of |U̲|, instead, the acoustic cue is a periodic acoustic structure whose first two formants are low, close to the fundamental frequency, i.e. a sound commonly transcribed as [u].

Notice that this is in line with ET literature:

> "It should be noted that the acoustic descriptions of |I|, |U|, |A| […] are not to be taken as precise or measurable phonetic properties; rather, they are general acoustic patterns which listeners identify in the speech signal and associate with linguistic information. For example, although |I| is identified by a high second formant, the exact frequency of F2 is unimportant – what matters is that it is high enough to merge with F3 and produce a concentration of energy

in the F2-F3 region of the spectrum. It is this F2-F3 energy peak which identifies |I|." (Backley 2012: 67)

It has to be pointed out, though, that, differently form what is assumed by standard ET literature (Backley 2011), acoustic correlates of elements are argued to 'change' (Section 6.3.1.1.1, 7.2, 7.3 and 7.4). In other words, they are not universal: as discussed in Section 6.3.1, these mappings are argued to be "arbitrary, language-specific and, therefore, learnt" (Hamann 2009, 2011; Cyran 2012; Scheer 2014). Hamann (2009: 122), for instance, maintains that in order to acquire these mappings, infants pass trough two stages: in the first one, they identify few salient acoustic features (such as, in the case of vowels, energy peaks), "keep track of the statistical distribution of [these] items along these cues dimensions" and "construct language-specific categories". In the second stage, instead, the lexicon guides the learners to acquire "the labels for the learnt phonetic categories", i.e. the elements that make up phonological representations. In other words, in this second stage the language user learns which piece of acoustic information uttered by the 'teaching' speaker[79] is phonologically relevant.

As suggested by Scheer (2014), though, assuming an arbitrary phonetics-phonology interface, we cannot exclude a language where, for instance, |A̲|, |I̲| and |U̲| are cued, respectively, by [i], [u] and [a]. A system such as this, however, would hardly survive inter-generation transmission. A child, indeed, would need other (than acoustic) cues to identify the elements making up a vowel, i.e. to understand "that what they hear is not what they need to store". In case these 'alternative' cues are lacking (or were lost), the learner would presumably 'store what she hears'[80].

It is not surprising, hence, that in the great majority of cases phonetic cues and the correspondent elements display a certain amount of similarity, as opposed, for instance, to the completely arbitrary mapping of morpho-syntactic structures on their phonological exponents. In the latter case, indeed, it's not even possible to calculate the similarity degree. This is due, of course, to the formal and ontological distance of the morpho-syntactic vocabulary from the phonological one. In the case of phonetics and phonology, however, the concept of similarity makes more sense.

---

[79] Together with children perceiving and analyzing their parents' speech, older speakers can also be considered to be possible initiators of sound change, as explicitly claimed by Ohala & Greenlee (1980:297): "all speakers, children and adults, by virtue of shared articulatory and perceptual constraints, are eligible to be the initiators of 'mini' sound changes". In fact, adolescent speakers have been considered extremely active as change promoters. Foulkes & Vihman (2013), for instance, claim that "peer influence during adolescence exerts an especially strong effect on linguistic patterns, with non-standard forms transmitted most readily at this stage in life". See also Labov (2001).

[80] Notice that the possibility for a learner to derive a phonological representation by "other (than acoustic) cues" (such as, for instance, the phonological behaviour of a given segment that cannot be accounted for by referring to its acoustic content) highlights the cognitive/abstract nature of elements: the hypothesis according to which they are acoustically 'grounded' does not imply that they contain actual acoustic information, but only that they interface with the acoustic side of a given sound's phonetics (Section 6.3.1.1.1), which constitutes therefore the principal, but crucially not the exclusive, source a learner has to build her set of sub-segmental phonological primitives from.

Indeed, even if vocabulary module-specificity implies, from a strictly formal point of view, the incommensurability of representations belonging to the two modules, they share analogous categories. This is due to the fact that phonology and phonetics are linked by a "grammaticalization boundary" (which is not true for morpho-syntax and phonology). Indeed, phonological categories can be considered the grammaticalized version of the phonetic ones (Anderson 2011). The two modules, hence, resort to categories displaying a 'phylogenetic' relationship and, as a consequence, a reasonable degree of similarity. As claimed by Scheer (2014), "this is also the reason why the default of the relationship between a phonological category and its phonetic exponent is complete identity"[81].

As we repeatedly claimed, cue constraints represent the phonetics-phonology interface. Now that we have completed their description, hence, we tackle the constraints that evaluate representations belonging to the phonological module.

6.2.3 Structural constraints

The structural constraints replace, in BiPhon, the 'traditional' OT markedness constraints. The difference between these two kinds of constraints resides in the structures they evaluate and in the vocabulary they are made up of. If, for instance, markedness constraints evaluate both purely phonological structures (such as syllable and foot structure) and phonetic details (such as the presence in a surface form of a given, arguably marked, segment), structural constraints only evaluate the structural properties of surface phonological representations. If, for instance, constraints such as *CODA and *COMPLEXONSET can be considered structural constraints, *RETROFLEX and MINDIST cannot. As discussed in the previous sections, the phonetic side of representations is evaluated by cue, sensorimotor and articulatory constraints (Hamann 2011).

The structural constraints we resort to in our analysis are presented in Tab. 6.5, where constraints evaluating the well-formedness of structures displaying various degrees of complexity (Tab. 6.5a) are merged in a single constraint (Tab. 6.5b) that assigns violation marks proportionally to the complexity of the structure it evaluates. To be more precise, the specific constraints assign a violation mark for every lexical unstressed nucleus (N_μ) that licenses a given elemental structure, i.e. a complex structure ($|\underline{X}Y|$), a headed element ($|\underline{X}|$), an unheaded element ($|X|$) or no elements at all ($|\ \ |$). The cover constraint $*(N\ |\text{STR}|)_\mu$, instead, assigns four violation marks to a structure such as $(N\ |\underline{X}Y|)_\mu$, three marks to $(N\ |\underline{X}|)_\mu$, two to $(N\ |X|)_\mu$ and one to $(N\ |\ \ |)_\mu$.

In Tab. 6.5c, furthermore, a constraint is presented that assigns a violation mark to surface phonological representations displaying an epenthetic vowel, i.e. a

[81] As for the cases in which a given phonological category is 'unfaithfully' mapped on an acoustic object, it is argued to be a diachronic by-product, i.e. an effect of the life cycle of a phonological process (Bermúdez-Otero in press): "mapping relations between phonology and phonetics are not born crazy - they may become crazy through aging. Most of them do not, though, and this is the reason why the overwhelming majority of mapping relations show little slack" (Scheer 2014).

nucleus lacking any morphological colour (Van Oostendorp 2005; see also Section 6.3.1.1.1). The morphological transparency of the epenthetic vowel is formalized by the absence of the subscript ($_{\mu}$), which, as in the constraints in Tab. 6.5a, defines the morphological affiliation of a given phonological object.

Tab. 6.5 Structural constraints

a. Specific constraints

*(N |$\underline{X}$Y|)$_{\mu}$:	a lexical N cannot license a complex elemental structure. Assign a violation mark for every lexical N that licenses a complex structure
*(N |$\underline{X}$|)$_{\mu}$:	a lexical N cannot license a headed element. Assign a violation mark for every lexical N that licenses a headed element
*(N |X|)$_{\mu}$:	a lexical N cannot license an unheaded element. Assign a violation mark for every lexical N that licenses an unheaded element
*(N | |)$_{\mu}$:	a lexical N cannot license elements. Assign a violation mark for every empty lexical N

b. Cover constraint

*(N |STR|)$_{\mu}$:	lexical N's cannot license complex structures
Violations:	(N |$\underline{X}$Y|)$_{\mu}$: ****; (N |$\underline{X}$|)$_{\mu}$: ***; (N |X|)$_{\mu}$: **; (N | |)$_{\mu}$: *

c. Anti-epenthesis constraint

*N:	a morphologically transparent N cannot be incorporated in the phonological representation

Evidently, these constraints draw upon the licensing constraints proposed, for instance, within GP literature (Kaye et al. 1985, 1990; Charette 1990; Harris 1997; van der Hulst 2006). A brief description of licensing is thus needed.

Licensing is an asymmetrical function that integrates a given unit into the phonological hierarchy by binding it with another unit (Harris 1997). For a given element to be phonetically interpreted, for instance, it has to be integrated in the relevant phonological representation, i.e. it has to be licensed by a syllabic/skeletal node. In this case, we can talk about a(utosegmental)-licensing (Goldsmith 1990; Harris 1997). A slightly different kind of licensing is p(rosodic)-licensing, namely an asymmetric relation that holds "within the prosodic hierarchy through the successively higher domains of the syllabic constituent, the foot and the prosodic word" (Harris 1997: 336). This relationship, hence, is entertained by objects such as onsets, nuclei and codas (Section 6.3.1.1.2).

Both a- and p-licensing can be considered instances of the more general Phonological Licensing Principle (Kaye 1990), according to which all the phonological units of a representation must be licensed (except for one: the head of the relevant domain). In fact, these two kinds of licensing are tightly interconnected[82]. Indeed, a given syllabic position's a-licensing power depends on its position within the prosodic hierarchy: given two adjacent positions, the p-licensing one displays greater a-licensing power than the p-licensed one. This can be seen, for instance, in coda-onset sequences, where the onset position (i.e. the licensor of the preceding coda) licenses more phonological contrast (i.e. it is a better a-licensor) than the coda position (i.e. the licensee, namely a bad a-licensor). The same holds within all the prosodic domains. Within the foot, for instance, stressed nuclei are better a-licensors than unstressed nuclei, which means that the melodic inventory unstressed nuclei have at their disposal cannot be bigger than that of stressed nuclei. The universal weakness of unstressed nuclei in terms of a-licensing lays the ground for the structural constraint formalization presented in Tab. 6.5. Furthermore, notice that the universality of unstressed vowels' bad-licensor status allows us to define the universal constraint hierarchy presented in Tab. 6.6. This, in turn, allows us to synthetize the specific structural constraints in the cover constraint *(N |STR|)$_{\mu}$.

Tab. 6.6 Universal structural constraints hierarchy

*N |$\underline{X}$Y| >> *N |$\underline{X}$| >> *N |X| >> *N | |

As for the anti-epenthesis constraint *N (Tab. 6.5c), it penalizes the presence, in a surface phonological representation, of a nuclear position lacking any morphological affiliation, i.e. of a vowel that belongs neither to the root nor to an affix[83]. This introduces the next section, where another set of structural constraints is introduced that refers to morphological colours.

6.2.4 Phonological Recoverability constraints

Phonological recoverability constraints (henceforth PRC's) have been introduced by Van Oostendorp (2005). Couched within the Coloured Containment framework, they militate against the underparsing of the phonological side of 'morphonemes' (Section 6.3.1.1.3), i.e. against the complete deletion of a morphological unit's

---

[82] This is formalized by Harris (1997: 340) in terms of Licensing Inheritance: "a licensed position inherits its a-licensing potential from its licensor".

[83] Notice that this constraint works similarly to the anti-epenthesis constraint proposed by Van Oospendorp (2005: 106), PARSE-*μ(α)*: "the phonological element *α* must be incorporated into the morphological structure. (No insertion.)".

phonological exponents from a surface phonological representation. They are grounded on the following general principle:

Tab. 6.7 Phonological recoverability (Van Oostendorp 2005: 59)

> Every morpheme in the input should be represented in the phonological output.

Interestingly, this principle could be given both a functional and a formal explanation:

> "if a morphologically complex form needs to be parsed, it is preferable to have cues in the phonological shape for every independent morpheme, but [it] can also be seen as a purely formal requirement on linguistic structure, perhaps a consequence of some more general principle of the architecture of the language faculty. In particular, it can be seen as an instance of what Jackendoff (1993) calls 'correspondence rules' between components of grammar; Jackendoff makes it clear that such rules satisfy a conceptual necessity under any view of the grammar." (Van Oostendorp 2005: 60)

PRC's, hence, work similarly to a functionally or formally grounded 'traditional' faithfulness constraint against the deletion (or underparsing) of morphologically 'sponsored/coloured' material.

In Tab. 6.8 the PR '*ur*constraint' is presented:

Tab. 6.8 PR *ur*constraint (Van Oostendorp 2005: 66)

EXPRESS-[F]:	The morphological feature F should be expressed in the phonological surface (Some phonological feature connected to the input expression of F should be present in the output)

Taking the *ur*constraint of Tab. 6.8 as a model, we formalize in Tab. 6.9 a set of PRC's militating against the underparsing of elements that are 'coloured' either by a root (ROOT), or by a nominal suffix (SG.MASC, SG.FEM, PL.MASC, PL.FEM).

Tab. 6.9 Phonological recoverability constraints

EXPRESS-$\|X\|_{SG.MASC}$:	SG.MASC-'coloured' elements must be present in the phonological representation
EXPRESS-$\|X\|_{SG.FEM}$:	SG.FEM-'coloured' elements must be present in the phonological representation
EXPRESS-$\|X\|_{PL.MASC}$:	PL.MASC-'coloured' elements must be present in the phonological representation

EXPRESS-$|X|_{PL.FEM}$: PL.FEM-'coloured' elements must be present in the phonological representation

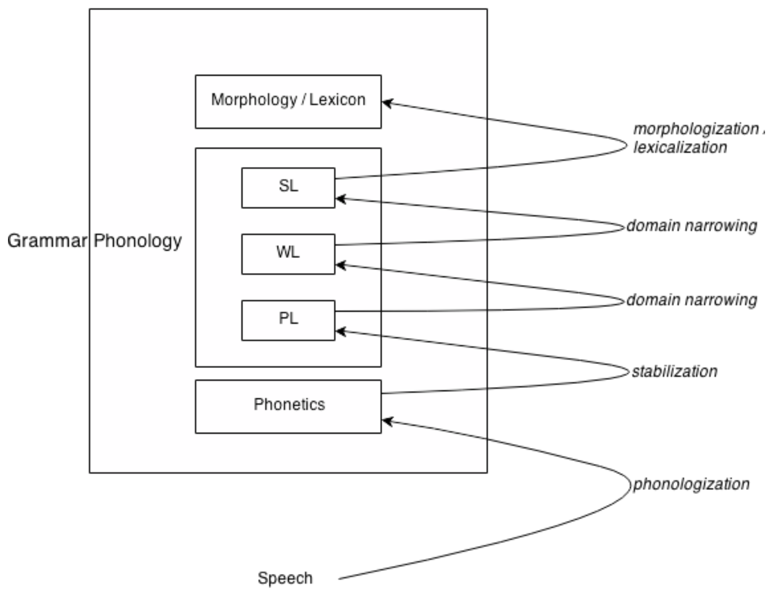
EXPRESS-$|X|_{ROOT}$: ROOT-'coloured' elements must be present in the phonological representation

As reported above, these constraints state that "some phonological feature connected to the input expression of F should be present in the output", i.e. in our case, that 'some *element* connected to the input expression of *a morpheme* should be present in the output'. As a consequence, these constraints assign a violation mark for every element belonging to the lexical(/underlying) representation of a morpheme that is not integrated in the surface representation. For instance, given a SG.MASC morpheme with an underlying |A$\underline{U}$| elemental structure, EXPRESS-$|X|_{SG.MASC}$ is violated once if SG.MASC surfaces as |A| or |$\underline{U}$|, but twice if it surfaces as | |, i.e. if both the (morphologically coloured) elements are not integrated in the surface phonological representation.

6.3 Grammar architecture

In Section 1.1 we hinted at some properties of the grammar architecture we are setting this work into, namely of the model described in Bermúdez-Otero & Trousdale (2012) and Bermúdez-Otero (in press). When discussing the correlation between diachrony and diatopy, for instance, we described the life cycle of a phonological rule as a process ascent within the *modular* grammar architecture reported in Fig. 6.3: during its diachronic journey, a phonological process is argued to enter the grammar from the lower level (the phonetics module), go through the phonology module and eventually enter the morphology/lexicon module (Bermúdez-Otero & Trousdale 2012; Bermúdez-Otero in press).

Fig. 6.3 The life cycle of phonological processes (Bermúdez-Otero & Trousdale 2012: 700)



Grammar architecture's modularity rests on a modular approach to cognition. According to this view, the mind is considered a system made up of different computational modules that are task-specific, non-teleological and symbolic (Fodor 1983; Scheer 2014). Each module, furthermore, resorts to a closed set of domain-specific vocabulary items, the bricks it manipulates to build structures. Syntax, for instance, manipulates items such as gender, number, person, tense etc. to build hierarchical structures such as trees. This holds, obviously, for all of the modules the grammar is made of, and hence also for phonetics and phonology. As we discussed in Section 6.2.2, vocabulary domain-specificity constrains our view of the inter-modular communication.

Together with modularity, a property characterizing the grammar architecture we are referring to is the serial arrangement of modules. This means that, during the process whereby the grammar maps module-specific representations onto each other, "information flow at the interfaces is feedforward" (Bermúdez-Otero in press). One major prediction related to this architectural property is the direction of the diachronic change within the grammar: it sets down the path a phonological process goes through while 'aging'. As claimed by Bermúdez-Otero (in press),

> "[t]his prediction follows from elementary considerations about the mechanism of grammar transmission, including both the construction of grammars by children and the updating of grammars by adults […] In both cases, individuals lack direct access to the linguistic representations generated by other individuals' mental grammars; rather, they reconstruct those representations from circumambient speech, starting, in the case of phonetic and phonological competence, with raw acoustic data. As a result, data reanalysis leading to representation restructuring becomes a primary mechanism for innovation […]. Because of the feedforward organization of the grammar, however, representations at lower levels furnish the data for the construction and updating of representations at higher levels. During grammar transmission, therefore, information flows predominantly from lower to higher modules: the grammar is bootstrapped from the bottom up. Mirroring this process, historical innovations generally propagate from lower to higher modules." (Bermúdez-Otero in press)

As discussed in Section 1.1, the diachronic development of both unstressed vowel reduction and vowel insertion meets the prediction just introduced: they "propagate from lower to higher modules"[84].

Beside the direction of phonological changes, the modular feedforward architecture also predicts, i.e. constrains, their typology. Indeed, they can be distinguished on the basis of the factors conditioning their implementation (Bermúdez-Otero in press): we can describe changes in terms of phonetic rules (phonetically gradual and lexically abrupt), phonological rules (phonetically and lexically abrupt) or as (lexical) representation restructuring (phonetically abrupt and lexically gradual). A change cannot instead be found which is both phonetically and

[84] It has to be pointed out that, together with modularity and the serial arrangements of modules, the grammatical architecture described in Bermúdez-Otero (in press) displays another property: phonological computation is argued to be "cyclic and stratified in the manner of Lexical Phonology […] and Stratal Optimality Theory[:] phonology applies iteratively over a hierarchy of nested domains defined by morphosyntactic structure, starting with the smallest domains and moving progressively outwards" (Bermúdez-Otero in press). Since the data we collected do not allow us to evaluate the relevance of this property for the changes under discussion, we do not refer to it in the following discussion. By enriching our corpus with data from other Lunigiana varieties, however, the relevance of this property could be proved for these changes as well.

lexically gradual (Bermúdez-Otero 2007: 503)[85]. This also rests on the hypothesis according to which each module may undergo a change independently of the others (Bermúdez-Otero 2007; Hamann 2011; Hamann 2014; Bermúdez-Otero in press)[86], and on the domain-specificity of its vocabulary. Indeed, a change is argued to be conditioned only by information it is sensitive to.

This is the case, for instance, of the very first stage of the changes under concern. As argued in Section 7.1, indeed, they start within the phonetic module, where they are sensitive to phonetic information alone. Unstressed vowel reduction, for example, starts as a purely phonetic process (undershoot), which is argued to have only indirect access to the prosodic structure of the form undergoing reduction: the fact that this process shows its more drastic effects (viz. 'melodic' reduction and, eventually, deletion) on unstressed vowels is rather due to the phonetic consequences of its being unstressed (i.e. having short duration and low intensity). Conversely, in this very first stage, a stressed vowel seems to be (melodically) immune to this process because of the phonetic properties of stressed vowels (i.e. long duration and high intensity): undershoot is blind to phonological information. However, the prosodic (viz. phonological) structure of the form under reduction becomes relevant for the learner, namely when the change starts its journey within the grammar. Indeed, in this crucial stage, acoustic data are used by the learner to derive phonological representations. In order to accomplish this process, the learner needs a 'translator device' (required by vocabulary domain-specificity; Section 6.2.2), by means of which she maps phonetic information on phonological structures. From this moment on, the change is conditioned by phonological information: undershoot is reinterpreted as hypoarticulation (Section 7.1).

Interestingly, this feedforward grammar architecture accounts for the fact that, when starting from the phonetics module[87], a change displays a neogrammarian style: since phonetics manipulates continuous and gradient objects (Kingston 2007; Hamann 2011), the change shows phonetic variability. Furthermore, since it has an (indirect) access to phonological representations, it is lexically regular (Bermúdez-Otero in press). Once again, these features characterize the changes under discussion (see especially Section 7.2).

As repeatedly claimed so far, perception plays a central role in phonological change (Ohala 1981; Blevins 2004; Bermúdez-Otero 2007; Boersma 2009; Hamann

---

[85] As hinted at in Section 2.3.1, a change affecting the lexical representations alone seems to be the intervocalic stop voicing in Carrarese. This change is argued to be an instance of lexical diffusion.

[86] A similar kind of change has been recently discussed by Hamann (2014: 252), who describes the diachronic change undergone by /u/ in Southern Standard British English as purely phonetic. She argues, indeed, that the younger generations pronounce /u/ as [ʉ] and that, crucially, this change does not alter their phonemic inventory, nor the phonological behaviour of the sound under concern. This is shown, for instance, by the identity of the optional process of homorganic glide ([w]) insertion in the two different generations: a [+back] spreading can be argued for both after [u] (older generation) and [ʉ] (younger generation), notwithstanding the 'non-backness' of the 'youngest' allophone.

[87] As opposed, for instance, to lexical diffusion changes.

2009; Garrett & Johnson 2013; Bermúdez-Otero in press)[88]. Indeed, a change is argued to occur whenever a listener maps a given phonetic object to a phonological category that is different from the one intended by the speaker. One of the mechanisms leading to this kind of change is traditionally referred to as hypocorrection (Ohala 1981): under this view, the listener reinterprets an 'automatic' coarticulatory effect as being 'intentionally' (i.e. phonologically) produced by the speaker. In the case that, for instance, a consonant's articulatory characteristics exert some effect on an adjacent vowel's articulation and, hence, on its formant structure, the listener could reinterpret this coarticulatory effect as phonological, i.e. as due to a phonological rule (or constraints system) that determines a change in the phonological representation of the vowel (see Section 7.3, in particular Tab. 7.30). The opposite can happen as well. It is the case, resorting to Ohala's terminology, of hypercorrection. This happens when the listener reinterprets an intended, phonologically determined effect as due to coarticulation. A third perception driven mechanism leading to a change applies when the listener, because of the similarity of two different acoustic objects, fails to extract the feature distinguishing the two sounds from the acoustic signal she hears[89].

The relevance of perception for phonological change has been recently formalized by Hamann (2009), who highlights phonology's contribution to a process that has generally been referred to as mainly (if not exclusively) phonetic. Ohala, for instance, claims that "this account of sound change also locates the mechanism centrally in the phonetic domain" (Ohala 1993: 263). However, as claimed by Hamann (2009) and Boersma (2009), the perception mechanisms driving the change in Ohala's approach can be also[90] considered phonological. Indeed, the perception driven reconstruction mechanism the listener resorts to in order to build her phonological representations

> "maps auditory information language-specifically to a phonological form. This mapping is only possible when we know which auditory information is of importance and which phonological categories exist in the language under investigation." (Hamann 2009: 118)

[88] Even if the relevance of perception has been explicitly put forward rather recently, some hints toward the importance of the listener for the initiation of a sound change have been already given by Neogrammarians. Indeed, while articulatory driven processes constitute the sparkle of the change (by accounting for phonetic variability), the listener is supposed by Neogrammarians to store the variants she hears in her "exemplar memory". This, in turn, results in the (gradual) change of the acoustic target a speaker aims at during production (Paul 1880). As can be noticed, though, perception is given, with respect to production, a secondary role (Garrett & Johnson 2013).

[89] This mechanism can be considered a kind of hypocorrection, where the 'disambiguating' cue temporally co-occurs with the ambiguous part. As noticed by Garrett & Johnson (2013), the *choice*, *chance* and *change* mechanisms proposed by Blevins (2004) can be considered extensionally similar to Ohala's (1981).

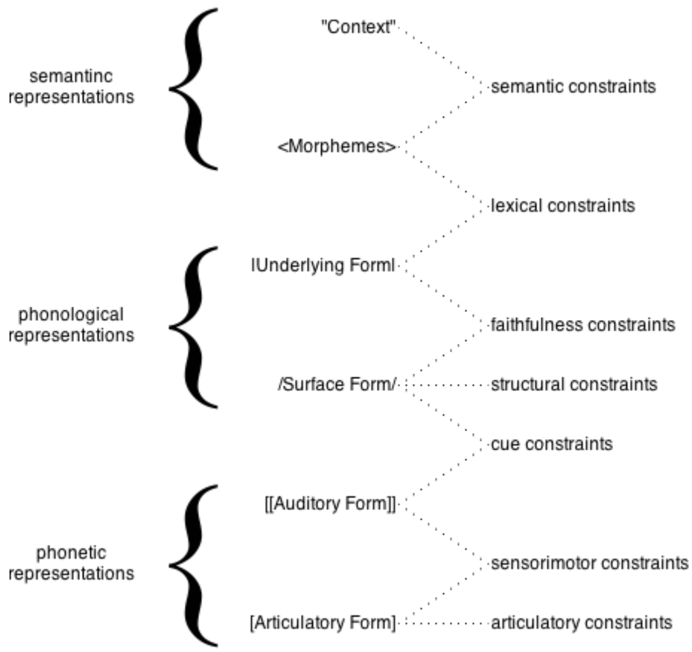
[90] As explicitly pointed out by Hamann (2009: 120), this does not mean that all perception is phonological. Indeed, it is argued to share some property with general auditory perception, such as the ability to encode "incoming acoustic data into processable auditory representations".

As can be grasped from this quote, a crucial importance in the reinterpretation process driving diachronic changes is granted to the mapping of acoustic objects on phonological categories. This is taken care of by a set of cue constraints (Section 6.2.2), which can be considered the cornerstone of the phonetics-phonology interface, the 'door' a phonetic by-product enters its life cycle through. These constraints, hence, constitute a crucial component of the perception grammars Hamann (2009) resort to in order to account for diachronic changes. Indeed, as already hinted at, a change is argued to start whenever a learner builds a different perception grammar with respect to that of the 'teaching' generation.

> "To summarize, an OT perception grammar as employed here expresses the fact that auditory information is not used homogeneously by all speakers across all languages, that no matter what speech sounds we hear we try to assign them abstract categories based on our language-specific knowledge, and that in sound change such language-specific knowledge changes across generations. In contrast to Ohala's account, sound change is not considered a misperception or a break-down in the communicative system. Instead, the learner constructs a working system, that is, a perceptual grammar, for the available input." (Hamann 2009: 127)

Recall that perception grammars are couched in the BiPhon model (Boersma 2007, 2009, 2011), a model that conflates production and perception into a single grammar. As represented in Fig. 6.4, this model consists of three major components, each presenting a pair of different representations. The mappings of these representations on each other are evaluated by semantic, lexical, faithfulness, cue and sensorimotor constraints, while structural and articulatory constraints evaluate the surface phonological and the articulatory representations alone.

Fig. 6.4 BiPhon grammar (Boersma 2011)



This grammar architecture closely resembles the one proposed by Bermúdez-Otero (2012, in press; see Fig. 6.3) to account for the life cycle of a phonological process, the more relevant differences being the focus of BiPhon on the various representations, Bermúdez-Otero's model focusing instead on the stratal structure of the phonological component. As for BiPhon's bidirectionality, it has to be pointed out that it follows from the way the constraints that make up the grammar are 'used' by the speaker/listener. Indeed, as hinted at above, this grammar is conceived of as a single system, which is travelled downward by the speaker and upward by the listener. Crucially, the constraints evaluating the single levels and the mappings between them are argued to be the same in both cases. As a consequence, the constraints mapping the relevant forms on each other must be 'readable' in both directions (Smolensky 1996; Section 6.2). As claimed by Boersma (2011), this property can "lead to apparent effects of bidirectional processing", as if the speaker took the listener into account, and vice versa. This notwithstanding, Boersma (2011: 10.2) explicitly states that the bidirectionality he is referring to is the "naïve kind in which both listening and speaking are performed by unidirectional evaluation". From this perspective, the bidirectional architecture of Boersma (2011) and the feedforward one of Bermúdez-Otero (2012, in press) are still more similar. BiPhon, however, also offers an explicit formalization of the phonetics-phonology interface, which is argued to consist of the mapping of the phonological and the auditory forms (Sections 6.3.1.2 and 6.2.2).

As for BiPhon's modularity, "[t]he strict division between phonology and phonetics is not only found in the representations [Section 6.3.1], but also in the constraints evaluating them [Section 6.2]" (Hamann 2011: 215).

Since the processes we are describing in the present work are instances of phonologization, an explicit formalization of the phonetics-phonology interface turns out to be an essential theoretical tool. This is the reason why the phonological analysis in Chapter 7 relies on BiPhon. However, as discussed in the next section, we argue for a model whose phonological module displays some difference with respect to BiPhon.

6.3.1 Levels of representation

6.3.1.1 Phonology

6.3.1.1.1 Below the skeleton

The representational primitives defining the subsegmental structure we resort to stem from standard Element Theory (henceforth ET; Backley 2011, 2012). Historically, ET developed from the seminal work of Kaye et al. (1985), which, in turn, rests on similar approaches proposed within Dependency (Anderson & Jones 1974) and Particle Phonology (Schane 1984). Similar theoretical assumptions can also be found in Radical CV Phonology (van der Hulst 1995, 2005).

In a nutshell, standard ET substitutes the traditional (i.e. articulatory-based) features[91] with the set of elements represented in Tab. 6.10, where their phonetic (viz. acoustic) properties are shown together with the phonological ones.

Tab. 6.10 Standard ET elements (Backley 2012)

	Acoustic properties	Phonological properties
|I|	high F2 (F2–F3 converge)	palatals, coronals, front vowels
|U|	lowering of all formants	labials, velars, uvulars, rounded vowels
|A|	high F1 (F1–F2 converge)	pharyngeals, coronals, liquids, non-high vowels
|H|	high-frequency energy	voiceless obstruents, high tone vowels
|L|	low-frequency energy	fully voiced obstruents, nasals, low tone vowels
|ʔ|	sustained drop in amplitude	oral/nasal/glottal stops, laryngealized vowels

[91] By 'traditional articulatory-based features' we mean the set of features developed on the basis of Chomsky & Halle (1968, henceforth SPE).

Differently from (binary) articulatory-based features, elements are unary: a given element cannot take a positive or negative specification; it can only be either present or absent. Phonological oppositions are hence defined in a privative way. A stop, for instance, differs from a fricative inasmuch as the former contains |ʔ|, an element that, evidently, is absent from continuants' representation. If we had used binary features instead, we should represent a stop and a fricative as, respectively, [-cont] and [+cont].

As a consequence of elements' privativity, the absence of a given property cannot be given an active phonological value[92]. Crucially, this constitutes a welcome generative power restriction: no process can be formalized that refers to the absence of an element.

Another formal difference with respect to SPE-like features is the possibility for elements to be used to represent both vocalic and consonantal properties. Actually, a similar result is obtained by Jakobson et al. (1952), who, similarly to what ET practitioners currently do, propose a set of acoustically-based features. In fact, the reference to acoustics is another major SPE-ET difference. Indeed, granted that both features and elements have a cognitive (viz. phonological) nature[93], the former mainly refer to the speaker, in that SPE-like features stress the cognitive relevance of articulation. ET, on the other hand, maintains that the linguistically relevant phonetic information must be accessible by both the speaker and the hearer and, therefore, should have an acoustic nature. In this respect, hence, ET seems to be closer to the pre-SPE (viz. Jakobsonian) tradition:

> "[elements] are properly understood as cognitive objects which perform the grammatical function of coding lexical contrasts. Nevertheless, continuing the essentially Jakobsonian line of thinking, we consider their phonetic implementation as involving in the first instance a mapping onto sound patterns in the acoustic signal. Viewed in these terms, articulation and perception are parasitic on this mapping relation. That is, elements are internally represented pattern templates by reference to which listeners decode auditory input and speakers orchestrate and monitor their articulations." (Harris & Lindsey 1995: 49)

The acoustic orientation of elements nicely fits with BiPhon's conception of the phonetics-phonology interface (Sections 6.3.1.2 and 6.2.2): in both cases,

---

[92] For instance, the feature specification [-nas] cannot be resorted to in ET to define the set of oral consonants: they do not share a common element and therefore cannot be considered, as a whole, as belonging to a single natural class. This is consistent with the heterogeneity of oral consonants (Backley 2012). Nasals, on the contrary, are identified by the presence of |L| and can thus be considered a natural class.

[93] Interestingly, a sharp distinction is made between representations and their realizations. "The claim is that representations are part of the grammar whereas phonetic knowledge is not. As such, it is possible for someone to acquire their native language even if they lack the ability to speak (e.g. for physiological or psychological reasons). This puts spoken language on a par with writing, to the extent that both provide ways of realizing and communicating linguistic knowledge yet neither constitutes linguistic knowledge itself" (Backley 2012: 62). See also Sections 6.3.1.2 and 6.2.1 on the status of BiPhon phonetic representations.

phonological representational primitives are directly linked to their acoustic correlate[94]. However, differently from standard ET, BiPhon argues for an ‘operative’ phonetics-phonology mapping: elements (or features; see Hamann 2011) do not constitute the interface *per se*; they need to be ‘operatively’ mapped, during language processing, onto autonomous acoustic representations (Section 6.2.2). In other words, we argue against the universality of elements’ acoustic correlates.

Finally, notice that ET can be considered a sub-theory of Government Phonology (henceforth GP; Kaye et al. 1985, 1990; Section 6.3.1.1.2). Similarly to GP, hence, ET maintains a representational approach according to which every unit enters an asymmetrical (head-dependent) relationship with the adjacent unit (see also Section 6.2.3). As a consequence, ET predicts the existence of elemental compounds, i.e. complex expressions whose head(ed) element can be accompanied by one or more dependent elements. The formal difference between the head and the dependent can be noticed both in the phonological and phonetic domains. Indeed, heads are argued to display a greater phonological and acoustic salience. Consider, for instance, the set of elements presented in Tab. 6.11:

Tab. 6.11 Elements compounds

$\|\underline{A}\|$	[a]	$\|\underline{A}I\|$	[ɛ]	$\|\underline{A}U\|$	[ɔ]
$\|\underline{I}\|$	[i]	$\|A\underline{I}\|$	[e]	$\|A\underline{U}\|$	[o]
$\|\underline{U}\|$	[u]				

As can be noticed, mid vowels are represented in ET as elements compounds. The head of these expressions, i.e. the underlined element, can be either the ‘low’ or the ‘high’ element. In the case that the head is |A|, the phonetic correlate of the compound ([ɛ] and [ɔ]) is acoustically closer to that of a low vowel than that of a high vowel. If, instead, |A| is the dependent, then the phonetic correlate ([e] and [o]) is acoustically closer to its high cognate. From a phonological point of view, these expressions are shown to pattern with their singleton headed cognates in various phonological generalizations (Backley 2011, 2012).

Before moving to the description of the suprasegmental phonological structures, we should highlight that, evidently, the acoustic dimension ET refers to is the spectral structure. In the case of vowels, in particular, what matters is the distribution of the formants within the relevant acoustic space. This is a consequence of their relevance in perception. As noticed by Lieberman (1971), for instance, peripheral vowels’ (i.e. $|\underline{A}|$, $|\underline{I}|$ and $|\underline{U}|$) formant distribution

> “yield[s] prominent spectral peaks (formed by the convergence of two formant frequencies […]) that make it easier to perceive the sounds, just as, in the domain of color vision, saturated colors are easier to differentiate than muted ones.” (Lieberman 1971: 57-58)

---

[94] Along with the formal economy characterizing ET, this is the reason why we decided to represent subsegmental structures in terms on elements.

So far we have described the structure of the subsegmental tier of phonological representations. These structures now need to be integrated within the autosegmental template we resort to for the phonological representational system. In the next section, hence, a description is given of the representational approach we assume for the suprasegmental tier(s).

6.3.1.1.2 Above the skeleton

As pointed out, for instance, by Scheer (to appear b), Optimality Theory mainly concerns computation. As for the representational side, indeed, OT does not posit any restriction: every phonological representation can be processed by an OT grammar. Phonological analyses resorting to this computational system are therefore free to adopt the representational theory that better fits the data under consideration and the grammar architecture one assumes (Section 6.3). The only proviso is that the principles accounting for representations' well-formedness must be translated into constraints, or rephrased as Gen's properties (Polgardi 1999, 2006). It is the case, for instance, of the principles assumed by the representational theory we resort to in our analysis, i.e. by standard Government Phonology (Kaye et al. 1985, 1990; Kaye 2000)[95].

GP is a principles-and-parameters approach to phonology: its principles are assumed to be inviolable, variation being accounted for in terms of differences in parameter setting[96]. Assuming an autosegmental framework (Goldsmith 1990), the GP system of principle and parameters manages the (language-specific) mapping of underlying to surface phonological forms by regulating the linking and delinking processes of supra- and sub-skeletal representational 'components' with the relevant skeletal positions: once phonology has built a well-formed representation, only the (sub-)structures thereof which are simultaneously linked to a skeletal node are phonetically interpreted. Notice that, within this framework, phonology constitutes a 'proper' module (Section 6.3), in that it resorts to the same vocabulary during the whole derivation[97]:

> "[u]nder this view, initial and final representations in phonological derivation are isotypic: processes map phonological objects onto other phonological objects rather than onto phonetic ones." (Harris & Lindsey 1995: 47)

As for the principles characterizing GP, the centrepiece bearing the whole GP framework is represented by government. Government, in turn, comes in two forms: p-licensing[98] and licensing. They both define an asymmetrical relation holding

[95] As for the subsegmental representation, see Section 6.3.1.1.1.

[96] This notwithstanding, analyses have been proposed that involve a conflict among principles (Charette 1990; Cyran 1996, 2005) and solve them within an OT approach (Polgardi 1999, 2006).

[97] In this respect it differs, for instance, from SPE.

[98] Notice that, notwithstanding the misleading similarity of the labels, p-licensing has the opposite effect of licensing. Furthermore, notice that the government principle just referred to

between two objects in a given domain, the difference consisting in the fact that p-licensing 'silences' the object undergoing this force, while licensing allows the 'licensed' object to be phonetically interpreted (Kaye et al. 1985, 1990; Kaye 2000; see also Section 6.2.2).

The domains in which these principles are argued to hold are defined by the syllabic nodes projected by the skeletal positions: onsets (O) and nuclei (N). As for the coda, it does not enjoy the constituent status; it is rather considered a consonantal adjunct to the rhyme (R), i.e. to the prosodic node projected by N. Two rhymes, in turn, constitute a foot, and feet can be organized in phonological words (Harris 1997).

The functioning of government is regulated by the two constraints presented in Tab. 6.12: Strict Adjacency Condition (SAC) and Strict Directionality Condition (SDC).

Tab. 6.12 SAC and SDC (Kaye et al. 1990)

SAC:	the governor must be adjacent to the governee at the P0 projection, i.e. the projection containing every skeletal point
SDC:	directionality of government at the skeletal level is universal and not subject to parametric variation: (i) Constituent government is head-initial; (ii) Interconstituent government is head-final

The theoretical devices presented in Tab. 6.12, i.e. the government principle and the two constraints defining its directionality (SDC) and (the structural properties, viz. continuity, of) its domain (SAC) allow us to derive the constituent structures presented in Tab. 6.13.

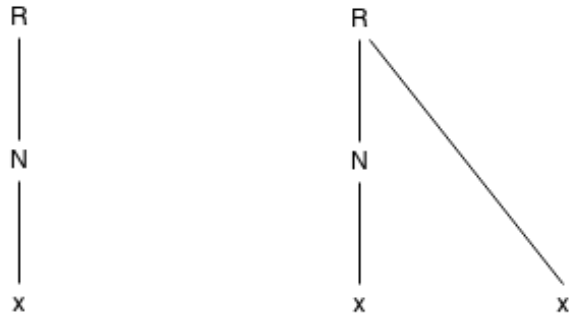
Tab. 6.13 GP constituent structures (Kaye 2000)

Nuclei

a. Non-Branching (1 position) b. Branching (2 positions)

is analogous to the licensing principle of, for instance, Harris (1997; see Section 6.2.3). Within the approach proposed by Harris (1997), the 'p-licensing' is referred to as 'government'.

Rimes
a. Non-Branching (1 position)   b. Branching (2 positions)



Onsets
a. Non-Branching (1 position)   b. Branching (2 positions)

Along with these formal properties, GP posits the existence of melodically empty nuclei, i.e. of skeletal positions that do not dominate any melodic content (viz. any element; Section 6.3.1.1.1).

In order to avoid the uncontrolled proliferation of empty positions, i.e. to rule out an ad hoc insertion of empty nuclei within a given phonological representation, GP stipulates the Empty Category Principle (ECP). According to the ECP, for a given position not to be phonetically interpreted, it has to be p-licensed. P-licensing, in turn, is defined by the following conditions:

Tab. 6.14 Empty Category Principle (adapted from Kaye 2000)

P-licensing:

a. domain-final (empty) categories are p-licensed (parameterised)

b. properly governed (empty) nuclei are p-licensed

c. magic licensing: s+C sequences p-license a preceding empty nucleus

Proper government: α properly governs ß if

a. α and ß are adjacent on the relevant projection

b. α is not itself p-licensed

c. neither α nor ß are government licensers

Government licensing: a nuclear position is a government licenser if

a. its onset governs a preceding rhymal complement (direct government licensing)

b. its onset is the head of a branching onset (indirect government licensing)

From these constraints, it follows that in order to stay 'mute', an empty N must be either parametrically (in word-final position) or magically (by a following sC cluster) licensed. This means, for instance, that word-final consonants are followed by an empty N (parametric licensing), and that, specularly, word-initial sC clusters are preceded by an empty N (magic licensing).

Alternatively, an empty N can be (properly) governed by a following N, provided that the latter, in turn, is adjacent (on the relevant autosegmental tier) to the former, is not itself p-licensed, nor dispenses government licensing. It is the case, for instance, of the French alternation *mne* 'to lead' vs. *men* 'he leads' (Kaye 2000): in the infinitive form, the word-final N p-licenses the preceding empty N (which is, therefore, properly governed). In the inflected form, instead, the word-final N is (parametrically) p-licensed and, therefore, the preceding N cannot be properly governed. As a consequence, it is phonetically interpreted.

On the other hand, an empty N cannot be (properly) governed if it is followed by a government domain, i.e. if it is followed either by a 'coda' (governed by the following onset) or by the first segment of a complex onset (whose second segment is governed by the first).

Interestingly, GP argues that all word-final consonants are followed by an empty N and that, as a consequence, all word-final consonants are onsets. An argument supporting the existence of the word-final empty N (henceforth FEN) is the fact that in many languages, word-final consonants are immune to the coda-effects. In particular, word-final consonants do not undergo lenition processes undergone by word-internal codas. Similarly, a vowel followed by a word-final C can resist processes (such as shortening) generally undergone by vowels occurring in closed syllables. In Pontremolese, for instance, a word-internal lateral coda diachronically undergoes lenition: CĂLĬDU(M) > [kau̯d] 'hot' and CŎLĂPHU(M) > [kurp] 'strike'. In the case that, however, the lateral is word final, it resistes lenition: PĀLU(M) > Pontr. [pal] 'pole'[99].

[99] See Sections 2.2.1, 2.3.1 and 7.4 (fn. 140) for some other examples.

Word-final nuclei are argued to display different degrees of licensing strength (Cyran 2005, 2008). In particular, FEN seems to be able to dispense either government licensing and licensing, or just licensing (henceforth Lic). In the first case, in turn, it can license 'its' O to govern either a preceding 'coda' (direct government licensing, henceforth DGLic), or both the coda *and* the second segment of a complex O (indirect government licensing, henceforth IGLic). These three licensing strength degrees (viz. Lic, DGLic and IGLic) rest on a consonant cluster (universal) complexity/markedness hierarchy, according to which a simple onset is simpler/less marked than a coda-onset sequence, which, in turn, is simpler/less marked than a complex onset. Therefore, it seems to be 'easier' for FEN to license (Lic) a single onset than a coda-onset sequence (DGLic), which, in turn, is easier to license than a complex onset (IGLic; Cyran 2005, 2008). The (implicational) consonant hierarchy just introduced allows us to make some predictions. For instance, since Carrarese tolerates word-final complex onsets (*magrØ* 'thin'), we predict the existence of word-final coda-onset sequences (*colpØ* 'strike') and single onsets (*capØ* 'head'). In other words, given that Carrarese FEN seems to be able to dispense indirect government licensing (IGLic), it is expected to also dispense direct government (DGLic) licensing and licensing (Lic). In Pontremolese, on the other hand, FEN seems to be able to dispense DGLic and Lic, but not IGLic: while forms such as *curpØ* 'strike' and *capØ* 'head' are grammatical, **magrØ* is repaired as *magarØ* 'thin' (Section 7.4).

Finally, in GP, FEN is argued to be able to properly govern (henceforth PGvt) a preceding empty N, which, as a consequence, can be phonetically uninterpreted. It is the case, for instance, of the Carrarese and Pontremolese outcomes of Latin word-medial unstressed vowels. These vowels underwent a diachronic process of reduction, which resulted in the complete deletion of unstressed N's melodic content (Sections 5.2.1, 5.2.2, 7.1 and 7.2). Unstressed vowel reduction, hence, affected both word-final and word-medial unstressed vowels. In both cases, though, deletion is argued to exclusively affect the melodic content of unstressed N's, the corresponding syllabic nodes being immune to the process and continuing therefore to be represented in the relevant underlying phonological form. Crucially, hence, notwithstanding the fact that its melodic content has been deleted, FEN seems to keep the same PGvt strength it had before undergoing reduction. This is shown, for instance, by forms such as SILVĀTĬCU(M) > Carr. *səlvatØcØ*, Pontr. *sarvadØgØ* 'wild', where FEN properly governs the preceding empty N.

As we saw at the beginning of this section, since GP is a principles-and-parameters approach, in the case one decides to resort to its representational technology, its principles need to be 'translated' into constraints. The government relations just described, hence, must be given a constraint-like format and ranked within the constraints hierarchy defining a grammar. This is shown in Tab. 6.15, where the government and the different degrees of licensing strength of FEN are translated into constraints. Notice that these constraints are given a negative form. This means that in the case that FEN dispenses licensing (Lic), direct government licensing (DGLic) and indirect government licensing (IGLic) and governs a preceding empty N (PGvt), the relevant form violates, respectively, *LIC, *DGLIC, *IGLIC and *PGVT.

Tab. 6.15 Constraint-like GP government principles

*IGLIC:	FEN cannot license a complex O
*DGLIC:	FEN cannot license a Cd-O consonant sequence
*LIC:	FEN cannot license a simple O
*PGVT:	FEN cannot properly govern a preceding empty N

As just hinted at, once GP principles have been given a constraint-like format, they need to be included within the constraints hierarchy. Furthermore, as a consequence of this translation, GP principles lose their inviolability: as every other OT constraint, if dominated, these constraints can be violated.

This seems to be the case for Carrarese. As shown by the few examples given above, indeed, forms such as *capØ* 'head', *colpØ* 'strike', *magrØ* 'thin' and *səlvatØcØ* 'wild' are grammatical. As a consequence, they violate the constraints banning the application of FEN's government duties, i.e. *LIC, *DGLIC, *IGLIC and *PGVT. We assume, therefore, that these constraints should sit very low within the hierarchy defining Carrarese grammar[100].

However, by 'aging' (Chapter 7), FEN seems to gradually lose its licensing strength. By 'gradually', we mean that the 'older' it gets (i.e. the longer it has been deprived of its melodic content), the less complex the structure it can license. It is the case, for instance, of Pontremolese (recall that, as argued throughout the whole dissertation, Pontremolese diachronically follows Carrarese. As a consequence, its FEN is argued to have been melody-less longer than in Carrarese). Indeed, as shown above, Pontremolese FEN is able to dispense just Lic (*capØ* 'head'), DGLic (*curpØ* 'strike') and PGvt (*sarvadØgØ* 'wild'). In terms of constraints, this means that while *LIC, *DGLIC and *PGVT are still low ranked and, therefore, 'easily' violable, *IGLIC has been raised up: it cannot be violated anymore. This raising, crucially, occurred in Pontremolese, but not (yet) in Carrarese.

To sum up, in the transition from Carrarese and Pontremolese, FEN loses its ability to license the word-final *muta cum liquida* complex onset[101]. As a consequence, it is repaired by means of the leftward spreading of *liquida*'s |A| (Section 7.4).

---

[100] The constraints listed in Tab. 6.15 can be opposed by 'general' constraints disfavouring onsetless syllable and sequences of empty nuclei. For instance, a form displaying a sequence of two nuclei (the second of which is FEN) distantiated by at least one consonant (i.e. N.cN#, Nc.cN# and N.ccN#) would satisfy a constraint such as ONSET, but violate *LIC, *DGLIC and *IGLIC. A form displaying, instead, a (word-final) sequence of two empty nuclei would satisfy *PGVT, but violate constraints such as *Ø-Ø (Cyran 2005) or NOLAPSE (Rowicka 1999).

[101] Interestingly, Scheer (2012) notices that a similar phenomenon can be observed in Polish. Indeed, he claims that Polish is "visibly following a movement from a stage where no clusters were vocalized at all in gen. plu. to a situation where more and more roots implement vocalized forms" (Scheer 2012: 639).

6.3.1.1.3 Coloured Containment

Differently from Boersma's (2011) approach, our analysis draws upon a particular development of Containment Theory (Prince & Smolensky 1993): Coloured Containment (Van Oostendorp 2005, 2007).

As in the case of Containment Theory (Prince & Smolensky 1993), Coloured Containment (Van Oostendorp 2005, 2007) maintains a monostratal approach to the phonological module. Indeed, differently from the theory that rapidly and pervasively substituted Containment Theory within OT literature, i.e. Correspondence Theory, it assumes an input-output relationship whereby the former is contained within the latter:

Tab. 6.16 Containment (McCarthy & Prince 1993: 88)

> No element may be literally removed from the input form. The input is thus contained in every candidate form.

As a consequence, the set of faithfulness constraints mapping surface and underlying phonological forms in BiPhon (see Fig. 6.4) is no longer needed:

> "Containment effect is to make it possible to state all constraints on the output, without reference to the input-output relation […]. Containment means, for example, that segmental deletion phenomena involve underparsing a segment of the input (e.g., ⟨k⟩now/acknowlege) rather than outright replacement of a segment by Ø." (McCarthy & Prince 1993: 88)

Traditional faithfulness constraints being out of the running, the relationship between the underlying form, i.e. the one occurring in the lexicon, and the surface form, i.e. the output of the phonological computation, is evaluated by well-formedness constraints only. Indeed, the formal difference between faithfulness and well-formedness constraints is eliminated: constraints can be formalized which only evaluate the output representations (as discussed in 6.2.4, this role is taken by the set of phonological recoverability constraints). Under this view, outputs that under the Correspondence approach are labelled 'unfaithful' are here rather considered "unwellformed outputs, since they contain unparsed or empty material" (Van Oostendorp 2005: 5).

As for the 'coloured' development of Containment Theory, it naturally follows from Consistency of Exponence, i.e. from a principle that, together with Containment and Freedom of Analysis[102], underlies the theory of Gen (McCarthy & Prince 1993).

[102] Freedom of Analysis: "Any amount of structure may be posited" (McCarthy & Prince 1993: 88).

Tab. 6.17 Consistency of Exponence (McCarthy & Prince 1993: 88)

> No changes in the exponence of a phonologically-specified morpheme are permitted[103].

If taken "seriously" (Van Oospendorp 2005: 39), Consistency of Exponence implies that the morphological affiliation of phonological objects must still be visible on surface phonological representations[104].

As a matter of fact, Van Oostendorp (2007: 126) points out that Containment can be seen as a "special case of Consistency of Exponence, since also the latter principle says that everything which is part of a morpheme should stay part of that morpheme".

To sum up, if the cue constraints formalize the phonetics-phonology interface, the phonological recoverability constraints (Section 6.2.4) concern the phonology-morphology interface: the exponent the phonological objects are provided with cues the morphological structure these objects occur in (Revithiadou 2007).

Furthermore, since the forms contained in the lexicon are traditionally assumed to be form-meaning pairs (Saussure 1916), where the form is defined in terms of phonological and morphological information (viz. *morphonemes*; Kurylowicz 1968), the interface managed by the Coloured Containment-grounded constraints can also be considered the 'door' a phonological change (of a given morpheme) enters the lexicon through.

As for the semantic side of these 'morphonemes', it is defined in BiPhon by their interface with the semantic module. This is represented in the top section of Fig. 6.4, where the relationship between the phonological and the semantic module is taken care of by a set of lexical constraints (Boersma 2011) evaluating the (arbitrary) association of form and meaning. In what follows, though, this interface is not taken into account (see Boersma 2011 for some examples and some further references).

---

[103] "[Consistency of Exponence] means that the lexical specifications of a morpheme (segments, prosody, or whatever) can never be affected by Gen. In particular, epenthetic elements posited by Gen will have no morphological affiliation, even when they lie within or between strings with morphemic identity. Similarly, underparsing of segments - failure to endow them with syllable structure - will not change the make-up of a morpheme, though it will surely change how that morpheme is realized phonetically. Thus, any given morpheme's phonological exponents must be identical in underlying and surface form." (McCarthy & Prince 1993: 88)

[104] "One way to visualize this is to assume that every morpheme has a specific colour, that every element in the underlying specification of morphemes also has this colour, and that Gen cannot change the colour of segments. Since colours are a little bit hard to use in modern print (and we would need a large number of colours for natural languages with large numbers of morphemes) we will use the descriptive notation of subscripts." (Van Oostendorp 2005: 40)

6.3.1.2 Phonetics

As discussed in Sections 1.1 and 6.3, the concept of life cycle (of a phonological process) implies the existence, within the grammar architecture, of two different modules: phonetics and phonology. This, in turn, opens the possibility for a change to independently apply just in one of them. Interestingly, this possibility supports the hypothesis according to which the relationship between phonetics and phonology is not automatic/universal: if this were the case, a change in the phonetic representation would entail a simultaneous change in the phonological one (Bermúdez-Otero 2007; Hamann 2011). This 'automatic' approach is upheld, for instance, by Hale (2000) and Hale & Kissock (2007). They maintain that a "phonetic representation" (i.e. the form "at the end of a derivation"; Hale 2000: 243) is "phonetically realized" by a set of "transducers", which converts the phonetic representation into a "bodily output"[105]. Furthermore, Hale & Kissock (2007) propose a twofold set of transducers which translate an auditory input into phonological features (in perception) and bundles of phonological features into "gestural scores" (in production). Crucially, transducers are assumed to be innate and invariant. Now, given that they also assume that phonological features are universal, the phonetics-phonology interface they argue for should be automatic and universal (Hamann 2011). As pointed out by Bermúdez-Otero (in press), however, this 'automatic' approach to the phonetics-phonology mapping is ill equipped to account for 'true' gradient changes. Indeed, since the phonetic target of a given phonological feature is argued to be innately (and fixedly) specified by the transducers, a change within the 'truly' continuous phonetic dimension is entangled with a change in the relevant phonological (viz. categorial) dimension.

Differently from Hale & Kissock (2007), the model we resort to assumes an independent phonetic module and a phonetics-phonology mapping that is arbitrary, language-specific and, therefore, learnt (Hamann 2009, 2011; Cyran 2012; Scheer 2014[106]). As argued in Section 6.3, this follows from the grammar architecture modularity and the vocabulary module-specificity. As an example of the language-specificity of this interface, consider the phonetic cue of a word-final [voice] specification in English and German. In English, if the word-final consonant is voiced (e.g. /liːdə/ 'leader'), then the preceding vowel duration is considerably longer that if it is followed by a voiceless consonant (e.g. /liːtə/ 'litre'). Crucially, such an amount of duration difference cannot be found in German: the high vowels of /liːdɐ/ 'songs' and /liːtɐ/ 'litre' display similar durations (Boersma 2011). In English, hence, the word-final consonant's [voice] specification is mainly cued by the preceding vowel length.

[105] Notice that the derivation of a "phonetic form" from a phonological input is, under their approach, a fully phonological process. Indeed, notwithstanding the "phonetic" label, the output of the phonological derivation is described in phonological (viz. abstract, categorical) terms. The translation into a different 'vocabulary' (see Section 6.3) is then performed by the transducers, which therefore work similarly to our cue constraints (Section 6.2.2).

[106] Scheer (2014), for instance, explicitly claims that "just as […] the relationship between morpho-syntactic categories and their phonological exponents", "the relationship between phonological categories and phonetic exponents thereof is arbitrary".

On the other hand, our BiPhon-like model resembles Hale & Kissock's (2007) in assuming the existence of two phonetic representations: as shown in Fig. 6.4, we distinguish among an acoustic and an articulatory representation. As for the first, it is argued to consist of

> "a sequence of events on auditory continua such as pitch, noise, spectral peaks and valleys, and silences, their durations, and their relations such as simultaneity and order." (Boersma 2011: 42)

In other words, the acoustic form represents, in perception, the acoustic string a listener receives as input and, in production, the acoustic targets a speaker aims at when phonetically implementing a given phonological form.

An articulatory form, instead, represents the configurations the articulatory system must assume to produce the desired acoustic targets. As a consequence, it consists of

> "a sequence of gestures by the multiple articulatory muscles that move, hold, tense, or relax the glottis, the larynx, the epiglottis, the pharynx walls, the tongue tip, the tongue body, the velum, the lips, the cheeks, the jaw, and the lungs." (Boersma 2011: 42)

Within BiPhon, this representational level is argued to be relevant in production only[107], acoustic representations enjoying instead a privileged linguistic status in both processing directions. This hypothesis is supported by arguments such as the antecedence of perception with respect to production in infants' linguistic development (Jusczyk 1997). Furthermore, while people displaying physical impairments that impede speech production are able to acquire a normal grammar anyway, deaf people rarely develop a native-like spoken language (Backley 2011)[108].

Another piece of evidence is represented by bite-block experiments (Lindblom, Lubker & Gay 1979). As shown by these experiments, for instance, if articulators' movements are artificially encumbered, speakers rapidly adjust their gestures in order to reach the acoustic target they are aiming at (Backley 2011; Hamann 2011). Interestingly, notice that these experiments also show that, as claimed above, speakers aim at an acoustic rather than an articulatory target. As discussed in Section 6.3.1.1.1, this represents an argument favouring the representation of the internal structure of segments in terms of elements. Furthermore, this also suggests that articulatory representations display a somehow different grammatical status with respect to the acoustic ones, in that the objects making them up do not directly convey any linguistically meaningful information. As Backley (2011) puts it:

[107] But see Fowler (1986) and Liberman & Mattingly (1985) for a different approach. Indeed, they assume that, in perception, a given auditory input is directly interpreted in terms of articulatory gestures. Notice that the discovery of mirror neurons (Fadiga, Craighero, Buccino & Rizzolatti 2002) renewed the interest in these articulatory-based models.

[108] See also fn 93.

> "it is through experience and experimentation during acquisition that infants learn how to articulate the sounds of their native language. In other words, speech production is not controlled by the grammar - tongue position, glottal state, lip position and the like are not part of linguistic knowledge. Instead, they function as a vehicle for delivering the speech signal and for carrying the linguistic message." (Backley 2011: 6)

This notwithstanding, in accordance with BiPhon architecture, we include the articulatory representational level in our analysis. As made evident in Chapter 7, this allows us to formalize the phonetic variability fostering the perception driven changes under concern. However, following Backley (2011), we suggest that knowledge of articulatory gestures does not properly belong to the linguistic module, being rather interpretable as (more general) knowledge of motor system (which can be resorted to for linguistic purposes)[109].

This section concludes the presentation of the theoretical tools we resort to for the phonological analysis worked out in the next chapter.

---

[109] Something along these lines has been proposed by Hamann (2009) for perception. Indeed, when discussing phonology's role in the perception process (Section 6.3), she claims that: "[s]tating that speech perception is phonological does not imply that all perception is phonological. Instead, [it] shares perceptual abilities with general auditory (and visual) perception […], namely the ability to turn incoming acoustic data into processable auditory representations […] Auditory and speech perception differ in that speech perception has as output phonological categories, i.e. it employs phonology, whereas auditory perception has a non-linguistic output" (Hamann 2011: 211).

7 Phonological analysis

7.1 Introduction

As reported by the dialectological literature on Carrarese (Bottiglioni 1911; Maffei Bellucci 1977; Luciani 1999, 2002) and Pontremolese (Papanti 1875; Restori 1892; Giannarelli 1913; Maccarrone 1923; Maffei Bellucci 1977), Latin post-tonic vowels occurring in word-final and word-medial position have been categorically deleted. This diachronic change is schematically represented in Tab. 7.1 (the proto-Romance forms being equated with their Italian cognates; Loporcaro 2011a).

Tab. 7.1 Apocope and syncope

Latin	CŎL(Ă)PHU(M) 'stroke'	SILVĀTĬCU(M) 'wild'
	↓	↓
proto-Romance	**colpo*	**selvatico*
	↓	↓
Carrarese	*colp*	*səlvatc*
Pontremolese	*curp*	*sarvadg*

The phonological nature of this process has been confirmed by the data analysis in 5.2, where it was shown that Carrarese and Pontremolese speakers regularly delete the word-final mid vowel, optionally realizing a schwa-like release if it is followed by a consonant-initial word or by a pause. Similarly, the etymological post-tonic word-medial vowels have been regularly deleted, a schwa-like release optionally occurring either word-medially or word-finally in Carrarese, and word-finally in Pontremolese. As discussed in Section 5.2.2, this optional vocoid must be rather considered a vowel-like release whose duration can be slightly increased because of articulatory and perceptual reasons. This means that, even if this phonetic by-product could be interpreted by the learner as a cue for a vocalic segment due to its acoustic properties (periodicity of the signal/harmonic structure), Carrarese and Pontremolese speakers do not map this periodic sound to any phonological segment. In other words, they know that, unless a word-final vowel is a feminine singular (*-a*) or a feminine/masculine plural (*-e*[110]/*-i*) morpheme, no post-tonic vowel can surface.

An acoustic object such as the schwa-like release we hinted at above, however, can be reinterpreted by the learner as a cue for a phonological element. In the case that, after its acoustic vocalic properties have been enhanced, this happens with a sufficient amount of systematicity, a phonological process of non-etymological vowel insertion, traditionally described as epenthesis, is triggered. This can be

[110] Recall that, in Pontremolese, the feminine plural morpheme has also been deleted (Section 2.2.2).

observed in the case that, for instance, the forms that underwent unstressed vowel deletion display a word-final consonant cluster with a rising sonority contour:

Tab. 7.2 Epenthesis

Latin	MACRU(M) 'stroke'	ASINU(M) 'donkey'
	↓	↓
proto-Romance	**magro*	**asino*
	↓	↓
Carrarese	*magr*	*asn*
	↓	↓
Pontremolese	*magar*	*asuŋ*

Before formalizing these observations, it is worthwhile to recall that Carrarese and Pontremolese phonological patterns can be interpreted as two stages along the big prosodic change that pushed Western Romance, and particularly Gallo Romance, towards the 'compensation' rhythmic pole (Schmid in press). Indeed, the reduction processes under concern have been considered symptoms of a language's compensation-oriented rhythmic nature (Crosswhite 2004; Loporcaro 2011a; Schmid in press). As argued in Sections 3.1.2 and 3.2.1, a reason for this drift can be found in the intensive nature of these varieties' stress. This property fostered the loss of acoustic prominence of the prosodically weak vowels: unstressed vowels gradually decreased in intensity and duration[111]. As a consequence, because of a process that can be articulatorily described as target undershoot (Recasens 2014), the unstressed vowels are centralized, displaying as a result the formant structure characterizing the schwa (Lindblom 1963; Crosswhite 2004). Under this view, hence, the acoustic space is compressed because the articulators fail to reach the vocalic target specified in the phonological representation, a vocalic target that can instead be reached in stressed, i.e. longer, nuclei (Flemming 1995; Kirchner 1998; Gendrot & Adda 2006). In other words, unstressed vowel reduction seems to be triggered by the phonetic implementation of unstressed nuclei's prominence. It has to be noticed, however, that, even if 'target undershoot' (coupled with gestural overlapping) is a more quantifiable correlate of vowel reduction than the naïve concept of 'ease of articulation', neither of them can be considered the only motivation driving this phonological change. Indeed, they are maybe more correctly interpreted as descriptions of the articulatory, i.e. speaker-oriented, correlates of vowel reduction (Warner 2011).

A slightly different approach resorts to the concepts of 'hyperarticulation' and 'hypoarticulation' (Lindblom 1990). Under this view, the alternation between the two production modalities is accounted for by an interaction of "production" and "reception" constraints. Namely, it is due to

[111] As pointed out by Recasens (2014: 66), "stress is expected to contribute to the compensatory shortening of the adjacent unstressed syllable and thus to the elision of its vowel nucleus."

> "physiological factors (mostly involuntary modulations such as emotion, disease, etc...), cognitive factors (speaking to oneself, propositional vs automatic styles [...], etc...), social and communicative factors (channel, listener, situation, degree of formality...). [However, this] is a deliberate simplification which is likely to be revised in the course of further work." (Lindblom 1990: 419)

Some "further work" has been done, for instance, by Harris (2005), who adds a further "factor". He considers these two articulatory modalities to characterize, respectively, prominent and non-prominent positions: an acoustic alternation is thus generated whose

> "overall communicative effect is to modulate attention across speech signals […]: the occurrence of hypoarticulated weak positions enhances the prominence of intervening strong positions. Positionally sensitive vowel reduction […] can be understood as accentuating the syntagmatic contrast between information-heavy prominent syllables and information-light weak syllables. On this view, reduction is part of planned speech behavior rather than an accidental by-product of vocal-organ inertia." (Harris 2005: 132)

Under this approach, then, unstressed vowel reduction seems to be a phonological process driven by the need to efficiently convey information (Pluymaekers et al. 2005; Warner 2011)[112].

As we are going to see, these two approaches are not mutually exclusive. In fact, the first is argued to 'feed' the second, the interaction of phonetic and phonological modules being what drives the phonological change under discussion.

As discussed in Chapter 6, phonology interfaces with the acoustic side of the phonetic component and represents the properties of the acoustic event that are linguistically meaningful. In the case of vowels, the phonologically relevant information resides in their formant structure, which is formally represented in terms of elements (Section 6.3.1.1.1). As a consequence, the speaker/listener's phonology is sensitive to the acoustic correlate of the articulatory change hinted at above: what is relevant for phonology is not the articulatory mechanics of vowel undershoot, but the loss of elements. Obviously, the same holds for vowel insertion: what matters to phonology is not the articulatory mechanics resulting in a vowel-like acoustic object, but the fact that it cues a phonological element.

Whatever the trigger is of the Gallo Romance rhythmic drift (Sections 3.1.2 and 3.2.1), the first phonological correlate is a decrease in licensing power of the prosodically weak N: unstressed nuclei gradually lost their ability to license phonological information (Van Oostendorp 1995; Harris 1997; Harris 2005). This process is represented in Tab. 7.3, where phonological information is represented by elements (Backley 2011).

[112] It has been noticed, furthermore, that reduction can convey to the listener extra-linguistic information about the speech style, as suggested by the naïve observation that, for instance, students reduce more when talking with their peers than during a job interview (Warner 2011 and references therein).

Tab. 7.3 Prosodically weak nuclei's decrease in licensing power

INITIAL STAGE (proto-Romance)

O	N_1	O	O	N_2
|	|	|	|	|
m	|A̲|	g	r	|U̲A|
|	|	|	|	|
[ˈm	aː	g	r	o]

INTERMEDIATE STAGE

O	N_1	O	O	N_2
|	|	|	|	|
m	|A̲|	g	r	|A|
|	|	|	|	|
[ˈm	aː	g	r	ə]

FINAL STAGE (Carrarese)

O	N_1	O	O	N_2
|	|	|	|	|
m	|A̲|	g	r	| |
|	|	|	|	|
[ˈm	aː	g$^{(ə)}$	^{ə}r	Ø]

As can be noticed in the diachronic change represented above, in the proto-Romance stage, the word-final N licenses a complex elemental structure: |U̲A|. This structure is interpreted by the phonetic module as [o]. In the following diachronic (intermediate) stage, N_2 is no longer able to license a complex structure, and |U̲| is thus deleted from the phonological representation. As a consequence, the word-final nucleus contains just |A|, which is phonetically interpreted as [ə] (Backley 2011). Interestingly, this pattern can still be found in the dialects spoken in the villages scattered between Carrara and Pontremoli (Giannarelli 1913; Luciani 2002), as well as in other peripheral areas (Loporcaro 2005-2006). Finally, the word-final nucleus weakening process concludes with the deletion of |A|: the unstressed nucleus definitively lost its licensing power. As a result, no phonetic trace can be found of the etymologically word-final N[113]. Notice that, on the other hand, the stressed N, namely N_1, keeps its original elemental complexity (in this case, its headedness) throughout the whole diachronic process. This is not surprising, since a prosodically prominent position is assumed to be able to license a complex phonological structure (Van Oostendorp 1995; Harris 1997, 2005; Nasukawa & Backley 2012).

The diachronic change sketched in Tab. 7.3, hence, shows that if proto-Romance speakers' grammar compels them to be faithful to the melodic composition of

[113] The little schwas between brackets displayed in the final stage of Tab. 7.3 represent the stop's release and the rhotic's intrinsic formant structure (Savu 2013), i.e. the articulatory driven schwa-like vocoid discussed in Chapter 5.

unstressed mid vowels, in the following generation(s) the grammar changes in such a way that unstressed vowels are no longer allowed: unstressed N's are no longer able to license elementally complex structures. As a consequence, they are first reduced to their simpler acoustic/phonological counterpart (they lose the headed element, i.e. the more prominent formant structure; Backley 2011), and are then deleted.

Once the deletion stage has been reached, the change just described can be reversed: as shown in Tab. 7.4, which represents the diachronic development following the final stage of Tab. 7.3, an unstressed N can gain back its licensing power: a nonetymological nucleus (N_{Ep}) containing an unheaded element (|A|) is first inserted in the intermediate stage, its complexity being then increased (|A̲|) in the final stage (Pontremolese).

Tab. 7.4 Prosodically weak nuclei's increase in licensing power

INITIAL STAGE (Carrarese)

O	N_1	O	O	N_2
|	|	|	|	|
m	|A̲|	g	r	| |
|	|	|	|	
[ˈm	aː	g$^{(ə)}$	^{ə}r	Ø]

INTERMEDIATE STAGE

O	N_1	O	N_{Ep}	O	N_2
|	|	|	|	|	|
m	|A̲|	g	|A|	r	| |
|	|	|	|	|	
[ˈm	aː	g	ə	r	Ø]

FINAL STAGE (Pontremolese)

O	N_1	O	N_{Ep}	O	N_2
|	|	|	|	|	|
m	|A̲|	g	|A̲|	r	| |
|	|	|	|	|	
[ˈm	aː	g	a	r	Ø]

As noticed by Recasens (2014), however, there is a correlation within the Romance languages between the acoustic properties of two adjacent consonants and the probability to develop an intrusive/epenthetic vowel:

> "in word-medial position, a short vowel-like element situated between two consonants may be categorized as an independent vowel segment, most typically in clusters with a rhotic where an opening period is generally available and in heterosyllabic consonant clusters with a stop or affricate C1 where the consonant release may be perceived as a short vowel by listeners

(Sp. [ˈtiɣeɾe] ‘Sp. tigre’, Brazilian Port. [futʃiˈbol] ‘Sp. futbol’).” (Recasens 2014: 35)[114]

It seems, hence, that the vowel intrusion process is triggered by the intrinsic phonetic properties of liquids and, as shown by Pontremolese data, by nasals.

Indeed, vowel intrusion can also occur when the word-final or word-medial nucleus following a *muta cum liquida* cluster has melodic content. See, for instance, Campidanese [ˈlavv(a)ra] < LABRA ‘lips’; Catalan [kər(ə)ˈβo] < CARBONE ‘coal’, [p(ə)ɾˈat] < PRATU ‘lawn’; Calabrian [ˈvaɾ(ə)və] < BARBA ‘beard’; Salentino [ˈamp(u)lu] < AMPLU ‘wide’; Molisano [ˈmal(ə)va] < MALVA ‘mallow’; Gascon [b(ə)ˈɾyma] < BRUMA ‘mist’, [k(a)ˈlaw] < CLAVE ‘key’; Pugliese [k(ə)ˈlassə] < CLASSE ‘classroom’ (Recasens 2014: 56). Also in these cases, hence, the major trigger of vowel insertion is represented by the nature of the consonant cluster’s second segment.

Once these articulatory driven vocoids are produced, they can undergo a phonologization process, namely they can be mapped on phonological elements. Furthermore, after this ‘epenthetic stage’, the ‘new’ elements can eventually become part of the lexical representation of the forms hosting them, as in Emilian dialects (Section 3.2.4; Passino 2013).

The diachronic change just described, however, is pretty sketchy. Indeed, Tab. 7.3 and Tab. 7.4 represent five static/synchronic stages of the change undergone by the speakers’ phonological knowledge. In fact, they do not say anything about the gradualness of the change, nor about the way the change climbs up along the grammar architecture presented in Chapter 6, i.e. about how a change starting from the phonetic module enters the phonological one. Furthermore, nothing has been said yet about the way learners build a grammar that differs from that of the previous generation. In order to account for these issues, a set of grammars must be formalized that, together with the production process, describe the way a learner perceives the previous generation’s speech. Indeed, at least since Ohala (1981), the interpretation of a percept has been considered an important cause driving diachronic sound changes (Hamann 2009).

In the next section, therefore, a formal account is given of the (diachronically) gradual unstressed vowel reduction, which can be summarized as a sequence of grammars that define how an articulatory driven process (undershoot) gradually enters phonology through a perceptually/phonologically driven mechanism. The intrusive-to-epenthetic vowel change is described along similar lines in Sections 7.3 and 7.4.

[114] As shown in Section 5.3, the same correlation can be found also in Pontremolese: in both paroxitones and proparxitones, an epenthetic vowel occurs if the unstressed vowel deletion processes creates a consonant cluster whose second segment is a sonorant.

7.2 Vowel reduction

As already stated in Chapter 6, the phonetics-phonology interface we need to refer to in order to describe this phonological change can be explicitly formalized by a BiPhon-like grammar model. Within this model, the phonetics-phonology interface, namely the mapping of concrete, acoustic objects to abstract phonological categories, is taken care of by a set of cue constraints (Section 6.2.2). The more relevant cue constraints for the processes under analysis are repeated in Tab. 7.5:

Tab. 7.5 Cue constraints

|X| [[x ms]]	:	an element has (at least) a short acoustic periodic structure
|A| [[ə Hz]]	:	|A| has an acoustic [ə]-like formant structure
|U̲| [[u Hz]]	:	|U̲| has an acoustic [u]-like formant structure
|H| [[ə Hz]]	:	|H| has an acoustic [ə]-like formant structure (C's release)

By means of these constraints, the relevant acoustic properties of the phonetic objects are translated into phonological elements which, in turn, are taken care of by a set of constraints evaluating the structural well-formedness of the phonological structures they are incorporated in. This is the case, for instance, of the structural constraints (Section 6.2.3) repeated in Tab. 7.6:

Tab. 7.6 Structural constraints

$*(N\ \lvert\text{STR}\rvert)_{\mu}$	:	lexical N's cannot license complex structures
*N	:	a morphologically transparent N cannot be incorporated in the phonological representation (no epenthesis)

As can be noticed, the structural constraints can come with a subscript indicating the morphological 'affiliation' of the structure(s) within the brackets. In other words, they evaluate the structural well-formedness of structures whose morphological 'colour' is defined within the lexicon[115]. Similarly, if a given structure lacks a subscript, then it is not represented in the Lexicon. This is the case, for instance, of epenthetic elements. *N must hence be interpreted as an anti-epenthesis constraint.

Finally, another set of 'morphologically-oriented' well-formedness constraints, i.e. the phonological recoverability constraints (Section 6.2.4) repeated in Tab. 7.7,

[115] As discussed in Section 6.3.1.1.3, the subscript occurring in structural and phonological recoverability constraints can be considered a consequence of *Consistency of Exponence* (McCarthy & Prince 1993, 1994; Van Oostendorp 2005). A slightly different formalization would posit the indexing of just N (instead of the elements thereof). In this case, another high ranked constraint would be needed that 'percolates' the subscript/'morphological colour' from the prosodic node to the relative element.

evaluates the presence in the phonological representation of 'morphologically-colored' elements, assigning a violation mark whenever an element belonging to the lexical representation of a given morpheme is absent from the phonological representation.

Tab. 7.7 Phonological recoverability constraints

EXPRESS-$\|X\|_{SG.MASC}$	:	SG.MASC-'coloured' elements must be present in the phonological representation
EXPRESS-$\|X\|_{SG.FEM}$	:	SG.FEM-'coloured' elements must be present in the phonological representation
EXPRESS-$\|X\|_{PL.MASC}$	:	PL.MASC-'coloured' elements must be present in the phonological representation
EXPRESS-$\|X\|_{PL.FEM}$	:	PL.FEM-'coloured' elements must be present in the phonological representation
EXPRESS-$\|X\|_{ROOT}$	:	ROOT-'coloured' elements must be present in the phonological representation

As already claimed, however, before entering phonology, a change affecting a language sound system starts from the lower level, namely from the phonetic module. This means that a change must first concern the way a phonological object is implemented by the phonetic module, i.e. by the way articulators translate the output of the phonological computation. During the production process, indeed, the phonological objects mapped onto the acoustic forms by means of the cue constraints must be implemented by the articulatory system.

This mapping is managed by a set of sensorimotor constraints (Section 6.2.1) referring to both the formant structure and the duration of the relevant phonetic objects. In Tab. 7.8 the formant sensorimotor constraints have been reported which turn out to be relevant for the processes we are going to describe:

Tab. 7.8 Sensorimotor constraints

[[ə Hz]]	[ə]	:	an acoustic schwa-like formant structure is produced by tongue and lips in rest/neutral position
[[u Hz]]	[u]	:	an acoustic u-like formant structure is produced by tongue in back position and rounded lips
[[x ms]]	[x ms]	:	an acoustic (periodic) structure of a given duration is produced by a (vocalic) gesture of the same duration

Finally, the actual phonetic output is filtered out by a set of articulatory constraints (Section 6.2.1). Basically, resting on the assumption that the more long and tense a vowel is, the more effortful it is to articulate (Lindblom 1983), they express the preference for gesture reduction, i.e. for the least stiff and long gestures as possible. The relevant articulatory constraints are repeated in Tab. 7.9:

Tab. 7.9 Articulatory constraints

*ART	:	do not articulate stiff and long (vocalic) gestures
CO-ART	:	overlap adjacent articulations

Under this approach, the variability of the phonetic output fostering the phonologization process (Kiparsky 1995; Hyman 2013) can be ascribed to the interaction of the sensorimotor and articulatory constraints, phonology not being involved yet in such a change. Therefore, this interaction can be argued to account for the very first stage of the unstressed vowel reduction of proto-Romance, a variety where no higher-level structural constraint can be assumed to be the trigger of this process. Indeed, proto-Romance is argued to license mid vowels (viz. elementally complex structures) also in prosodically weak position (Väänänen 1963; Pulgram 1975; Vineis 1984; Herman 1990; Calabrese 2003; Loporcaro 2011a)[116].

Assuming, as discussed in Section 6.2.1, perfect knowledge of the sensorimotor and cue constraints, we take as a starting point for the diachronic change under analysis the grammar summarized in Tab. 7.10[117].

[116] In fact, the high-mid/low-mid vowel contrast occurring in stressed nuclei is neutralized in unstressed position, where only high-mid vowels occur. See, for instance, It. [ˈmɔrto] 'dead SG.MASC' vs. [moˈriːre] 'to die' and [ˈbɛlːa] 'beautiful SG.FEM' vs. [belˈletːsa] 'beauty'. Depending on the version of Element Theory one resorts to (Backley 2012), this can be formalized as a loss of |A| headedness in weak position. In this case, unheaded structures are allowed (Harris & Lindsey 1995) and the ˈN $|\underline{A}U|$ [ɔ]~N |AU| [o] and ˈN $|\underline{A}I|$ [ɛ]~N |AI| [e] alternations are accounted for by the $*(N\ |\underline{X}|)_\mu >> *(N\ |X|)_\mu$ constraint hierarchy. In the case that, instead, unheaded complex structures were not allowed (Backley 2012), this alternation could be described as a change in headedness (ˈN $|\underline{A}U|$ [ɔ]~N $|A\underline{U}|$ [o] and ˈN $|\underline{A}I|$ [ɛ]~N $|A\underline{I}|$ [e]) due to the *N $|\underline{U}|$, *N $|\underline{I}|$ >> *N $|\underline{A}|$ constraint hierarchy). In any case, it seems that a prosodically weak N is not able to license $|\underline{A}|$, which suggests that it should be considered somehow more complex that the other headed elements. This, in turn, suggests that |A| could be represented differently with respect to the other elements (Pöchtrager 2006).

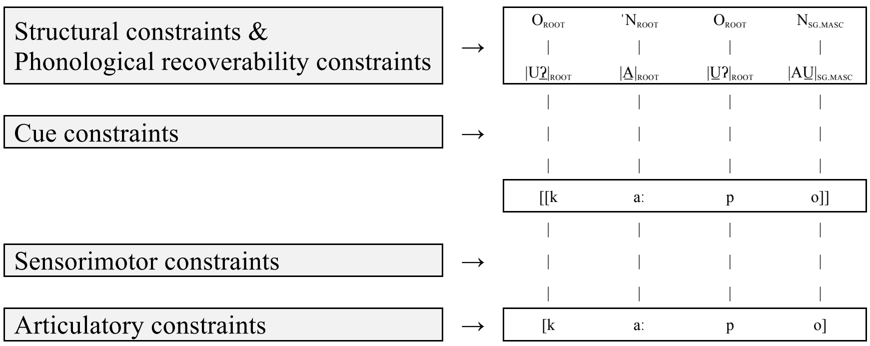
[117] Notice that the phonological recoverability constraints must be ranked higher than the structural constraints. Indeed, as shown by Tab. 11.1 and Tab. 11.3 (Section 11), the need for a morphologically-coloured element (i.e. of some lexicalized information) to be present in the phonological representation counteracts the pressure exerted by the structural constraints toward the reduction of N's complexity.

Tab. 7.10 Proto-Romance grammar

EXPRESS-|X|$_{ROOT}$, EXPRESS-|X|$_{INFL}$
|
*(N |STR|)$_{\mu}$, *N
|
|X| [[x ms]], |A| [[ə Hz]], |U̲| [[u Hz]]
|
[[ə Hz]] [ə], [[u Hz]] [u]
|
*ART

As shown in Tab. 7.11, this grammar maps the underlying structure |cap-|$_{ROOT}$ + |-o|$_{SG.MASC}$ to the phonetic output [ˈkaːpo] ‘head’, i.e. to its unreduced output (see Tab. 11.1 for the relative tableau; notice that the representation in Tab. 7.11 is only meant to show the levels the various sets of constraints apply into. In other words, this does not imply that these constraints display the same order within grammars).

Tab. 7.11 Proto-Romance |cap-|$_{ROOT}$ + |-o|$_{SG.MASC}$ = [ˈkaːpo]



In the production process represented in Tab. 7.11, the articulatory constraints favouring undershoot are assumed to sit at the bottom of the hierarchy (see Tab. 11.1) and cannot therefore force the violation of the other constraints, which are hence satisfied. As a consequence, the phonetic output is maximally faithful to the phonological representation.

However, as already discussed, due to speech rate or style-related conditioning, the speaker can fail to reach the articulatory targets necessary to produce the acoustic form she knows to be associated to the relevant element. From a formal point of view, this can be accounted for by a higher ranking of the articulatory constraint favouring undershoot, *ART, as shown in Tab. 7.12.

Tab. 7.12 STAGE I: Proto-Romance production of articulatory driven reduced vowel (undershoot); *ART vs. sensorimotor constraints; {SG.MASC} = |AU̲|; [Tab. 11.3][118]

O_R ˈN_R O_R N_SM | | | | k |A̲|_R p |AU̲|_SM	*ART	[[ə Hz]] [ə]	[[u Hz]] [u]	[[x ms]] [x ms]
a) ☞ O_R ˈN_R O_R N_SM | | | | | |A̲|_R | |AU̲|_SM | | | | [[k aː p o]] | | | | [k aˑ p ᵊ]	****(ˈN) *(N)		*	*(ˈN) *(N)
b) O_R ˈN_R O_R N_SM | | | | | |A̲|_R | |AU̲|_SM | | | | [[k aː p o]] | | | | [k aː p o]	**W** ****!*(ˈN) *!**(N)		**L**	**L**
c) O_R ˈN_R O_R N_SM | | | | | |A̲|_R | |AU̲|_SM | | | | [[k aː p o]] | | | | [k aˑ p ᵘ]	**W** ****(ˈN) *!*(N)	**W** *	**L**	*(ˈN) *(N)

As shown by the tableau, *ART favours candidate a), namely the candidate which, differently from candidate b), reduces the duration of both nuclei. This, in turn, entails a (double) violation of the low-ranked sensorimotor constraint requiring a faithful correspondence between the acoustic duration the speaker knows a vocalic segment has and the duration of the corresponding vocalic gesture. As can be noticed, the same duration violations of candidate a) are incurred by candidate c): the two forms, indeed, reduce the vowel's duration to the same degree. The difference is that, while the winning candidate centralizes the unstressed vowel quality ([ᵊ]), candidate c) peripheralizes it ([ᵘ]). As shown in Section 6.2.1, this translates to an extra violation of *ART of candidate c). Another consequence of this difference in the reduction path is that candidate a) violates [[ə Hz]] [ə], while candidate c) violates [[u Hz]] [u]. In other words, assuming that [[o]]'s formant structure can be analysed as the sum of [[ə]]'s and [[u]]'s (Sections 6.2.2 and 6.3.1.1.1), *ART impairs the realization of the peripheral/tense component in candidate a) and of the centralized one in candidate c). Interestingly, the violation of these low-ranked sensorimotor constraints implies the satisfaction of the correspondent higher-ranked cue constraints. This is shown in Tab. 7.13, where the

[118] In this tableau, as in all the tableaux presented in this chapter, only the relevant constraints are included due to space requirements. For the same reason, the SG.MASC, SG.FEM, PL.MASC and PL.FEM subscripts are substituted, respectively, by SM, SF, PM and PF. At the end of the heading of every tableau, however, together with the lexical phonological shape of the relevant inflectional morpheme, the reference is given to the complete tableau presented in Section 11.

winning candidate of Tab. 7.12 is confronted with a candidate, b), that displays the same output form but a difference in the acoustic form:

Tab. 7.13 STAGE I: Proto-Romance production of articulatory driven reduced vowel (undershoot); cue vs. sensorimotor constraints; {SG.MASC} = |AU̲|; [Tab. 11.3]

<table>
<tr><td colspan="2">O_R ˈN_R O_R N_{SM}
| | | |
k |A̲|$_R$ p |AU̲|$_{SM}$</td><td>|A|
[[ə Hz]]</td><td>|U̲|
[[u Hz]]</td><td>[[ə Hz]]
[ə]</td><td>[[u Hz]]
[u]</td></tr>
<tr><td>a) ☞</td><td>O_R ˈN_R O_R N_{SM}
| | | |
| |A̲|$_R$ | |AU̲|$_{SM}$
| | | |
[[k aː p o]]
| | | |
[k a˙ p ᵊ]</td><td></td><td></td><td></td><td>*</td></tr>
<tr><td>b)</td><td>O_R ˈN_R O_R N_{SM}
| | | |
| |A̲|$_R$ | |AU̲|$_{SM}$
| | | |
[[k aː p ə]]
| | | |
[k a˙ p ᵊ]</td><td></td><td>**W**
*!</td><td></td><td>**L**</td></tr>
</table>

As shown by this tableau, the higher ranking of the constraints managing the phonetics-phonology interface with respect to the purely phonetic ones forces the reduction process to be confined within the articulatory domain. What is reduced is the actual phonetic output, the acoustic target a speaker aims at being unaffected by this low-level variation.

It has to be pointed out that the articulatory driven reduction occurring in this stage is assumed to be optional. As a consequence, the presence in the linguistic input the listener/learner is exposed to of unreduced forms allows her to infer that the reduced N's phonological representation is |AU̲|, and that there is no structural constraint driving the reduction process: if this process were managed by a phonological constraint, it would indeed be systematic. Furthermore, a normalization procedure can be assumed to be active during the perception process, by means of which the auditory effect of this articulatory driven reduction would be attenuated.

This, in turn, implies that a listener sharing the same grammar of the speaker correctly interprets the reduced forms she is exposed to. Namely, given a reduced form such as the winning candidate of the preceding tableau, the listener maps it to the phonological representation the speaker was phonetically interpreting. This is shown in the perception tableau given in Tab. 7.14, where the input cell displays the reduced auditory form the listener perceives and the candidates' column the possible underlying forms she could infer.

Tab. 7.14 STAGE I: Proto-Romance perception of articulatory driven reduced vowel; {SG.MASC} = |AU̲| [Tab. 11.4]

[[k aˑ p ᵊ]]	EXPRESS -$|X|_{ROOT}$	EXPRESS -$|X|_{SG.MASC}$	*(N $|STR|)_{\mu}$	|X| [[x ms]]	|A| [[ə Hz]]	|U̲| [[u Hz]]
a) ☞ O_R ˈN_R O_R N_{SM} | $|A̲|_R$ | $|AU̲|_{SM}$ [[k aˑ p ᵊ]]			***	*		*
b) O_R ˈN_R O_R N_{SM} | $|A̲|_R$ | $|A|_{SM}$ [[k aˑ p ᵊ]]		W *!	L *	*		L
c) O_R ˈN_R O_R N_{SM} | $|A̲|_R$ | $|U̲|_{SM}$ [[k aˑ p ᵊ]]		W *!	L **	*	W *	*
d) O_R ˈN_R O_R N_{SM} | $|A̲|_R$ | $|\ |_{SM}$ [[k aˑ p ᵊ]]		W *!*	L	L	W *	L

As can be noticed, both the articulatory and sensorimotor constraints are excluded from the perception tableau. Indeed, the articulatory dimension is assumed to be irrelevant for the listener (Hamann 2009; Backley 2011; Boersma 2011). As a consequence, the listener cannot ascribe the reduction to the high ranking of the articulatory constraints, and equates the sensorimotor constraint ([[u Hz]] [u]) violation the speaker incurs with a violation of the cue constraint (|U̲| [[u Hz]]) concerning the same acoustic object ([[u Hz]]). This is shown by the winning candidate, a), and by candidate c). In both the cases, indeed, the listener cannot find any auditory cue for the underlying |U̲|. Candidate c), however, incurs an extra violation of the cue constraints: the (durationally reduced) melodic content of the word-final N ([[ᵊ]]) is wrongly mapped on |U̲|, which translates to a violation of |A| [[ə Hz]]. Candidate a), instead, satisfies this constraint: [[ᵊ]] is correctly mapped on |A|.

The same cue constraint is satisfied by candidate b). Furthermore, differently from the winning candidate, candidate b) satisfies the other cue constraint as well: |U̲| [[u Hz]]. Because of this, this candidate behaves better than the winning candidate with respect to the structural constraint (*(N $|STR|)_{\mu}$) requiring a simpler elemental structure: by not inferring the presence of |U̲| in the underlying representation, the learner would get rid of two of the three violation marks incurred by candidate a). However, candidate b) (together with candidates c) and d)) incurs this way the fatal violation of EXPRESS-$|X|_{SG.MASC}$. The learner, indeed, because of the optionality of the reduction process, knows that the underlying representation of a SG.MASC morpheme is |AU̲|[119]. The lack of these 'morphologically coloured'

[119] We assume, furthermore, that the discourse context helps the listener to correctly 'comprehend' (Boersma 2011) that the form under concern refers to a singular masculine

elements in the phonological representation, hence, entails a violation of the relevant phonological recoverability constraint which, crucially, is ranked above the structural constraint.

All in all, hence, the perception process just described doesn't force any change in the grammar of the listener. The only difference with respect to the speaker's grammar of the same (diachronic) stage is that the perception winning candidate violates the cue constraint |U̲| [[u Hz]]. Furthermore, notice that the same grammar allows the listener to correctly 'comprehend' unreduced forms: given an auditory form such as [[ka:po]], the listener correctly maps it to the underlying form $|\text{cap-}|_{\text{ROOT}}$ + $|\text{-o}|_{\text{SG.MASC}}$.

A more drastic change in the grammar, however, is forced by the perception process in the case that, for sociolinguistic reasons driving the transmission dimension of a phonological change (Labov 2001; Scheer to appear), the reduced forms the learning child is exposed to increase. Assuming that the speaker grammar remains the same as in the preceding tableaux, namely that the reduction process is still articulatory driven, and that the learner has reasons to believe that the underlying representation of [[o]] is still |AU̲|[120], the overwhelming majority of reduced forms calls for a structural/phonological explanation: unstressed nuclei do not seem to be able to license elementally complex structures anymore. This is shown by the perception grammar of Tab. 7.15:

Tab. 7.15 STAGE Ia: perception of articulatory driven reduced vowel (hypoarticulation); {SG.MASC} = |AU̲| [Tab. 11.5]

[[k a· p ə]]	*(N |X̲Y|)μ	EXPRESS -|X|SG.MASC	*(N |X̲|)μ	*(N |X|)μ	*(N | |)μ
a) ☞ O_R 'N_R O_R N_SM | |A̲|_R | |A|_SM [[k a· p ə]]		*		*	
b) O_R 'N_R O_R N_SM | |A̲|_R | |AU̲|_SM [[k a· p ə]]	W *!	L		L	
c) O_R 'N_R O_R N_SM | |A̲|_R | |U̲|_SM [[k a· p ə]]		*	W *!	L	
d) O_R 'N_R O_R N_SM | |A̲|_R | | |_SM [[k a· p ə]]		W *!*		L	W *

referent. In other words, the discourse context helps in defining the 'morphological colour' of phonological objects.

[120] The assumption of an unchanged speaker's grammar, together with the graduality of the transmission process, implies that forms which display a full vowel can still be produced, and hence perceived. It has to be pointed out that no phonological alternation can cast any light on the underlying structure of the SG.MASC morpheme, since it can never be stressed.

As shown by Tab. 7.15, a learner growing up in a linguistic context where unstressed vowel reduction is fairly systematic might ascribe this process to the high ranking of $*(\mathrm{N}\ |\underline{X}Y|)_{\mu}$, i.e. of the structural constraint against the more elementally complex structure[121]. In other words, the learner is interpreting the articulatory nature of speakers' reduction process (undershoot) as a case of hypoarticulation (Section 6.3.1), namely as a process that "is part of planned speech behaviour rather than an accidental by-product of vocal-organ inertia" (Harris 2005: 132).

Crucially, since we are assuming that the learner still has some evidence about the underlying complexity of SG.MASC morpheme, $*(\mathrm{N}\ |\underline{X}Y|)_{\mu}$ must be more highly ranked than EXPRESS-$|X|_{\text{SG.MASC}}$:

Tab. 7.16 STAGE Ia: grammar change

STAGE I	→	STAGE Ia
EXPRESS-$\|X\|_{\text{ROOT}}$, EXPRESS-$\|X\|_{\text{SG.MASC}}$		$*(\mathrm{N}\ \|\underline{X}Y\|)_{\mu}$
|		|
$*(\mathrm{N}\ \|\underline{X}Y\|)_{\mu}$		EXPRESS-$\|X\|_{\text{ROOT}}$, EXPRESS-$\|X\|_{\text{SG.MASC}}$
|		|
$*(\mathrm{N}\ \|\underline{X}\|)_{\mu}$		$*(\mathrm{N}\ \|\underline{X}\|)_{\mu}$
|		|
$*(\mathrm{N}\ \|X\|)_{\mu}$		$*(\mathrm{N}\ \|X\|)_{\mu}$
|		|
$*(\mathrm{N}\ \|\ \ \|)_{\mu}$, *N		$*(\mathrm{N}\ \|\ \ \|)_{\mu}$, *N

Given this change, a 'lexically' faithful candidate such as b) (see Tab. 7.15) is bested by the candidates which behave better with regard to the top ranked structural constraint. It is the case, for instance, of candidates a), c) and d). As for d), even if it is the candidate that better satisfies the whole set of structural constraints, the price it has to pay is too high. Indeed, by deleting all of the 'morphologically coloured' elements from the phonological representation, it incurs in an extra (fatal) violation of EXPRESS-$|X|_{\text{SG.MASC}}$. As for the two candidates still competing, the tableau shows that the winning candidate, a), is selected by the (intrinsic fixed ranking of the) structural constraints still sitting below EXPRESS-$|X|_{\text{SG.MASC}}$, which favour the deletion of the headed element, i.e. $\underline{U}$[122].

We hinted above at the graduality of phonological change transmission. This graduality could be formalized by a stochastic grammar (Boersma 1998), or by

---

[121] Recall that the structural constraints of this tableau represent an 'analytic' instance of the 'synthetic' constraint, $*(\mathrm{N}\ |STR|)_{\mu}$, resorted to in the preceding tableaux.

[122] Or, of course, $|\underline{I}|$. It is the case, for instance, of SG.MASC nous ending in /e/ ($|A\underline{I}|$), such as *mare* 'sea' (Carr. and Pontr. *mar*). As already pointed out in Sections 2, 3.2 and 5.2, this process applies to word-medial vowels as well (REALIZE-$|X|_{\text{ROOT}}$ and REALIZE-$|X|_{\text{SG.MASC}}$ are ranked on the same hierarchy level), but not to unstressed vowels making up the SG.FEM, PL.MASC and, in the case of Pontremolese, PL.FEM morphemes (which are thus argued to be higher-ranked).

postulating an intermediate stage where EXPRESS-$|X|_{SG.MASC}$ and *(N $|\underline{X}Y|)_{\mu}$ sit on the same hierarchy level. In this case, assuming that the learner still has some clue about the SG.MASC morpheme's elemental complexity, an underlying form such as $|cap\text{-}|_{ROOT}$ + $|\text{-}o|_{SG.MASC}$ could still be selected as the winning candidate in the perception process.

However, given the variability of the output realizations, it could also be the case that the learner is not sure about the SG.MASC morpheme's lexical representation. In a situation such as this one, the mechanism of Selective Lexicon Optimization (Van Oostendorp 2014) can help the learner to restructure the relevant lexical representation[123]. Its definition is given in Tab. 7.17:

Tab. 7.17 Selective lexicon optimization (SLO) (Van Oostendorp 2014: 80)

SLO: choose the input-output mapping with the lowest violation profile.

Differently from the 'classical' Lexicon Optimization mechanism, where, given the uniqueness of the output realization, faithfulness constraints play a crucial role in selecting the 'right' underlying representation (Nevins & Vaux 2003), in SLO the markedness constraints participate in the selection mechanism. Consider, for instance Tab. 7.18, where the tableaux assuming, respectively, {SG.MASC} = $|A\underline{U}|$ and {SG.MASC} = |A| (see Tab. 11.6 and Tab. 11.7 for the full tableaux), are integrated in a single tableau[124].

---

[123] Differently from the 'classical' Lexicon Optimization (Nevins & Vaux 2003), Selective Lexical Optimization assumes variation in the learner input, i.e. a situation where "the learner does not [...] know precisely what the output form is supposed to be, either because she did not hear it correctly, or a speaker mispronounced, or [...] also sociolinguistic or dialect variation might instigate this kind of change in the language learner" (Van Oostendorp 2014: 80).

[124] As can be noticed by the high-ranking of *ART, these tableaux represent the phonetic outputs resulting from undershoot.

Tab. 7.18 STAGE Ia: {SG.MASC} = |A$\underline{U}$| and {SG.MASC} = |A|

<table>
<tr><th>O$_R$ ˈN$_R$ O$_R$ N$_{SM}$
| | | |
k |$\underline{A}$|$_R$ p |A$\underline{U}$|$_{SM}$</th><th>*ART</th><th>*(N |$\underline{X}$Y|)$_\mu$</th><th>EXPRESS-|X|$_{SG.MASC}$</th><th>|$\underline{U}$|
[[u Hz]]</th></tr>
<tr><td>a) ☞ O$_R$ ˈN$_R$ O$_R$ N$_{SM}$
| | | |
| |$\underline{A}$|$_R$ | |A$\underline{U}$|$_{SM}$
| | | |
[[k aː p o]]
| | | |
[k aˑ p ᵊ]</td><td>****(ˈN)
(N)</td><td></td><td></td><td></td></tr>
<tr><td>b) O$_R$ ˈN$_R$ O$_R$ N$_{SM}$
| | | |
| |$\underline{A}$|$_R$ | |A$\underline{U}$|$_{SM}$
| | | |
[[k aː p ə]]
| | | |
[k aˑ p ᵊ]</td><td>****(ˈN)
(N)</td><td></td><td></td><td>W
*!</td></tr>
<tr><th>O$_R$ ˈN$_R$ O$_R$ N$_{SM}$
| | | |
k |$\underline{A}$|$_R$ p |A|$_{SM}$</th><th>*ART</th><th>*(N |$\underline{X}$Y|)$_\mu$</th><th>EXPRESS-|X|$_{SG.MASC}$</th><th>|$\underline{U}$|
[[u Hz]]</th></tr>
<tr><td>c) O$_R$ ˈN$_R$ O$_R$ N$_{SM}$
| | | |
| |$\underline{A}$|$_R$ | |A|$_{SM}$
| | | |
[[k aː p o]]
| | | |
[k aˑ p ᵊ]</td><td>****(ˈN)
*(N)</td><td></td><td></td><td>W
*!</td></tr>
<tr><td>d) ☞ O$_R$ ˈN$_R$ O$_R$ N$_{SM}$
| | | |
| |$\underline{A}$|$_R$ | |A|$_{SM}$
| | | |
[[k aː p ə]]
| | | |
[k aˑ p ᵊ]</td><td>****(ˈN)
*(N)</td><td></td><td></td><td></td></tr>
</table>

Both of the winning candidates of these tableaux, a) and d), behave equally well with respect to EXPRESS-|X|$_{SG.MASC}$. Namely, they are both ‘faithful’ to the elemental composition of the SG.MASC morpheme defined within the lexicon, which is hypothesized to be |A$\underline{U}$| for candidates a) and b) and |A| for candidates c) and d). However, the two winning candidates behave differently with respect to the structural (viz. markedness) constraint *(N |$\underline{X}$Y|)$_\mu$. This is shown in Tab. 7.19.

Tab. 7.19 STAGE Ia: {SG.MASC} = |AU̲| vs. {SG.MASC} = |A|

	$*(N\ \vert \underline{X}Y \vert)_\mu$	EXPRESS-$\vert X \vert_{SG.MASC}$
☞ a) O_R ˈN_R O_R N_{SM} $\vert \underline{A} \vert_R$ $\vert A \vert_{SM}$ [[k aː p ə]] [k a· p ᵊ]		
b) O_R ˈN_R O_R N_{SM} $\vert \underline{A} \vert_R$ $\vert A\underline{U} \vert_{SM}$ [[k aː p o]] [k a· p ᵊ]	W *!	

Notice, by the way, that the same winner would be obtained even if $*(N\ |\underline{X}Y|)_\mu$ were ranked on the same level of EXPRESS-$|X|_{SG.MASC}$, namely, if the variability of the input the learner is exposed to did not allow her to find a stable relative ranking of these two constraints. The crucial constraint for the selection of the underlying form, indeed, would still be the structural one.

The mechanism of SLO, hence, can help the learner to fix the constraint ranking and to solve her 'doubts' about the correct lexical representation of the SG.MASC morpheme: while for the previous generation it was $|A\underline{U}|_{SG.MASC}$, she prefers $|A|_{SG.MASC}$. As a consequence, the perception tableau presented in Tab. 7.15 can be substituted by the one in Tab. 7.20:

Tab. 7.20 STAGE Ib: perception of articulatory driven reduced vowel (hypoarticulation); {SG.MASC} = |A| [Tab. 11.8]

[[k a· p ᵊ]]	$*(N\ \vert \underline{X}Y \vert)_\mu$	EXPRESS-$\vert X \vert_{SG.MASC}$	$*(N\ \vert \underline{X} \vert)_\mu$	$*(N\ \vert X \vert)_\mu$	$*(N\ \vert\ \ \vert)_\mu$
☞ a) O_R ˈN_R O_R N_{SM} $\vert \underline{A} \vert_R$ $\vert A \vert_{SM}$ [[k a· p ᵊ]]				*	
b) O_R ˈN_R O_R N_{SM} $\vert \underline{A} \vert_R$ $\vert A\underline{U} \vert_{SM}$ [[k a· p ᵊ]]	W *!	W *		L	
c) O_R ˈN_R O_R N_{SM} $\vert \underline{A} \vert_R$ $\vert \underline{U} \vert_{SM}$ [[k a· p ᵊ]]		W *!	W *!	L	
d) O_R ˈN_R O_R N_{SM} $\vert \underline{A} \vert_R$ $\vert\ \ \vert_{SM}$ [[k a· p ᵊ]]		W *!		L	W *

Since the SG.MASC morpheme has been restructured as $|A|_{SG.MASC}$, the winning candidate, as opposed to candidate b), violates neither $*(N\ |\underline{X}Y|)_{\mu}$ nor EXPRESS-$|X|_{SG.MASC}$: the change climbed up the grammar architecture presented in Section 6.3 and entered the lexicon.

Once the SG.MASC morpheme's lexical representation and the speaker's grammar have been restructured, in the production process the phonological forms can be faithfully realized or undergo another round of reduction. As usual, the reduction process is formalized by a higher ranking of the articulatory constraints:

Tab. 7.21 STAGE II: production of articulatory driven reduced vowel (undershoot, second round); {SG.MASC} = |A| [Tab. 11.7]

		O_R ˈN_R O_R N_{SM} | | | | k $|\underline{A}|_R$ p $|A|_{SM}$	*ART	[[x ms]] [x ms]
☞	a)	O_R ˈN_R O_R N_{SM} | | | | | $|\underline{A}|_R$ | $|A|_{SM}$ | | | | [[k aː p ə]] | | | | [k aˑ p ᵊ]	****(ˈN) *(N)	*(ˈN) *(N)
	b)	O_R ˈN_R O_R N_{SM} | | | | | $|\underline{A}|_R$ | $|A|_{SM}$ | | | | [[k aː p ə]] | | | | [k aː p ə]	**W** ****!*(ˈN) **(N)	**L**

Also in this case, hence, the reduction process is assumed to start from the lowest grammatical level: it is a matter of undershoot. Indeed, the speaker is assumed to fail in reaching the acoustic targets she knows to be associated with the relevant underlying elemental structure. As a consequence, candidate a) of Tab. 7.21 wins out over the unreduced candidate b).

Now, assuming that, as in the preceding undershoot-hypoarticulation round, some sociolinguistic reason drove the diffusion of the reduced outputs, the learner's grammar can undergo a further change. Indeed, as shown in Tab. 7.22, the listener can hallucinate the articulatory driven reduction as being due to some high-ranked structural constraint.

Tab. 7.22 STAGE IIa: perception of articulatory driven reduced vowel (hypoarticulation); {SG.MASC} = |A|; grammar change I; [Tab. 11.9]

<table>
<tr><th></th><th>[[k a˙ p ᵊ]]</th><th>*(N |X|)$_\mu$</th><th>EXPRESS
-|X|$_{SG.MASC}$</th><th>*(N | |)$_\mu$</th></tr>
<tr><td>a) ☞</td><td>O$_R$ ˈN$_R$ O$_R$ N$_{SM}$
| | | |
| |A̲|$_R$ | | |$_{SM}$
| | | |
[[k a˙ p ᵊ]]</td><td></td><td>*</td><td>*</td></tr>
<tr><td>b)</td><td>O$_R$ ˈN$_R$ O$_R$ N$_{SM}$
| | | |
| |A̲|$_R$ | |A|$_{SM}$
| | | |
[[k a˙ p ᵊ]]</td><td>**W**
*!</td><td>**L**</td><td>**L**</td></tr>
</table>

Similarly to what happened in STAGE Ia (Tab. 7.15), before the regularization of this process, the learners are assumed to go through an intermediate stage that gives them some clue about the underlying elemental structure of the SG.MASC morpheme. In other words, the learner knows that its lexical representation is likely to be |A|. As a consequence, she restructures her grammar in such a way that the structural constraint *(N |X|)$_\mu$ outranks the phonological recoverability constraint EXPRESS-|X|$_{SG.MASC}$.

Tab. 7.23 STAGE IIa: grammar change I

<table>
<tr><th>STAGE II</th><th>→</th><th>STAGE IIa</th></tr>
<tr><td>*(N |X̲Y|)$_\mu$
|
EXPRESS-|X|$_{ROOT}$, EXPRESS-|X|$_{SG.MASC}$
|
*(N |X̲|)$_\mu$
|
*(N |X|)$_\mu$
|
*(N | |)$_\mu$, *N</td><td></td><td>*(N |X̲Y|)$_\mu$
|
*(N |X̲|)$_\mu$
|
*(N |X|)$_\mu$
|
EXPRESS-|X|$_{ROOT}$, EXPRESS-|X|$_{SG.MASC}$
|
*(N | |)$_\mu$, *N</td></tr>
</table>

By means of this change, candidate b) of Tab. 7.22 is ruled out.

This grammar change, however, turns out not to be enough for the selection of the actual optimal output. This is shown in Tab. 7.24, where a different winning candidate, a), has been added which shows a difference with respect to Tab. 7.22's winner in the phonological interpretation of the word-final extra-short schwa-like acoustic object. Indeed, while in the 'old' winning candidate (i.e. candidate b)) of Tab. 7.24) [[ᵊ]] is mapped on an elementally empty N, in the 'new' winning candidate this acoustic object is interpreted as the vowel-like release of the preceding stop. In other words, while in candidate b) it is a cue for no element[125], in the winning candidate it cues the |H| element of the preceding stop.

Tab. 7.24 STAGE IIa: perception of articulatory driven reduced vowel (hypoarticulation); {SG.MASC} = |A|; grammar change II; [Tab. 11.8]

<table>
<tr><th>[[k a˙ p ᵊ]]</th><th>*(N |X|)_μ</th><th>EXPRESS -|X|_{SG.MASC}</th><th>*(N | |)_μ</th><th>|A| [[ə Hz]]</th><th>|H| [[ə Hz]]</th></tr>
<tr><td>a) O_R ˈN_R O_R N_{SM}
| | | |
☞ | |A̲|_R | | |_{SM}
| | | ǂ
[[k a˙ p ← ᵊ]]</td><td></td><td>*</td><td>*</td><td>*</td><td></td></tr>
<tr><td>b) O_R ˈN_R O_R N_{SM}
| | | |
| |A̲|_R | | |_{SM}
| | | |
[[k a˙ p ᵊ]]</td><td></td><td>*</td><td>*</td><td>*</td><td>W
*!</td></tr>
</table>

As can be noticed, a) and b) display the same violation pattern for the structural and phonological recoverability constraints: they both satisfy $*(\text{N }|\text{X}|)_\mu$ and violate EXPRESS-$|\text{X}|_{\text{SG.MASC}}$ and $*(\text{N }|\ \ |)_\mu$. Furthermore, they both violate |A| [[ə Hz]]: the schwa-like acoustic object is mapped on an |A| in neither candidate. The selection of the winning candidate, hence, rests on some other constraint. This burden is met by the cue constraint |H| [[ə Hz]], which is satisfied by a) but violated by b). Indeed, as shown by the leftward arrow of this candidate, [[ᵊ]] is argued to be reinterpreted as the vowel-like release burst of the preceding /p/, i.e. of |ʔU̲H|[126].

Following Hamann (2009), we argue that the introduction of this constraint in the grammar formalizes one aspect[127] of the "perceptual reinterpretation" that is often involved in the (perception) grammar change: "the language learner does not merely construct a different ranking of the same constraints from the input, but can employ different constraints than the previous generation" (Hamann 2009: 114). In the case at hand, this implies that a learner can construct cue constraints unknown to the 'teaching' speaker. Namely, that she can learn new mappings between the acoustic objects the linguistic context gives her and the phonological elements that

[125] Or, alternatively, of a higher prosodic node (such as an empty N). See Boersma (2007) for a similar treatment of the schwa surfacing in the French *une hausse* 'an increase'. In his analysis, indeed, the surfacing of the schwa can be considered a "means to improve the perceptibility of an underlying glottal stop or syllable boundary" (Boersma 2007: 2051).

[126] Notice that in Tab. 7.24, as in the following tableaux, |H| [[ə Hz]] is violated by the word-initial consonant, and, in general, by every obstruent preceding a full vowel (more on this below). As a consequence, since this violation is incurred by all the competing candidates and is therefore irrelevant, we did not add the relative violation marks. We hope in this way to improve the readability of the tableaux.

[127] Hamann (2009), indeed, points out that a diachronic change can also result from an intergenerational difference in cue-weighting, "where some cues are given much less (or no) weight by the younger generation than they received by the parent generation [...] because some cues become less reliable due to variation in their distribution" (Hamann 2009: 136).

make up the phonological expressions[128]. Under this approach, the perception driven change under concern could be considered an instance of the 'Ohalian' mechanism (Ohala 1995), whereby a perceptual cue for a given phonological category (viz. for a reduced |A| in our speaker's grammar) is parsed by the learner as belonging instead to a different object (viz. to *p*'s |H|). However, as pointed out by Hamann (2009), the mechanism of cue re-association suggested by the Ohalian model sounds like a "simplified view of sound change". Indeed, perceptual cues can also be shared not simply referring either to one or another phonological category. As a consequence, the diachronic change cannot be described as just the delinking and re-linking of an association line between an acoustic object and the phonological category it is supposed to be the cue for.

A shared-cue scenario is that shown in Tab. 7.24, where the schwa-like acoustic object is simultaneously mapped on word-final N_{μ}'s |A| and p_{μ}'s |H|. Together with the grammar change of Tab. 7.23, hence, the learner of STAGE IIa has to make the |H| [[ə Hz]] constraint as relevant as the other cue constraints. This effect can be reached in different ways.

We could think, for instance, to a kind of 'fine-tuning' of an already existing cue constraint: since |H| is reported as being (universally) acoustically characterized by "a period of aperiodic energy similar to that observed in fricatives, albeit much shorter in duration" (Backley 2012: 71), we could argue for a change in the relative cue constraint, whereby, paraphrasing Backley, |H| is now associated with a 'period of *periodic* energy similar to that observed in *central vowels*, albeit much shorter in duration'. Interestingly, Backley (2012) explicitly refers to the relevance of the acoustic correlate of obstruents' |H| in perception:

> "although the presence or absence of audible release is never contrastive in stops, the release burst does carry important linguistic information in the form of resonance cues that are crucial for perceiving stops accurately. So in order to reflect the significance of its linguistic role, E[lement]T[heory] includes |H| in the structure of released stops." (Backley 2012: 71)

This cue constraint 'fine-tuning' could occur as a consequence of the completion of the unstressed vowel reduction process. Indeed, by deleting an adjacent vowel, the formantic transitions conveying stops' place information lack the acoustic space necessary for their expression. Therefore, the relevant obstruent release can be acoustically enhanced, thereby becoming acoustically similar to a schwa-like vocoid (Hall 2006). This acoustic object can then be used to 'update' the |H| related cue constraint and make it 'fine-tuned' with the actual (or more frequently occurring) acoustic cue. In this case, hence, the 'updated' cue constraint would become 'as relevant as the other cue constraints' as a consequence of unstressed vowel deletion.

Alternatively, since the obstruent releases can also display synchronic variability depending on the degree of consonantal gestures overlapping (Hall 2006), a second possibility would be to consider |H| as simultaneously associated to more than one

[128] As discussed in Sections 6.2.2, 6.3 and 6.3.1.1.1, we argue that, while elements could belong to the universal set of phonological primitives, their mapping on phonetic objects is learnt, or 'fine-tuned', on a language-specific basis.

acoustic cue (a kind of mirror-version of [[ə]]'s double mapping on |A| and |H|). Namely, it could be mapped to tokens belonging to an acoustic *continuum* that ranges from Backley's short "period of aperiodic energy" to the schwa-like periodic structure under concern. In this case, a process could then be argued for which, as a consequence of unstressed vowel deletion, assigns a higher phonological relevance (in terms of ranking) to the cue constraint which maps |H| on the schwa-like vocoid.

It has to be highlighted that, in both cases, the completion of the unstressed vowel reduction process is crucial: for |H| [[ə]] to be active, the following N must be empty. And in fact, even in the case that the cue constraints mapping |H| on different acoustic cues (or to an acoustic *continuum*) were simultaneously present in the same hierarchical level, and that, therefore, the shared-cue scenario we hinted at above were created, |H| [[ə]] would be presumably active[129] only when |H| does not occur before an elementally contentful N. Only in this case, indeed, because of perceptual and articulatory reasons, the vowel-like 'allo-cue' would be realized.

Notice that it could be the case that, immediately before this constraint has become relevant for the learner's grammar and the winning candidate has been selected whose [[^{ə}]] is parsed as the preceding consonant's release, the SLO mechanism can be argued to apply again.

As in STAGE Ia, indeed, we assume that the learner can observe a bimodal distribution of SG.MASC realizations because of the graduality of change transmission and the articulatory driven nature of the preceding generation's reduction process (Tab. 7.21). This means that the learner is exposed to a variability of the input she is building the relevant lexical representation on. As we have seen, SLO can help her to construct this lexical representation by means of the selection of the candidate showing the lowest violation profile. This is shown in Tab. 7.25, where the winning candidates in the case that of SG.MASC were, respectively, | | and |A|, are compared (see Tab. 11.9 and Tab. 11.10 for the complete tableaux). Candidate a) displays the violations incurred in case {SG.MASC} was | |, and candidate b) shows the ones in the case {SG.MASC} was |A|.

[129] It has to be noticed that in perception, |H| [[ə]] can conflict with |A| [[ə]]. In this case, for the learner to interpret [[ə]] as a cue for |H| instead of |A|, |H| [[ə]] should be higher-ranked than |A| [[ə]]. Alternatively, as in the grammars under concern, they both have to be dominated by a constraint that forces the |A| [[ə]] violation. This is the case, for instance, of *(N |X|)$_{\mu}$ of Tab. 7.22 and Tab. 7.24, which drives |A|$_{\text{SG.MASC}}$ deletion (see also Tab. 11.8 for the full tableau).

Tab. 7.25 STAGE IIa: {SG.MASC} = | | vs. {SG.MASC} = |A|

a) {SG.MASC} = | |; b) {SG.MASC} = |A|	*(N |X|)$_{\mu}$	EXPRESS -|X|$_{SG.MASC}$	*(N | |)$_{\mu}$	|A| [[ə Hz]]
a) ☞ O_R ˈN_R O_R N_{SM} | |$\underline{A}$|$_R$ | | |$_{SM}$ [[k aˑ p^{ə}]]			*	*
b) O_R ˈN_R O_R N_{SM} | |$\underline{A}$|$_R$ | | |$_{SM}$ [[k aˑ p^{ə}]]		W *!	*	*

As in the case of Tab. 7.19, the two candidates show a similar violation pattern: they both violate |A| [[ə Hz]] (since in neither case the schwa cues |A|) and *(N | |)$_{\mu}$ (since |A|$_{SG.MASC}$ is parsed in none of the cases). However, since candidate b) assumes that the lexical representation of SG.MASC is |A|, the price of satisfying *(N | |)$_{\mu}$ is a violation of EXPRESS-|X|$_{SG.MASC}$. Namely, it incurs an extra violation with respect to candidate a). As a consequence, the learner restructures the SG.MASC morphems's lexical representation as | |, i.e. as an N node that lacks any elemental content. Once again, the phonological change climbed up the grammar architecture, its effects being stored in the relevant lexical representations[130].

The perception tableau presented in Tab. 7.24 can now be substituted by the one in Tab. 7.26. As we discuss in the next section, the grammar represented in this diachronic stage corresponds to Carrarese's.

Tab. 7.26 STAGE IIb (Carrarese): perception of articulatory driven reduced vowel (hypoarticulation); {SG.MASC} = | |; [Tab. 11.10]

[[k aˑ p ᵊ]]	*(N |X|)$_{\mu}$	EXPRESS -|X|$_{SG.MASC}$	*(N | |)$_{\mu}$	|A| [[ə Hz]]	|H| [[ə Hz]]
a) ☞ O_R ˈN_R O_R N_{SM} | |$\underline{A}$|$_R$ | | |$_{SM}$ [[k aˑ p^{ə}]]			*	*	
b) O_R ˈN_R O_R N_{SM} | |$\underline{A}$|$_R$ | | |$_{SM}$ [[k aˑ p ᵊ]]			*	*	W *!

Now that the unstressed vowel deletion is accomplished and that the extra-short schwas are reinterpreted as cues for the preceding obstruent release, the acoustic object we have referred to so far as an 'intrusive vowel' enters the picture.

[130] Recall that the processes we have just described affect all the post-tonic vowels, i.e. all of the unstressed vowels whose elements are 'morphologically coloured' by the ROOT index. This is formally assured by the joining of EXPRESS-|X|$_{SG.MASC}$ and EXPRESS-|X|$_{ROOT}$ on the same hierarchical level, and is consistent with the data presented in Sections 5.2.1 for paroxitones and 5.2.2 for proparoxitones.

7.3 Vowel intrusion

In the previous section, we reached the diachronic stage where, except for word-final vowels expressing SG.FEM, PL.MASC and PL.FEM, all unstressed vowels have been deleted. This is mainly due to the high ranking of the structural constraint *(N |X|)$_{\mu}$, which outranks EXPRESS-|X|$_{SG.MASC}$ and EXPRESS-|X|$_{ROOT}$ and is, in turn, outranked by EXPRESS-|X|$_{SG.FEM}$, EXPRESS-|X|$_{PL.MASC}$ and EXPRESS-|X|$_{PL.FEM}$. The various diachronic changes undergone by the grammar have been so far exemplified by paroxitones showing, as a consequence of apocope, a word-final single obstruent. In cases such as these, the schwa-like extra-short vocoid produced by speaker's generation as a result of the articulatory driven reduction of |A|'s acoustic correlate is reinterpreted by the learner as a cue for the preceding obstruent's |H|.

The very same acoustic object may also occur with an increased duration. This notwithstanding, the grammar of the diachronic stage under consideration does not allow the learners to interpret it as a cue for a vocalic element.

In order to see this lengthening process, forms must be considered which display a word-final branching onset, i.e. a *muta cum liquida* cluster[131]. It is the case, for instance, of proto-Romance *magro* 'thin' presented in Tab. 7.27, where the brackets surrounding the schwa-like release of *g* represent its variable nature (see the preceding section) and the superscript 'ə' occurring before *r* highlights the intrinsic schwa-like formant structure of the rhotic (Ladefoged 1996; Stevens 2000; Savu 2013).

Tab. 7.27 STAGE IIb: articulatory driven vowel insertion; {SG.MASC} = | | [Tab. 11.11]

<table>
<tr><td>O_R ˈN_R O_R O_R N
| | | | |
m |A̲| g r | |_{SM}</td><td>|X|
[[x ms]]</td><td>|A|
[[ə Hz]]</td><td>|H|
[[ə Hz]]</td><td>[[ə Hz]]
[ə]</td></tr>
<tr><td>a) O_R ˈN_R O_R O_R N_{SM}
| | | | |
☞ m |A̲| g r | |_{SM}
| | | |
[[m aː g^(ə) ^ər]]
| | | |
[m aː g^ə→ ə ←^ər]</td><td>*
(g's |H|)</td><td>*
(g's [[^ə]])</td><td></td><td></td></tr>
<tr><td>b) O_R ˈN_R O_R O_R N_{SM}
| | | | |
m |A̲| g r | |_{SM}
| | | |
[[m aː g^(ə) ^ər]]
| | | |
[m aː g ^ər]</td><td>*
(g's |H|)</td><td>*
(g's [[^ə]])</td><td></td><td>W
*!
(g's [[^ə]])</td></tr>
</table>

[131] Interestingly but not surprisingly, the same lengthening can also be observed in proparoxitones. See, for instance, the antepenultimate stressed [ˈteːnər] *tenero* 'soft', [ˈdzoːvəŋ] *giovane* 'young' and [ˈliːbər] *libero* 'free'/*libro* 'book' presented in Tab. 5.5 (see Tab. 5.12 for [ˈliːbər] *libro* 'book').

The candidates of this tableau display the same cue constraints violation profile. In both cases, *g*'s |H| is cued by an *extra-short* acoustic object ([[ᵊ]]), which, in turn, correctly cues *g*'s |H| but fail to cue |A|. As a consequence, both candidates satisfy |H| [[ə Hz]] but violate |A| [[ə Hz]] (and |X| [[x ms]]).

As shown by candidate a), however, unless an obstruent is unfaithfully realized in its unreleased form (see the [[ə Hz]] [ə] violation of candidate b)), the release's schwa-like acoustic structure may 'add' to the following liquid's. This results in a periodic structure whose duration is longer than the obstruent release's and which, because of its duration and formant structure, could be perceived as a nonetymological, i.e. epenthetic, vocalic segment:

> "Vowel insertion may take place next to an alveolar rhotic or lateral in the syllable-initial clusters [Cɾ, Cl], where the consonant preceding the liquid may be a bilabial, dental or velar stop or [f] […] This insertion process is rendered possible through the integration of a short vocal tract opening period occurring between the two consecutive consonants as an independent vowel by the listeners." (Recasens 2014: 55)

As we claimed above, however, this lengthened periodic structure is not interpreted as a vowel by STAGE IIb, i.e. Carrarese, speakers. In other words, the articulatory driven vowel-like acoustic structure appearing between the *muta* and the *liquida* perfectly fits with the 'intrusive vowel' label proposed by Hall (2006). This has already been argued for in Section 5.3.1, where it has been shown that, notwithstanding the fact that this acoustic object can occur with a duration similar to the stressed vowel's, Carrarese speakers do not consider it a cue for a vocalic segment. Formally, this is described in Tab. 7.28, where the perception of the auditory input [[maːgər]] is represented:

Tab. 7.28 STAGE IIb (Carrarese): intrusive [[ə]] perception; {SG.MASC} = | |; [Tab. 11.12]

[[m aː gᵊ ᵊr]]	*(N |X|)$_{\mu}$	EXPRESS -|X|$_{ROOT}$	*N	|X| [[x ms]]	|A| [[ə Hz]]
a) O$_R$ ˈN$_R$ O$_R$ O$_R$ N$_{SM}$ | | | | | ☞ | |A|$_R$ | | | |$_{SM}$ | | | | [[m aː g$^{(ə)}$→ ə ←ᵊr]]				*	*
b) O$_R$ ˈN$_R$ O$_R$ N O$_R$ N$_{SM}$ | | | | | | | |A|$_R$ | |A| | | |$_{SM}$ | | | | | [[m aː g$^{(ə)}$→ ə ←ᵊr]]			**W** *!	**L**	**L**

In the case that *g*'s release is integrated with *r*'s intrinsic vocalic structure and, as a consequence, a longer (than a release) schwa-like vocoid occurs in the auditory form the listener is exposed to, *N blocks the mapping of this periodic structure on |A|. If, instead, the listener mapped these two objects, it would result, as shown by candidate b), in the satisfaction of the cue constraint |A| [[ə Hz]]. However, since this constraint is crucially ranked below *N, candidate a) wins. Furthermore, the mapping of the short ([[x ms]]) schwa on |A| would determine the satisfaction of the durational cue constraint according to which an acoustic structure displaying a sufficient (i.e. *short*) duration cues a phonological element: |X| [[x ms]][132]. Once again, however, the lower ranking of this constraint with respect to *N rules out candidate b). To sum up, the structural constraint banning the integration in the phonological representation of elements lacking any morphological affiliation blocks the intrusive vowel phonologization.

It has to be noticed that the same would happen regardless of the reason behind the lengthening of the vowel-like release (see, for instance, the 'emphatic conditioning' reported by Savoia 1983). As shown by the acoustic data presented in Section 5.3.1, indeed, it can occur in its lengthened form also in consonantal contexts different from *muta cum liquida*. In paroxitones displaying a word-final cluster with a falling sonority contour, for instance, word-final schwa-like vocoids can be found whose duration is as long as the stressed vowels', or even more (see Tab. 5.1). Also in this case, the lengthened vocoid lacks any phonological correlate because of the high ranking of the structural constraint banning 'morphologically transparent' elements from phonological representation with respect to |X| [[x ms]].

As we claimed at the beginning of this section, though, the phonological context triggering the intrusion of the epenthetic vowel's forerunner is the one where an obstruent is followed by a liquid[133]. Another consonant class favouring vowel intrusion is that of nasals: from *asino* 'donkey', we have Carr. [ˈazŋ̩]/[ˈazᵊŋ]/[ˈaːzəŋ] and Pontr. [ˈazuŋ]. Interestingly, laterals and nasals are consonants that, mainly as a consequence of an adjacent vowel deletion, can acquire syllabic properties (Bell 1978). A syllabic realization of these consonants can thus be added to the set of allophones of /r l n/ in the relevant consonantal contexts. As shown by Pouplier & Beňuš (2011), their syllabicity is articulatorily conveyed by the degree of overlapping among their gestures and that of the adjacent consonant[134]: the consonants occurring in syllables projected by a consonantal segment overlap less with respect to the ones occurring in syllables projected by a vocalic segment. Also because of this (Hall 2006), these syllabic consonants frequently alternate with the realization of their non-syllabic counterpart flanked by a schwa-like vocoid:

> "[i]n word-final two-consonant clusters where C2 is prone to occupy the syllable nucleus, i.e., mostly [Cɾ] and [Cl] but also [Cn], a vowel may be appended immediately after the cluster or between its two consonants […]. Both vowel restoration strategies seek to avoid the presence of a syllabic liquid through the vocalic integration of either the consonant release, or a

---

[132] Notice that, as shown in the complete tableau of Tab. 11.12, |X| [[x ms]] is violated by *g*'s [[ᵊ]]. Indeed, the obstruent's |H| is associated with an *extra-short* acoustic object, instead of, as required by the cue constraint under concern, on a *short* (or longer) one. Since this violation is incurred by every form, the relative violation marks are not recorded in the tableaux presented in this Section to increase their readability.

[133] As for the lateral liquid, see, for instance, a form such as *zoccolo* 'clog', which gives Carr. [ˈtsɔkl̩]/[ˈtsɔkᵊl]/[ˈtsɔːkəl] (and Pontremolese [ˈsɔːkal]).

[134] Their kinematics, instead, is quite stable: the articulation of a syllabic consonant is not more 'vowel-like' than that of the correspondent consonant occurring in a vocalic syllable (Pouplier & Beňuš 2011).

short opening period occurring between the stop and the liquid as in English *idol*, *Hungary* and *lightening* where syllabic [l̩], [ɹ̩] and [n̩] may sound [əl], [əɹ] and [ən] respectively." (Recasens 2014: 59-60)

As in English, hence, in Carrarese, independently of its actual acoustic duration, the schwa-like object under concern never cues a vocalic element. As we have seen, this is due to the higher ranking of *(N |X|)$_{\mu}$ with respect to |X| [[x ms]]. By 'growing older', though, this schwa-like vocoid can start to be mapped onto a vocalic segment. This is shown in the next section.

7.4 Vowel epenthesis

Coming back to our diachronic path, we argued that Carrarese phonological grammar represents a stage diachronically preceding that of Pontremolese. The diachronic and grammatical distance between these two varieties, however, must still be covered. Indeed, if Carrarese shows an intrusive (viz. non-phonological) vowel, Pontremolese displays its phonologized counterpart (Section 5.3.2). In other words, if Carrarese speakers do not brake branching onsets by inserting a nonetymological N, Pontremolese speakers do: depending on the final consonant of the cluster, they add an N containing either |A̲| or |U̲|. A formal account must hence be given of the way the schwa-like acoustic structure under concern becomes a cue for a phonological element, which in turn, in a following stage, becomes headed.

As we discussed in the previous section, unstressed vowel deletion fosters an articulatory driven production of liquid and nasal consonants ranging from their syllabic counterparts to schwa-consonant sequences whose vocoid can be variably lengthened. The rhotic, for instance, can be realized as [r̩], [ᵊr] or [ər]. If, as assumed for the preceding changes, some sociolinguistic reason determines the diffusion of the forms displaying a longer schwa-like vocoid, a listener might be 'tempted' to hallucinate the presence of a contentful nucleus between the *muta* and the *liquida*. This way, the 'new' mapping would be consistent with the one concerning the other (stressed) vowels of the system: in both cases, a periodic acoustic structure displaying a sufficient amount of duration (i.e. at least *short*; see Tab. 7.5) cues a vocalic element. As argued by Hall (2006), indeed, who rests on Ohala (1981) and Browman & Goldstein (1990),

> "[t]he 'segmentalisation' […] of intrusive vowels is likely a case of listener-initiated sound change […]. If intrusive vowels become acoustically too similar to segmental vowels, speakers may reanalyze them as segments." (Hall 2006: 36)

This perception driven effect can be obtained by the raising of durational cue constraint |X| [[x ms]] above, crucially, structural constraint *N[135]. This is shown in

[135] A different possibility would be to posit the raising of cue constraint |A| [[ə Hz]] instead of the durational one. As far as we can see, the resulting mapping would be the same.

Tab. 7.29, where the perception is formalized of an acoustic input displaying a *short* schwa:

Tab. 7.29 STAGE III: perception driven intrusive-to-epenthetic [ə]; [Tab. 11.13]

[[m a: gᵊ ᵊr]]	EXPRESS -$\|X\|_{ROOT}$	|X| [[x ms]]	*N	|A| [[ə Hz]]
a) O_R ˈN_R O_R N O_R N_{SM} | | | | | | ☞ | $\|\underline{A}\|_R$ | |A| | | $\|_{SM}$ | | | | | [[m a: $g^{(ə)}$→ ə ←ᵊr]]			*	
b) O_R ˈN_R O_R O_R N_{SM} | | | | | | $\|\underline{A}\|_R$ | | | $\|_{SM}$ | | | | [[m a: $g^{(ə)}$→ ə ←ᵊr]]		W *!	L	W *

If the durational cue constraint were still ranked in the same level of |A| [[ə Hz]], the structural constraint banning morphologically transparent N's (i.e. banning epenthesis) would force, as in Carrarese, the mapping represented in candidate b): no N would break the branching onset. If instead, as in the case at hand, |X| [[x ms]] outranks *N, the listener reconstructs a phonological representation such as the one of the winning candidate a), where a nonetymological N has been inserted. Notice that the insertion of a phonological structure lacking any morphological affiliation does not result in a violation of the high-ranked EXPRESS -$|X|_{ROOT}$: as indicated by the subscript, this constraint evaluates only structures belonging to the root. Furthermore, notice that by satisfying the mapping defined by the durational cue constraint, the winning candidate behaves better with respect to the lower-ranked constraint |A| [[ə Hz]] as well.

Once the learner has built this 'new' grammar, the realization of the non-etymological vowel can be synchronically accounted for by a regular (viz. phonological) process of epenthesis that inserts the (typologically) less marked vowel in the relevant consonantal contexts, i.e. in the case that the word-final cluster displays a rising sonority contour[136].

To ascertain which of the two possibility better fits the picture, a variety should be analysed in which the schwa-like vocoid cues a phonological element, i.e. a dialect showing regular (viz. phonological) schwa epenthesis. In this case, a perception test could be performed where the schwa-like vocoid is manipulated both from a formantic and a durational point of view. Interestingly, varieties showing an epenthetic schwa seem to be still available in Lunigiana, as suggested by the dialectological literature of the past century (Giannarelli 1913). Waiting for further analyses, we opt here for |X| [[x ms]] movement because of the fact that schwa is lacking from the phonological inventory of Carrarese (Section 2.3). As a consequence, Carrarese speakers' knowledge of the |A| [[ə Hz]] mapping could be not so robust, the relative cue constraint being therefore low-ranked.

[136] It should be highlighted that, as far as the morphological 'colour' is concerned, the epenthetic segment is argued to be 'transparent'. Indeed, lexicon-wise, this segment belongs neither to an affix, nor to the root. By 'aging', though, the epenthetic segment can be lexicalized (as in Emilian dialects; Passino 2013).

Now that we have reached the diachronic stage at which a change in the perception grammar determines the phonologization of the vowel insertion process (viz. epenthesis), the phonetic interpretation of this nuclear position can be argued to show the variation characterizing phonetics. As a consequence, the |A|'s phonetic counterpart can be influenced by the articulatory characteristics of the adjacent consonants. In the case at hand, this coarticulatory effect is triggered by liquid and nasal consonants.

As for the liquids, their articulatory mechanics has been shown to trigger the lowering of the preceding schwa. This results in the insertion of a vocoid showing the formant properties of /a/:

> "Anticipatory tongue dorsum lowering and backing for [r] accounts for [a] insertion […], as exemplified by Port. *arreceber* RECIPERE […], Aromanian *arîu* RIVU. […] Low vowel insertion may also operate […] before [l], which may be articulated with more or less tongue dorsum lowering independently of darkness degree, e.g., Port. *alembrar* MEMORARE […], Emilian-Romagnol [alˈdaːm] LAETAMEN […]. Interestingly enough, [a] insertion takes place essentially before the preconsonantal liquids [r] and [l] in Romansh." (Recasens 2014: 52-53)[137]

As for the nasal, which in Carrarese and Pontremolese is always velar (Sections 2.2.1 and 2.3.1), its articulatory properties can favour instead the backing and rounding of the preceding schwa:

> "Velars appear to be actively involved in the assimilatory process [e, a, ə] > [o, u] which is in line with the tongue postdorsum being raised toward the velar zone during their production." (Recasens 2014: 84)

This is what arguably happened in the change leading from STAGE III to Pontremolese. The phonetic details of Pontremolese epenthetic vowel colouring were given in Section 5.3.2, where it has been shown that the epenthetic vowel occurring before liquids displays the same acoustic properties of the (unstressed) /a/ feminine morpheme[138]. Indeed, the epenthetic tokens analysed in Section 6.2.3.2 cluster together with /a/ tokens, and are significantly different from the schwa-like releases optionally occurring in word-final position (Fig. 6.8). The epenthetic vowel occurring before a word-final nasal, instead, displays the acoustic properties of a back rounded vowel, as shown by the overlapping of the two vowels' token clouds in Fig. 6.7.

From a formal point of view, this coarticulatory process can be described as determined by a constraint favouring coarticulation, i.e. by a constraint favouring the

[137] See also Sampson (2010: 164-165) for other Romance outcomes.

[138] As shown in Section 5.3.2, both the SG.FEM morpheme and the a-like epenthetic vowel are phonetically interpreted as [ɐ]. Stressed *a*'s, instead, are slightly lower: [a]. This difference can be considered an instance of undershoot, unstressed N's being shorter than stressed ones. In order to highlight the phonological equivalence between stressed and unstressed N's elemental content, in these tableaux, the epenthetic vowel is transcribed as [a].

keeping of a stable articulatory configuration: CO-ART. This is shown in Tab. 7.30, where the production is represented of *magr* 'thin':

Tab. 7.30 STAGE IV: epenthetic vowel [a/u]-colouring (coarticulation) [Tab. 11.14]

O_R ˈN_R O_R O_R N_{SM} | | | | | m |A̲|$_R$ g r | |$_{SM}$	CO-ART	|A| [[ə Hz]]	[[ə Hz]] [ə]
a) ☞ O_R ˈN_R O_R N O_R N_{SM} | | | | | | | |A̲|$_R$ | |A| | | |$_{SM}$ | | | | | [[m aː g ə ᵊr]] | | | | | [m aː g a ← r]			*
b) O_R ˈN_R O_R N O_R N_{SM} | | | | | | | |A̲|$_R$ | |A| | | |$_{SM}$ | | | | | [[m aː g ə ᵊr]] | | | | | [m aː g ə r]	**W** *!		**L**

Unless the speaker resists the intrinsic coarticulatory effect of liquid and nasal consonants on a preceding vowel (Recasens 2014), thus violating the high-ranked CO-ART, she is assumed to produce a form such as the one represented by the winning candidate, a). As can be noticed, both forms display a faithful mapping of |A| on the correspondent acoustic target, as required by the |A| [[ə Hz]] cue constraint. They differ, though, in the articulatory implementation of this acoustic target: while candidate b) is faithful to the acoustic-articulatory mapping defined by [[ə Hz]] [ə], the winning candidate violates this sensorimotor constraint by anticipating the rhotic-related tongue dorsum lowering and backing during the production of the preceding schwa. The acoustic correlate of this coarticulatory effect is a vowel showing, as expected, an a-like formant structure.

Now, assuming that, as in the preceding stages, this coarticulatory effect spreads within the speech community because of some sociolinguistic reason, and that, as a consequence, the epenthetic vowel consistently surfaces either as a low or a high back vowel, the listener may hallucinate its formant structure as being phonologically determined. In other words, she may think that the acoustic properties of the epenthetic vowel are a consequence of its phonological structure, and not just a low-level, articulatory driven acoustic side effect: as in the preceding diachronic stages undershoot was reinterpreted as hypoarticulation, so here coarticulation is reinterpreted as assimilation. This is represented in Tab. 7.31, where the perception grammar is given for the winning candidate of Tab. 7.30: [[maːgar]].

Tab. 7.31 STAGE IVa (Pontremolese): [a]-coloured epenthetic vowel perception (assimilation); [Tab. 11.15]

<table>
<tr><th>[[m aː g a r]]</th><th>*N</th><th>|A|
[[ə Hz]]</th><th>|A̲|
[[a Hz]]</th></tr>
<tr><td>a) O_R ˈN_R O_R N O_R N_{SM}
| | | | | |
☞ | |A̲|$_R$ | |A̲| ←|A|$_R$ | |$_{SM}$
| | | | |
[[m aː g a r]]</td><td>*</td><td></td><td></td></tr>
<tr><td>b) O_R ˈN_R O_R N O_R N_{SM}
| | | | | |
| |A̲|$_R$ | |A| |A|$_R$ | |$_{SM}$
| | | | |
[[m aː g a r]]</td><td>*</td><td>**W**
*!</td><td>**W**
*</td></tr>
</table>

As shown by this tableau, once the epenthetic vowels the listener is exposed to consistently display an a-like acoustic structure, the low-ranked cue constraints lead her to reconstruct a phonological representation that optimally fits the acoustic forms she hears. Indeed, while candidate b) violates |A| [[ə Hz]] (|A| is unfaithfully cued by [[a]]) and |A̲| [[a Hz]] ([[a]] is unfaithfully mapped on |A|), the winning candidate satisfies both of the constraints[139].

The relevance of the cue constraints for the phonologization of the articulatory driven colouring of epenthetic vowels can be observed in proparoxitones as well. Consider, for instance, the two forms represented in Tab. 7.32: *tenero* [teːnar] 'tender' and *asino* [aːsuŋ] 'donkey'.

Tab. 7.32 STAGE IVa (Pontremolese): [a/u]-coloured epenthetic vowel perception (assimilation) [Tab. 11.16]

<table>
<tr><th>[[t eː n a r]]</th><th>*N</th><th>|U̲|
[[u Hz]]</th><th>|A̲|
[[a Hz]]</th></tr>
<tr><td>a) O_R ˈN_R O_R N O_R N_{SM}
| | | | | |
☞ | |AI̲|$_R$ | |A̲| ←|A|$_R$ | |$_{SM}$
| | | | |
[[t eː n a r]]</td><td>*</td><td></td><td></td></tr>
<tr><td>b) O_R ˈN_R O_R N O_R N_{SM}
| | | | | |
| |AI̲|$_R$ | |A| |A|$_R$ | |$_{SM}$
| | | | |
[[t eː n a r]]</td><td>*</td><td></td><td>**W**
*!</td></tr>
</table>

139 This change sounds similar to the Selective Lexicon Optimization mechanism (Van Oostendorp 2005), where the object undergoing optimization is not the representation of a lexical item, but that of an epenthetic vowel. Indeed, assuming an intermediate stage in which [[a]] alternates with [[ə]] (possibly because the coarticulatory effect still has to be generalized within the speech community) SLO could help the learner to reconstruct the phonological representation that shows the best violation profile.

[[aː s u ŋ]]	*N	|U̲| [[u Hz]]	|A̲| [[a Hz]]
c) ☞ ˈN_R O_R N O_R N_{SM} |A̲|$_R$ | |U̲| ←|UL|$_R$ | |$_{SM}$ [[aː s u ŋ]]	*		
d) ˈN_R O_R N O_R N_{SM} |A̲|$_R$ | |U| |UL|$_R$ | |$_{SM}$ [[aː s u ŋ]]	*	**W** *!	

As discussed in Sections 3.2.2 and 5.2.2, word-medial unstressed vowels have been completely deleted. From a formal point of view, this is accounted for by the lower ranking of EXPRESS -|X|$_{ROOT}$ with respect to *(N |X̲Y|)$_\mu$, *(N |X̲|)$_\mu$ and *(N |X|)$_\mu$ (Section 7.2). As a consequence, a form such as *selvatico* 'wild' gives Pontremolese [sarˈvadg(ə)], namely a form in which the post-tonic vowels have both been deleted, a schwa-like release optionally occurring in word-final position (Section 5.2.2.2). However, in the case that the second segment of the 'new' consonant cluster is either a liquid or a nasal, the intrusive-to-epenthetic vowel change applied. The effect of this change can be observed in the form just quoted, [sarˈvadg(ə)], which displays a pre-tonic a-like epenthetic vowel, and by the two forms presented in Tab. 7.32. These forms show, once again, the relevance of the cue constraints: as in the first form, [[teːnar]], candidate b) is ruled out by the violation of |A̲| [[a Hz]], so in the second form, [[aːsuŋ]], candidate d) is ruled out by the violation of |U̲| [[u Hz]]. To sum up, the winning candidates are, in both cases, the ones that satisfy the relevant cue constraints.

Now, since the quality of the epenthetic vowel is predictable on the basis of the following consonant ([a] before liquids and [u] before the velar nasal), it does not have to be stored in the lexicon. As a consequence, given that, as we have just seen, the speaker's coarticulation is reinterpreted as assimilation, the learner may posit a phonological process that inserts a nonetymological N, whose melodic content is then spread from the following consonant. This is graphically represented by the leftward arrow of candidates a) and d) of Tab. 7.32, which formalizes the spreading of |A| from the following liquid and of |U| from the following velar nasal.

As for these consonants' elemental representation, the liquids are argued to be represented as |A| (/r/) and |AU| (/l/). As for *r* = |A|, see, for instance, German *vier* [fiːɐ] 'four', *Pferd* [pfeːɐt], where *r* is reinterpreted as [ɐ] (Backley 2011: 172). As for *l* = |A̲U|, see Pontremolese [kau̯d] 'hot' (It. *caldo*), where |A̲U| is reduced to |U̲|, and [kurp] 'strike' (It. *colpo*), where it is instead reduced to [A][140]. Nasals, instead,

[140] As can be noticed, in Pontremolese, the two liquids are both reduced in coda position, but they differ as far as the 'surviving' element is concerned. Interestingly, this difference in neutralization depends on the following consonant: if alveolar (or palatal), the lateral is reduced to [u̯]; if labial or velar, to [r] (see also Section 2.2.1). This difference could be due to a kind of Obligatory Contour Principle (Odden 1986) applying in a coda-onset domain: the coda segment cannot contain the same element occurring in the following onset. For instance, OCP would exclude forms such as *[kuu̯p] and *[kard] because of the co-occurrence of two instances of |U| in the first case and two |A| in the second. Indeed, velars and labials are argued to contain |U|, and coronals |A| (Backley 2011; as for the palatal, Backley 2011 relates

are represented by |L|, an element which is "cued by an acoustic pattern called murmur" (Backley 2011) and which, from an articulatory point of view, can be produced by lowering the velum. Nasals' place, then, can be specified by the vocalic elements |A|, |I| and |U| (see Backley 2011 for the language-specificity of their interpretation). In our case, the nasal triggering the intrusive-to-epenthetic vowel change is velar, and is thus represented as |LU|, where |U| is associated with the "predominance of low-frequency energy" (Backley 2011) characterizing the jakobsonian [grave] segments: back vowels, and labial and velar consonants.

It has to be pointed out that, as the careful reader will have already noticed, the element that is spread from the consonantal node of candidate a) is unheaded, while in its nuclear position it occurs headed. While cue constraints have been shown to be extremely relevant for the perception process (and for the diachronic change just discussed), a device must be worked out which allows the speaker to produce the right candidate, i.e. the candidate showing a headed element.

This could be accounted for by a general well-formedness constraint banning unheaded (single) elements, *|X|, which, if top-ranked, would ban every unheaded element from representations[141]. A consequence of this high ranking is that the language displaying this hierarchy bans unheaded elements from representations. This is the case of Pontremolese, where, for instance, schwa is absent from the vocalic inventory (Maffei Bellucci 1977): when the articulatory dynamics favours the production of a schwa-like vocoid, it is never associated with the correspondent (unheaded) element: |A|. The functioning of *|X| is represented in Tab. 7.33, where it conflicts with a (cover) constraint favouring a leftward spreading of elements, i.e. | |←|X|.

it to |I|. As a consequence, a deeper analysis of Pontremolese laterals could require a change in the formulation of the proposed OCP constraint, or the abandonment thereof). It is interesting to notice that the behaviour of Pontremolese laterals can be resorted to as evidence for the onset status of word-final consonants. Consider, for instance, a form such as [myl] 'mule' (It. *mulo*), where the word-final lateral, i.e. the onset of a syllable projected by an empty N, is not reduced (obviously, since it is not followed by any consonant, OCP would not apply).

[141] As Backley (2012: 65) puts it, "[i]n expressions containing just one element, this element is usually taken to be headed by default […]. This is a reasonable assumption because, if an element has only one marked property, then that property is presumably its most salient characteristic". However, under the approach we are pursuing, this 'assumption' is formalized as a constraint, and is hence violable. This allows us to argue for the intermediate stage occurring between Carrarese and Pontremolese (STAGE III, Tab. 7.29), where *|X| would be violated, and henceforth ranked lower than in the Pontremolese grammar.

Tab. 7.33 STAGE V (Pontremolese): headed element epenthesis

<table>
<tr><th>O_R $'N_R$ O_R O_R N_{SM}
| | | | |
m $|\underline{A}|_R$ g $|A|_R$ $|\ |_{SM}$</th><th>SSG</th><th>*|X|</th><th>| |←|X|</th><th>*N</th></tr>
<tr><td>a) O_R $'N_R$ O_R N O_R N_{SM}
| | | | | |
☞ | $|\underline{A}|_R$ | $|\underline{A}|$ ←$|A|_R$ $|\ |_{SM}$
| | | | |
[[m aː g$^{(ə)}$ a ᵊr]]
| | | | | |
[m aː g a r]</td><td></td><td></td><td>*</td><td>*</td></tr>
<tr><td>b) O_R $'N_R$ O_R N O_R N_{SM}
| | | | | |
| $|\underline{A}|_R$ | $|A|$ ←$|A|_R$ $|\ |_{SM}$
| | | | |
[[m aː g$^{(ə)}$ ə ᵊr]]
| | | | | |
[m aː g ə r]</td><td></td><td>**W**
!</td><td></td><td>*</td></tr>
<tr><td>c) O_R $'N_R$ O_R O_R N_{SM}
| | | | |
| $|\underline{A}|_R$ | $|A|_R$ $|\ |_{SM}$
| | | |
[[m aː g$^{(ə)}$ ᵊr]]
| | | | |
[m aː g$^{(ə)}$ ᵊr]</td><td>**W**
*!</td><td></td><td>**L**</td><td>**L**</td></tr>
</table>

As can be noticed, another constraint has been introduced which rules out a candidate in which epenthesis does not apply and, as a consequence, displays a word-final consonant cluster with a rising sonority contour. This could be formalized by a constraint that refers to the Sonority Sequencing Generalization (Sievers 1881; Jespersen 1904; Blevins 1995: 210):

Tab. 7.34 Sonority Sequencing Generalization

SSG: between any member of a syllable and the syllable peak, a sonority rise or plateau must occur.

In Tab. 7.33, candidate c) behaves better with respect to the other candidates relative to *N, | |←|X| and, with respect to candidate b), also *|X|. Indeed, candidate c) does not insert a nonetymological N, does not spread its element (since there's no empty N for it to land in) and shows no morphologically transparent element. This notwithstanding, candidate c) is ruled out by SSG. As for the other two candidates, they both violate *N by inserting an extra N, but in reward, they satisfy the top ranked SSG. However, they differ with respect to *|X|: while both candidates satisfy | |←|X| by spreading the place element (|A|) from *r* to the preceding N, candidate b) violates the higher-ranked *|X|. This constraint, instead, is satisfied by candidate a), which then surfaces as the winner.

Before concluding this section, it has to be pointed out that SSG can be dispensed with if we decide to take into consideration instead the word-final empty N's (i.e. FEN; Section 6.3.1.1.2) licensing strength (Cyran 2005, 2008).

As we hinted at in Sections 6.3.1.1.2 and 7.1, the gradual reduction of unstressed vowels correlates with a decrease in licensing strength of word-final N's. In proto-

Romance, the word-final N is melodically full and is thus able, for instance, to dispense licensing (Lic; *capo* ‘head’), direct government licensing (DGLic; *colpo* ‘strike’) and indirect government licensing (IGLic; *magro* ‘thin’) to the preceding O. Furthermore, proto-Romance word-final N is assumed to be also able to properly govern a preceding empty N. However, since no empty N is argued to occur before the word-final N (syncope does not apply in proto-Romance; Section 3.1), the PGvt effect cannot be noticed.

By ‘aging’, then, word-final N loses its melodic content but, crucially, keeps its government properties. In Carrarese, for instance, *capØ* ‘head’, *colpØ* ‘strike’, *magrØ* ‘thin’ and *səlvatØcØ* ‘wild’ are grammatical forms. These forms, thus, violate the whole government constraints set: *LIC, *DGLIC, *IGLIC and *PGVT (Section 6.3.1.1.2, Tab. 6.15). As a consequence, these constraints are argued to sit on the bottom of the hierarchy defining Carrarese grammar.

However, by ‘getting older’, FEN is argued to gradually lose its government properties. In Pontremolese, for instance, forms such as *capØ* ‘head’, *curpØ* ‘strike’ and *salvadØgØ* ‘wild’ are still grammatical. A form such as **magrØ* ‘thin’, instead, is ungrammatical and is repaired by spreading |A| from the following *liquida*: Pontr. *magar* ‘thin’. In terms of constraints, this means that Pontremolese forms still violate *LIC, *DGLIC and *PGVT, but satisfy *IGLIC. This pattern suggests that, while *LIC, *DGLIC and *PGVT are still on the bottom of the hierarchy, *IGLIC has been raised up.

Crucially, *IGLIC is argued to be raised above *N and | |←|X|, i.e. above the constraint banning a morphologically transparent N from phonological representations and the one favouring element spreading. This is shown in Tab. 7.35:

Tab. 7.35 STAGE V bis (Pontremolese): *N vs. *IGLIC

O_R ˙N_R O_R O_R N_{SM} | | | | | m |A̲|$_R$ g |A|$_R$ | |$_{SM}$	*IGLIC	*|X|	| |←|X|	*N
a) ☞ O_R ˙N_R O_R N O_R N_{SM} | | | | | | | |A̲|$_R$ | |A̲| ←|A|$_R$ | |$_{SM}$ | | | | | [[m aː g$^{(ə)}$ a ᵊr]] | | | | | | [m aː g a r]			*	*
b) O_R ˙N_R O_R N O_R N_{SM} | | | | | | | |A̲|$_R$ | |A| ←|A|$_R$ | |$_{SM}$ | | | | | [[m aː g$^{(ə)}$ ə ᵊr]] | | | | | | [m aː g ə r]		W *!	*	*
c) O_R ˙N_R O_R O_R N_{SM} | | | | | | |A̲|$_R$ | |A|$_R$ | |$_{SM}$ | | | | [[m aː g$^{(ə)}$ ᵊr]] | | | | | [m aː g$^{(ə)}$ ᵊr]	W *!		L	L

As can be noticed, the candidate displaying a word-final complex O (candidate c)) is ruled out by *IGLIC: Pontremolese FEN is no more able to dispense government licensing to the preceding O.

In Carrarese, on the other hand, in order for word-final complex onsets to be grammatical, *IGLIC has to be ranked lower than *N:

Tab. 7.36 STAGE IIb (Carrarese; see Tab. 7.28): *N vs. *IGLIC

<table>
<tr><th>O$_R$ ˈN$_R$ O$_R$ O$_R$ N$_{SM}$
| | | | |
m |A̲|$_R$ g |A|$_R$ | |$_{SM}$</th><th>*|X|</th><th>| |←|X|</th><th>*N</th><th>*IGLIC</th></tr>
<tr><td>a) O$_R$ ˈN$_R$ O$_R$ O$_R$ N$_{SM}$
| | | | |
| |A̲|$_R$ | |A|$_R$ | |$_{SM}$
☞ | | | |
[[m a: g$^{(ə)}$ ^{ə}r]]
| | | | |
[m a: g$^{(ə)}$ ^{ə}r]</td><td></td><td></td><td></td><td>*</td></tr>
<tr><td>b) O$_R$ ˈN$_R$ O$_R$ N O$_R$ N$_{SM}$
| | | | | |
| |A̲|$_R$ | |A̲| ←|A|$_R$ | |$_{SM}$
| | | | |
[[m a: g$^{(ə)}$ a ^{ə}r]]
| | | | | |
[m a: g a r]</td><td></td><td>W
*!</td><td>W
*</td><td></td></tr>
<tr><td>c) O$_R$ ˈN$_R$ O$_R$ N O$_R$ N$_{SM}$
| | | | | |
| |A̲|$_R$ | |A| ←|A|$_R$ | |$_{SM}$
| | | | |
[[m a: g$^{(ə)}$ ə ^{ə}r]]
| | | | | |
[m a: g ə r]</td><td>W
!</td><td></td><td>*</td><td></td></tr>
</table>

As for the other government constraints, since they are argued to be ordered in a universal hierarchy that is inversely proportional to the complexity of the structure they ban (Section 6.3.1.1.2), they are assumed to be lower than *IGLIC. Crucially, this means that, in the cases at hand, they are lower than *N and *(N |X|)$_\mu$ as well. Indeed, Cd-O sequences are not repaired by epenthesis (because of *N >> *DGLIC) in either dialect: Carr. *colpØ* and Pontr. *curpØ*. Similarly, word-medial empty N's are not phonetically interpreted (because of *(N |X|)$_\mu$ >> *PGVT): Carr. *səlvatØcØ* and Pontr. *sarvadØgØ*. Finally, word-final consonants are well formed (because of (*(N |X|)$_\mu$ >> *LIC), as shown by forms such as Carr. and Pontr. *capØ*.

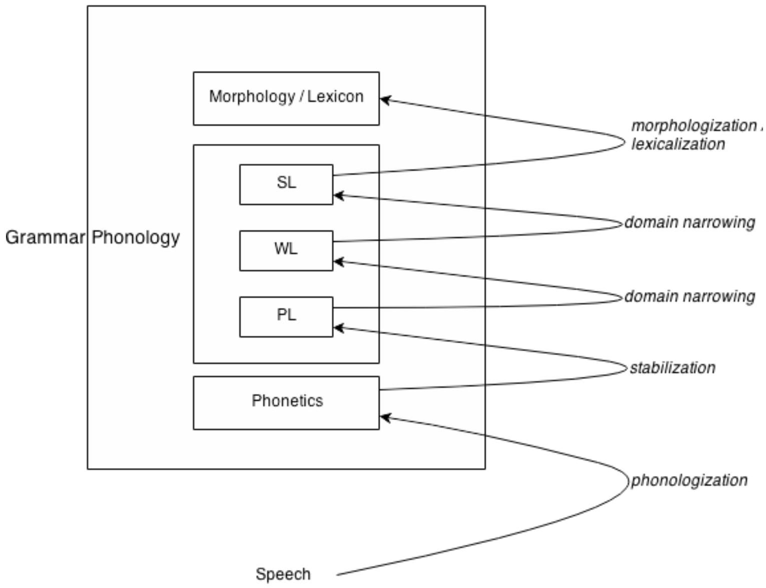
8 Conclusions

In order to better explain the inter-linguistic similarities that cannot be accounted for by referring to the schleicherian tree model, Schuchardt (1868-1870) and Schmidt (1872) developed the wave model (*Wellentheorie*). According to this model, the presence, within a set of languages, of a given linguistic feature can be understood as due to these languages' geographical adjacency. Indeed, changes are argued to apply in (the grammar of) a language and then spread towards the peripheral area of the linguistic *continuum* of which the innovating language represents the centre. Interestingly, the wave model predicts a relationship between diachronic and diatopic variation: the further from the centre, the later the language is affected by the relevant change. Furthermore, this difference in timing also correlates with a difference in the 'degree of completion' of a given change in the languages constituting such a *continuum*. Indeed, the later a language is reached by the change, the milder the outcome of such a process: while in the centre a given process synchronically displays a systematic and categorical behaviour, the more we get close to the periphery, the less systematically and categorically it applies (Section 1.1).

Interestingly, this (epiphenomenal) difference in 'systematicity', coupled with diatopic and diachronic considerations, can be resorted to to shed some light on the way the human mind analyses/organizes sound patterns. More precisely, by analysing what Bermúdez-Otero (2012, in press) defines as the "life cycle of a phonological process", we can find arguments supporting the hypothesis according to which grammar constitutes an autonomous cognitive module (Fodor 1983; Scheer 2014), whose architecture, in turn, can be decomposed in a set of different but interacting sub-modules (Bermúdez-Otero 2012, in press; Scheer 2014; Section 6.3).

By 'growing older', a process that is "at first exhaustively determined by extragrammatical factors (physics and physiology) becomes ever more deeply embedded in the grammar of a language" (Bermúdez-Otero in press). This process of 'becoming more deeply embedded in the grammar' can be graphically represented as the ascence of a sound pattern within the architecture presented in Section 1.1, reported here in Fig. 8.1: by entering this module, a change is argued to undergo various degrees of grammaticalization (Hyman 2013), until it eventually reaches the morphologization/lexicalization stage, i.e. a stage in which it is no more productive, its effects being stored as (phonological) lexical properites (Bermúdez-Otero in press).

Fig. 8.1 The life cycle of phonological processes (Bermúdez-Otero & Trousdale 2012: 700)



By analyzing the geographical distribution of a phonetic/phonological pattern, we can thus test which grammatical level this pattern has reached in a given linguistic community and, crucially, how it is represented in the speakers' mind. In other words, we can deepen our understanding of how a physical world object, i.e. a sound, enters a speaker's symbolic system of knowledge. This way, we can also improve our understanding of phonologization and, interestingly, get some more insight into the phonetics-phonology interface. Furthermore, by analysing the geographical micro-variation of a phonological process, we can improve the definition of a linguistic *continuum*'s internal borders (thereby improving dialects' classification) as well as of the timing of this change's spread within such a *continuum*.

In this dissertation, we contribute to the understanding of the issues just hinted at by analysing the distribution and the phonetic/phonological properties of unstressed vowel reduction (syncope and apocope) and non-etymological vowel insertion (intrusion and epenthesis) in two dialects spoken at the Italian southern edge of the Western Romance-speaking world: Carrarese (Section 2.3) and Pontremolese (Section 2.2).

In particular, we provide arguments supporting the hypothesis according to which Carrarese and Pontremolese currently represent two frozen stages of these processes' diffusion within the Western Romance linguistic *continuum* (Chapters 5 and 7).

The unstressed vowel reduction processes, for instance, are argued to start from France, where they are carried through to completion by 6^{th}-7^{th} century, and, from there, to radiate towards the surrounding Romance-speaking regions, where they reach the various peripheral varieties with a timing that is proportional to these varieties' distance from the centre. Similar diachronic and diatopic variation is argued to characterize the distribution of anaetymological vowel insertion as well (Chapters 3 and 7). Crucially, Lunigiana (Section 2.1), i.e. the region where Carrarese and Pontremolese are spoken, is argued to display a detailed picture of such a 'peripheral delay', Carrarese currently representing the diachronic stage Pontremolese has already gone through.

While the two dialects behave similarly with respect to apocope and syncope (Sections 5.2 and 7.2), the diachronical relationship between Carrarese and Pontremolese is supported by the non-etymological vowel insertion process. As maintained throughout the whole dissertation, indeed, this process first broke the tautosyllabic consonant clusters of the dialect that earlier and completely underwent unstressed vowel reduction, i.e. of Pontremolese. Then, by 'growing older', the phonetic content of this vocoid has been gradually enhanced (i.e. lengthened and *a*/*u*-coloured) and, eventually, considered a cue of a phonological segment belonging to the Pontremolese vowel inventory. In other words, the intrusive vocoid has been phonologized, thereby entering the Pontremolese grammar (Section 7.4). On the other hand, the vocoid occurring in Carrarese, i.e. in the more peripheral variety, currently displays the phonetic characteristics that the Pontremolese one is argued to have shown before phonologization, and should be rather considered a phonetic by-product that can be optionally enhanced (i.e. lengthened), but never cues an underlying vocalic segment (Section 7.3).

In order to substantiate this hypothesis, we collected the relevant data (Section 4) and analysed the acoustic and statistical properties of the two dialects' non-etymological vocoids in various phonological contexts (Chapter 5). This analysis shows that Carrarese and Pontremolese vocoids differ in term of acoustic and distributional properties: while the Pontremolese vocoid displays acoustic characteristics that correspond to the ones of *a* and *u*, i.e. to those of vowels belonging to Pontremolese vowel inventory (Sections 2.2.2 and 5.3.2), the Carrarese vocoid displays the acoustic characteristics of a schwa, i.e. of a vocoid that does not belong to the Carrarese vowel inventory (Sections 2.3.2 and 5.3.1). Furthermore, while Pontremolese speakers systematically produce it whenever syncope and apocope generate consonant clusters displaying a rising sonority contour (Section 5.3.2), Carrarese speakers show a greater 'tolerance' with respect to these (typologically marked) consonant clusters: the schwa-like vocoid of Carrarese, indeed, lacks the systematicity and categoricity properties of the Pontremolese one (Section 5.3.1). In other words, while Pontremolese non-etymological vocoids display the phonetic and phonological caracteristics of epenthetic vowels (Hall 2006; Section 1.2), the Carrarese one should be rather considered an articulatory/perceptually driven vowel-like release (of the preceding stop) which can be optionally and gradually enhanced because of phonosyntactic, speech rate and 'emphatic' conditionings, and which, crucially, falls outside of Carrarese speakers' phonological competence.

This is argued for in Chapter 7, where the phonological analysis we propose shows that, once apocope and syncope reduced the melodic content of unstressed vowels, the (articulatory driven) vocoids that can appear within sonority-wise ill-formed consonant clusters are rather interpreted (by, for instance, Carrarese speakers) as the acoustic correlate of the preceding stops' release. More precisely, the schwa-like acoustic structure occurring 'under' the prosodic node once projected by a(n unstressed) vowel, i.e. N, is rather considered a cue of |H|, i.e. of the element representing stops' release. This is forced by the crucial rising, within an OT (BiPhon-)grammar (Section 6.1), of the anti-epenthesis structural constraint *N (Section 6.2.3) above the cue constraint (Section 6.2.2) mapping a schwa-like acoustic structure on the vocalic element |A|, namely above |A| [[ə Hz]]. In other words, the structural constraint banning the integration in the phonological representation of elements lacking any morphological affiliation (viz. those of the epenthetic vowel) blocks the phonologization of intrusive vocoids, which are hence mapped onto preceding stops' |H| (thereby satisfying the cue constraint |H| [[ə Hz]]; Section 7.2).

Once (the constraint ranking defining) the grammar reached this diachronic stage, the schwa-like vocoid is assumed to display the variation (formally defined by the interaction of sensorimotor and articulatory constraints; Section 6.2.1) characterizing every other speech element. Now, in the case that, for sociolinguistic reasons (Labov 2001; Scheer to appear), the language learners of a given speech community are increasingly exposed to intrusive vocoids showing an acoustic structure more and more similar to that of the other (phonologically represented) vowels (i.e. they are lengthened and coarticulatorily *a*/*u*-coloured), they can interpret these vocoids as cues for vocalic elements and, therefore, for nuclear positions. From a formal point of view, this perception driven effect can be obtained by the raising of the durational cue constraint |X| [[x ms]], crucially, above the structural constraint *N (Section 7.4). Once this constraint has been raised up, the lower ranked cue constraints |A̲| [[a Hz]] and |U̲| [[u Hz]] account for the melodic content of the epenthetic vowels (*a* and *u*), which, therefore, is considered by the speaker to be due to an assimilation process that spreads the relevant element from the following consonats (see the constraint | |←|X| of Tab. 7.33). Crucially, the set of consonants triggering this process comprises the liquids and the velar nasal, namely the consonants that can occur as the second member of a word-final consonantal cluster displaying a rising sonority contour (and that, from an acoustic point of view, display an intrinsic formant structure that can foster the intrusive vocoid perception/production; Recasens 2014; Sections 7.3 and 7.4). We suggest, therefore, that the Pontremolese epenthesis is synchronically triggered to 'repair' such a cluster. This can be accounted for by the high ranking of a constraint banning Sonority Sequence Generalization-violating (word-final) clusters: SSG (Tab. 7.34).

Alternatively, this process can be related to the licensing strength of the word-final nuclear position. Indeed, as we show in the last part of Section 7.4, the crucial raising of the constraint banning word-final complex onsets (i.e. banning indirect government licensing: *IGLIC), above *N and | |←|X|, i.e. above the constraint banning a morphologically transparent N and the one favouring element spreading, results in a grammar that is able to account for Pontremolese epenthesis. In Carrarese, instead, this constraint is argued to sit, together with the other

Government Phonology-inspired constraints (i.e. *LIC, *DGLIC, and *PGVT; Section 6.3.1.1.2) below *N and | |←|X|. This way, epenthesis is blocked.

Crucially, this alternative analysis rests on the hypothesis according to which the unstressed vowel reduction gradually removes the elemental content of prosodically weak nuclei, while the corresponding prosodic nodes (N's) keep on being represented in the relevant phonological forms. This amounts to saying that we argue for the presence, within a phonological representation, of (melodically) empty nuclei which, in turn, are assumed to enter a governing relationship with the adjacent prosodic nodes. In other words, we assume a GP representational approach (whose lateral forces have been translated into OT-like constraints; Section 6.3.1.1.2).

Under this approach, (melodically contentful) nuclei are argued to display the full set of lateral forces. Indeed, they can properly govern a preceding empty nucleus (proper government: PGvt) and dispense licensing (Lic), direct government licensing (DGLic) and indirect government licensing (IGLic)[142].

In the case that word-final nuclei undergo the reduction characterizing unstressed vowels and are thus 'deprived' of their (etymological) melodic content, though, their governing strength is here argued to be increasingly 'threatened': the longer they have been 'deprived' of their melodic content, the less (laterally) strong they are.

This is the case, for instance, of Pontremolese, which, as argued throughout the whole dissertation, underwent unstressed vowel reduction before Carrarese. As a consequence, its final empty nucleus (FEN) has been melody-less longer than Carrarese's: it 'grew older', therefore losing part of its licensing strength. Indeed, as shown in Section 7.4, Pontremolese FEN is able to dispense just Lic (*capØ* 'head'), DGLic (*curpØ* 'strike') and PGvt (*sarvadØgØ* 'wild'), but no longer IGLic. In terms of constraints, this means that, while *LIC, *DGLIC and *PGVT are still low-ranked and, therefore, 'easily' violable, *IGLIC has been raised up: it cannot be violated anymore, and word-final complex onsets are thus 'repaired' by means of the epenthesis (**magrØ* > *magarØ* 'thin'). This has not (yet?) happened in Carrarese: its FEN still preserves its ('etymological') licensing strength (viz. all of its relevant constraints are still low-ranked), and word-final complex onsets happen to be well-formed (*magrØ* 'thin').

There is another aspect of the phonological analysis worthy of mention. It concerns the (phonological) grammar architecture and, more precisely, the phonetics-phonology interface.

As discussed in Section 7.1, the processes under discussion start within the phonetic module, where they are argued to be sensitive to phonetic information alone. Unstressed vowel reduction, for instance, starts its "life cycle" as a purely phonetic process (undershoot; Sections 3.1.2, 3.2.1 and 7.2), which has only an indirect, and therefore irrelevant, access to the prosodic structure of the phonological

---

[142] These three licensing strength degrees rest on a consonant cluster (universal) complexity/markedness hierarchy, according to which a simple onset is simpler/less marked than a coda-onset sequence, which, in turn, is simpler/less marked than a complex onset. Therefore, it seems to be 'easier' for FEN to license a single onset than a coda-onset sequence (DGLic), which, in turn, is easier to license than a complex onset (IGLic; Cyran 2005, 2008).

form undergoing the reduction[143]. Similarly, the non-etymological vowel insertion processes described in Sections 7.3 (vowel intrusion) and 7.4 (vowel epenthesis) start as articulatory driven processes.

The acoustic outputs of these phonetic processes, though, can be then reinterpreted by the learner as being phonologically controlled. Once this happens, the process enters the phonological module and continues its 'ascensional' "life cycle" (Fig. 8.1). A formal account of these (diachronically) gradual processes needs thus to be given which consists of a sequence of perception/production grammars which, in turn, define how an articulatory driven process (undershoot, overshoot, coarticulation[144]) is reinterpreted by the learner as being phonologically controlled (hypoarticulation, vowel insertion, assimilation; Sections 6.3 and 7.2).

Crucially, the possibility for a given process to 'proceed' from phonetics to phonology, along with the fact that in the two stages, this process displays different properties, support the hypothesis of a modular grammar architecture, in which phonetics and phonology constitute two autonomous modules, each one displaying its peculiar vocabulary (Scheer 2014). As discussed in Sections 6.1 and 6.2.2, the interface between these modules, in turn, is argued to be managed by a set of cue constraints, i.e. by a set of OT (hence, violable) constraints which map an acoustic structure onto a phonological object (and which function similarly to a 'translation device'; Scheer 2014). More precisely, they are argued to map (physical) acoustic dimensions such as formant structures and duration (viz. objects belonging to the 'phonetic vocabulary') onto (abstract) phonological primitives such as elements and length (viz. objects belonging instead to the 'phonological vocabulary')[145].

It has to be highlighted that, as hinted at above, perception plays a central role in these processes (Ohala 1981; Blevins 2004; Bermúdez-Otero 2007; Boersma 2009; Hamann 2009; Garrett & Johnson 2013; Bermúdez-Otero in press). Indeed, the phonetics-to-phonology change of a given process is argued to occur whenever a listener maps a phonetic object onto a phonological category that is different from the one intended by the speaker (Hamann 2009). As a matter of fact, production seems to be as relevant as perception. Indeed, as just recalled, the perception driven reinterpretation processes driving the phonological changes under discussion are fed by the acoustic outcomes of articulatory driven processes. The set of grammars accounting for these diachronic changes (and, ultimately, for phonologization) must be therefore able to formalize the relevance of both perception and production.

In the present dissertation, the needed formalism is borrowed from the Bidirectional Phonetics and Phonology model (BiPhon; Boersma 2007, 2009, 2011; Hamann 2009, 2011), whose architecture is repeated in Fig. 8.2. Within this

---

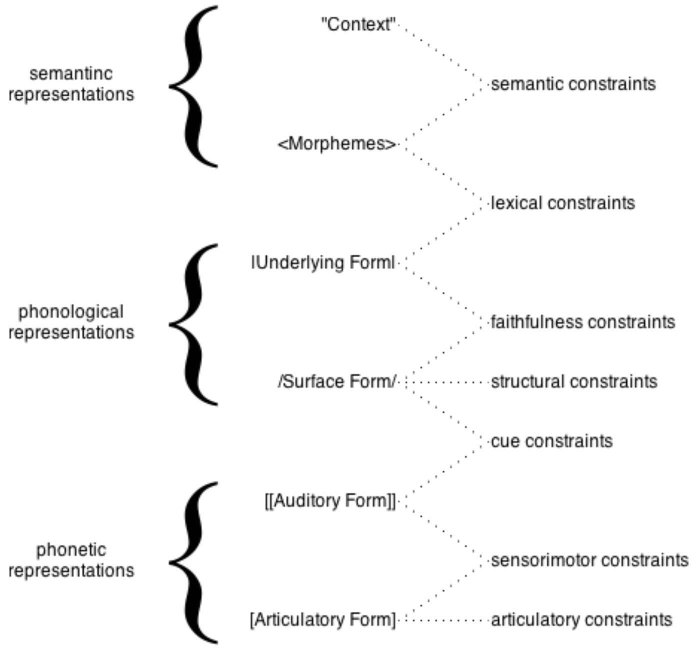
[143] Recall that the fact that this process produces the most 'dramatic' effects when applied to unstressed vowels is rather due to the phonetic consequences of their being unstressed, namely to their short duration and low intensity.

[144] Interestingly, as discussed in Section 3.2.1, the (co)occurrence of these processes supports the hypothesis according to which Western Romance varieties gradually shifted from the "controlled" to the "compensation" pole (Bertinetto & Bertini 2008) of the isochrony *continuum* (see also Loporcaro 2011a).

[145] The structures these primitives can be combined into, in turn, are argued to be accounted for by the interaction of the cue constraints with the structural ones (Section 6.2.3).

approach, indeed, a single (OT) grammar is meant to account for both production and perception (Section 6.1).

Fig. 8.2 BiPhon grammar (Boersma 2011)



Notice that, as shown by the bottom side of Fig. 8.2, this model assumes a phonetics-phonology interface in which, as already recalled, phonological objects are directly mapped onto their acoustic(/auditory) correlates by a set of cue constraints. The 'privileged' status recognized to acoustics, in turn, supports an approach to the subsegmental representational system whose primitives are represented in terms of elements (Section 6.3.1.1.1). According to (the standard) Element Theory (ET; Backley 2011), indeed, the phonologically relevant phonetic information is constituted by the speech objects' formant structure, which in turn, during language acquisition, is 'translated' into the corresponding element[146]. This

[146] As discussed in Section 6.2.2, the arbitrariety of the phonetics-phonology mappings implied by the modular approach to grammar (and, generally, to cognition) architecture opens the possibility for these mappings to be learnt and, therefore, for them not to be universal. Interestingly, these mappings are argued to (rarely) display a phonetic-phonology 'schizofrenic' mismatch because of diachrony (see, for instance, the |A| [[e Hz]]-to-|H| [[e Hz]] mapping change recalled above and discussed in Section 7.2): the "mapping relations between phonology and phonetics are not born crazy - they may become crazy through aging. Most of them do not, though, and this is the reason why the overwhelming majority of mapping relations show little slack" (Scheer 2014).

representational system, furthermore, is consistent with the representational system resorted to to account for the suprasegmental phonological structures, i.e. with Government Phonology (see, particularly, Kaye et al. 1985, 1990; Charette 1990; Harris 1997; Kaye 2000; van der Hulst 2006; and Sections 6.2.3 and 6.3.1.1.2). The lateral relationships entertained by the prosodic nodes (O, N and, possibly[147], Cd), indeed, directly translate into their ability to license elemental structures. This, in turn, is defined in terms of structural constraints (Harris 1997; van der Hulst 2006; Section 6.2.3).

An additional aspect of our phonological analysis deserves to be mentioned. Indeed, the phonologization processes under consideration seem to be sensitive to the morphological information stored within the underlying/lexical forms. For instance, apocope is shown to affect all the word-final unstressed vowels except the ones representing the phonological exponent of SG.FEM, PL.MASC and, in Carrarese, also PL.FEM, i.e. respectively, *-a*, *-i* and *-e*[148] (Sections 2.2.2 and 2.3.2). As shown in Section 7.2, this is accounted for by the high ranking of *(N |X|)$_{\mu}$, which outranks EXPRESS-$|X|_{SG.MASC}$ and is, in turn, outranked by EXPRESS-$|X|_{SG.FEM}$, EXPRESS-$|X|_{PL.MASC}$ and, in the case of Carrarese, by EXPRESS-$|X|_{PL.FEM}$ as well. In other words, the structural constraint favouring the delinking of elements from prosodically (and morphologically 'sponsored': $_{\mu}$) weak N's, viz. *(N |X|)$_{\mu}$, outranks the constraints requiring the integration, within the phonological representation to be phonetically interpreted, of elements expressing SG.MASC. The delinking-favouring constraint, though, is not ranked high enough to trigger the delinking from unstressed N's of the elements expressing SG.FEM, PL.MASC and, in Carrarese, PL.FEM (Tab. 7.26).

Similarly, the mapping of the intrusive schwa-like vocoid on a vocalic element (and, ultimately, on a nuclear position) is shown to be blocked by the crucial ranking of the anti-epenthesis *N above the cue constraints |A| [[ə Hz]] and |X| [[x ms]]. Indeed, as shown in Section 7.3, if *muta*'s release is integrated with the following *liquida*'s intrinsic vocalic structure and, therefore, a longer (than a release) schwa-like vocoid occurs in the auditory form the listener is exposed to, the higher-ranked *N blocks the mapping of this periodic structure onto |A|. In other words, the structural constraint banning the integration in the phonological representation of a morphologically 'transparent' N blocks the intrusive vowel phonologization.

In order to integrate morphological information within our phonological model, we resort to a set of phonological recoverability constraints (EXPRESS-[F]; Van Oostendorp 2005; Section 6.2.4), which militate against the underparsing/delinking of a morphological unit's phonological exponent(s) from a surface phonological representation. Interestingly, by using these constraints, we can get rid of the traditional faithfulness constraints accounting for the relationship between

---

[147] Given the formal (and empirical) inconsistencies of the standard Government Phonology pointed out by Scheer (2004), a future development of the formal approach developed in the present dissertation could be couched within the more restrictive CVCV framework (that, indeed, gets rid of codas).

[148] Notice that, in the case that *-e* does not express PL.FEM, it undergoes deletion in Carrarese as well. The SG.MASC augmentative suffix -ONE, for instance, is realized as [oŋ]: It. [palˈloːne] vs. Carr. [baˈɖoŋ] 'ball'.

phonological underlying and surface forms (Fig. 8.2). The phonological recoverability constraints, indeed, do not need to take into account the two phonological representations just mentioned: they only care about phonological surface representations' well-formedness, i.e. about the presence, in surface representations, of the lexically defined morphological exponents/'colours'.

It is not surprising, hence, that these constraints have been developed within an approach, Coloured Containment (Van Oostendorp 2005, 2007; Section 6.3.1.1.3), which maintains a monostratal approach to phonological representations: differently from the theory that rapidly substituted Containment Theory (Prince & Smolensky 1993), namely Correspondence Theory, Coloured Containment assumes an input-output relationship whereby the former is contained within the latter. Interestingly, notice that if the cue constraints formalize the phonetics-phonology interface, the phonological recoverability constraints can be argued to manage the one between phonology and morphology: the exponent(/morphological 'colour') of phonological objects, indeed, cues the morphological structure these objects occur in (Revithiadou 2007). Furthermore, since the forms contained in the lexicon are assumed to be form-meaning pairs (Saussure 1916), whose form side is defined in terms of phonological and morphological information (viz. *morphonemes*; Kurylowicz 1968), the interface managed by the phonological recoverability constraints can also be considered the 'door' a phonological change (of a given morpheme) enters the lexicon through (see, for instance, the restructuring of SG.MASC resulting from unstressed vowel deletion discussed in Section 7.2).

Concluding, let us recall that, as we claimed in Chapter 1, the formal account we hereby propose of phonologization and dia-topic/-chronic variation should be primarily considered an attempt to reduce "the smallest differences between dialects [to] manifestations of universal principles underlying the organization of language systems" (Hinskens, Hermans & Van Oostendorp 2014: 2).

Indeed, our phonological analysis (Chapter 7) rests on a set of assumptions (such as the architecture modularity of cognition and, particularly, of the phonological grammar; Fodor 1983; Scheer 2014; Bermúdez-Otero in press; Chapter 6) "that constitutes a serious attempt at an overarching conception of the nature of human language and human cognitive structure" (Carr 2000: 85).

At the same time, our phonological analysis is 'grounded' on a preliminary acoustic and statistical analysis (Chapter 5) of a set of data collected by means of fieldwork (Chapter 4).

To sum up, in this dissertation we tried to develop an approach that "places variation and laboratory work at the heart of phonological enquiry, but at the same time rests on a properly articulated overall conception of the nature of human language, human cognition, and the structure of human languages" (Carr 2000: 85).

APPENDIX

9 The questionnaire

a) *colpo* CŎL(Ă)PHU(M) ‘strike’

i. Gli è venuto un *colpo*
‘He had a stroke’
ii. Stai attento a non prendere un *colpo* di sole
‘Be careful not to get sunstroke’
iii. Gli ho dato un paio di *colpi*
‘I hit him a couple of times’
iv. Gli ho dato un *colpo* o due
‘I hit him one or two times’

b) *merlo* MĔRŬLU(M) ‘blackbird’

i. Ha due gambe talmente fini che sembra un *merlo*
‘His legs are so skynny that he looks like a blackbird’
ii. Il *merlo* grottaro non ha il petto bianco come il *merlo* acquaiolo
‘The blue rock thrush (*Monticola solitarius*) doesn’t have a white chest like the white-throated dipper (*Cinclus cinclus*)’
iii. Quello è un *merlo* nero nero
‘That blackbird is really really dark’
iv. Mi sembra un *merlo* indiano
‘It looks like a common hill myna (*Gracula religiosa*)’

c) *forno* FURNU(M) ‘oven’

i. Il castagnaccio viene meglio nel *forno* a legna che nel *forno* di casa
‘The chestnut cake comes off better in a wood oven than in a electric oven’
ii. Quando ero piccolo andavo a lavorare al *forno*
‘When I was young I used to work at the bakery’

d) *magro/-a* MĂCRU(M)/-A(M) ‘thin SG.MASC/FEM’

i. Quando ero piccolo ogni giorno era un giorno di *magro*…
‘When I was young, every day was a “lean” day…’
ii. …ma *magro* davvero
‘…but really lean’
iii. Questo pezzo (di carne) è *magro* o no?
‘Is this meat lean or not?’

e) *quattro* QUATŬŎR ‘four’

i. Se non la smetti ti do *quattro* schiaffi che ti lascio lì
‘If you don’t knock it off, I’ll slap you so hard (lit. I give you four slaps) that you won’t be able to move’
ii. Da giovane andavo sempre in giro con *quattro* amiche
When I was young, I used to hang out with four friends’
iii. Il mio numero preferito è il *quattro*
‘My favourite number is four’

f) *libro* LĬBRU(M) ‘book’

i. Mi sono comprato un bel *libro*
‘I bought a nice book’
ii. E’ un *libro* nuovo nuovo
‘It’s a really new book’
iii. Ho trovato un bel *libro* antico
‘I found a nice ancient book’
iv. Ho comprato un paio di *libri*
‘I bought a couple of books’

g) *tiepido/-a* TĔPĬDU(M)/-A(M) ‘lukewarm SG.MASC/FEM’

i. Il latte ti piace *tiepido* o caldo?
‘Do you like your milk lukeward or hot?’
ii. Mi piace *tiepido*
‘I like it lukewarm’
iii. Il caffè è *tiepido* ma buono
‘The coffee is lukewarm, but good’
iv. La zuppa è ancora *tiepida*
‘The soup is still lukewarm’

h) *selvatico/-a* SILVĀTĬCU(M) ‘wild SG.MASC/FEM’

i. Questa carne sa di *selvatico*…
‘This meat tastes like wild (animal)…’
ii. …ma di *selvatico* buono
‘…but like tasty wild (animal)’
iii. Allora? Sa di *selvatico* o no?
‘So? Does it taste like wild (animal) or not?’
iv. No, non è *selvatica*
‘No, it’s not wild’

i) *tenero/-a* TĔNĔRU(M)/-A(M) 'tender SG.MASC/FEM'

i. Questo arrosto è *tenero* davvero!
   'This roast is really tender!'
ii. Quell'altro invece non è molto *tenero*
   'That one is not so tender instead'
iii. Ti sembra *tenero* o no?
   'Do you think it's tender or not?'
iv. Questa carne è molto *tenera*
   'That meat is really tender'

j) *giovane* IŬVĔNE(M) 'young'

i. Luigi è ancora troppo *giovane*
   'Luigi is still too young'
ii. *Giovane* e un po' scemo
   'Young and a little silly'
iii. Lui è *giovane* davvero…
   'He is really young…'
iv. …lei invece non è così *giovane*
   '…she's not that young instead'

k) *libero/-a* LĪBĔRU(M)/-A(M) 'free SG.MASC/FEM'

i. Ogni uomo si deve sentire *libero*
   'Every man should feel free'
ii. Deve essere *libero* di decidere della propria vita
   'He should be free to decide about his own life'
iii. Il prigioniero è *libero* o no?
   'Is the prisoner free or not?'
iv. La prigioniera è sicuramente *libera*
   'The prisoner is free for sure'

l) *stomaco* STŎMĂCHU(M) 'stomach'

i. Mi è venuto un bel bruciore di *stomaco*
   'I got strong heartburn'
ii. A forza di bere così tanto ho tutto lo *stomaco* annacquato
   'Because I've been drinking so much, my stomach is all watered-down'
iii. A forza di bere vino ha tutto lo *stomaco* rovinato
   'Because of my heavy wine drinking, my stomach is all damaged'
iv. Per fare la trippa non vanno bene tutti gli *stomaci*: ci vuole quello bovino
   'To make tripe, not any stomach is suitable: you need the bovine one'

m) *manico/-a* *MĂNĬCU(M)/-A(M) 'handle/sleeve SG.MASC/FEM'

i. La tazza prendila per il *manico*
'Hold the mug by the handle'
ii. Prendi quella con il *manico* azzurro, non quella con il *manico* nero
'Take the one with a blue handle, not that with a black handle'
iii. Mi si è rotta una *manica* del cappotto.
'A sleeve of my coat teared up'

n) *asino* ĂSĬNU(M) 'donkey'

i. Quello lì è proprio un *asino*
'That guy is really a donkey'
ii. Ieri ho visto un *asino* bianco
'Yesterday I saw a white donkey'
iii. Una volta c'erano tanti *asini*
'Once there were a lot of donkeys'

10 The speakers

CARRARESE

- Speaker initials: AC
  Place of birth: Carrara
  Age: 68
  Gender: female
  Level of education: secondary school + music degree
  Job: retired
  Parents place of birth: Carrara
  Use of the dialect: both with relatives and friends

- Speaker initials: AM
  Place of birth: Carrara
  Age: 85
  Gender: male
  Level of education: elementary school (not finished)
  Job: retired
  Parents place of birth: Carrara
  Use of the dialect: both with relative and friends

- Speaker initials: BD
  Place of birth: Carrara
  Age: 81
  Gender: male
  Level of education: secondary school
  Job: retired
  Parents place of birth: Carrara
  Use of the dialect: both with relatives and friends

- Speaker initials: ED
  Place of birth: Carrara
  Age: 65
  Gender: male
  Level of education: secondary school
  Job: retired
  Parents place of birth: Carrara (mother); Catanzaro (father)
  Use of the dialect: both with relatives and friends

- Speaker initials: MV
  Place of birth: Carrara
  Age: 59
  Gender: female
  Level of education: secondary school
  Job: employee
  Parents place of birth: Carrara
  Use of the dialect: both with relatives and friends

PONTREMOLESE

- Speaker initials: AS
  Place of birth: Pontremoli
  Age: 72
  Gender: male
  Level of education: middle school
  Job: retired
  Parents place of birth: Pontremoli
  Use of the dialect: with both relatives and friends

- Speaker initials: DP
  Place of birth: Pontremoli
  Age: 81
  Gender: male
  Level of education: secondary school
  Job: retired
  Parents place of birth: Pontremoli
  Use of the dialect: with both relatives and friends

  Speaker initials: GB
  Place of birth: Pontremoli
  Age: 70
  Gender: male
  Level of education: middle school
  Job: retired
  Parents place of birth: Borgotaro (mother); Pontremoli (father)
  Use of the dialect: with both relatives and friends

- Speaker initials: LB
  Place of birth: Pontremoli
  Age: 68
  Gender: male
  Level of education: master degree
  Job: retired
  Parents place of birth: Pontremoli
  Use of the dialect: with both relatives and friends

- Speaker initials: MM
  Place of birth: Pontremoli
  Age: 69
  Gender: male
  Level of education: middle school
  Job: retired
  Parents place of birth: Pontremoli
  Use of the dialect: with both relatives and friends

As can be noticed, all the speakers claim to use the dialect in ordinary conversations, namely as their primary language, resorting to Italian in more formal contexts. In other words, they use the dialect as the 'low variety' of a diglossic system, Italian being the 'high variety' (Berruto 1987). As for place of birth, they were all born either in Carrara or in Pontremoli, where they spent the greatest part of their lives. A slightly smaller homogeneity can be found as far as the place of birth of their parents is concerned: in two cases (ED and GB) one of the parents didn't come from either Carrara or Pontremoli. More variation is found in age and level of education, the speakers ranging between 59 (MV f.) and 85 (AM m.) and between completing the first years of elementary school (AM) and a master's degree (LB).

11 Tableaux

Tab. 11.1

Proto-Romance production of non-reduced vowel; {SG.MASC} = |AU̲|

O$_R$ 'N$_R$ O$_R$ N$_{SM}$ k |A̲|$_R$ p |AU̲|$_{SM}$	EXPRESS -|X|$_{ROOT}$	EXPRESS -|X|$_{INFL}$	*N |STR|	|X| [[x ms]]	|A| [[ə Hz]]	|U| [[u Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[x ms]] [x ms]	*ART
a) ☞ O$_R$ 'N$_R$ O$_R$ N$_{SM}$ |A̲|$_R$ |AU̲|$_{SM}$ [[k aː p [[o]] [k aː p o]			***							*****('N) ***(N)
b) O$_R$ 'N$_R$ O$_R$ N$_{SM}$ k |A̲|$_R$ p |AU̲|$_{SM}$ [[k aː p o]] [k aˑ p ᵊ]			***					W *	W *('N) *(N)	L ****('N) *(N)
c) O$_R$ 'N$_R$ O$_R$ N$_{SM}$ k |A̲|$_R$ p |AU̲|$_{SM}$ [[k aː p o]] [k aˑ p ᵘ]			***				W *		W *('N) *(N)	L ****('N) **(N)

Tab. 11.2

Proto-Romance perception of non-reduced vowel; {SG.MASC} = |AU̲|

<table>
<tr><th>[[k a: p o]]</th><th>EXPRESS
-|X|_{ROOT}</th><th>EXPRESS
-|X|_{SG.MASC}</th><th>*N |STR|</th><th>|X|
[[x ms]]</th><th>|A|
[[ə Hz]]</th><th>|U̲|
[[u Hz]]</th><th>[[ə Hz]]
[ə]</th><th>[[u Hz]]
[u]</th><th>[[x ms]]
[x ms]</th><th>*ART</th></tr>
<tr><td>a) ☞ O_R – ˈN_R |A|_R – O_R – N_{SM} |AU̲|_{SM}
[[k a: p o]]</td><td></td><td></td><td>***</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>b) O_R – ˈN_R |A|_R – O_R – N_{SM} |A|_{SM}
[[k a: p o]]</td><td></td><td>W
*!</td><td>L
*</td><td></td><td></td><td>W
*</td><td></td><td></td><td></td><td></td></tr>
<tr><td>c) O_R – ˈN_R |A|_R – O_R – N_{SM} |U̲|_{SM}
[[k a: p o]]</td><td></td><td>W
*!</td><td>L
**</td><td></td><td>W
*</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Tab. 11.3

STAGE I: Proto-Romance production of articulatory driven reduced vowel (undershoot); {SG.MASC} = |AU̲|

O_R $'N_R$ O_R N_{SM} |k |A|$_R$ p |AU̲|$_{SM}$	*ART	EXPRESS -|X|$_{ROOT}$	EXPRESS -|X|$_{SG.MASC}$	*N |STR|	|X| [[x ms]]	|A| [[ə Hz]]	|U̲| [[u Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[x ms]] [x ms]
a) ☞ O_R $'N_R$ O_R N_{SM} |A|$_R$ |AU̲|$_{SM}$ [[k a: p o]] [k a· p ᵊ]	****('N) *(N)			***					*	*('N) *(N)
b) O_R $'N_R$ O_R N_{SM} |A|$_R$ |AU̲|$_{SM}$ [[k a: p o]] [k a: p o]	W ****!*('N) *!**(N)			***					L	L
c) O_R $'N_R$ O_R N_{SM} |A|$_R$ |AU̲|$_{SM}$ [[k a: p o]] [k a· p ᵘ]	W ****('N) *!*(N)			***				W *	L	*('N) *(N)
d) O_R $'N_R$ O_R N_{SM} |A|$_R$ |AU̲|$_{SM}$ [[k a: p ə]] [k a: p ə]	W ****!*('N) **(N)			***			W *		L	L

Tab. 11.4

STAGE I: Proto-Romance perception of articulatory driven reduced vowel; {SG.MASC} = |AU̲|

[[k a˙ p ᵊ]]	EXPRESS -|X|ROOT	EXPRESS -|X|SG.MASC	*N |STR|	|X| [[x ms]]	|A| [[ə Hz]]	|U| [[u Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[x ms]] [x ms]	*ART
a) ☞ O_R – 'N_R – O_R – N_SM; |A̲|_R, |AU̲|_SM; [[k a˙ p ᵊ]]			***	*		*				
b) O_R – 'N_R – O_R – N_SM; |A̲|_R, |A|_SM; [[k a˙ p ᵊ]]		W *!	L *	*		L				
c) O_R – 'N_R – O_R – N_SM; |A̲|_R, |U̲|_SM; [[k a˙ p ᵊ]]		W *!	L **	*	W *	*				
d) O_R – 'N_R – O_R – N_SM; |A̲|_R, | |_SM; [[k a˙ p ᵊ]]		W *!	L	L	W *	L				

Tab. 11.5

STAGE Ia: perception of articulatory driven reduced vowel (hypoarticulation); {SG.MASC} = |AU̲|

[[k a· p ə]]	*N |XY|	EXPRESS -|X|$_{ROOT}$	EXPRESS -|X|$_{SG.MASC}$	*N |X|	*N |X|	*N | |	|X| [[x ms]]	|A| [[ə Hz]]	|U| [[u Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[x ms]] [x ms]	*ART
a) ☞ O_R 'N$_R$ O_R N_{SM} |A|$_R$ |A|$_{SM}$ [[k a· p ə]]			*		*		*						
b) O_R 'N$_R$ O_R N_{SM} |A|$_R$ |AU|$_{SM}$ [[k a· p ə]]	W *!		L		L		*		W *				
c) O_R 'N$_R$ O_R N_{SM} |A|$_R$ |U|$_{SM}$ [[k a· p ə]]			*	W *!	L		*	W *	W *				
d) O_R 'N$_R$ O_R N_{SM} |A|$_R$ | |$_{SM}$ [[k a· p ə]]			W *!*		L	W *	L	W *					

Tab. 11.6

STAGE Ia: production of articulatory driven reduced vowel (undershoot); {SG.MASC} = |AU̲|

O_R – k · $'N_R$ – $\|A̲\|_R$ · O_R – p · N_{SM} – $\|AU̲\|_{SM}$	*ART	*N |X̲Y|	EXPRESS -|X|$_{ROOT}$	EXPRESS -|X|$_{SG.MASC}$	*N |X̲|	*N |X|	*N | |	|X| [[x ms]]	|A| [[ə Hz]]	|U| [[u Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[x ms]] [x ms]
a) ☞ O_R $'N_R$ O_R N_{SM} – $\|A̲\|_R$ $\|AU̲\|_{SM}$ – [[k aː p o]] – [k aˑ p ᵊ]	****('N) *(N)	*										*(N)	*('N) *(N)
b) O_R $'N_R$ O_R N_{SM} – $\|A̲\|_R$ $\|AU̲\|_{SM}$ – [[k aː p ə]] – [k aˑ p ᵊ]	****('N) *(N)	*								W *!		L	*('N) *(N)
c) O_R $'N_R$ O_R N_{SM} – $\|A̲\|_R$ $\|AU̲\|_{SM}$ – [[k aː p o]] – [k aː p o]	W ****!*('N) ***(N)	*										L	L
d) O_R $'N_R$ O_R N_{SM} – $\|A̲\|_R$ $\|AU̲\|_{SM}$ – [[k aː p ə]] – [k aː p ə]	W ****!*('N) **(N)	*								W *		L	L

Tab. 11.7

STAGE II: production of articulatory driven reduced vowel (undershoot, second round); {SG.MASC} = |A|

O_R $ˈN_R$ O_R N_{SM} | | | | |k $\|A\|_R$ p $\|A\|_{SM}$	*ART	*N |XY|	EXPRESS -$\|X\|_{ROOT}$	EXPRESS -$\|X\|_{SG.MASC}$	*N |X|	*N |X|	*N | |	|X| [[x ms]]	|A| [[ə Hz]]	|U| [[u Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[x ms]] [x ms]
a) ☞ O_R $ˈN_R$ O_R N_{SM} $\|A\|_R$ $\|A\|_{SM}$ [[k a: p ə]] [k a· p ᵊ]	****(ˈN) *(N)					*						*(N)	*(ˈN) *(N)
b) O_R $ˈN_R$ O_R N_{SM} $\|A\|_R$ $\|A\|_{SM}$ [[k a: p o]] [k a· p ᵊ]	****(ˈN) *(N)					*				W *!		L	*(ˈN) *(N)
c) O_R $ˈN_R$ O_R N_{SM} $\|A\|_R$ $\|A\|_{SM}$ [[k a: p o]] [k a: p o]	W ****!*(ˈN) ***(N)					*				W *		L	L
d) O_R $ˈN_R$ O_R N_{SM} $\|A\|_R$ $\|A\|_{SM}$ [[k a: p ə]] [k a: p ə]	W ****!*(ˈN) **(N)					*						L	L

Tab. 11.8

STAGE Ib: perception of articulatory-driven reduced vowel (hypoarticulation); {SG.MASC} = |A|

[[k a· p ᵊ]]	*N |XY|	EXPRESS -|X|ROOT	EXPRESS -|X|SG.MASC	*N |X|	*N |X|	*N | |	|X| [[x ms]]	|A| [[ə Hz]]	|U| [[u Hz]]	|H| [[ə Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[x ms]] [x ms]	*ART
a) ☞ O$_R$ – ˈN$_R$ – O$_R$ – N$_{SM}$ / |A|$_R$ |A|$_{SM}$ / [[k a· p ᵊ]]					*		*		*	*				
b) O$_R$ – ˈN$_R$ – O$_R$ – N$_{SM}$ / |A|$_R$ |AU|$_{SM}$ / [[k a· p ᵊ]]	W *!		W *		L		*		L	*				
c) O$_R$ – ˈN$_R$ – O$_R$ – N$_{SM}$ / |A|$_R$ |U|$_{SM}$ / [[k a· p ᵊ]]			W *!	W *	L		*	W *	L	*				
d) O$_R$ – ˈN$_R$ – O$_R$ – N$_{SM}$ / |A|$_R$ | |$_{SM}$ / [[k a· p ᵊ]]			W *!		L	W *	L	W *	L	*				

Tab. 11.9

STAGE IIa: perception of articulatory driven reduced vowel (hypoarticulation); {SG.MASC} = |A|

[[k a· p ᵊ]]	*N |XY|	*N |X|	*N |X|	EXPRESS -|X|$_{ROOT}$	EXPRESS -|X|$_{SG.MASC}$	*N | |	|X| [[x ms]]	|A| [[ə Hz]]	|U| [[u Hz]]	|H| [[ə Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[xms]] [x ms]	*ART
a) ☞ O_R ˈN_R O_R N_{SM} |A|$_R$ | |$_{SM}$ [[k a· p ← ᵊ]]					*	*	*(*p*'s |H|)	*						
b) O_R ˈN_R O_R N_{SM} |A|$_R$ |A|$_{SM}$ [[k a· p ᵊ]]			W *!		L	L	W *(|A|) *(*p*'s |H|)			W *				
c) O_R ˈN_R O_R N_{SM} |A|$_R$ | |$_{SM}$ [[k a· p ᵊ]]					*	*	*(*p*'s |H|)	*		W *!				

Tab. 11.10

STAGE IIb: perception of articulatory-driven reduced vowel (hypoarticulation); {SG.MASC} = | |

[[k a· p ᵊ]]	*N |XY|	*N |X|	*N |X|	EXPRESS -|X|ROOT	EXPRESS -|X|SG.MASC	*N | |	|X| [[x ms]]	|A| [[ə Hz]]	|U| [[u Hz]]	|H| [[ə Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[xms]] [x ms]	*ART
a) ☞ O$_R$ ˈN$_R$ O$_R$ N$_{SM}$ |A|$_R$ | |$_{SM}$ [[k a· pᵊ]]						*	*(p's [[ᵊ]])	*						
b) O$_R$ ˈN$_R$ O$_R$ N$_{SM}$ |A|$_R$ |A|$_{SM}$ [[k a· p ᵊ]]					W *!	L	W *(|A|) *(p's |H|)	L		W *([[ᵊ]]) *(p's |H|)				
c) O$_R$ ˈN$_R$ O$_R$ N$_{SM}$ |A|$_R$ | |$_{SM}$ [[k a· p ᵊ]]						*	*(p's |H|)	*		W *([[ᵊ]])! *(p's |H|)				

Tab. 11.11

STAGE IIb (Carrarese): articulatory driven vowel insertion

O_R $'N_R$ O_R O_R N_{SM} |			| m $\|A\|_R$ g r $\| \|_{SM}$	*N |XY|	*N |X|	*N |X|	Express - $\|X\|_{ROOT}$	Express - $\|X\|_{SG.MASC}$	*N | |	|X| [[x ms]]	|A| [[ə Hz]]	|U| [[u Hz]]	|H| [[ə Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[x ms]] [x ms]	*Art
a) O_R $'N_R$ O_R O_R N_{SM} ☞ m $\|A\|_R$ g r $\| \|_{SM}$ [[m a: $g^{(ə)}$ ^ər]] [m a: $g^ə$→ ə ← ^ər]						*	*(g's |H|)	*(g's [[ə]])						*****('N)
b) O_R $'N_R$ O_R O_R N_{SM} m $\|A\|_R$ g r $\| \|_{SM}$ [[m a: $g^{(ə)}$ ^ər]] [m a: g ^ər]						*	* (g's |H|)	* (g's [[ə]])			W *! (g's [[ə]])		W * (g's [[ə]])	*****('N)

Tab. 11.12

STAGE IIb (Carrarese): intrusive [[ə]] perception

[[m a: g^ə ^ər]]	*N |XY|	*N |X|	*N |X|	EXPRESS -|X|$_{ROOT}$	EXPRESS -|X|$_{SG.MASC}$	*N | |	*N	|X| [[x ms]]	|A| [[ə Hz]]	|U| [[u Hz]]	|H| [[ə Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[xms]] [x ms]	*ART
a) ☞ O_R ˈN_R O_R O_R N_{SM} | |A|$_R$ | r | |$_{SM}$ [[m a: g$^{(ə)}$→ ə ←^{ə}r]]						*		*(g's |H|) *([[ə]])	*([[ə]])		*(g's |H|) *([[ə]])				
b) O_R ˈN_R O_R N O_R N_{SM} | |A|$_R$ | |A| r | |$_{SM}$ [[m a: g$^{(ə)}$→ ə ←^{ə}r]]						*	*!	L *(g's |H|)	L		*(g's |H|) *([[ə]])				

Tab. 11.13

S TAGE III: perception driven intrusive-to-epenthetic [ə]; | |-to-|A|

[[m a gᵊ ᵊr]]	*N |XY|	*N |X|	*N |X|	EXPRESS -|X|ROOT	EXPRESS -|X|SG.MASC	*N | |	|X| [[x ms]]	*N	|A| [[ə Hz]]	|U| [[u Hz]]	|H| [[ə Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[xms]] [x ms]	*ART
a) ☞ O_R – $'N_R$ – O_R – N – O_R – N_{SM} | |A|$_R$ | |A| | | |$_{SM}$ [[m a g$^{(ə)}$→ ə ←ᵊr]]						*	*(g's |H|)	*			*(g's |H|) *([[ə]])				
b) O_R – $'N_R$ – O_R – O_R – N_{SM} | |A|$_R$ | | | |$_{SM}$ [[m a g$^{(ə)}$→ ə ←ᵊr]]						*	W *(g's |H|) *!([[ə]])	L	W *([[ə]])		*(g's |H|) *([[ə]])				

Tab. 11.14

S TAGE IV: epenthetic vowel [a/u]-colouring (coarticulation)

<table>
<tr><th>O_R 'N_R O_R O_R O_{SM}
| | | | |
m |A|_R g r | |_{SM}</th><th>Co-Art</th><th>*N |XY|</th><th>*N |X|</th><th>*N |X|</th><th>Express -|X|_{ROOT}</th><th>Express -|X|_{SG.MASC}</th><th>*N | |</th><th>|X|
[[x ms]]</th><th>*N</th><th>|A|
[[ə Hz]]</th><th>|U|
[[u Hz]]</th><th>|H|
[[ə Hz]]</th><th>[[ə Hz]]
[ə]</th><th>[[u Hz]]
[u]</th><th>[[xms]]
[x ms]</th><th>*Art</th></tr>
<tr><td>a) O_R 'N_R O_R N O_R N_{SM}
☞ | |A|_R | |A| | | |_{SM}
[[m aː g ə ᵊr]]
[m aː g a ← r]</td><td></td><td></td><td></td><td>*</td><td></td><td></td><td>*</td><td>*(g's |H|)</td><td>*</td><td></td><td></td><td>*(g's |H|)</td><td>*</td><td></td><td></td><td>*****('N)
***(N)</td></tr>
<tr><td>b) O_R 'N_R O_R N O_R N_{SM}
| |A|_R | |A| | | |_{SM}
[[m aː g ə ᵊr]]
[m aː g ə r]</td><td>W
!</td><td></td><td></td><td></td><td></td><td></td><td>*</td><td>*(g's |H|)</td><td>*</td><td></td><td></td><td>*(g's |H|)</td><td>L</td><td></td><td></td><td>L
*****('N)
**(N)</td></tr>
</table>

Tab. 11.15

S TAGE IVa (Pontremolese): [a]-coloured epenthetic vowel perception (assimilation)

[[m a: g a r]]	*(N |X̲Y|)$_{\mu}$	*(N |X̲|)$_{\mu}$	*(N |X|)$_{\mu}$	EXPRESS -|X|$_{\text{ROOT}}$	EXPRESS -|X|$_{\text{SG.MASC}}$	*(N | |)$_{\mu}$	|X| [[x ms]]	*N	|A| [[ə Hz]]	|A̲| [[a Hz]]	|H| [[ə Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[xms]] [x ms]	*ART	CO-ART
a) ☞ O$_R$ – ˈN$_R$ – O$_R$ – N – O$_R$ – N$_{SM}$ | |A̲|$_R$ | |A̲| ←|A|$_R$ | |$_{SM}$ [[m a: g a r]]						*	*(*g*'s |H|)	*			*(*g*'s |H|)					
b) O$_R$ – ˈN$_R$ – O$_R$ – N – O$_R$ – N$_{SM}$ | |A̲|$_R$ | |A| |A|$_R$ | |$_{SM}$ [[m a: g a r]]						*	*(*g*'s |H|)	*	W *!	W *	*(*g*'s |H|)					

Tab. 11.16

S TAGE IVa (Pontremolese): [a/u]-coloured epenthetic vowel perception (assimilation)

[[t e: n a r]]	*(N |XY|)$_μ$	*(N |X|)$_μ$	*(N |X|)$_μ$	Express -|X|$_{ROOT}$	Express -|X|$_{SG.MASC}$	*(N | |)$_μ$	|X| [[x ms]]	*N	|U| [[u Hz]]	|A| [[a Hz]]	|A| [[ə Hz]]	|H| [[ə Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[xms]] [x ms]	*Art
a) O$_R$ ˋN$_R$ O$_R$ N O$_R$ N$_{SM}$ | | | | | | ☞ | |AI|$_R$ | |A| ←|A|$_R$ | |$_{SM}$ | | | | | [[t e: n a r]]						*		*				*(t's |H|)				
b) O$_R$ ˋN$_R$ O$_R$ N O$_R$ N$_{SM}$ | | | | | | | |AI|$_R$ | |A| |A|$_R$ | |$_{SM}$ | | | | | [[t e: n a r]]						*		*		W *!	*	*(t's |H|)				
[[a: s u ŋ]]	*(N |XY|)$_μ$	*(N |X|)$_μ$	*(N |X|)$_μ$	Express -|X|$_{ROOT}$	Express -|X|$_{SG.MASC}$	*(N | |)$_μ$	|X| [[x ms]]	*N	|U| [[u Hz]]	|A| [[a Hz]]	|A| [[ə Hz]]	|H| [[ə Hz]]	[[ə Hz]] [ə]	[[u Hz]] [u]	[[xms]] [x ms]	*Art
c) ˋN$_R$ O$_R$ N O$_R$ N$_{SM}$ | | | | | ☞ |A|$_R$ | |U| ←|UL|$_R$ | |$_{SM}$ | | | | [[a: s u ŋ]]						*		*								
d) ˋN$_R$ O$_R$ N O$_R$ N$_{SM}$ | | | | | |A|$_R$ | |U| |UL|$_R$ | |$_{SM}$ | | | | [[a: s u ŋ]]						*		*	W *!							

List of abbreviations

Languages

Bol.	Bolognese
C.Lat.	Classical Latin
Canav.	Canavesanese
Carr.	Carrarese
Cat.	Catalan
Em.	Emilian
En.	Engadinese
Fior.	Fiorenzuolese
Fr.	French
It.	Italian
Lad.	Ladin
Lig.	Ligurian
Liv.	Livignese
Log.	Logudorese
Lom.	Lombard
Mil.	Milanese
Mod.	Modenese
Nov.	Novellarese
O.Fr.	Old French
Ort.	Ortonovese
Pian.	Piandelagotti
Pontr.	Pontremolese
Pied.	Piedmontese
Prov.	Provencal
Pt.	Portuguese
Ro.	Romanian
Romagn.	Romagnolo
Sp.	Spanish
Tusc.	Tuscan
Ve.	Veglioto
Ven.	Venetian

Grammar

abl.	ablative
Cd	coda
FEN	final empty nucleus
gen.	genitive
nom.	nominative
N	nucleus
O	onset

References

Abercrombie D. (1967). *Elements of general phonetics*. Edinburgh: University Press.

Adank P., R. Smits & van Hout R. (2004). A comparison of vowel normalisation procedures for language variation research. *Journal of the Acoustical Society of America, 116(5)*, pp. 3099-3107.

Allen W.S. (1973). *Accent and Rhythm. Prosodic Features of Latin and Greek: a Study in Theory and Reconstruction*. Cambridge: Cambridge University Press.

Ambrosi A.C. (1956). Osservazioni sugli attuali limiti dell'area fonetica cacuminale nelle Alpi Apuane. *Giornale storico della Lunigiana, VII, 1-2*, pp. 5-25.

Ambrosi, A. C. (1967). *Itinerari nella Lunigiana medioevale*. Massa-Carrara: Ente provinciale per il turismo.

Andersen H. (1988). Center and periphery: adoption, diffusion, and spread. In J. Fisiak (ed.), *Historical Dialectology, Regional and Social.* Berlin: Mouton de Gruyter, pp. 39–83.

Anderson J. (2011). *The Substance of Language. Vol.1 The Domain of Syntax. Vol.2 Morphology, Paradigms, and Periphrases. Vol.3 Phonology-Syntax Analogies*. Oxford: Oxford University Press.

Anderson J. & Jones C. (1974). Three theses concerning phonological representations. *Journal of Linguistics, 10*, pp. 1-26.

Ascoli G. I. (1882-5). L'Italia dialettale. *Archivio Glottologico Italiano, 8*, pp. 98-128.

Backley P. (2011). *An introduction to element theory*. Edinburgh University Press.

Backley P. (2012). Variation in Element Theory. *Linguistic Variation, 12.1*, pp. 57-102.

Banti L. (1932). Via Placentia-Lucam. Contributo alla guerra annibalica. *Atene e Roma, XIII*, pp. 98-120.

Barbera M. (2008). Terre di mezzo. Osservazioni acustiche e fonologiche sulla durata consonantica nell'italiano di Carrara. *L'Italia dialettale, 69*, pp. 13-48.

Baroni M. & Vanelli L. (2000). The relationship between vowel length and consonantal voicing in Friulian. In L. Repetti (ed.), *Phonological Theory and the Dialects of Italy*. Amsterdam-Philadelphia: Benjamins, pp. 13-44.

Bell A. (1978). Syllabic consonants. In J. Greenberg (ed.), *Universals of Human Language. Volume 2: Phonology*. Stanford: Stanford University Press, pp. 153-201.

Bermúdez-Otero R. (2007). Diachronic phonology, in Paul de Lacy (ed.), The Cambridge handbook of phonology. Cambridge: Cambridge University Press, 497-517.

Bermúdez-Otero R. (2012). The architecture of grammar and the division of labour in exponence. In J. Trommer (ed.), *The morphology and phonology of exponence (Oxford Studies in Theoretical Linguistics, 41)*. Oxford: Oxford University Press, pp. 8-83.

Bermúdez-Otero R. (in press). Amphichronic explanation and the life cycle of phonological processes. In P. Honeybone & J. C. Salmons (eds), *The Oxford handbook of historical phonology*. Oxford: Oxford University Press, pp.

Bermúdez-Otero R. & Trousdale G. (2012). Cycles and continua: on unidirectionality and gradualness in language change. In T. Nevalainen & E. C. Traugott (eds), *The Oxford handbook of the history of English*. New York: Oxford University Press, pp. 691-720.

Berruto G. (1974). Piemonte e Valle d'Aosta. In M. Cortelazzo (ed.), *Profilo dei Dialetti Italiani, vol. 5*. Pisa: Pacini.

Berruto G. (1987). Lingua, dialetto, diglossia, dilalìa. In G. Holtus & J. Kramer (eds.), *Romania et Slavia adriatica. Festschrift für Zarko Muljačić*. Hamburg: Buske, pp. 57-81.

Bertinetto P. M. (1989). Reflections on the dichotomy between 'stress- vs. syllable-timing'. *Revue de Phonétique Appliquée, 91/93*, pp. 99-130.

Bertinetto P. M. & Bertini C. (2008). On modeling the rhythm of natural languages. In P. A. Barbosa, S. Madureira & C. Reis (eds.), *Speech Prosody 2008: Proceedings of the Fourth Conference on Speech Prosody, May 6-9, Campinas, Brazil*. São Paulo: Capes, pp, 427-430 [cd-rom].

Bertinetto P.M. & Bertini C. (2010). Towards a unified predictive model of natural language rhythm. In M. Russo (ed.), *Prosody Universals. Comparative studies in rhythmic modeling and rhythm typology*. Roma: Aracne, pp. 43-77.

Bertocchi L. (2006). *Al chër d'Puntremal*. Pontremoli: Artigianelli.

Bertoni G. (1905). *Il dialetto di Modena*. Torino: Loescher.

Bertoni G. (1925). *Profilo storico del dialetto di Modena*. Génève: Leo S. Olschki.

Bertoni G. & Bartoli M. (1925). *Breviario di neolinguistica*. Modena: Società Tipografica Modenese.

Blevins J. (1995). The syllable in phonological theory. In J. Goldsmith (ed.), *The handbook of phonological theory*. Cambridge: Blackwell, pp. 206–244.

Blevins J. (2004). *Evolutionary phonology: The emergence of sound patterns*. Cambridge: Cambridge University Press.

Bloomfield L. (1933). *Language*. New York: Holt, Rinehart and Winston.

Boersma P. (1998). *Functional Phonology: Formalizing the Interactions between Articulatory and Perceptual Drives*. Ph.D. dissertation, University of Amsterdam.

Boersma P. (2007). Some listener-oriented accounts of h-aspiré in French. *Lingua, 117*, pp. 1989-2054.

Boersma P. (2009). Cue constraints and their interactions in phonological perception and production. In P. Boersma & S. Hamann (eds.), *Phonology in perception*. Berlin: Mouton de Gruyter, pp. 55-110.

Boersma P. (2011). A programme for bidirectional phonology and phonetics and their acquisition and evolution. In A. Benz & J. Mattausch (eds.), *Bidirectional Optimality Theory*. Amsterdam: John Benjamins, pp. 33-72.

Boersma P. & Weenink D. (2014). *Praat: doing phonetics by computer* [Computer program]. Version 5.3.63, retrieved 24 January 2014 from http://www.praat.org/

Booij G. (1995). *The Phonology of Dutch*. Oxford: Clarendon Press.

Borgioli M. (2008). *La colpa a d'è d'l vent*. Carrara: Società Editrice Apuana.

Bottiglioni G. (1911). Dalla Magra al Frigido. Saggio fonetico. *Revue de dialectologie romane, III*, pp. 77-143.

Bottiglioni G. (1955). L'Apuania. *Revue de dialectologie romane, 19*, p. 164.

Browman C. & Goldstein L. (1990). Gestural specification using dynamically-defined articulatory structures. *Journal of Phonetics, 18*, pp. 299–320.

Bürki A., Fougeron C., Gendrot C. & Frauenfelder U. H. (2011). Phonetic reduction versus phonological deletion of French schwa: Some methodological issues. In *Journal of Phonetics, 39*, pp. 279-288.

Calabrese A. (2003). On the evolution of the short high vowel of Latin into Romance. In A. Perez-Leroux & Y. Roberge (eds.), *Romance Linguistics. Theory and Acquisition*. Amsterdam: John Benjamins, pp. 63-94.

Campbell L. (1998). *Historical Linguistics*. Edinburgh: Edinburgh University Press.

Canalis C. & Garrapa L. (2012). Stressed vowel duration and stress placement in Italian. What paroxytones and proparoxytones have in common. In I. Franco, S. Lusini & A. Saab (eds.), *Romance Languages and Linguistic Theory 2010: Selected papers from 'Going Romance' Leiden 2010*. Amsterdam: John Benjamins, pp. 87-114.

Caracausi G. (1986). *Lingue in contatto nell'estremo Mezzogiorno d'Italia. Influssi e conflitti fonetici*. Palermo: CSFLS.

Carpitelli E. (1995). Vocalismo pontremolese: alcune osservazioni fonetiche e geolinguistiche. *Mélanges en mémoire de Marco Perron*, *Nouvelles du Centre d'Études Francoprovençales René Willien*, *31*, pp. 77-90.

Carr P. (2000). Scientific realism, sociophonetic variation, and innate endowments in phonology. In N. Roberts, P. Carr & G. Docherty (eds.), *Phonological Knowledge. Conceptual and Empirical Issues*. Oxford: Oxford University Press, pp. 67-14.

Caselli C. (1933[2010]). *Lunigiana ignota*. Sala bolognese: Arnoldo Forni editore.

Castellani A. (2000). *Grammatica storica della lingua italiana*. Bologna: Il Mulino.

Charette M. (1990). Licence to govern. *Phonology, 7*, pp. 233–254.

Chomsky N. & Halle M. (1968). *The Sound Pattern of English*. New York: Harper and Row.

Coco F. (1970). *Il dialetto di Bologna*. Bologna: Forni.

Contini G. (1935). Per il trattamento delle vocali d'uscita in antico lombardo. *L'Italia Dialettale*, *11*, pp. 33-60.

Crosswhite K. (2004). Vowel Reduction. In B. Hayes, R. M. Kirchner & D. Steriade (eds.), *Phonetically Based Phonology*. Pearson Education, pp. 191-231.

Cyran E. (1996). *Licensing Properties of Nuclei and Principle Ranking in Irish*. The Linguistic Review, 13, pp. 1-31

Cyran E. (2005). Sound patterns of Polish: phonotactic paradoxes at the right edge of words. *Studies in Polish Linguistics*, *2*, pp. 61-89.

Cyran E. (2008). Consonant Clusters in Strong and Weak positions. In J. Brandão de Carvalho, T. Scheer & P. Ségéral (eds.), *Lenition and Fortition*. Berlin: Mouton de Gruyter, pp. 447-481.

Cyran E. (2012). Cracow sandhi voicing is neither phonological nor phonetic. It is both phonological and phonetic. In E. Cyran, B. Szymanek & H. Kardela (eds.), *Sound, Structure and Sense. Studies in Memory of Edmund Gussmann*. Lublin: Wydawnictwo KUL, pp. 153-184.

D'Arcy A. (in press). Variation, transmission, incrementation. In P. Honeybone & J. C. Salmons (eds.), *The handbook of historical phonology*. Oxford: Oxford University Press.

Dauer R. M. (1983). Stress-timing and syllable-timing reanalyzed. *Journal of Phonetics, 11*, pp. 51-62.

De Mauro T. (2002). *Storia linguistica dell'Italia unita*, Bari: Laterza.

Dorian N. (1965). *A phonological description of Brora, Golspie, and Embo Gaelic: an East Sutherland dialect*. PhD dissertation, University of Michigan.

Engstrand O. (1987). Preaspiration and the voicing contrast in Lule Sami. *Phonetica*, *44*, pp. 103-116.

Escudero P. & Boersma P. (2003). Modelling the perceptual development of phonological contrasts with Optimality Theory and the Gradual Learning Algorithm. In *Proceedings of the 25th Annual Penn Linguistics Colloquium (Penn Working Papers in Linguistics 8.1)*, pp. 71-85.

Fabricius A. H., Watt D. & Johnson D. E. (2009). A comparison of three speaker-intrinsic vowel formant frequency normalization algorithms for sociophonetics. *Language Variation and Change*, *21*(03), pp. 413-435.

Fadiga L., Craighero L., Buccino G. & Rizzolatti G. (2002). Speech listening specifically modulates the excitability of tongue muscles: A TMS study. *European Journal of Neuroscience, 15*, pp. 399-402.

Fairbanks G. (1950). A physiological correlative of vowel intensity. *Communications Monographs*, *17(4)*, pp. 390-395.

Fanciullo F. (1997). Anticipazioni romanze nel latino pompeiano. *Archivio Glottologico Italiano, 82*, pp. 186–98.

Fanciullo F. (2007). *Introduzione alla linguistica storica*. Bologna: Il mulino.

Fant G. (1968). Analysis and synthesis of speech processes. In B. Malmberg (ed.), *Manual of Phonetics*. Amsterdam: North-Holland Publ. Co., pp. 173-276.

Fedeli U. (2004). *Anarchismo a Carrara e nei paesi del marmo; dall'Internazionale ai moti del 1894*. Carrara: La Cooperativa Tipolitografica

Ferrari Disner S. (1983). Vowel Quality: the Relation Between Universal and Language Specific Factors. *UCLA Working Papers in Phonetics, 58*, pp. 1-27.

Filipponio L. (2012). *La struttura di parola dei dialetti della valle del Reno*. Bologna: Arnaldo Forni Editore.

Flemming E. (1995). *Auditory representations in phonology*. PhD dissertation, UCLA.

Flemming E. (2009). The phonetics of schwa vowels. In D. Minkova (ed.), *Phonological Weakness in English. From Old to Present-Day English.* Basingstoke and New York: Palgrave, pp. 78-95.

Flemming E. & Johnson S. (2007). Rosa's roses: Reduced vowels in American English. *Journal of the International Phonetic Association*, *37(1)*, pp. 83-96.

Flynn N. (2011). Comparing vowel formant normalisation procedures. *York Papers in Linguistics*, *2*(11), pp. 1-28.

Fodor J. (1983). *The modularity of the mind*. Cambridge, Mass.: MIT-Bradford.

Fortson IV W. B. The historical background to Latin within the Indo-European language family. *A companion to the Latin language* (Vol. 82). Oxford: Wiley-Blackwell, pp.: 199-219.

Foulkes P. & Vihman M. (2013). First language acquisition and phonological change. In P. Honeybone & J. C. Salmons (eds.), *Oxford Handbook of Historical Phonology*. Oxford: Oxford University Press.

Fowler C. A. (1986). An event approach to the study of speech perception. *Journal of Phonetics, 14*, pp. 3-24.

Garrett A. & Johnson K. (2013). Phonetic bias in sound change. In A. Yu (Ed.), *Origins of Sound Change: Approaches to Phonologization*. Oxford: Oxford University Press, pp. 51-97.

Gendrot C. & Adda M. (2006). Is there a universal impact of duration on formant frequency values of oral vowels? An automated analysis of speech from eight languages". *Laboratory Phonology, X*.

Giannarelli D. (1913). Studi sui dialetti Lunigianesi compresi fra la Magra e l'Appennino Reggiano. *Revue de dialectologie romane, V*, pp. 261-311.

Goldsmith J. A. (1990). *Autosegmental and metrical phonology*. Oxford: Blackwell.

Greene D. (1952). Middle quantity in Irish. *Ériv, 16*, pp. 212-218.

Gsell O. (1996). Chronologie frühromanischer Sprachwandel. *Lexikon der Romanistischen Linguistik, II, 1*, pp. 557–84.

Hale M. (2000). Marshallese phonology, the phonetics-phonology interface and historical linguistics. *The Linguistic Review, 17*, pp. 241-257.

Hale M. & Kissock M. (2007). The phonetics-phonology interface and the acquisition of perseverant underspecification. In G. Ramchand & C. Reiss (eds.), *The Oxford Handbook of Linguistic Interfaces*. Oxford: Oxford University Press, pp. 81-102.

Hall N. (2006). Cross-linguistic patterns of vowel intrusion. *Phonology, 23*, pp. 387–429.

Hall N. (2011). Vowel epenthesis. In M. van Oostendorp, C. Ewen, E. Hume & K. Rice (eds.), *The Blackwell companion to phonology, Volume III*. Oxford, UK: Wiley-Blackwell, pp. 1576-1596.

Halle M. (1962). Phonology in generative grammar. In *Word, 18*, pp. 54-72.

Hamann S. (2003). *The Phonetics and Phonology of Retroflexes*. Ph.D. dissertation. Utrecht: LOT Press.

Hamann S. (2009). The learner of a perception grammar as a source of sound change. In P. Boersma & S. Hamann (Eds.), *Phonology in Perception*. Berlin: Mouton de Gruyter, pp. 111-149.

Hamann S. (2011). The Phonetics-Phonology Interface. In N. Kula, B. Botma & K. Nasukawa (eds.), *Continuum Companion to Phonology*. London: Continuum, pp. 202-224.

Hamann S. (2014). Phonological change. In C. Bowern & B. Evans (eds.), *Handbook of Historical Linguistics*. Routledge, pp. 249-263.

Harms R. T. (1976). The segmentalization of Finnish 'nonrules'. In *Texas Linguistic Forum, 5 (Papers from the Transatlantic Finnish Conference)*, pp. 73-88.

Harrington J. (2010). *The Phonetic Analysis of Speech Corpora*. Wiley-Blackwell.

Harris J. (1997). Licensing Inheritance: an integrated theory of neutralisation. In *Phonology,* 14, pp. 315-370.

Harris J. (2005). Vowel reduction as information loss. In P. Carr, J. Durand & C. J. Ewen (eds.), *Headhood, elements, specification and contrastivity*. Amsterdam: Benjamins, pp. 119-132.

Harris J. (2011). Deletion. In M. van Oostendorp, C. Ewen, E. Hume & K. Rice (eds.), *The Blackwell companion to phonology, Volume II*. Oxford, UK: Wiley-Blackwell, pp. 1597-1621.

Harris J. & G. Lindsey (1995). The elements of phonological representation. In J. Durand & F. Katamba (eds.), *Frontiers of phonology: atoms, structures, derivations*. Harlow, Essex: Longman, pp. 34-79.

Herman J. (1968). Statistique et diacronie: essai sur l'évolution du vocalisme dans la latinité tardive. In *Word, 24*, pp. 242-251.

Herman J. (1990). *Du latin aux langues romanes. Etudes de linguistique historique*. Tübingen: Niemeyer.

Hinskens F., Hermans B. & Van Oostendorp M. (2014). Grammar or lexicon. Or: Grammar and lexicon? Rule-based and usage-based approaches to phonological variation". *Lingua, 142*, pp. 1-26.

Hulst H. van der (1995). Radical CV Phonology: the categorial gesture. In J. Durand & F. Katamba (eds.). *Frontiers of Phonology: Atoms, Structures, Derivations*. Harlow, Essex: Longman, pp. 80-116.

Hulst H. van der (2005). The molecular structure of phonological segments. In P. Carr, J. Durand & C. Ewen (eds.). *Headhood, Elements, Specification and Contrastivity*. Amsterdam: John Benjamins, pp. 193-234.

Hulst H. van der (2006). Licensing constraints in phonology. *Linguistic review, 23(4)*, pp. 383-427.

Hyman L. M. (2013). Enlarging the scope of phonologization. In A. Yu (Ed.), *Origins of Sound Change: Approaches to Phonologization*. Oxford: Oxford University Press, pp. 3-28.

Jackendoff R. (1993). *The Architecture of the Language Faculty*. Cambridge, Mass.: The MIT Press.

Jakobson R., Fant G. & Halle M. (1952). Preliminaries to speech analysis: the distinctive features and their correlates. *Acoustics Laboratory Technical Report, 13*, MIT, Cambridge, MA.

Jespersen O. (1904). Phonetische Grundfragen. Leipzig and Berlin: Teubner.

Jusczyk P. W. (1997). *The Discovery of Spoken Language*. Cambridge (Massachusetts): MIT Press.

Kager R. (1997). Rhythmic vowel deletion in Optimality Theory. In I. Roca (ed.), *Derivations and Constraints in Phonology*. Oxford: Oxford University Press, pp. 463-499.

Kaye J. (1990). 'Coda' licensing. *Phonology, 7*, pp. 301-330.

Kaye J. (1992). Do you believe in magic? The story of s+C sequences. In *SOAS Working Papers in Linguistics and Phonetics, 2*, pp. 293-313.

Kaye, J. (2000). *A User's Guide to Government Phonology (GP)*, ms..

Kaye J., Lowenstamm J. & Vergnaud J. R. (1985). The internal structure of phonological representations: A theory of charm and government. *Phonology Yearbook, 2*, pp. 305–328.

Kaye J., Lowenstamm J. & Vergnaud J. R. (1990). Constituent structure and government in phonology. *Phonology, 7*, pp. 193–231.

King R. D. (1969). *Historical linguistics and generative grammar*. Englewood Cliffs, NJ: Prentice-Hall.

Kingston J. (2007). The phonetics-phonology interface. In P. De Lacy (ed.), *The Cambridge Handbook of Phonology*. Cambridge: Cambridge University Press, pp. 435-456.

Kiparsky P. (1968). Linguistic universals and linguistic change. In E. Bach & R. Harms (Eds.), *Universals in linguistic theory*. New York: Holt, Rinehart & Winston, 170-202.

Kiparsky P. (1995). The phonological basis of sound change. In J. Goldsmith (ed.), *The handbook of phonological theory*. Oxford: Blackwell, pp. 640-670.

Kirchner R. M. (1998). *An effort-based approach to consonant lenition*. PhD dissertation, UCLA.

Kiss S. (1971). *Les transformations de la structure syllabique en latin tardif.* Debrecen: Kossuth Lajos Tudomanyegyetem.

Kurylowicz J. (1968). The notion of morpho(pho)neme. In W.P. Lehmann & Y. Malkiel (eds.), *Directions for historical linguistics*. Austin: University of Texas Press, pp. 66-81.

Labov W. (2001). *Principles of linguistic change. Volume 2, Social factors*. Oxford: Blackwell.

Ladefoged P. (1975). *A course in phonetics*. New York: Harcourt Brace Jovanovich.

Ladefoged P. (1996). *Elements of acoustic phonetics*. Chicago: University of Chicago Press.

Lausberg H. (1976). *Linguistica romanza*. Milan: Feltrinelli.

Lehiste I. (1970). *Suprasegmentals*. Cambridge, MA: MIT Press.

Lehmann C. (2005). Latin syllable structure in typological perspective. In Calboli, G. (ed.), *Latina lingua! Proceedings of the Twelfth International Colloquium on Latin Linguistics (Bologna, 9-14 June 2003)*. Roma: Herder (Papers on Grammar, 9), pp. 127-147.

Levin J. (1987). Between epenthetic and excrescent vowels. In *Proceedings of the West Coast Conference on Formal Linguistics*, 6, pp. 187-201.

Liberman A. & Mattingly I. (1985). The motor theory of speech perception revised. *Cognition, 21*, pp. 1-36.

Lieberman, P. (1971). *Uniquely human: The evolution of speech, thought, and selfless behavior*. Cambridge, MA: Harvard University Press.

Lindblom B. (1963). Spectrographic study of vowel reduction. *JASA, 35*, pp. 1773-1781.

Lindblom B. (1983). Economy of speech gestures. In MacNeilage (ed.), *The Production of Speech*. Berlin: Springer Verlag, pp. 217-246.

Lindblom B. (1990). Explaining phonetic variation: a sketch of the H&H Theory. In H. J. Hardcastle & A. Marchal (eds.), *Speech production and speech modeling*. Dordrecht: Kluwer, pp. 403-439.

Lloyd James A. (1940). *Speech signals in telephony*. London: Pitman & Sons.

Loporcaro M. (1998). Syllable structure and sonority sequencing: evidence from Emilian. In A. Schwegler, B. Tranel & M. Uribe-Etxebarria (eds.), Romance linguistics: Theoretical perspectives. Amsterdam & Philadelphia: John Benjamins, pp. 155-170

Loporcaro M. (2005). La lunghezza vocalica nell'Italia settentrionale alla luce dei dati del lombardo alpino. In M. Pfister & G. Antonioli (eds.), *Itinerari linguistici alpini. Atti del convegno di dialettologia in onore del prof. Remo Bracchi,* *Bormio, 24-25 settembre 2004*, [Grosio], Istituto di Dialettologia e di Etnografia Valtellinese e Valchiavennasca: LEI, pp. 97-113.

Loporcaro M. (2005–6). I dialetti dell'Appennino tosco-emiliano e il destino delle atone finali nel(l'italo-)romanzo settentrionale. *L'Italia Dialettale, 66–67*, pag. 69-122.

Loporcaro M. (2009). *Profilo linguistico dei dialetti italiani*. Bari: Laterza.

Loporcaro M. (2011a). Syllable, segment and prosody. In M. Maiden, J. C. Smith & A. Ledgeway (eds.), *The Cambridge History of the Romance Languages*, *vol. I.: Structures*. Cambridge: Cambridge University Press, pp. 50-108.

Loporcaro M. (2011b). Phonological processes. In M. Maiden, J. C. Smith & A. Ledgeway (eds.), *The Cambridge History of the Romance Languages*, *vol. I.: Structures*. Cambridge: Cambridge University Press, pp. 109-154.

Loporcaro M. & Bertinetto P. M. (2005). The sound pattern of Standard Italian, as compared with the varieties spoken in Florence. In *Journal of the International Phonetic Association*, 35(2), pag. 131-151.

Luciani L. (1999). *Il dialetto Carrarese. Suoni, forme, costrutti, parole*. Carrara: Aldus.

Luciani L. (2002). *Vocabolario del dialetto Carrarese*. Carrara: Fondazione Cassa di Risparmio di Carrara.

Maffei Bellucci P. (1977). Lunigiana. In M. Cortelazzo (ed.), *Profilo dei Dialetti Italiani, vol. 9/1*. Pisa: Pacini.

Manzini M. R. & Savoia L. M. (2005). *I dialetti italiani e romanci. Morfosintassi generativa*, 3 voll.. Alessandria: Edizioni dell'Orso.

Marotta G. (1985). *Modelli e misure ritmiche*. Bologna: Zanichelli.

Marotta G. (1995). Proposte per l'interpretazione del cambiamento fonologico in area romanza nel segno della non linearità. In G. Ruffino (ed.), *Atti del XXI Congresso Internazionale di Linguistica e Filologia Romanza, Palermo, 18-24 settembre 1995, vol. I, Grammatica storica delle lingue romanze*. Tübingen: Niemeyer, pp. 439-454.

Marotta G. (1999). The Latin syllable. In H. van der Hulst & N.A. Ritter (eds.), *The Syllable: Views and Facts*. Berlin-New York: Mouton de Gruyter, pp. 285-310.

Marotta G. (2006a). An OT Account of Tuscan Spirantization. *Lingue e Linguaggio*, *V*, pp. 157-184.

Marotta G. (2006b). L'algoritmo accentuale latino nel confronto di due teorie fonologiche. In R. Oniga & L. Zennaro (eds.), *Atti della Giornata di Linguistica Latina, Venezia, 7 maggio 2004*. Venezia: Libreria Editrice Cafoscarina, pp. 133-158.

Marotta G. (in press). Prosodic Structure. In M. Maiden & A. Ledgeway (eds.), *Oxford Guide to Romance Languages*, Oxford: Oxford University Press.

Martinet A. (1956). *La description phonologique avec application au parler franco-provençal d'Hauteville (Savoie)*. Geneva and Paris: Droz and Minard.

Matte E.J. (1982). *Histoire des modes phonétiques du français*. Geneva: Droz.

McCarthy J. & Prince A. (1993) Generalized alignment. *Yearbook of Morphology*, pp. 79-153.

McCarthy J. & Prince A. (1994). The emergence of the unmarked: optimality in Prosodic Morphology. *Proceedings of the North East Linguistic Society, 24*, pp. 333-379.

Menéndez Pidal R. (1968). *Manual de gramática histórica española*. Madrid: Espasa Calpe.

Merlo C. (1956a). Liguri o Mediterranei i moderni Apuani? *L'Italia dialettale, 20*, p. 86.

Merlo C. (1956b). Chiara risposta a un ingrato. *L'Italia dialettale, 21*, pp. 196-199.

Michelotti S. (2005). *Al mal d'Puntremal*. Pontremoli: Artigianelli.

Montgomery M. (1999). Eighteenth-Century Sierra Leone English: Another Exported Variety of African American English. In *English World-Wide, 20.1*, pp. 1-34.

Montreuil J. P. (1991). Length in Milanese. In D. Wanner & D. Kibbee (eds.), *New Analyses in Romance Linguistics*. Amsterdam-Philadelphia: Benjamins, pp. 37-47.

Morin Y. (2006). On the phonetics of rhymes in Classical and Pre-classical French: a sociolinguistic perspective. In R. Gess & D. Arteaga (eds.), *Historical Romance Lingusitics. Retrospective and Perspectives*. Amsterdam-Philadelphia: Benjamins, pp. 131-62.

Nam H., Goldstein L. & Saltzman E. (2009). Self-organization of syllable structure: A coupled oscillator model. In F. Pellegrino, E. Marsico & I. Chitoran (eds.), *Approaches to phonological complexity*. Berlin and Boston: De Gruyter Mouton, pp. 299-328.

Nasukawa K. & Backley P. (2012). Prosody controls melody. In *Phonological Studies, 15*, pp. 11-18.

Nevins A. & Vaux B. (2003). Metalinguistic, Shmetalinguistic: the phonology of Shm-reduplication. In *The Proceedings of the 39th Chicago Linguistics Society*, pp. 702-721.

Nespor M. (1990). On the rhythm parameter in phonology. In I. Roca (ed.), *The logical problem of language acquisition*. Dordrecht: Foris, pp. 157-175.

Odden D. (1986). On the role of the Obligatory Contour Principle in phonological theory. *Language, 62*, pp. 353-383.

Odden D. (2011). The Representation of Vowel Length. In M. van Oostendorp, C. Ewen, E. Hume & K. Rice (eds.), *The Blackwell companion to phonology, Volume I*. Oxford, UK: Wiley-Blackwell, pp. 465-490.

Ohala J. (1981). The listener as a source of sound change. In *Proceedings of the Chicago Linguistics Society, 17*, pp. 178-203.

Ohala J. (1993). The phonetics of sound change. In C. Jones (ed.), *Historical linguistics: Problems and perspectives*. London: Longman, pp. 237-278.

Ohala J. (1995). The perceptual basis of some sound patterns. In B. A. Connell & A. Arvaniti (eds.), *Phonology and phonetic evidence: Papers in Laboratory Phonology IV*, pp. 87-92.

Ohala J. & Greenlee M. (1980). Phonetically motivated parallels between child phonology and historical sound change. In *Language Sciences, 2*, pp. 283-308.

Olson K. (2003). *Word minimality and non-surface-apparent opacity in Mono*. Talk given at WOCAL 4, Rutgers University.

Van Oostendorp M. (1995). *Vowel quality and syllable projection*. Ph.D. dissertation, University of Tilburg.

Van Oostendorp M. (2005). *A theory of morphosyntactic colours*.

Van Oostendorp M. (2007). Derived environment effects and consistency of exponence. In: S. Blaho, P. Bye & M. Krämer (eds.), *Freedom of Analysis?* Berlin/New York: Mouton de Gruyter, pp. 123-148.

Parker S. (2011). Sonority. In M. van Oostendorp, C. Ewen, E. Hume & K. Rice (eds.), *The Blackwell companion to phonology, Volume II*. Oxford, UK: Wiley-Blackwell, pp. 1160-84.

Pasolini P. P. (1973). Sfida ai dirigenti della televisione. *Corriere delle Sera* (9 December 1973).

Passino D. (2013). A place in the lexicon for the epenthetic vowels of the Emilian dialects". *Lingue e linguaggio, XILI*, pp. 5-30.

Paul H. (1880). *Principien der Sprachgeschichte*. Max Niemeyer.

Pearce M. (2004). *Kera foot structure*. Ms., University College London.

Pellegrini G. (1977). *La Carta dei Dialetti d'Italia*. Pisa: Pacini editore.

Pellegrini G. (1992). Il 'Cisalpino' e l'italo-romanzo. *Archivio Glottologico Italiano, 77*, pp. 272-296.

Pensado Ruiz, C. (1984). *Cronología relativa del castellano*. Salamanca: Universidad de Salamanca.

Pike K. L. (1945). *The intonation of American English*. Ann Arbor: University of Michigan Press.

Pistarino, G. (1986). La Lunigiana storica. *Memorie dell'Accademia Lunigianese di Scienze e Lettere 'G. Cappellini', LIV-LIV*, pp.3-22.

Pluymaekers M., Ernestus M. & Baayen R. H. (2005). Articulatory planning is continuous and sensitive to informational redundancy. *Phonetica, 62*, pp. 146-159.

Pöchtrager M. (2006). The Structure of Length. Vienna. PhD dissertation, University of Vienna.

Politzer F. R. & Politzer R. (1953). *Romance Trends in 7th and 8th Century Latin Documents*. Chapel Hill: The University of Carolina Press.

Polgardi C. (1999). Constraint ranking, Government Licensing and the fate of final empty nuclei. In J. Rennison & K. Kühnhammer (eds.). *Phonologica 1996. Syllables!?* The Hague: Holland Academic Graphics, pp. 167-82.

Polgardi C. (2006). *Vowel Harmony. An Account in Terms of Government and Optimality*. Utrecht: LOT Press. Reprint: electronic publication on the web site of LOT (the Netherlands Graduate School of Linguistics / Landelijke Onderzoekschool Taalwetenschap).

Pouplier M. & Beňuš Š. (2011). On the phonetic status of syllabic consonants: Evidence from Slovak. *Laboratory phonology*, *2(2)*, pp. 243-273.

Prieto P. (2000). Vowel lengthening in Milanese. In L. Repetti (ed.), *Phonological Theory and the Dialects of Italy*. Amsterdam-Philadelphia: Benjamins, pp. 255-72.

Prince A. & Smolensky P. (1993). *Optimality Theory: Constraint Interaction in Generative Grammar*. Malden: Blackwell.

Pulgram E. (1975). *Latin-Romance Phonology: Prosodics and Metrics*. München: Fink.

Ramus F., Nespor M. & Mehler J. (1999). Correlates of linguistic rhythm in the speech signal. *Cognition, 73*, pp. 265-292.

Recasens D. (2014). *Coarticulation and Sound Change in Romance*. Amsterdam: John Benjamins.

Repetti L. (1992). Vowel length in northern Italian dialects. *Probus, 4*, pp. 155-82.

Repetti L. (1995), Variazione nella sillabificazione: il caso dei dialetti emiliani e romagnoli. *Rivista Italiana di Dialettologia, 19*, pp. 41-56.

Restori A. (1892). *Note fonetiche sui parlari dell'alta valle di Magra*. Livorno: Vigo.

Revithiadou A. (2007). Colored turbid accents and Containment: A case study from lexical stress. In: S. Blaho, P. Bye & M. Krämer (eds.), *Freedom of Analysis?* Berlin/New York: Mouton de Gruyter, pp. 149-174.

Rohlfs G. (1937). *La struttura linguistica dell'Italia*. Leipzig: Keller.

Rohlfs G. (1966). *Grammatica storica della lingua italiana e dei suoi dialetti. Fonetica*. Turin: Einaudi.

Romano A. (2013). A preliminary contribution to the study of phonetic variation of /r/ in Italian and Italo-Romance. In Spreafico L. & Vietti A. (eds.), *Rhotics. New data and perspectives*. Bozen: BU Press, pp. 209-226.

Rowicka G. (1999). *On ghost vowels. A strict CV approach*. The Hague: Holland Academic Graphics.

Savoia L. (1980). Fonologia delle varietà apuane e garfagnine: consonantismo. *Studi Urbinati di Storia, Filosofia e Letteratura, 2/2*, pp. 233-293.

Saussure F. de (1916). *Cours de linguistique générale*. Edited by C. Bally, A. Sechehaye & A. Riedlinger (eds), Paris: Payot & C^ie^.

Savoia L. M. (1983). La trascrizione fonetica delle varietà lunigianesi. Appunti storici e metodologici. *Quaderni dell'Istituto di Linguistica dell'Università di Urbino, 1*, pp. 155-177.

Savu C. (2013). Another look at the structure of /r/ constricted intervals and vocalic elements. In Spreafico L. & Vietti A. (eds.), *Rhotics. New data and perspectives*. Bozen: BU Press, pp. 145-158.

Sampson R. (2010). *Vowel Prosthesis in Romance. A Diachronic Study*. Oxford: Oxford University Press.

Scheer T. 2004. *A lateral theory of phonology. Vol 1: What is CVCV, and why should it be?* Berlin: Mouton de Gruyter.

Scheer T. (2012). Variation is in the lexicon: yer-based and epenthetic vowel-zero alternations in Polish. In E. Cyran, B. Szymanek & H. Kardela (eds.). *Sound, Structure and Sense. Studies in Memory of Edmund Gussmann*. Lublin: Wydawnictwo KUL, pp. 631-672

Scheer T. (2014). Spell-out, post-phonological. Handout for the *Workshop on the relationship between phonetics and phonology, OCP-11 Leiden, 22-25 January 2014*.

Scheer T. (to appear). Crazy rules, regularity and naturalness. In J. Salmons & P. Honeybone (eds.), *The Handbook of Historical Phonology*. Oxford: Oxford University Press.

Scheer T. (to appear b). Optimality Theory (in phonology). In P. Karlík & M. Nekula (eds.), *Encyklopedický slovník ceštiny (Encyclopaedic dictionary of the Czech language)*.

Scheer, Tobias (in press). What final empty Nuclei are good for. In J. Rennison (ed.), *Phonologica 2002*. Mouton de Gruyter.

Schmid S. (1998). Tipi sillabici nei dialetti dell'Italia settentrionale. In G. Ruffino (ed.), *Atti del XXI Congresso Internazionale di Linguistica e Filologia Romanza. Vol. 5. Dialettologia, geolinguistica, sociolinguistica.* Tübingen: Niemeyer, pp. 613-625.

Schmid S. (2012). Phonological typology, rhythm types and the phonetics-phonology interface. A methodological overview and three case studies on Italo-Romance dialects. In A. Ender A., A. Leemann & B. Wälchli (eds.), *Methods in contemporary linguistics. A Festschrift in honour of Iwar Werlen*. Berlin/New York: Mouton de Gruyter, pp. 45-68.

Schmid S. (to appear). Segmental Phonology. In M. Maiden & A. Ledgeway (eds.), *Oxford Guide to Romance Languages*, Oxford: Oxford University Press.

Schmidt J. (1872). *Die Verwantschaftsverhältnisse der Indogermanischen Sprachen*. Weimar: Böhlau.

Schürr F. (1970). *La Diphthongaison romane*. Tübingen: Narr.

Scott D. R. (1982). Duration as a cue to the perception of a phrase boundary. *The Journal of the Acoustical Society of America, 71(4)*, pp. 996-1007.

Sievers E. (1881). *Grundzüge der Phonetik*. Leipzig: Breitkopf und Hartel.

Silverman D. (2011). Schwa. In M. van Oostendorp, C. Ewen, E. Hume & K. Rice (eds.), *The Blackwell companion to phonology, Volume I.* Oxford, UK: Wiley-Blackwell, pp. 628-642.

Schane S. (1984). The fundamentals of particle phonology. *Phonology Yearbook, 1*, pp. 129-155.

Sloos M. & Van Oostendorp M. (2012). "The relationship between phonological and geographic distance. Umlaut on the diminutive in Dutch dialects". *Taal en tongval*, *62*, pp. 204-250.

Smolensky P. (1996). On the comprehension/production dilemma in child language. *Linguistic Inquiry, 27*, pp. 720-731.

Stevens K. N. & House A. S. (1955). Development of a Quantitative Description of Vowel Articulation. *The Journal of the Acoustical Society of America, 27*, pp. 484-493.

Stevens K. N. (2000). *Acoustic phonetics* (Vol. 30). Cambridge, MA: MIT press.

Stieber Z. (1955). Na marginesie dyskusji fonologicznej [On the margin of phonological discussion]. *Rozprawy Komisji Językowej Łódzkiego Towarzystwa Naukowego*, 2, pp. 73-74.

Stuart-Smith J., Pryce G., Timmins C., & Gunter B. (2013). Television can also be a factor in language change: Evidence from an urban dialect. *Language*, *89*(3), pp. 501-536.

Thomas E. R. & Kendall T. (2007). *NORM: The Vowel Normalisation and Plotting Suite*. Online Resource. URL: http://ncslaap.lib.ncsu.edu/tools/norm.

Trouvain J. & Gut U. (2007). *Non-native prosody. Phonetic description and teaching practice. Berlin: Mouton de Gruyter*.

Trudgill P. (1992). Dialect typology and social structure. In E. H. Jahr (ed.), *Language contact: theoretical and empirical studies*. Berlin: Mouton de Gruyter, pp.195-212.

Tuttle E. F. (1991). Nasalization in Northern Italy: Syllabic constraints and strength scales as developmental parameters. *Rivista di linguistica*, *3(1)*, pp. 23-92.

Väänänen V. (1963). *Introduction au latin vulgaire*. Paris: Klincksieck.

Vallée N. (1994). *Systèmes vocaliques: de la typologie aux prédictions*. PhD dissertation, Université de Grenoble.

Veer M. van 't (2015). *Building a phonological inventory. Feature Co-occurrence Constraints in acquisition*. Ph.D. Dissertation, Leiden University. Utrecht: LOT Press.

Vineis E. (1984). Problemi di ricostruzione della fonologia del latino volgare. In E. Vineis (ed.), *Latino volgare, latino medievale, lingue romanze. Atti del Convegnio della Società Italiana di Glottologia*. Pisa: Giardini, pp. 45-62.

Vineis E. (1997). Latino. In A. Giacalone Ramat & P. Ramat (eds.), *Le lingue indoeuropee*. Bologna: Il Mulino, pp. 289-348.

Warner N. (2011). Reduction. In M. van Oostendorp, C. Ewen, E. Hume & K. Rice (eds.), *The Blackwell companion to phonology, Volume III*. Oxford, UK: Wiley-Blackwell, pp. 1866-1891.

Wartburg W. von (1950). *Die Ausgliederung der romanischen Sprachräume*. Bern: Francke.

Weiss M. L. (2009). *Outline of historical and comparative grammar of Latin*. Ann Arbor: Beech Stave Press.

Wilkinson L. (2009). *SYSTAT for Windows: statistics, graphics, data, getting started, version 13*.

Wolfram W. (2002). Language death and dying. In J. K. Chambers & N. Schilling-Estes (Eds.), *The handbook of language variation and change*. Oxford, U.K. and Malden, Massachusetts: Blackwell, pp. 764-787.

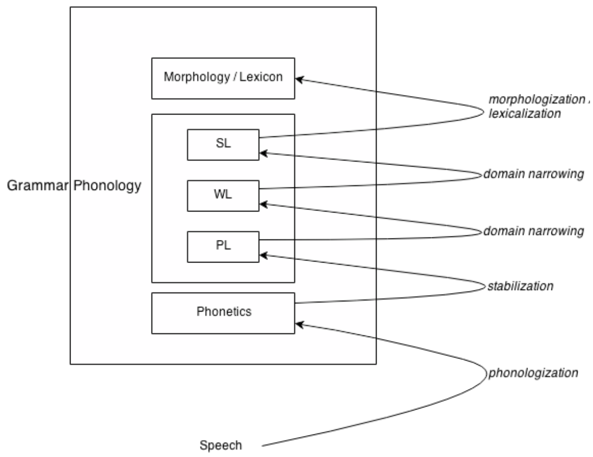
Wolfram W. & Schilling-Estes N. (2003). Dialectology and Linguistic Diffusion. In B. D. Joseph & R. D. Janda (Eds.), *The handbook of historical linguistics*. Malden, MA: Blackwell, pp. 713-735.

Samenvatting

Zoals voorspeld in de *Wellentheorie* (Schuchardt 1868-1870; Schmidt 1872), bestaat er een correlatie tussen het verschil in tijd en ruimte en het verschil in 'mate van voltooiing' van een bepaalde verandering: hoe verder verwijderd van het centrum, hoe later de taal wordt bereikt door zo'n verandering, en hoe milder de effecten ervan. Dit soort generalisaties kan worden gebruikt om inzicht te verkrijgen in de grammaticale status van generalisaties over de klanksystemen van nauw verwante talen, en, uiteindelijk, in de architectuur van de (fonologische) grammatica. Bovendien kunnen we onze begrip van fonologisatie (de manier waarop een fysiek object, dat wil zeggen, een klank, opgenomen wordt in het systeem van symbolische kennis van de spreker) verdiepen.

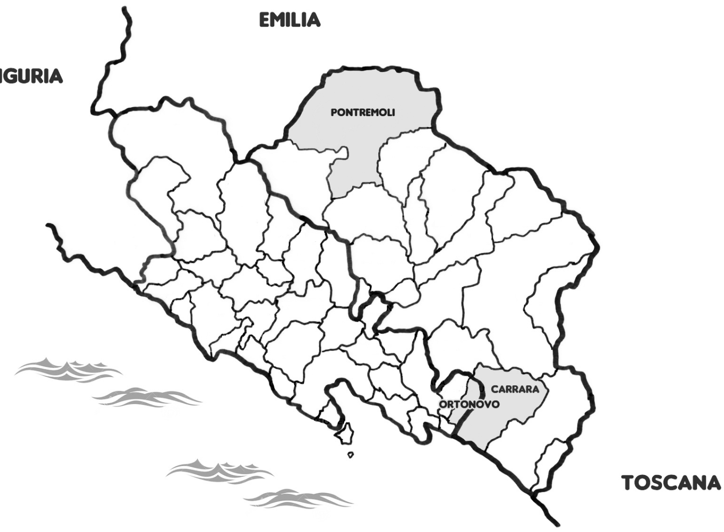
In deze dissertatie probeerden we dan ook aan te tonen dat een proces dat "in eerste instantie bepaald is door buitengrammaticale factoren (fysisch en fysioligisch) steeds verder opgenomen wordt in de grammatica [Fig. S.1] van een taal" (Bermúdez-Otero in druk).

Fig. S.1 De levenscyclus van fonologische processen (Bermúdez-Otero & Trousdale 2012:700)



Om een bijdrage te leveren aan het begrip van de hierbovengenoemde zaken analyseren we de distributie en de fonetisch/fonologische eigenschappen van de reductie van onbeklemtoonde klinkers (syncopie en apocopie) en niet-etymologische klinkerinvoeging (intrusie en epenthese) in twee dialecten die gesproken worden in Lunigiana [Fig. S.2]: Carrarese (paragraaf 2.3) en Pontremolese (paragraaf 2.2).

Fig. S.2 Politieke en taalkundige grenzen van Lunigiana



Door middel van deze analyse dragen we argumenten aan voor de hypothese dat Carrarese en Pontremolese twee bevroren stadia vertegenwoordigen in de verspreiding van deze processen (hoofdstukken 5 en 7), waarbij Carrarese in een diachroon stadium verkeert waar Pontremolese reeds voorbij is.

Deze diachrone relatie wordt voornamelijk ondersteund door het insertieproces van de niet-etymologische klinker. We argumenteren dat dit proces in eerste instantie tautosyllabische consonantclusters opbreekt in het dialect dat eerst syncopie en apocopie onderging (Pontremolese). Naarmate de verandering 'ouder' wordt, wordt de fonetische kwaliteit van deze schwa-achtige klinkerachtige versterkt (door verlenging en a/u-kleuring). Uiteindelijk zal dit leiden tot het opnemen van de klank als fonologisch segment in de klinkerinventaris van het Pontremolese. Met andere woorden, de intrusieve klinkerachtige zou gefonologiseerd kunnen zijn, en op deze manier onderdeel zijn geworden van de grammatica (paragraaf 7.4). De klinkerachtige die in Carrarese (de meer perifere variant) voorkomt heeft tegenwoordig fonetische eigenschappen waarvan beargumenteerd kan worden dat de Pontremolese variant ze had vóór fonologisatie (paragraaf 7.3).

Om deze hypothese te toetsen hebben we akoestische en statistische eigenschappen van de niet-etymologsische klinkerachtigen in beide dialecten verzameld en geanalyseerd (hoofdstuk 5). De analyse toont aan dat de Carrarese en Pontremolese klinkerachtigen verschillen op zowel akoestisch als distributioneel gebied: daar waar de Pontremolese variant akoestische gelijkheid vertoond met de lexicale *a* en *u* (paragrafen 2.2.2 en 5.3.2), lijkt de Carrarese klinkerachtige meer op schwa, een klank die niet in de Carrarese klinkerinventaris voorkomt (paragrafen 2.3.2 en 5.3.1). Bovendien produceren sprekers van Pontremolese de klank systematisch wanneer door syncopie en apocopie clusters van stijgende sonorantie ontstaan (paragraaf 5.3.2), terwijl sprekers van het Carrarese meer 'tolerantie' voor dit soort medeklinkerclusters ten toon spreiden. De Carrarese klinkerachtige ontbeert de systematiek en categoriciteit die de Pontremolese klinkerachtige karakteriseren (paragraaf 5.3.1). Met andere woorden, daar waar de Pontremolese niet-etymologische klinkerachtige fonetische en fonologische eigenschappen van epenthetische klinkers laat zien (Hall 2006; paragraaf 1.2), kunnen we de Carrarese variant het beste zien als een articulatorisch of perceptueel gemotiveerde klinkerachtige 'release', die optioneel en gradueel versterkt kan worden, omwile van fonosyntactische, spreeksnelheidgerelateerde of emfatische redenen. De Carrarese klinkerachtige valt dus buiten de fonologische competentie van de sprekers van het dialect.

Vanuit een formeel perspectief kunnen we de epenthese in Pontremolese omschrijven als synchroon geactiveerd om een medeklinkercluster met een dalend sonorantieprofiel te 'repareren'. Een alternatieve analyse is dat dit proces gerelateerd is aan de 'licensing'-sterkte van de woord-finale nucleuspositie (paragraaf 7.4). Dit alternatief rust op de hypothese dat door klinkerreductie van onbeklemtoonde klinkers gaandeweg melodisch materiaal verdwijnt uit prosodisch zwakke posities, terwijl de prosodische posities zelf blijven bestaan in de betreffende fonologische vormen. Dit betekent dat we uitgaan van het bestaan van melodisch lege nuclei die bovendien een 'government'-relatie onderhouden met naastgelegen prosodische posities. Met andere woorden, we gaan uit van representaties zoals we die kennen in Government Phonology (GP; Kaye, et al. 1985, 1990; Charette, 1990; Harris, 1997; Kaye, 2000; van der Hulst, 2006), waarbij hier laterale krachten vertaald zijn naar schendbare constraints (paragraafen 6.2.3 en 6.3.1.1.2).

Ingebed in dit theoretisch kader beargumenteren we dat wanneer woordfinale nuclei reductie ondergaan, en dus ontdaan worden van (etymologische) melodische inhoud, de sterkte van hun 'government' steeds verder verminderd wordt: hoe langer ze van hun melodische inhoud ontdaan zijn, hoe minder sterk (in laterale zin) ze zijn.

Dit blijkt inderdaad het geval te zijn voor Pontremolese, dat reductie van onbeklemtoonde klinkers onderging voordat dat gebeurde in Carrarese. Het gevolg hiervan is dat de finale lege nucleus al langer melodieloos is dan in Carrarese, waardoor een deel van de licentiekracht verloren is gegaan. In paragraaf 7.4 laten we zien dat de finale lege nucleus in Pontremolese inderdaad in staat is om Licentie aan te gaan (Lic: *capØ* 'hoofd'), en ook Direct Government Licensing (DGLic: *curpØ* 'staking') en Proper Government (PGvt: *sarvadØgØ* 'wild'), maar dat dit niet meer geldt voor Indirect Government Licensing. Woordfinale complexe onsets worden dus gerepareerd door middel van epenthese: (**magrØ* > *magarØ* 'dun'). Dit verval heeft (nog?) niet plaatsgevonden in Carrarese, waar de woordfinale lege nucleus nog steeds dezelfde (etymologische) licentiekracht heeft, en waar dus woordfinale complexe onsets welgevormd zijn (*magrØ* 'dun').

Een ander aspect van de fonologische analyse dat het waard is benoemd te worden betreft de architectuur van de (fonologische) grammatica, en meer in het bijzonder, de fonologie-fonetiek interface.

In paragraaf 7.1 bespreken we hoe de processen die we in deze dissertatie onder de loep nemen beginnen in de fonetische module, en als zodanig alleen gevoelig zijn voor fonetische informatie. Reductie van onbeklemtoonde klinkers begint zijn 'levenscyclus' als een puur fonetisch proces ('undershoot', paragrafen 3.1.2, 3.2.1 en 7.2), met alleen indirecte toegang tot de prosodische structuur van de fonologische vorm die de reductie ondergaat. Op vergelijkbare wijze beargumenteren we dat klinkerinsertie begint als een articulatorisch gedreven proces (klinkerintrusie, paragraaf 7.3).

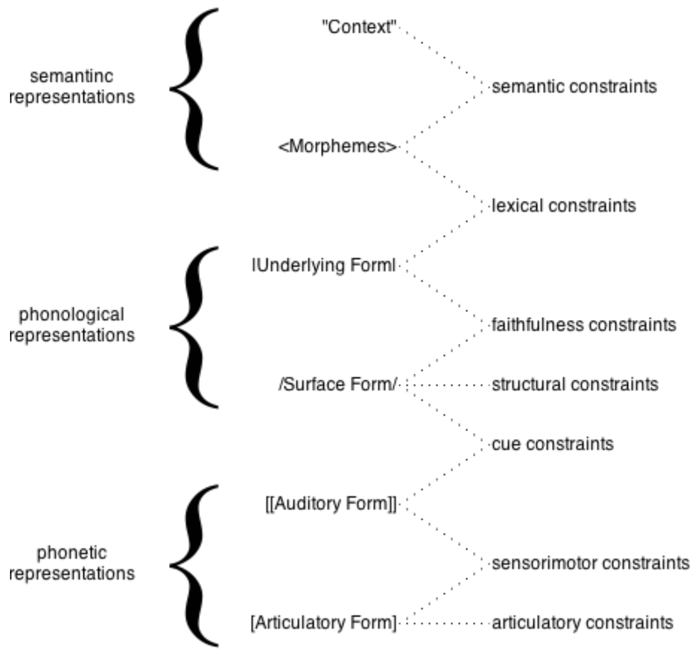
De akoestische output van deze processen kan echter door leerders worden geïnterpreteerd als zijnde onder fonologische controle. Wanneer dit gebeurt komt het proces in de fonologische module en zet zijn opwaartse levenscyclus voort (Fig. S.1). Een formele rekening van deze (diachrone) graduele processen wordt gegeven, die bestaat uit een opvolging van perceptie-/productiegrammatica's die op hun beurt bepalen hoe articulatorisch gemotiveerede processen (undershoot, overshoot, coarticulatie) als zijnde fonologisch gereïnterpreteerd worden door de leerder (als hypoarticulatie, klinkerinsertie, of assimilatie; paragrafen 6.3 en 7.2).

De mogelijkheid dat een gegeven proces overgaat van de fonetiek naar de fonologie, en het gegeven dat zo'n proces in de verschillende stadia verschillende eigenschappen tentoonspreidt, onderschrijft de hypothese dat de architectuur van de grammatica modulair is. Onder deze hypothese zijn fonologie en fonetiek twee afzonderlijke en autonome modules, elk met een eigen vocabulair (Scheer 2014). In paragrafen 6.1 en 6.2.2 bespreken we dat het grensvlak tussen deze twee modules bepaald wordt door een verzameling van schendbare 'cue constraints' die een akoestische structuur op een fonologisch object projecteren. Preciezer gezegd projecteren ze fysieke akoestische dimensies zoals duur en formantstructuren (dat wil zeggen, objecten die thuishoren in het 'fonetisch vocabulair') op abstracte fonologische primitieve eenheden zoals elementen en lengte (objecten die in het fonologisch vocabulair thuishoren).

Zoals hierboven al enigszins aangegeven speelt perceptie een centrale rol (Ohala 1981; Blevins 2004; Bermúdez-Otero 2007; Boersma 2009; Hamann 2009; Garrett & Johnson 2013; Bermúdez-Otero in druk). De overgang van fonetiek naar fonologie vindt plaats waneer een luisteraar een fonetisch obect op een andere fonologische categorie projecteert dan op de categorie die door de spreker bedoeld werd (Hamann 2009). Tegelijkertijd is productie minstens even relevant, aangezien de perceptueel gedreven reïnterpretatieprocessen die de besproken fonologische veranderingen tot stand brengen gevoed worden door de uikomst van artikulatorisch gemotiveerde processen. De verzameling van grammatica's die rekenschap geven voor deze diachrone veranderingen (en, uiteindelijk, voor fonologisatie) moeten daarom de relevantie van zowel productie als perceptie formaliseren.

Het benodigde formalisme wordt geleend van het 'Bidirectional Phonetics and Phonology'-model (BiPhon; Boersma 2007, 2009, 2011; Hamann 2009, 2011). De architectuur van dit model wordt weergegeven in Fig. S.3. Binnen dit model wordt zowel productie als perceptie beschreven en verklaard door één en dezelfde grammatica, in de vorm van Optimaliteitstheorie (paragraaf 6.1).

Fig. S.3 BiPhon grammatica (Boersma 2011)



Dit model bevat een interface tussen fonetiek en fonologie waarin, zoals we eerder al bespraken, fonologische objecten direct geprojecteerd worden op akoestische correlaten door middel van een verzameling cue constraints. De ‘gepriviligeerde’ status van akoestiek ondersteunt een manier van subsegmentele representatie waarin primitieve eenheden worden weergegeven als elementen (paragraaf 6.3.1.1.1). Volgens de standaardversie van Elemententheorie (ET, Backley 2011) bestaat de fonologische relevante fonetische informatie uit de formantstructuren, die gedurende de fase van de fonologische verwerving ‘vertaald’ worden naar de relevante elementen. Voorts is dit representationele systeem zeer goed verenigbaar met het theoretische kader dat we aannamen voor suprasegmentele fonologische structuren, namelijk Government Phonology. De laterale relaties tussen prosodische knopen kunnen direct vertaald worden naar de mate waarin die knopen in staat zijn om elementaire structuren te licenseren. Deze ‘licensing ability’ wordt in dit proefschrift gedefinieerd door middel van structurele constraints (paragraaf 6.2.3; Harris 1997; van der Hulst 2006).

Er is nog een aspect van de huidige analyse dat het verdiend genoemd te worden. De fonologisatieprocessen die we behandeld hebben lijken gevoelig te zijn voor de morfologische informatie die opgesloten is in de onderliggende en/of lexicale vormen. Apocopie, bijvoorbeeld, raakt alle woordfinale onbeklemtoonde klinkers, behalve wanneer die klinkers de fonologische exponent zijn van de morfemen SG.FEM, PL.MASC en in het Carrarese ook PL.FEM: *-a*, *-i* en *–e* respectievelijk (paragrafen 2.2.2 en 2.3.2). In paragraaf 7.2 wordt dit verklaard doordat de structurele constraint die verantwoordelijk is voor het ontkoppelen van elementen in prosodisch zwakke nuclei hoger geordend is dan de constraint die verantwoordelijk is voor de fonetische interpretatie van de fonologische elementen die SG.MASC uitdrukken. De ontkoppelingsconstraint is daarentegen niet hoog genoeg geordend om ontkoppeling van onbeklemtoonde nuclei te forceren wanneer die nuclei de uitdrukking zijn van SG.FEM, PL.MASC en, in Carrarese, PL.FEM (Tab. 7.26).

Op vergelijkbare wijze wordt gedemonstreerd dat de projectie van de intrusieve schwa-achtige klinker op een vocalisch element (en, uiteindelijk, op een nucleaire positie) geblokkeerd wordt door de ordening van een structurele constraint, welke een ban legt op de integratie in de fonologische representate van een morfologisch transparante nucleus (*N) boven de relevante cue constraints (|A| [[ə Hz]] en |X| [[x ms]]). In paragraaf 7.3 wordt inderdaad aangetoond dat wanneer de release van *muta* geintegreerd word met de intrinsiek vocalische structuur van *liquida* (en als gevolg daarvan, een langere op schwa gelijkende klinkerachtige ontstaat in de auditieve vorm waaraan de luisteraar bloot staat) de hoog geordende *N voorkomt dat deze periodische structuur op het |A|-element geprojecteerd wordt.

Om morfologische informatie te integreren in ons fonologische model maken we gebruik van een verzameling fonologische herstelbaarheidsconstraints (EXPRESS-[F]; Van Oostendorp 2005; paragraaf 6.2.4), die ageren tegen de onderparsering (of ontkoppeling) van de fonologische exponent van een morfologische eenheid in de fonologische oppervlakterepresentatie. Bovendien stellen deze constraints ons in staat om te werken zonder constraints die een relatie tussen de fonologische onderliggende en oppervlakte representative uitdrukken (zgn. faithfulness constraints): herstelbaarheidsconstraints zijn slechts gevoelig voor de welgevormdheid van fonologische oppervlakterepresentaties – dat wil zeggen, voor de aanwezigheid van lexicaal gedefinieerde morfologische exponenten/'kleuren'.

Het is interessant om op te merken dat terwijl cue constraints de interface tussen fonetiek en fonologie reguleren, hetzelfde gezegd kan worden van herstelbaarheidsconstraints met betrekking op de interface tussen fonologie en morfologie: de morfologische 'kleur' van fonologische objecten signaleren inderdaad de morfologische structuren waarin deze fonologische objecten voorkomen (Revithiadou 2007).

Concluderend kunnen we stellen dat, zoals reeds aangegeven in hoofdstuk 1, de formele uiteenzetting van fonologisatie en diatopische/-chrone variatie die in dit proefschrift voorgesteld wordt, primair gezien moet worden als een poging om "de kleinste verschillen tussen dialecten terug te brengen tot manifestaties van universele principes die ten grondslag liggen aan de organisatie van taalsystemen (Hinskens, Hermans & Van Oostendorp 2014: 2).

Curriculum Vitae

Edoardo Cavirani was born on April 9, 1983 in La Spezia, Italy. He began studying Russian and Arabic language and literature, and general linguistics in 2002 at the University of Pisa, Italy. He obtained his Bachelor's degree in 2006 with a dissertation on Russian pupulism. Right after that, he started a Master's degree in historical and comparative linguistics. Beside historical and comparative linguistics, though, he studied computational and theoretical linguistics. He obtained his Master's degree with distinction in 2010 at the University of Pisa with a dissertation entitled "Il vincolo nella fonologia generativa" ["The Constraint in Generative Phonology"]. From 2011 till 2014 he carried out his PhD project at both the University of Pisa and the Leiden University Center for Linguistics (LUCL). This has been made possible by a Joint Supervision agreement. Furthermore, from April to October 2014 he carried out his research in the Meertens Instituut, Royal Netherlands Academy of Arts and Sciences (KNAW), as a visiting researcher. The present dissertation is the result of the work he did in the University of Pisa, the Leiden University Center for Linguistics (LUCL) and the Meertens Instituut (KNAW) for this PhD project.