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Italian Roots in Australian Soil:

Dynamics of contact and cross-linguistic phonetic influence
in first-generation heritage speakers

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Introduction

This research aims to give a significant contribution to the literature and data on speech features exhibited by multilingual immigrant speakers. We note in fact that: on the one hand, little attention has been given so far to phonetic and phonological variation among late consecutive bilinguals (De Leeuw, 2008), and even less to late consecutive trilinguals (Cabrelli Amaro, 2017); on the other hand, there is still scarceness in corpus collection and speech analysis methods specific for contact situations and immigrant settings. Hence, it has been observed that possibilities to further theoretical developments could be limited (Nagy, 2011, 2015). It follows that there is an overall need to increase comparability across studies of different multilingual communities, so as to gain greater understanding of contact-induced native language change.

Specifically, the analysis of micro-structure phonetic/phonological features of Italian immigrants in Australia has been somehow neglected, as the majority of studies concerns phenomena of attrition and shift in morphology, lexicon, syntax and pragmatics (see e.g. Bettoni, 1981; 1985a; 1985b; Bettoni & Rubino, 1996; Caruso, 2010; Rubino, 2014, among others). For this reason, this work mainly tries to provide an innovative contribution to this field of research, by taking into consideration Veneto immigrants' L1 speech features in contact with Australian English, and demonstrating either their maintenance or attrition at a fine-grained level of sound structure.

It is worth remarking that the linguistic inventory of oldest Italian communities currently living abroad is undeniably unique. Given the peculiar socio-political, economic and cultural identity of the Peninsula from the period between WWI and WWII, dialect was in fact the first and primary language for the major part of the Italian population. Therefore, first Italian communities who settled abroad in those years were made up of people who were – almost exclusively – dialectal speakers at the time of departure. Additionally, first-generation immigrants formally acquired Italian as a second language in its regional/popular variety, which was mastered at different levels, according to the degree of schooling achieved by the subject before migration (Bettoni, 1991; Tosi, 1991). Upon arrival in the host country, immigrants were then forced for surviving to learn a third language (i.e., English for Italians who moved to Australia), at different times and to different extents. In summary, these first massive groups of Italian immigrants who migrated in the first decades of the XX[th] century constitute a variegated multilingual community. For these reasons, they represent a fruitful field of analysis to investigate language maintenance, loss, attrition shift, convergence and restructuring in their first (L1) and second language (L2) in long-standing contact with the host language (L3).

The present study employs a subset of the speech samples included in the *Italian Roots in Australian Soil* (IRIAS) corpus (see Galatà, Avesani, Best, Di Biase & Vayra (submitted)), whose charachteristics will be extensively illustrated in Chapter 5. Through a socio-phonetic and acquisitional approach, this thesis explores the phonetic influence exerted by late-acquired L3 English on the native dialect of four first-generation Italo-Australian speakers from Northern Veneto (specifically from the areas of Feltre and Cadore, Belluno province), who moved to Sydney in the mid-late 50s. Overall, we adopted an experimental method to address questions regarding language maintenance or change, and further implemented our research by exploring less-studied dynamics of third-language acquisition. Also, we based our observations and predictions about these phenomena on the most accounted theoretical models for language perception and production.

The choice to select such a small subset of informants is motivated by several factors, which we will illustrate below.

First, because managing a limited number of subjects could allow to perform an in-depth fine-grained analysis on a wide range of sounds – either fricatives and vowels – uttered spontaneously. Such a detailed and refined analysis would not have been possible, had we decided to include a larger number of speakers, both for the nature of the linguistic material and for the echological setting of its elicitation, as we are going to show in the next point. Having said that, we are deeply aware that present-day sociophonetic studies are mostly oriented towards the analysis of bigger oral datasets, as they reasonably aim to describe specific phenomena that go beyond possible idiosyncratic behaviours displayed by informants. At the same time, we note, however, that they often present analyses on either a limited number of sounds or sound categories (for instance, obstruents, rhotics, etc.), or on single parameters (for instance, VOT, fricative duration, etc.). We therefore believe that these are two different – yet both valid approaches – that to some extent cannot always be integrated, but are both led by motivated choices. Undoubtedly, an optimal research design would combine an in-depth analysis of multiple phenomena and/or categories with the selection of a considerable number of subjects, since the degree of permeability or resistance to contact-induced change can be maximally assessed when taking in consideration the *entire* linguistic system of a speaker. In this respect, we recall what argued by Berruto (1995: 72) and Berruto & Cerruti (2015: 12), according to whom sociolinguistic research should concentrate not only on the repertoire of the whole speaking community, but, at the same time, also on the repertoire of the individual conceived as a single identity. Bearing in mind these observations, in the present work we will employ individual's linguistic and extra-linguistic features as a magnifying glass for detecting whether a given phonetic/phonological system is monolithic and resists external pressure, or undergoes alterations triggered by contact. Overall, to support the hypothesis of a large-scaled phonetic change occurring in the Italo-Australian community, further analyses are indeed warranted; nonetheless, we are confident that the experimental methodology developed here can offer a rigorous approach to perform future investigations in this field.

Second, we analyze dialect, that is, a non-standard variety that is essentially oral and not written, and we cope with productions that have not been elicited neither through a read-and-translate procedure nor through the usual laboratory way to embed a target word in a frame sentence and ask the subject to read it. Specifically, the authors of the IRIAS corpus have appropriately chosen to avoid the elicitation method traditionally used in the dialectological studies of presenting the informant a word in Italian and asking him/her to pronounce it in dialect, method that comes down to the process of translating a linguistic code into another. Nor have they adopted the classical "laboratory speech" approach, whereby a target word is embedded in a context frame and is presented in written form to the subject in order to be pronounced. One reason of this choice was the inconvenience to provide an unnatural setting for eliciting the dialectal word; moreover, the absence of any established transcription system of the local dialectal varieties here considered that could be known to the informants, prevented the possibility to present them any sentence or word in a written form. Both methods, where used, could have provided the possibility to use automatic segmentation and labeling procedures to isolate the target sounds, therefore dramatically cutting the time spent in transcribing the spontaneously uttered sentences, in segmenting and coding the relevant sounds. Conversely, the target sounds have been elicited through structured interviews, in which a set of images presented to the speakers triggered the spontaneous production of the word corresponding to the image and descriptions of memories related to the referent of the target word. The advantage of this method is that many tokens of the target word were produced, and produced in a very spontaneous way, but the drawback is that no automatic speech-to-text aligner can be used to ease the identification, segmentation and transcription of the target sounds, as no speech recognition system is available for the Veneto dialects.

Specifically, we thoroughly examined the phonetic features of selected L1 categories in a long-standing contact with similar - but not phonetically identical - categories of Australian English:

- A selected subset of voiceless coronal fricatives: /θ/, shared with Australian English (AusEng) L3 but absent in the inventory of their Standard Italian (SI) L2, and /s/, present in all the three repertoires. In this set we include also the postalveolar affricate /ʧ/ (shared by the three systems), of which we will acoustically analyse only the fricative release phase, [ʃ]. This choice is due to the fact that NVen does not include singleton /ʃ/ in its phonological inventory; however, we believed it was necessary to maintain homogeneity with respect to preliminary analyses on voiceless coronal obstruents carried out in Avesani, Galatà, Vayra, Best, Di Biase, Tordini & Tisato (2015). Keeping in mind such point, for the sake of simplicity, we will refer to it only as [ʃ]. In, this respect, it is worth mentioning that we found occurrences of singleton [ʃ] in L1 productions (presumably due to the influence of Veneto regional Italian) of both control and heritage speakers. Nonetheless, the number of tokens was insufficient to perform any type of analysis on this specific sound;

- The vowels /i, ɛ, e, a, ɔ, o, u/, which are present in both the Northern Veneto (NVen) and SI inventories, in contact with the Australian English vowels / iː, ɪ, e, ɜː, æ, ɐ, ɐː, ɔ, oː, ʉː, ʊ/.

In order to assess whether target sounds have undergone cross-linguistic influence from AusEng L3 to NVen L1, dialectal productions were compared to those of four ad-hoc-recorded Italian control-group informants, who were born and currently live in the same area of origin of the four first-generation Italo-Australian speakers. Also, we formulated considerations on immigrant speakers' phonological awareness with respect to single or multiple phonetic categories in contact coexisting in their multilingual inventory. In detail, the thesis is organized as follows.

In **Chapter 1**, we introduce notions concerning Second and Third Language Acquisition in adults, and describe typologies of late bilingual and multilingual speakers in situations of linguistic contact. Next, we focus on the special-status category of heritage speakers (HS), namely (predominantly) monolingual first-generation immigrants who establish in the host country as adults, and mostly learn the majority language as a second (or additional) language late in life. Then, we apply such assumptions to the description of the multilingual Veneto community in Australia, asserting that both their dialect and their variety of Regional Italian should be understood as heritage languages (HL), as they were both acquired before migrating and are still employed for HSs' communicative needs. We hence introduce the concept of "social network", with the purpose to contextualize and implement the description of speech features of the Veneto heritage community in Australia, by investigating their social and communicative experience within their network. Finally, within the research domain of "Cross-linguistic influence" (CLI) we discuss how and to what extent native linguistic knowledge can influence/interfere with the production, comprehension and development of a target language. Specifically, we follow the approach adopted by Cabrelli Amaro (2017), in which reverse CLI occurring from L3 to L1 is referred to as "regressive transfer".

In **Chapter 2**, we explore problems concerning the lack of a univocal definition within CLI studies for the notions of "language loss", "attrition" and "shift" in migrant communities. We observe that such set of problems arises due to multiple concurrent factors triggering these strictly-connected phenomena, either linguistic (reduction in competence and/or use; lack of input, etc.) and extra-linguistic (age of arrival, age of onset, level of education in a given language, attitude and social identity). Then, we restrict our field of analysis to the non-pathological type of native language erosion that might occur within individuals, i.e. "first language attrition", which indicates a decline in proficiency in a speaker's L1 in a situation of a reduced amount of L1 external input and an increasing use of an L*n* in an *Ln*-speaking environment. Finally, we postulate that HS which undergo CLI may be defined as "attriters", in case their productions would not resemble those of monolingual speakers.

The purpose of **Chapter 3** is to integrate our sociophonetic perspective with an analysis of the hypotheses behind some of the most accounted models of perception and production of non-native speech. In order to accomplish this task, we examine the hypotheses behind the most accounted frameworks for perception and production of non-native speech. These models demonstrate that L2 experience can exert a significant influence on L1 oral productions, provoking a phonological restructuring of the native language. We take into consideration, respectively: the Speech Learning Model (SLM: Flege, 1987, 1995); the Perceptual Assimilation Model (PAM and PAM-L2: Best, 1995; Best & Tyler, 2007); the Native Language Magnet Model Theory (NLM: Kuhl, 1992, 1993, 1997); the Second Language Linguistic Perception Model (L2LP: Escudero, 2005). We observe that, despite their differences, the common assumption behind these theories is that cross-language phonetic distance between native and non-native phones can predict the relative difficulty or ease of perception and production of non-native speech. To give a more extensive review on this topic, we also examine the notion of typological markedness as indicator of the difficulty in the acquisition of L2 structures, by presenting the Markedness Differential Hypothesis (MDH: Eckman, 1977) and the Ontogeny Phylogeny Model (OPM: Major, 2001). Besides, we briefly discuss the role of Universal Grammar in the acquisition of a non-native phonological system, as proposed by advocates of the Optimality Theory (OT: Prince & Smolensky, 1993).

In **Chapter 4**, we examine the multiple linguistic competence displayed by Italians in Italy and Italian immigrants in Australia, respectively, for what concerns the period spanning from mid 40s to mid 50s. We firstly introduce the notion of "diglossia" (Ferguson, 1959; Fishman, 1967; Auer, 2005) to describe the linguistic situation in Italy right before and after WWII, and discuss the concepts of "standard Italian" and "local dialect" as both exhibiting intermediate varieties existing along a continuum (Cerruti & Regis, 2014). Afterwards, we first restrict our scope to the linguistic situation of the Veneto region and draw a general picture of the Veneto dialectal macro-system. Subsequently, we concentrate on the phonetic and phonologic properties of the Northern Veneto (NVen) varieties, spoken in the areas of origin of our heritage speakers, and where our control-group informants currently live (i.e., Cadore and Feltre). In particular, we provide a description of the NVen target coronals and vowels in Cadorino and Feltrino from a phonetic and phonological perspective. Afterwards, we focus in on the compresence of dialect and Italian as HLs in Australia and other English-speaking countries. Namely, we first give an historical and sociolinguistic perspective on Italian heritage speakers overseas, and provide specific statistical data regarding such migration movements. Next, in light of the current state of art on dialect and Italian as heritage languages, we formulate hypotheses on HL maintenance or attrition as a consequence of persistent contact with the host language.

Successively, in **Chapter 5** we illustrate the protocol employed to collect data for the IRIAS corpus, which we followed and adapted to record the Veneto control-group in Italy. We describe the single stages of the analysis conducted on spoken data, i.e.: an orthographic transcription of elicited and spontaneous productions in dialect through the ELAN software; a semi-automatic segmentation through a forced alignment procedure; a narrow phonetic transcription through an accurate manual check; coding of target consonants and stressed vowels features'; extraction of segmental features through ad-hoc Praat scripts.

In **Chapter 6**, we introduce the acoustic description of coronal fricatives and vowels as targets sounds of our experimental analysis. Also, we define the acoustic parameters generally adopted in literature for the analysis of fricatives (i.e., the four spectral moments: Center of Gravity, Standard Deviation, Skewness and Kurtosis) and vowels (i.e., formant frequencies tracked on multiple temporal points). Then, we draw comparisons among the phonological/phonetic properties of target coronals and vowels across Northern Veneto dialect, Standard Italian (more precisely, the regional variety of SI spoken in Veneto) and Australian English, with the purpose to provide a general framework for our hypotheses on maintenance or loss of L1 target sounds in IRIAS speakers. Finally, we illustrate specific predictions on possible effects of cross-linguistic phonetic influence and attrition deriving from the contact with Australian English, according to the theoretical frameworks presented in Chapter 3.

Conclusively, in **Chapter 7** we illustrate results for the acoustic analysis carried out on target sounds, according to the parameters illustrated in Chapter 6. Specifically, we describe through ad-hoc graphs the acoustic behaviour of each target sound in both control-group and IRIAS informants. Subsequently, we compare these results – either based on group and dialectal sub-system – and assess the degree of maintenance of each target sound by means of a mixed-model statistical method. Finally, we support our interpretations through the theoretical frameworks on non-native perception and production, observing that the immersion in a non-native language environment has not exerted any influence on the native dialect of the Italo-Australians involved in this study.

Our findings therefore suggest that, despite averagely 50 years of persistent contact with Australian English L3, Italo-Australians' utterances of target coronal fricatives and vowels in dialect L1 substantially resemble those of Italian control-group informants. At the same time, we also note that subtle acoustic differences emerge across either the two groups (controls *vs* heritage speakers) and at sub-dialectal level (Cadorino *vs* Feltrino). In sum, both quantitative and qualitative outcomes of the present work overall support the validity of all hypotheses on native sounds' maintenance, as we demonstrate that no meaningful regressive transfer from AusEng to NVen has occurred in our heritage speakers' L1 spoken productions.

1. Multiple Languages in Contact

1.1 Bilingualism in adult speakers

One of the early definitions of bilingualism dates back to 1933, with Bloomfield's influential work "*Language*". The scholar firstly defined a bilingual as an individual having native-like control of two or more languages, i.e. as someone who has simultaneously learned two languages since birth and has a balanced mastery and use of those two systems. Nevertheless, there is mounting evidence that these two conditions are not sufficient to describe the many-sided issue of bilingualism. In fact, other several factors have been pointed out through the last decades, which revealed to be crucial in determining the degree of knowledge and competence of each language coexisting in a speaker's mind. A fundamental variable to describe the degree of bilingualism is age of acquisition, namely the period of life in which the languages are acquired. Respectively, a vast literature[1] discriminates between: "*early bilingualism*", which refers to the acquisition of two languages before puberty, and "*late bilingualism"*, also known as adult second-language acquisition, which typically occurs after puberty (Montrul, 2013: 168). Besides, in early bilingualism, it is also fundamental to outline whether the two languages develop at the same time or one after the other, as following:

- *Simultaneous bilingualism* refers to the acquisition of two languages starting at birth (Matras, 2009: 61). So, acquisition can be defined as "simultaneous" if inputs from both the two languages take action simultaneously. Simultaneous bilinguals are therefore individuals who exhibit two (unordered) native languages (Meisel, 2004).
- *Sequential bilingualism* refers to the acquisition of two languages in consecutive chronological stages. In childhood, a situation of sequential bilingualism is typically set after at least 3-4 years of age. It means, a second language is

[1] See e.g. Singleton & Lengyel, 1995; Harley & Wang, 1997; Birdsong, 1999.

acquired after the basic foundations of the first language (L1) are assumed to be in place.

Plenty of studies have shown that, when acquiring a second language (L2), adults follow different mechanics with respect to the youngsters. The most influential framework for a cognitive approach to bilingualism in children (i.e., early bilinguals) and adults (i.e., late bilinguals), respectively, is the "critical period hypothesis" (CPH), developed by Lenneberg in 1967. The scholar argued that age and language acquisition are strictly related on a neurological basis. Specifically, CPH states that:

1) age of acquisition is predictor of ultimate language proficiency: the older one starts to learn a language, the fewer the possibilities he will attain complete mastery of that language.
2) age-related decline in neural plasticity provokes difficult in language learning, which is led by brain maturational constraints (Pallier, 2007).

Lenneberg and advocates of the CPH demonstrated that the window of cognitive flexibility that leads the early acquisition of language begins to shrink with the end of puberty, closing completely during adulthood (Matras, 2009). According to Klein (1986: 15), three processes can be therefore distinguished: "first-language acquisition", either monolingual or multilingual, which takes place during the child's first three years; "child second-language acquisition", occurring between the age of 3-4 years and puberty; "adult second-language acquisition" that begins after puberty.

According to CPH, the process of "lateralization", which implies a specialization of the two brain sides, implies a certain loss of cerebral plasticity[2] and a restriction for language acquisition capacities (Scheibel, 1993). As described by Singleton & Ray, (2004: 134), this ontogenetic specialization of the two hemispheres is dependent from

[2] Dirven, R., Wolf, H., & Polzenhagen, F. (2007:1210) discuss the role of Universal Grammar in Lenneberg's theory of biological foundations of language. The scholars suggest that the Language Acquisition Device (see Chapter 3 for further details) stops operating around puberty and enters a postcritical phase in which it loses its flexibility: as a result, all later language learning might reveal to be highly difficult and ineffective. In this perspective, such maturational (i.e., internal) factors can be explored without recurring to the notion of a language-specific mental faculty, which is instead a substantial postulate of UG theory.

brain maturation and exposure to the linguistic environment. Initially, both hemispheres have equal potential regarding specialization for language functions. Subsequently, however, we observe a gradual establishment of left hemisphere for language functioning, in parallel with a decline in the language processing capacity for the right hemisphere. Substantially, Lenneberg conceives the critical period as a span coinciding with the lateralization process, beginning at age two and ending around puberty. This standpoint is supported by Penfield & Roberts (1959), who argue that children are usually able to re-learn language in case of damages (due to injury or disease) involving speech areas in the dominant hemisphere. Moreover, the speech mechanism is frequently transferred by youngsters from the impaired dominant hemisphere to the healthy minor hemisphere, with complete success. Instead, recuperation is much more problematic in adults, for whom such transfers do not seem to occur. For these reasons, they suggest that «*for the purposes of learning languages, the human brain becomes progressively stiff and rigid after the age of nine*» (Penfield & Roberts, 1959: 236). In summary, it becomes more difficult to learn a language past a certain age, «*either because the L1 has fixed the neural connections or because the language learning systems are disposed of when the L1 is acquired*» (Pallier, 2007: 158)[3]. Moreover, Lenneberg formulates two different scenarios within his CPH, i.e. a weaker and a stronger hypothesis, respectively:

1) The weaker version asserts that a successful language acquisition should commence within the critical period. The sooner language acquisition begins after the beginning of the critical period (around 2 years of age), the more effective it will be;
2) The stronger version claims that even if the language acquisition process starts within the critical span it does not endure after the closure of that window (Singleton & Ray, 2004: 34).

Nevertheless, Lenneberg's claim that lateralization completes at puberty has been challenged by some scholars, who have argued that the acquisition process is already

[3] For more in depth discussions on the cognitive and neuronal bases for second language acquisition, see e.g. Paradis (2004).

set in early childhood[4]. For instance, some studies (see Bohn, 2000 for a review) suggest that even right after the first year of life, babies have already circumscribed their attention to the discrimination of their mother tongue's sounds, leaving aside all possible non-native language sounds. On the other hand, Werker & Tees (1994), Werker & Polka (1993), Werker (1994) indicate that the influence from the native language shapes native and non-native sounds perception between 6 months and 12 months of age[5]. Accordingly, the sensitive period for discriminating sounds in foreign languages would end within the first year of life.

On the other hand, a large number of studies has recognized Lenneberg's position as too strict, establishing instead that language development is not arrested after a given maturational point, but rather extends from birth onwards. For example, Flege (1987) provided a counter-evidence against CPH, showing circumstances in which adults may produce or perceive L2 sounds as well as, or even better than, children. Also, consistently with Walsh & Diller (1981), he claimed that there is no evidence for a discontinuity in neural development: «*human cerebral functions and neuronal synaptic arrangements continue to develop, often as the result of a specific environmental experience, long beyond puberty*»[6] (Flege, 1987: 166).

In conclusion, we have shown that Lenneberg's stark dichotomy on mature laterality of functions is debatable. Effects of age and brain constraints on L2 acquisition have been at the core of a consistent amount of research (see Singleton & Lengyel, 1995 for further details), which has concentrated on non-native-like speech productions of second language acquirers. Issues related to the questionable nature of CPH will be more thoroughly investigate in Chapter 3, with particular attention on the phonetic and phonological domain. Specifically, we will illustrate theoretical models describing L2

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[4] See Krashen (1973), according to whom the offset of lateralization is around age 6.

[5] See also Best, 1993, 1994.

[6] In addition, Newport (1990) demonstrated that late L2 learners exhibited great command of the morphological system. However, the "closure" of cognitive plasticity is reported to be chronologically different for each language domain. With respect to syntax, morphology, and lexicon, the flexibility which allows a greater ability to control articulation of sounds is commonly more prone to restriction (Birdsong, 2006). Concerning the puberty threshold Long (1990) rather suggests a series of sensitive periods (i.e., more than one) for second language, the first period culminating around age six (Francis, 1999: 326).

speech production and perception in late bilinguals which rely on the availability of speech learning mechanism across the whole life-span.

1.1.1 Stages in bilingual acquisition

Beside the specific notion of a sensitive period for second-language acquisition, it has been suggested that late bilinguals generally approach language learning as a different kind of task with respect to early bilinguals (Matras, 2009: 69)[7]. Weinreich is one of the first scholars to argue that the L2 acquisition strategy in adults is based on cognitive assumptions provided by the mastery of the native language. As we will discuss in §1.4, their familiarity with the principles of their L1 acts as a basis on which they can build when acquiring the L2 (Matras, 2009: 71). In *Languages in Contact*, Weinreich also suggests a classification of linguistic competence based on how the speaker has access to vocabulary, namely:

1) Compound bilingualism: namely, as reported in Forsyth (2014: 432), when speakers «*acquire both languages at the same time or in the same context, and therefore have an identical mental representation, yet two verbal representations, for a single concept*» (i.e., one for each language involved). That is to say the speaker exhibits a unitary competence of the two linguistic systems, whereby specific structures for each language correspond to a single semantic content.

2) Coordinate bilingualism: when bilinguals «*learn two languages in two distinct separate environments, meaning that words for a single concept take on different meanings*» (Forsyth, 2014: 432) (i.e., in which equivalent lexical elements correspond to different conceptual representations). In other words, a situation of coordinated bilingualism is observed when there is a chronological and contextual discrepancy between the stages of acquisition of each language. In this case, bilinguals' competence is structured on the basis of distinct conceptual units, with separate lexeme-meaning correspondences for each system.

[7] Francis (1999: 321) claims that adults applying general learning mechanisms such, for instance, inductive approaches, can reach more success in language learning with respect to cognitively immature children performing the same task.

3) Subordinate bilingualism; in which only the lexical item belonging to the primary language embodies the conceptual element. As a result, for the second language, accessing to the concept requires the mediation of native lexical elements.

According to the literature, another important factor in assessing a bilingual's linguistic knowledge is the degree of language use, which may or may not be related to age or sequence of acquisition of the two languages, as observed by Montrul (2013: 169). In account to this, it is necessary to introduce another distinction, which mainly concerns the psycholinguistic dimension, i.e. between primary and secondary language: the former is the psycholinguistically *dominant* language, used most often, whereas the latter is the language that is used less and/or in more restricted contexts. Typically, a first and native language is also a primary language for monolinguals, whereas for adult second-language learners their L1 is their primary language and the second language is their secondary language. Nonetheless, in particular settings this pattern might be reversed: the case of the so-called "heritage speakers" is in this sense quite remarkable, as we will show in the following paragraphs.

An important distinction should also be made between "additive" or "subtractive" bilingualism. As said by Montrul (2013), the former type accounts for situations where both languages continue to be useful and valued; the latter, on the other hand, typically occurs when one language is more dominant, while the other is declining. Given this differentiation, a crucial issue is raised, which we will try to untangle throughout the present work: does acquiring/learning a new language imply an expansion of the phonological repertoire or rather a certain replacement of the native/earlier system?

1.2 Second Language Acquisition (SLA) and Third Language acquisition (TLA)

As Fouser (1995) notices, the phenomenon of third language acquisition has spread out quickly in the last few decades, also due to the fast-growing migration movements. Consequently, research on multilingual settings (i.e., where more than two languages are involved) has received mounting interest and started to gain its own place within the wider dimension of non-native language acquisition studies. However, giving a univocal definition of third languages (L3) and L3 acquirers is still posing challenges.

To begin with, it is first necessary to shed light on the problems concerning the distinction between SLA and additional languages acquisition, which lacks common agreement among scholars. Ss De Angelis (2007) points out, the term "second" has traditionally accounted both for second language and for any other non-native language in the acquisition process (e.g., Ringbom, 1986, 2001, 2005). It follows that, in this perspective, acquiring an L2 could be considered equivalent with respect to acquiring multiple/additional linguistic systems. It is evident that broad interpretations do not account for differences between types, stages and chronology of acquisition. In his recognition of studies concerning Third Language Acquisition (TLA), Fouser (1995) underlines how confusing the terms "bilingual" and "multilingual" may be, when describing different types of language experience. The author states that:

> «*the terms 'bilingual' and 'multilingual' are themselves vague and controversial. 'Bilingual' and 'multilingual' often refer to two or more languages being taught and used in a given geo-political unit, or to a person who is highly proficient in two or more languages. These terms should be used to describe the state of language use in society and individuals; the terms 'L2' and 'L3' should be used to describe the order of acquisition in the language acquisition process*»[8].

"Bilingual/bilingualism" and "multilingual/multilingualism" are still often used as synonyms in several works on language acquisition[9]. An example of such terminological ambiguity (provided by De Angelis, 2007: 8) is the definition given by, Myers-Scotton (2002: 1), who states that the term "bilingual" refers to individuals who speak "two or more" languages. We observe that no discrimination is drawn between the bilingual and the multilingual subject: bilingual and multilingual knowledge are equated. Additionally, De Angelis (2007:10) provides an outline of the labels commonly given to

[8] Concerning the order of acquisition, as De Angelis (2007: 8) reports « *[...] A third or additional language is often referred to as an L3, regardless of whether it is a third, fourth or sixth language. Some researchers label languages according to order of acquisition (L3, L4 or L6) without taking into account issues of language proficiency*».

[9] Vice versa, multilingualism has been traditionally subsumed under bilingualism (e.g. Haugen 1956: 9).

the acquisition process involving languages beyond an L2[10]:

a) Multiple Language Acquisition: this definition does not highlight the difference between simultaneous (i.e. concurrent) acquisition of two (or more) languages and sequential (i.e. at different points in time) acquisition of two (or more) languages.

b) Multilingual Acquisition: this umbrella term might risk being ambiguous. According to the author, in fact, the adjective "multilingual" refers to the learner, rather than to the language being learned (i.e., the individual is multilingual, not the acquisition itself).

c) Third Language Acquisition: is considered scarcely effective, as the adjective "third" accentuates the role of the third language, to the detriment of the other languages mastered by the learner.

d) Third or Additional Language Acquisition: refers to all languages beyond the L2 without placing emphasis on any particular system. Literature on SLA employs the term "additional" as interchangeable with/equivalent to "second" language acquisition, while in the case of 'third or additional language acquisition' the purpose is indeed the inverse.

More recently, van Compernolle (2016: 62) provided another definition: the term "multilingual speaker" refers to: individuals immersed/raised in a bi- or multilingual environment, and who are identified as having more than one native language; individuals who have learned additional languages later in life (for instance, foreign language learners). It follows that, in this perspective, multilingualism broadly pertains to speakers with a not necessarily high or complete mastery in a given number of languages.

In line with Flynn, S., Foley, C. & Vinnitskaya, I. (2005), we believe that distinguishing simultaneous and sequential acquisition is necessary when assessing the role of prior language knowledge and experience in the acquisition of an L*n*. Specifically, with

[10] Issues concerning multilingualism and multilingual communication are accurately investigated also in Auer & Wei, 2007.

respect to second language learners, third/*Ln* language learners display a larger phonological awareness, as well as wider linguistic repertoire (Gut, 2010): consequently, as we will show in the next paragraph, their multilingual competence makes it more likely for cross-linguistic influence phenomena (CLI) to occur.

One could argue that discriminating between an L2 and an L3/*Ln* acquisition process is superfluous, if we considered such learning dynamics as perfectly comparable within all non-native languages. Instead, prior knowledge and prior learning experience can significantly affect the acquisition process. In fact, there is empirical evidence demonstrating that the multilingual learner's approach to subsequent language learning diverges from that of an L2 learner. Namely, L3 learners rely on certain language-learning strategies already developed along the process of an L2 acquisition (e.g., see Cenoz, Hufeisen & Jessner, 2001 for some discussion on this point and further references). Yet, unequivocally defining the chronology of L*n* acquisition process itself represents quite a challenge: the terms L1, L2, L3, L*n,* in fact, often refer to as a consecutive and non-interrupted acquisition, although multilingual acquisition may sometimes be simultaneous and intermittent. For instance, according to Hammarberg (2001) a *first language* is any language acquired during infancy (i.e., within the first year of life), while a *second language* includes any language acquired after infancy. On the other hand, the term *third language* refers to a non-native language which is acquired or employed when the speakers already masters one or more L2s. Besides, Cenoz (2003) states that:

> «[...] *third language acquisition refers to the acquisition of a non-native language by learners who have previously acquired or are acquiring two other languages. The acquisition of the first two languages can be simultaneous (as in early bilingualism) or consecutive*».

In his standpoint, the scholar does not discriminate between individuals who have firstly acquired their native language and, at a later time, a second and third non-native systems, and individuals who have acquired two languages at the same time, and subsequently an L3. It is noticeable that this kind of perspective substantially neglects the development of multifaceted language skills and the proficiency levels attained throughout the whole process. In our viewpoint, coherently with Clyne (2003: 4), bi- and trilingualism should rather be investigated as subsets of plurilingualism. In account to this, it is worth reporting Grosjean's (1982) and Romaine's (1995) remarkable observations, according to which bilinguals are not double monolinguals, and therefore should not be studied from monolingual perspectives.

With the purpose to go more in depth in this controversial issue, De Angelis (2007: 12) also proposes the following parameters to assess multilinguals' cognitive and psycholinguistic processes activated in the acquisition of non-native languages:

- Age of acquisition of each non-native language;
- Sequence of acquisition of all languages;
- total number of languages known by the speaker and proficiency level in all non-native languages;
- exposure to native and non-native language environments;
- manner of acquisition (driven learning versus natural acquisition);
- amount of formal instruction in each non-native language;
- context of use of each linguistic code (for example with relatives, with peers at school or in professional environments);
- active or passive use of all languages;
- assessment of both productive and receptive skills for each language.

Taking into consideration these assumptions[11], we will try to describe the multiple competence of first-generation Italian immigrants from Belluno, Veneto, who arrived in the Australia as adults. A preliminary observation is that these speakers can be considered as early sequential bilinguals, since they acquired local dialect and Regional Italian during childhood before migrating. Moreover, since they successively acquired English on the Australian soil, Veneto speakers can effectively be considered as a trilinguals (this statement was firstly formulated and discussed in Bettoni & Rubino,

[11] The Italo-Australians' linguistic situation precisely complies with the one described by Cenoz (2003).

1996, and will be further explored throughout the present work)[12].

1.3 Bilingualism/multilingualism and Language Contact

Research on language contact has gained increasing interesting over the last decades, as a direct consequence of globalization effects and increased migration movements. Studies have generally addressed this topic from two main perspectives: diachronically, by historical linguists; synchronically, by both sociolinguists and psycholinguists (Thomason, 2010). Concerning the synchronic viewpoint, it has been observed that the notions of "contact" and "bilingualism" are strictly related. For instance, as reported by Wei (2013), bilingualism (and multilingualism in general) refers to the coexistence, contact, and interaction of different languages, which may take place at the societal level or at the individual level. The relationship between contact and mastery of more than one linguistic system was firstly outlined by Weinreich (1953), who suggested that "*two or more languages are said to be in contact if they are used alternately by the same individual(s). The language-using individuals are thus the "locus" of the contact".* According to the scholar, the concept of "contact" can be defined in this sense as the habitual closeness between and within speakers of two or more linguistic codes. Also, Weinreich introduces the notion of "locus" of contact, which might either be a specific place or a geographic area, an entire community, or the speaker himself. On the one hand, the scholar describes a "societal" locus, given by the coexistence of (at least) two different systems in everyday communicative situations within the entire speaking community[13]. Additionally, he suggests the presence of an "individual" locus, originating from the coexistence of different linguistic systems in the competence of the individual speaker. The two aspects of contact are undoubtedly complementary, yet cannot be overlapped. This controversial issue has been more recently investigated by

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[12] Linguistic and sociolinguistic features of Italo-Australian HS will be more extensively discussed in Chapter 5.

[13]A "community of speakers" can be defined as the set of individuals who use a particular language, «*who are in habitual contact with each other by means of speech which involves either a shared language or shared ways of common language used in the area*» (Mesthrie R., Swann J., Deumert A. & Leap L. W., 2009: 36).

Berruto (2009), who again states that contact has to be considered:

- From the language perspective: two or more systems (either two languages or a language and a dialect at the same time) are said to be "in contact" if they interact with one another.
- From the speaker's perspective: two or more systems are in contact if they are mastered to any extent, at the same time, from one or more speakers.

Mounting evidence in the literature reports that interaction between different linguistic systems is generally due to several factors, such as geographical proximity (i.e., in border areas), socio-political and ethno-cultural choices both at an intra- and inter-speaker level[14]. In fact, as claimed by Williamson R. C. & Van Eerde J. A. (1980: 44),

> «*(b)ilingualism involves more than linguistic ability in two or more languages for the individual and ultimately for the society at large. Knowing and speaking a language also involves a personal sense of identity with, and a set of attitudes towards the speech community which uses that language*».

Consistently with Clyne's claims (2003: 2), both theoretical and empirical approaches to contact should embrace the concept of linguistic behavior as an expression of and as a response to multiple identity. In fact, besides being a medium of cognitive and conceptual development, language is also a means by which people can identify themselves and others within a speaking community.

1.3.1 The case of Heritage Speakers

We have so far observed that the ever-growing incidence of mass movements on cultural, social and linguistic habits across the world has boosted the attention of a certain number of scholars[15], who investigated both sociolinguistic and cognitive factors interacting in situations of linguistic contact. When classifying the typologies of

[14] Berruto (2010) points out that language contact may appear also in speakers who do not display a full bilingual proficiency. An example is given by the numerous situation of linguistic contact between English and any other given language, the former traditionally learned mandatorily through schooling.

[15] Bibliographical overviews of heritage language definitions can be found in Valdés (2005) and Polinski (2011).

late bilingual and multilingual speakers in contact situations, a special-status category has been thence identified: the "heritage speakers", i.e. speakers of a "heritage language". The term heritage language (henceforth HL) began to be employed in the 1990s to indicate the minority languages of immigrants. In the context of the United States, Valdés (2000: 1) defined HL as a language other than English spoken by immigrants and their children. However, as successively pointed out by Rothman (2009: 156), this characterization of HL acquisition does not account, of course, for phenomena specific to North America:

> «*in other loci such as Europe, Australia, and Latin America such bilingualism with similar yet idiosyncratic issues is omnipresent; however, they are called "background", "minority" and "ethnic language" speakers. The difference, however, is for the most part a terminological one*».

Nonetheless, Kelleher (2010) underlined substantial problems concerning the term "minority language". Firstly, the general definition of "minority" traditionally refers to as a smaller number of individuals in terms of demographic percentage (i.e. less than 50% of a group), with respect to a numerical majority[16]. Moreover, the term is usually connoted by frequent negative interpretations, and, most importantly, in some social settings in the United States, a language other than English may on the contrary be employed by a numerical majority. It follows that, although it encompasses the great variability in knowledge and aptitude among heritage speakers, Valdés' definition does not account for the various statuses of immigrant languages within the same territory (Montrul, 2013: 170). Several other definitions have been given to HLs and HS (heritage speakers) [17], also with a certain variability among the authors. Yet, there seems to be unanimity in claiming that HLs are languages related to the cultural heritage of the speaker and that are not the dominant language of the country (Aalberse & Muysken,

[16] Valdés (2005: 411) equates "minority languages" and "heritage languages" to indicate both indigenous languages that are often in danger of disappearing (for instance, Scots Gaelic, Maori, Romani) as well as languages that are commonly spoken in many other regions of the world (Spanish in the United States, Arabic in France).

[17] Pioneer investigations on HL were carried out by Fishman (1964), who concentrated on the individual language history of immigrant speakers and on their social network to describe patterns of maintenance and change in their repertoires.

2013).

Montrul (2013: 168) recently defined HS as *«individuals who have been exposed to an immigrant or a minority language since childhood and are also very proficient in the majority language spoken in the wider speech community».* According the scholar, HS are predominantly monolingual first-generation immigrants[18], who arrive in the host country as adults, and mostly learn the majority language as a second language late in life. Montrul (2013: 185) also argues whether HS can be defined as native speakers of their L1: «*The answer is yes and no […] If there were a continuum of nativeness, with L1 speakers on one extreme and late bilingual (L2 speakers) on the other, heritage speakers would fall comfortably in between*». There is plenty of evidence, in fact, that HS can experience phenomena of "attrition" after more than 10 years of intense exposure to the majority language (see e.g. Rothman, 2009[19]; Polinski, 2011). Namely, first-language input for HS declines precipitously, provoking some phonological, lexical, morphosyntactic, syntactic, semantic, and pragmatic restructuring (see chapters §2 and §3 for a more detailed discussion about the notions of "attrition" and "restructuring"). Also in cases where HS are introduced to formal education in the host country and start interacting with peers speaking the majority language, the everyday amount of input and use of the HL dramatically declines. In fact, since HL are usually not taught at school[20], HS start missing opportunities to use their language outside family settings.

In parallel with a decreasing L1 input, we also witness the effects of circumscribed L2

[18] A definition of *second-generation* immigrants is given by Silva-Corvalán (1994), who includes in this group: children of the first-generation adults; children born in the host country to at least one first-generation parent; immigrant children who come to the host country before the age of 5 years. According to their bilingual profiles, they can be divided into: *simultaneous bilinguals*, that is, those exposed both to the HL and the majority language before the age of 5; *sequential bilinguals* or *child L2 learners*, that is, those exposed to the HL at home until age 4–5 years and to the majority language at the onset of pre-school; *late child L2 learners*, that is, children monolingual in the heritage language, who received some elementary schooling in their home country and immigrated around ages 7–11 years. The scholar defines the latter group as "generation 1.5".

[19] Scholars have argued that both quantitative and qualitative differences in HL input, the immersion in the language and the culture of the majority, as well as the differences in literacy and formal education can result in a cutoff of the HL development or in phenomena of attrition in adult bilingual knowledge.

[20] On the other hand, the term "heritage language learner" (HLL) refers to HS who are relearning their HL in special second/foreign language education programs. Valdés (2005: 411), defines as "*heritage language students*" those members of linguistic minorities who take interested in the study, maintenance, and revitalization of their minority languages.

input for HS, especially on the informal, non-structured acquisition process. Specifically, Matras (2009: 71) describes situations of limited linguistic input as resulting from social isolation and only basic communication at the work place[21]. Such types of settings crucially restrict immigrant workers' chances of reaching proficiency in the target language. Moreover, it has been reported that first-generation immigrant workers were often exposed to a simplified register of the L2. This type of linguistic input, defined by the literature as "foreigner talk" (see e.g. Ferguson 1977, Clyne, 1982) appears in situations where native speakers regard learners as socially inferior with respect to the native population. Groups of HS who acquire and start using two or more languages to survive in the new social settings and occupy inferior positions with respect to the majority have been referred to as *circumstantial bilinguals/multilinguals.* On the contrary, *elite* or *elective bilinguals/multilinguals* are individuals who learn an L2 in classroom settings, i.e. predominantly through formal education rather than natural acquisition, and therefore have few opportunities to use the language for spontaneous communication (Valdés & Figueroa, 1994).

These designations and considerations can be indeed applied to describing the linguistic repertoire of the heritage Italo-Australian community, and particularly the Veneto-speaking Italo-Australian group, which is the object of our study. Based on the above-presented definitions, we can in fact consider both their dialect and their variety of Regional Italian as heritage languages, respectively: their L1 Veneto dialect as the native heritage language, and their L2 Regional Italian as the second heritage language (Avesani, C., Galatà, V., Vayra, M., Best, C., Di Biase, B. & Ardolino, F., 2017), both acquired before migrating and still employed for HS' communicative needs. These preliminary observations will be more thoroughly explored in Chapter 4.

1.3.2 Bilingualism/Multilingualism and Social Networks

The notion of contact within the speech community is also related to a crucial issue for the sociolinguistic research, namely the concept of "social network" (SN). Social

[21] See the case of industrial workers who moved to northwestern European countries such as Germany and the Netherlands in the 1960s (Klein & Dittmar, 1979.)

networks were introduced into sociolinguistics in 1972 by Blom & Gumperz's study of alternation in language use between the local dialect and standard (*bokmål*) Norwegian in the village of Hemnesberget. (Hinskens, Auer & Kerswill, 2005: 37). Subsequently, especially in the last few decades, SN theory has been successfully applied both as a methodological and an analytical tool for social, anthropological and linguistic investigations (Villena-Ponsoda, 2005: 308), and currently constitutes an important point for the elaboration of a quantitative statistical measure for describing community integration (Milroy 1980, 1987; Milroy & Margrain 1980, a. o.). Broadly speaking, a SN can be interpreted as a set of relational structures involving social actors, i.e. individuals moving within a social environment. Defining SNs can therefore allow to understand the behavior of the subjects constituting the network itself: applying these concepts in the linguistic field helps to clarify the mechanisms that regulate specific modes of expression in certain groups of individuals. Each subject, in fact, creates a network of personal contacts according to his communicative needs, and these networks of individuals are constituted by ties that can vary in type and intensity. The variability encountered among ties' cohesive force allows to discriminate between types of SNs, respectively "strong" and "weak" ties, based on the degree of cohesion among the actors involved[22].

Scholars observe that networks of interconnected people exhibit a series of regularities capable of affecting individual behaviour. To quantitatively assess proximity, complexity and strength of such relationships[23], the following parameters have been identified (see Villena-Ponsoda, 2005: 308):

1) Structural measures: density, centrality, clustering, and partition in subgroups (see e.g. Fagyal, Swarup, Escobar, Gasser, & Lakkaraju, 2010). They account for the number and cohesion of connections in a network. In a low-density network,

[22] Paolillo (1999) defines "strong ties" as typical of family and friendship relationships, characterized by frequent interaction anchored to the territory, and association in more than one social capacity (e.g. two people being both siblings and business partners). On the other hand, "weak ties" are typically found in casual acquaintances, characterized by less frequent and temporary contact.

[23] For instance, relations can be made up of bonds of family, friendship, professional collaboration, and so on.

individuals usually are related to the central member but not to each other, while in a high-density network members are mutually related and interact with each other habitually (Deumert & Mesthrie, 2009:122)

2) Interactional measures; multiplexity, frequency, and content of the network links. We speak of a multiplex network when individuals in a network are linked to each other in more than one function (co-employee, relative, friend, neighbor, member of the same sports club and so on). On the other hand, a network in which the members are linked to each other in only one capacity (for example, co-employee) is called a uniplex network. Such parameters therefore account for compositional properties of the network: i.e., social role of the member, frequency of contact[24] and language(s) used within the network[25].

A notable example of the SN theory applied to monolingual communities is Lesley Milroy's ground work in 1980. The scholar investigated the relationship between gender and integration in the social network of the Belfast community, developing a six-point scale to indicate the degree of density and multiplexity[26] of an individual's network (the so-called "Network Strength Scale") (Deumert & Mesthrie, 2009: 124). According to Milroy's analysis, men had more and stronger ties to the local community than women, as well as a higher degree of vernacular use. These results showed that stronger network ties in males enforced the use of local speech norms[27], and, more

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[24] Concerning the type of contact between members, Rocchi (2008) describes the distinction between "exchange networks" and "interactive networks". The former refers to individuals who interact on a regular basis and reciprocally exchange help (i.e. relationships of kinship and close friendship); the latter accounts for individual with habitual interactions, yet with no sharing of material or symbolic support (i.e. commercial relationship with customers).

[25] The graph theory is commonly used to depict these scenarios. SNs can in fact be represented as a set of nodes placed in relation to each other: the higher the number of nodes linked through relational ties, the greater the density of the network. This density value is given by the ratio between the actual number of bonds and the number of possible links, usually expressed as a percentage. A high-density network will therefore be the basis of a highly cohesive community, which tends to "monitor" and lead language use as well as other social behaviors; on the contrary, a low-density network will characterize a group that is not very compact, even on the linguistic level (Rocchi, 2008: 230).

[26] High-density and high-multiplexity networks are referred to as "close-knit" (i.e., compact, cohesive). As we will discuss below, immigrant communities which tend to be structured into close-knit networks would exhibit more resistance to their native language erosion.

[27] Lesley Milroy (1980) argues that vernacular use is typical in dense and multiplex network structures, typical of rural areas and old urban working-class districts, where solidarity within and between groups

generally, that variability in language use is closely related to the type of social network in which the speakers are embedded. It has hence been suggested that high density and multiplexity can lead to conservative behaviour of the vernacular forms (Milroy 2002)[28]. SN analysis has been also successively applied in the study of bilingual communities: strong bonds act as a support mechanism for vernacular forms as well as for minority languages, implementing resistance to variation. At the same time, a break-up of the traditional network patterns can initiate linguistic change. When this happens, since variants spread through networks, a close-knit SN characterized by intense contact among the actors would facilitate the spread of innovations[29]. (Milroy 1980: 162)

Arguably, bilingual social actors living in communities characterized by one dense and hyper-connected network are predicted to speak the same language to all members of their network. In support to this claim, Tosi (1991) reported that Italian immigrants who settled in urban areas mostly developed personal kinships and social contacts with people from the same region (for instance, within the local regional club). In the meanwhile, while acquiring and developing English for other social and professional purposes outside the immigrant group, first-generation Italians have predominantly used the local dialect both at home and outside with close members of their community. Concerning Veneto immigrants in Australia, it has been observed that they encountered not only with individuals from the same village/area speaking their very same dialectal variety, but also with individuals from different regions, whose native language was the respective local dialect (Avesani *et al.*, 2017). Moreover, they came into contact with other varieties of Standard Italian spoken in those regions that exhibited different

pushes to employ local forms.

[28] Paolillo (1999) claims that linguistic changes towards the standard variety are spread through weak network ties, whereas changes diverging from the standard variety and heading towards vernacular, non-standard varieties are propagated through strong network ties.

[29] As reported by Kristiansen & Jørgensen (2005: 291) *«(t)he social network model operates with a "close-knit network" as the main norm-enforcement mechanism and "weak ties" as the main potential for change»*. However, they also argue that this claim should be taken cautiously. In fact, weak ties are not sufficient to provide a full social explanation of linguistic change, since they do not account for the social psychological processes involved in it. Rather, the model proposes a set of conditions that are necessary – but not sufficient – for linguistic change to take place (Milroy & Milroy 1992).

speech features from those of their own variety of SI. This point will be in depth discussed in Chapter 4.

To describe the relationship between language choice and personal social network in bilingual communities, Vietti & Spreafico (2018)[30] have proposed to compute Shannon's entropy. In brief, a low entropy value corresponds to the use of the same code to communicate with members of the network: in fact, entropy decreases if the organization of the system increases, or if the system is predictable. On the other hand, maximum entropy corresponds to a balanced use of codes within one's social network. If we apply this assumption to the first-generation Italo-Australian speakers belonging to the present study, we would expect that who built family, kinship and friendship ties with individuals speaking their very same dialectal variety would almost exclusively employ their dialect L1 to communicate with members of their SN: entropy would hence be minimal. On the other hand, in circumstances of a more extensive and prolonged contact with:

- other local varieties of the same dialectal system (for example, immigrants from North Veneto and from Central Veneto), and/or:
- other varieties of Italian languages (local dialects and different forms of SI) spoken by other Italian immigrants, and/or;
- English both within and outside the family,

entropy would be higher (e.g. we could have cases in which speakers might employ 50% dialect and 50% English in their everyday social interaction).

For the purposes of the present work, we will explore the HS' social and communicative experience within their network, in order to contextualize and implement the description of speech features of the Veneto community in Australia. Namely, we will discuss data collected through *ad-hoc* sociolinguistic questionnaires (which will be presented in detail in Chapter 6), respectively:

[30] In Vietti (2017) a computer-assisted interview on in Italo-German bilinguals in Bozen was carried out using Egonet, a software designed to elicit data on networks, based on the last 15 people with whom the subject has spoken.

- Data regarding the social and individual features of each immigrant subject (e.g. age, gender, age and type of acquisition of the non-native system, etc.);
- Data regarding compositional features of the immigrant's network (e.g. social and professional role, which languages are spoken in the network and with whom, etc.)[31].

Far from being exhaustive, our overview of possible interpretative approaches to social network analysis is yet preliminary to explorative sociolinguistic explanations of our small-scaled data. In the present work, we will rather account for the *quality* and amount of contacts within and outside the Veneto immigrant community, and for the speaker's own attitudes (positive or negative) towards each repertoire employed in everyday communication, with the purpose to predict potential phenomena of cross-linguistic interference (see below). As a possible direction of future research, we could take into consideration to compute structural measures such as density, centrality and closeness between nodes to carry out a quantitative evaluation on a larger dataset.

1.4 L1 phonetic influence and interference on non-native system(s)

Evidence from native-language interference on later-acquired systems has been extensively discussed since mid '50s, from the pioneer works carried out by Weinreich (1953), and Lado (1957) onwards. Starting from the assumption that adult learners process their second language through their knowledge of their native language, Weinreich outlined two possibilities:

1) "positive transfer": i.e. when modelling a new structure on the L1 facilitates to learn correctly the corresponding non-native structure. In this case, L1 structure offers an advantage in the L2 acquisition process;
2) "negative transfer": i.e. when the speaker erroneously infers a certain similarity between the structures of his own language and those of the L2. In this case, the

[31] Due to the small dimension of our data-set, it was not possible to quantitatively identify Therefore, our observations on SN structures of Veneto HS in Australia should be considered as merely explorative.

native language does not support, but rather interferes with the correct production of a given structure of the target language (Matras, 2009: 72).

In *Languages in Contact*, Weinreich (1953: 1) firstly included under the label "interference":

> «*those instances of deviation from the norm of either language which occur in the speech of bilinguals as a result of their familiarity with more than one language, i.e. as a result of language contact […] interference implies the rearrangement of patterns that result from the introduction of foreign elements into the more highly structured domains of language, such as the bulk of the phonemic system, a large part of the morphology and syntax, and some areas of the vocabulary*».

Also, he discriminated "speech interference" from the more extended "language interference", suggesting that phonetic/phonological interference specifically concerns the way in which a speaker perceives and reproduces the sounds of a language B (secondary language) in relation to a language A (primary language), through the mechanisms of (i) hypo-differentiation, (ii) hyper-differentiation, (iii) reinterpretation of distinctions, (iv) substitution of phones/phonemes.

Hypo-differentiation of phonemes occurs, for instance, in those cases in which language B exhibits two similar sounds, which are expressions of two distinct phonemes, while in language A the same sounds have an allophonic value for the same phoneme. A notable example is given by Italian learners of English as L2 who undergo interference from their native language: namely, they might not be able to discriminate and produce English high front vowels /i/ and /ɪ/ (respectively tense and lax), since in Italian the two sounds have an allophonic value[32].

Hyper-differentiation of phonemes, on the contrary, occurs when a phonetic distinction is imposed on language B on the basis of the one existing in language A. Weinreich reports the example of Latvian-German bilingual speakers: in this case, a hyper-

[32] This example will be presented and further examined in Chapter 3, in light of the recent perceptual theories on non-native language acquisition.

differentiation is produced in German between velar and palatal consonants based on the Latvian model.

Reinterpretation of distinctions occurs when the speaker distinguishes phonemes of a system B on the basis of features which are redundant in that same system, but are instead relevant in the primary system A. In this case, a feature specification which is redundant in A will be re-interpreted as phonemic, because it has phonemic value in B. Weinreich (1953: 19) provides the following example: the Schwyzertüütsch ['fili] (/'fili/) could be interpreted by Romansh speakers as /'filli/, as they would erroneously recognize as distinctive the semi-lengthening of [l] in Schwyzertüütsch in post-vocalic position. Though, since vocalic length is not relevant in Romansh, Romansh speakers would neglect the shortening of [i], which is instead a distinctive trait in Schwyzertüütsch.

Sound replacing (or *phone substitution*) involves those phonemes which are realized differently in languages A and B, yet are characterized by the same traits. Weinreich gives the example of romance-schwyzertütsch bilinguals: both languages exhibit open front vowels, which are represented respectively by /ɛ/ and /æ/. For such speakers, it is common to employ one of the two phones as an allophone of the other[33].

As far as Lado's contributions are concerned, his seminal studies led to the development of the Contrastive Analysis Hypothesis (CAH), which primarily aimed to describe and motivate L2 learners' errors in their production. Briefly, the CAH predicted that aspects (or features) of the L2 that were similar to the L1 would be easy to acquire, while those aspects that were different in the two languages would be difficult to acquire: its purpose was hence to compare languages based on their features ("contrastive features" in phonetics), and teach L2 learners those non-native features which differentiated from the L1 (Hansen Edwards & Zampini, 2008: 2-3)[34]. Since then however, "transfer" and "interference" started to be considered as negative events (i.e.

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[33] A wider and more in depth discussion on issues of contact, transfer and borrowing at other linguistic levels can be found in Regis, 2013.

[34] Transfer is at the core of other theories specific to L2 phonology, which will be presented and discussed in Chapter 3.

as errors) in the learning process and as markers of difficulty or failure to acquire the correct structures of the target language. Yet, we agree with Matras (2009: 74) when claiming that errors could instead mirror learners' overall repertoires of linguistic forms. In this perspective, phenomena of transfer and interference could, for instance, reveal different phonetic realizations among L2/L3 acquirers, either throughout their learning process, and/or with respect to full monolinguals[35].

Regarding speech production, plenty of research has clearly demonstrated that the first language habitually interferes with second language production in bilinguals, causing in native listeners the perception of a "foreign accent" (i.e. an accent which is noticeably different from that of native speakers of the language)[36]. In other words, a non-native language is supposed to be learned through the "filter" of the native language, which acts at all linguistic levels. As observed in §1.1, crucial studies in this field have recognized in the onset of L2 (i.e. age of foreign language acquisition) a trigger for differences between bilingual speech productions and those of monolinguals (e.g. Flege, 1987; Flege, Munro, & MacKay, 1995).

Broadly speaking, studies on phenomena of "Cross-linguistic influence"[37] have generally aimed to describe how and to what extent native linguistic knowledge influences/interferes with the production, comprehension and development of a target language (De Angelis, 2007). However, as described by Flege (2007):

> *«cross-language interference is a two-way rather than a one-way street, that is, learning an L2 leads to both L1-on-L2 and L2-on-L1 influence rather than just the "interference" of previously learned L1 structures*

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[35] Paradis (2004: 188) discriminates "static" from "dynamic" interference: the former accounts for a speaker's implicit competence which differs from that of native speakers, while the latter is given by errors in L2 performance, or by the unintentional intromission of an L1 element into L2 (or vice versa).

[36] According to Munro (1998), foreign accent can be defined as «*non-pathological speech produced by second language learners that differs in partially systematic ways from the speech characteristics of native speakers of a given dialect*».

[37] Measurable effects on languages produced by linguistic contact (either relatively brief or long-lasting) are generally referred to as cross-linguistic influence or interferences (CLI) (see e.g. Flege, 1987; Pavlenko, 2004; Schmid, Köpke, 2013). This term was first coined by Sharwood-Smith & Kellerman (1986) with the purpose to include all phenomena of (inter)language influence, such as "transfer", "interference", "avoidance", "borrowing" (Sharwood-Smith and Kellerman, 1986: 1), and the various aspects of language loss (see Chapter 2 for a discussion on language loss).

on L2 learning or the "transfer" of phonic elements from the L1 to an L2 learned later in life».

Also, according to Antoniou, Best, Tyler & Kroos (2011), the resulting influence of the L1 on the L2 is just one out of the four possible outcomes of interference involving bilingual speech[38].

A second possibility for interlanguage interaction is that learning an additional language may eventually affect spoken productions of the L1, compared to L1 productions prior to L2 learning. Besides unidirectional L1-influence on the L2 and bidirectional L1-L2 interaction, a third possible outcome is that, if the later-acquired L2 becomes the dominant language, it may not undergo L1 interference anymore, and will instead influence the native system[39]. The fourth possibility is that there is no cross-linguistic interaction: L1 and L2 do not influence one another: in this case, phonetic performance of bilinguals could be equated to that of monolinguals of each language.

In the present work, we will deal with a linguistic situation comparable to the second scenario presented in Antoniou *et al.* (2011), which we will henceforth refer to as "regressive transfer" (see below). Our purpose, in fact, is to test whether specific sound patterns of HSs' dialectal repertoires are still comparable to those of monolingual speakers, or have undergone phenomena of CLI due to the extended contact with the host country's language, thus modifying their fine-grained features.

[38] When exploring the multiple manifestations and implications of CLI, Antoniou *et al.* (2011) employed code-switching (CS) to detect the immediate phonetic effects of L1-L2 interaction. The scholars claim that CS can be considered as an innovative too in this field: its effects on phonetic realization during speech production have in fact received little attention compared to other levels of language use. For instance, manifestations of code-switching have been thoroughly investigated in their syntactic, morphological and lexical constraints, as well as the social contexts within which CS occurs.

[39] Studies have designated language dominance to be the crucial factor in determining which language (L1 or L2) will influence the other, non-dominant language. For instance, Piske, Flege, MacKay & Meador (2002) studied early Italian-English bilinguals who after prolonged L2 use had become dominant in their L2 (English): based on the ratings of native English listeners, they did not exhibit detectable foreign accents. Hence, they suggested that L2-dominant bilinguals may be the most likely to suppress L1 phonetic interference on L2 production, because of their highest proficiency level in the L2.

1.5 Cross-language interference between L1 and L3: regressive transfer

At synchronic level, the interferential effects can be explored within speech acts of a multilingual speaker, a consequence of the cognitive processing of more than one linguistic system. Nonetheless, De Angelis (2007) points out that thus far CLI research has gone hand in hand with studies on Second Language Acquisition (SLA), while dynamics of interference involving more than two languages have been essentially neglected (or rarely mentioned). On the contrary, Third Language Acquisition (TLA) indeed provides quite an interesting subject of investigation for CLI: since L3 acquisition has to cope with two previous acquired languages, it has to choose the L1 or the L2 system as language supplier (or source language) (Cenoz, 2001). In fact, it has been acknowledged in recent L3 acquisition research that not only L1, but also prior L2s may have a considerable influence on learners' interlanguages. (Hammarberg & Koptjevskaja-Tamm, 2003). More specifically, L2 proficiency may influence not only the amount, but also the type of language transfer that takes place in acquiring a third language (Fouser, 1995: 395). In order to predict which background language/s (L1 or L2) might be more prone to be taken as a source language, CLI studies have pointed out several factors: language distance, (i.e. typological relation), target language proficiency and source language proficiency, length of residence and exposure to a non-native language environment, order of acquisition, and degree of formality in the acquisition and in contexts of use (De Angelis, 2007). Among studies concerning TLA, Ringbom (1986: 156) accurately investigated the importance of L2 proficiency in lexical transfer into L3[40]. He claimed that:

> *«[...] where cross-linguistic influence is found, usually between to related foreign languages, this influence is generally confined to the area of lexis. Influence from languages other than the L1 seems to be*

[40] It is also worth mentioning two remarkable studies on source languages for L3 acquisition: one carried out by Magiste (1984) on L3 learning strategies in bilingual immigrant students, and one by Klein (1995), who investigated acquisition of L3 lexical items and syntactic constructions trough a Universal Grammar parameter-setting framework.

insignificant in the area of grammar and non-existent in phonology»[41].

However, consistently with Cabrelli Amaro's (2017) recent remarks, we observe that phonetic/phonological influence exerted by a third language on the native system(s) has so far received insufficient attention, with respect to the larger amount of studies concerning patterns of L2 interaction with L1 in late bilinguals (Cabrelli Amaro, 2012; see also De Angelis, 2007; Hammarberg, 2001; Rothman, Cabrelli Amaro & de Bot, 2013, for a review). Also, as Cabrelli Amaro (2017) further highlights, most studies on CLI have addressed progressive transfer from the L1 and/or L2 to the L3, to the detriment of L3 regressive transfer (i.e. when L3 affects the L2 and/or L1)[42].

Concerning the language distance factor, as reported in the literature review carried out by Fouser (1995), studies on TLA have established typological controls over L1, L2, and L3 to test hypotheses regarding the relationship among the three languages in contact (for instance, by comparing Indo-European languages with one another or with non-Indo-European languages) [43]. It has been demonstrated (see e.g. Francis, 1999) that structural closeness or distance can indeed play a crucial role, either accounting for a successful or unsuccessful acquisition[44], respectively, as well as possible contact-induced changes. In other words, according to Thomason (2010: 40-41): the degree of typological distance between specific subsystems of a source language and a receiving language favors predictions of possible interference occurring under differing degrees of contact intensity[45]. Specifically, the scholar argues that «*minimal typological distance*

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[41] Fouser (1995: 400) confirms that research on third language acquisition has mostly focused on the facilitative effects of lexical transfer from L1/L2 in learning an L3.

[42] For instance, CLI exerted by L2 on L3 acquisition has been investigated by Chamot (1973) who argued that a closely related L2 hampers L3 acquisition. To describe interference caused by transfer from L1 and/or L2 linguistic structures, the scholar (as well as a consistent number of other scholars) mainly took into account learner's errors in the target L3 (Fouser, 1995: 392).

[43] De Angelis (2007: 22), however, argues that «*sometimes the term formal similarity refers to a relationship of similarity between the features or components of two or more languages without necessarily implying a genetic relationship between them*». Multiple connotations of "language distance" can in fact be found: language distance based on genetic relatedness, e.g. Romance or Germanic languages, (b) typological similarity of particular structures (i.e. formal similarity) and (c) psychotypology, e.g. the learner's perception of similarity of languages (see Duhalde Solís, 2015 for a review).

[44] Concerning adult learners' L1, a typologically related L2 will thus be easier to learn than one that is genetically distant (Fouser, 1995: 395).

[45] See also the outstanding work carried out by Llama, Cardoso, & Collins (2010) concerning the role of

is in part responsible for the frequency of inter-dialectal interference involving inflectional features that are rarely transferred in cases of foreign interference. Where contact is very intense, typologically significant contact-induced changes may occur», including borrowed phonology and phonetics in native vocabulary.

For instance, Cabrelli Amaro (2017) examined the acquisition of L3 Brazilian Portuguese by two groups of sequential bilinguals: L1 Spanish/L2 English vs L1 English/ L2 Spanish. In the former case, L1 and L3 are typologically similar, while in the latter L1 is typologically different from L2 and L3.

1.5.1 Multiple cross-language interference in Italo-Australian Heritage Speakers

With respect to the influential study conducted by Cabrelli Amaro, the peculiarity of the present work lies in the fact that dialect L1 and Standard Italian L2 are in diglossic relationship with one another[46], rather than being two completely separate systems: each of them exhibits particular features, yet shows a certain degree of similarity, as well as an evident typological closeness. On the other hand, L1 Veneto Dialect and L3 English are typologically different, thus showing a comparable picture with respect to the second group analyzed by Cabrelli Amaro. In support of our assumptions, some studies point out that multilingualism also indicates «*diglossic situations with a functional specialization between two languages or varieties (one vernacular and one superposed*)» (Clyne, 2003: 5). For instance, Dal Negro & Vietti (2011: 90) claim that there are «*various degrees of multilingualism, meaning passive and active mastery of more than one dialect (including koiné varieties and more prestigious dialects) or minority language*».

Considering the lack of research on phonetic and phonological factors interacting in TLA, this contribution aims to shed light on the speech dynamics arising in multiple CLI, in order to better describe the roles played by the native language(s) interacting with

typological distance and language status in TLA.

[46] As we will illustrate in Chapter 4, however, the term "diglossia" defines the linguistic situation of Italy in the post WWII period (i.e., at the time of our informants' migration), while the term "dilalìa" has been purposely introduced to describe the current Italian linguistic situation.

systems beyond an L2. Specifically, we will explore regressive CLI occurring from L3-English on L1-Veneto dialect through the segmental analysis of selected speech features of Italo-Australian HS from the area of Belluno. As pointed out by Benmamoun, Montrul & Polinsky (2013), in fact, heritage speakers can diverge from native speakers on several levels: phonology, lexical knowledge, morphology, syntax, case marking, and code-switching. The scholars claim that L2 or L3 phonology is generally a domain in which heritage speakers excel. Conversely relatively recent studies on adult late bilinguals argued that native speakers are sometimes judged as non-native after a prolonged emigration (de Leeuw *et al*. 2010; Opitz, 2011; Nagy, 2015, a.o.), showing that non-native accent may develop due to low use of a heritage language and prolonged lack of exposure.

Taking into account these considerations, we can hence formulate preliminary research questions: do Italo-Australian HSs from Veneto retain their native phonology? If yes, to what extent? Are the phonetic values of both their vowels and consonants affected by L3 regressive transfer, thus contributing to a heritage accent? As we will discuss in the following chapter, a "heritage accent" may, in fact, arise due to weakening of the HL structure that culminates in the so-called phenomenon of "language attrition" (Godson, 2003).

2. Loss, attrition and shift: a phonetic perspective

In this chapter, we will present the diverse, yet strictly-connected concepts of "language loss", "attrition" and "shift", by taking into account recent studies carried out on this field (§2.1). Moving from the first definition of "attrition" given by Lambert & Freed (1982), we will observe how research has strived to provide a unique label for patterns of language impoverishment, due to the large number of concurrent factors triggering this phenomenon (as outlined by Van Els, 1986). As a consequence, each factor generally causing language loss (i.e. forgetting due to age, reduced L1 or L2 input, or migration in a non-native language environment) has become itself a research object, and has therefore brought about differences in definition among the scientific community (de Leeuw, 2008). We will observe that the cover term "language loss" includes various phenomena that can be divided into two main categories, depending on the context in which they occur: (i) if they occur within individuals, they can be either pathological (aphasia) or non-pathological (attrition) (Schimd, 2011); (i) if they occur at a societal level, i.e. within a whole community, they can either imply a language shift or language death (Yağmur, 2004). Moreover, we will point out how attrition and shift can be interpreted, respectively, as a structural reduction and a functional reduction in the use of the L1, the former suggesting change in language competence, the latter implying a change in the use of language, within or between generations (Celata & Cancila, 2010). Then, in §2.2, we will narrow down the discussion, principally focusing on phonetic aspects of attrition in immigrant communities. Finally, in §2.3, we will deal with extra-linguistic factors concurring in attrition phenomena, i.e. age of arrival, age of onset, level of education in a given language, attitude and social identity of the immigrant speaker. The purpose of his chapter is to provide theoretical tools to investigate native language attrition of in spoken productions of first-generation Italo-Australian immigrants from Belluno, Veneto. In light of the above-mentioned approaches, we will mainly explore to what extent specific Dialect-L1 phonetic features may have undergone structural change at an intra-generational level, presumably due to a reduced amount of L1 external input and an increasing use of English. Moreover, we will draw some considerations on sociolinguistic implications of attrition, namely a possible decline in proficiency observed within a whole speech community.

2.1 Definition of "loss", "attrition" and "shift"

Within the last few decades, a considerable number of studies have introduced and developed in several ways the multi-faceted notions of "language loss" "shift" and "attrition". In particular, two major events lead to acknowledge the study of language loss in general as an actual field of research. In first place, the conference "*Attrition of Language Skills*", which was held at the University of Pennsylvania in 1980, and, successively, a second conference that took place in the Netherlands in 1986 (Yağmur, 1997). Before these proceedings, the discipline's purpose was mainly to deal with the loss of language ability related to aphasia or other language disorders (Caruso, 2010). However, since then, the area of language attrition went beyond the analysis of pathological cases and began to extend to other perspectives, hence paving the way for the subsequent research in more recent times. In the 1980 conference, Lambert & Freed (1982: 1) first defined language attrition as:

> *«The loss of any language or any portion of a language by an individual or a speech community. It may refer to the declining use of mother tongue skills by those in bilingual situations or among ethnic minorities in (some) language contact situations where one language, for political or social reasons, comes to replace another»*.

To give a more exhaustive description of such phenomenon, early contributions on these topics widened the perspective by taking into account both linguistic and sociolinguistic aspects involved in the process of attrition. For example, also Andersen (1982) suggested that language attrition within an individual refers to forgetting a language as a consequence of lack of use, while at a societal level it refers to the loss of a language by successive generations in immigrant or minority communities. Henceforth, the concept of "individual language loss", which had been identified as language attrition over time in language contact situations, started to be distinguished from "societal loss" (Caruso, 2010).

To throw light on this ever-growing field of research, Weltens, De Bot, & Van Els (1986) first provided an exhaustive classification of language attrition studies within the European framework. Leaving aside the issues related to pathological implications, their work only focused on the concept of "natural language attrition", described as a process which basically implies an impoverishment, or, more generally, a change in the knowledge of a given linguistic code. In Van Els (1986: 4), we can find a thorough categorization of the phenomenon, according to what is lost and in terms of the environment in which it is lost, as following[47]:

1. Loss of first or primary language (L1) in the environment of that language, e.g., dialect loss or aging;
2. Loss of L1 in a second language (L2) environment, e.g., loss of the native language by immigrants;
3. Loss of L2 in L1 environment, e.g., foreign language loss;
4. Loss of L2 in L2 environment, e.g., second language loss by aging immigrants.

As we can see from the above-mentioned contributions by Andersen (1982) and Van Els (1986), and also from the terminology used in de Bot & Clyne (1994), the term "attrition" is frequently included within the wider - and more general - concept of "language loss", which is used as its cover term (Opitz, 2011: 10). In fact, while language loss is generally employed to indicate the phenomenon of change or reduction of linguistic skills, the notion of attrition specifically refers to «*the loss of a language by a healthy individual (that is, loss which is not caused by brain injury or some pathological condition, such as aphasia or dementia)*» (Schmid, 2011:2).

Therefore, it is possible to claim that attrition is in first place a psycholinguistic and sociolinguistic phenomenon that affects the individual linguistic behavior of a healthy speaker, and concerns an overall change (usually a decline) in language use and

[47] This classification is also provided by Olshtain (1989: 152).

proficiency (Schmid & Köpke, 2013:2). Also, its effects can be observed within a speaker's whole lifespan, and either in his first or second-language knowledge (de Bot, 2007).

Firstly, it is therefore necessary to differentiate between "first" and "second language attrition", the former occurring in the above cases 1 and 2 and the latter occurring in cases 3 and 4, respectively, as described by Van Els (1986). Specifically, case 1 mainly refers to the ageing process, and to its consequences on the memory and the level of attention, as main factors responsible for the impoverishment of an individual's native language skills in a native-language environment. The gradual process of forgetting, either partial or total, appears to have as main effects "errors" (i.e., a lack of adherence to L1 linguistic norms) that a speaker with a full competence in a certain code would not commit[48].

Case 2, instead, occurs in the settings described by Selinger & Vago (1991: 3):

> «*The disintegration or attrition of the structure of a first language (L1) in contact situations with a second language (L2). [...] Attrition phenomena develop in bilingual individuals as well as bilingual societies, in both indigenous and immigrant communities*».

According to this observation, we could claim that a contact situation with an L2 can exert a certain influence on both individual and communities, triggering substantial variations in the quality of linguistic interactions[49]. In account to this, Schmid & Köpke (2013) rightly assert that changes and reductions of linguistic skills, in general, are commonly associated to acquisition where the input is restricted to certain contexts. Additionally, we see that the reduction of the linguistic input can affect both L1 and L2, either in a native or in a non-native environment (case 3). Concerning situations of

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[48] The decline at the mnemonic level of particular constructs can also be observed in ageing non-native speakers of an L2 in a second-language environment, as in case 4.

[49] Particulary, the need to discriminate between attrition in individuals and attrition within communities is stressed by Sorace (2004: 1), who claims that «*it is essential to ascertain what speakers knew when the attrition process began, since by definition attrition can only affect what was within the speaker's knowledge*».

attrition affecting an individual's second language, Olshtain (1989: 151) observes that they occur:

> « *[...] whenever there is a reduction in second language use due to group or individual needs and preferences or due to environmental changes limiting the use of the language (or languages) in question with respect to another language that is dominant in the new environment».*

Taking into consideration these assumptions, for the purposes of our work we will henceforth focus on native language attrition in communities of healthy individuals living in a second language environment (i.e., on cases of type 2). This particular process of language forgetting, in fact, often takes place within migration settings - namely, when people move to an environment in which their mother tongue is not (widely) spoken (Schmid, 2004) - which are at the starting point of our study on Italo-Australian immigrants.

This type of situation implies an extensive use of a non-native language, which gradually becomes the medium of privileged communication in daily life, and an extremely reduced use of the L1 (Köpke, Schmid, Keijzer & Dostert, 2007: 3; Chamorro, Sorace & Sturt, 2016: 521). Migrants stop receiving a constant L1 input and simultaneously modify their social relations, habits and lifestyle, thus substantially decreasing their use of their native language. That means that their L1, no longer used in all communication settings, undergoes the effects of a robust "attrition" with the L2 of the host country which is permanently active (Kroll, Bobb, & Wodniecka, 2006). In this respect, we report a recent study carried out by Chamorro *et al.* (2016), who examined within the framework of the Interface Hypothesis (see Sorace & Filiaci, 2006; Sorace, 2011) Spanish speakers experiencing L1 attrition from L2 English. Judgment tasks and eye-tracking experiments revealed that attrition effects decreased when speakers were re-exposed to L1. Accordingly, the scholars argue for the modularity of "online" sensitivity of bilinguals to input changes, with respect to an irreversible change in speakers' native knowledge representations.

It is therefore noticeable that migration/population movements do exert a significant influence on the linguistic competence of both individuals and whole communities, hence offering a unique perspective to observe attrition phenomena. Nonetheless, it still seems quite challenging to accurately define the use of the term "language loss" in the context of linguistic research. Within a perspective that spans across communities and generations of speakers, the notion of "shift" takes its place alongside the concept of "attrition", indicating a gradual replacement of a given language as a new mean of everyday communication in an entire community, as well as the overall extinction or death of a particular language[50].

It has been reported that the term "loss" covers a broad semantic area, and we have so far claimed that the interpretation of the forgetting process is given by the more circumscribed and gradual term "attrition". Though, to delineate a boundary between the processes of "attrition" and "shift" within the more general panorama of language loss phenomena still seems to be somehow problematic. In the attempt to shed light on these relatively complex notions, Yağmur (2004: 135) described loss as a:

> «[...]*generic term denoting a decline in language skills in both individuals and groups. This approach assumes attrition and shift to be individual and societal aspects of loss, respectively: attrition suggesting the loss of skills in individuals and shift implicating a decline in language use on the community level*».

Taking into account these definitions, we will henceforth consider the type of attrition within an individual as relatively different from the type observed within the speech community. As reported by Caruso (2010: 22),

> «*While the former is investigated from a psycholinguistic perspective and deals mainly with forgetting a language due to the lack of use, the latter is approached from a sociolinguistic perspective, and deals with attrition across groups*».

To recapitulate, the concepts included under the cover term "language loss" can be summarized as in the following schema (see Schmid, 2011:2):

[50] The concept of "societal loss" is commonly termed as "language shift", as reported in Caruso, 2010.

LANGUAGE LOSS

by individuals	**by communities**
pathological: *aphasia*	*language shift*
in healthy speakers: *language attrition*	*language death*

It is also appropriate to point out the perspective presented by Celata & Cancila (2010), according to which language shift is to be interpreted as a consequence of attrition occurring in immigrant communities:

> *«[...] that is when immigrants gradually come to abandon their L1 and conform to the variety of the majority. The linguistic decay caused by an asymmetric contact would imply both a functional reduction (shifting) and a structural reduction (attrition) in the use of the L1*».

Regarding the types of change that occur in language shift and language reduction, they hence suggest that there would be a change in the use of language and a change in language competence, respectively. In order to better distinguish the above-mentioned phenomena, Yağmur (2004: 134) defines the former as “inter-generational” and the latter as “intra-generational”. That is, the loss of linguistic skills respectively takes place within generations or within individuals over a more or less extended period of time. Specifically, in Köpke & Schmid (2013:37), Gürel & Yılmaz assess that:

> «*inter-generational change observed in the native language of second or third generation immigrants is generally considered to be a case of incomplete L1 acquisition rather than L1 loss because these individuals (also called heritage speakers) may have failed to acquire linguistic properties of their L1 completely in their childhood due to early L2 exposure in an L2 country at the expense of L1 exposure*”.

On the other hand, intra-generational change can be defined as:

> «*a gradual decrease in L1 proficiency that had previously been acquired completely by individuals (first generation immigrants) who move to an L2 country at an adult age and begin to use the L2 extensively while keeping little or no contact with their L1*».

We notice that the authors also raise issues related to the different implications of incomplete *vs* complete L1 acquisition. The first case is commonly represented by the so-called "child attriters", who have not reached a complete monolingual/native proficiency before being fully immersed in an L2 dominant environment, and whose process of L1 acquisition is therefore arrested or reversed (Opitz, 2011: 13). The second case, on the other hand, refers to as "late L1 attriters" (i.e., late bilinguals), who started from the same level of L1 competence as other monolinguals and reached a full mastery of their native language within adolescence/adulthood, before migrating. (Bergmann, Nota, Sprenger & Schmid, 2016).

This panorama accurately depicts the condition of Italian immigrants permanently living in an English-speaking country, who are the object of the present study. Almost all Italians who migrated to Australia after WWII fall in the category of late bilinguals/late attriters, since they were late adolescents or young adults at the moment of their departure toward the host country (Avesani *et al*., 2015). Also, in line with the situation described by Van Els (1986) in the second type of attrition phenomena, after their arrival in the new homeland they started to acquire English (mainly spontaneously) for surviving and integrating in the social life of the new environment.

Moreover, as extensively explained in Chapter 4, once in their adoptive country, Italians came in contact not only with the Australian variety of English, but also with many local dialects and varieties spoken by Italian immigrants originating from other regions, who formed a wide and diversified community. As reported in previous studies by Avesani *et al*. (2015) and Avesani *et al.* (2017), interactions between subject originating from the same region are predominant, with respect to communication with Italians of other regions. Consequently, local dialect L1 (or a dialectal *koinè*) is supposed to be employed as vehicular language with more frequency than (regional) Italian.

Based on these observations, one possible scenario is that adult Italian immigrants might experience changes or reductions in their native language features, i.e. in their local dialect, due to the extensive contact with linguistic structures of English. In fact, there is mounting evidence (Seliger & Vago 1991; Yağmur 1997; Schmid, Köpke, Keijzer & Weilemar, 2004; Köpke *et al.,* 2007; De Leeuw, 2008; De Leeuw, Schmid & Mennen,

2010) that being immersed in an L2 environment can have profound effects also on this category of late bilinguals, in which language dominance reversal in favour of the L2 can occur (Mägiste, 1979; Opitz, 2011). In this perspective, English may become the dominant language after years of extensive use, thus exerting pressure on communicative contexts and linguistic structures of both dialect and Italian[51].

Conversely, if the amount of use of English is circumscribed to few communication settings, it might not exert any influence on dialect (or Italian): immigrants could hence preserve native linguistic features, without showing signs of attrition. In this scenario, these subjects are expected to display the same phonetic and phonological characteristics attested in their native speech, and to consequently have crystalized the state of the native language(s) at the time of migration[52]. Broadly speaking, we can observe from a significant amount of studies that the restructuring of the L1 system according to L2 patterns is receiving an ever-growing attention from scholars (see the review in Köpke & Schmid, 2013). This is due to the fact that we are again witnessing large waves of migration, and more and more frequent situations of persistent and active presence of an L2 in the individuals' linguistic repertoires. In account to this, Pavlenko (2004: 54) describes the consequences of native language attrition in a bilingual environment:

> « (It) *involves a more or less permanent restructuring, convergence, or loss of previously available phonological and morphosyntactic rules, lexical items, concepts, classification schemas, categorical distinctions, and conversational and narrative conventions, exhibited not only in the L2 but also in a monolingual L1 context, and not only in production but also in perception and comprehension.*

[51] Such hypothesis has been discussed in Avesani *et al.* (2015), who detected phenomena of erosion of native phonetic features in one speaker out of the four investigated. With respect to the others, this subject had a more formal exposure to English from a younger age and over a longer period of time. In fact, this speaker arrived in Australia at the age of 14 and received her education in English from high school through university.

[52] The second hypothesis has been confirmed in Avesani *et al.* (2015) for the remaining three speakers. They showed maintenance of their L1 target linguistic features, after more than 5 decades of residence in Australia. English apparently did not interfere with their native productions, even though the subjects exhibited frequent code switches to English in spontaneous conversations.

2.2 Phonetic aspects of attrition

L1 attrition has been found in a variety of domains: both in speech production (Schmid, 2002) and in perception (Major, 2010) as well as across a wide range of linguistic levels: lexical (Köpke, 2002; Pavlenko, 2000; Schmid & Jarvis, 2014), morphological (Keijzer, 2010; Ribbert & Kuiken, 2010; Schmitt, 2010), syntactic (Gürel, 2004, 2008; Tsimpli, Sorace, Heycock, & Filiaci, 2004) and pragmatic (Brown & Gullberg, 2008, 2011).

However, Pavlenko (in Schmid, 2011:18) reports that, among all components of linguistic knowledge, most change is observable in the mental lexicon, for the following reason:

> « […] *unlike grammatical and phonological systems, the mental lexicon is what has been called an open-class system. This means that it is relatively easy to add new items to the lexicon or to change the meaning of existing ones, even in predominantly monolingual contexts*».

So, the lexicon seems to be more significantly influenced by phenomena of attrition, with respect to other areas of linguistic competence. In account to this, the scholar adds that the vocabulary of a linguistic community and the meaning of words can change quickly, because the lexicon consists of thousands of items, and might therefore present overlaps in case of persistent contact between native and non-native repertoires. Nonetheless, a single transfer of a lexical item from L2 to L1 cannot be classified as a manifestation of attrition processes, since it does not imply a reduction in the competence of the native language. Instead, what can properly be called "lexical attrition" occurs when there is a suppression of a L1 lexical item, as a consequence of the presence of a new linguistic context. Such effect may come about in the replacement of a L1 with a L2 term, or in desuetude of a given expression. In general, this phenomenon takes place when, among the elements involved in competitive relations (i.e., the ones which display semantic or morphological similarities), we have one item prevailing in its frequency of use. Commonly, the predominant item belongs to the L2, that is the predominant linguistic environment in the speaker's everyday communication.

On the other hand, other observations have to be made when considering categories with restrained boundaries, such as phonetics and phonology. Differently from the lexicon, the phonetic inventory is averagely composed by a rather low number of elements, yet the phonetic and phonological systems are similarly exposed to a conspicuous and constant intersecting of elements of L1 and L2 (also within individual speech acts). This means that , while a single lexical item can occur with low or null frequency, a phonetic or phonemic element will occur with the highest frequency, thus producing significant effects at the mnemonic level. Cognitively, in fact, the former intertwines less binding relations with respect to the latter. The cancellation of a single word might condition its related items only superficially, whereas the modification of a single phoneme would entail profound rearrangements in the whole system[53]. In account to this, De Leeuw (in press: 23) claims that

> «*phonetic attrition would thus reflect the start of an unbalancing of the native language system, which arises from the perception of phones, before distinctive phonemes, lexemes, and syntactic structure*».

Recent studies have generally revealed that native speech is ductile and can undergo modifications upon L2 acquisition (De Leeuw *et al.*, 2017) and that phonetic attrition is an indicative clue of L1 plasticity in the acquisition of a new dialect or language in the post-adolescence (De Leeuw, 2012: 3) At the same time, according to De Leeuw (2008: 29), we should be cautious in assuming that L1 loss, in general, is mostly related to the interaction between L1 and L2 phonetic systems. As the author claims,

> «*(i)t is still unknown, in fact, whether interference is caused by an intruding L2 system, or whether L2 phonetic properties take over an L1 system which is already undergoing attrition, for different reasons aside from solely the acquisition of the L2*» (see also Schmid, 2002).

Also, issues raised by intra-speaker variability should be properly addressed to evaluate the extent of phonetic attrition (as highlighted by De Leeuw *et al.*, 2010; Bergmann *et al.*, 2016). To provide an accurate description of phenomena of erosion

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[53] Attrition effects have been found at both the segmental and prosodic level in De Leeuw, 2008; De Leeuw *et al.,* 2010, 2012; De Leeuw, Mennen & Scobbie, 2013, a.o.

and modification of phonetic elements, we believe that studies of phonetic and phonological attrition should simultaneously consider and compare the attriters' and non-attriters' inventories. For this reason, in this contribution we will address the question of maintenance or attrition of specific L1 phonetic features by comparing production of Italo-Australian immigrants with those of monolingual speakers in Italy living in the same areas or villages from where the emigrants originated, and of the same generation.

Besides, we will base our assumptions on the parameters set by Pavlenko (in Schmid, 2011), which aim to classify the various manifestations of attrition at a phonetic/phonological level, as following:

- *Borrowing:* i.e., when elements from one language (L2) are integrated into another (L1). Borrowing can appear either temporarily, when a speaker uses an L2 form within a single utterance in his L1, or permanently, if the L2 item is routinely employed within native productions by the whole speech community. In most cases, attrition triggers phonological transfer only within lexical loans: these items are usually implemented and pronounced according to the phonological norms of the recipient language, while single phonemes or sounds are usually not borrowed and integrated into the L1.
- *Restructuring:* on the other hand, phonetic restructuring is reported to occur frequently, as a consequence of an extended contact with a non-native phonological system. Pavlenko recalls the case of restructuring in the pronunciation of L1 German /r/ in an immigrant's speech (Gertrud U.). This subject, who was a late German-American English bilingual, showed signs of attrition on her non-rhotic native accent. While her L1 originally displayed the allophones [ʁ] and [Ø], her speech showed presence of German uvular [ʁ] and American English retroflex allophone [ɻ], hence revealing a slight restructuring due to the immersion in an L2 environment.
- *Convergence*: as demonstrated by a significant amount of studies (e.g., Flege, 1987; Major, 1992; Chang, 2009, 2012, among others), if a given phoneme has different pronunciations in the two languages, the attrited speaker will produce

both in L1 and L2 an allophonic form of the same phoneme which has intermediate acoustic/articulatory characteristics between the two systems. According to Chang (2009), this process of classifying a new L2 sound as equivalent to an existing L1 sound means generating a cross-language perceptual link, that causes input in L1 or L2 to reciprocally affect the sounds in the two systems. To give an example, in an early study, Flege (1987) examined the inter-speaker variation related to phonetic attrition in Voice Onset Time (VOT) in American English and French speakers. He analyzed VOT of /t/ productions in native American-English speakers immersed in a French environment, and in native French speakers immersed in an American-English environment. It results in what he referred to as "merged" [t], i.e. intermediate between the target language norms (since English exhibits longer VOT values than French). Similarly, Major (1992) brought out thought-provoking results on the VOT of 5 native American-English speakers who acquired Brazilian-Portuguese in adulthood. Although all bilinguals exhibited changes in their L1 realisation of VOT (which tent to be shorter and therefore more Portuguese-like), as a consequence of L2 acquisition, attrition was more consistent in casual/informal speech. As an extreme consequence of such convergence (or "merge") of phonetic features, «*the L2 user would no longer be perceived as a native speaker of his L1 when interacting with monolingual speakers of L1*» (Bergmann *et al.*, 2016:72) (see cases of adult bilinguals in: Cook, 2003; Clyne, 2003; Pavlenko 2003; De Leeuw, 2008)[54].

- *Shift:* in a diachronic perspective, this process generally consists in a decline in language use across a lifespan or across generations, related to the gradual replacement of a new language as mean of everyday communication. This phenomenon is accurately described in several works on Italo-Australian communities by Bettoni, 1985a, 1985b; Bettoni & Rubino, 1996, Rubino, 2014, a.o. Specifically, Rubino (2014) defines "language shift" as the transition to

[54] The issue concerning convergence of phonetic traits due to contact with similar phonetic/phonological categories will be more thoroughly investigated in the following chapter.

> English as a domestic language, operating at the group or at the individual level. Higher rates of language maintenance occur (i) in those areas where a group is numerically strongest but also there is less dispersion; (ii) in the urban rather than the rural setting; and (iii) in the local areas with high concentrations of speakers. Among Italians (and other ethnic groups), at the individual level we found generation, gender, age and type of conjugal union as relevant variables in assessing the extent of shift. In fact, the Italo-Australians who declare to speak more English at home are: (i) second generation, (ii) men more than women, (iii) the younger speakers of the first generation and the older ones of the second; and (iv) who has a partner who is not Italian. Consequences of shift at a phonetic/phonological level are exemplified by Pavlenko through the case of the immigrant Gertud U. Namely, in her spoken productions of /l/, she shows consistent shift to the use of American English velarised allophone [ʟ̥], in place of her German L1 alveolar [l].

In addition to these considerations, in the following paragraph we will aim to provide a panorama of adjoining extra- and socio-linguistic factors, i.e., education, social network patterns, degree of formality, etc., as other possible causes triggering phenomena of phonetic attrition.

2.3 Extra-linguistic factors of attrition

As we observed in the previous paragraphs, much research on language loss/maintenance has been recently conducted on more circumscribed phenomena of language attrition and shift, also in relation with L2 acquisition.

In particular, age of acquisition (AOA) of a second language has been acknowledged as a relevant factor in assessing bilinguals' competence and has therefore received considerable attention in this area of research in recent decades. As reported in the reviews carried out by DeKeyser & Larson-Hall (2005), Hyltenstam & Abrahamsson (2003) and Kroll & de Groot (2005), studies on age-related maturational constraints have provided explanations in determining patterns in the acquisition and proficiency of a second language. However, as Anh, Chang, DeKeyser & Lee-Ellis (2017:696) point out: «*(a)lthough empirical studies are increasingly providing insights into how Age of Acquisition (AOA) affects acquisition of L2 phonology, age effects on the L1 have rarely been investigated directly*».

A possible explanation is that, when identifying correlations between linguistic change and social variables that contribute to first language attrition (Romaine, 2010), much ambiguity has been found for what concerns age effects on the L1. More specifically, it has been recognized that these can mirror loss or reduction in the L1 competence after a complete or incomplete acquisition (Anh *et al*., 2017:696), thus drawing a complex and manifold panorama. As already observed in this work, there is a general consent among scholars in claiming that early exposure to a L2 that goes in parallel with a reduced contact with the L1 may play a role not only in bilinguals' L2 competence, but also in their native language proficiency (Ammerlan, 1996; Pelc, 2001; Schmitt, 2001; Schmid, 2002). It has been proven, in fact, that the amount and frequency of contact has consequences on the activation of L1, hence conditioning the psycholinguistic balance between the two languages. However, it is still unclear how to predict effects of L1 attrition with respect to the bilingual's age at which the contact with the native language decreases (Anh *et al.*, 2017). Moreover, the extent of attrition as a consequence of the predominant use of L2 does not seem to progress linearly over longer time-periods (e.g. de Bot, Clyne, 1994), thus making it difficult to describe its effects in a straightforward perspective.

As already pointed out, in fact, «*(a)ttrition of L1 among older children and adults differs from the L1 attrition process among pre-puberty children*» (Kaufman, 2001:185). This statement, consistently with a large number of findings in the literature (e.g. Kaufman & Aronoff, 1991; Bode, 1996; Isurin, 2000; Montrul, 2008; Bylund, 2008, 2009) suggests that an L1 system can be consistently influenced and modified if the attrition process sets in well before puberty. For this reason, Köpke & Schmid (2004) propose that attrition might be affected by the same factors which are involved in the "critical period hypothesis" (CPH) (Lenneberg, 1967). In brief, Lenneberg's theory postulated that, due to brain maturation constraints, it becomes more difficult to learn a L2 past a certain age. Such span is assumed to end with the beginning of puberty, around age 12

(Birdsong, 2006), with phonology being more prone to restriction with respect to syntax, morphology, and lexicon, respectively (Köpke & Schmid, 2004). For instance, it has been proven by Bylund (2008)[55] that after age 12, the L1 seems to show some resistance to attrition, without significant differences between adolescent and adult speakers. These observations can be assimilated to the theories concerning the critical period: if the process of L2 acquisition takes place before the end of the plasticity window, it is more likely to affect the stabilization of the L1 structures, consequently triggering phenomena of attrition. However, the existence of this critical window of time for L2 learning still raises questions among scholars. In account to this, Harley & Wang (1997) rather suggested the hypothesis of a "sensitive period", which decreases gradually after the age of 6 or 7 years. With respect to the CPH, it would imply that the easier it is for the child to learn L2, the more likely is it that he will forget his native language.

Therefore, we can observe that, when assessing age effects on L1 attrition in a bilingual context, the distinction between *children* and *adult* speakers[56] is crucial (Köpke & Schmid, 2004: 9). This debated issue is strictly related to the concept of simultaneous, early and late bilingualism. As introduced in the previous paragraph, Andersen (1982: 85) already described adult attriters (i.e. late bilinguals) as speakers who after having reached full mastery of their mother language would undergo a "true attrition". In children, on the other hand, we would rather witness what he refers to as "failure to acquire". This means that early and simultaneous bilinguals would undergo attrition of their native linguistic system when it has not yet become established, and is incomplete or interrupted. While it is reasonable to assume that a young adult who leaves his country has already reached a mature and complete competence in his L1, the situation is significantly more complex for youngsters, especially for those who are going through a period of "stable" bilingualism before the onset of L1 attrition. In fact, in accordance

[55] Bylund's experiment was conducted on migrant adolescents with Spanish L1 and Swedish L2, the latter acquired within puberty.

[56] Concerning adult, it is undebatable that the acquisition of a second language is driven by multiple concurring factors, such as the motivation to integrate in the host country's social and professional community, aptitude, time and effort employed in the language learning process, as well as the choice to maintain or modify features of cultural identity.

with the sensitive period hypothesis, in could be assumed that the younger a child is when she changes her linguistic environment (i.e. his *age of departure* is low) the higher the probability that the L2 will replace the L1.

More recently, Montrul (2008) also shed light on the distinction between “attrition” and “incomplete acquisition”: while the former indicates the modification or loss of a skill that was previously mastered, the latter refers to cases where the individual has not had the opportunity to fully learn a given language structure, due to reduced and insufficient input. To limit possible ambiguities, Schmid (2009) proposes to speak of "attrition" for late bilinguals who emigrated after the age of 10 or 12, and to use the expression “incomplete acquisition” to similar processes that occur among younger migrants or early bilinguals.

We have so far observed that, since the first studies on attrition, the question of the level attained in a language before the onset of attrition has been raised (Jaspaert, Kroon & van Hout 1986). As a matter of fact, the onset of bilingualism and the onset of attrition are often confused when we speak of “*age of onset*”. For this reason, Köpke & Schmid (2011) point out that, when selecting the typology of attriters, the minimum age for the time of emigration is determined to ensure that the L1 has been completely acquired, both before the onset of bilingualism or attrition. According to these authors, the minimum age is between 14 and 17 years old.

At the same time, the *length of time since the onset of attrition* plays a relevant role. Psycholinguistic research has proven that immersion in a different linguistic environment leads to a change in language dominance, (Köpke & Schmid, 2004: 11) and may occur after a relatively short period. In this regard, Köpke & Schmid (2011) claim that only those subjects who have spent a minimum of 7-15 years in an L2-dominated environment are likely to be exposed to attrition[57].

Although this criterion is often combined with some assessment of the frequency of use

[57] Köpke & Schmid (2011) report that in studies carried out by Lachman & Mistler-Lachman (1976) and Mägiste (1979), answers in L2 were found to become faster than in L1 on a picture naming test after approximately 7 years. On the other hand, Frenck-Mestre (1993) proved that a lexical decision task produced a similar effect after three years.

of L2, age and duration of immigration generally remain the main criteria for assessing the level of attrition (Köpke & Schmid, 2011). Besides, research that has examined the frequency of use of L1 show that it is a very complex variable. The quantitative aspects of the frequency of use (usually the only "measured" ones) would probably intervene to a lesser degree than the qualitative ones. Thus, even a moderate practice of L1 in formal situations (as for example in a professional setting) seems more effective for its maintenance than a more frequent use in a family setting (Schmid, 2007).

In addition to the above-mentioned factors, it should be appropriate also to consider the attriter's *level of education.* This aspect that has been largely neglected so far, probably due to the difficulty in quantify its implications in a multilingual and multicultural context. However, we could claim that a higher education level would lead to more explicit knowledge of a language.

Also, as Olshtain (1989) suggests, it is indispensable to evaluate the status, the prestige and overall dominance of each of the two languages belonging to the attriter's repertoire. Respectively, a higher status of the second language in the new environment might predict greater influence of that language on both individuals and entire communities, while low status might increase possibilities of attrition due to both lack of use and lack of motivation in the learning process. Another considerable variable is the incidence of immigrants' *social identity* within a community. For this purpose, Köpke *et al.* (2007) provide a classification of subjects liable to linguistic attrition, namely:

- Immigrants who do not have any relationship with the linguistic environment of origin. These speakers might present phenomena of erosion, especially when accessing to the lexicon.

- Immigrants who relate mainly to other subjects of the same linguistic origin, in which the attrition involves all levels of their linguistic structures.

- Speakers who maintain regular contacts with other members belonging to their community of origin. Such inputs allow a good level of maintenance of the native language, with a very low incidence of attrition.

We can suggest that, in some of these cases, we would plausibly observe levels of advanced bilingualism. According to the above-mentioned studies, therefore, isolated first generation speakers would tend in a first phase to assume a more "conservative" attitude towards their own L1. On the contrary, speakers integrated in a larger community would be more likely to embrace variations in their system.

3. Theoretical frameworks for Second Language Acquisition and Perception

In the previous section, we observed that the native language should not be conceived as static and invariable dimension, but rather as a dynamic and ever-changing system. Purposely, we shed light on the alterations that can occur in the L1 as a consequence of L2 acquisition, i.e. on phenomena of first language attrition in multilingual environments, caused by a bi-directional interaction between L1 and an L2. Within the broader phenomena of attrition, such patterns of linguistic change are traditionally identified by the literature through headings such as ''convergence'' (Schmid, 2011), ''cross-language interaction/influence'' (CLI) and ''reverse interference'', (Pavlenko, 2004; Schmid, Köpke, 2013). In the last few decades, issues related to CLI have been addressed by a considerable amount of studies, which demonstrated that L2 experience may exert a considerable influence also on L1 oral productions, provoking a phonetic restructuring of the native language (e.g., Flege, 1987, 1995, 2007; Flege, McKay & Meador, 1999; Flege, Schirru & McKay, 2003; Major, 1992, 2010; Chang, 2012).

In the following chapter, we will illustrate recognition of non-native language influence on L1 speech in some fundamental theoretical frameworks, respectively developed by: Flege (1987, 1995): Speech Learning Model (SLM); Kuhl: Native Language Magnet Model theory (NLM) (Kuhl, 1992, 1993, 1997); Best: Perceptual Assimilation Model (PAM) (e.g Best, 1995; Best & Tyler, 2007) and its extension PAM-L2 (Best, 1995; Best, Tyler, 2007); Escudero (2005): Second Language Linguistic Perception model (L2LP). These frameworks rely on the cross-language phonetic distance between native and non-native phones to predict the relative difficulty or ease of perception and production of non-native speech (Bergmann *et al.,* 2016; Mennen, Scobbie, de Leeuw, Schaeffler & Schaeffler, 2010). In addition, we will examine the notion of typological markedness as indicator of the difficulty in the acquisition of L2 structures, by presenting the Markedness Differential Hypothesis (MDH, Eckman, 1977) and the Ontogeny Pylogeny Model (OPM, Major, 2001). Moreover, we will briefly discuss the role of Universal

Grammar in the acquisition of a non-native phonological system, as suggested by L2 phonologists through the Optimality Theory (OT, Prince & Smolensky, 1993).

Among the molteplicity of approaches for the acquisition of non-native sounds, we will then select the SLM as the main framework to support our general predictions on sound maintenance or change. Additionally, we will employ the main postulations of the L2LP model to examine the dynamics of acquisition of the AusEng L3 vocalic system and its interaction with the native vocalic system. The motivations behind these choices are be provided below.

3.1 Speech Learning Model

Within the field of cross-language perception research, the SLM has been developed with the primary aim to describe how individuals reach – or fail to reach – accuracy in producing and perceiving phonetic segments in a second language. This model is built upon the following essential premises: firstly, that L2 learners, given adequate and sufficient input, could perceive the phonetic properties of L2 speech sounds accurately (Flege, 2005); secondly, as in L1 development, that L2 speech production is guided by perceptual representations stored in long-term memory; furthermore, but not less important, that the degree of perceived cross-language dissimilarity between the phonetic categories in contact plays a relevant role in determining how effectively sounds in an L2 will eventually be produced (Flege, 2005).

Contrary to the hypothesis of a critical period[58], the starting point of SLM is that learning mechanisms that guide L1 phonetic acquisition remain available and accessible throughout life, such that a specific L1 phonetic category « […] *continues to develop in adulthood under the influence of all sounds identified with that category*» (Chang, 2012: 250)[59]. As a result, even proficient late bilinguals are likely to experience

[58] By developing the Critical Period Hypothesis (CPH), Lenneberg (1967) observed that it is difficult to learn to pronounce an L2 without a foreign accent after onset of puberty (i.e., after the age of 12 years). So, he considered the presence of foreign accent (FA) as evidence that L2 learning might be limited by a critical period.

[59] Children are assumed to be more likely to form phonetic categories for L2 sounds than adults, because their L1 categories are not completely developed. According to Flege *et al.* (2003: 469), category assimilation will be more likely to occur in late bilinguals than in early bilinguals, who will be more likely

restructuring in the L1 at a phonetic level as a consequence of L2 experience (Schmid, 2011)[60]. More precisely, also based on studies carried out by Bohn, Best, Avesani & Vayra (2011) and Chang (2012), it is possible to claim that such restructuring is affected by the perceived phonetic similarities/dissimilarities between the native language and the L2. In other words, restructuring is due to the internal structure of the systems in contact during the acquisition process of the new language, rather than being solely interactional and driven by sociolinguistic factors. According to Flege's model, L2 speech production is constrained by L1 phonetic influences on the perception of L2 phones. In this hypothesis, both the native and target language are represented in a common perceptual space, where they mutually influence each other. That is, L1 and L2 sounds are posited to exist in a shared system, where there is a general pressure to keep them distinct, and to be related to each other on an allophonic, rather than phonemic, basis (Chang, 2012). Within this dimension, the relationship of L2 phonetic categories with L1 phonetic categories falls along a continuum that runs from "identical" through "similar" to "new" and bidirectional influence between the sounds of both languages is likely to occur.

3.1.1 Hypotheses and postulates

As Flege (1995: 233) postulates,

> «*(p)honetic systems reorganize in response to sounds encountered in an L2 through the addition of new phonetic categories, or through the modification of old ones*».

Differences in processing individual phones are outlined based on whether new perceptual categories can be established for them, as following:

- Given sufficient dissimilarity from the closest L1 sound, a new sound encountered in the L2 triggers the formation of a new phonetic category, which will allow the

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to display dissimilation. Nonetheless, SLM postulates that the processes and mechanisms favouring the fully successful acquisition of an L1 by monolinguals are available across the life span, i.e. adults can preserve the ability to form new categories for L2 phones with the right kind of input and amount of time (Flege, 2005).

[60] A similar assimilatory process towards L2 phonetic settings has recently been found also in the L1 of beginner learners (Chang, 2012).

L2 sound to be produced accurately (de Leeuw, 2008). Therefore, any L2 learner would be able to establish a new phonetic category for an L2 sound which is *perceived* to be sufficiently dissimilar from the L1 sound ("dissimilar sounds" were originally named as "new" in Flege, 1987). This means that L2 phones that are sufficiently divergent from any L1 sound will undergo "category dissimilation" (or polarization) with respect to the closest L1 sound and will be perceived and produced accurately by late L2 learners. As reported in Flege *et al.* (2003: 470), the newly established L2 phonetic category will shift away from the closest L1 sound by a mechanism of category dissimilation, because «*bilinguals strive to maintain phonetic contrast between all of the elements in their L1/L2 phonetic space, just as monolinguals strive to maintain phonetic contrast among the elements making up their L1 phonetic space*». As a result, the phonetic properties of a new L2 category and the closest L1 category will diverge from one another: productions of bilinguals will display values that are more extreme than in monolinguals, due to polarization (Tordini, Galatà, Avesani & Vayra, submitted).

- On the other hand, the mechanism of "category assimilation" will operate in case an L2 sound is perceived as the same (i.e. "identical") sound or as similar to an existing sound in the native system (i.e. a more or less deviant exemplar of a L1 phonetic category). Namely, category assimilation is activated when a new L2 category fails to be established despite audible differences between it and the closest L1 speech sound (Bergmann *et al.*, 2016; Tordini *et al.*, submitted). The process hampering the formation of a new category is called by Flege "equivalence classification". The scholar (1987: 49) uses this term to define «*a basic cognitive mechanism which permits humans to perceive constant categories in the face of the inherent sensory variability found in the many physical exemplars which may instantiate a category*». In this case, instances of an L2 speech category continue to be identified as instances of an L1 category (Flege *et al*., 2003; de Leeuw, 2008), and *«a single phonetic category will be used to process perceptually linked L1 and*

L2 sounds» (Flege, 1995: 239)[61]. It means that a ''merged'' category will be developed over time, incorporating the phonetic properties of the perceptually linked L1 and L2 speech sounds. Concerning production, given that a single, merged L1–L2 category is used to produce corresponding speech sounds in the L1 and L2, the SLM predicts that «*[...] the more a bilingual approximates the phonetic norm for an L2 speech sound, the more her production of the corresponding L1 speech sound will tend to diverge from L1 phonetic norms*» (Flege *et al.*, 2003: 469-470) (Tordini *et al*., submitted).

Taking into account these observations, it is possible to assess that the perception of sounds implies a discrimination of the phonetic traits or of the properties present in the signal, thanks to which phonetic categories are deposited in long-term memory. In the first phase of the acquisition process, this leads to an incapability, or at least a difficulty, for the L2 learner to recognize phonetic differences, with respect to the target linguistic system. In cases where the subject shows himself capable of discriminating the differences between the sounds of the two languages, he develops new perceptual categories. As reported in Munro, Flege & MacKay (1996: 315):

> « *[...] Flege's Speech Learning Model (SLM) predicts that phones from the L2 that are "new" (i.e., relatively different from any LI phone) will eventually be perceived and produced correctly by late L2 learners, while L2 phones that are "similar" (i.e., differ only slightly from LI phones) will not be».*

Thus, according to the above-mentioned postulates, we could claim that sounds which are perceived as most similar are also the most problematic to learn during the L2 acquisition process (Flege, 1995; Flege *et al.,* 2003). Difficulties are more likely to occur in the case of similar sounds than in dissimilar sounds, because equivalence classification prevents from producing similar, but not dissimilar sounds, authentically. This is supposed to lead to long-term pronunciation problems, since similar phones are less easily perceived (de Leeuw, 2008: 29).

[61] Speech sounds that are subjected to such process of assimilation are called "diaphones" (Weinreich, 1957).

In addition, we see that the SLM not only predicts that L2 sounds are influenced by L1 diaphones (Weinreich, 1957; Bergmann *et al.,* 2016), but also that L1 sounds are realised differently when linked to L2 sounds through equivalence classification.

Recapitulating, when a new category is formed for an L2 sound, it will deflect away from nearby L1 categories (Antoniou Best, Tyler & Kroos, 2010), in order to maintain phonetic contrast, resulting in inauthentic and less accurate production of both the native and non-native ones from the point of view of normative values obtained from monolinguals. As shown also in Piske, Flege, MacKay & Meador (2002: 51), «*even if early bilinguals establish a category for an L2 sound, they may not produce and perceive it exactly like monolinguals*». These assumptions evidently apply what had already been observed by Grosjean (1982, 1998) that a bilingual cannot be "two monolinguals in one person". If no new category is formed -because an L2 sound differs insufficiently from the closest L1 sound, the L2 sound will merge with the L1 category. This cross-language relation will lead properties of the L1 and L2 phones to combine one with another. Respectively, productions of the L2 sound continue to resemble the L1 sound, while productions of the L1 sound will shift in the direction of the L2 sound. As an example of these postulations, it is worth mentioning the work carried out by Flege (1992), in which he analyzed productions of /i/-/ɪ/ and /ɛ/-/æ/ by early and late Spanish (L1)-English (L2) bilinguals. Acoustic measurements showed that both groups produced native-like duration differences between the two pairs of vowels. However, only the formers produced spectral differences between each pair of vowels that closely resembled the spectral differences found in native English monolinguals. Notably, he demonstrated that late Spanish-English bilinguals merged the L2 sounds/i/-/ɪ/ with the L1 /i/, and exaggerated the difference between /ɛ/-/æ/ by substituting two Spanish vowels (the [ɛ] allophone of Spanish /e/ and Spanish /a/) for /ɛ/ and /æ/, respectively (Piske *et al*., 2002).

In conclusion, the main assumption of the SLM is that proficient adult bilinguals cannot fully separate their L1 and L2 phonetic systems, since they build up a common phonetic space and will unavoidably influence one another (Antoniou *et al.*, 2010: 640). With respect to the issues concerning first language attrition, we could claim that according to SLM two interaction processes may occur: assimilation and dissimilation, depending on whether new categories are formed for similar sounds (de Leeuw, 2008: 29).

3.2 Perceptual Assimilation Model

As observed by (Antoniou, Best, Tyler & Kroos, 2011), SLM has often been compared with the Perceptual Assimilation Model in cross-language perception research (PAM: Best, 1993, 1995). To untangle the cross-linguistic task of classifying foreign language sounds with respect to L1 categories, these two dominant approaches have been developed to assess how and to what extent L1 linguistic experience determines the behavior of nonnative listeners. PAM focuses on the early period of speech perception, i.e. the first year of life, before infants acquire word meaning and contrastive phonology. Also, it has been more recently proposed also as a predictive model for the perception of a second language (PAM-L2, see Best & Tyler, 2007). The main difference between the earlier PAM and PAM-L2 is that the former accounts for non-native speech perception by naive listeners, while the latter pertains to L2 learners, and considers the influence of a learner's progress in the phonetic and phonological knowledge of the L2. This extension gives great relevance to patterns of language acquisition and use in explaining L2 speech perception, and allows to explore new predictive possibilities.

Both PAM-L2 and SLM theorize that the development of an L2 phonetic category is determined by its perceived distance from existing L1 phones. As a result, interference might occur from the initial misperception and the eventual misclassification of an L2 sound as belonging to an L1 category (Newlin-Łukowicz, 2014). Best's model assumes that listeners tend to perceive non-native phones as exemplars of categories entering phonological contrasts in their native language, and employs the term "perceptual assimilation" to define the specific role that phonological categories play in shaping speech perception (Shaw, J. A., Best, C., Docherty, G., Evans, B. G., Foulkes, P., Hay, J. & Mulak, K. E., in press). More specifically, PAM assumes that non-native phones tend to be assimilated by listeners to the "closest" phonological category, based on articulatory similarity (Best, 1993; 1994; 1995; Bohn *et al*., 2011; Vayra, Avesani, Best & Bohn, 2012). Its predictions on the discrimination of non-native pairs of sounds are based on the phonological oppositions in L1, with which the two L2 phones interact:

1) If a non-native sound is assimilated a native phoneme, it will be defined as "categorized" (Bohn *et al.*, 2011; Vayra *et al.*, 2012).
2) However, if a non-native sound is moderately similar to more than one native allophone, and is assimilated to more than one native category, it is considered as an "uncategorized" phone.
3) On the other hand, when the articulatory characteristics of the non-native phone are dissimilar from those of any native sound, it will not be assimilated to any sound of the L1 phonological system and will therefore be defined as "non-assimilable". An example is provided by the avulsive consonants of Zulu and other African languages, which lie completely outside the phonetic and phonological space of most European languages. Such sounds, in fact, are reported to be perceived by English speakers as non-linguistic sounds (see Best, 1993; Bohn *et al.,* 2011).

When each of the two sounds that are involved in a non-native phonological contrast are assimilated to different native categories (TC: "Two-categories assimilation"), the discrimination between the two phones will be excellent. However, if two contrasting non-native phones are assimilated to the same native phonological category, their discriminability can no longer be supported by the phonological system of the native language. That is, their discriminability depends on the degree of similarity between their inherent phonetic properties and those of the allophones of the native phoneme. Discrimination will be poor if the two non-native phones are equivalent in terms of phonetic correspondence to the native category (SC: Single Category assimilation). On the other hand, it may be good if one of the two non-native phones represents a phonetically better exemplar of the native category (CG: Category Goodness assimilation)[62].

[62] Best (1993: 296) suggests that «*Discrimination of Category-Goodness differences should vary with differences between the two non-native phones in the magnitude of their discrepancy from native tokens [...] (it) will be relatively low if there is only a small difference in discrepancy between the non-native phones*».

The classification according to contrast assimilation and related discrimination effects are summarized in the following table (see Best, 1993: 296):

Contrast Assimilation	**Discrimination Effect**
Two-Category (TC)	**excellent discrimination**: each non-native phone assimilated to a different native phoneme category
Category-Goodness (CG)	**good to moderate discrimination**: both non-native phones assimilated to the same native category, but differ in discrepancy from native category
Single-Category (SC)	**poor discrimination**: both non-native phones assimilated to the same native category, but are equally distant from native category
Uncategorizable (UNC)	**poor to moderate discrimination**: both non-native phones fall within uncommitted phonetic space
Non-Assimilable (NA)	**good to moderate discrimination**: both non-native phones fall outside the bounds of native phonetic space and are heard as non-speech

Hence, the formation of a new category:

- will be inhibited if the two phones realizing a phonological opposition display the same degree of similarity to the allophones of a single native phonological category (SC);

- will be favored if the two non-native phones differ from one another in the degree of phonetic similarity with respect to the allophones of the L1 category.

3.2.1 PAM's developments

As already observed, in the SLM similar sounds (i.e. deviant) are assimilated to the same category of L1, preventing the formation of a new phonetic category, while dissimilar sounds would trigger the formation of new ones (Chang, 2012, Munro *et al.*, 1996). Conversely, in the PAM-L2, if two L2 sounds are assimilated to the same L1 category a but one of them is perceived as a deviant (not prototypical or diverging for subtle phonetic details) exemplar of that category (CG assimilation) the diverging phone can eventually lead to the formation of a new category. Moreover, while the SLM mainly focuses on cross-linguistic similarity based on acoustic features (e.g., Flege, 1995), PAM and PAM-L2 set up the study of L2 perception within the principles of Articulatory Phonology. It posits that unfamiliar L2 speech contrasts may be interpreted in light of the "gestural constellations" of L1 phonological categories (Chang, 2012: 251). As extensively described in Antoniou *et al.* (2010: 640), this model employs as its framework the theorizations developed within the Articulatory Phonology (AP: Browman & Goldstein, 1989, 1992)[63]. According to AP, speech perception and

[63] AP aims to overcome the traditional dichotomy involving the continuous physical structure (phonetics) and the abstract cognitive structure (phonology) of linguistic sounds. For AP, the seemingly incommensurable domains of phonetics and phonology correspond to different levels of the same system: a microscopic and a macroscopic dimension, respectively. In this viewpoint, while the physical *products* of speech perception (articulatory movements, airflow, acoustics) are continuous, the *act* of speech production can be divided into discrete dynamical units of action and information, called *gestures*. Phonological structures can be explained according to the various dynamic parameters that characterize such "articulatory gestures": place of constraint (CL), degree of constriction (CD), orientation of the apex of the language (CO), etc. The "gesture" is here conceived as a dynamic neuromotor-like structure that coordinates articulators and muscles in forming a constriction of the vocal tract. It shows physical properties (microscopic level), related to the dynamic systems that guide the coordination of articulators and muscles. At the same time, "gestures" are discrete phonological units (macroscopic dimension) of opposition or combination of dynamic parameters and are potentially distinctive.

production are phonologically linked and users produce and perceive “articulatory gestures”, i.e. dynamic units of phonetic and phonological information which form gestural constellations (Goldstein & Fowler, 2003). By acquiring an L2, learners are exposed to a new set of articulatory gestures, characterized by new dynamic parameters and new coordination strategies. The type of assimilation that occurs in a contrast predicts the degree of difficulty that L2 learners will have with discriminating that opposition. More specifically, PAM-L2 postulates that L2 learners will have difficulty in forming new L2 categories for phonological contrasts in which:

- sounds are "assimilated" to a single native category (SC for BCL), or
- sounds are "assimilated" to two distinct native categories (TC).

In the first case, neither the native phonological system nor the phonetic similarities between the L2 and L1 induce the learner to form a new category. In the second case, being two L2 sounds "assimilated" to two different phonemes of L1, respectively, the pressure fails to form new categories -and therefore a new phonological contrast (Antoniou *et al.*, 2011: 558). On the other hand, in the case of assimilation based on CG, L2 learners should easily establish a new category for the one of two non-native phones that phonetically represents the worse exemplar of the native phoneme.

A notable example of PAM testing is given by Sisinni & Grimaldi (2009), who successfully applied Best’s framework to assess the perception and discrimination of English L2 vowel phonemes by Salento Italian speakers. Their aim was to verify how the 11 English monophthongs are assimilated to the 5 Salento stressed vowels and to test the difficulty displayed by Salento learners in perceiving (i.e., in discriminating) them. They demonstrated that Italian speakers from Salento consistently identified English /iː/ as good exemplar of Salento /i/ (which also belongs to the SI phonological inventory). On the other hand, English /ɪ/ was identified as less good exemplar of the same SI phoneme. This panorama was described by the two scholars as a case of Category Goodness assimilation, according to which when the two phones that realize a non-native opposition are assimilated to the same native phonological category (in this case, /ɪ/-/iː/ that are assimilated to the native /i/), their discriminability depends on the degree of similarity between their inherent phonetic properties and those of the allophones of the native phoneme. According to PAM, CG discrimination is expected to be intermediate, and it appears to be the case of the non-native contrast in question, which was discriminated moderately well by Salento learners of English.

3.2.2 Critical observations

As indicated also by Sancier & Fowler (1997), SLM accounts for a change in the native system, activated by the "equivalence classification" mechanism involving similar L1 and L2 sounds. By perceptually linking the phones to the same category, this process causes both sounds to be affected by the input in L1 or L2. However, this phonetic shifting has mostly been investigated in speakers who have been living in an L2 environment for a long time. That is, the afore-mentioned works on adult L2 learners have explored L2 learners' speech at the "end state" of L2 acquisition, i.e. fluent or highly proficient bilinguals. So, as Chang (2009, 2012) ascertains, there is still lack of work regarding the establishment of equivalence between L1 and L2 categories after a short period of contact.

Also, it has been claimed that the core of the SLM lies in the concept of cross-language phonetic similarity. However, Flege (1991: 266) acknowledges that «(a) valid and reliable method has yet to be developed for determining which sounds of an L2 will be treated by L2 learners as new and which as similar». So, as de Leeuw (2008) underlines, it is still not clear which of the many acoustic parameters used to describe speech segments must be satisfied to label two sounds as "similar". Furthermore, Chang (2012: 264) puts emphasis on the fact that both SLM and PAM do not account for cross-linguistic perceptual investigations beyond the segmental level. He therefore suggests that:

> «*A complete model of cross-linguistic phonetic influence must also account for cross-language developments that occur at a non-segmental level, which constitute a large part of cross-language phonetic effects [...]. Such a model will need to acknowledge the multiple sources of information and influence in speech production, including general mechanisms of speech motor control and somatosensory feedback*».

In addition, both SLM and PAM/PAM-L2 assume that, once they have been established, L1 and L2 phonetic categories remain unaffected by social factors. Concerning this point, we agree with the standpoint assumed by Newlin-Łukowicz (2014), who debates that the sociolinguistic dimension seems to be not fully investigated and that these models do not describe cases of transfer across generations. On the contrary, several other studies have discussed about the importance of social settings and cross-linguistic dynamics when providing an explanation of transfer patterns (e.g., Horvath, 1985; Nagy, 2015, a.o.). Such research has extensively addressed the issue concerning consistent presence of sociolinguistic and cross-generation interference in L2 speech, showing that interference is a multi-faceted phenomenon simultaneously involving a wide range factors.

3.3 Native Language Magnet Theory

Within the field of cross-language speech perception, also the Perceptual Magnet Effect (Kuhl, 1991) - developed within the Native Language Magnet Theory - has aimed to explain learners' perceptual performances. Similarly to PAM, it assumes that non-native speakers display a hierarchical structure of perceptual relations among sounds, based on perceived phonetic distance (auditory, acoustic, articulatory) between L1 and L2 in contact (Celata & Cancila, 2010). Theories supporting NLM model and PAM both cover the early period of speech perception. Namely, one of their main aims is to address the question of how and to what extent infants process speech information and discriminate acoustic differences between phonetic categories (Kuhl, 1993). However, while Best's research has addressed the discriminability *between* phonetic categories, Kuhl's studies have focused on the internal structure of phonetic categories. Respectively, Best has concentrated

> «*on the problem of whether infants can discriminate exemplars of one non-native phone category vs. exemplars from a contrasting non-native phone category*», while Kuhl has investigated «*the degree to which physically different instances are perceived as the same native language phone*» (Best, 1993: 277).

Broadly speaking, the NLM Theory *«accounts for a change from a language-general mode of speech perception to one that is language-specific»* (Kuhl, 1997: 145). At its basis, lies the Perceptual Magnet Effect, according to which the perceptual space is divided into phonetic categories that constitute "the best exemplars", i.e. prototypes. Sounds within a phonetic category differ in discriminability: sounds near good exemplars of the category are less discriminable than the ones close to poor exemplars. Within this dimension, *«the best members of a category function like perceptual magnets for surrounding stimuli»* (Kuhl, 1997: 145). Specifically, the prototype attracts similar sounds, which result in converging into the same category. It follows that the discrimination of sounds is related to the auditory distance between a prototype and the other sounds. As Kuhl (1993: 268) states, in fact:

> *«(p)erceptual magnets warp the acoustic space underlying phonetic distinctions by shrinking the perceived distance between a magnet and its surrounding stimuli, and stretching the perceived distance in the region of the phonetic boundary. This will cause certain perceptual distinctions to be maximized (those near the boundaries between two magnets) while others are minimized (those near the magnet attractors themselves)».*

At the basis of the perception of sounds, there are complex neural perceptual patterns, which activate the categorization processes and establish language-specific perceptive representations that will be stored in memory. These neural structures influence and constrain the learning of an L2, since they can interfere in the creation of new categories when encountering a new input.

Kuhl argues that children's perceptual systems are modeled based on sounds' variation and dissimilarities that characterize their linguistic environment (Kuhl, 1991, 1993). In other words, infants display an innate ability to discern sounds belonging to different phonetic categories, and, at the same time, to perceive sounds of the same category as similar. Before around six months of age (i.e., when L1 is not yet fully acquired), infants do not display the native language magnet effect[64]. After this period, they learn to

[64] Individual perceptual experience counterpoises to the CPH. Nevertheless, Kuhl (2000) considers that the effects of interference are minimal before puberty, and that, on the contrary, the ability to acquire of

attribute phonetic categories from a dynamic signal, and poor discrimination in the region of prototypic exemplars of phonetic categories in their native language becomes evident (Kuhl, 1997; Iverson & Kuhl, 1995). In account to this Kuhl (1993: 260) states that:

> *«(t)his ability is attributable to infants' general auditory perceptual processing mechanisms, since it is exhibited for phonetic units the infant has never heard and thus does not depend on language experience».*

Oppositely, infants' perception of phonetic prototypes becomes "language specific" by 6 months of life. As it has been observed, after this first phase, prototypes start to exert a magnetic effect on similar sounds, such that, at a perceptive level, they are incorporated together. However, they can become an obstacle when the subject comes in contact with sounds from another language, which are grouped differently with respect to the L1 system. It is therefore observable that the NLM theory gives emphasis to an idiolinguistic kind of non-native language speech perception and to its influence on the recognition of a foreign accent. In this perspective, the perception of the same acoustic stimuli is categorised differently, depending upon the native language of a speaker. Quotable examples of this statement are shown in the studies carried out by Kuhl, 1993 on vowels[65]. In this experiment, she tested infants from United States and Sweden on two vowel prototypes -/i/ and /y/, respectively. Each prototype was synthesized and then modified to create 32 additional variants. The results demonstrated that infants from both countries showed a significantly stronger magnet effect for their native-language prototype, confirming the hypothesis that linguistic experience in the first half-year of life alters phonetic perception. Namely, American infants perceived the American English /i/ prototype as more similar to its variants, compared to Swedish infants listening to the same stimuli. Swedish infants perceived the Swedish /y/ prototype as more similar to its variants, compared to American infants listening to the same stimuli.

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two different linguistic systems is higher.

[65] In Kuhl, 1992, the author also proved that American and Swedish vowels were perceived as prototypes by native speakers and poor instances, or non-prototypes, by foreign speakers.

Accordingly, it is possible to claim that, although this model mainly accounts for how a first language is acquired, it can be adopted and productively applied when describing the dynamics of L2 acquisition. In fact, it is indeed plausible that also the external input would trigger the Perceptual magnetic effect (de Leeuw, 2008: 206) - as demonstrated by Iverson & Kuhl (1995), who examined the native language experience exerted on non-native phonemes in adulthood.

As already observed, slight phonetic deviances are here perceived as equivalent to an already established prototype. Similarly to the mechanism of equivalence classification developed in the SLM, the NLM theory argues that the closer an L2 sound is to an L1 sound (specifically to its prototype), the more it will be assimilated to this L1 sound (Kuhl, 1997: 137). Nonetheless, MacKay, Flege, Piske & Schirru (2001: 517) observe that the SLM's predictions diverge from Native Language Magnet model, with regard to the phonetic learning in the absence of category formation. More specifically, NLM model accounts for a kind of cross-language ''categorical perception", according to which «*listeners remain sensitive to sub-categorical phonetic differences across languages, although they may no longer ''attend'' to such differences*». In the viewpoint of SLM, instead, the native phonological system acts as a filter for the acoustic properties of L1 sounds that are needed to distinguish sounds in the L1 but not in the L2. Differently from what the SLM postulates, for the NLM theory L2 speech learning would be then hampered in the absence of category formation, «*because the sensory input needed to guide learning for an L2 speech sound would be unavailable*»

3.4 The Second-Language Linguistic Perception model

The Second-Language Linguistic Perception (L2LP) model has been developed by Escudero & Boersma (2004) and Escudero (2005) with the purpose to define and predict L2 sound perception at different stages of the acquisition process, i.e. initial, developmental, and final. Specifically, L2LP assumes listeners to be optimal perceivers of their native language, and that L2 learners at the initial phase start with a copy of their L1 optimal perception[66]. Successively, learners are supposed to adjust and adapt their initial L2 perception through the same mechanism employed by L1 learners.

To describe the process of acquisition and perception of non-native sounds, the model depicts two different “scenarios”, i.e. NEW and SIMILAR, respectively[67].

- If two L2 sounds are perceived and mapped to a single sound in the L1, the learner encounters the NEW sounds scenario, in which the learning challenge is to create new perceptual mappings and categories.
- On the other hand, L2 sounds that are phonemically equivalent but phonetically different from L1 sounds, are called SIMILAR L2 sounds. In the SIMILAR sounds scenario, the model predicts that learners will associate two L2 phonemes with two L1 phonemes for purposes of lexical storage.

The distinction between “new” and “similar” sounds is not new in the literature. As we observed in the previous paragraphs, in fact, it is also found in other models of L2 perception, such as: SLM, PAM, and NLM model (Kuhl 2000), as well as Major’s *Ontogeny Phylogeny Model* (Major 2001). Nonetheless, these approaches yield opposite predictions with regard to the difficulties encountered in L2 sounds’ perception. In summary:

- According to Best and Kuhl, a SIMILAR sounds scenario does not pose any L2 perceptual learning challenge, thanks to the presence of L2 phonetic features in the L1. That is, the learner becomes a native-like perceiver, since categories are identical in L1 and L2;
- Conversely, according to Major and Flege[68], a SIMILAR scenario poses the most

[66] According to the “Optimal Linguistic Perception Hypothesis” (Escudero & Boersma, 2003), an “optimal” listener will build up auditory inputs as those vowels and consonants that are most likely to have been intended by the speaker. It follows that differences in the productions of two languages (or language varieties) will conduce to differences in their respective optimal perception. In other words, if two languages diverge in the way acoustic dimensions are used and embedded in production, the optimal listeners of these languages will have different ways of perceiving these languages.

[67] For further details, see Escudero, 2009.

[68] For instance, Flege claims that SIMILAR L2 sounds will be equated to L1 sounds and therefore L2 learners will not be able to form new L2 categories for these sounds, which in turn results in non-native perception.

difficult L2 task. In their perspective, similar categories are the most difficult to acquire and, consequently, the subject might never be able to achieve full L2 mastery.

On the other hand, L2LP proposes a different assessment of L2 learning challenges. Unlike PAM and NLM model, it postulates that SIMILAR sounds do pose a task, namely the adjustment of perceptual mappings. Also, unlike SLM and the Ontogeny Phylogeny Model, it suggests that learners would adjust their existing L1 categories instead of creating new ones for L2. Nonetheless, despite both scenarios require perceptual challenges, SIMILAR L2 sounds are anyhow easier to master than NEW L2 sounds (i.e. elements which do not exist in the learners' native inventory). The NEW scenario, in fact, entails both category creation and boundary shifting of L1 phonetic categories, while the SIMILAR scenario will only involve the boundary shifting mechanism. Such postulations have been confirmed, for instance, by the gradual shifting of the category boundary between /æ/ and /ɛ/ in Canadian English learners of Canadian French; namely Escudero (2009) found that the learners' perceptual boundaries of F1 and duration indeed gradually shifted in the direction of the boundaries for L2.

Although both account for similarities and dissimilarities on an acoustic basis[69], remarkable differences are noticeable when comparing L2LP with SLMs positions. Expressly, Escudero states that L2 learners (and bilinguals in general) exhibit separate systems for perceiving their two languages, which are characterized by two separate grammars. In contrast, Flege suggests that L1 and L2 sounds coexist in a common perceptual space, i.e. in a shared system where they relate to each other on an allophonic basis. From these divergent premises, we will have diametrically opposite predictions for what concerns the L2 end state. Namely, while the L2LP expects that an L2 learner can reach optimal L1 and L2 perception because they are handled by two separate systems, the SLM predicts that being L1 and L2 in a shared space, any L2 development will unavoidably influence the learner's L1, resulting in native categories

[69] Namely, vowel duration and formant measurements. For example, these parameters were both employed by Flege (1992) and Elvin & Escudero (2015) to assess perceptual discrimination and quality in productions of /i/ and /ɪ/, which represent a phonological opposition in English L2, but not in other languages (i.e., Spanish and Brazilian Portuguese L1, respectively).

adjustments.

On the other hand, some correspondences can be found between L2LP and PAM/PAM-L2, since both models hypothesize that perceptual similarity between native and target language (vowel) inventories is predictive of difficulties encountered in non-native/L2 (vowel) perception. Specifically:

- the NEW scenario in L2LP, i.e. when two non-native sounds in a contrast are perceived as one single native sound, is also known as SINGLE-CATEGORY ASSIMILATION in PAM and PAM-L2. For this scenario, a high degree of discrimination difficulty is predicted.
- the SIMILAR scenario in L2LP, i.e. when two non-native sounds are equated to two separate native categories, is also known as TWO-CATEGORY ASSIMILATION in PAM and PAM-L2. For this scenario, less difficulty is predicted for discrimination (see Escudero, 2002 for a discussion).

3.5 Acquiring a whole non-native phonological system: the notion of typological markedness

There is mounting evidence that the number of L1 phonological elements affects the perception of an L2 learner (see Bundgaard-Nielsen, Best & Tyler, 2011)[70]; Escudero, 2009; Elvin & Escudero, 2015). Concerning vowels, the starting point of this assumption is that the size and organization of the L1 vowel inventory influences how L2 learners perceive the vowel contrasts in their new language. Namely, it appears harder for learners with few L1 vowels (such as Spanish) to acquire a wider L2 vowel inventory, with respect to speakers of L1s with a more conspicuous number of vowels (such as English and its varieties). This is because several non-native vowels may be perceived as similar to a single native vowel category, and accordingly will pose a challenge in

[70] Bundgaard-Nielsen *et al.* (2011) take into consideration a whole vowel system, rather than a subset of nonnative and native sounds, to investigate the correlation between L2 vocabulary growth and L2 phonological acquisition during the first 12 months of L2 immersion.

their discrimination[71]. Nonetheless, we believe that difficulties in acquiring L2 should be evaluated not only through a delimited comparison of L1 and L2 structures in contact, but also with respect to the general principles which lay behind the language acquisition process. More precisely, it seems appropriate that assessing similarities and dissimilarities between first and second language structures should include the notion of inter-linguistic typological markedness as a crucial predictive parameter for acquisitional strategies. This concept was first introduced by Trubetzkoy within the Prague School of Linguistics. More precisely:

> *«(t)he idea behind markedness is that binary oppositions between certain linguistic representations (e.g., voiced and voiceless obstruents, or open and closed syllables) are not simply polar opposites, but that one member of the opposition is assumed to be privileged in that it has wider distribution, both across languages and within a languag*e» (Eckman, 2012: 93).

In other words, the term "unmarked" started to be employed to denote the simpler, more basic, and more natural element, with respect to the less widely occurring - i.e., "marked"- member of the opposition. Subsequently, the term "markedness" has been included in several different linguistic approaches to assess cross-linguistic, implicational generalizations. Within the framework of language universals, markedness was defined by Greenberg (1966) as following:

> «*A structure X is typologically marked relative to another structure, Y, (and Y is typologically unmarked relative to X) if every language that has X also has Y, but every language that has Y does not necessarily have X*».

The notion was then introduced into Second Language Acquisition (SLA) research, as supplement for the crucial, yet insufficient framework of the Contrastive Analysis Hypothesis (CAH, Lado, 1957). Specifically, markedness was incorporated to CAH as a measure of relative difficulty encountered in L2 phonology. Considering language acquisition in general, in fact, the notion of universal markedness based on

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[71] For example, Escudero & Boersma (2004) demonstrated that native speakers of Spanish (which does not exhibit temporal or tense-lax oppositions) strive to discriminate between either Southern and Scottish English /i/ and /ɪ/, because both are perceived as native instances of /i/.

implicational[72] hierarchies «*has explained the reason for learning difficulties for elements that are not very natural or infrequent and the conditioning, in manner and time, of interlanguage developmen*t» (Costamagna, 2007: 139).

The concept of typological markedness was then implemeted by Eckman (1977) in his Markedness Differential Hypothesis (MDH)[73]. In his work, the scholar pointed out how the difficulty in learning/acquiring an L2 must relate to the difficulty connected with implicational markedness: namely, the degree of difficulty corresponds to typological markedness. In brief, as reported by Giannini, S. (2003: 404), «*the aspects of a language that are consistent with a linguistic universal should be easier to acquire than those which seem inconsistent*». Possible predictions can then be made according to markedness features of a category and the ease/difficulty with which it is acquired. Namely:

- less marked properties will be easier to acquire (even if the property is found in L2 but not L1);
- more marked properties will be more difficult to acquire (even if the property is found in both L2 and L1)[74];

According to these parameters, acquiring the structure of any given target language is foreseen to be more difficult if it is both different from the corresponding native language structure, and also more marked than that structure (Eckman, 2012: 93)[75].

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[72] It is worth reminding that the term "implicational universals" refers to connections between features at a cross-linguistic level, such that the presence of a single feature requires the presence of another or more (Ellis, 1994: 418).

[73] Although transfer was assumed by CAH to a play a relevant role in discriminating non-native accents, it became evident that it was not always predictive of learner error. For this reason, Eckman enhanced CAH through the Markedness Differential Hypothesis and the latter-developed Structural Conformity Hypothesis (SCH) (1991), according to which "the universal generalizations that hold for primary languages hold also for interlanguages" (Pickering, 2012: 355). Despite both theories employ linguistic typology to approach issues of L2 phonology, the crucial difference is that MDH is relevant only in cases where the native and the target language are different with respect to some representation or structure, whereas the SCH is neutral on such differences. The MDH can be considered a special case of the SCH, i.e. the case when the typological generalization in question involves an area of L1-L2 differentiation (Eckman, 2012: 98).

[74] Another hypothetical condition can hence be formulated: «*properties common in interlanguage (and therefore not very marked) can be acquired easily even if neither the first nor the second language has them*» (Giannini, 2003: 404).

[75] For instance, a phoneme /t/ is reported to be close to a universal in the world's languages, while a phoneme /θ/ is quite rare. Also /t/ is acquired earlier than /θ/ by children learning English as a first

These postulations are thoroughly discussed also within the Ontogeny Phylogeny Model (Major, 2001)[76], which outlines the phases of L2 acquisition, from the early stages to the development of the interlanguage. The core of this approach is to draw a panorama in which not only L1 and L2, but also transfer and universal, evolutional factors are involved in the learning process. Within this model, the scholar formulates four corollaries, respectively concerning chronology, style, similarity and markedness. The *Chronological Corollary «describes the formation of the interlanguage as a process in which, within the growth of the L2 and decrease of L1, the influence of universal factors first grows and then decreases»* (Costamagna, 2007: 138). Namely, it states that the interlanguage develops in the following steps: a) L2 increases; b) L1 decreases; c) universals increase and then decrease. The early stages of the SLA process are characterized by a predominant influence of L1 (i.e., by a great transfer), which is strong enough to block the influence of universals. Concerning the phonological dimension, he claims that in the first phases the speaker only displays his L1 resources, which transfers into the L2. This block/stasis in the evolution of the phonological acquisition is presumably caused by the transfer from the L1 to the L2 of semantically similar, but phonologically differentiated, lexical material. The increase of universals (stage (c)) regards the intermediate stages of acquisition; conversely later stages of acquisition present a decrease of universal, as L2 learner approaches to native-like pronunciations (Carlisle & Cutillas Esponosa, 2015: 185). Substantially, Major debates that the nature of L2 sound substitutions due to L1 transfer changes over time, and that transfer decreases as the learner progresses and as the speaking situation becomes more formal (*Style Corollary*). That is, the trend reverses in the developmental stages of acquisition (i.e., when the speaker becomes aware of this mechanism), hence provoking phenomena in the interlanguage which are motivated neither by the L1 influence nor by the development of the L2 (Costamagna, 2007). The *Similarity Corollary* states that, when acquiring structures that are similar across L1 and L2, the role of L1 transfer is first more significant than the role of L2 and universals. It follows that, according to the

language. It follows that, arguably, /t/ is less marked than /θ/ (Thomason, 2010: 43).

[76] Major firstly formulated the Ontogeny Model in 1987. With respect to the OM, the latter-implemented OPM introduces the role of language universals that constrain L2 phonology.

Markedness Corollary, the influx of Universal is supposed to increase when the speaker starts to adapt to the phonological system of the L2.

3.6 The role of Universal Grammar in the acquisition of a non-native phonological system

We have so far given an overview of some fundamental frameworks for the acquisition and perception of a non-native phonology. In this paragraph, instead, we will briefly provide some general considerations on Universal Grammar's principles applied to SLA, in order to untangle issues of L2 acquisition through a different standpoint. To do this, we firstly recall UG's central aspect, i.e. its view of language knowledge as *a priori*, internal in the human mind (Chomsky, 1986). Specifically, Universal Grammar can be assumed as the fundamental component of the human Language Acquisition Device (LAD)[77]. As such, it explains the initial state of grammatical development in first language acquisition, and it shapes the form of developing grammars at each moment in the acquisition process (Meisel, 2011: 15). Moreover, it is worth reminding the crucial role of universal principles and parameters[78], as firstly conceived in Chomsky (1981). Although the Principles and Parameters theory (PPT) has undergone significant modifications since its early version, it can still be considered a fundamental theoretical framework to account for universals and first language development in children.

Postulating that first language development is guided by the LAD, it follows that the possible role of UG in second language acquisition should also be taken into consideration. In fact, the complex task is determining whether, how and to what extent

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[77]According to the definition given by Meisel (2011: 260), «*LAD is the centrepiece of the human language faculty. Chomsky […] argues that it 'takes experience as "input" and gives the language as an "output"'. Although it is frequently equated with UG, the LAD must comprise, in addition to UG, discovery principles, bootstrapping children into grammatical systems, and learning mechanisms, allowing them to acquire non-universal properties of their target grammars. The LAD comprises all domain-specific principles and mechanisms*».

[78] As summarized by Ellis (1994: 430): «*The term "principles" refers to highly abstract properties of grammar which apply to language in general and which, therefore, underline the grammatical rules of all specific languages […] The term "parameters" refers to principle that vary in certain restricted ways from one language to another. That is, they take the form of a finite set of options which individual languages draw on and which define the variation possible within languages*».

UG can be accessed when learning an L2, and if UG access may or may not be mediated by previously acquired languages. Through the acquisition stages, the following alternatives are presented:

a) the UG can be fully accessed: L2 learners have access to all principles and parameterized options, at every stage of the acquisition process. Learners are expected either (a) to base on the knowledge provided by UG, or (b) to initially base on previously acquired knowledge and to rely to UG knowledge only if the former fails to provide the desired results (Meisel, 2011: 141).

b) the UG cannot be accessed: L2 learners do not have direct access to the implicit knowledge provided by UG, and entirely rely on non-linguistic, i.e. on non-domain-specific cognitive processes.

Another scenario suggests that principles set in the L1 grammar can be used in L2 acquisition, although parameter values cannot be changed (i.e. principles not activated in the L1 grammar (both the non-parameterized and parameterized ones) are lost). This implies that UG principles are only indirectly available through the L1 grammar and the learners' knowledge about L2 structure is thus predicted to conform only partially to constraints imposed by UG on natural grammars (Meisel, 2011: 142).

Concerning possible applications of the UG framework to L2 phonology, scholars have invoked linguistic universals to explore L2 phonological patterns that are not directly attributable either to the learner's native language or to the target language, but might instead represent a fundamental feature in the phonologies of other world languages (Eckman, 2012: 96). For example, Archibald, (1995) employed prosodic universal hierarchies and metrical grids to investigate the acquisition of stress patterns by English L2 learners. Also, for the examination of L2 pronunciation patterns some L2 phonologists have opted for constraint-based analyses within an Optimality Theory (OT) framework (Prince & Smolensky, 1993). Briefly, OT suggests the existence of a universal set of violable constraints accessible to all speakers. Each language ranks these constraints differently, according to language-specific phonological dissimilarities. In other words, OT postulates that constraints, constraint rankings and constraint re-rankings in the learner's interlanguage, rather than rules, determine the time course of acquisition (for further details, see Archangeli & Langendeon, 1997, Broselow, Chen & Wang, 1998). Within this framework, «*phonologies of languages result from different rankings of the universal constraints; any ranking of the universal constraints should yield a phonology of some language, and any phonological system of a language should conform to one of the possible rankings of the constraints*» (Eckman, 2012: 98).

In conclusion, among the multiple approaches to L2 acquisition and perception so far presented, one main difference can be observed. Namely, some models (§3.1, §3.2, §3.3, §3,4) account for the description of L2 learner's phonological patterns, by considering the sound structures of the languages in contact, i.e. either single or multiple phonetic/phonological categories; other perspectives, instead, focus on patterns observable throughout the whole process of L2 acquisition (§3.5), that are not directly attributable either to the learner's L1 or to the target language *per se*, and that can be interpreted through the lens of Universal Grammar (§3.6).

In the present research, we will mainly employ the theoretical frameworks with a data-driven approach. As already observed, in fact, they appear to be particularly appropriate for the following reasons: first, because we will analyze single native categories in contact with (more or less) similar non-native sounds, and will not consider a phonological system in its wholeness; second, since our aim is to assess the influence exerted by English on L1 dialectal productions of Italo-Australian speakers, we will evaluate language-specific phonetic features in contact, rather than universal sets of sounds.

More precisely, we will chose the SLM as the main framework of reference for our sociophonetic investigations, since it allows to draw predictions on maintenance/phonetic restructuring based on the *acoustic* properties of sounds in contact in bilingual/multilingual adult speakers. For vowels, we will also take into account the hypothesis of the L2LP model, as this framework is specifically focused on vowel perception and production in learners with a smaller native vowel inventory – such as the Northern Veneto system – with respect to that of the non-native language – such as the Australian English system.

4. Italian and Dialects

4.1 Diglossia

We have so far observed that language contact can occur both at a societal/community level and at an individual level, and that it involves either two or more languages interacting with each other (see e.g. Aikhenvald & Dixon, 2006 for further considerations). In this paragraph, we aim to shed light of a peculiar case of language contact defined as "vertical bilingualism", i.e. when a standard official language coexists alongside a given dialect within a speaking community. Ferguson (1959) was one of the first scholars to address questions concerning this type of situation. Purposely, he introduced the term "*diglossia*", which he described as follows:

> *[...] a relatively stable language situation in which, in addition to the primary dialects of the language (which may include a standard or regional standards), there is a very divergent, highly codified [...] superposed variety, the vehicle of a large and respected body of written literature [...] which is learned largely by formal education and is used for most written and formal spoken purposes but is not used by any sector of the community for ordinary conversation. (*Ferguson, 1959: 336*).*

From this definition, we infer that in a diglossic setting the competence of a bi- or multilingual community is characterized by the presence of two distinct systems distributed in a complementary way along the diaphasic and diastratic axes. It means that certain communication tasks can only be carried out in one language or another. In other words, the choice of which language to use mostly depends from the communicative situation, the social class of the interlocutor, and on interactions' needs. Additionally, a native speaker of a given language might also be able to understand other languages used in the community: a bidialectal/multidialectal person could hence identify both with his/her language speech community as well as with his/her dialect speech community(ies).

In his seminal work, Ferguson took into consideration different languages to discuss phenomena of "standard-language-plus-dialects configuration"[79] (Joseph, 2004: 358). For instance, he pointed out that since Standard French is commonly used for ordinary conversation in France, it does not coexist in a diglossic relation with non-standard French dialects. On the other hand, Standard French in Haiti is perceived as the "high" variety, while Haiti Creole represents the "low" variety used in ordinary communicative settings: therefore, these languages can be considered as in a diglossic relation (Joseph, 2004). As we will show below, however, this definition does not seem to be exhaustive.

The complex task to clarify the relationship from the notion of diglossia to that of bilingualism was subsequently faced by Fishman (1967, 1970)[80]. Considering the functional differences (i.e. domain complementarity: Pauwels, 1986: 9) exhibited by the two languages in contact within a speech community, the scholar yielded four possible outcomes:

Type 1) + Bilingualism + Diglossia: for instance, Spanish and Guarani in Paraguay;

Type 2) + Bilingualism – Diglossia: such as the situation of L1-speaking immigrants in a L2-speaking environment.

Type 3) - Bilingualism – Diglossia[81];

Type 4) - Bilingualism + Diglossia: for example, before WWI European elites spoke French, while the population spoke another language.

Fishman's model, however, was later criticized by Timm (1981), who pointed out that his analysis solely considered the functional use of each language in different linguistic domains, substantially neglecting the variety of features presented by Ferguson. Instead, Timm provided a model of diglossic relations in immigrant groups in the

[79] He investigated diglossia in Arabic, Modern Greek, Swiss German and Haitian Creole, based on the description of the following nine features: function, prestige, literary heritage, acquisition, standardization, stability, grammar and lexicon, as well as phonology (Pauwels, 1986: 8).

[80] Respectively, Ferguson's model is understood as the standard/dialect, or high/low model, while Fishman's approach is referred to as societal behavior model (see Fernàndez, 1993 for a full literature review on studies about diglossia conducted from 1960 to 1990).

[81] No examples for this type are provided (see Pauwels, 1986: 9).

United States and introduced the distinction between inter-lingual and intra-lingual diglossia, the first indicating a relationship between languages, the latter a disposition of varieties within the same language[82].

4.1.1 Diglossia in Italy: from Standard Italian to local Dialects

Before going more in-depth with our observations, it is worth recalling the definition of "linguistic repertoire", which commonly indicates the overall set of languages, dialects and varieties available to the speaking community (see Berruto, 1993). Concerning the Italian community, its repertoire can be described as a continuum having two extremes: Standard Italian (SI) and regional/local Dialect. More precisely, it would be appropriate to speak about a continuum ranging from the local dialects to SI, which is composed of two separate (sub)continua: the dialectal continuum and the Italian continuum, each of them exhibiting intermediate varieties (Cerruti & Regis, 2014). Having said that, however, it is unanimously acknowledged by a vast literature on this field (see Cerruti, 2011 and Cerruti & Regis, 2014 for a review) that Italy's linguistic situation is far from being easily definable. Unlike other European countries (take, for instance, France or Great Britain), where a recognized standard variety is shared by most speakers regardless their distribution across the country, the standard variety in Italy is rather an abstract model of reference. The term Standard Italian, in fact, has traditionally indicated - and is still understood as - the variety of Italian formalized in grammars and employed in school teaching, in written forms and, in general, for educational purposes. Particularly, approximately until half of the XXth century, the use of Italian was strictly limited to writing and formal styles. It coexisted in a diglossic relationship with a dialect (employed, instead, for everyday communication (see below)), and was mastered by a minority of the population. Throughout the following decades, however, several factors of social and cultural change have contributed to its diffusion in use and knowledge among the speakers. Namely, as pointed out by Cerruti (2011: 11), these factors are:

[82] For instance, such differentiation has been taken as a reference point by Pauwels (1986) for her studies on German and Dutch standard and dialect speakers in Australia, in which she explored diglossic speech communities who migrated to a country where neither of their varieties was spoken, and where those immigrants had to learn the host country's language as L3.

«*the gradual spread of education, the introduction of compulsory military service (that brought together for the first time speakers from different regions, hence speakers of different dialects), the transition from an agrarian society to an industrial society, and the advent of modern mass communication*».

Yet, until only a century ago, almost half of the Italian population (nearly 70% in the South) was illiterate, and therefore did not have access to any knowledge of Italian, while around 1950 the number of illiterate people dropped to 12.9% (but was still more than 28% in the South) (De Mauro 1963: 91; Coluzzi, 2009: 41).

On the contrary, the use of local dialect as both native and primary language has been predominant for a long time among the Italian population, with an almost exclusive use within the lowest social classes. Data from the 1951 census of the Italian National Institute of Statistics (ISTAT)[83] reveal that between the late 1940s and early 1950s 61% of the Italian population spoke mainly dialect; two decades later, in 1974, 51.3% of the population still spoke only dialect (De Mauro, 2014). Although it is not difficult to notice a significant imbalance in the amount of use of the two systems, these data are not sufficient for a full description of the Italian linguistic situation in these decades. Hence, for the purposes of these work, we believe it is necessary to address the questions: what does speaking dialect as native language imply in Italy? How can we apply such assumptions to describe the diglossic competence of our speakers – either the ones currently living in Veneto and the ones who moved to Australia between the late 1940s and early 1950s?

First, it is worth recalling that within the conspicuous and fruitful amount of studies on language varieties in Italian soil (e.g. for instance: De Mauro, 1963, 1974, 1992; Maiden, 1998; Maiden & Parry, 1997; Sobrero, 1997; Cortelazzo, Marcato, De Blasi & Clivio, 2002; Loporcaro, 2009; Cerruti, 2011; Dal Negro & Vietti, 2011), the concept of "dialect" has traditionally indicated independent linguistic systems which are not social or geographical variations of the standard national language (Cerruti & Regis, 2014). As

[83] Istituto Nazionale di Statistica. *L'uso della lingua italiana, dei dialetti e di altre lingue in Italia*. Retrieved from https://www.istat.it/it/archivio/207961.

pointed out by Chambers & Trudgill (1998: 3), outside Italy the term "dialect" commonly to refers to as subdivisions or ramifications of a given language. Undoubtedly, however, such perspective cannot be applied to the linguistic composition of the Italian country (Coluzzi, 2009: 47), since Italo-Romance dialects account for the local continuations of the Latin languages spoken across the Italian peninsula ever since the loss of Latin[84]. Instead, the national language stems from the Florentine vernacular variety, promoted since the 14th century by a long-lasting literary and cultural tradition which extended across centuries. It follows that dialects across the Italian peninsula are all (autonomous) "sister" languages of Italian, exhibiting different degrees of structural distance (especially as far as phonetics, phonology and prosody are concerned) and mutual intelligibility[85]. They evolved in parallel to the standardization process[86], since SI developed through a series of spontaneous or superimposed modifications aiming to smooth Florentine's mostly marked dialectal features. For these reasons, even native speakers of the Tuscan or Florentine variety cannot be considered as native speakers of SI, since Tuscan or Florentine Italian still display marked features that have purposely been levelled throughout the development of the national language (see e.g. Cerruti, 2011 for further details).

For the purposes of our work, we will henceforth focus on a peculiar stage of the Italian language history, i.e. the period spanning from the first 30s to mid 50s. The speakers who are the object of this study - both the ones who migrated to Australia as adults and those who instead have been living in Italy for all their life, were in fact born and raised in this historical phase. It is clearly observable that their sociolinguistic characteristics

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[84] Berruto 2005 and Cerruti, 2011 assert that, since Italo-Romance dialects are geographical varieties which developed alongside the Florentine dialect from which SI descends, they should be understood as primary dialects, coherently with the subdivision proposed by Coseriu (1980).

[85] In this respect, Cerruti (in press) states that most Italo-Romance dialects can be understood as "*Abstand*" languages. Namely, they generally exhibit a remarkable structural distance both from each other and from SI, which can be indeed compared to the distance exhibited by the various Romance languages across Romània (see also Berruto, 1997: 305)

[86] Issues concerning the development of dialectal varieties stemming from Italo-Romance dialects has been extensively investigated by a long-standing tradition of studies, e.g. Rohlfs, 1968; Cortelazzo, 1977; Pellegrini, 1977; Grassi, Sobrero & Telmon, 2003; Maiden & Perry, 1997; Maiden, 1998; Loporcaro, 2009, Cerruti, 2011; Dal Negro & Vietti, 2011; Cerruti & Regis, 2014; Vietti, 2016, a.o. Hence, our observations should be intended as merely descriptive of the multifaceted linguistic and socio-linguistic history of the Italian peninsula, as they only aim to provide a general framework for the purposes of the present study.

(such as age, level of education, profession, place of residence, etc.)[87] indeed play a relevant role in determining the degree of diglossic competence (see Chapter 5 for an in-depth description of both immigrants' and control informants' sociolinguistic features). Still nowadays, in fact, dialects represent the L varieties, which are in a diglossic relationship with Italian, i.e. the H variety. They are reported to be predominantly spoken by older, less educated people (more by men than by women) living in smaller towns and villages, particularly in Northeastern Italy (as, for instance, in Veneto) and in the South (Coluzzi, 2009: 40). The configuration of such repertoire, which includes a standard variety structurally related with vernacular varieties (i.e. dialects), complies with the Type A described in Auer (2005), i.e. "medial diglossia with an endoglossic standard". This kind of structure is characterized by the following parameters:

a) in the perception of the speakers, the two varieties are clearly delimited from each other, yet closely related on a genetic basis;

b) the standard represents the H-variety, which is mainly used for writing purposes and potentially spoken in formal situations, but not employed for primary socialization;

c) the dialect as the L-variety is not (usually) written and is instead employed for primary socialization;

Considering the above-mentioned socio-linguistic and socio-cultural settings, it has been hence suggested by Cerruti & Regis (2014) that upon the first half of the XXth century dialect speakers were engaged in a process of collective Second Language Acquisition. In fact, Italian – if acquired – was only learned from age 6, when dialect speakers entered elementary school: exposure to this linguistic code was therefore solely formal, and both input and use were circumscribed to a restricted number of contexts outside the family nucleus. In this respect, Bettoni (1981), among others, has reported situations in which native speakers of dialect have had insufficient exposure

[87] See Chapter 5 for a more thorough sociolinguistic description of both IRIAS speakers and control-group informants.

to SI and have hence acquired it imperfectly. This severely unbalanced bilingual competence has led to a particular outcome, defined as *popular Italian*[88], i.e., «*il tipo di italiano imperfettamente acquisito da chi ha per madrelingua il dialetto*» (Cortelazzo l972: 11). Such imperfect learning of Italian-L2 by speakers of local dialect-L1 has been included in the continuum of "interlanguages" (Cerruti 2011), and has subsequently favored the occurrence of dialect features in the varieties of Italian.

A wide number of regional varieties of Italian have therefore derived from this process, thusly increasing the amount of variation between and within the multiplicity of repertoires. In fact, in place of a widespread SI norm, we rather observe - yet with a certain degree of approximation – an ample variety of regional linguistic systems, indeed related to the geographical diversities of Italian arisen after its social diffusion (Cerruti & Regis, 2014). The definition of "regional varieties" of Italian encompasses the different realizations of a supra-local norm influenced by the dialectal background, which they incorporate and reproduce at various levels (see e.g. Trumper & Maddalon, 1982; Cortelazzo & Mioni, 1990). According to a preliminary definition given by Pellegrini (1960: 148), regional Italian (RI) can be collocated along the continuum ranging from the literary language and diatopically-marked dialects. Namely, it results from the interpenetration between local linguistic pressures and the necessity for the linguistic community to homologate to a national linguistic code. It appears to be not rigidly structured nor easily reducible within fully defined patterns, yet it holds a certain autonomy as an independent system, both in speech and in writing. In fact, as subsequently underlined by D'Achille (2002: 26), a given regional variety of Italian employed in a specific area systematically conveys, at different levels of analysis, characteristics that differentiate it from both the varieties used in other areas, as well as from SI. In summary, it somehow represents a key passage between the local variety and the national language for the dialectal speaker which strives to master SI[89].

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[88] Berruto 2005 poses the "*italiano popolare*" along the Italian continuum, as it results from a process of "dialectization of (varieties of) Italian. On the other hand, along the dialect continuum Sobrero (1997) has collocated the "*dialetto italianizzato"* (Italianized dialect), as it results from a long-term process of "Italianization of the dialects" (see e.g. Cerruti & Regis, 2014 for further details).

[89] Nonetheless, it is worth reminding that varieties of Italian can be marked not only diatopically (i.e. having different regional Italians as outputs), but also diastratically (according to the social status of the

However, it would be incorrect to claim that there are as many regional varieties of Italian as there are regions in Italy, for two main reasons. In the first place, because linguistic phenomena often exceed regions' administrative boundaries. Secondly, due to a certain internal mobility within the country, to the influence of the mass media and to a more widespread schooling, in the last decades we have observed the rising of macro-types corresponding to the principal Italian dialectal partitions: i.e. Northern dialects, Tuscan dialects, dialects of middle area, Central-Southern and extreme Southern varieties (see Lepschy & Lepschy, 1977; Pellegrini, 1977). Ultimately, rather than solely relying on a categorization based on regional varieties, it is preferable to speak of Northern, Central and Southern interregional "*koiné*" (see e.g. Berruto, 2005; Cerruti & Regis, 2014). As defined by Siegel (2001: 175):

> «*A koine is a stabilized contact variety which results from the mixing and subsequent levelling of features of varieties which are similar enough to be mutually intelligible, such as regional or social dialects. This occurs in the context of increased interaction or integration among speakers of these varieties*».

The scholar provides a prototypical characterization of koiné, outlining its most salient features. We observe that at the core of this definition lies the similarity among language subsystems (i.e. "mutual intelligibility"), which differentiates koineisation from other macro-processes leading instead to the development of pidgins and creoles (Vietti, 2016: 179). On the other hand, as Kerswill (2002: 670) and Vietti (2016) assert, koines are remarkably characterized by specific mechanisms of feature mixing and levelling. Namely, the koineisation processes implies interactions characterized by a mixture of features from the different language varieties; also, a selection is applied from the overall distribution of variants, with the aim to neutralize (i.e. level) irregular or marked phenomena. As a consequence, we witness a *reduction* in the number of variants per variable, as well as a *simplification* in grammatical (and/or social) markedness, which both act as filters. At the same time, Vietti appropriately underlines the prominent role played by the language variety of the major demographic group in

speakers), diaphasically (depending on the communication setting), and diamesically (with respect to the typology of communication strategy, either written or oral (Dal Negro & Vietti, 2011).

this process of selection. In light of this, it is therefore possible to claim that the process of mixing/levelling implies an overall re-configuration of the sociolinguistic settings, norms, linguistic models, and speakers' social identities. Substantially, contact between different varieties somehow related to a dominant language might bring through a koineisation process to a homogeneous, neutralized or de-regionalized dialect: a new, *convergent* variety of that language is thusly created (Kerswill, 2002). When observing the diachronic relationship between two contiguous varieties, two possible outcomes can therefore occur: *dialect convergence*, when the two varieties in contact tend to increase similarities between one another, and *dialect divergence*, which instead leads to an increase of the structural differences between them. In other words, the former accounts for a trend towards the homogenization of a linguistic area, whereas the latter for the creation of diverse linguistic areas (see Trudgill, 1986; Auer, Hinskens & Kerswill, 2005; Berruto, 2005 for a more in-depth discussion on convergence between language varieties).

Concerning the SI-dialectal continuum in Italy, Bettoni, (1981: 36) points out that since half of XXth century the linguistic situation of the country has seen a progressive shift (see Chapter 2 for a definition of this term) either from local to regional dialect and from regional dialect to regional Italian. For the above-mentioned reasons related to the increasing of population mobility and the overall level of schooling, this ongoing process is presumably characterized by an ever-growing interference of SI into the domains of the dominated languages (Coluzzi, 2009: 42), as well as by a decrease in the number of native speakers of the lowest varieties. Specifically, particularly since after WWII some dynamics of *horizontal convergence* have arisen within the continuum from local and regional varieties to SI. On the one hand, we assist to a consistent reduction in frequency of regionally marked non-standard features, while on the other, especially among the youngest, regional varieties are meanwhile introducing some features from other contiguous regional varieties (Berruto 2012). As a result, Cerruti & Regis (2014) observe that also the amount of variability along the geographic dimension is basically declining.

Overall, the description given by De Mauro of the linguistic situation of Italy from 1861 up to the Second World War seems to well suit the definition of diglossia. This term, however, has been judged as inaccurate to depict the current situation in Italy, as far as the domain distribution is concerned. In this respect, it is worth underlining that at the present day the concept of "high" variety accounts for the various regional *Italians* oriented towards the standard, rather than for a *single* model of reference. Hence, the term "*dilalìa*" has been ad-hoc coined by Berruto (1987), according to which this high variety commonly adapts to a wide range of socio-communicative situations, while the "low" varieties (i.e. local dialects) restrict their scope to familiar and marked informal contexts. As a result, we nowadays observe a functional overlap between the high and low varieties in informal use domains, as well as in primary socialization settings (this situation complies with Type C in Auer's classification).

Currently, the most recent ISTAT surveys (2015)[90] reveal that 45.9% of the population above 6 years of age (about 26,3 million people) predominantly employ Italian in familiar contexts, while 32.2% express themselves both Italian and dialect. On the other hand, only 14% (about 8,7 million people) mostly use dialect. Confirming the picture above delineated, statistical data show a gradual decrease of an exclusive use of local dialect, even among the oldest generations to which our control-group speakers belong. Compared to a 47% of dialectal speakers in 2000 and to a 37.1% in 2006, in 2015 only 32% of people over 75 speak exclusively or prevalently dialect within the family (see also Repetti, 2014 for a discussion). As we will show in Chapter 5, our control-group speakers from Veneto are 67 years old on average, two of them being around 60 and two around 74 years of age. Coherently with these recent statistical data, for younger subjects a lower age goes together with a more extended use of regional Italian, due to a higher level of schooling. Nonetheless, interviews and informants' self-assessments reveal a remarkable use of the Veneto local dialect (either Feltrino or Cadorino) within the whole control group, still employed with some familiar members, friends and peers. This peculiar linguistic attitudeof Veneto speakers - with respect to other Northern

[90] Retrieved from: https://www.istat.it/it/archivio/207961 (last accessed 10.10.2018).

regions - is mirrored in statistical data[91] describing the amount of use per region of dialect and Italian, respectively. In Veneto, 57.4% employ exclusively Italian in formal contexts, such as workplace, while 30.6% employ both Italian and dialect. Figures are visibly different for Lombardy and Piedmont, for which, respectively, 85.6% and 88.2% of the population exclusively uses Italian, and 9.8% and 8.6% uses both Italian and dialect. Presumably, informants' linguistic orientation towards dialect is also related to the characteristics of their place of residence. Namely, since both Feltre and Domegge di Cadore are relatively small rural villages (20.000 and 5.000 inhabitants, respectively)[92] in the peripheral province of Belluno, these factors might have reinforced maintenance of dialect use. Also, being rather close to each other (approximately 10 km) and both quite distant from Venice – which is the center of propagation for prestigious linguistic norms – these local varieties may be not particularly affected by its influence with respect to other major centers (such as Treviso and Padova) (Zamboni, 1988: 519) [93]. These aspects will be further discussed and clarified in the following paragraph.

4.2 Dialects in Veneto

The Veneto region is a wide area located in Northeastern Italy covering 18375 sq. km, with almost one million inhabitants[94]. It is organized in 7 provinces: Venezia (the Regional County Seat and administrative center), Padova, Treviso, Vicenza, Verona, Rovigo and Belluno. Its natural boundaries are, as described by Zamboni (1974: 5):

«*a Ovest il sistema Garda-Mincio, a Sud il Po, a Est il M. Adriatico e il*

[91] Retrieved from: https://www.istat.it/it/archivio/207961 (last accessed 10.10.2018).

[92] Demographic data for Feltre and Domegge di Cadore are retrieved by http://www.comuni-italiani.it/025/021/ and http://www.comuni-italiani.it/025/018/, respectively (last accessed 10.10.2018).

[93] In account to this, on the contrary, Zamboni claims that Cadorino has undergone a profound influence of Venetian, due to a direct domination of the *Serenissima* on that area. However, to our knowledge, no experimental analyses have been carried out so far to demonstrate a possible phonetic interference of Venetian on the phonetics and phonology of Cadorino. Also, as our experimental data will reveal, we did not found consistent differences with respect to the Feltrino variety of Bellunese, confirming the compatibility of these two varieties from both a phonetic and phonological point of view.

[94] Demographic data are retrieved from: https://www.citypopulation.de/php/italy-admin.php?adm1id=05.

complesso Livenza-Tagliamento; quindi la regione si va restringendo verso Nord, dov'è limitata via via dalle Prealpi venete occidentali e dai grandi spartiacque dolomitici [...], che la dividono a Ovest dal Trentino-Alto Adige; all'estremo Nord si tocca il confine naturale e politico con l'Austria sul crinale alpino, mentre ancora a Est la separazione dalla Carnia e dal Friuli avviene sullo spartiacque tra il bacino del Piave e quelli del Tagliamento, Cellina e Livenza».

Veneto does not show large industrial settlements, with respect to other Northern areas in Italy, like for instance Lombardy and Piedmont (Zamboni, 1988). Such lack of metropolitan centers (i.e., Milan and Turin) is supplanted by an ample variety of small and medium-sized towns, which have witnessed mass immigration movements only in the last few years. This type of socio-economical and socio-political configuration thus goes hand in hand with a low level of urban development, which indeed has bared on the maintenance and vitality of the rich dialectal varieties. These have been defined as «*la continuazione regolare e ininterrotta del latino parlato dai veneti romanizzati*» (Cortelazzo (1985). In fact, as we will show below, each local variety still holds a strong socio-cultural and linguistic identity, as well as peculiar phonological, morphological and lexical systems, whose specificities cannot be neglected. With this purpose, a significant amount of historical and linguistic documentation about the Veneto varieties has been gathered so far (see e.g. a long tradition of studies carried out by Trumper, 1972, 1977; Zamboni, 1974, 1988; Pellegrini, 1977; Canepari, 1984; Cortelazzo, 1985; Trumper & Vigolo, 1995; Marcato, 2002, a. o.) In addition to a conspicuous literature, it is also worth reminding the morpho-lexical investigations conducted in the last decades across the Italian Peninsula, which also focused on the North-Eastern area. The material collected for Veneto through these surveys can be consulted in the following atlases: the *Sprach und Sachatlas Italiens und der Südschweiz* (Atlante Italo-Svizzero, AIS), collected for the Veneto region by Scheuermeier in 1921[95] and the *Atlante Linguistico Italiano* (ALI)[96], which contains data for 58 survey points in Veneto. Recently, a spoken

[95] The original AIS geolinguistic charts for place names can be consulted on NavigAIS, a Javascript software developed by Tisato, 2010. The online version of NavigAIS is available at http://www3.pd.istc.cnr.it/navigais-web/.

[96] Information about ALI is available at: http://www.atlantelinguistico.it.

database entitled *Multimedia Atlas of Veneto Dialects* (Atlante Multimediale dei Dialetti Veneti, AMDV; Tisato, Barbierato, Ferrieri, Gentili & Vigolo, 2013) has been built which collects oral dialectal productions of around 850 lexical items (that correspond to a subset of those included in AIS).

Concerning the socio-linguistic stratification of Veneto, it is possible to claim that it ranges from a diglossic configuration to a plurality of registers constantly interacting with RI, which encompass the local *patois*, the suburban dialect, the urban dialect and the regional koiné (Pellegrini 1974; Trumper, 1977). In this respect, Trumper (1977) introduced the term "*macrodiglossia*" to describe the peculiar situation of Veneto-speaking areas. In his definition, phenomena of code-switching involving the above-mentioned systems embrace a large number of socio-cultural domains, and commonly appear even within the same communicative context (i.e. informal conversation with family, peers, etc.).

Regarding the disposition of Veneto dialects throughout the region, their partition approximately follows the geographical delimitations created by the river Po, as well as the ancient historical-linguistic boundaries that arose during the Middle Ages (Pellegrini, 1977; Cortelazzo, 1985). Accordingly, the Veneto dia-system is made up of:

- an Eastern dialect spoken in Venice, called "*Veneziano lagunare*" (Zamboni, 1974, 1988), which represents the *koiné* of the whole Veneto region. Namely, it can be considered as a model of social, cultural and political-administrative prestige, due to a long-standing hegemony of the *Serenissima* on the surrounding towns throughout the centuries. Within the Eastern area, literature also reports a "Jewish-Venetian" type, i.e. a Venetian influenced by lexical Judaisms.

- a central dialect named "*padovano-vicentino-polesano*". It has its crucial point in the variety spoken in Padua, which deeply bears on the idioms of Vicenza and Rovigo. It covers the area that extends up to Trentino in the North (specifically, Valsugana and Tesino), and borders with the Emilian dia-system to the South (Trumper & Vigolo, 1995).

- a Western dialect spoken in Verona, which encompasses the area from the Val d'Alpone to the Garda Lake, bordering the varieties spoken either in Mantua and in Brescia;

- a Northern dialect called "*trevigiano-feltrino-bellunese*". In the area of contact with Venetian and Ladin, it generates the "liventina" and the "agordina" varieties, respectively, as a result of inter-language interference. In the Northern area, Veneto also includes Ladin dialects, such as "comelicano", "cadorino" and "livinallese" (Zamboni 1974: 9);

- further Western sub-varieties employed in Trentino. Respectively, Primierotto displays the same dialect of Feltre (which has a Northern dialect), while Valsugana shows the same central system spoken in Vicenza; also, Southern Trentino undergoes influences either of the Veronese type or of Venetian *koiné*;

- a "*colonial dialect*" with a Venetian origin, which had been formerly exported outside the Eastern area through the geographical, political and socio-cultural expansion of the Venetian Republic. Currently, although it has almost disappeared in Dalmatia and Istria, it maintains a certain prestige along the Adriatic coast in Friuli.

The geo-linguistic partition of Veneto dialects is shown in **Figure 1**:

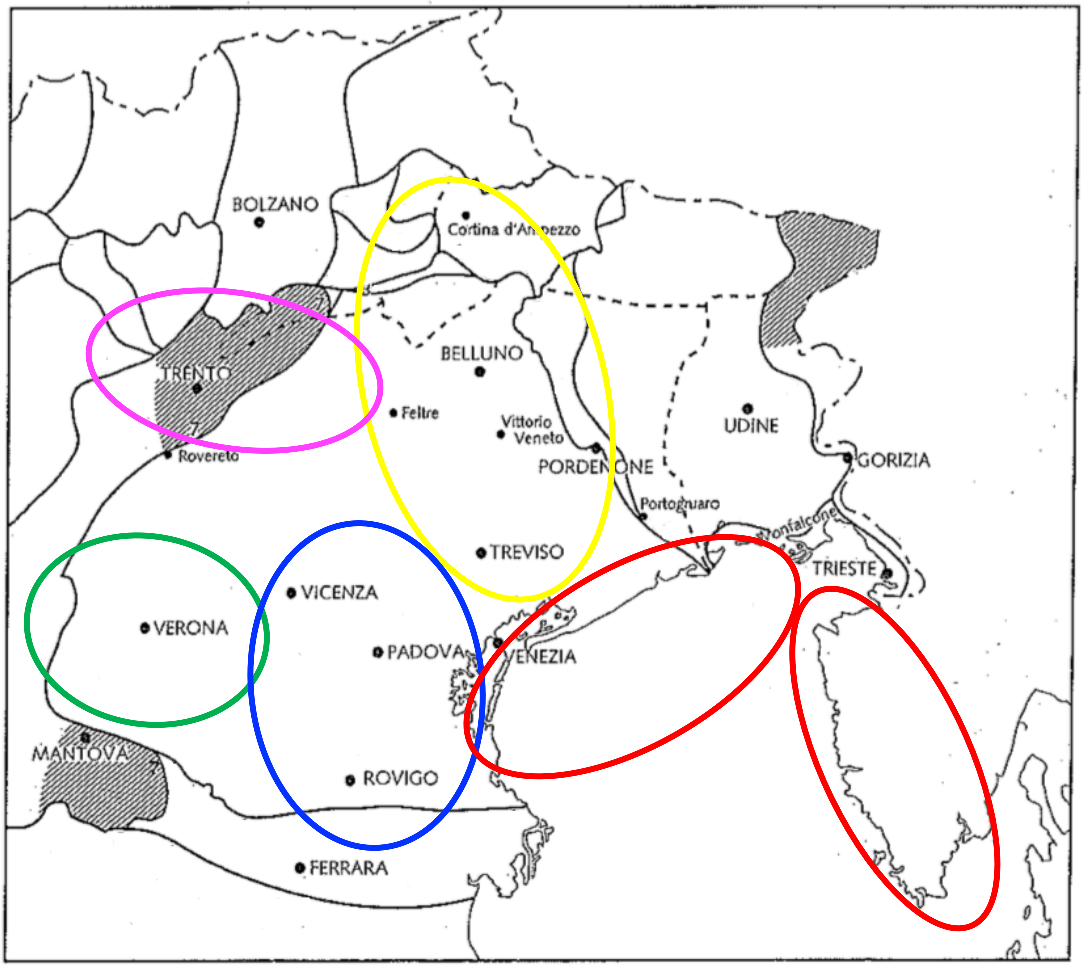

Fig. 1: *Subdivision of Veneto sub-systems according to Pellegrini, 1977*[97]

In addition to this intra-regional classification, it is worth mentioning the Veneto varieties exported by immigrant communities around the world, generally characterized by a non-Venetian base and still conserved to different extents. In this perspective, Veneto dialect should be understood as "diasporic heritage language" (Perrino, 2013) which has mostly undergone CLI – especially on a lexical level – as a consequence of the contact with the hegemonic languages of the settlement areas (see e.g. Corrà 1980). Consequently, «*new hybrid forms are being created by communities of Veneto living abroad (such as Veneto-Brazilian, or Veneto- Argentine, etc.). This hybridity may help contribute to "heritaging", as Veneto dialect is used and reproduced in different*

[97] Respectively, red indicates the "Veneziano lagunare"; blue indicates "padovano-vicentino-polesano"; green indicates Western dialects spoken around Verona; yellow indicates "trevigiano-feltrino-bellunese", while pink indicates further Western varieties spoken in Trentino.

'polycentric' environments» (Perrino, 2013: 575). Beside the 5 million native speakers living in Veneto, we also find 4 million speakers in Brazil, 50.000 in Croatia (mostly in Istria, Fiume and Dalmatia) and 2.500 in the state of Chipilo, Mexico[98]. As we will extensively discuss in the next chapter, the vitality of Veneto dialect(s) is also observable among the numerous Italian communities who settled in Australia since after WWII.

4.2.1 Phonetic and phonological features of the Veneto macro-system

The Veneto varieties we have so far mentioned belong to a common regional macro-system that has been unanimously placed by scholars among the dialects of Western Romània (see Mioni & Trumper, 1977 and Pellegrini, 1977 for a discussion). In fact, all these varieties similarly share the phenomenon of "sonorization" (i.e. voicing), included within the larger set of "lenition" processes[99] (see e.g. Maiden, 1998; Marotta, 2008; Brandão de Carvalho, Scheer & Ségéral, 2008 for an in-depth analysis of this topic). Within the whole Veneto macro-system, sonorization involves voiceless obstruents within words in intervocalic position, so that we have:

- /p/ > [v]: for example, SI "sapere" [saˈpeːre] (to know) > [saˈver];
- /t/ > [d]: SI "ruota" [ˈrwɔːta] (wheel) > [ˈrɔda];
- /k/ > /g/: SI "amico" [aˈmiko] (friend) > [aˈmigo]

Additionally, especially in the inland and rural areas, it is possible to observe a lenition phenomenon which also occurs in the Eastern Lombard and Ibero-Romance dialects, i.e. a general weakening that involves voiced obstruents in intervocalic context, which are often realized in their *lenis* variant (Zamboni, 1988: 525). Specifically, we have /β, ð, γ / in correspondence of /b, d, g/, respectively, as in SI [ˈrɔːba] > Ven. [ˈrɔːβa] (stuff);

[98] Data are extracted from the online Ethnologue database: https://www.ethnologue.com/language/vec.

[99] A wide gamut of studies has addressed both phonological and phonetic aspects involved in lenition, since the seminal work of Martinet (1955). Here, we will present the general definition given by Kirchner (2004: 313), according to which «*the term "lenition" refers to synchronic alternations, as well as diachronic sound changes, whereby a sound becomes 'weaker', or where a 'weaker' sound bears an allophonic relation to a 'stronger' sound [...] the core idea, as applied to consonants, is some reduction in constriction degree or duration*». Beside voicing and degemination, other possible outcomes of this phenomenon are: flapping, spirantization, reduction to approximants, debuccalisation and elision.

SI [sko'dɛlːa] > Ven. [sku'ðɛːla] (bowl); SI ['seːga] > Ven. ['seːɣa] (saw). In common with the Gallo-italic system, we also have consonant degemination, like in "sella" ['sɛlːa] (saddle) > ['sɛːla] and deaffrication of palato-alveolar affricates /ʧ/ and /ʤ/ in front of /e, i/ (for instance: SI "cento" ['ʧɛnto] (one hundred) > ['sɛnto] or ['θɛnto]) (see Zamboni, 1988).

Additionally, another characteristic of the Veneto macro-system is that Latin *nexi* /kl, gl/ undergo palatalization, resulting in (/kj, gj/) >/ʧ, ʤ/. For example: Lat. "clamāre" and SI ['kjamaːre] (to call) > [tʃa'maːre]; Lat. "clāvem" and SI ['kjaːve] (key) > ['ʧaːve]; Lat. "ecclēsiam" and SI ['kjeːza] (church) > ['ʧeːza] (Grassi, Sobrero & Telmon, 2003: 53). However, when addressing the question of the typology and classification of the Venetian dialects, researchers have generally separated Veneto dialects from other Gallo-romance varieties, as illustrated in Holtus & Metzeltin (1983: 2). According to Devoto & Giacomelli (1972), this is essentially due to the following factors: the relative absence of terms that come from a possible Celtic substratum; the lack of front rounded vowels /ø, y/ (D'Achille, 2003: 16); the lack of fronting of stressed /a/ to /ɛ/; the absence of the nasal velar in intervocalic position, as well as of the palatalization of /kt/ and the diphthongization of /e, o/ (see Zamboni, 1988 for further details).

4.2.2 The Northern Veneto dialectal sub-system

Among the dialectal varieties belonging to the Northern Veneto (NVen) area, we will hereafter take into consideration the ones spoken by our informants, namely Feltrino and Cadorino[100]. Their geographical position is described by Zamboni (1974):

> «*I fenomeni che storicamente caratterizzano il veneto di Nord-Est cominciano a trovarsi oltre Montebelluna, alla stretta di Quero [...] fino a Feltre [...] e alla val Belluna, che rappresentano un territorio d'interferenza trevigiano-bellunese: sulla sinistra del Piave, distinguiamo il triangolo Vidor - Ponte della Priùla - Vittorio Veneto (area basso-bellunese) e, oltre il crinale prealpino, la zona del bellunatto vero e proprio [...] dopo questo comincia la zona d'interferenza veneto-*

[100] Interdentals occuring in the Cadore sub-variety undoubtedly derive from the Veneto macro-variety. On the other hand, they do not occur in the Ladin varieties present in the same (and contiguous) territories so far mentioned.

ladina. Infine, un tipo di trevigiano rustico è diffuso nella pianura tra Piave e Livenza fino al Portogruarese e al Tagliamento, dove peraltro si fanno sentire anche influssi veneziani, trattandosi della fascia costiera da lungo tempo sottoposta al diretto influsso di quella città».

Differently from Venetian, the whole Northern system is characterized by the presence of interdental fricatives: the sounds /θ/ and [ð][101] are mainly present in the low registers, namely in the rural varieties of the minor centers around Belluno, Valsugana and Liventino (Pellegrini, 1949). The voiceless interdental occurs in place of the SI voiceless affricates /ts/ (SI [fatːso'letːo] (handkerchief) > NVen [faθo'let]) and /ʧ/ (SI [ʧimi'tɛːro] (cemetery) > NVen [θimi'tɛːro]). Regarding the outputs of the SI voiced affricates /dz/ and /dʒ/, we observe a tendency to surface as the obstruent /d/, which - as we already showed - undergoes lenition in intervocalic position. As a consequence, we will have, respectively: [ð] in [p'ɛːðo] vs SI ['pɛːdʒo] (worse) and ['pjaŋder] vs SI ['pjaŋdʒere] (see Canepari, 1984; Cortelazzo, 1985; Zamboni, 1988; Marcato, 2002). On the contrary, interdentals are nearly absent in major urban centers and among youngsters, where a common regional variety is generally employed. In these cases, [θ] and [ð] tend to be realized as the alveolar fricatives [s] [z] and the voiced alveo-dental [d], respectively: that is, confirming our previous remarks, they are generally assimilated to sounds belonging to the phonological inventory of SI. As highlighted by Trumper (1977: 282), in such a situation of *macrodiglossia* in which the L and H languages in contact are structurally related, the structures of L and H languages may tend to resemble each other. In our case, since the H language (Italian) does not exhibit the interdental [θ] and [ð], this unbalance may imply the merging of such phonemes with other phonemes shown by both L and H, namely with the correspondent alveolar sounds /s/ and /z/.

Beside the presence of interdental sounds in the Northen Veneto phonological

[101] It is worth reporting that /θ/ holds a phonemic status, while [ð] establishes systematic morpho-phonemic relations with its voiceless counterpart (for instance: m. ['mɛθ] (half) vs f. ['mɛːða]) and with /d/ (m. ['frɛt] (cold) vs f. ['frɛːða]). This phenomenon can be ascribed to the general tendency to neutralize the contrast between voiceless and voiced consonants in final position (see e.g. Cortelazzo, 1985 for a discussion). In addition, we observe that [ð] retracts its articulation to the dental position of [d], when occurring in strong position (i.e. initial or postconsonantal). For instance, we have [d] in [spul'dar] (to debug), but [ð] in ['frɛːða] (cold).

inventory, we can observe other relevant phenomena which will be illustrated below. As far as consonants are concerned, we have the deletion of /l/ and resolution in [ɛ] in nouns ending with -al, -ol, -el, such as [fra'dɛl] (brother) which results in the plural [fra'dɛːi]; elision of the nexus -vr-; palatalization of the nexus -li, -ri, -di and -vi that become /g/ (for example: [kaal'ger] (knight) and ['gaːol] (devil)), whereas the nexus -ti results in the alveo-palatal affricate /ʧ/, like in [ʧɛn] (he holds); rare betacisms as in ['buo] (had); sporadic outcomes of /f / in /h/ as in ['hɛr] (iron) > SI [fɛrːo].

4.2.3 Target coronals and vowels in Bellunese

For the purposes of these work, we will henceforth concentrate on the phonological description of voiceless coronal fricatives within NVen sub-systems of Feltre and Cadore. It is worth noting that the post-alveolar fricative /ʃ/ only occurs in VRI – in the same phonological contexts of the correspondent phoneme in SI – but is absent in the NVen phonological inventory (see Zamboni, 1974, 1988). In VRI, it can be found in #CV position, like in [ʃiːmja] (or [siːmja]) (monkey), intervocalic contexts, like in ['biːʃa] (snake). If we consider this sound from a phonetic perspective, we can observe its occurrence in word-final position as the release portion of the post-alveolar affricate /tʃ/ in both VRI and NVen, like in: ['birɔtʃ] (chariot), differently from SI. As already motivated in the Introduction, for the purposes of this work we will consider the release portion [ʃ] as target sound for our acoustic analyses.[102]

Differently, singleton voiceless alveolar fricative /s/ in NVen can be found in all the following contexts:

- in initial position, both before vowels (for example: ['seːʧa] (bucket)) and before voiceless consonants (['spɛːʧo] (mirror) and [sku'ðɛːla] (bowl), similarly so SI.
- in intervocalic position, like in ['fɔːso] (moat) vs SI ['fɔsːo] and [a'dɛːso] (now) vs SI [a'dɛsːo]. In this case, the alveolar fricative that undergoes the degemination process maintains its voiceless nature in dialect: contrarily, in SI /s/ becomes [z]

[102] Zamboni (1988: 529) claims that singleton [ʃ] in NVen could be preceded by an alveolar phase [s]. For this reason, he suggests the use of this representation: [s-ʃ], to underline a higher degree of complexity with respect to the post-alveolar fricative occurring in SI. However, when we transcribed and analyzed our data, we did not find correspondence at acoustic level of such assumption.

in intervocalic context. In this respect, it is worth noting that in few cases /s/ and /z/ represent instead a productive phonological opposition in the Veneto dia-system. Example of minimal pairs are ['ka:sa] (box) (SI: ['kas:a]) vs ['ka:za] (house); ['me:se] (put) (SI: ['mes:e]) vs ['me:ze] (month); ['ro:so] (red) (SI: ['ros:o]) vs ['ro:zo] (eroded)[103].

- In final position, like in [mus] (donkey) and ['pu:lis] (louse).

Correspondingly, interdental fricative /θ/ occurs:

- in initial position before vowels, for instance: [θa'rje:za] (cherry), in place of the SI post-alveolar affricate /ʧ/, like in the correspondent SI lexeme [ʧi'lje:dʒa], or in place of the SI dental affricates /ts/ and /dz/, such as in [ka'θɔ:la] and ['θu:kero], which correspond to the SI [ka't:swɔ:la] and ['dzu:kero], respectively.
- in intervocalic position, such as in [faθo'let] (handkerchief), in place of the SI /ts/ (SI [fat:so'let:o]).
- in final position, like for instance in [riθ] (hedgehog), [sa'leθ] (willow), [laθ] (lace), in place of SI /ʧ/: ['rit:ʃo], ['sa:litʃe], ['lat:ʃo], respectively.

In the latter case, we observe a particular phenomenon which occurs in Northern varieties. Namely, unstressed vowels tend to fall in final position, leading to outcomes like, for example: SI ['bɛl:o] > NVen [bɛl]; SI ['ti:no] > NVen [tin]; SI ['ɔs:o] > [ɔs], and so on. Vowel elision hence yields the formation of oxytones with a consonantal termination, which in turn trigger the neutralization of the contrast between voiceless and voiced consonants in final position. For instance, two distinct words in SI, respectively: ['pɛt:so] (weight) and ['pe:ʃe] (fish) converge to a single term ['pɛs] in NVen, while in Venetian we still have ['pe:zo] e ['pes:e] (Zamboni, 1988: 531). For what concerns vowels, no difference is observable between SI and Bellunese dialects (Maddalon & Miotto, 1986). As Zamboni (1988: 527) reports, NVen stressed vowels shows four degrees of opening (high, mid-high, mid-low, low). Mid-high and mid-low

[103] As pointed out by Benincà, Parry & Pescarini (2015: 190), Latin intervocalic geminates are shortened in whole Northern Italy. Nonetheless, they have remained distinct from the original short consonants and have never been subject to voicing. In fact, unvoiced consonants deriving from geminates are maintained in intervocalic contexts.

vowels (i.e. /e, ɛ ~ o, ɔ/) are phonologically distinctive as in SI, although in dialect they occur with a different distribution; a central phoneme /a/ and diphthongization in open syllable. Similarly, NVen unstressed vowels are /i, a, e, o, u/, as in SI, which generally undergo reduction processes within words, like: SI ['femːina] > ['feːmena]; ['reːdini] > ['reːðene], and so on (see Benincà, Parry & Pescarini, 2016 for further details).

We have so far tried to generally clarify the main issues concerning the phonological system of Northern Veneto sub-system, to which Feltrino and Cadorino varieties belong. Purposely, a wider examination of phonological and phonetic features of both NVen and SI coronal fricatives and vowels will be presented in Chapter 6, where we will in depth discuss the interaction between NVen, SI and AusEng inventories.

4.3 Heritage speakers in Australia: a historical and sociolinguistic perspective

In the post-WWII period, most Italians left from rural centers, which offered little economic, social and working opportunities to young men with low levels of education. Thus, it is not difficult to acknowledge that for these people migration was the only solution to satisfy the urgent need to improve their life quality (Stiassi, 1979). However, migratory movements to Australia had a rather modest start with respect to other overseas countries [104]. In fact, besides being extremely distant from Italy, Australia showed a lower economic progress and a lower quality of life compared, for instance, to United States: for these reasons, at the beginning of the XXth century, Australia was hosting only 5.660 Italians. On the other hand, data show that movements became significantly more consistent in the immediate post-war-years. Specifically, it is reported that 360,000 Italians settled overseas within the second wave of migration that occurred between 1947 and 1976 (Stiassi, 1979; Castles, 1992; Cavallaro, 2003; Campolo, 2009). In fact, differently from United States, which imposed restrictions concerning the incoming populations, Australia's local government favored migrations

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[104] As indicated by Stiassi (1979: 38): «*i primissimi emigranti italiani furono attirati verso il 1850 dalla scoperta dell'oro, anche se l'alto costo del viaggio e l'assenza di linee dirette di collegamento fra l'Italia e l'Australia resero trascurabile l'entità di questa corrente*».

by adopting ad-hoc policies. Right after World War II, negotiations began to be carried out with Britain and other European countries for assisted migration programs, led by the necessity to "populate or perish" (Avesani *et al*., 2017: 274). In 1951, as reported by Campolo (2009), a bilateral agreement was signed by the Australian government with Italy, in order to allow the annual introduction of 20,000 immigrants to the host country. Accordingly, so-called "chain" migration[105] movements favored the birth of numerous Italian communities: by that time, as reported by Rubino (2014b), Italians represented the largest group with a non-English-speaking background. Demographic data for Italian born immigrants in Australia are illustrated in the following **Table 1**:

Census year	Italian born population
1947	33.632
1954	119.897
1961	228.296
1971	289.476
1981	275.883
1991	253.332
1996	238.246
2001	218.718
2006	199.124
2011	185.402

***Table 1**: Figures for Italian born population resident in Australia from 1947 to 2011, based on ABS (2013)*[106]

Soon after mid '40s but gradually continuing through the late 1970's, these communities settled in the principal urban areas of mainland Australia (Rubino, 2014a: 242), mainly in Melbourne and Sydney – which still nowadays host the major part of the Italian population (68.823 immigrants in Melbourne and 41.783 in Sydney,

[105] "Chain migrations" basically indicates situations in which some migrants successively bring in their new homeland relatives and friends of their country of origin (Stiassi, 1979: 39).

[106] ABS (Australian Bureau of Statistics) (2013). *2011 QuickStats.* Retrieved from http://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/0 (accessed 10.09.2018).

according to the SBS Census Explorer, 2011[107]). Regarding their regions of origin, most of them came from Calabria and Sicily, but also from two less industrialized regions in the North: Veneto and Friuli (see e.g. Bettoni, 1981; Bettoni & Rubino, 1996; Campolo, 2009; Caruso, 2010; Gallina, 2011; Rubino, 2014a, 2014b, among others). As far as their professional occupation is concerned, most post-war Italian migrants were agricultural laborers or workers with limited formal and professional qualifications, and hence they were employed in a limited range of jobs, such as agriculture, manufacturing and fishing industries. Once they succeeded in establishing a stronger presence in this environment, Italians were then introduced also to construction and retail sectors (Caruso, 2010).

Besides the regionally-differentiated cultural characteristics, the Italo-Australian community has always been characterized by the maintenance of strong family ties, indeed related both to a chain-type of migration and a high rate of endogamy among first-generation individuals (Rubino, 2014b; Ware, 1981)[108]. Such type of setting undoubtedly facilitated the establishment of both regional and super-regional social networks, which consequently led, to different extents, to a robust maintenance of immigrants' linguistic and cultural heritage (Kloss, 1966). Moreover, Rubino (2014b: 7) underlines that many post-war migrants, as a consequence of the strong immigration policy oriented towards assimilation, «*reacted by sheltering within their networks in the Italo-Australian community and minimizing any contact with the Anglo section of society, while others, particularly the younger ones, reacted by assimilating*». Due to its strong cultural value as marker of a defined socio-cultural identity and due to its large use in diverse communication settings, from 1976 to 2006 Italian and varieties of Italian have appeared to be the most widely used languages after English: in fact, up until the 2006 Census[109], Italians represented the largest non-English language group in Australia (yet, in 2011 their predominance was overtaken by Chinese and Indians).

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[107] Retrieved from http://www.sbs.com.au/news/census-explorer (accessed 9.09.2018).

[108] In fact, such importance of familiar settings is an ethno-cultural specificity which been recognized as Italians' major "core" value by Smolicz (1981).

[109] Australian Bureau of Statistics (2007). *2006 Census of population and housing*. Retrieved from http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/2914.02006 (accessed 9.09.2018).

4.3.1 *Italian and Dialect as Heritage Languages*

Concerning immigrants' linguistic repertories, we have so far observed that within the peculiar socio-political, economic and cultural identity of the Peninsula from the period among WWI and WWII, dialect was the first and primary language for the major part of the Italian population. In the migration wave preceding the Second World War Italians were late adolescents or young adults of the same generation, and were almost exclusively dialectal speakers at the time of departure. For this reason, the low literacy rate of immigrants, combined with the circumscribed knowledge and use of Italian with respect to dialectal dominance, led to similar outcomes in new communities also in different areas of migration. As we presented in the previous chapter, a vast literature unanimously reports that regional/local dialect was acquired spontaneously in family settings, and employed frequently and naturally for everyday communication needs (Cortelazzo *et al.,* 2002, De Mauro, 1963, 1974, Bettoni, 1981; Bettoni & Rubino, 1996; Berruto, 1997, Maiden, 1998, a.o.). On the other hand, repertoires of first-generation heritage speakers (see Chapter 1) included Italian as a second language in its regional/popular variety, which was mastered at various levels, according to the degree of schooling achieved by the subject before migration (see e.g. Caruso, 2010). It was used with Italians from other regions and in more formal situations (for example with other casual acquaintances within the immigrant community). In summary, these first massive groups of Italian immigrants can be understood as multilingual speakers whose L1 co-existed in a diglossic relation with an L2 in their local community, and who learned a third linguistic system for surviving, at different times and to different extents. For these reasons, they indeed represent a rich - and still promising - field of analysis to investigate language maintenance, loss, attrition, shift, convergence and phonetic/phonological restructuring in their HLs in contact with the host language.

Upon arrival, immigrants were then forced to learn English quickly, without the support of local institutions (Gallina, 2011: 441-442). Since social interactions were rather limited, they did not have the possibility of being exposed to a conspicuous linguistic input: therefore, the first groups of Italian HS perpetrated an exclusive use of local and regional dialects[110], to the detriment of English. On the other hand, HSs migrated in the post-World War II phase had a more widespread contact with Italian through schooling, although circumscribed to a formal and/or passive knowledge (Bettoni, 1981; Bettoni & Rubino, 1996)[111]. Statistical data confirm the knowledge of English in first-generation speakers as rather variable, yet generally low both in terms of passive and active skills (Gallina, 2011). As we have so far discussed, it heavily depends on factors such as age at the time of arrival, employment, and degree of integration within the social networks of the new community. According to the 1991 ABS census[112], 39.6% of first-generation immigrants aged 65 and over (i.e. first-generation HSs) declared to have a limited competence in English, while 12% claimed to have no mastery at all. Within these oldest groups of Italian HSs, moreover, females claim to have a lower knowledge of English with respect to males (18.3% of women, compared to only 6.3% of men, declared they did not master English at all). As highlighted in Rubino's investigations (2002, 2010), people whose dominant language is English are: (i) the second generation of HSs, (ii) men (compared to women), (iii) the youngest speakers of the first generation, i.e. the ones who migrated during early adolescence or childhood; and (iv) who has a non-Italian partner.

In account to this, it is necessary to underline that the majority of immigrants to Australia, included first-generation Italians, generally acquired the low variety of the host country, that is the "broad variety" of AusEng (Giles, 1973; Giles & Powesland, 1975)[113]. Namely, it has been reported by Wells (1982) that these HSs tended to

[110] Moreover, the diffusion of regionally-specific associations has played a significant role in the conservation of cultural and linguistic identities of immigrants', often boosting the orientation towards the use of local dialect, with respect to Italian (Rubino, 2010).

[111] Regarding the HS' competence in Italian and its use in public and in private domains, the difference between first and second generation is indeed relevant (see e.g. Ciliberti, 2007 and Rubino, 2010 for a discussion). Also, Santello (2014) investigated repertoires of Italian-English circumstantial bilinguals in Australia, according to a "dominance-based" classification of the two systems. Speakers whose dominant languages are English and Italian (and not Italian regional languages) are reported to be a rising group, yet still largely understudied.

[112] Australian Bureau of Statistics (1991). *1991 Census of population and housing*. Retrieved from http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/2101.01991?OpenDocument (accessed 10.09.2018)

[113] Literature unanimously identifies three main types of variations varieties of AusE (i.e. "cultivated", "general" and "broad"), which are posed in a continuum (see e.g. Mitchell, 1946; Wells, 1982; Harrington, Cox & Evans, 1997). Each of them can be identified mainly by differences in the pronunciation of vowels

approximate the accent of the lower working class for their daily interactions. Because of their closeness due to similar socio-economic features and level of education, in fact, this group is the one they have stronger social bonds with. It is worth reminding, however, that once in their new homeland, HSs came into contact not only with English, but also with plenty of varieties of Italian languages spoken by the other Italian immigrants in that area. Specifically:

- dialects from different regions in Italy that are structurally distant enough from their own dialect as to be mutually unintelligible;
- varieties of SI spoken in those regions that exhibited phonetic, phonological and morphosyntactic features different from those of their own variety of SI;
- other local varieties of the same dialectal system (for example, migrants from North Veneto and from Central Veneto, as discussed in Avesani *et al*., 2015 and Avesani *et al.*, 2017).

Before going more in depth with our investigations, we will firstly provide in §5.2.1. the current state of art on these phenomena, specifically on what has been so far observed in Italian immigrants' HL in contact with English in Australia and other English-speaking countries.

4.3.2 State of art on Italian HS in Australia

In the last decades, some noteworthy studies have investigated phenomena of HL maintenance, attrition and shift in Italian immigrant communities in English-speaking countries, either from an acoustic and/or perceptual perspective. In this paragraph, we will firstly provide a literature review in chronological order of the most important investigations conducted in this area. In the following paragraph, we will focus in on what has been so far observed (and on what is still to be observed) regarding the analysis of speech features of Italo-Australian immigrants. In §4.3.3 on the other hand,

and intonation patterns, that also distinguish them from other spoken varieties of English. "Cultivated" and "general" Australian English are commonly perceived as "correct" or "proper" speech patterns, showing tendency to identify with British English, the first looking to the *Received Pronunciation* as the standard of prestige variety. On the other hand, the low variety of AE, the so-called "Broad Accent" or "Strine" (Wells, 1982) is evaluated less positively than the others.

we will describe the most important investigations carried out of Italian HSs' speech in English-speaking countries other than Australia.

It is worth underlining that the linguistic situation of Italo-Australians is rather peculiar with respect to other Italian communities abroad, since these HSs constitute a relatively recent community. Hence, they still show linguistic dynamics that, due the active presence of a large first generation, already disappeared elsewhere. Moreover, Italian HSs' trilingualism is (more or less) integrated within the broader dimension of the rich Australian linguistic environment. As we will show below, previous studies on Italian HSs have thoroughly examined maintenance, attrition and shift in the lexicon, grammar and pragmatic features both in their regional Italian and dialects (e.g. Bettoni, 1981; Bettoni, 2000; Bettoni & Rubino, 1996; Rubino, 2006; Rubino, 2014). If we circumscribe our literature review on research concerning HSs in Australia, including Italians, we notice that studies have been particularly productive and innovative. The work carried out by Clyne (1967, 1972) on the Anglicization of the speech of Germans in Australia firstly introduced the issues related to immigrants' language change and paved the way for subsequent research. Furthermore, following Fishman's seminal work (1970) and the above-mentioned investigations carried out by Horvath in mid 80s, studies of immigrant languages "flourished in the field of language maintenance and shift" (Rubino, 2010). In a literature review carried out in 2002, Rubino pointed out preliminary works such as the one carried out by Rando 1968, who investigated changes occurring in the Italian language of first-generation migrants under pressure from the new English-language environment, with particular attention to phenomena of lexical transference (such as "*il carro*" and "*la fenza*" from the English "car" and "fence").

Except for some sporadic investigations (see Rubino, 2002), Bettoni (1981) was the first who systematically applied a robust method of analysis to study the process of contact and anglicisation in Italian HSs. In her study, 47 informants (20 males and 27 females, either belonging to the first or second generation) were recorded: 22 of them came from Venice. Tape-recorded informal and spontaneous interviews were conducted between 1977 and 1979, and subsequently transcribed. In this work, Bettoni described phenomena of "transference" at the phonic, morphological, lexical, semantic and discourse level, suggesting that phonic transference[114] is found almost exclusively in the speech of HSs who are dominant in English, namely who emigrated during childhood, as well as II generation HSs. On the other hand, she reported very few cases of phonic transference in those who migrated as adults. In these cases, the phenomenon affected Italian words, which were either partly or fully assimilated into the phonic system of English. Also, words transferred from English to Italian in their original meaning seemed to acquire, to some extent, different forms depending on the degree of their phonic and morphological integration. Specifically, the process of phonic integration (either complete or incomplete) alters the words by substitution, loss, addition or redistribution of phones both at the phonetic and phonemic levels to make these words acceptable in Italian (see Bettoni, 1981: 59 for a detailed discussion about phonic integration of lexical transfers). Although in this contribution phonemic transcription was used only occasionally, i.e. in cases of integrated lexical transfers, the scholar outlined some interesting sound substitutions, such as the positional aspiration of voiceless plosives, followed by the alveolarization of dental plosives (for instance, in words like [lune'di] English alveolar plosives may replace the Italian dental ones). No recordings of English speech, nor specific tests for measuring the informants' competence in English were carried out by Bettoni (1981). Yet, the scholar's qualitative observations, as well as informants' own ratings on their proficiency, suggested that knowledge of English in first-generation speakers generally increases among those who arrived after the War - when contacts with English-speaking Australians became more frequent - and among those who came at an earlier age.

Also, we it is worth mentioning a study carried out by Horvath in 1987, which aimed to give a sociolinguistic interpretation to the differences observable within the Sydney linguistic community. To do this, the scholar took into consideration the variables connected to the massive presence of immigrants, mostly Italian and Greek, and explored the range of variability encountered in the pronunciation of AusEng diphthongs [ɪi]; [ɛɪ]; [a̠ɪ̞]; [ɞ̆ʊ]. This work suggests that ethnicity might be relevant in

[114] I.e. the transference of phonemes or allophones.

describing the speech of each class present in Australian English, that is: "cultivated", "general" and "broad". More specifically, Horvath concludes that social and socio-economic factors contribute in separating almost all the Italian adult immigrants from the rest of the speech community. Their vowels are, in fact, associated with the broad variant, perceived as low, which makes such subjects a "satellite community". However, the origin of the Italian speakers is not further specified, thus hindering a proper comprehension of their linguistic and sociolinguistic features and the impact of English on their native dialectal variety.

Later, Bettoni & Gibbons (1988)[115] investigated Italo-Australians' language attitudes, revealing the presence, particularly among first-generation migrants, of negative attitudes towards the main language varieties spoken in the community, i.e. dialect and English/dialect or English/Italian mixtures (Rubino, 2002). Also, Bettoni (1990) reports results of an analysis involving 20 informants (all originating from Veneto), which were interviewed and preliminary analyzed in 1984. Their parents were born there and subsequently migrated as young adults between 1955 and 1965. Venetian dialect was the mother tongue of these HSs, regularly used at home and among friends from the same region. On the other hand, for communicative needs in formal situations, and with Italians from different regions, HSs kept exhibiting a certain mastery of regional Venetian Italian. The purpose of her work was to investigate how the two HL varieties subject to language attrition (i.e. Venetian and Italian) interact during this process. Results showed that erosion of either Venetian dialect or Italian at a discourse level did not happen indiscriminately. That is, in on-going speech production HSs exhibited a certain code-fluctuation, in which a consistent choice was made in favor of the dialect for weak function words, and in favor of English for strong content words. Several other studies were hence carried out also on second-generation speakers, such as: Rubino (1993, 2000, 2014), Bettoni & Rubino (1996) and Cavallaro (1998), generally demonstrating a high degree of code-switching (see Schmid, 2005), language mixing and simplification as markers of L1/L2 erosion together with a shift to English. Following this line of approaches, Caruso (2010) investigated trilingualism of 20 first-

[115] See also Bettoni, 1985.

and second-generation Italo-Australian HSs from Calabria from a morphosyntactic perspective. More specifically, she thoroughly examined phenomena of attrition in verbal morphology within the framework of the markedness hypothesis, and discussed the presence of code-switching phenomena in HSs' discourse (see Schmid, 2005 for further details on this issue). The scholar demonstrated that Italian future and perfective tenses represented a notable example of grammatical erosion across generations, correlated to the interparadigmatic overgeneralization of (unmarked) Italian "*Presente*". An overall trend of simplification was observed throughout the whole Italian verbal system, except for the "*Passato remoto*", which instead was still significantly used in conversations. In account to this, Caruso proposed the following interpretations: on the one hand, the maintenance of "*passato remoto*" could be due to the influence of the Calabrian dialect, which is still relevant in the linguistic repertoire of both first- and second-generation HS; on the other hand, the attrition in the verbal tense could be the result of a "failure to acquire" occurred for Italian (see Chapter 1 for a definition). However, although the author collected semi-structured interviews in Italian, this corpus is, to our knowledge, not available. Also, since this work mainly focused on morphosyntactic and discourse analysis, no speech analysis was carried out. More recently, Santello (2014) studied 103 Italian-English circumstantial bilinguals, born in Italy or of Italian descent and living in Australia. The scholar employed self-reported language dominance as a tool to identify language dominance through an ad-hoc scale. Participants were asked to indicate language use in the home domain, language preference and language of mental calculation. Also, they had to report, if experienced and/or perceived, the degree of phonological interference between their systems. While the large majority of Italian dominants (IDs) reported to have phonological interference when speaking English, over half of English dominants (EDs) reported having no audible interference when speaking Italian. In other words, IDs tend to identify phenomena of interference of their dominant language when speaking the other, whereas EDs less so.

Additionally, we believe it is necessary to report a recently-built audio collection for cross-linguistic and diatopic comparisons: the Australian Sydney English corpus[116] (AUSYE: Travis & Torres Cacoullos, 2013). It contains recordings of adult informants of different ages and provenience: Anglo-Celtic, Italian, Greek, Cantonese, Vietnamese, Arabic, and belongs to a wider project which explores the social and linguistic factors affecting variation in Sydney immigrant communities, in order to address key questions for language change. Nonetheless, we observe that the regional origin of the Italian speakers included in the corpus is not specified. Therefore, although the AUSYE corpus indeed provides a notable contribution to this field of research, it was not possible to take it as a point of reference for the present work, due to the lack of information on the socio-linguistic identity of Italian immigrant communities. Specifically, we assumed that the remarkable differences existing among Italian dialects at all linguistic levels - even within the same region - could not be neglected. Another relevant contribution in HSs data collection is given by the Australian National Database of Spoken Language (ANDOSL)[117], which is currently being implemented. Among other materials, it includes 200 sentences uttered by 9 speakers from the most populous migrant language groups, including Italian. However, speech data for Italian speakers are not yet available in digital format. Moreover, once again the region of origin of these informants is not indicated.

4.*3.3 State of art on Italian HS in other English-speaking countries*

In 1992[118], Busà examined productions of English [u] and [ʊ] in Italian immigrants living in the United States. An acoustic analysis indicated that nearly all speakers tended to produce English [u] more Italian-like (i.e. with lower F2 values) than those of native English speakers. In the case of [ʊ], however, Fl and F2 values revealed that a larger number of Italians produced [ʊ] tokens with more native-like spectral and temporal properties with respect to [u]. Hence, Italians showed to produce more accurately the

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116 The audio material was extracted in 2010s, thus continuing the dialects surveys started by Horvath in the 1970s.

117 Retrieved from http://andosl.rsise.anu.edu.au/andosl/ (accessed 9.09.2018).

118 Also, in 1992 Flege suggested that early bilinguals may not perceive all L2 vowels in a native-like fashion. He reported the study of Blankenship (1991), in which native English listeners attempted to identify native Spanish speakers' productions of four English vowels /i, ɪ, æ, ɛ/. Both the early and late bilinguals produced large temporal differences between /i/-/ɪ/, /ɛ/-/æ/.

new non-native sound [ʊ] than [u], which instead belongs to their phonetic system. For this reason, the findings of Busà (1992) appear to support the SLM (see Chapter 3 for a discussion about the Speech Learning Model). Besides, Munro *et al.* (1996) studied English vowel productions of 240 native speakers of Italian who migrated to Canada[119], whose AoA ranged from 2 to 22 years, and native English listeners rate on vowels /i ɪ eᶦ ɛ æ ʌ ɚ ɒ oᵘ u ʊ/ produced by Italian immigrants. Acoustic comparison of Canadian English and Italian vowel inventories was defined by mean Fl and F2 formant frequencies. LPC formant tracks and measurements were carried out at the acoustic midpoint of each vowel. However, it appeared that an accurate prediction of vowel production quality could not be carried out solely on the basis of acoustic distances. Hence, a vowel identification task was performed, which revealed that the foreign accent perceived by native English listeners increased as the subjects' AOAs increased. This meant that the later the native Italian subjects were first exposed to English, the more their vowels differed from native English monolinguals' vowels. Not one of the vowels was observed to be produced in a consistently native-like manner by the latest-arriving learners, even though they had been living in Canada for an average of 32 years. Flege (1999) also examined the production and perception of English vowels by Italians who migrated to Canada, both early or late bilinguals. The subjects were selected according to their AoA in the host country, their years of experience of English and the amount of L1 use. These investigations confirmed that the later in life the native Italian subjects began to learn English, the less accurately they produced and perceived English vowels. 10 Canadian vowels (/i ɪ eᶦ ɛ æ u ʊ o ɒ ʌ ɚ/) were taken into account (partly similar to those analyzed by Munro *et al*., 1996). Neither of two groups of early/late Italian/English bilinguals differed significantly from native speakers of English either for production or perception. Once again, this finding is consistent with the hypothesis of the Speech Learning Model that early bilinguals establish new

[119] The origins of the speakers are here specified: Calabria, Abruzzo, Sicilia, Puglia, Molise and Lazio. As reported by the authors, «*Although we cannot rule out the possibility that LI dialect differences influenced the Italian talkers' success in producing the English vowels, it is highly unlikely that such differences played a systematic role in the results. First, the distribution of dialects across the AOL groups was quite uniform. Second, a survey, by region, of the talkers who correctly produced or failed to produce individual vowels in a native-like way revealed no consistent patterns*».

categories for vowels found in the non-native language[120].

In the last few years, there has been an increasing attention (yet more circumscribed with respect to other levels of linguistic analysis) in the collection of spoken data to explore HLs phonetic and phonological features. For instance, Celata & Cancila investigated the perceptual processing of length contrast in consonants by 15 Lucchese immigrants in San Francisco[121]. The local variety of Lucchese is the mother-tongue of the speakers, used for daily informal communication, while SI was acquired at school and is still used for supra-regional communication. The scholars outline that only SI has a phonological distinction between the singleton and the geminate consonants, while American English (AE) does not exhibit such distinction. On the other hand, Lucchese is characterized by consonant's degemination, which shows, however, regression within the youngest subjects of the community, presumably, according to the authors, due to an increasing use of SI. Three groups of subjects were tested: a first-generation immigrant group, a second-generation immigrant group, and a Lucchese-dialect-speaking group (still living in Italy). Native Italian speakers of varieties lacking any degemination process were included as a control group. This work also includes the analysis of phonological attrition in a specific psycholinguistic background for cross-language speech perception. The discrimination of pairs of Italian words opposing a singleton to a geminate consonant and the identification of a geminate vs. singleton consonant in non-words revealed that first-generation immigrants could perform better than second-generation immigrants. Accordingly, the perceptual behavior of second generation speakers appeared to be based on an American English phonological

[120]Although it does not involve Italian speakers, is also worth mentioning De Leeuw's study (2008), which analyzed speech of first-generation German immigrants to either Canada or the Netherlands. Participants were first generation late bilinguals who acquired their native language fully and as adults moved to a country where contact with their L1 was reduced. The experiment consisted in assessing whether a foreign accent is perceived in the native speech of German migrants by native speakers of German, resident in Germany. The production of selected elements of the L1 and L2 was investigated to examine whether effects of first language attrition could appear through an acoustic analysis of segmental and prosodic elements (the lateral phoneme /l/; tonal alignment and pitch range). With respect to our work, this study focuses on perception, rather than production, of foreign accented native speech and accounts for different languages in contact. Yet, it still can be helpful for the well-discussed theoretical frameworks and for its fruitful discussion on maintenance and loss of HLs.

[121] In this respect, it is worth reporting the original contributions on this topic by Scaglione (2000).

system, where no length distinctions in intervocalic consonants are lexically represented. Moreover, as far as the identification task on non-words was concerned, they exhibited some degree of sensitivity to variations in the length feature only in the case of the [r] vs [r:] contrast, where a new sound – based on the SLM's equivalence classification paradigm – was involved. Although Celata & Cancila's contribution did not involve acoustical analysis of speech, it provided a for our work a on phonological attrition in Italian immigrant communities.

Another notable example of Italian HL analysis in English-speaking countries is represented by the Heritage Language Variation and Change in Toronto Project (HLVC: Nagy, 2011, 2015). This multilingual collection of naturally-occurring speech in lesser-studied languages has the purpose to examine linguistic variation and change across languages, across locales (homeland vs. transplanted area), and across speakers (different ages, generations, ethnic orientations, etc.). The project focuses on the variation and inter-generational change in several heritage languages (HL) spoken in the city: it consists in a corpus of transcribed conversational speech, accompanied by relevant information about the speakers' linguistic habits and attitudes (Nagy, 2014). It comprehends recording of Cantonese, Faetar, Korean, Italian, Russian, Ukrainian for 40 subjects in total, covering three generations[122]. These languages were selected due to their contrasting inherent features and differing degrees of divergence from English, in phonetic, phonological, morphological and syntactic domains. Segmental analyses are currently being carried out on VOT in Italian immigrants from Calabria, to evaluate the maintenance of their HL (Nodari, Celata & Nagy, 2016[123]). Results have shown that all three generations of Calabrese speakers produce VOTs near the values identified for Calabrian Italian by Sorianello (1996), none drifting to English patterns.

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[122] In this work, the author has defined the *first-generation* group as speakers who grew up in the homeland (until at least age 18) and then migrated directly to the Toronto at least 20 years ago. These speakers are here considered not to be actively acquiring either the Heritage Language or English. *Second generation* speakers are defined as people whose parents (at least one) are first generation speakers. *Third generation* speakers are defined as people whose parents (at least one) are second generation speakers.

[123] Preliminary results are retrieved from https://l1attrition.files.wordpress.com/2016/03/nodaricelatanagy.pdf.

In conclusion, we note a substantial lack in the analysis of fine speech features of Italian HSs in Australia, the majority of studies concerning phenomena of attrition and shift in morphology, lexicon, syntactics and pragmatics. For this reason, this work mainly tries to provide a new contribution to this field of research, by taking into consideration Veneto HSs' L1 speech features in contact with Australian English, and demonstrating either their maintenance or attrition at a fine-grained level. Also, we will formulate considerations on HSs' phonological awareness with respect to single or multiple phonetic categories coexisting in their multilingual inventory.

4.3.4 Hypotheses on Heritage Language maintenance or attrition

Based on these observations, and in light of the dynamics of inter-language interaction so far presented, we can hence formulate hypotheses about phonetic and phonological maintenance of native linguistic features in first-generation Bellunese HSs (see Avesani *et al.*, 2015):

1. *Conservation of the phonetic/phonological features* of the HL: Bellunese HSs might preserve their linguistic heritage, crystalizing the state of both their local dialect and RI L2 at the time they migrated. Consequently, (i) they would maintain more archaic linguistic features with respect to the language(s) currently spoken in their homeland by control-group speakers, due to the lack of input coming from the center of linguistic propagation (Bartoli, 1945); (ii) they would not experience any CLI from dialect to RI nor from RI to dialect, thus perpetrating the diglossic relationship existing in the late 40s/early 50s in Italy before their departure; (iii) English L3 would not exert any influence on dialect or SI, and their speech productions would substantially resemble those of control-group informants.

2. *Effects of attrition, convergence and cross-linguistic phonetic interaction*: Bellunese HSs might experience phenomena of CLI involving L1, L2 and L3. This hypothesis suggests other possible outputs:

    - Immigrants whose local dialects L1 are mutually unintelligible and who found themselves living in the same area might use Italian as their vehicular language (i.e. as *lingua franca*) to overcome communication difficulties (Bettoni, 1981). As a consequence, we might observe a drift from L1-dialect towards L2-Italian in a process of vertical *advergence* (see e.g. positions of Auer, 2005; Berruto, 2005; Cerruti & Regis, 2011 discussed in Chapter 4), according to which the dialect would lose diatopically-marked features and become Italianized. Alternatively, we could witness the formation of a particular dialect-Standard continuum (i.e. type C according to Auer, 2005): that means, a new version of Standard Italian will develop that exhibits a range of phonetic features belonging to the various dialectal substrata of the local Italian community[124].

- Native dialectal speakers may have come into contact with other HSs from the same regions who speak a different dialectal sub-system. In this case, they might lose the specificity of their L1 speech features, and their HL may undergo phenomena of *convergence* toward a regional dialectal koiné. Based on Siegel's (1985) observations, such type of koiné can be understood as a set of dialectal *isoglosse* that have widened their extension with respect to the local dialects. Accordingly, we would have a new Italo-Australian immigrant koiné as a linguistic variety born in a new area where speakers of different varieties have relocated (Avesani et al., 2015; Avesani et al., 2017).

- English L3 may become the predominant language of HSs after averagely 50 years of persistent contact and extensive input and use: accordingly, it would exert a strong influence on both heritage languages. Within the broader area of attrition, this specific case of CLI falls under the heading of "regressive transfer" (see Cabrelli Amaro, 2017: Chapter 1): possible effects of this phenomenon will be explored through the acoustic analysis of Italo-

[124] We remind that in the present work we did not experimentally analyze speech productions in Italian, and in English either. Consequently, we will not discuss here the possible outcomes of this scenario, yet we believed it was necessary to provide a general panorama for all types of cross-linguistic influence. Nonetheless, further works will be carried out on these data, so that we will able to test the validity of all our predictions.

Australians' dialectal speech features.

As we will motivate in Chapter 6, our hypotheses will be tested based on the theoretical frameworks provided in the previous chapter: effects of maintenance or attrition/regressive transfer, respectively, will be examined and determined by taking into consideration each target sound in contact between L1 and L3.

5. Experimental study: aims, corpus and method

In §5.1., we will provide details on the methodology employed to build the IRIAS speech corpus, also followed to record the control group of Veneto informants. Then, we will describe and compare sociolinguistic features of both the selected Italo-Australian speakers from the IRIAS corpus, and of the Italian speakers of the control group (§5.1.1 and §5.1.2, respectively.). Once the experimental protocol was set, the data preparation was achieved in several steps, described in the following paragraphs: an orthographic transcription of elicited dialectal speech through the ELAN software (§5.2.1.); segmentation at word and phone level through a forced alignment procedure (§5.2.3); narrow phonetic transcription through an accurate manual check, coding of target consonants and stressed vowels features' extraction through ad-hoc Praat scripts (§5.2.3).

5.1 The IRIAS corpus and the Veneto Control Group: data acquisition and protocol of elicitation

The present study is included in the wider project *Italian Roots In Australian Soil* (IRIAS: Avesani, Galatà, Vayra, Best, Di Biase, Tordini & Tisato, 2015; Avesani, Galatà, Best, Di Biase, Vayra & Ardolino, 2017; Tordini, Galatà, Avesani & Vayra, submitted), which results from the partnership between the MARCS Auditory Labs of the Western Sydney University (C. Best, B. Di Biase), the Italian Federation of Migrant Workers and Families (FILEF: http://www.filef.org), Sydney, the Institute of Cognitive Sciences and Technologies of the National Research Council CNR of Padua (C. Avesani, V. Galatà, G. Tisato), and the University of Bologna (M. Vayra). Through this collaboration, a spoken corpus was built between 2011-2012 with the aim to collect elicited productions of first- and second-generation Italian immigrants currently living Western Sydney, Australia (58 speakers in total). The corpus was created to collect speech samples in each of the three linguistic codes concurrently used by Italian immigrant communities in Australia, namely: regional dialect, Italian and the Australian variety of English[125].

The interest that lead to gather spoken data of Italo-Australian communities lies in several factors: firstly, it seemed necessary to document and preserve specific speech features of the oldest generations of Italian immigrants, that would otherwise be lost; secondly, as illustrated in Chapter 4, these groups represent a peculiar case among immigrant communities, given the coexistence of multiple linguistic systems in their repertoire. Although spoken productions of Italo-Australian immigrants have been collected in some studies (see Chapter 4), an in-depth socio-phonetic analysis has never been carried out so far[126]. Using the audio material provided in the IRIAS corpus, our aim therefore is to carry out an experimental sociophonetic study on four Italo-Australian immigrants from Belluno, Veneto, to explore the maintenance or change of their native speech features both at an intra and inter-speaker level, after decades of living in the host country. For this purpose, spoken productions of Italo-Australians are compared to those uttered by an ad-hoc-recorded control group of four Veneto informants from their very same areas of origin, and who never left Italy.

Concerning the procedure adopted to record the IRIAS corpus, speech samples were elicited and recorded by means of a MatLab recording tool (*SyncR*ec by G. Tisato). For the purposes of the present work, the same protocol was employed to collect spoken data from a control group of Veneto informants from the same area of origin of the Italo-Australian speakers (province of Belluno). Such data collection, in fact, allows us to set up a contrastive analysis between the two communities. Namely, our aim is to assess whether and in which contexts target sounds are attested in the Veneto Dialects currently spoken in Italy and in the Veneto Dialect spoken in Sydney; whether target sounds' fine-grained acoustic features are comparable across the languages in contact;

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125 In the two campaigns carried out in 2011 and 2012 in Sydney and its surrounding areas, 58 speakers originating from Veneto and Calabria, or born in Australia from parents emigrated from the same regions, were recorded by V. Galatà through the collaboration with the MARCS laboratories (for further details, see Galatà *et al.*, submitted).

126 It is worth mentioning that 200 utterance of read speech of 9 Italian immigrants in Australia have been collected within the ANDOSL project (Australian National Database of Spoken Language: http://andosl.rsise.anu.edu.au/andosl/). However, these data are not fully available yet. Also, other oral interviews have been conducted by Caruso (2010), although they have been employed for other typologies of analysis (morphosyntactic and pragmatic).

whether it is possible to observe phenomena of attrition, maintenance or loss of subtle native phonetic features at both an intra- and inter-speaker level.
For the IRIAS group, audio was captured through a Shure model SM10A-CN headset microphone connected to an external Edirol UA-25 EX sound card. For the control group recoding, we employed a Shure model WH20QTR headset microphone connected to an external audio card Focusrite Scarlett 2i2. Each interview was recorded at 96 kHz 24bit-mono, ranging in duration from 1:30' to 2:30'. All informants were first asked to fill in both an ethics form and a sociolinguistic questionnaire, which included information about age, area of origin and area of residence. Then, they were required to provide details about their level of competence in each linguistic repertoire (regional dialect L1, Italian L2, and English L3 solely for the IRIAS speakers), type of L1, L2 and L3 acquisition (spontaneous or driven), as well as their attitude towards the different linguistic systems, with respect to specific communication settings. Also, we retrieved information about which type of linguistic code they usually adopt within their social networks, according to the interlocutor and the context. The purpose to collect detailed socio-linguistic data through a specific questionnaire was to gather significant information on informants' competence and use of each language in their daily interactions. In light of these data, and complying with the results of the experimental analysis, we hence drew preliminary conclusions on language maintenance/erosion, which will be discussed in Chapter 6.

The following interview protocol was firstly adopted for IRIAS recordings, and subsequently adapted for the purposes of the control-group data collection. V. Galatà and B. Di Biase conducted the interview on Italo-Australian speakers. On the other hand, interviews on Veneto informants in Veneto were conducted by the author and C. Avesani, in collaboration with a native speaker, who facilitated the interactions with local informants. It consisted in several phases, as already illustrated in Avesani *et al*., 2015; Avesani *et al*., 2017; Galatà *et al*., submitted;

- Dialectal attunement: Firstly, in order to perceptually attune the Italo-Australian participants into their local dialect, they were asked to listen to a speech sample from the informant's area of origin extracted from the *Atlante Multimediale dei*

Dialetti Veneti (AMDV; Tisato, Barbierato, Ferrieri, Gentili & Vigolo, 2013)[127]. The attunement phase was not necessary for the control-group informants, since they usually employ their native dialect in their daily interactions.

- Guided interview in dialect[128]**:** participants were informally asked to report in dialect their memories, proverbs, nursery rhymes, stories and events from the childhood;
- Elicited production of 64 target words in Dialect: 64 pictures, matching to likewise target lexemes, were randomly presented on a monitor to be described and denominated in dialect. Participants' productions were stimulated through a conversation, in order to elicit as many tokens as possible for each target item.
- Guided interview in Italian (through attunement): the same procedure was then repeated in Italian, while both interviewers interacted with the informant. The aim was to collect oral information on: Italian language acquisition; situations in which the informant prefers Italian or Dialect; possible suppression or exaggeration of the dialectal accent in particular situations; linguistic competence in each of the two systems; whatever useful to the conversation.
- Spontaneous production of target words in Italian: 46[129] target pictures were presented to be described and denominated in Italian.
- A brief interview in English (only for the IRIAS speakers): Italo-Australian participants were finally asked to provide information about the contexts and amount of use of the English language, as well as their personal attitude towards it.

[127] The AMDV is based on Jaber & Jud's *Sprach und Sachatlas Italiens und der Südschweiz* data (Atlante Italo-Svizzero, AIS). It contains both the data collected in 1921 for the Veneto region by Scheuermeier and new data collected in 2009 by the authors of the AMDV. For the 1921 data, only graphic forms are available, while for the 2009 data also phonetic transcriptions in IPA and audio recordings are available.

[128] Since the author is not a native speaker of the Veneto local variety, the interview in Dialect was stimulated by a native mediator in order not to condition through other linguistic codes the informants' productions.

[129] A subset of the dialectal target words (46 vs 64) was chosen for the Italian production phase (see Avesani *et al.*, 2017).

As shown in the above-mentioned contributions, the list of 64 words[130] was ad-hoc compiled, with the main purpose to include in their realization (at least) one of the target consonants (for dialect, [θ, ð, t, d, s, ʧ]). Since the original aim of the experiment was to analyze coronal obstruents, the word list was designed based on target consonants' positions: word-initial, word-medial, word-final, as well as on the phonetic context. Subsequently, the author decided to include in the experimental study the whole range of stressed vowels in CV contexts within the target words, with the purpose to obtain a broader and more in-depth insight into phenomena of cross-linguistic interference. The lexical corpus used for the dialectal production task consisted of 64 depictable words, each represented by a picture. This choice allowed to elicit the target item without employing written form - which might instead interfere with the corresponding oral production. The complete list of target words is shown in **Appendix 1**.

5.1.1 Italo-Australian speakers

For the present work, 4 first-generation Italo-Australian speakers from the area of Belluno have been selected from the IRIAS speech corpus: two male speakers (GPZ and MZN) and two female speakers (CZM and ACS). These subjects were chosen based on several factors. Firstly, they are balanced with respect to: age, local Dialect as L1 (2 speaking the Cadorino and 2 the Feltrino varieties, respectively), number of years of experience of English as expressed by length of residence (LOR) in Australia (range in years = 51-57). Moreover, the age they started to acquire Italian as L2 corresponds for all of them with the beginning of primary school in Italy at age 6. The age of arrival in Australia (AoA) represents the age they began to learn English as L3 (AoA Eng) and spans from 17 to 19 years of age. This means that all these IRIAS informants emigrated as late adolescents/young adults, i.e. with a full mastery of their native language, and well after they completed their education in their native country. For all of them, English has been acquired spontaneously trough their social interactions.

[130] Most of the lexical items selected for this project are comparable with the data available in the AMDV.

CZM (74 years old, female, housewife) was born in Ponte nelle Alpi (southern part of the province of Belluno BL), where she lived until the age of seventeen (i.e., when she moved to Sydney). CZM learned the local dialect from birth through her parents (both from Ponte nelle Alpi), while the acquisition of Italian as L2 took place at the age of 6, at the beginning of her formal education at primary school. The learning of English as L3 was instead quite spontaneous. Both in Italy and in Australia, she has used dialect within her family (with her parents, her eight brothers and other relatives). Since she was a child, she has spoken to friends or dialect or Italian, depending on the origin of the interlocutor. Instead, she has been employing English in more formal settings.

GPZ (82 years old, male, craftsman) was born and lived in Domegge di Cadore (northern part of the province of BL) until he moved to Australia, at the age of 29. His father was born in Domegge, too, while his mother came from the nearby small village of Valleselle. He acquired the local dialect (Cadorino) from his parents since birth, Italian as L2 through formal schooling since age six, and English spontaneously. He usually employs his native dialect with his family (siblings, parents, grandparents and other relatives), while he used Italian mainly at school. Both English and Italian (occasionally) are used with colleagues at work.

ACS (78 years old, female) was born in Feltre (southern part of the BL province), where she lived until the age of 23 (except for some months spent in Milano and Verona), before migrating. Both her father and her mother originated from Feltre. She learned the local Dialect (Feltrino) as L1 from her parents, Italian as L2 since age 6 at school; and English from age 23 at work. She employs Dialect to communicate with her parents, grandparents, and her six siblings, as well as with other relatives; both Italian and Dialect with her child, with friends and with other people originating from Veneto; Italian with colleagues; English or Italian in all the other situations.

MZN (72 years old, male) was born and raised in Feltre until age of 21, when he moved to Sydney. He acquired local Dialect (Feltrino) since birth from his parents, both from Feltre, and used it also with his two siblings. Concerning Italian and English, their acquisition started at the age of 6 and at the age of 21, respectively, but it is not specified *from whom/where*. MZN employs English to speak with his son.

Socio-linguistic details of the selected IRIAS speakers from Belluno are summarized in **Table 2:**

ID	**Sex**	**Age**	**AoA Eng**	**LOR**	**L1**	**L2**	**L3**	**Level of education**	**Profession**
CZM	F	74	17	57	Dialect (Bellunese: Cadorino)	Italian	English	primary school	housewife
GPZ	M	82	29	53	Dialect (Bellunese: Cadorino)	Italian	English	primary school	craftsman
ACS	F	78	23	55	Dialect (Bellunese: Feltrino)	Italian	English	primary school	NA
MZN	M	72	21	51	Dialect (Bellunese: Feltrino)	Italian	English	primary school	NA

Tab. 2: *Italian-Australian speakers' sociolinguistic information: Age = age at time of recording; LOR = Length of Residence in Australia; AoA Eng = Age or Arrival and onset of Acquisition of English*

5.1.2 Italian speakers from Veneto

The control group of Veneto informants was selected to respect the same sociolinguistic parameters identified for the selected IRIAS speakers, and *ad hoc* recorded according to the same above-mentioned criteria of homogeneity. For this reason, Veneto speakers were recruited from the very same villages in which the Italo-Australians were born. Analogously, the control group is composed by two male (ALM and SPR) and two female subjects (BCL and RDP), which are balanced with respect to local Dialect as L1 (Cadorino and Feltrino varieties, respectively) and competence of Italian as L2 (learned in primary school since age 6). Yet, it is noticeable that the 2 speakers from Cadore (BCL and ALM) are younger than their Italo-Australian counterparts (about 60 vs about 80 years of age) and report to have a higher level of education (middle and high school vs primary school). It follows that for these subjects a lower age is also accompanied by a more extended use of Italian, since it is the language of the formal instruction.

Informants from Pieve and Domegge di Cadore do not belong to the same social network, whereas the two speakers from Feltre are married.

BCL (62 years old, female, employee) was born in Vallesella, municipality of Domegge di Cadore, where she lived until she was 26. Since then, she has lived in Pieve di Cadore (a nearby village). Her father and her mother were born in Domegge and Lozzo di Cadore, respectively.[131] BCL started learning Italian formally at the age of 6, and completed a technical high school. She also has a medium level of competence in French (learned at school from the age of 11) and Spanish (learned since the age of 45). Among all the informants we took into consideration, she reached the highest level of formal education.

ALM (59 years old, male, farmer) was born in Pieve di Cadore and has always lived in Domegge di Cadore, from where both his parents come. He has had knowledge of the Cadorino variety since birth, while he started acquiring Italian L2 from the age of 6 at school. He has also learned French formally since the age of 8. After finishing middle school, he started working as a farmer in Domegge.

RDP (73 years old, female, nanny) was born in Feltre, where her parents came from. She worked from 11 years onwards as a nanny and as a maid. She lived in Feltre until 15 years of age, then in Varese and then in Zurich, from 19 to 28 years of age. Eventually, she moved again to Feltre (village of Santa Giustina) with her husband, SPR. She has always used the native Feltrino Dialect with her parents, her daughters and her husband. Sometimes, she also employs Italian (acquired since she was 6 through schooling) with them and with her grandchildren, as well. She has a predominantly passive competence of Swiss German, acquired in Zurich.

SPR (75 years old, male, craftsman) was born in Feltre (village of Lasen, where his parents came from), and he lived there until the age of 19. Then, he started working as a craftsman in Zurich (Switzerland) and at the age of 30 he moved back to Feltre (village of Santa Giustina), where he still lives. He reports that the Dialect (Feltrino) is still very

[131] It is worth reporting that all villages except Feltre (Pieve, Domegge, Vallesella and Lozzo) are all very close to one another. The largest distance between two of them is 10 km.

rooted in his everyday use, especially with people of his age. He learned Italian at school from the age of 6 to 11. He uses Italian mostly when interacting with the community and with his nephews. Sometimes, also with his wife (RDP) and daughters. SPR also displays a medium level of competence in Swiss German, acquired spontaneously during his staying in Zurich. Socio-linguistic data of the control-group informants are summarized in **Table 3**:

ID	**Sex**	**Age**	**L1**	**L2**	**Highest education achieved**	**Professio n**
BCL	F	62	Cadorino	Italian	secondary school	employee
ALM	M	59	Cadorino	Italian	middle school	farmer
RDP	F	73	Feltrino	Italian	primary school	nanny
SPR	M	75	Feltrino	Italian	primary school	craftsman

Tab. 3*: Control-group speakers' sociolinguistic information*

5.2 Segmentation and annotation of the audio material

In the present study, data preparation was achieved through the following steps: first, by carrying out an orthographic transcription of the recordings (§5.2.1); second, by processing the transcription through a forced-alignment procedure (§5.2.2), and, finally, by identifying and annotating the output (§5.2.3). The procedure allowed us to set the ground in view of the analysis of target acoustic features, which will be extensively investigated in the following chapter.

5.2.1 ELAN: orthographic transcription

The first step of our analysis consisted in an orthographic transcription of the audio files (2 hours per speaker on average) performed through the software ELAN (version 4.9.4)[132], in which two separated levels of speech (i.e. Interviewer and Speaker) were reported. Applying the "Fine Segmentation for Expression-Level Audio Splitting", the implemented auto-recognizer allowed to create strings boxes, eliminate unnecessary pauses, and highlight, at a preliminary analysis, the occurrence of target words and switching codes. The transcription and annotation procedure with ELAN was defined and set also with the purpose to obtain a written corpus (in Unicode format), which also allows explorations through regular expressions. Disposing of an orthographic transcription of the recorded interview, in fact, is essential not only to have a general overview of the data, but also for the perspective to plan further analysis on other linguistic levels[133].

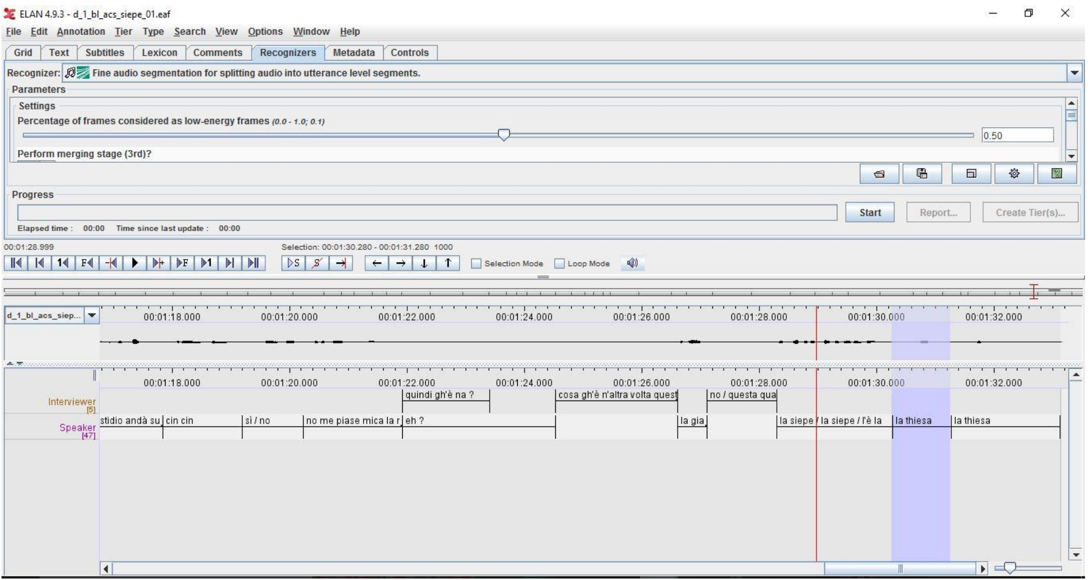
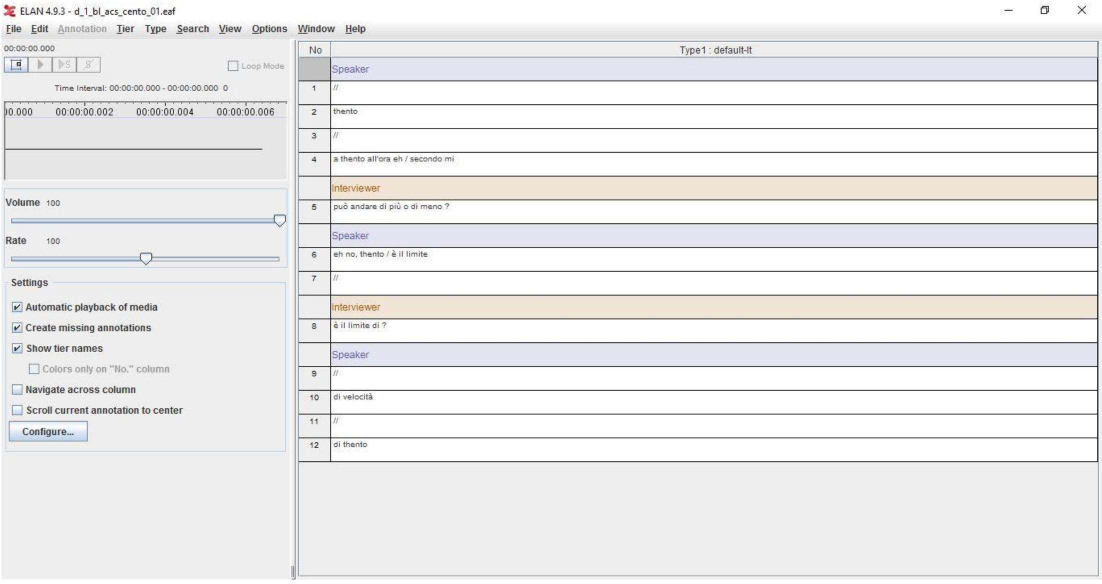


Fig. 2*: example of orthographic transcription through the "annotation mode" of the target word "siepe", uttered by an Italo-Australian first-generation female speaker from Belluno (aged 78 years-old)*

132 ELAN (Version 4.9.4) [Computer software] (19 May 2016). Nijmegen: Max Planck Institute for Psycholinguistics. Retrieved from https://tla.mpi.nl/tools/tla-tools/elan/.

133 For example, regular expressions applied on the plain text make it possible to identify tokens, contexts, frequencies, etc.



.

***Fig. 3**: example of orthographic transcription through the "transcription mode" of the word "cento", uttered by an Italo-Australian first-generation female speaker from Belluno (aged 78 years-old).*

Moreover, through the "transcription mode" function, it was possible to add and edit the text for the contents of each string. In account to this, an *a priori* definition of specific transcription guidelines was necessary to guarantee overall uniformity and comparability within our speech corpus. For this reason, conventional characters were adopted, following the guidelines provided in Galatà *et al.* (submitted.).

It is worth remarking that we performed an accurate orthographic transcription of *all* the utterances, i.e.: dialect, (both spontaneous and elicited), Italian (both spontaneous and elicited, and English (spontaneous).

5.2.2 Forced Alignment: from text to Textgrid

Afterwards, we performed an automatic segmentation of the audio signal synchronized to the *.eaf files resulting from the ELAN transcription. This step, i.e. the forced Forced Alignment (FA) procedure, was carried out by means of WebMaus (Munich AUtomatic Segmentation system)[134]. The WebMaus tool computes a phonetic segmentation and labeling based on the speech signal and the corresponding orthographical

[134] The Chunk Preparation and FA tool are both available from: https://clarin.phonetik.uni-muenchen.de/BASWebServices/interface.

transcription.

First, through the Chunk Preparation tool, we generated from our *eaf files derived tiers resulting in a partiture file (*par), which were necessary for a successful procedure. Afterwards, the *par files and their correspondent *wav files were uploaded in WebMaus. Subsequently, the tool translated the input into a phonological transcript, which was then time-aligned to the speech signal. For this purpose, WebMaus employed the implemented G2P (i.e., "grapheme-to-phoneme conversion"), which reads a continuous text or word list, and estimates the most likely string of phonemes that a standard speaker of that language is expected to articulate[135]. G2P uses Part-of-speech tagging, morphological segmentation and language-specific pronunciation dictionary to improve the decision process[136]. This phase required a time-consuming double check to assess the quality of the G2P, as the tool is currently trained on standard languages only (see Introduction).

5.2.3 PRAAT: settings for the acoustic analysis

By means of the afore-mentioned FA procedure, *TextGrid files were created as output, each composed by the following tiers: an orthographic transcription of the interviewer's utterances; an orthographic transcription of the speaker's utterances; a segmentation separating each utterance produced by the informant; IPA transcription of the target word in dialect. Moreover, we added few other tiers to obtain the following annotations:

- transcription of the identified dialectal target word in Italian;
- a manually-refined narrow IPA transcription which identified target consonants at both phone and word level, respectively, with the aim to show more fine-grained details;

[135] Errors in phonological transcripts deriving from the discrepancies between Veneto dialect and Italian were hand-corrected, as no recognition tool is available specifically for Veneto dialects (see Itroduction).

[136] The WebMaus' pronunciation dictionary for Italian is based on the spoken data included in CLIPS (Corpora e Lessici dell'Italiano Parlato e Scritto), which can be retrieved from http://www.clips.unina.it/it/corpus.jsp/.

- identification of target consonants' phonetic context (the previous and the following phones were considered);
- coding of the target consonant for manner of articulation (C*f for fricatives, C*a for affricates and C*o for obstruents) and position (VC*V if intervocalic; i*C if initial).

The *TextGrid files were processed within the software Praat (version 6.0.26)[137]. When defining the acoustic of target voiceless fricatives, the onset was set in correspondence with the beginning of the aperiodic signal on the waveform – which paralleled the appearance of noise in the spectrogram. The offset was set as the first zero-crossing of the periodic waveform belonging to the following vowel (Jongman, Wayland & Wong, 2000; Li, Edward & Beckman, 2009). As far as affricates are concerned, we separately segmented and transcribed the constriction and release phases. For our analysis, we took into consideration the frication phase only (see Introduction). In this work, we selected a subset of the fricatives that occurred in the corpus, based on their context of occurrence: we selected only those fricatives that occurred before /a/, /e, ɛ/ and /o, ɔ/, with the purpose to balance the anticipatory coarticulatory influence of the following vowel (see Avesani *et al.*, 2015)[138]. As far as vowels are concerned, they were chosen independently from the prosodic conditions. Namely, for the purposes of this study, we did not consider whether vowels were in nuclear context, and, overall, whether possible enhancement conditions could exert influence on their phonetic features[139].

[137] Retrieved from: http://www.praat.org/.

[138] When computing spectral values for /ʃ/, variability related to the presence of the high front unrounded vowel /i/ has been pointed out, for instance, in Shadle, 2006.

[139] Yet, we are conscious that prosodic conditions may affect F1 in specific contexts. Further analyses could take into account also prosodic domains to give a more in-depth insight on vowels' phonetic features.

The output is shown in the following TextGrid example:

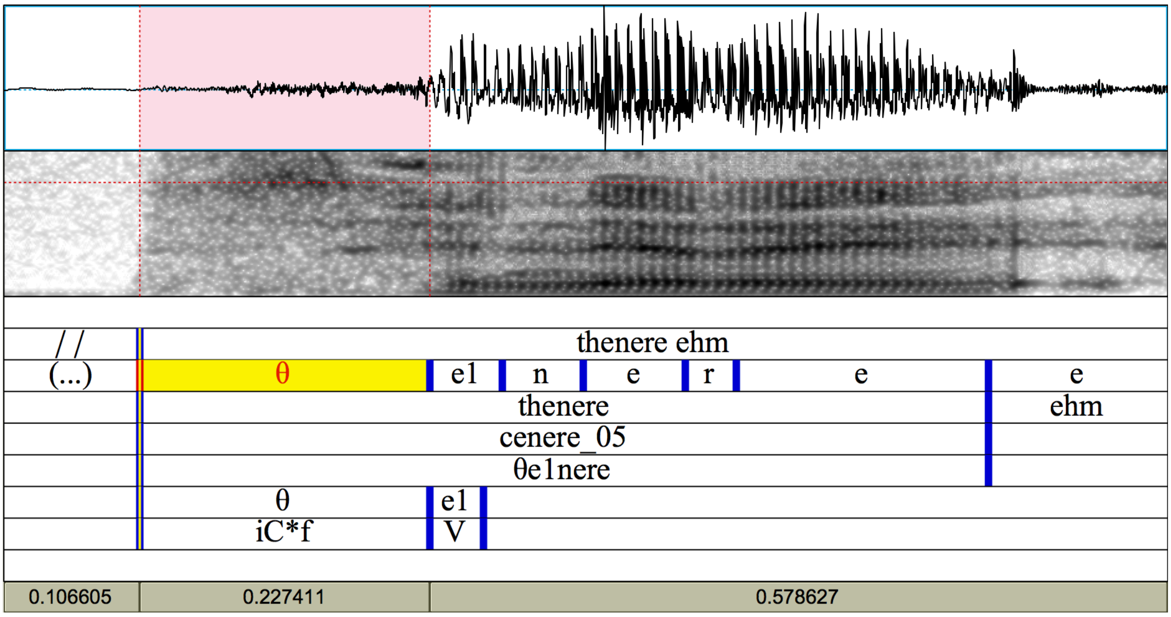


Fig. 4: *TextGrid output for the target word "cenere", uttered by an Italo-Australian male speaker (aged 72 years old)*

Although we orthographically transcribed the whole recording sessions for each of the 8 speakers (i.e. either spontaneous and elicited productions in both Veneto dialect and Italian, as well as spontaneous utterances in English for IRIAS speakers), we did not translate files of spontaneous speech into acoustic annotations for the following reasons: first, because the FA procedure did not produce satisfactory results for spontaneous dialectal speech[140]. Consequently, it would require numerous time-consuming manual annotations; second, because the overall duration of spontaneous utterances exhibited considerable differences among our speakers, generally ranging from 10 to 30 minutes. Therefore, the amount of spontaneous speech data (and hence the number of target tokens for the acoustical analysis) was indeed not comparable across the informants, neither in dialect nor in Italian. On the contrary, orthographic transcription of elicited speech produced fitting results, showed comparable duration and contained an adequately similar number of target tokens among the speakers.

[140] In frequent cases, in fact, the string of phonemes for dialectal spontaneous speech was not recognized due to the larger amount of dialectal words and expressions, with respect to the more controlled elicited speech. For this reason, the WebMaus tool implemented on SI was often not able to perform correctly.

Then, as already pointed out, we circumscribed the analysis to dialectal elicited productions, in order to acoustically explore manifestations of regressive transfer from English L3 to Veneto dialect L1 (see Chapter 1) in IRIAS speakers, with respect to Veneto speakers in Italy[141]. The task of predicting acoustic behavior of both consonants and vowels in contact with a non-native phonetic/phonological system will be tackled in the following Chapter.

[141] We remind that productions of CZM and GPZ in Veneto Regional Italian have been investigated in the parallel study conducted by Avesani *et al.,* 2017. New data in VRI for ACS and MZN will be explored in further investigations.

6. Target Sounds across Languages in Contact

In this chapter, we will introduce the acoustic description of coronal fricatives (§6.1), the parameters usually employed for their acoustic analysis (§6.1.1), and the comparison between the phonological/phonetic properties of coronal consonants across the Veneto Dialect, Standard Italian (more precisely, the regional variety of SI spoken in Veneto) and Australian English (§6.2) to provide a general framework for our hypotheses on maintenance or loss of L1 target sounds in IRIAS speakers.Then, we will present an overview on the acoustic properties of vocalic segments (§6.3), as well as the acoustic parameters usually employed for segmental investigations on these sounds (§6.3.1). Then, we will illustrate phonological/phonetic properties of vowels (§6.4) across L1, L2 and L3. Finally (§6.5.), we will present our predictions on possible effects of cross-linguistic phonetic influence and attrition deriving from the long-standing contact with English, according to the theoretical frameworks presented in Chapter 3.

6.1 Acoustic description of coronal fricatives

Fricative configurations are characterized by a small constriction along the length of the vocal tract, resulting from articulators coming close together, which produce turbulence when air is forced through the constriction (Shadle, 1985). Differently from stops, in which the airflow is obstructed and then released, the airflow during the articulation of a fricative is never entirely blocked (Fu, Rodman, McAllister, Bitzer & Xu, 1999). In the last few decades, acoustic features of fricatives have been extensively investigated (Hughes & Halle, 1956; Fant, 1960; Strevens, 1960; Ladefoged & Maddieson, 1996; Shadle, 1985, 2006; Narayanan & Alwanan, 2000; Jones & McDougall, 2009; Li, Edwards & Beckman, 2009; Maniwa, Jongman & Wade, 2009; Vaux & Miller, 2011, a.o.). Works carried out by Fant (1960) first pinpointed the location of the source (i.e. tongue or teeth) as the main cue to detect a fricative's place of articulation. Namely, the scholar recognized that modifying the source location would result in a change in the output frequencies. Thence, coherently with the notion of source-tract interaction, the output resulting from the source would be affected by the configuration of the surrounding vocal tract. In the same year, Strevens (1960) also distinguished between groups of fricatives according to their place of constriction, i.e., front, mid, and back (labiodental /f, v/, (inter)dental /θ, ð/, alveolar /s, z/, and palato-alveolar /ʃ, ʒ/). As observed in these two studies, the frequency at which the energy appears in the spectrum would distinguish fricatives by constriction location. That is, Fant and Stevens demonstrated that when the constriction is small, the noise source excites the front-cavity resonances, accordingly causing longer front cavities (i.e. for palatals and velars) show energy at lower frequencies. Beside constriction location, an additional feature for classifying fricatives is "sibilancy" (Shadle, 1985; Lindblad, 1980), which allows to categorize fricatives according the direction of the airflow during the articulation setting. Depending on their noise, fricatives can be sibilant or non-sibilant (e.g., Jongman *et al*., 2000). Namely, in sibilant (or "strident") fricatives such as /s/ and /ʃ/ the airstream flows through a narrow channel at high velocity and meets a perpendicular rigid obstacle, thus producing a high degree of turbulence. In non-sibilant fricatives (also defined as "slit" fricatives), on the other hand, there is no perpendicular obstacle, but a rigid surface parallel to the airflow (Brannen, 2011: 22; Mazzaro, 2011: 21). More specifically, they are produced through a wider channel between the active and passive articulators. Because of the lack of obstacle, these sounds generate little noise and show a flat spectrum with very low intensity, due to lower degree of friction with respect to sibilant fricatives (Shadle, 1990; Jones, 2005)[142]. To summarize, as reported in Shadle (1985: 24), «*the front fricatives have the lowest intensity and the smoothest spectra: the mid fricatives have the highest intensity and significant peaks in the middle frequency range; back fricatives have medium intensity and a marked formant-like structure*».

Nonetheless, although the afore-mentioned parameters have already been explored, there is still lack of research on fricatives' specific definition (Shadle, 2006). Silbert &

[142] Several studies also report that formant transitions into a following vowel allow to discriminate between strident and non-strident sounds (e.g. Heinz & Stevens 1961; Brannen, 2011).

de Jong (2008) and Vaux & Miller (2011: 673) claim that this issue lies in their complex inherent "state". Namely, these consonants mostly consist of random turbulent noise, thus posing challenges for an accurate description of both their phonetic and phonological *stati*. Furthermore, there is mounting evidence that fricatives may display a noticeable variation in their frequency range and show overlapping across subjects (Shadle, 1985). Taking into account the above-mentioned statements, we will henceforth concentrate on the class of coronal consonants, in which our target fricatives are included, and which is characterized by a "special status" in the world's languages (Paradis & Prunet, 1991; Broadbent, 1999) because of its inherently variable articulatory and acoustic features. As reported in Derrick, Fiasson & Best (2014), coronal consonants exist cross-linguistically and are produced by tongue tip movements towards articulators (i.e., lips, teeth, palate, alveolus). Their variability is due to the flexibility and possibility of movement of the anterior portion of the tongue, and is evinced by the huge variety of segments that can notably vary even within a given language (e.g., among regional accents or specific talkers or contexts). As suggested by Shadle (1985) and Ladefoged & Maddieson (1996), we can notice that coronal consonants require a very precise articulatory configuration, since their production involves different constriction locations, different constriction length, width, and depth, as well as a different level of tongue body raising and degree of contact. As already highlighted in Avesani *et al.* (2015), we can therefore state that coronals are also especially useful for cross-language and cross-generation comparisons, since they show a wide range of variation in fine-grained details across languages and regional accents.

Concerning voiceless coronal fricatives,[143] we can observe a clearly defined mouth position for each specific segment: for /θ/, the tongue is between the upper and lower teeth; for /s/ the mouth is in a neutral position; for /ʃ/ the lips are extruded (Fu, 1999). Voiceless fricatives /s/ and /ʃ/ are produced by the formation of a constriction between the tongue-tip or tongue-blade, which takes place in the upper anterior portion of the oral cavity (Jones & McDougall, 2009: 280). However, /ʃ/ is characterized by a longer

[143] Henceforth, for the purposes of this study, we will solely take into consideration target voiceless coronals /θ/, /s/, /(t)ʃ/.

front cavity than /s/. That is, the post-alveolar is produced with a more posterior place of articulation and is characterized by a lip protrusion (in the context of unrounded vowels) that further extends in the front cavity. For this reason, according to the literature (Jongman, Wayland & Wong, 2000), realizations of /ʃ/ are supposed to involve lower frequency concentrations of energy (spectral peak at around 2.5–3 kHz), with respect to the voiceless alveolar fricative (around 6 kHz). On the other hand, /θ/ displays a broad peak in the high-frequency region, generally above 5 kHz, which is attributed to the relatively short front cavity (Narayanan & Alwan, 2000).

6.1.1 Parameters for the analysis of coronal fricatives

The spectral moments analysis, in which the power spectrum is treated as a probability distribution (Forrest, Weismer, Milenkovic, & Dougall, 1988; Li *et al*., 2009), is commonly used to identify stable acoustic cues[144] of fricative noises, and to evaluate their nature (e.g., Hughes & Halle, 1956; Harrington, 2010; Shadle, 1985, 1990, 1991; 2012; Jongman *et al.,* 2009)[145]. In the present work, we adopted this method to classify our speakers' dialectal productions of coronal fricatives. Parameters for spectral moment analysis were based on the above-mentioned studies, and identified through a script adapted from Di Canio (2013)[146]. Specifically, we extracted the following spectral moments: Center of Gravity, Standard Deviation, Skewness and Kurtosis (see Avesani *et al*., 2015).

- Center of Gravity (CoG) (Buder, Kent, R., Kent, J., Milenkovic, & Workinger, 1996; Forrest *et al*., 1988; Nittrouer, 1995) is understood as the center of mass of the

[144] According to the definition given by Jongman *et al*. (2000: 1253), «*Static properties pertain to acoustic information that is measured at one location of the speech signal*».

[145] Recently, Spinu & Lilley (2016) suggested that cepstral coefficients allow to classify the fricatives for place of articulation with a 10% more accuracy than spectral moments (95%). However, the analysis based on spectral moments in the latest studies provide an accuracy rate in the classification of fricatives that can be as high as 85% (Tordini *et al.*, submitted). As we will demonstrate in §7.1.2 and §7.1.3, the spectral moment analysis allowed to successfully separate sibilant from non-sibilant fricatives both in control-group and Italo-Australian speakers. Further analyses on these data could take into consideration both spectral moments and cepstral coefficients to evaluate more in depth the fine-grained nature of our target sounds, with the aim to provide a more precise picture of fricatives spoken by Veneto speakers in Veneto and Veneto speakers in Australia.

[146] The script is retrieved from http://www.acsu.buffalo.edu/~cdicanio/scripts.html. We thank Vincenzo Galatà for the adaptation of the original script to our purposes.

distribution (Li *et al.*, 2009). It measures the weighted mean frequency of the spectrum and provides information about the fricative's place of articulation, that is, where the energy is concentrated. As observed, it has been suggested that variability in the place of articulation will result in variability in the location of the average frequency peak in the spectrum (Shadle, 1985). Frequency peaks in the fricative spectrum are negatively correlated with the narrowing of the oral cavity in front of the constriction. It is therefore expected that the CoG would be higher for the consonants with a more advanced place of articulation, that is, the ones that are produced through a smaller front cavity (Li *et al.,* 2009).

- Standard Deviation (SDev) describes the spectral shape and the distribution of the range of frequencies. It indirectly indicates the degree of laminality. The higher the SDev, the higher the laminality of a given fricative, namely a more consistent involvement of the laminal portion of the tongue.
- Skewness (Skew) indicates the difference between the spectrum below the centroid and the spectrum above the centroid and negatively correlates with the length of the front resonating cavity (Li *et al.*, 2009). It hence provides information on the spectral tilt: a positive value (i.e. when the spectral envelope hangs to the left) suggests a negative tilt with a concentration of energy in the lower frequencies, while a negative skewness (i.e. when the spectral envelope hangs to the right) suggests a positive tilt and a predominance of energy in the higher frequencies. For these reasons, Skewness is also related to the CoG, since it indicates the (a)symmetry of the distribution around the average, i.e. concentration of the energy in high/low frequency bands, in correlation with the location of the constriction.
- Kurtosis (Kurt) indicates the peakedness in the distribution: the higher the value, the more peaked the distribution, i.e. a clearly defined spectrum with a small number of relatively sharp peaks. On the contrary, a negative value suggests a flat spectrum without clearly defined peaks (Avesani *et al*., 2015). It is determined by the portion of the tongue (apex, blade) involved in the articulation: it follows that Kurt is correlated with the degree of laminality, and

therefore with Standard Deviation.

6.2 Coronal consonants in L1, L2 and L3

In this paragraph, phonetic/phonological similarities and discrepancies across Northern Veneto (NVen) Dialect L1, regional variety of Italian L2 and Australian English (AusEng) L3 are illustrated. Purposely, we will mainly focus on voiceless coronal fricatives' phonetic traits, which show fine-grained variability among the varieties considered. After comparing specific phonological/phonetic properties of these sounds in contact, we will then make predictions about possible phenomena of maintenance, change or loss of their fine phonetic details.

The variety of Standard Italian spoken both by Veneto immigrants and by the Veneto control group is the Veneto Regional Italian (VRI), which was acquired formally through schooling in Italy. With respect to Standard Italian (SI) consonants, it shows peculiar phonetic realizations defined by Canepari (1984) as "morbide" (*soft*). This means that consonants tend to be lenited, with a simpler articulation or shortened duration, and that voiceless ones can be produced as voiced.

The phonological system shared by the whole Veneto region (that means, both by VRI and Dialectal varieties) is composed by the following 17 consonants /p, b, t, d, k, g, tʃ, dʒ, m, n, ɲ, f, v, s, z, l, r / (Cortelazzo, 1987: 16). As already observed in Chapter 4, Northern Veneto varieties (i.e., Cadorino and Feltrino) slightly differentiate not only from VRI, but also from the other Veneto Dialects, due to the presence of the voiceless /θ/ fricative in their phonological inventory[147]. Within a synchronic dimension, the interdental phoneme corresponds paradigmatically to the voiceless alveolar affricates /ts, dz/ in VRI[148]: for instance, the Italian lexemes ['tsɔk:oli] ("clogs") and ['dzap:a] ("hoe"), are paralleled in Dialect by ['θɔ:koj] and ['θa:pa][149], respectively. Ultimately, according to Trumper (1977) and Zamboni (1984), NVen Dialects display the following

147 For instance, for the Italian lexeme ['kjɔ:do] ("nail") we have ['ʧɔ:ðo] in NVen.

148 Yet, in a phonetic perspective, in VRI dental affricates are pronounced as de-geminated in word medial position as in SI ['pɛts:o] "pezzo" (*piece*), i.e. with a shorter duration (Avesani *et al.*, 2017).

149 Origins and development of this sound from Latin to this Italo-Romance Dialect, as well as different outcomes observed in SI, are further explained in Chapter 4.

coronal phonemes /t, d, θ, s, z, ʧ, ʤ/. As already mentioned, our analysis will concentrate on the voiceless fricatives [θ, s] and the fricative release of the affricate [ʧ] in Dialectal productions to conduct a detailed cross-linguistic comparison on phonetic categories shared by the NVen variety and English inventories we concentrate on. Concerning the sound [ʃ], it is worth reminding that it is not included in the phonological inventory of the NVen dialect, as underlined by Zamboni (1974, 1988). On the other hand, it is present in both SI and VRI – as well as English, as we will show below. When transcribing and annotating the audio files, however, we noted the presence of singleton [ʃ] in *all* the speakers' L1 productions. Presumably, the presence of singleton [ʃ] in L1 utterances is motivated by an influence of Veneto regional Italian on productions in native dialect, as well as by a certain number of code-switching instances from NVen to SI/VRI (for example, informants produce the word ['bi:ʃa] (snake) in place of the less common NVen word [karbo'naθ]). Nonetheless, in both control and heritage speakers the number of occurrences was insufficient to perform any type of analysis on this sound. Therefore, as mentioned in the Introduction, we chose to acoustically analyze the fricative release of the affricate [ʧ] to comply with previous research performed on voiceless coronal fricatives (Avesani *et al*., 2015), with the aim to extend the study on a larger number of speakers within a homogeneous field of analysis. Bearing in mind such observations, for the sake of simplicity we will now on refer to this sound as [ʃ].

Below, we provide an overall phonetic and phonological description of coronal consonants across all the linguistic systems here presented, with the intent to contextualize our theoretical hypotheses on maintenance and attrition. As highlighted in the following **Table 4** (adapted from Loporcaro & Bertinetto, 2005: 132) coronal fricatives belonging to the VRI (and Standard Italian) phonological inventory present a partially different pattern with respect to NVen, because they do not include the interdental phoneme /θ/. Still, we can observe that the systems in *diglossia* share both the voiceless coronals /s/ and /tʃ/:

	Bilabial	Labio-dental	Dental	Alveolar	Post-alveolar	Palatal	Velar
Plosive	p b		t d				k g
Affricate			ts dz		tʃ dʒ		
Nasal	m	ɱ		n			[ŋ]
Vibrant				r			
Fricative		f v		s [z]	ʃ [ʒ]		
Lateral				l		ʎ	
Approximant						[j]	[w]

Tab. 4: *Consonantal system in Standard Italian (Loporcaro & Bertinetto, 2005: 132)*

Nonetheless, as Cortelazzo (1987) clearly highlights, while coronal /s, z/ are produced as dental fricatives (or lamino-alveolar in Loporcaro & Bertinetto, 2005: 132) in SI, they are generally uttered as apical-alveolar [s̺, z̺] in NVen, namely with a more posterior place of articulation. As a result, the articulatory retraction involving the alveolar fricative /s/ makes this sound perceptually similar to the postalveolar /ʃ/. For this reason, Canepari (1984: 102) refers to these coronal fricatives as "scibilanti". Nonetheless, we note that no study has so far experimentally demonstrated this possible closeness at acoustic level, neither in VRI nor in NVen spoken productions.

Regarind consonantal features in the Australian English variety, they have been investigated only in few studies, and far less thoroughly than vowel features (e.g. Tabain, 2001; Tollfree, 2001; Stevens & Harrington, 2016[150]). This is because the consonants display many of the same variations present in other major dialects of English (Cox & Palethorpe, 2008). The consonantal system that characterizes the

[150] Acoustic data reported in Stevens & Harrington (2016) also show the tendency to produce /s/ in /str/ with a retracted articulation. The spectral centre of gravity for /s/ in /spr, str, skr, st, sp, sk/ was lower than for the same sibilant in pre-vocalic position, which was interpreted as evidence of articulatory retraction (and possibly lip rounding) in such cluster contexts. Moreover, pre-vocalic /s/ for females showed a higher frequency, a much more defined peak and more dynamic change over the course of the fricative noise than the same fricative produced by males.

Australian variety of English (AusEng) is shown in the following **Table 5**, in which coronal sounds are highlighted:

	Bilabial	Labio-dental	Dental	Alveolar	Post-alveolar	Palatal	Velar	Glottal
Plosive	p b			t d			k g	
Affricate					tʃ dʒ			
Nasal	m			n			ŋ	
Fricative		f v	θ ð	s z	ʃ ʒ			h
Approximant				r		j	w	
Lateral approximant				l				

Tab. 5: *Consonantal system in Australian English (Cox & Palethorpe, 2007: 342)*

From **Tables 4** and **5**, we observe that SI lacks the voiceless interdental fricative /θ/, which is instead shared by English and by the NVen dialect. Similarly, the voiced interdental fricative [ð] solely occurs in English and in NVen, respectively as phoneme and as lenited allophone of /d/ in CVC contexts. Concerning stops /t, d/, they are described as alveolar in AusEng, while they are produced as dental [t̪, d̪] in SI and VRI[151]; moreover, in AusEng they are aspirated in stressed and unstressed syllable onset in word-initial position, and in stressed syllable onset in within-word position, but always unaspirated in SI and in Veneto dialects (Avesani *et al.,* 2017: 289). On the other hand, SI has dental affricates /ts, dz/ that are not present in the NVen Dialect nor in English.

[151] Avesani *et al.* (2017: 295) showed evidence that in VRI productions the coronal stops /t, d/ were always produced by IRIAS speakers as dental stops, as it was expected in SI. This means that at a phonetic level their regional variety of SI has not drifted towards English, since the Italian dental place of articulation is maintained, and no shift to an alveolar place of constriction (as in English) is attested. In NVen dialectal productions, on the contrary, Avesani *et al.* (2015) demonstrated that /d/ undergoes lenition in intervocalic context, as commonly reported in the literature (e.g. Zamboni, 1988). However, none of the IRIAS speakers produced any lenited allophone in their productions of Italian target words. These data suggest that in the case of coronal stops no transfer from the local dialect to Italian has taken place.

The voiceless postalveolar fricative /ʃ/ and postalveolar affricates /ʧ, ʤ/, both voiced and voiceless, are shared by SI, VRI and English.

We observe that, although all the three systems in contact display the voiceless sibilant /s/, this sound is reported to vary in its phonetic details at a cross-linguistic level. In fact, it is alveolar in Australian English (Tabain, 2001), while in Italian it is described as (lamino-)alveolar according to several authors (Loporcaro & Bertinetto, 2005: 132; Mioni, 2001: 156), and in VRI it is referred to as "scibilante", perceptually close to the prepalatal /ʃ/ (Canepari, 1984: 102). Such /s/-retraction is also attested in several varieties of English, but not in RP nor Australian English (Baker, Arcangeli & Mielke, 2011). Recent studies (Stevens & Harrington, 2016; Stuart-Smith, Sonderegger, McAuliffe, Mcdonald, Mielke, Thomas & Dodsworth, 2018) have demonstrated that such retraction complies with the lower frequency spectral energy for /s/ in /str/ than in singleton /s/, and that its phonetic bases are rather subject to "dialectal" and social factors[152]. In the following **Table**, we distinguished coronal consonants based on their presence or absence in the linguistic systems here considered:

Northern Veneto (Cadorino, Feltrino)	**Standard Italian**	**English**
/t/	/t/	/t/
/d/ > [ð]	/d/	/d/
/θ/	/ts/ /dz/	**/θ/** /ð/
/s/ /z/	/s/ /z/	**/s/** /z/
/ʧ/ /ʤ/	/ʃ/ /ʧ/ /ʤ/	**/ʃ/ /ʧ/** /ʤ/

Tab. 6: *Coronal consonants in the three linguistic systems in contact: Northern Veneto (Cadorino and Feltrino varieties); Standard Italian and Australian English*

[152] The phenomenon of /s/-retraction has also been investigated by Mereu (2017) in the Sardinian variety spoken in Cagliari. The author demonstrates that the realization of /s/ as the local stereotype [ʃ], i.e. the substandard variant, is correlated to stylistic variation.

Examples of NVen voiceless coronal fricatives occurring within the target words of our corpus are here presented[153]:

	θ	s	(t)ʃ
IPA transcription	[ˈpɛːθa]	[ˈsɛːla]	[ˈʧaːve]
Correspondent lexeme in SI	"pezza"	"sella"	"chiave"
Correspondent lexeme in English	"rag"	"saddle"	"key"

Tab. 7: *Examples of target dialectal words containing target voiceless coronal fricatives*

6.3 Acoustic description of vowels

As already observed by Fant (1960) and Stevens (1960), different dispositions of the articulatory organs correspond to different spectral configurations, i.e. to a change in the output frequencies (Fant, 1960). Within the vocal tract, the tongue assumes specific positions, accordingly modifying the overall configuration of the surrounding articulators, as well as the tension of the vocal folds. To quantify the position of the tongue in vowels from an articulatory phonetic point of view, the main features identified by Stevens & House (1955) and Fant (1960) are «*the position of the point of maximum constriction of the vocal tract, and the cross-sectional area of the vocal tract at that point*». (Ladefoged & Maddieson, 1996: 283). From an acoustic perspective, source signal and filter are combined during the articulation process and the quality of the acoustic signal is the output of their interaction. That is, for each different conformation of the epilaringeal cavities, spectral components are selected to identify acoustic indexes of each sound's articulatory properties: a filtering effect is thus determined, which leads to the selection of bands in which the components are emphasized and

[153] The correspondent Italian lexemes and Italian IPA transcriptions are, respectively: "pezza" [ˈpɛt:sa], "sella" [ˈsɛl:a], "chiave" [ˈkja:ve].

bands in which the components are instead attenuated.

We have shown that, at a cross-linguistic level, the configuration of the vocal tract accounts for acoustic differences among speech sounds. If we consider sounds with a stable acoustic configuration, i.e. vowel productions, other fundamental parameters are necessary to evaluate the nature of specific segmental features. Assuming that the vocal tract is a sequence of acoustic tubes that resonate at particular frequencies (Fant, 1960), such frequency values correspond to formants (*Fn*: F1, F2, F3, ...), which mainly depend on the length and shape of the vocal tract during the articulation[154].

Being the acoustic correlate of the epilaringeal articulatory dimension, formants are representative for vowels' inherent phonetic features. As reported in the description of Ladefoged & Maddieson (1996: 284), variations in vowel quality involve articulatory features of Height, Backness, and Rounding, each of them corresponding to a specific formant value. Lienard (1999: 91) clearly illustrates that:

> *«F1 corresponds to the opposition "open-closed": [a] is an open or low vowel: its value of F1 is high. [i] and [u] are closed or high vowels [...]. In addition, F2 corresponds to the front-back opposition: [i] and [e] are front vowels, for their place of articulation is close to the front part of the vocal tract; their F2 is high; [o] and [u] are back vowels and their F2 is low».*

Albano Leoni & Maturi (2002) report that F1 shows low frequencies (200-300 Hz) for high vowels, and that these values gradually increase for medium-high, medium-low and low vowels (800 Hz), respectively: it follows that F1 is directly proportional to the degree of vowel opening. F2 instead, displays minimum values for high back vowels (800-900 Hz) and maximum values for high front vowels (2200 Hz): thusly, F2 is directly proportional to vowel fronting[155].
However, the first and second formant frequencies, carrying information on Height and Backness, respectively, are not sufficient for a complete acoustic description of the vowel: the articulatory effect of lip rounding may, in fact, contribute to determine a vowel's acoustic features. Namely, labial protrusion triggers changes in frequency and

[154] See also Di Benedetto & Esposito (1999).

[155] We solely reported formant values for adult male speakers, with the only purpose to give a general overview of acoustic patterns across vowels.

amplitude values observable between F2 and F3, which should either way be considered for an accurate acoustic analysis.

6.3.1 Parameters for the analysis of vowels

In the last decades, surveys into the detailed acoustic nature of vowels have grown exponentially. Also, scholars have increasingly started to employ acoustic analysis of vowel formants as index to detect gradient sociolinguistic variation at an intra- and inter-speaker level, and sound change (Labov, 1974)[156]. In account to this, even if it is the spectral structure in its wholeness that gives accurate information on vowel quality, Foulkes & Docherty (1999) point out that a large amount of studies has mainly pertained to comparisons between F1 and F2 values, ultimately postulating that the first two formants would carry alone all the information[157].

Traditionally, the acoustic representation of a vowel system is elaborated through Cartesian diagrams, whose coordinates are the mean frequencies of the first and second formant (additionally, second and third formant) of a given vowel (Ferrero, 1968; Harrington & Cassidy, 1999). Namely, a spectrographic analysis is performed, and frequency values for vowel formants are extracted and plotted on Y-axis against X-axis. As Harrington (2010: 121) observes,

> «*since the first formant frequency is negatively correlated with phonetic vowel height, and since F2 is correlated with vowel backness, then a shape resembling the vowel quadrilateral emerges by plotting vowels in the (decreasing) F1 × F2 plane*».

Generally, coordinates used to draw the areas of existence of the vowels are expressed in Hz. Then, a statistical analysis applied to formant values for each vowel allows to trace "equiprobable dispersion ellipses" of the single measurements. However, when samples display numerical inhomogeneity, it is preferable to consider the theoretical

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[156] See also Shattuck-Hufnagel (2014).

[157] It is worth reminding that the interaction between F2 and F3 should also be explored to detect possible effects of the lip protrusion, which is reported to lower all the formants.

In this respect, it is generally reported that differences among formant values are more often used than formant values *tout court* (see e.g. Lindau 1978). Nonetheless, Minissi, Romano & Rivoira (in prep.) report that, for Italian vowels, the first two formants are sufficient for a good acoustic description, because of the limited number of elements in system.

dispersion of the average value of each sample, which is graphically represented by the so-called "equiprobability centroid" (for example, at 95%). The centroid is substantially similar to a dispersion ellipse, and is calculated by replacing the "standard deviation" of the population with the "standard error of the mean" (i.e., the theoretical standard deviation of the mean value of the sample). In brief, F1-F2/F2-F3 measurements of each vowel are conventionally identified by means of a centroid, an ellipse whose center is the mean value of the sample (Sorianello, 2002; Minissi, Romano & Rivoira, in prep.; Clemente, Savy & Calamai, 2006), whose area is measured in Hz^2 (see e.g. Calamai, 2003: 51). Its position depends on the average values computed for each formant and its two semi-axes' dimensions are proportional to the joint variance estimated from the data (i.e., they are given by ± 1 standard error). The mean value of any other sample extracted from the same population thus has a given probability of falling within the centroid.

Following the methodology here presented, the acoustic characteristics of the vowels were established by measuring pitch and formant frequencies, the latter representing the first three peaks of energy in the acoustic spectrum correlating with: vowel height (F1), vowel retraction (F2), and lip rounding (F3), respectively. In order to reduce variability, we computed acoustic parameters only on stressed vowels in open syllable CV within paroxytone words: / i, e, ɛ, a, ɔ, o, u/, for both groups' dialectal productions. The frequencies of f0 and of the first three formants were automatically tracked with the help of ad-hoc-built Praat scripts[158]. Vowel onset was measured from onset of the periodic signal (at zero crossing), while vowel offset was set at the point when the amplitude dropped to near zero (Jacewicz & Fox, 2015). For f0, F1, F2 and F3 of each vowel, we detected 7 measurement points, stipulated, respectively, at 5%, 10%, 25%, 50%, 75%, 90% and 95% of the overall segment duration[159]. Compared to a single-

[158] We thank Vincenzo Galatà and Jane Stuart-Smith for providing the original model of the script, which we successively adapted to our purposes by adding more points of analysis along the vowel trajectory.

[159] Although we extracted duration and f0, F1, F2, F3 at multiple time points, in the present work we took into consideration only the first two formants to describe vowel space. Future analyses will include either f0 and F3, as well as formant differences F2-F1 and F3-F2. Once a wider number of subjects will be involved in this study, we will also normalize formant frequencies, so as to gain more information about target vowels'features and a more accurate description of vowel spaces.

steady-state analysis at the mid temporal point (50%), often used in the literature (see, for instance, Munro, Flege & MacKay, 1996; Harrington, Cox & Evans, 1997), the implementation of multiple time points provides a more fine-grained description of the formants' dynamics, and is useful for the detection of potential onglides, arguably non-monophthongal formant measures and of possible CV and VC transitions (Harrington, 2010).

Furthermore, it has been demonstrated that listeners are sensitive to formant movement trajectories (Nearey & Assmann 1986) and that «*vowel categories are separated with far greater accuracy by models that take spectral change into account than otherwise comparable models using features sampled at steady-state*» (Hillebrand, 2013: 9). Namely, vowels differ on more parameters than on midpoint formant frequencies (Peperkamp, 2015: 75). Broadly speaking, a procedure that considers formants' dynamics allows to have both a global and a detailed overview of the segmental analysis, and, moreover, to detect likely formant tracking errors derived from the segmentation or from the automatic extraction of features. For instance, Cox & Palethorpe (2012) computed the degree of onglide for high AE vowels /iː/ and /ʉː/ by examining the distance in Hertz for F2 between the vowel onset and the target. This can provide a measure of possible vowel diphthongization process, by describing how articulators move from the beginning to the target of the vowel. In the present work, for each formant the vowel trajectory is drawn as following:

1) A transition from the onglide to the vowel nucleus target (from 5% to 25% of the overall segment duration);
2) a transition (middle 50 % of vocoid) that spans from nucleus to offglide, i.e. the temporal midpoint. It is presumed to be the acoustic vowel target, namely the section of the vowel that is influenced least by context effects and is relatively steady-state (i.e., unchanging) (Harrington & Cassidy, 1999);
3) a vowel offglide target frequency-state (from 75 % to the end of the vocoid) (Nearey, 2013).

6.4 Vowels in L1, L2 and L3

Concerning vowels, it is unanimously reported in the literature (Zamboni, 1974, 1988; Canepari, 1984; Cortelazzo, 1987; Maddalon & Miotto, 1986) that the Veneto dia-systems show an inventory that with good approximation can be assimilated to the Venetian model and are characterized by an eptavocalic system, whose 7 vowels (in stressed position) are in common with the Standard Italian (SI) phonemic inventory: /i, e, ɛ, a, ɔ, o, u/. Three vowels (/i, e, ɛ/) are front and unrounded; three vowels are back and rounded /u, o, ɔ/. The low vowel /a/ is neither front nor back: phonetically it is a central-to-front vowel, but since it does not take part in any phonological process in which front vowels are involved (such as velar palatalization), it is often regarded as phonologically central (Krämer, 2009: 50-51). The two high vowels /i, u/ are always tense and the low vowel is lax, while the mid vowels distinguish between tense and lax or mid-closed and mid-open, respectively. Since vowel duration is contextually conditioned, Italian has no phonological vowel quantity (Marotta, 1985; Loporcaro & Bertinetto, 2005). Analogously, both SI and Veneto dialects comprise five elements only (/i, e, a, o, u/) in unstressed position. As far as we know, however, there is still lack of evidence for a complete correspondence of SI and NVen vowels from a detailed phonetic perspective.

For this reason, we acoustically analyzed stressed vowels /i, e, ɛ, a, ɔ, o, u/ in paroxytone words in CVC contexts, within elicited Dialectal productions of both IRIAS and control group speakers[160]. Subsequently, we will compare these values with the ones reported in literature for SI vowels. Ultimately, we will compare our results with the acoustic values commonly identified for AusE vowels /iː, ɪ, e, ɜː, æ, ɒ, ɒː, ɔ, oː, ʊ, u/ in order to assess whether IRIAS speakers' vowels have undergone phenomena of cross-linguistic phonetic influence and/or attrition.
So far, the main reference for the acoustic description of the Italian vocalic system is represented by the works carried out by Ferrero (1968), which have been followed by

[160] In order to collect a balanced number of occurrences for each vowel token, we took into consideration stressed vowels both within target words and spontaneous utterances.

numerous contributions concerning specific diatopic or diastratic varieties (e.g. Ferrero, Magno Caldognetto, Vagges & Lavagnoli 1978; Ferrero, Genre, Boë & Contini, 1979; Cosi, Ferrero & Vagges, 1995; Ferrero, 1996; Albano Leoni & Maturi, 2002; Sorianello, 2002; Calamai, 2004; Grimaldi, 2003; Filipponio & Cazzorla, 2016; Combei & Tordini, 2018, among others). The SI vowel inventory, which is shared by the Veneto Dialects, is traditionally represented as follows (**Fig. 5**):

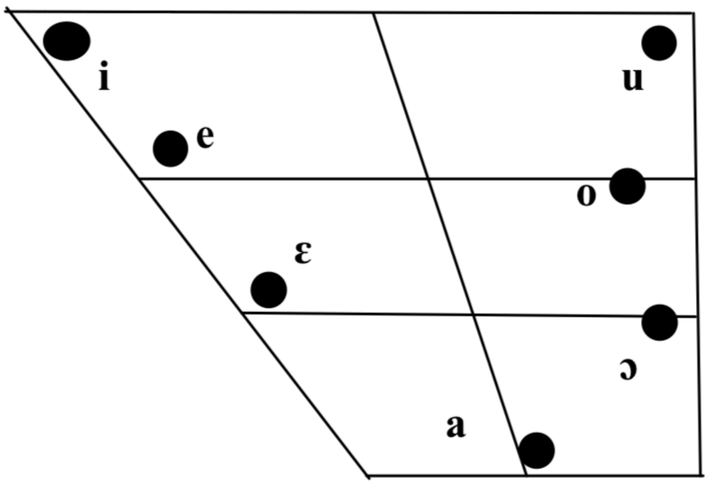

Fig. 5: *Representation of the SI eptavocalic inventory, extracted from Bertinetto (2010: 7)*

From **Fig. 5**, we observe that: /i, u/ are high vowels, /a/ is a low vowel, and /ɛ, ɔ/ are mid-low vowels, /e, o/ are mid-high vowels. Concerning the front, central and back positions, respectively: /i e, ɛ/ are front, /a/ is central and /u, o, ɔ/ are back vowels. Average formant values for SI monophthongs uttered by 20 male and 20 female subjects extracted from the AIDA database[161] are given in the following Table, retrieved from Cosi *et al.* (1995).

[161] For further details about other databases of spoken Italian, see Calamai (2002).

M	i	e	ɛ	a	ɔ	o	u
F1	291	394	513	742	447	552	325
F2	2251	2082	1989	1420	856	949	789
F3	3079	2752	2669	2532	2528	2569	2529

F	i	e	ɛ	a	ɔ	o	u
F1	339	436	630	875	506	688	360
F2	2672	2508	2302	1614	990	1115	838
F3	3595	3158	2999	2697	2606	2712	2466

Tab. 8: *Average F1, F2 and F3 values for the 7 vowels in the Standard Italian inventory, uttered by 20 male (M) and 20 female (F) speakers, respectively (Cosi et al., 1995: 156)*

Examples of NVen stressed vowels occurring within the target words of our corpus are here presented[162]:

	i	e	ɛ	a	ɔ	o	u
IPA transcription	[bu'tiːɾo]	['ʧeːza]	['pɛːθa]	[sa'laːme]	['tɔːɾo]	['ɾoːso]	[iŋ'kuːðeŋ]
Correspondent lexeme in SI	"burro"	"chiesa"	"pezza"	"salame"	"toro"	"rosso"	"incudine"
Correspondent lexeme in English	"butter"	"church"	"rag"	"salami"	"bull"	"red"	"anvil"

Tab. 9: *Examples of target dialectal words containing open stressed vowels /i, e, ɛ, a, ɔ, o, u/ in CV contexts*

The acoustic representation of Standard Italian vowels through dispersion ellipses is provided by Cosi *et al.* (1995):

[162] The correspondent Italian lexemes and Italian IPA transcriptions are, respectively: "burro" ['burːo], "chiesa", ['kjeːza] "pezza" ['pɛtːsa], "salame" [sa'laːme], "toro" ['tɔːro], "rosso" ['rosːo], "incudine" [iŋ'kuːdine].

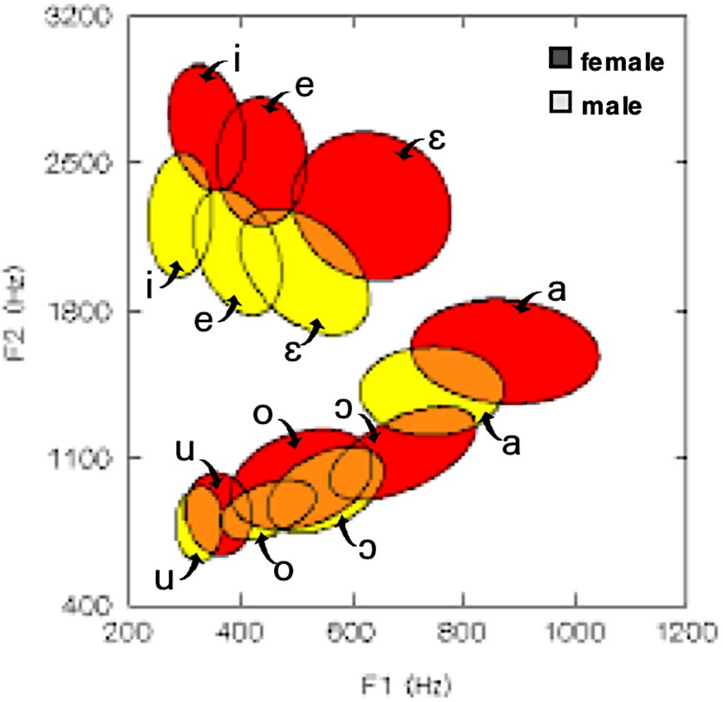

Fig. 6: *Dispersion ellipses of SI vowels uttered by 20 male and 20 female speakers (F1-F2 expressed in Hz) (Cosi et al., 1995: 155)*

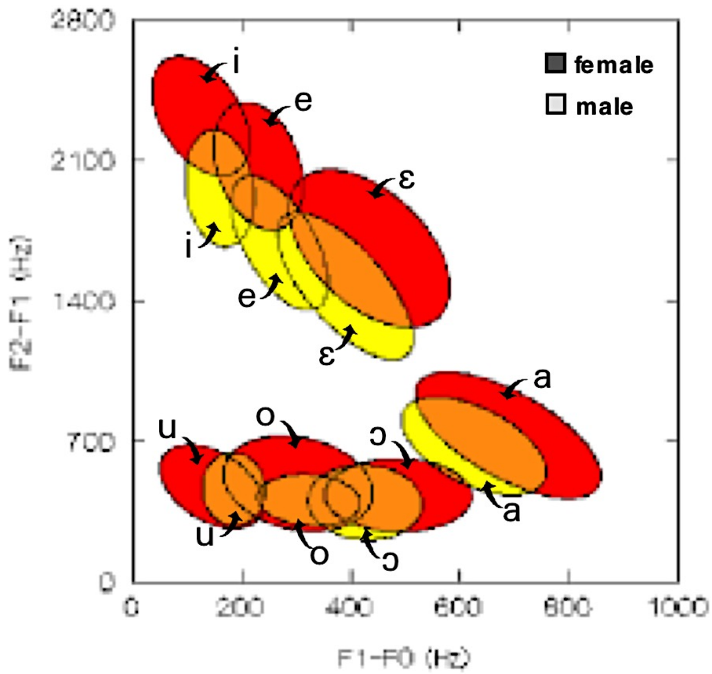

Fig. 7: *Dispersion ellipses of SI vowels uttered by 20 male and 20 female speakers (F1-F0 on the x-axis and F2-F1 on the y-axis expressed in Hz) (Cosi et al., 1995: 155)*

Italian vowels show a more definite spectrum and less-overlapping formant frequencies, with respect to Australian English. The latter, in fact, displays a wider range of vowels, since the seven basic vowel nuclei are significantly modified by the presence of off-glides (Harris & Hatano, 1978). In order to understand properly the complexity observable in AusEng vowels, it seems appropriate to give a general overview of their configuration. From a phonological perspective, as reported by Wells (1982), Australian English is close to RP. That is, the its vowel system «*can be set in one-to-one correspondence with the RP system*» (Wells, 1982: 595). Nevertheless, the phonetic differences in the realizations are relevant when it comes to compare RP productions with the *Broad variety* (i.e. the variety spoken by immigrant and low-class workers[163]), which has undergone the so-called "diphthong shift" (Horvath, 1985). Also, differently from Italian vowels, AusEng vowels are characterized by a "centralization" trend, which – as we will more thoroughly discuss below – could represent a source of cross-linguistic interference in the Italian heritage speakers' vowel configuration. Harrington, Cox & Evans (1997) analyzed the acoustic phonetic features of contemporary Australian English continuum, using productions of isolated words extracted from the Australian National Database of Spoken Language (ANDOSL)[164]. Based on this analysis, the authors provide a renewed classification of AusEng vowels which has been used by Cox (2008) for a data-based acoustic representation of the overall AusEng vocalic system, as in the following **Figure 8**:

[163] As reported in Chapter 5, the majority of immigrants to Australia, included first-generation Italians, tend to approximate the accent of the lower working class (Wells, 1982). Because of their closeness due to similar socio-economic features and level of education, in fact, this group is the one they have stronger bonds with. Therefore, immigrants are supposed to acquire through their social networks the low variety of the host country, that is the "broad variety" (Giles, 1973; Giles & Powesland, 1975).

[164] Retrieved from http://andosl.rsise.anu.edu.au/andosl/.

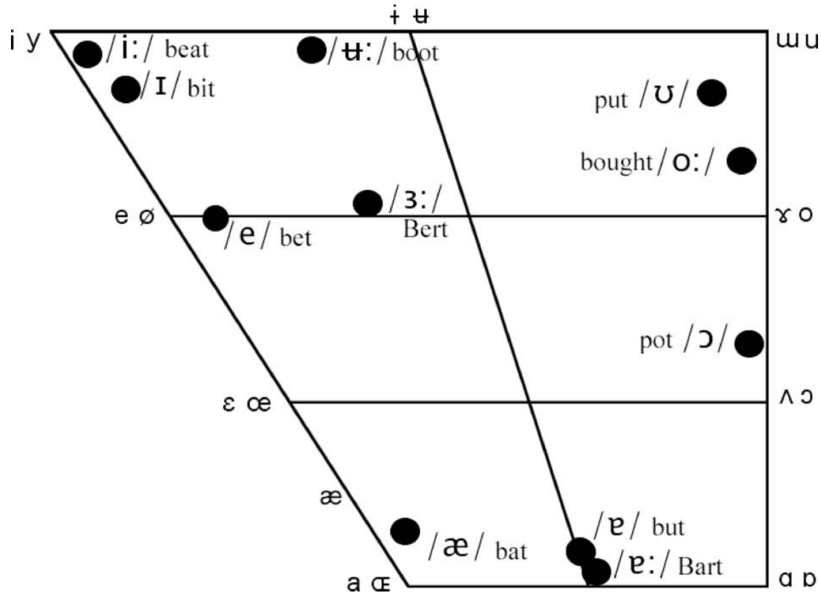

Fig. 8: *Transcription system of AusEng monophthongs, with black dots and superimposed onto the traditional vowel map with IPA cardinal vowels (Cox, 2008: 330)*

Looking at the IPA chart of AusEng provided in **Fig. 8**, we observe that /iː, ɪ, ʉː, ʊ, oː/ are high vowels, /æ, ɐ, ɐː/ are low vowels and /e, ɜː, ɔ/ are mid vowels. Concerning the front, central and back positions, /iː, ɪ, e, æ/ are front vowels, /ɐː, ɐ, ɜː, ʉː/ are central vowels and /ɔ, oː, ʊ/ are back vowels. Another kind of distinction between AusEng vowels is given by duration; the short vowels are /ɪ, e, æ, ɐ, ɔ, ʊ/ and the long vowels are /iː, ɐː, ɜː, ʉː, oː/. For some vowel pairs, length is phonemically relevant. This distinction is present for /ɐː/ – /ɐ/ and /iː/ – /ɪ/, although /iː/ often undergoes diphthongization, which further contributes in discriminating it from its lax counterpart (Cox & Palethorpe, 2012).

Henceforward, for our investigations and predictions about possible influence of L3 on L1 at the segmental level, we will take as reference point for AusEng vowel formants' values the contribution of Elvin *et al.* (2016)[165] here presented. Acoustic values of AusEng monophthongs are shown in the following **Table 10**, while dispersion ellipses for vowels are given in **Fig. 9** and **Fig. 10**, for males and females, respectively.

[165] The variety of AusE spoken by the participants of this study (7 males and 12 females aged 18-30) is not specified. Furthermore, formant values for the open-mid vowel /ɔ/ are not reported.

M	iː	ɪ	e	ɜː	æ	ɒ	ɒː	oː	ʊ	u
Dur_{ave}	168	101	117	195	150	125	217	200	108	148
$F1_{ave}$	358	378	575	537	776	688	711	484	413	342
$F2_{ave}$	2202	2079	1820	1475	1609	1226	1173	798	991	1736
$F3_{ave}$	2869	2732	2642	2467	2519	2552	2627	2635	2478	2214

F	iː	ɪ	e	ɜː	æ	ɒ	ɒː	oː	ʊ	u
Dur_{ave}	174	112	129	205	148	132	216	202	124	166
$F1_{ave}$	454	469	744	715	972	879	916	608	520	445
$F2_{ave}$	2580	2529	2048	1844	1768	1522	1422	1033	1192	2130
$F3_{ave}$	3022	3008	2813	2879	2581	2877	2829	3020	2930	2636

Tab. 10: *Average duration and formant values (F1, F2, F3) for male and female speakers of AusE (adapted from Elvin, Wiliams & Escudero 2016: 578)*

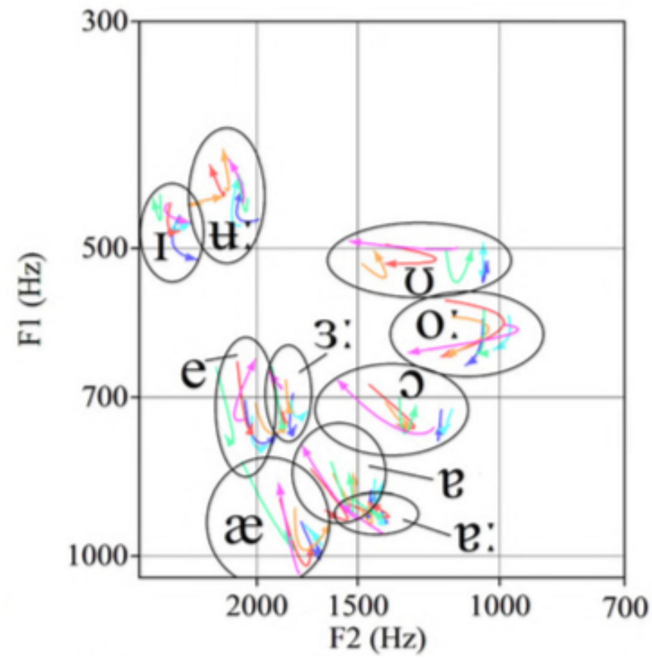

Fig. 9: *Dispersion ellipses describing the vowel space of 7 male speakers of AusEng (Elvin et al., 2016: 580)*

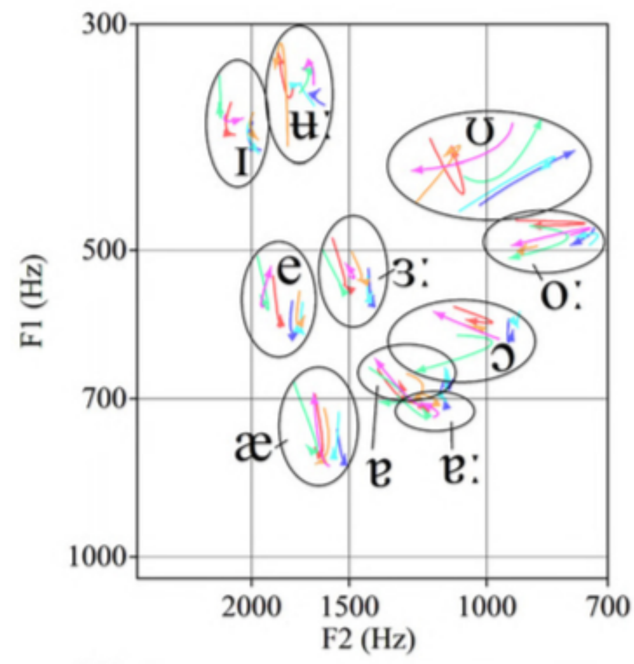

Fig. 10: *Dispersion ellipses describing the vowel space of 12 female speakers of AusEng (Elvin et al., 2016: 580)*

6.5 Predictions about sound maintenance or change

To describe phenomena of cross-language phonetic influence possibly exerted by AusE on dialectal productions of Italo-Australian speakers, we will mainly refer to the theoretical frameworks of Speech Learning Model (Flege, 1995; Flege, Schirru & MacKay, 2003) presented in Chapter 3. This approach places emphasis on speech production, which is also the core of our study, differently from PAM, which instead mainly focuses on speech perception. Moreover, Flege's model mainly addresses the production of L2 phonemes by experienced L2 learners (i.e., L2 learners who actively acquire the L2 in a natural context, as Italian immigrants in Australia), while PAM addresses the perception of nonnative contrasts by naïve listeners (i.e., functional monolinguals not learning or using the L2) (Sisinni & Grimaldi, 2009: 1681).

Based on previous assumptions about the phonetic (and phonological) features of the three linguistic systems in contact, we ask: first whether the long-standing constant interaction between similar L1 and L3 sounds would facilitate the maintenance of native speech features; second, whether possible fine-grained phonetic differences across similar categories would affect the spoken productions of Italo-Australians, resulting in variations at the segmental level with respect to productions of monolinguals. In §6.5.1, we will illustrate hypotheses and predictions about the maintenance of voiceless coronal fricatives /θ, s, (t)ʃ/ in L1, in contact with similar L3 categories, in the repertoire of Italo-Australian speakers. In §6.5.2, we will instead focus on the fine-grained variation that L1/L2 vowels - shared by local dialect and SI - could undergo in their formant configuration, due to a possible cross-linguistic influence exerted by a centralization trend, as well as by onglides and offglides frequently observable in AusEng monophthongs.

6.5.1 Coronal fricatives

In this work, we considered Feltrino and Cadorino as both belonging to the Northeastern Veneto (NVen) Dialectal sub-system, inasmuch as there is complete correspondence between their phonological inventories. Henceforth, for the purposes of our predictions, we will include these two varieties under the same heading of NVen.

In light of the description of coronal fricatives' phonetic and phonological features so far provided, we will identify possible phenomena of cross-linguistic phonetic influence exerted on the following consonants, occurring both in L1 and L3:

- L1 and L3 /θ/:

According to our hypothesis, Italo-Australians' dialectal productions of /θ/ are likely to undergo the *equivalence classification* effect (see §3). Being /θ/ present also in the target language[166], it could possibly be perceived and produced by immigrant speakers as similar to the voiceless interdental occurring in the native system. Specifically, assimilation mechanism blocks the formation of a new category: instances of the L3 category continue to be identified as instances of an L1 category (Flege *et al*., 2003). In this case, *«a single phonetic category will be used to process perceptually linked L1 and L2 sounds»* (Flege, 1995: 239), and the maintenance of the native category in L1 production would be favoured by the link with the L3 category, independently of the amount and quality of experience and use of L3. In our analysis, the assumption is that the extended contact with English is supposed to reinforce the *maintenance* of the dental fricative in the NVen system, as it is a shared consonant. In fact, as Avesani *et al*. (2015) demonstrated, interdental fricatives in target contexts were produced regularly by the two Bellunese speakers CZM and MZN. With no exceptions, they employed [θ] in dialect words originating from Latin stops /t, k/, that undergo palatalization in SI due to a following front vowel or glide /i, j, e/ (for instance: Latin *ceresea > NVen [θaˈɾjeːza], SI "ciliegia" [tʃiˈljeːdʒa] (cherry)).

- L1 and L3 /s, (t)ʃ/:

As already observed in § 6.3., although the phonological subset of target coronal fricatives /θ, s, (t)ʃ/ is shared by the three languages in contact, there is empirical evidence that at least the phonetic properties of /s/ differ from L1-dialect and L3-English. Generally, in the regional Italian spoken in Northen areas (as in other dialectal varieties of the Veneto region) /s/ has a retracted place of articulation, as indicated by

[166] It is worth reminding that /θ/ occurs both in NVen dialect L1 and English L3 with phonemic relevance, yet in different contexts.

Canepari (1984). Phonetically, the retracted /s/ sounds more like /ʃ/, and its acoustic properties (i.e., Center of Gravity, which indicates the concentration of energy in the frication noise) do not differ from those of the fricative release of the postalveolar affricate /ʧ/. Evidence articulatory retraction of singleton alveolar fricatives in intervocalic position has been reported in a previous work (Avesani *et al.,* 2015), in which dialectal productions of two IRIAS speakers from Belluno (CZM and GPZ, included in the present analysis) were acoustically and statistically explored.

Based on these empirical considerations and on the assumptions of the SLM, we can formulate two hypotheses:

1) In the first hypothesis, Veneto immigrants would fail to create a new L3 phonetic category for English /s/ for one of the following reasons:
   - either because they perceive L1 and L3 /s/ as the same sound;
   - or because they perceive L3 /s/ as slightly deviant but not sufficiently dissimilar with respect to the L1 sound. It this case, the L3 phone would undergo the *equivalence classification* effect, and the immigrant speakers will merge the native and non-native categories. As a result, we expect that the acoustic properties of /s/ in the dialectal productions of IRIAS speakers to be intermediate between those of the native category and those of English, since in time they have diverged from the L1 norms and have approximated the L3 phonetic norms. That is, based on the acoustic and articulatory features presented in §7.3, we expect that the /s/ of the multilingual speakers will be *less* retracted than in the speech of monolingual Veneto speakers living in Veneto.
2) In the second hypothesis, instead, if immigrant speakers have formed a new L3 category for /s/, the process of phonetic category dissimilation might occur. In this case, the acoustic properties of the frication noise of /s/ as spoken in Bellunese dialect will shift away from the properties of English /s/, thus causing /s/ in immigrants' dialectal productions to be *more* retracted than in monolingual speakers.

Consequently, in case 1) acoustic and articulatory characteristics of /s/ in dialectal productions of IRIAS speakers might diverge from those of postalveolar [ʃ], because they would be influenced by the alveolar place of constriction expected in the English norm. On the other hand, in case 2) they would appear as considerably similar to those of [ʃ], since the dialectal feature of articulatory retraction will be exaggerated because of the category dissimilation process.

6.5.2 Vowels

With respect to consonants, the process of acquiring, and thusly producing, the vocalic system of a second language might be somehow problematic, as vowels exhibit a less precise articulatory identity. In fact, while most consonants are produced by a contact of articulators in the vocal tract, vowels can only be described as approximations along two dimensions of height and frontness or backness.
The following considerations fall into the ample research into the acquisition of foreign languages with larger vowel inventories than the learners' L1 (Elvin & Escudero, 2015). Namely, as already highlighted in Chapter 4, the Northern Veneto dia-system only shows 7 vowels in stressed position, which are in shared with the Standard Italian inventory: /i, ɛ, e, a, ɔ, o, u/. On the other hand, with respect to NVen/SI vowels, it has been observed that AusEng monophthongs exhibit a certain degree of complexity and internal variation, which are related to both the larger number of vocalic elements and the influence of diphthongization processes that can often occur in spoken productions of the immigrants' variety (Giles & Powesland, 1975; Horvath, 1985).

Henceforward, comparisons with the AusEng L3 vocalic system will be drawn considering the eptavocalic system as phonologically comparable across L1 and L2[167], coherently with the assumptions provided by the literature (Maddalon & Miotto, 1986). Hypotheses on cross-linguistic phonetic influence concerning L1/L2 and L3 vowels in contact are here illustrated, based on the perceptual models discussed so far. It this work, we will adopt the methodology provided by Bohn & Flege (1992), who tested the

[167] To our knowledge, acoustic measurements for vowels of the NVen variety have never been collected so far.

hypothesis that adult learners are able to establish phonetic categories for new L2 sounds, and thus eventually produce them authentically, whereas similar sounds will remain foreign-accented even after lengthy exposure to the L2, because category formation is blocked by equivalence classification[168]:

1) Maintenance of /i/:

As shown in the chart provided by Cox & Palethorpe (2001), the AusEng vowel system displays the high-fronted unrounded tense monophthong /iː/ (for example, "BEAT": /biːt/), which phonologically differs from the NVen/SI system for its intrinsic longer duration. Clark (1989) describes /iː/ as a complex target long vowel, whose realizations in AusEng range from a slight onglide to a full diphthongization. In light of this, we can postulate a situation of maintenance of the native category, in that the standard L3 sound /iː/ could be perceived as the same sound /i/ existing in L1. Accordingly, the assumption is that the pressure of the corresponding non-native category is supposed to reinforce the maintenance of the target vowel in native productions. At segmental level, this would result in no differences in the formants' configuration. The parameter of vowel duration in dialectal productions of both IRIAS and control group speakers could show whether the native /i/ would tend to show longer duration due to the influence of the correspondent AusEng category /iː/. It is worth reminding that we considered for our purposes only stressed vowels in open syllables, which are reported to exhibit an intrinsic long duration in NVen and SI (Ferrero, 1968), as well (for example: "BUTIRO" /butiːro/ (butter)). Therefore, our hypothesis is that no significant change will occur.

On the other hand, a second hypothesis is that Italo-Australians' native vowel /i/ could undergo changes at a fine-grained level, because of the influence of the diphthongization process typical of the AusEng Broad variety, spoken by Italian-Australian immigrants and low class workers. For example, words like "FLEECE": /fliːs/

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[168] The authors classified perception and production of English vowels from the standpoint of German L1 experienced and unexperienced learners of English. Their evaluations were carried out on an acoustic-phonetic, not a phonological level. In fact, this type of approach employs a model of L2 speech learning that assumes interlingual identification to occur on a phonetic level. Also, because this model makes predictions about measurable phonetic properties of L2 learners' speech.

can be uttered by speakers of the Broad variety as [fləːɪs] (as reported by Wells, 1982; Horvath, 1985). It means that in the low variety of AusEng, spontaneously acquired as L3 by IRIAS speakers, /i/ shows a progress towards [əɪ]. At a segmental level, this process corresponds to the appearing of an onglide in the formant trajectories: since the diphthong displays a lower starting point with respect to the monophthong, the onglide is supposed to attract the target phoneme to the central position. Based on these observation, we can posit that a regressive transfer might occur from the Broad variety of AusEng L3 to NVen dialect L1, which would result in a starting of a diphthongization process, i.e. in a transition from lower to higher F2 values along the overall trajectory;

Alternatively, the native /i/ could undergo CLI from the nearby high-fronted unrounded lax /ɪ/, which is included in the AusEng system but not in the NVen/SI vowel inventory. In order to formulate the following hypothesis, it is first necessary to consider the assumptions of Flege's SLM[169], according to which if the sounds (in this case /i/ and /ɪ/) which are in contact within the speaker's mental representation are not perceived as sufficiently dissimilar to be discriminated, a "merge" could occur. In our predictions, it is therefore conceivable that /ɪ/ would be perceived (and therefore produced) by IRIAS speakers as its tense counterpart /i/, which is the closest category occurring in their native language. The sounds in question, in fact, diverge for the feature of tenseness but share a set of features (i.e., they are both high, fronted, not rounded). Similar predictions have been confirmed for Spanish, Portuguese and Russian listeners (Morrison, 2009; Rauber, Escudero, Bion & Baptista, 2005; Kondaurova & Francis, 2008), who perceived the English contrast /ɪ/- /i/ as their single native /i/ category (Elvin *et al.*, 2016)[170]. In this perspective, articulatory differences

[169] Flege, MacKay & Meador (1999) examined the production and perception of English vowels by Italians who migrated to Canada, both early or late bilinguals. The subjects were selected according to their AoA in the host country, their years of experience of English and the amount of continued to L1 use. These investigations confirmed that the later in life the native Italian subjects began to learn English, the less accurately they produced and perceived English vowels. 10 Canadian vowels (/i ɪ eɪ ɛ æ u ʊ o ɒ ʌ ɚ/) were taken into account (see Munro *et al.*, 1996). Neither of two groups of early/late Italian/English bilinguals differed significantly from native speakers of English either for production or perception. This finding is consistent with the hypothesis of the Speech Learning Model that early bilinguals establish new categories for vowels found in the second language L2.

[170] See also Rojczyk (2010).

will lead to the association and convergence[171] in the system of a bilingual speaker (i.e., to the reciprocal influence of properties of the L1 and L3 categories), and will cause productions of the L1 sound to shift in the direction of the L3 sound. In this case, the presence of /ɪ/ could drive changes in vowel's formant configurations in native productions of /i/ in the speech of IRIAS speakers, compared to the control group's utterances. Specifically, a possible influence of the lax vowel on the tense could cause an increase of F1 values, due to a shift to a lower articulatory position[172]. If we take into account the postulations of PAM/PAM-L2, it is possible to claim that we might be facing a case of Category Goodness assimilation (CG). The model assumes that, when the two phones that realize a non-native opposition are assimilated to the same native phonological category (in this case, /ɪ/-/iː/ that are assimilated to the native /i/), their discriminability depends on the degree of similarity between their inherent phonetic properties and those of the allophones of the native phoneme (Escudero & Elvin, 2016). In this case, one of the two non-native phones, /iː/, represents a phonetically better exemplar of the native category with respect to /ɪ/.

2) Maintenance of /a/:

As observed in §6.3, /a/ in NVen and SI is phonetically a central-to-front unrounded vowel. On the other hand, the AusE phonological system shows the near-open central unrounded vowel /ɐ/ (for example, in "BUT": /bɐt/), in length contrast with /ɐː/ (BART: /bɐːrt/). Also, we could posit that a longer duration of /ɐː/, in phonological opposition with /ɐ/ would affect Italo-Australians' utterances of /a/, resulting in vowel lenghtening. Nevertheless, as we already observed for /iː/, we considered only L1/L2

[171] This panorama is reported by Escudero (2005) to be common for learners/acquirers with a smaller vowel inventory than that of the target language.

[172] Sisinni & Grimaldi (2009) demonstrated that Italian speakers from Salento consistently identified American English /iː/ as good exemplar of Salento /i/ (which also belongs to the SI phonological inventory). On the other hand, /ɪ/ was identified as less good exemplar of the same SI phoneme. In SLM, similar sounds are assimilated to the same category of L1, preventing the formation of a new phonetic category, while dissimilar sounds would trigger the formation of new ones. Conversely, in case of CG assimilation, PAM predicts that non-native sounds which are similar to a L1 category but perceived as deviant (not prototypical or diverging fore subtle phonetic details) can lead to the formation of a new category and therefore to a better discrimination. Namely, the formation of a new category will be favored if the two L3 phones differ from one another in the degree of phonetic similarity with respect to the allophones of the L1 category.

stressed vowels in open syllables, namely vowels which are intrinsically long (for example: /ʧaːve/ (key)). In this perspective, no significant changes in the target vowel length are expected due to the contact with the L3 category. Hence, we will also take into account duration as an additional parameter to assess the degree of sound maintenance or change. We find the phonological representation /ɐ/ both in Harrington *et al.* (1997) and in Cox & Palethorpe (2001), and /a/ by Mitchell & Delbridge (1965). In light of these observations, we can formulate the following hypotheses:

- One possibility is that a reverse transfer from L3 to L1 might cause a shift of /a/ to a more posterior position with respect to the control group's productions, which would correspond to a lowering of F2 values[173].
- A second possibility is that influence on NVen/SI low vowel might be exerted by the L3 open-mid /æ/ ("BAT": /bæt/). /æ/, in fact, is not included in the Veneto Dialects and SI vocalic inventories[174]. This is a complex target vowel, more fronted with respect to the above-mentioned /ɐ/ and /ɐː/, and reported in Cox & Palethorpe (2001) to be closer to /a/. As already observed, according to the postulations of SLM the cross-language relation between the sounds in contact can cause phonetic features of the L1 and L3 productions to combine one with another. Namely, productions of the L1 sound could shift in the direction of the L3 sound, in case these are not sufficiently dissimilar to be discriminated. From a phonetic perspective, it is therefore necessary to test whether native exemplars of stressed /a/ would present, respectively, a lowering of F1 and a raising of F2 values in Italo-Australians' productions, with respect to Italian monolinguals, thus showing effects of category assimilation. On the other hand, in case /a/ and /æ/ are successfully discriminated, category dissimilation would

[173] Additionally, we raised the issue whether the AusEng near-open central unrounded vowel could be perceived as sufficiently dissimilar from the NVen and SI /a/ to form a new distinct category or, on the other hand, it would undergo equivalence classification and be perceptually assimilated to - and therefore produced as - /a/ from Italo-Australians. Nonetheless, it is not possible to verify this hypothesis, since our corpus does not include elicited productions in English of Italo-Australian speakers (except for short spontaneous utterances, as illustrated in Chapter 5).

[174] Although it appears in some Tuscan varieties (see, for example, Calamai, 2004).

occur: L3 phonetic category will shift away from the closest L1 category in order to maintain phonetic contrast. At acoustic level, phonetic properties of a new L3 category and the closest L1 category will substantially diverge from one another, and Italo-Australians' productions of /a/ will overall resemble those of native speakers in Italy.

3) Maintenance of /u/:

The L1/L2 vowel system shows the high back close rounded /u/ (for example, in the Dialectal word "THUCHERO": /θuːkero/ and in the correspondent SI "ZUCCHERO": /dzukːero/ (sugar)). In the description given by Mitchell & Delbridge (1965), this sound is represented as /u/, as well, while subsequently Wells (1982), Clark (1989) and Cox & Palethorpe (2001) introduced the diacritic /ʉ/, to underline a fronting process. On the other hand, /ʊ/ appears in AusE in mid-high back position ("PUT": /pʊt/). Within the theoretical framework of cross-linguistic interaction, English [u] and [ʊ] productions of Italian immigrants living in the United States have been examined in a noticeable study conducted by Busà (1992) (see Chapter 4). Acoustic analyses indicated that nearly all speakers tended to produce English [u] with lower F2 values (i.e., more Italian-like) than those of native English speakers. In the case of [ʊ], however, a larger number of Italian talkers produced [ʊ] tokens with English-like spectral and temporal properties than was the case for [u] (Munro, Flege & MacKay 1996). The Italians, then, appeared to have more success with English [ʊ] than [u]. These results support the SLM, according to which, given sufficient dissimilarity from the closest L1 sound, a new sound encountered in the L2 triggers the formation of a new phonetic category. As a result, any L2 learner would be able to establish a new phonetic category for an L2 sound which is perceived to be sufficiently dissimilar from the L1 sound, and this will allow the L2 sound to be produced accurately (de Leeuw, 2008). In this case, non-native sound [ʊ] was perceived by Italian immigrant speakers as sufficiently dissimilar to the closest L1 sound (/u/) to block the mechanism of equivalence classification and to create a new category. It follows that this vowel was produced more accurately than the other.

With respect to the observations so far presented, we hypothesize that both the AusE

/u/ (/ʉ/) and /ʊ/ will be perceptually assimilated by IRIAS speakers to the /u/ occurring in NVen and SI. In this specific case, the cross-language relation entwined between NVen-SI /u/ and AusEng /ʉ/ and /ʊ/ might lead to a merge of the phonetic properties of the perceptually-linked native and non-native sounds. In Flege's words, the *«production of the corresponding L1 speech sound will tend to diverge from L1 phonetic norms»* (Flege *et al.*, 2003: 469-470). Using the terminology employed within the L2LP model (Escudero, 2005), we can hypothesize that in this SIMILAR scenario SIMILAR L2 sounds will be equated to L1 sounds: as a result, the L2 learner's native categories will undergo effects at phonetic level from the contact with a non-native system. In this case, effects would result in a raising of F2 values, while maintaining F1 values that are similar in both L1 and L3. Another possibility is that Italo-Australians' productions of /u/ would undergo subtle changes, because of the influence of the diphthongization process involving the Broad variety. In this case, /u/ would show a shift to [əːʉ]. In the vowel's spectral configuration, this dynamic produces and onglide in the formant trajectories, since there are two different targets (from a more central to a higher position).

4) Maintenance of /ɛ/ and /e/:

Both in Northern Veneto dialect and in Standard Italian, front vowels /e/ and /ɛ/ have phonological relevance. From an articulatory perspective, the former is close-mid, the latter is open-mid (for example, in Northern Veneto dialect we have the minimal couple /pɛːso/ (worse) and /peːso/ (weight)). /e/ also occurs in AusE (for example: "BET": /bet/), while the other does not. On the other hand, the AusE inventory includes the mid-close /ɜː/ (for example, in "BERT", /bɜːrt/), which is characterized by a more central position with respect to the Italian front mid vowels. Concerning /e/, a first hypothesis is that this L1 category would be maintained through the perceptual link with the similar category occurring in L3. According to the SLM, since this element is shared by the two systems in contact, the assumption is that the pressure of the corresponding non-native category is supposed to reinforce the maintenance of the mid-close vowel in the NVen and SI vocalic system. On the other hand, the L2LP model proposes a different perspective with regard to learning of similar non-native sounds.

This scenario refers to the perception of L2 sounds that are phonologically equivalent but may present phonetic differences from the acoustically closest sounds in the learner's L1, which is presumably the case for /e/ in NVen/SI and AusE. According to Escudero (2009: 29), the learner would adjust his L1 perception to become an optimal L2 listener. The author demonstrates that, in the case of a "similar scenario", the learners' native features of formants and duration could shift in the direction of the features displayed by the L2. The analysis of acoustic parameters for native /e/ compared to those of the phonologically equivalent non-native /e/, will allow us: to evaluate whether or not their segmental features are similar at a cross-linguistic level (i.e., across the NVen/SI and AuseE inventories); whether, on the other hand, if Italo-Australian speakers have adjusted such features, accommodating to the norms of the L3 phonetic category.

Another possibility is that, given that the L1 /e/ and the L3 /ɜː/ share similar articulatory features (they are both mid-high), a non-native speaker would presumably fail to create a new category for the AusE /ɜː/. This sound, in fact, could be perceived as insufficiently dissimilar from the closest vowel /e/ and might undergo the equivalence classification effect and be merged with it. Based on these observations, one could assume that the acoustic properties of /e/ in the speech of multilinguals might shift to a more central position due to this merge with the AusE category. In fact, as already pointed out, the SLM predicts that a merged category will incorporate the phonetic properties of the perceptually linked L1 and L3 speech sounds, and that it will be used to produce corresponding speech sounds in the L1 and L3. Moreover, that « *[...] the more a bilingual approximates the phonetic norm for an L2 speech sound, the more her production of the corresponding L1 speech sound will tend to diverge from L1 phonetic norms*» (Flege *et al.*, 2003: 469-470). In this viewpoint, a second hypothesis is that, after decades in Australia, productions of /e/ of multilingual speakers would resemble productions of /ɜː/. Effects of centralization would appear at a segmental level trough the lowering of F2 values, with respect to monoliguals' productions.

Concerning /ɛ/, we can notice its proximity with the mid-low front vowel /æ/ occurring in the AusE inventory, which shows similarity also with /a/. As already observed for

/a/, in case of category assimilation (i.e., of a merge between native and the non-native categories), phonetic features of the L3 category could trigger subtle changes in productions of /ɛ/. In this case, in the SLM hypothesis holds true, we expect that F1 values of /ɛ/ would increase, and F2 values would decrease, resembling productions of /æ/. On the contrary, in case the two sounds in question were perceived are sufficiently dissimilar from one another, their phonetic properties would diverge, and Italo-Australians' productions of /ɛ/ would overall exhibit native-like values, showing no effects of CLI[175].

5) Maintenance of /ɔ/ and /o/:

Specularly to the articulatory configuration characterizing front mid vowels, in NVen and SI we also find an open-mid vowel /ɔ/ (for instance, in /sɔːto/ (lame)) and a close-mid vowel /o/ (in /soːto/ (under)) in back position. We notice that such symmetry is not encountered in the AusE vocalic system, which instead exhibits /ɔ/ ("POT": /pɔt/), /oː/ ("BOUGHT": /boːt/) and /e/, but not /ɛ/. For both vowels, one prediction it that this category would be maintained through the contact with the similar category occurring in L3. As predicted for /e/, in fact, the perceptual link with the similar non-native category is supposed to reinforce the maintenance of the native category in the NVen and SI vocalic system. Specifically, in our hypothesis, the non-native /ɔ/ and /oː/ will be perceived as similar to the native /ɔ/ and /o/ and the vowels will be comparable at a segmental level. Consequently, no differences in their formant features are expected in Italo-Australians' productions with respect to those of Italian informants. Similarly to /e/, /ɔ/ can be described as phonologically equivalent across NVen/SI and AusE, but at the same time could exhibit phonetic differences along the systems in contact. Our task is to measure formant and duration values for /ɔ/ in order to attest whether the learners' native phonetic features have shifted in the direction of the features displayed by AusE. As we already observed for /iː/ and /ɐː/, category assimilation is supposed to occur for L3 /oː/. Concerning duration, our hypothesis is

[175] Regarding open-mid vowels, some acoustic differences across similar phonetic categories were found by Bohn & Flege (1992: 154). They proved that the English /ɛ/ produced by German learners of English did not differ spectrally from the native English speakers' /ɛ/, although both German /ɛ/ and /ɛː/ were found to be higher in the acoustic vowel space than English /ɛ/.

that no significant discrepancy will appear at a cross-linguistic level, according to the prediction of the SLM.

7. Acoustic Analysis

7.1 Coronal fricatives

In the following section, we will show and discuss results for the acoustic analysis of the three L1 target coronals [θ], [s] and [ʃ][176], which was carried out through the methodology so far illustrated. In the next paragraph, we will report the distribution of tokens across the elicited productions (§7.1.1.); then, we will provide boxplots[177] describing the acoustic behaviour of target sounds examined in utterances of both control-group and IRIAS informants (§7.2.2.). Each of the four spectral moments will be presented in the following order: Center of Gravity (CoG), Standard Deviation (SDev), Skewness (Skew), Kurtosis (Kurt). These representations will allow us to compare results either based on gender, group or dialectal sub-system, and to draw preliminarly observations. For each spectral moment, we will present and discuss results for males - specifically: Italian control-group males (ALM and SPR) *vs* Italo-Australian males (GPZ and MZN); Italian control-group females (BCL and RDP) *vs* Italo-Australian females (CZM and ACS).

[176] It is worth reminding that we considered the fricative release of [(t)ʃ] instead of singleton [ʃ], for the reasons provided in Chapter 4, 5 and 6.

[177] Boxplots (also called box-and-whisker diagram) allow to summarize data measured on an interval scale and to obtain a graphic visualization of where these data are concentrated. In exploratory analyses, they are used to show the shape of the distribution, its central value, and variability, and how far the extreme values are from most of the data. The boxplot structure is built up on five values: the minimum value, the first (lower) quartile, the median, the third (upper) quartile, and the maximum value. It is obtained by reporting on a vertical (or horizontal) axis these five values. Specifically, the first quartile of a group of values is the value such the 25% of the values fall at or below this value. The third quartile of a group of values is the value such that 75% of the values fall at or below this value (retrieved from http://www.stats.gla.ac.uk/steps/glossary/). The "inter-quartile range" corresponds to the distance between the first and the third quartile. The median divides the box into two parts. The whiskers are obtained by joining the first quartile to the minimum and the upper quartile to the maximum, and indicate the symmetry of the distribution: the more similar the length of the upper and lower whiskers, the more symmetric the distribution of the data. Values falling outside these limits are called outliers, and are individually reported in the box-plot, as they also provide relevant information about (a)symmetry in the distribution (Brillinger, 2011).

7.1.1 Distribution of coronal fricatives

Data extracted through scripts during the experimental procedure were firstly cleaned and successively explored through the software R (R Core Team. 2018)[178]. Regarding data cleaning, we followed two distinct procedures, according to whether we analyzed either target consonants or vowels. In both cases, evident outliers were excluded, which were mainly caused by: overlapping noise in the recording; presence of creaky voice (which prevented from having a clearly-defined spectrum); laughing, whispering, coughing, etc., within the utterance.

Complying with previous acoustic studies carried out in this domain (e.g. Fant, 1960; Shadle & Mair, 1996, among others, who reported consistent effects of lip-rounding on fricative spectra), vocalic contexts presenting /u/ were excluded from our analysis on coronal fricatives. Similarly, we excluded target consonants occurring before the high vowel /i/, thusly selecting only those fricatives that occurred before /a/, /e, ɛ/ and /o, ɔ/ with the purpose of balancing the anticipatory coarticulatory influence (see also Avesani *et al*., 2015). Also, word final fricatives were excluded, together with all those fricatives with a duration shorter than 37ms. The distribution of target tokens per speaker (1443 tokens in total) is summarized in **Table 11**:

		speaker							
		ACS	CZM	BCL	RDP	MZN	GPZ	ALM	SPR
phone	θ	86	32	57	33	48	35	43	38
	s	173	23	79	18	114	16	70	112
	ʃ	82	37	83	12	93	44	55	60

Table 11: *Number of retained tokens grouped by phone and speaker*

The distribution of target tokens per group (Control *vs* Ita-Aus) and dialect (Cadorino *vs* Feltrino) is summarized in **Table 12**:

[178] R Development Core Team (2018). R: A language and environment for statistical computing. http://www.R-project.org/.

			dialect	
		group	Cadorino	Feltrino
phone	θ	Control	100	71
		Ita-Aus	67	134
	s	Control	149	130
		Ita-Aus	39	287
	ʃ	Control	138	72
		Ita-Aus	81	175

Table 12: *Number of retained tokens grouped by phone. group of speakers and by dialect*

After carrying out an accurate selection and a double-check on target fricatives occurring in target contexts, we computed spectral measurements for each of these tokens. Acoustical analysis of coronal fricatives is presented in §7.1.2.

7.1.2 Acoustic analysis: Italian control group vs Italo-Australian Heritage Speakers

As already mentioned in Chapter 6, acoustic measurements for Center of Gravity, Standard Deviation, Skewness and Kurtosis were extracted for target fricatives through an ad-hoc praat script. Results were then explored and successively plotted through the *ggplot* function of the *ggplot2* package of the software R (Wickham, 2016). Data for CoG values computed for Italo-Australians, respectively for males (GPZ from Cadore; MZN from Feltre) and females (CZM from Cadore; ACS from Feltre) are reported in the graph below:

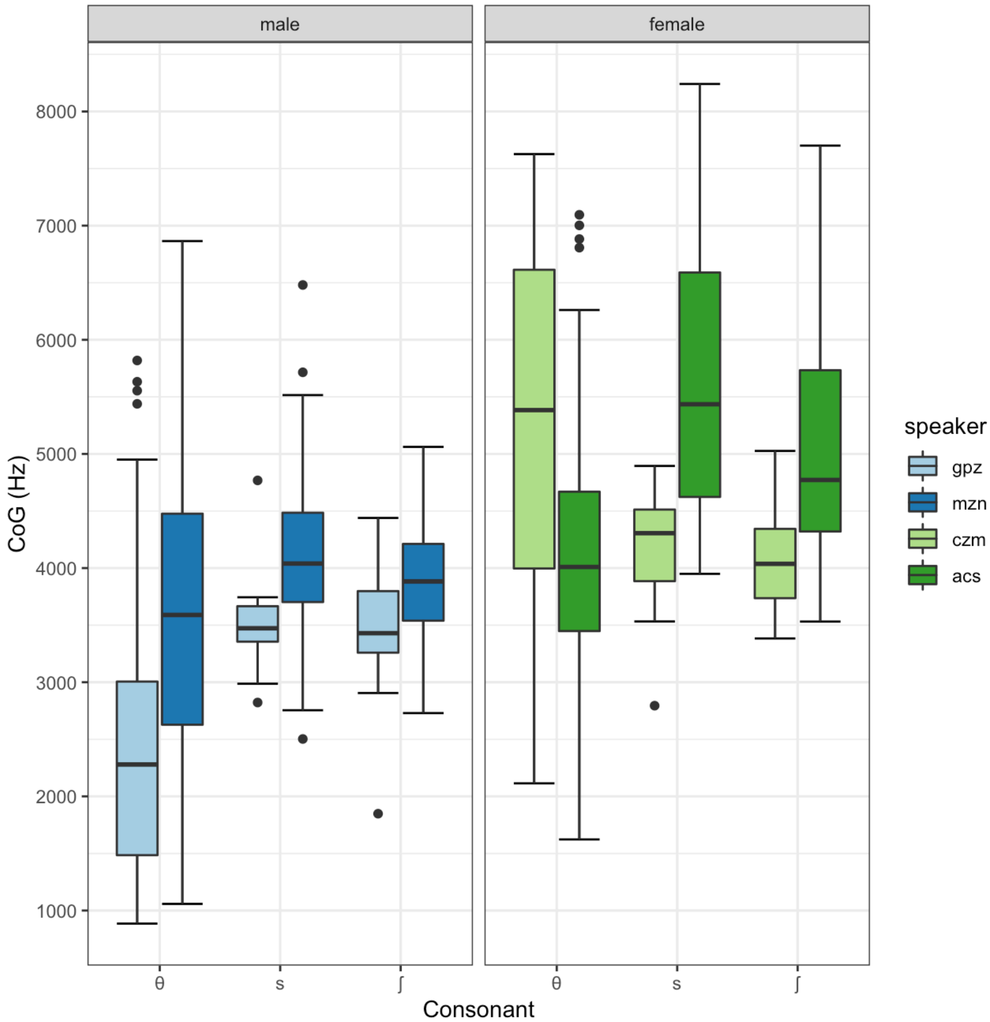

Fig.11: *Boxplots for CoG values (in Hz) per Ita-Aus speakers and type of consonant*

For what concerns the target fricatives' Center of Gravity, it is worth reminding that its values - expressed in Hz – are positively correlated with the fricatives' location of constriction: a higher CoG indicates a more advanced place of articulation. Regarding GPZ we observe that CoG for [θ] is lower with respect to [s] and [ʃ]. The inter-quartile range is between 1500 Hz and 3000 Hz, although whiskers of the boxplot indicate an extension up to 5000 Hz and more. On the other hand - and differently from what we expected - values for [s] are higher, concentrating approximately around 3500 Hz. Median is roughly similar across [s] and [ʃ], although the latter displays an overall higher range. In MZN productions, the interdental's CoG exhibits an inter-quartile range from 2700 to 4500 Hz: median is attested at 3500 Hz. [s] displays a lower inter-quartile range (from 3750 Hz to 4500 Hz) and higher median values (at 4000 Hz). Median is quite similar for [ʃ]. Substantially, in both speakers (particularly in GPZ) [θ] presents a thought-provoking behaviour for what concerns its place of articulation. Namely, since it is articulated with the teeth, i.e. at the front extremity of the vocal tract, we expected it to show the highest CoG with respect to the other fricatives.[179] Concerning productions of female Italo-Australian speakers, we observe instead that CZM has the highest CoG values for the interdental, which range from 4000 Hz to 6500 Hz a displays median at 5500 Hz. Differently, CoG for [s] ranges between 4000 to 4500 Hz, while CoG values for [ʃ] are comprised between 3750 Hz and 4400 Hz. In ACS, on the other hand, median is attested at 4000 Hz for the interdental - although whiskers of the boxplot indicate an extension up to 6250 Hz, with some tokens around 7000 Hz. Again, median of CoG is lower if compared to the other target consonants [s] and [ʃ], which are respectively at 5500 and 4800 Hz. From this representation, we observe that CZM is the only speaker whose target fricatives behave as expected - namely with a highest CoG median for [θ], an intermediate value for [s] and the lowest value for [ʃ].

Data for CoG values computed for the Veneto control-group, respectively for males (ALM from Cadore; SPR from Feltre) and females (BCL from Cadore; RDP from Feltre) are reported in the graph below:

[179] Such pattern is also attested in English, as indicated by Jongman *et al.* (2000). Further research could take into consideration values for [θ] in other languages, in order to assess whether spectral features are comparable al cross-linguistic level.

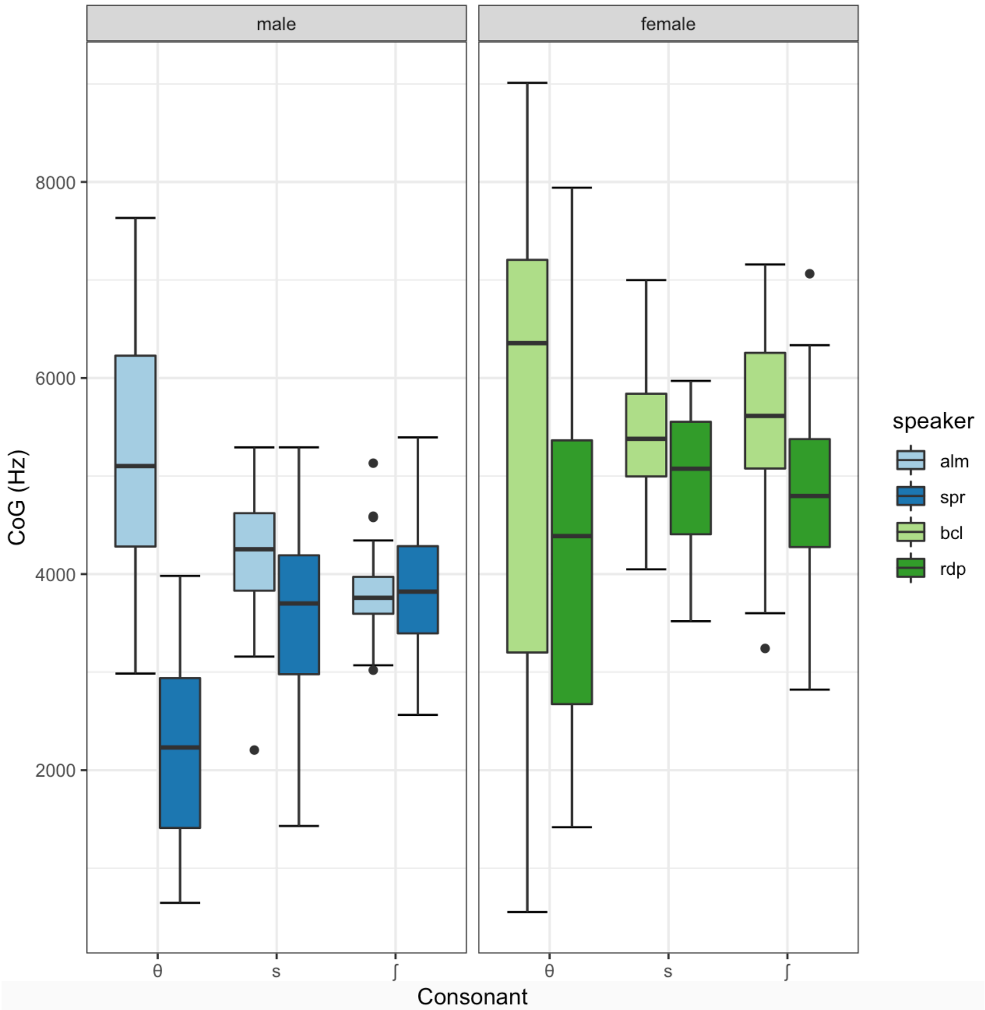

Fig. 12*: Boxplots for CoG values (in Hz) per control-group speakers and type of consonant*

Regarding ALM, we observe that CoG for [θ] has the highest values for the interdental, which range from 4300 Hz to 6200 Hz (median at 5000 Hz). CoG values for [s] are comprised in the inter-quartile range between 3900 Hz and 4600 Hz. As expected, [ʃ] displays the lowest CoG values - between 3700 Hz and 4000 Hz. On the other hand, and differently from ALM, SPR exhibits the lowest values for [θ], which are comprised in the inter-quartile between 1500 Hz and 3000 Hz. Instead, the interquartile range for [s] indicates that CoG values are attested between 3000 Hz and 4100 Hz. [ʃ] for SPR shows a similar configuration with respect to [s], yet with lower dispersion. Respectively, their medians are attested around 5700 and 5800 Hz. Concerning CoG for BCL, we observe a consistent degree of variation for [θ]. It ranges from 3100 Hz to 7100 Hz - although the boxplot overall extends from 500 Hz to 9000 Hz. Median is attested at 6400 Hz. On the contrary, less variation is encountered in [s] (from 4000 Hz to 5000 Hz) and in [ʃ] (medians are roughly similar, being both around 4500 Hz). As far as RDP is concerned, median of CoG values for [θ], [s], and [ʃ] are attested, respectively: at 4400 Hz, at 5000 Hz and 4800 Hz.

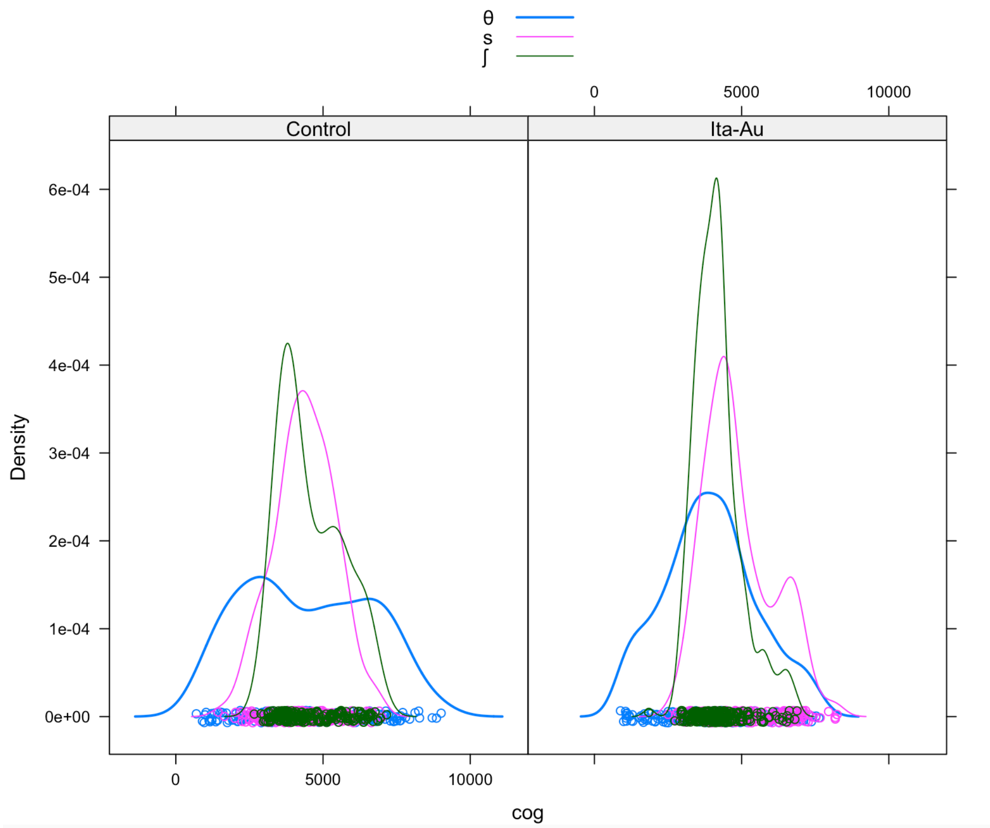

***Fig.13**: Density plot for CoG values (in Hz) pooled by group*

This graph indicates the probability distribution of CoG values for each target fricative. By comparing control-group with Italo-Australian speakers, we can draw some interesting observations. Visibly, across the two groups [s] and [ʃ] display a similar behaviour, which is instead remarkably different with respect to the distribution of [θ]. In Italian speakers in particular, [θ] shows in fact greater dispersion of values, with two peaks of distribution around approximately 3000 Hz and 7000 Hz, while sibilants both reach a major peak of distribution around 4500/4800 Hz. In Italo-Australians, the peakedness in distribution of CoG values for both [θ] and [s] is almost entirely comprised between that of [ʃ] (around 4500/4800 Hz), with minor peaks for both fricatives around 6500 Hz.

In the following graph, we will present data for SDev values computed for the Italo-Australians, respectively for males (GPZ from Cadore; MZN from Feltre) and females (CZM from Cadore; ACS from Feltre):

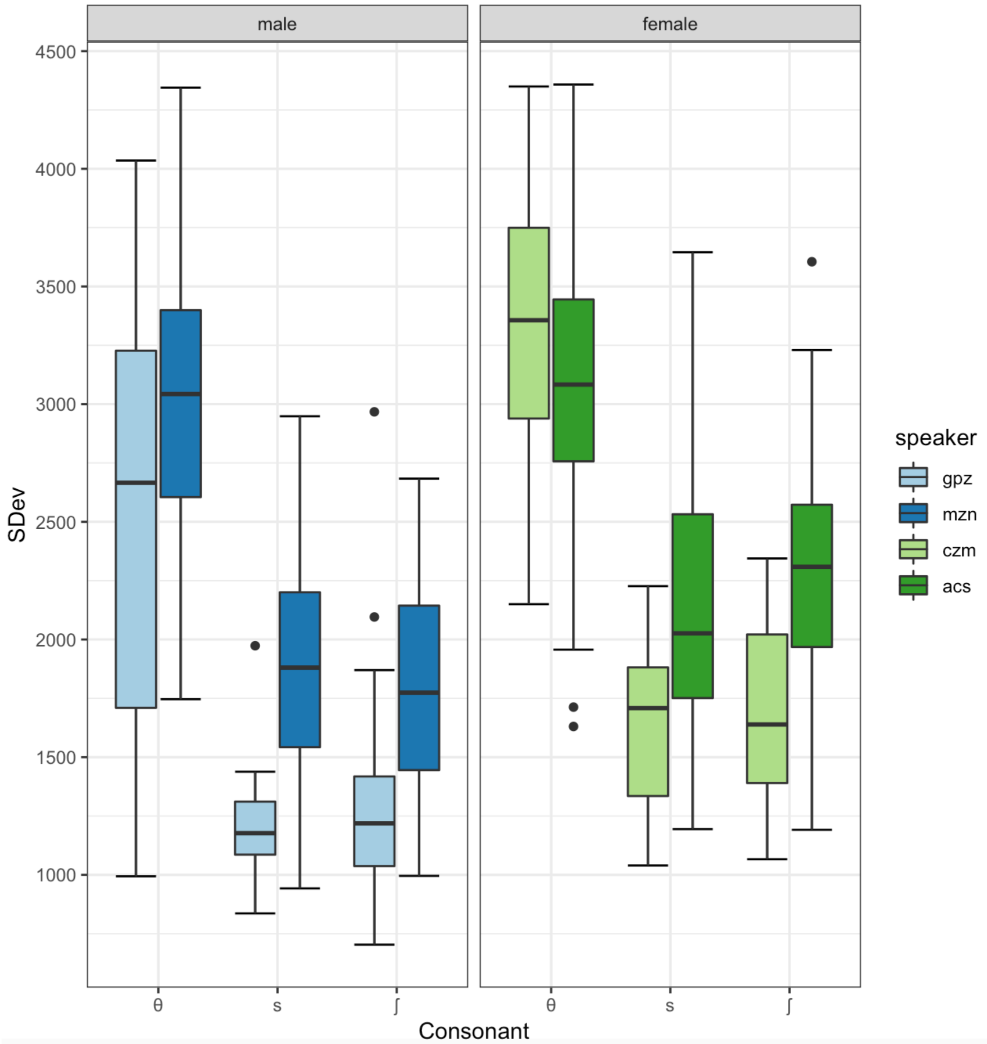

Fig. 14: *Boxplots for SDev values per Ita-Aus speakers and type of consonant*

As far as target fricatives' Standard Deviation (SDev) is concerned, it is worth reminding that it describes the spectral shape and the distribution of the range of frequencies around the mean: it indicates whether the fricative spectrum is diffuse or compact and indirectly indicates the degree of laminality. Accordingly, the higher the SDev, the higher the laminality of a given fricative: for this reason, we expect that the interdental would show the highest values, since its articulation directly involves the laminal portion of the tongue. In GPZ, we observe that SDev for [θ] is consistently higher with respect to [s] and [ʃ]. The inter-quartile range is between approximately 1700 and 3250, although whiskers of the boxplot indicate an extension from 1000 up to 4000. The median of data points is attested 2700. On the other hand, median values for [s] are slightly lower than for [ʃ], respectively at approximately 1200 and 1250. An overall similar pattern is encountered in MZN: SDev values for the interdental are the highest, being comprised in the inter-quartile range from around 2600 to 3450 (median values at 3000). Differently, [s] ranges from 1550 to 2200 (median values at 1850), and [ʃ] ranges from 1450 to 2150 (median values at 1750). SDev for [θ] is the highest also across the female Italo-Australian speakers. For CZM, the inter-quartile range extends from 2950 to 3750, while for ACS it goes from 2750 to 3450: respectively, median is attested at 3350 and at 3100. Concerning [s], females show a dissimilar pattern. In CZM, median SDev for [s] is slightly higher than for [ʃ] (1750 vs 1650), while in ACS median SDev for the two consonants are attested at 2000 and 2300, respectively. Eventually, we can claim that for what concerns laminality the acoustic behaviour of the interdental overall appears to be coherent with what we expected at articulatory level.

In the following Figure, we will presents SDev results obtained for the Veneto control-group, respectively for males (ALM from Cadore; SPR from Feltre) and females (BCL from Cadore; RDP from Feltre):

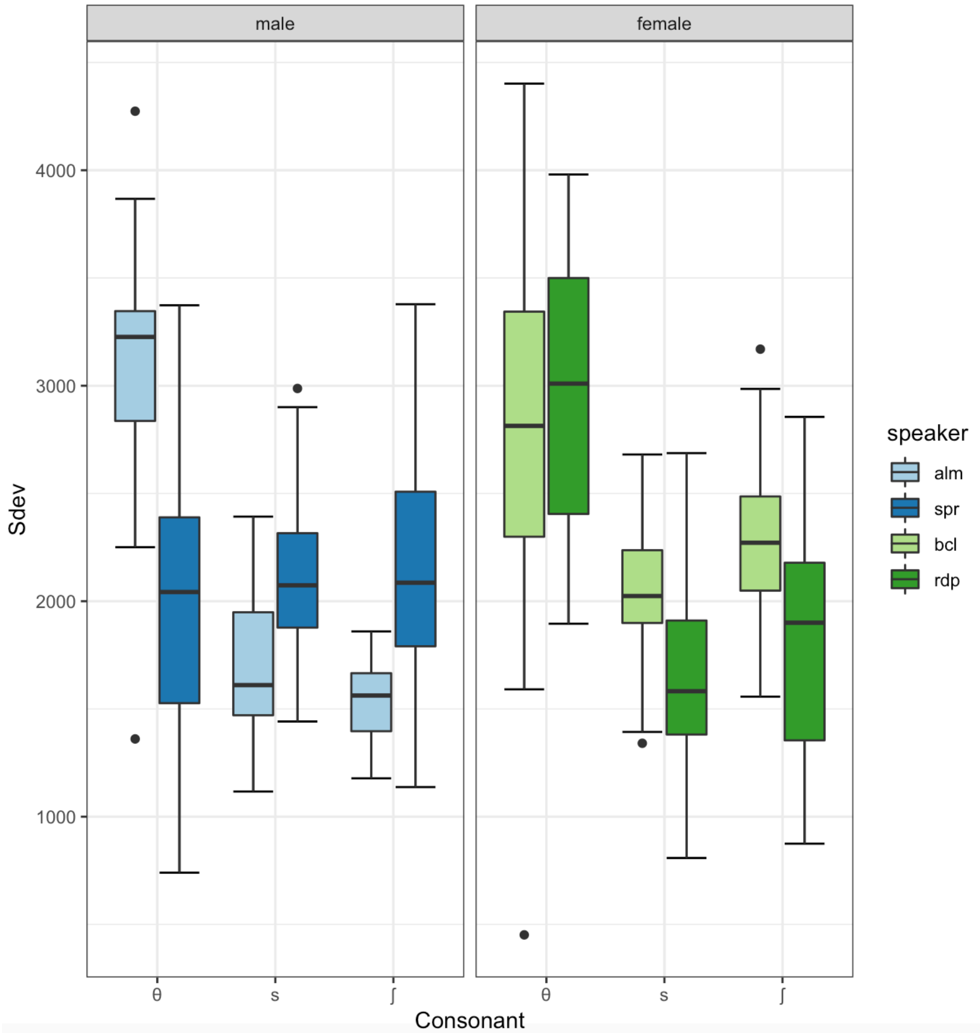

Fig. 15*: Boxplots for SDev values per control-group speakers and type of consonant*

In ALM, SDev for [θ] is significantly higher with respect to [s] and [ʃ]. The inter-quartile range indicates a concentration between 2850 and 3350, with median values attested at 3250. On the other hand, median values for [s] and [ʃ] are roughly similar (around 1600). Instead, for SPR median of SDev is equivalent across the three consonants (around 2050-2100). As far as female speakers are concerned, SDev for [θ] is again visibly higher compared to the other consonants. For BCL, median is attested at 2800, while for ACS it is attested at 3000. Median of SDev for [s] is lower than for [ʃ] in both speakers: 2000 *vs* 2500 in the female speaker from Cadore, and 1500 *vs* 1900 in the speaker from Feltre.

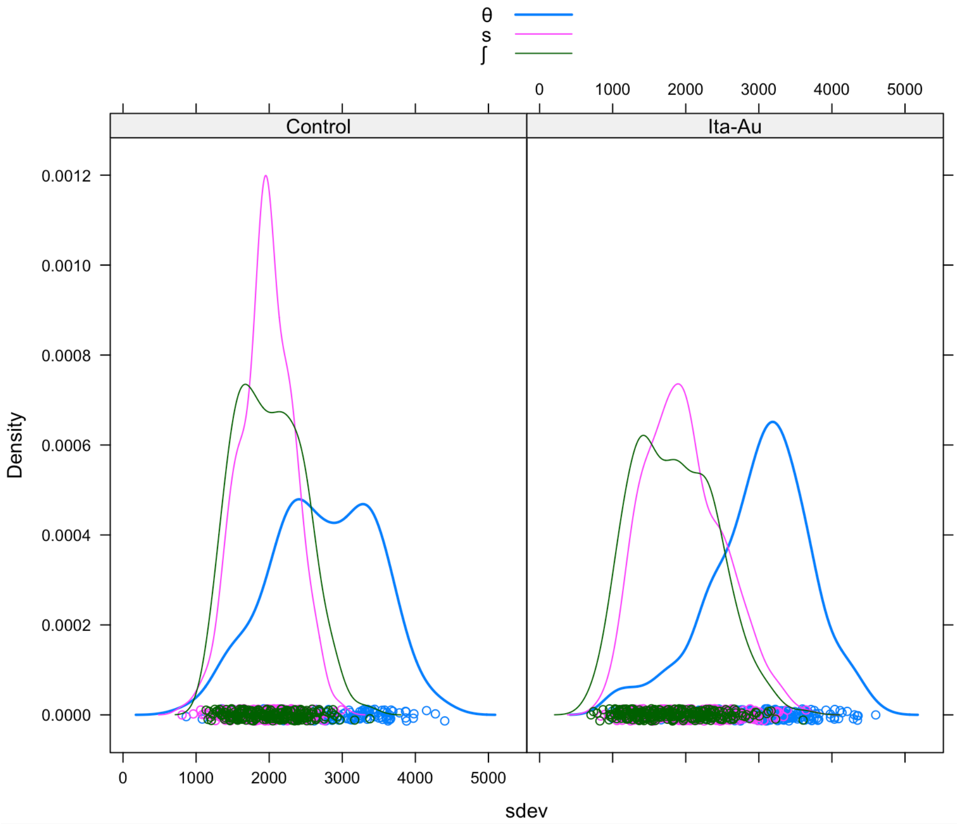

Fig. 16: *Density plot for SDev values pooled by group*

From this graph, we note that distribution of SDev values for sibilants presents a similar pattern across the two groups. Specifically, [ʃ] displays a major peak at 1500 for both Italians and Italo-Australians; a major peak is found for [s] at 2000 in both groups, with a clearly sharper peak for controls (density = 0.0012) compared to Italo-Australians (density = 0.0007). Overall, curves indicating density for the two sibilants present a partial overlapping, which is instead not encountered for interdentals. Namely, distribution of [θ] for controls shows two peaks, respectively at 2500 and 3500, while for Italo-Australians it presents only a major peak at approximately 3250.

In the graph below, we will present data for Skewness calculated for the Italo-Australian group, respectively for males (GPZ from Cadore; MZN from Feltre) and females (CZM from Cadore; ACS from Feltre):

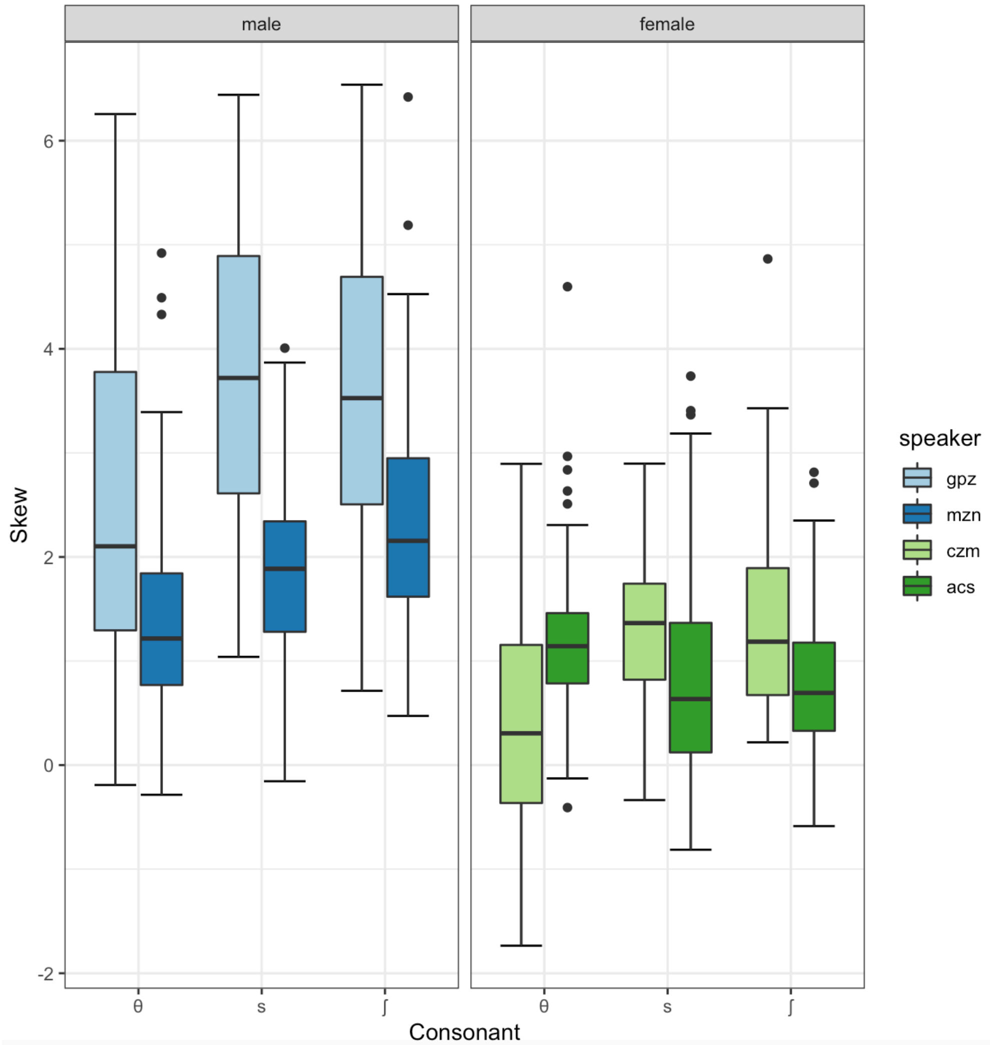

***Fig. 17**: Boxplots for Skew values per Ita-Aus speakers and type of consonant*

Concerning this spectral moment, we recall that a positive value for Skewness suggests a negative tilt with a concentration of energy in the lower frequencies, while a negative Skewness indicates a positive tilt and a predominance of energy in the higher frequencies. Looking at data for Italo-Australian males, we observe that GPZ overall displays positive values, which correspond to a prevalence of low frequencies. Specifically, median values for [θ], [s] and [ʃ] are, respectively: 2; 3.75 and 3.5. MZN also exhibits exclusively positive values, yet with lower medians, respectively: 1.25; 1.9 and 2.1. Globally, Skewness is lower for females, yet still display positive values (except for the first quartile for CZM's interdental). Respectively, median values for [θ], [s] and [ʃ] are 0.3; 1.4 and 1.25 for CZM, and 1.25; 1.6 and 1.6 for ACS. In all cases, lowest values for [θ] with respect to the other consonants indicate that the interdental shows the highest frequencies.

Data for Skew obtained for the Veneto control-group, respectively for males (ALM from Cadore; SPR from Feltre) and females (BCL from Cadore; RDP from Feltre) are reported in the graph below:

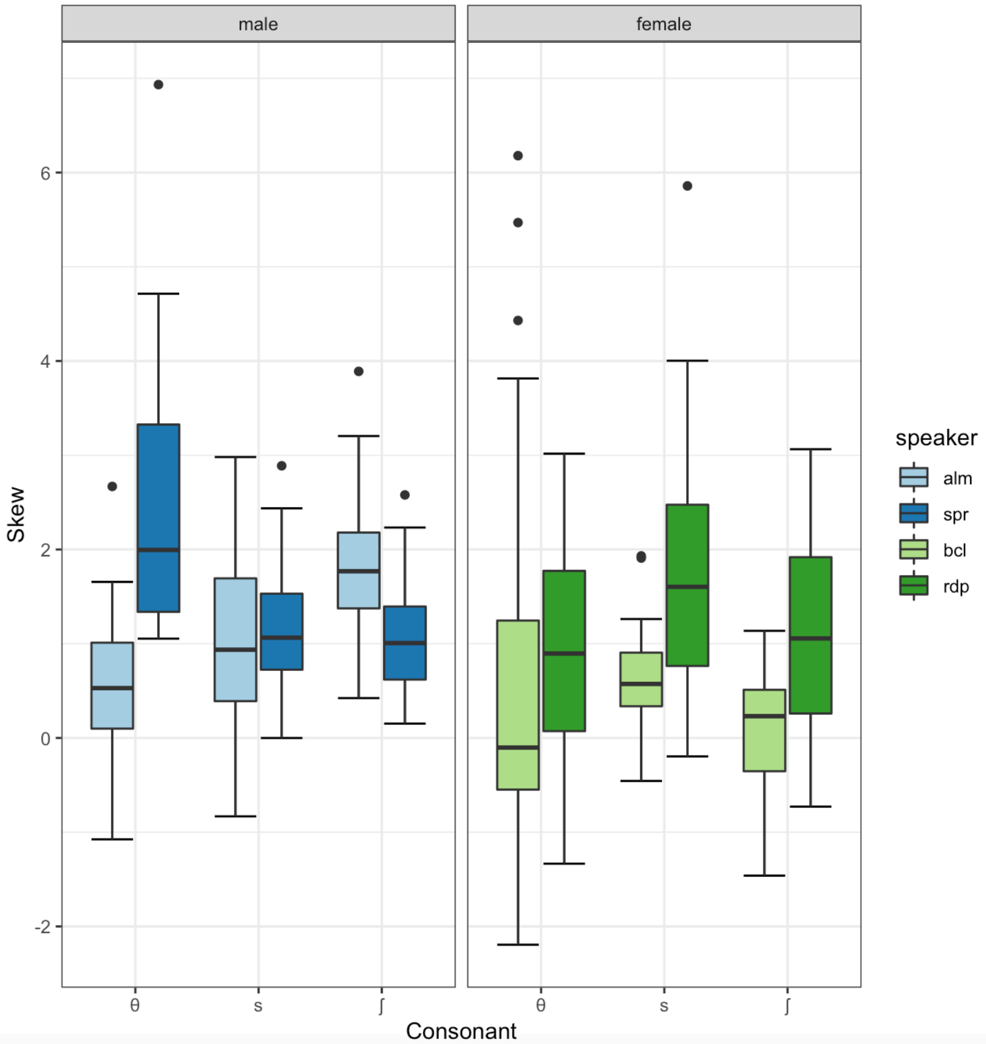

***Fig. 18**: Boxplots for Skew values per control-group speakers and type of consonant*

ALM shows values comprised within exclusively positive inter-quartile ranges, with lowest values for [θ] (median = 0.5), intermediate for [s] (median = 1) and highest for [ʃ] (median = 1.75). Similarly, SPR solely displays positive inter-quartile ranges, but with different medians, respectively: 2 for [θ] and 1 for both [s] and [ʃ]. The global pattern for Skewness is roughly similar across females, who also display overall positive values - except for the first quartiles of [θ] and [ʃ] in BCL. Specifically, [θ], [s] and [ʃ] present the following medians: 0; 0.5 and 0.25 in BCL; 1; 1.5 and 1 in RDP. According to these results, we can claim that the two speakers from Cadore show the highest frequencies for [θ] with respect to the speakers from Feltre.

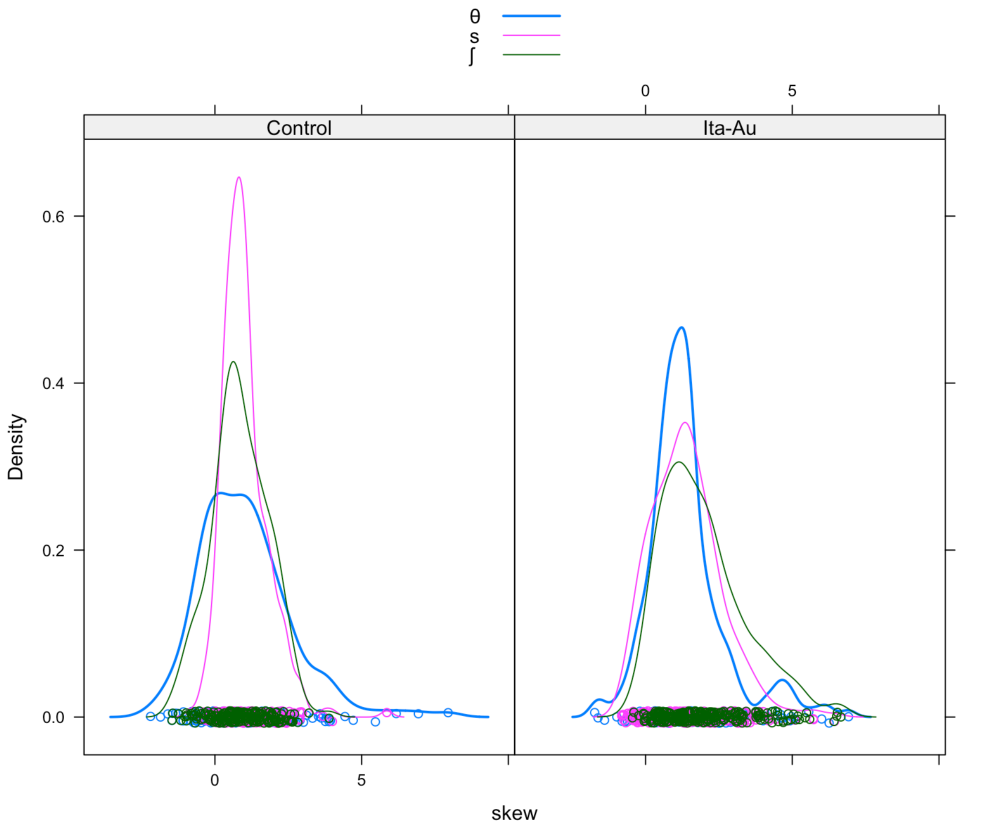

Fig. 19: *Density plot for Skew values pooled by group*

The density plot shows that in both groups the distribution of Skew values for [ʃ] is almost entirely comprised between that of [s]. However, although both sibilants display peaks at 1 in both groups, density values in controls and Italo-Australians are visibly different (respectively, 0.65 *vs* 0.35 for [s] and 0.4 vs 0.3 for [ʃ]). Concerning [θ], on the other hand, peakedness in the distribution are attested at 1 in both groups, yet density values are lower for controls (0.25) with respect to Italo-Australians (0.45).

Next, we will present data for Kurtosis calculated for the Italo-Australian group, respectively for males (GPZ from Cadore; MZN from Feltre) and females (CZM from Cadore; ACS from Feltre):

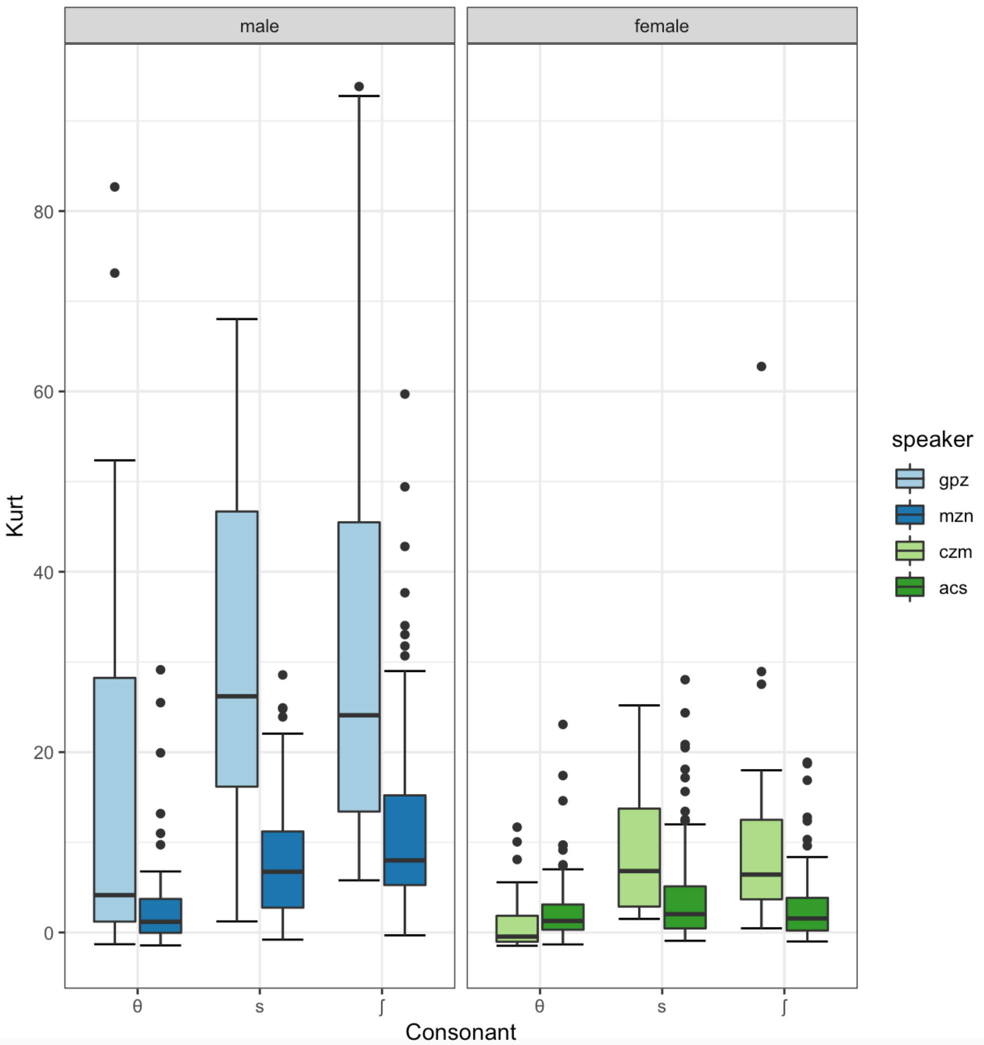

Fig. 20*: Boxplots for Kurt values per Ita-Aus speakers and type of consonant*

The boxplots clearly indicate a relevant number of outliers for Kurtosis across the four Italo-Australian speakers. Visibly, GPZ shows the highest dispersion of values with respect to the others. Looking at values for the interdental, we see that medians are attested at 1 for both the male and the female speaker from Feltre. On the other hand, medians for GPZ and BCL are 4 and 0, respectively. Regarding [s], GPZ has the highest median (attested around 27); MZN and BCL have intermediate medians (both at 7), while ACS has the lowest median (at 2). Ultimately, [ʃ] displays highest values for

Kurtosis in the speaker from Cadore (with median at 24); intermediate values are exhibited by MZN and BCL (median at around 8 and 6, respectively), and lowest values for ACS (around 2).

Finally, we report data for Kurtosis for the Veneto control-group, respectively for males (ALM from Cadore; SPR from Feltre) and females (BCL from Cadore; RDP from Feltre):

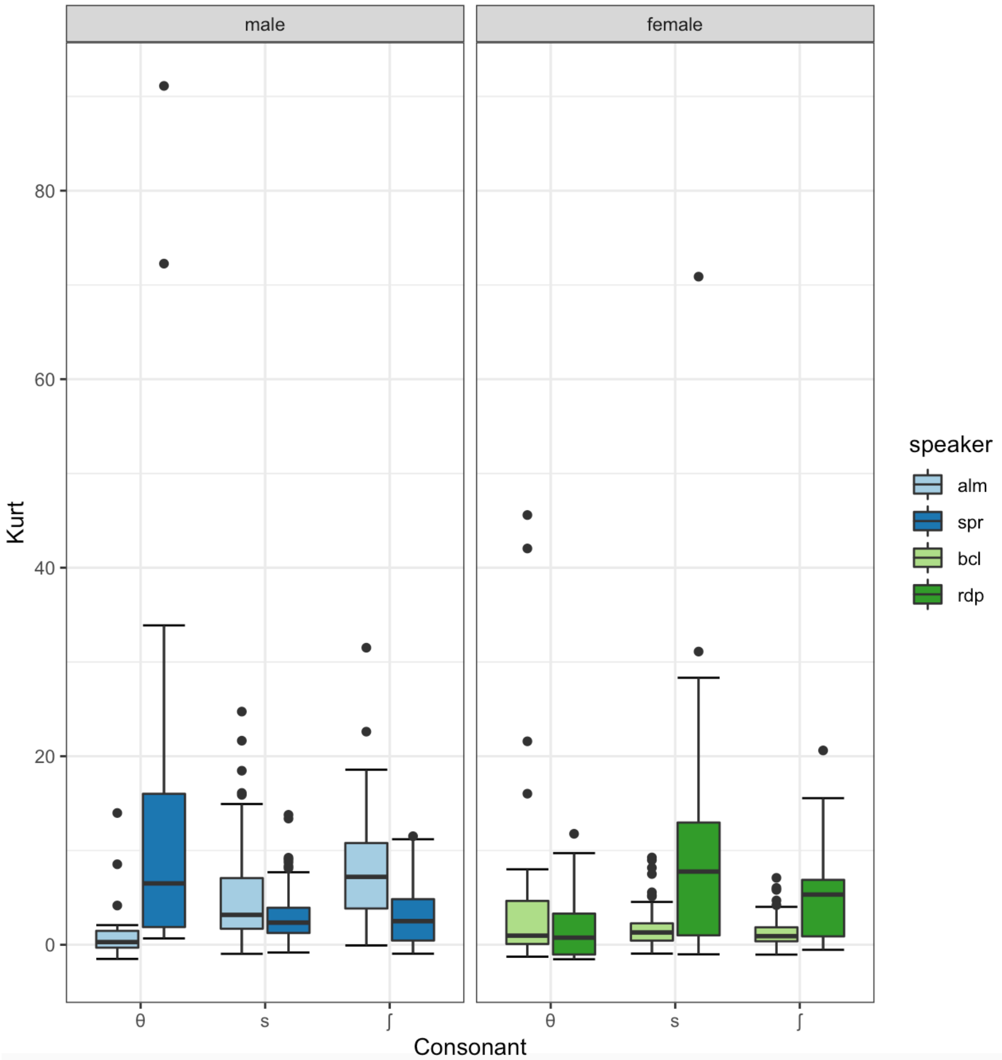

***Fig. 21**: Boxplots for Kurt values per control-group speakers and type of consonant*

As we can see from the graph, Kurtosis displays a huge variability also across the four Italian speakers. Concerning [θ], its medians are attested around 0 for three out of four speakers. Differently, for SPR it is attested around 6. Concerning [s], medians are roughly similar for ALM and SPR (around 4); on the other hand, medians for BCL and ACS are attested, respectively at 1 and 8. Concerning [ʃ], ALM exhibits the highest values (median = 8), while SPR shows lower values (median = 2). Within females, ACS shows the highest median at 7, and BCL the lowest at 1. Overall, we observe for Kurtosis a high instability both at intra- and inter-group level, which we will further investigate in the following statistical analysis.

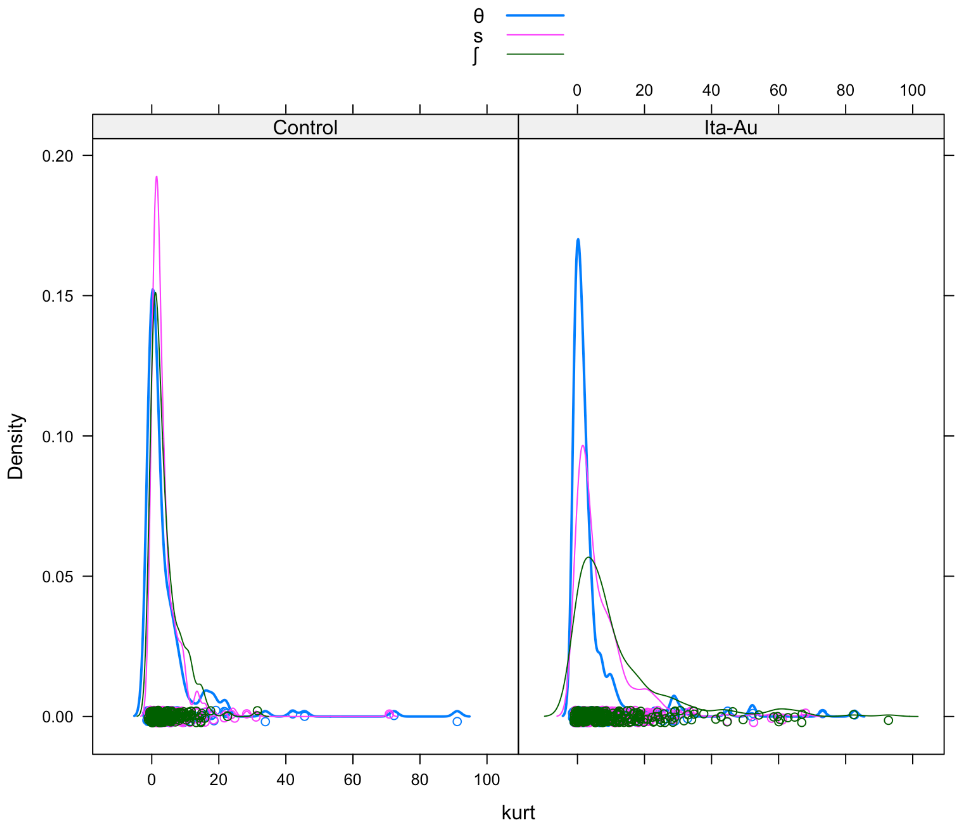

Fig. 22: *Density plot for Kurt values pooled by group*

The density plot confirms what so far observed: the distribution of values for Kurt is overall more homogeneous in controls than in IRIAS speakers, although values in both groups are visibly scattered. Concerning Italian speakers, observe that [θ] [s] and [ʃ] present a comparable pattern, in that most values are comprised between 0 and 20. Nonetheless, [s] shows a higher peak of density in the distribution with respect to the other two fricatives (0.19 *vs* 0.15). On the other hand, sibilants present more dispersion and lower peakedness (0.09 for [s] and 0.05 for [ʃ]) with respect to [θ] (0.17) in Italo-Australians' productions.

7.1.3 Statistical results[180]

For the statistical analysis, we fitted linear mixed-effects models (LMM) using the *lmer* function of the *lme4* package (Bates, Maechler, Bolker & Walker, 2015) and the *lmerTest* package (Kuznetsova, Brockhoff & Christensen, 2017) in R. In order to test the overall main effects and interactions we built up the full model by adding one predictor at a time from a baseline model (*null.model*) which solely included the intercept ([θ])[181]. The baseline model was fitted for each of the dependent variables (CoG, SDev, Kurt and Skew) by entering the factor *speaker* as random effect with *phonelabel* ([θ] vs [s] vs [(t)ʃ]) nested within *speaker* (to account for the repeated measures design). The predictors entered in each model are the following: *gender* (female *vs* male); *phonelabel* ([θ] *vs* [s] *vs* [ʃ]); *group* (Control group (Ita) vs. Italo-Australians (Ita-Au)); three two-way interaction terms *phonelabel*group, phonelabel*dialect* and *group*dialect*. Also, we added the predictor *dialect* (Cadorino *vs* Feltrino) in order to test whether possible differences could be related to the local sub-variety spoken by our informants. Additive models were hence fitted one at the time using R's *update()* function by adding potential predictors as fixed effects and their interactions. Models were subsequently compared with the *anova()* function from the package *stats4*. Goodness of fit of each model was evaluated by means of Akaike's Information Criterion (AIC), while *p*-values of overall effects were determined using Likelihood Ratio Tests (L.Ratio), as implemented in the *anova()* function. Both baseline and additive models were fitted and compared using maximum likelihood (ML) method. In order to appropriately compare results, the same fitted model was employed to explore all the dependent variables. After comparing the models for each dependent variable, the chosen models were re-fitted to the data using residual maximum likelihood (REML) estimation to obtain unbiased estimates of the covariance parameters (cfr. West, Welch & Galecki, 2014: 334). Further assessments were carried out through a pairwise post-hoc analysis (Tukey adjusted) using the *emmeans* package (Lenth, 2018) with a 95% confidence level and Kenward-Roger

[180] We are thankful to V. Galatà and C. Avesani for their essential contribution in bulding up the mixed-model analysis on target consonants (see Tordini *et al.*, submitted).

[181] In our case, the intercept is [θ] as produced by the Italian female speaker from Cadore (BCL).

correction of degrees-of-freedom. For the post-hoc analysis we will provide the estimated marginal mean and the associated standard error (±SE). In **Table 14**, we report the results of each model fitted for the four dependent variables: CoG, SDev, Kurt and Skew:

	Dependent variables			
	CoG	SDev	Kurt	Skew
Intercept	5821.199***	3103.086***	-1.615	-0.039
	(309.289)	(197.388)	(5.086)	(0.532)
gender male	-1215.106***	-303.291*	6.511	1.094**
	(188.265)	(119.684)	(4.179)	(0.417)
phonelabel [s]	-378.155	-1080.293***	2.944	0.415
	(394.642)	(252.176)	(3.501)	(0.446)
phonelabel [ʃ]	-374.246	-1026.882***	2.742	0.331
	(394.946)	(252.285)	(3.504)	(0.446)
group Ita-Au	-1155.245**	-23.765	7.302	0.986
	(376.861)	(239.378)	(6.364)	(0.661)
dialect Feltrino	-1854.285***	-461.418	6.496	1.261
	(376.499)	(239.253)	(6.362)	(0.661)
phonelabel s * *group* Ita-Au	191.858	-409.641	6.807	0.554
	(461.576)	(293.234)	(4.091)	(0.520)
phonelabel [ʃ] * *group* ItAu	-31.288	-442.589	8.701*	0.815
	(460.749)	(292.975)	(4.085)	(0.519)
phonelabel s * *dialect* Feltrino	1291.722**	479.538	-5.033	-0.841
	(461.674)	(293.251)	(4.091)	(0.520)
phonelabel [ʃ] * *dialect* Feltrino	1212.977**	487.923	-6.555	-0.949
	(460.735)	(292.971)	(4.084)	(0.519)
group Ita-Au * *dialect* Feltrino	1535.140***	562.708*	-13.250	-1.434
	(376.875)	(239.433)	(8.358)	(0.834)
Observations	1443	1443	1443	1443
Log Likelihood	-11987.310	-10899.310	-5152.900	-2051.968
Akaike Inf. Crit.	24002.620	21826.630	10333.800	4131.936
Bayesian Inf. Crit.	24076.460	21900.470	10407.640	4205.779
Note: *p <0.05; **p <0.01; ***p <0.001				

Table 13: *Results of the four LMMs fitted for the dependent variables CoG, SDev, Kurt and Skew with b estimates and standard errors in parentheses and significance level p for significant predictors in the analysis*

Observations and comparisons are reported below.

Concerning gender differences, a significant effect was found (p <.0001). Within the final model, the pairwise comparison performed on on *gender* through the function *emmeans* (Lenth, 2018) revealed that male speakers display *overall* lower CoG values with respect to female speakers: male = 3678.5±132.3SE; female = 4893.6±134.5SE. With respect to the intercept, both the *group Ita-Au* factor and the *dialect*[182] factor show a statistically significant difference. This means that, as far as place of articulation is concerned: a) [θ] as uttered by the Italian woman in Cadore (5821.199±309.289SE) has a higher CoG than that of Italo-Australian woman from Cadore (-1155.245 ± 376.861SE); b) CoG for [θ] is higher in the Italian woman from Cadore with respect to the Italian woman from Feltre (-1854.3±376.5SE).

The interaction *group Ita-Au***dialect* is also significant: [θ] as uttered by the Italo-Australian female from Feltre has a CoG attested at 4346.8±306.8SE. Moreover, we observe an apparent total lack of contrast in the coronals produced by women speaking cadorino, so that the CoG of [θ] is not significantly different from CoGs of [s] and [ʃ], respectively, both in Veneto and Australia. Nonetheless, we note that in the Italian female from Cadore [θ] differs in degree of laminality from [s] and [ʃ], as indexed by SDev. Namely, with respect to the intercept, which has a SDev value of 3103.086±197.4SE, [s] e [ʃ] exibit lower values: -1080.293±252.18 and -1026.882±252.3SE, respectively.

Concerning males, it is worth reporting that the Italian male from Cadore presents the highest estimated means for [θ] (4606.09±310.9SE), with respect to either the Italian male from Feltre (2751.8±313.83SE), to the Italo-Australian male from Cadore (3450.8±314.77SE) and to the Italo-Australian male from Feltre (3131.7±308.77SE).

Furthermore, a significant difference was found within the final model for what concerns CoG values in the interaction *group*dialect* ($F(1, 12.85) = 16.592$, $p = .0013$). The pairwise post-hoc analysis showed that there is a marginal difference within the speakers originating from Cadore: namely, the group of control informants (i.e.

[182] The factor "dialect" refers to both Italo-Australian and control-group speakers.

including males) *overall* exhibits higher CoG values with respect to the correspondent Italo-Australian group ($Ita_{Cadorino}$ = 4962.8±184.6; $Ita\text{-}Au_{Cadorino}$ = 3861.1± 193.4; p = .0735). Also, the analysis revealed a difference between the Cadorino controls and Feltrino controls (p = .0908), with CoG values globally higher in the fricatives of the informants from Cadore ($Ita_{Cadorino}$ = 4962.8±184.6; $Ita_{Feltrino}$ = 3943.5±193.8;). Regarding the single differences and similarities for the three consonants between the two groups (*phonelabel*group*):

- $\theta_{Control}$ (4286.5±230.6SE) and $\theta_{Ita\text{-}Au}$ (3898.8±229.9SE) do not statistically differ in their CoG values (p = 0.8). This result is to some extent unexpected, as we observed that [θ] exhibits significantly higher values in both control informants from Cadore with respect to all the other informants (this point will be discussed more in depth below). Presumably, however, this difference does not surface if we consider the control speakers' values as a whole (i.e. including both Cadore and Feltre);
- $s_{Control}$ (4554.21±229.5SE) and $s_{Ita\text{-}Au}$ (4358.04±233.5SE) do not statistically differ in their CoG values (p = 0.98);
- $ʃ_{Control}$ (4518.7±234.45SE) is higher with respect to $ʃ_{Ita\text{-}Au}$ (4099.8±227.12SE), yet this difference does not appear to be statistically significant (p = 0.78).

As noted above, although single pairwise comparisons between the Italians and the HS reveal to be non-significant, the system of target fricatives *overall* presents significantly higher CoG values in the former group.

The differences and similarities between the two sub-dialectal varieties (*phonelabel*dialect*) are reported below:

- CoG for $\theta_{Cadorino}$ (4636.02±231.05SE) is significantly higher with respect to $\theta_{Feltrino}$ (3549.3±229.4SE) (p = 0.05);
- Concerning [s], the difference between $s_{Cadorino}$ (4353.8±235.27SE) and $s_{Feltrino}$ (4558.8±227.27SE) is not significant (p = 0.9).
- Similarly, CoG for $ʃ_{Cadorino}$ (4246.134±228.15SE) and CoG $ʃ_{Feltrino}$ (4372.4±233.41SE) do not display statistical differences: (p = 0.9).

That is, as the interaction *phonelabel*group* for both [s] and [ʃ] is not significant, we could carefully suggest that these two target coronal sounds as produced by the Italian speakers in Veneto *overall* present CoG values that do not differ from the same sounds as produced by the Italo-Australian speakers. In a nutshell, HSs would produce [s] and [ʃ] with the same place of articulation as the control-group speakers.

For Standard Deviation, as well, we found a significant effect of *gender* (p = .0253), *phonelabel* (p <.0001) and a significant interaction *group*dialect* (p = .0358). Similarly to what has been observed for CoG, the difference for *gender* is due to females exhibiting higher SDev values compared to males (female = 2317.9±85.1; male = 2014.7±84.3; p = .0854).

For *phonelabel,* [θ] differs from [s] (p < .0001) and from (p < .0001) with higher SDev values for [θ] (2849.5±103.5SE) compared respectively to [s] (1804.2±103.8SE) and [ʃ] (1845.3±103.7SE). Differently, SDev for [s] is not significantly different from [ʃ] (p = .95). Regarding the single differences and similarities for the three consonants between the two groups (*phonelabel*group*), we found that:

- $\theta_{Control}$ (2720.7±146.5SE) and $\theta_{Ita\text{-}Au}$ (2978.3±146.26SE) do not show statistical differences in SDev (p = 0.8);
- $s_{Control}$ (1880.2±146.9SE) and $s_{Ita\text{-}Au}$ (1728±146.2SE) do not show statistical differences in SDev, as well (p = 0.97);
- Also, $ʃ_{Control}$ (1937.8±147.95SE) and $ʃ_{Ita\text{-}Au}$ (1752.8±145.33SE) are not statistically different in their degree of laminality (p = 0.94).

Below, we show the differences and similarities encountered between the two sub-dialectal varieties (*phonelabel*dialect*):

- SDev for $\theta_{Cadorino}$ (2939.558±146.67SE) is only slightly higher with respect to $\theta_{Feltrino}$ (2759.5±146.11SE) (p = 0.9);
- Concerning [s], there is a marginal difference between $s_{Cadorino}$ (1654.445±148.15SE) and $s_{Feltrino}$ (1953.9±145.57SE) (p = 0.7);
- A marginal difference is also found between SDev for $ʃ_{Cadorino}$ (1691.382±145.7SE) and for $ʃ_{Feltrino}$ (1999.24±147.6) (p = 0.6).

Concerning the *group*dialect* interaction, we find a small effect, whereby Feltrino speakers in Australia exhibit a slightly higher SDev (+562.708±239.43SE) with respect to the intercept's values (3103.086±197.4). Pairwise comparisons between [s] and [ʃ] result non-significant.

Concerning Skewness, all main effects and interactions are non-significant, except for *gender* ($F(1, 2.95) = 6.8925$; $p = .08$) with female speakers having lower Skew values (0.9±0.3) compared to males (1.9±0.3). As for Kurtosis, no significant main effects are found.

The significance detected for the gender effect across the spectral moments (excluding Kurtosis) of the three target fricatives is coherent with a large amount of studies in this domain (see e.g., Jongman *et al*., 2000). Namely, it is widely acknowledged in literature that females have higher values of CoG and lower values of Skew, both indexing a smaller size of their vocal tract, and higher values of SDev. Despite the slight differences showed above, we note the non-significance of the interaction *phonelabel*group* in any spectral moment. This might suggest that *overall* there is no difference in place of articulation (as indexed by CoG and Skew), nor in tongue shape (as indexed by SDev and Kurt) in the target fricatives as spoken by the Italian and the Italo-Australian speakers.

Nonetheless, post-hoc tests carried out on the significant interaction *phonelable*dialect* revealed a difference induced by the local sub-variety (Cadorino *vs* Feltrino) on the spectral properties of [θ] in particular. Specifically, we observed that the interdental fricative of speakers originating from Cadore (both ALM and BCL) displays higher values of CoG, both with respect to speakers originating from Feltre and to Cadorino speakers in Australia. Accordingly, we hypothesized that such dissimilarity at acoustic level could be related to the difference in age of these speakers both compared to Feltre controls and to the HS from the same area. Averagely, controls from Cadore are 60.5 years old while the Italo-Australians born in the same area are 78 years old. On the other hand, the age of speakers originating from Feltre is balanced across groups (Italian control group = 75 years old, Italo-Australians = 74 on average) and such spectral difference does not surface. In light of these data, we could posit: on the one hand, that the local dialect spoken by Italians in Cadore has undergone a subtle change in the last decades, after the Italo-Australians left the region. If on the right track, this could reinforce the hypothesis on native sound maintenance in a non-native environment for the IRIAS speakers; on the other hand – and more likely – we are facing individual/idiosyncratic differences. Nonetheless, the limited number of subjects analyzed in this research hinders to fully assess whether these results are representative of a more general trend or whether they are due to an idiosyncratic linguistic behavior of the two younger Veneto speakers from Cadore. Further research to test the validity of either the first or the second hypothesis is indeed warranted.

Overall, we encountered greater dispersion of values for [θ] as compared to [s] and [ʃ], both across groups and across dialects, which reflects in the fluctuation of both acoustic and statistical values. Compared to values found in the literature for the corresponding English category (Tabain, 2001; Jones & McDougall, 2009), [θ] as spoken by Italian and Italo-Australian speakers exhibits a low intensity and a spread spectrum, as expected for a non-sibilant fricative. Nevertheless, similarly to what has been reported for Australian English - and for other varieties of English, as well (see Jongman *et al.*, 2000) – dialectal [θ] is indexed by a significantly higher SDev with respect to [s] and [ʃ], which corresponds to a higher degree of laminality. Such acoustic behavior is not peculiar: as we observed in Chapter 6, it has already been demonstrated that at cross-linguistic level [θ] displays greater acoustic instability and a greater articulatory variability than sibilant fricatives (see EPG analysis performed by Tabain, 2001).

As already mentioned, our data show that the sibilant fricatives [s] and [ʃ] do not differ for any spectral moment in the dialectal productions of either group of speakers (i.e., Controls *vs* Ita-Aus). From both acoustic values and statistical results, we observe a trend whereby CoG values for [s] approximate those for [ʃ], indicating a clear retraction of [s]. Conversely, as we already described in Chapter 6, experimental studies have demonstrated that AusEng [s] and [ʃ] *do* differ in their spectral moments, with significantly higher CoG values for [s]. Namely, Jones & McDougall (2009) report the CoG of [s] is 7725 Hz and for [ʃ] is 4774 Hz (for female speakers only). In another study (Tabain, 2001), [s] is reported to have a concentration of energy above 7-8 kHz and [ʃ] above 5 kHz (for female speakers only). Moreover, results show that in both groups [s] and [ʃ] are not distinguished by SDev either. Hence, we can claim that: in first place, we witness a merge in place of articulation of [s] and [ʃ] within the control group as a whole; second, that this merge is maintained in the L1 NVen dialect of the HS, even after more than 50 years of contact with Australian English; finally, that either in the dialect of the Italians or in the dialect of the Italo-Australians, the degree of laminality of these two sounds is not sufficiently different. Based on these observations, in §7.3. we will draw final interpretations on HS' linguistic behaviour, in light of the theoretical frameworks so far presented.

7.2 Vowels

In the following section, we will show and discuss results for the acoustic analysis of the seven L1 target vowels [i, e, ɛ, a, ɔ, o, u], which was carried out through the methodology so far illustrated. In the next paragraph, we will report the distribution of tokens across the elicited productions (§7.2.1.); in §7.2.2., we will then present R graphs for each speaker of both control-group and IRIAS informants. as follows:

- a representation of the native vocalic system through dispersion ellipses (F1xF2) with a confidence interval at 68% of equiprobability[183]. All the ellipses were created using the of *plotVowels* function of the *phonR* package (McCloy, 2016) [184];
- an exemplification of vowel ellipses' orientation through the use of vectors representing the trajectory automatically identified for vowel formants (F1 and F2) at 50% of their normalized duration. Vectors were created using the *ggplot* function of the *tidyverse* package (Wickham, 2017)[185];

[183] The choice to use an interval of confidence at 68% for dispersion ellipses was made to provide a compelling representation of the overall vocalic system. Also, avoiding a 95% confidence interval let us exclude outliers that would create numerous overlapping, thusly impeding a clear visualization of the vowel space.

[184] Retrieved from https://cran.r-project.org/web/packages/phonR/phonR.pdf (accessed 10.07.2018).

[185]Retrieved from https://cran.r-project.org/web/packages/tidyverse/index.html (accessed 10.07.2018).

- violin plots[186] for F1 and F2 values computed at 50% of their normalized duration, respectively, which indicate the overall variation along the y-axis and concentration of tokens around the mean. These graphs were created using the *ggplot* function of the *ggplot2* package (Wickham, 2016) [187];
- a general representation grouping overall F1 and F2 trajectories across the 7 temporal points extracted through the ad-hoc-developed Praat script (see Chapters 6, 7 for details). Trajectories were printed using the *ggplot* function of the *tidyverse* package[188].
- results for either raw and normalized vowel duration for both males and females. Raw values for vowel duration were extracted through the same ad-Praat script employed for formant extraction (see Chapters 6, 7 for details). To obtain parameters for the normalization of vowel duration, we adapted the script developed by de Jong & Wempe (2009).

These representations will allow us to compare results either based on group or dialectal sub-system[189], and to draw preliminarly observations from the acoustical results. We will present and discuss results for males. Specifically: Italian control-group males (ALM from Cadore and SPR from Feltre) *vs* Italo-Australian males (GPZ from Cadore and MZN from Feltre); Italian control-group females (BCL from Cadore and RDP

[186] An accurate definition of what a violin plot represents is given by Hintze & Nelson (1998: 191): « [...] *the violin plot includes a boxplot with two slight modifications. First, a circle replaces the median line which facilitates quick comparisons when viewing multiple groups. Secound, outside points which are traditionally classified as mild and severe outliers, are not identified by individual symbols. [...] The violinplot [...] combines the boxplot with density traces. The density trace is plotted symmetrically to the left and the right of the (vertical) boxplot. There is no difference in these traces other than the direction to which they extend*». We chose to employ this type of graphic visualization for vowels because of the greater number of target sounds (with respect to consonants) that we had to consider simoultaneously. Also, since we had to consider a wider set of tokens, we wanted to assess more accurately their concentration and dispersion.

[187]Retrieved from https://cran.r-project.org/web/packages/ggplot2/index.html (accessed 10.07.2018).

[188] It is worth underlining that all these graphs implicitly include a type of normalized duration, as formant quality is detected in all cases at a specified percentage of the segment's duration (either at 50% or along the 7 temporal points). Therefore, we can consider such values as absolute values. On the other hand, specific values for duration in ms were calculated and then reported separately, as we will in-depth discuss in §7.1.3.

[189] In this work, we did not perform normalization on the acoustic values obtained for males and females, respectively. For this reason, we opted to not compare results based on gender, and to carry out acoustic and statistical analyses on the two groups separately.

from Feltre) *vs* Italo-Australian females (CZM from Cadore and ACS from Feltre).

As we already pointed out, possible alterations in the formant patterns of single vocalic elements might occur in Italo-Australian speakers due to their extensive contact with a different phonological inventory, with respect to Italian speakers in Veneto. However, it is conceivable phenomena of CLI may affect not only single categories in contact, but also the overall configuration of the vocalic system. Namely, it has been reported (see Escudero, 2005 and Marusso, 2016) that inventories exhibiting a larger number of vowels, such as AusEng, should cover a larger area in the acoustic space than those with fewer elements (in this case, vowels exhibited by Veneto dialect and Italian). Therefore, according to our predictions, if IRIAS speakers have undergone CLI from AusEng to NVen dialect, such regressive transfer would result in an extension of their vocalic space with respect to that of Veneto control-group speakers. In order to test this hypothesis, we computed specific measurements to evaluate the extension of each speakers' vocalic space. Results will be provided below.

7.2.1 Distribution of vowels

Concerning target vowels, we operated an accurate data selection, based on the parameters described in the previous chapter. Namely, we retained from elicited utterances only stressed vowels in CV contexts within paroxytone words (total number of tokens = 3630). Nonetheless, since the corpus was originally built to collect spontaneous productions of target consonants, we had to deal with an unbalanced distribution of target vowel tokens across informants (see, for instance, ACS *vs* RDP). Such variability was also related to the overall amount of spoken productions, which was consistently higher in two speakers (ACS and MZN) with respect to the others. Moreover, expecially for the oldest informants GPZ and SPR, we had to drop a consistent number of tokens, due to: a bad quality of the signal, unintelligibility of the word, whispering, coughing, and esitations. In light of this, the following observations on the results of the acoustic analyses should be understood as explorative and preliminary to the statistical analysis (which will be presented in Chapter 8). The distribution of target tokens per speaker is summarized in **Table 14**:

		speaker							
		ACS	CZM	BCL	RDP	MZN	GPZ	ALM	SPR
phone	i	110	16	62	23	60	14	37	28
	e	176	43	167	36	146	41	28	37
	ɛ	166	24	126	25	90	22	37	48
	a	278	28	62	33	145	39	71	55
	ɔ	189	32	97	23	122	37	68	45
	o	129	17	42	21	83	10	21	29
	u	96	14	30	18	46	11	19	13

Table 14*: Number of retained tokens grouped by phone and speaker*

The distribution of target tokens per group (Control *vs* Ita-Aus) and dialect (Cadorino *vs* Feltrino) is summarized in **Table 15**:

			dialect	
	group		Cadorino	Feltrino
phone	i	Control	99	51
		Ita-Aus	30	170
	e	Control	195	73
		Ita-Aus	84	322
	ɛ	Control	163	73
		Ita-Aus	46	256
	a	Control	133	88
		Ita-Aus	67	423
	ɔ	Control	165	68
		Ita-Aus	69	311
	o	Control	63	50
		Ita-Aus	27	212
	u	Control	49	31
		Ita-Aus	25	142

Table 15*: Number of retained tokens grouped by phone, group of speakers and by dialect*

After carrying out a refined manual check on target vowels occurring in target contexts, we computed formant analyses for each of these tokens. Results are presented in §7.2.2.

7.2.2 Acoustic analysis: Italian control group vs Italo-Australian Heritage Speakers

Firstly, we illustrate acoustic values of first and second formants for male control-group speakers. In the following **Figure 23**, we find the representation of ALM's vocalic space (male, control group, Cadore):

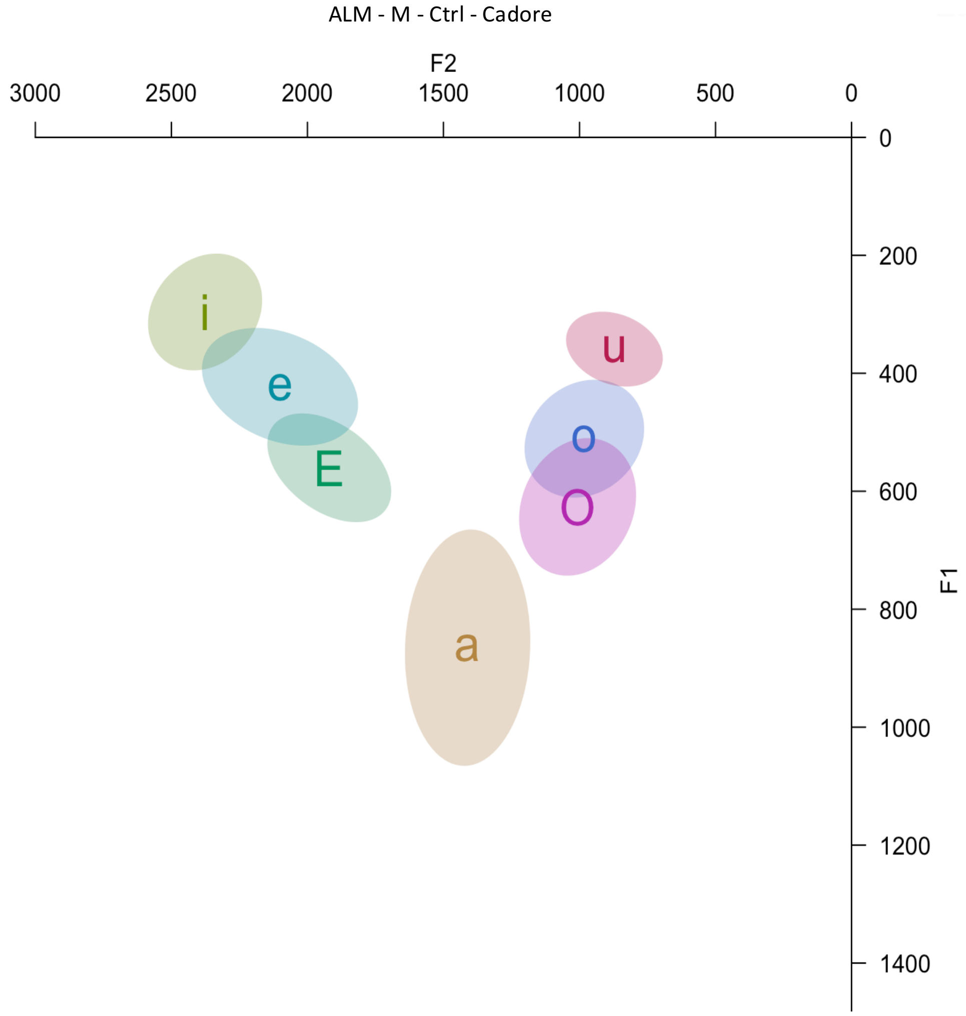

Fig. 23*: Dispersion ellipses in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (ALM, male, control group, Cadore)*

As we can see from the graph, F1 values for [i] appear to be lower and sparser with respect to [u]. Some overlapping occurs between [i] and [e], but not between [o] and [u]. On the contrary, close-mid vowels [e] and [o] present visible overlapping with [ɛ] and [ɔ], respectively. In particular, similarity in F1 values between [o] and [ɔ] is encountered between around 500 Hz and 600 Hz. [a] is visibly distant from the other vowels and shows the greatest dispersion within the overall vocalic space. Its position is low-centered: with respect to the open mid-vowels, it appears to be closer to [ɔ] than to [ɛ]. The orientation of the ellipses is given by the vectors shown in **Figure 24**:

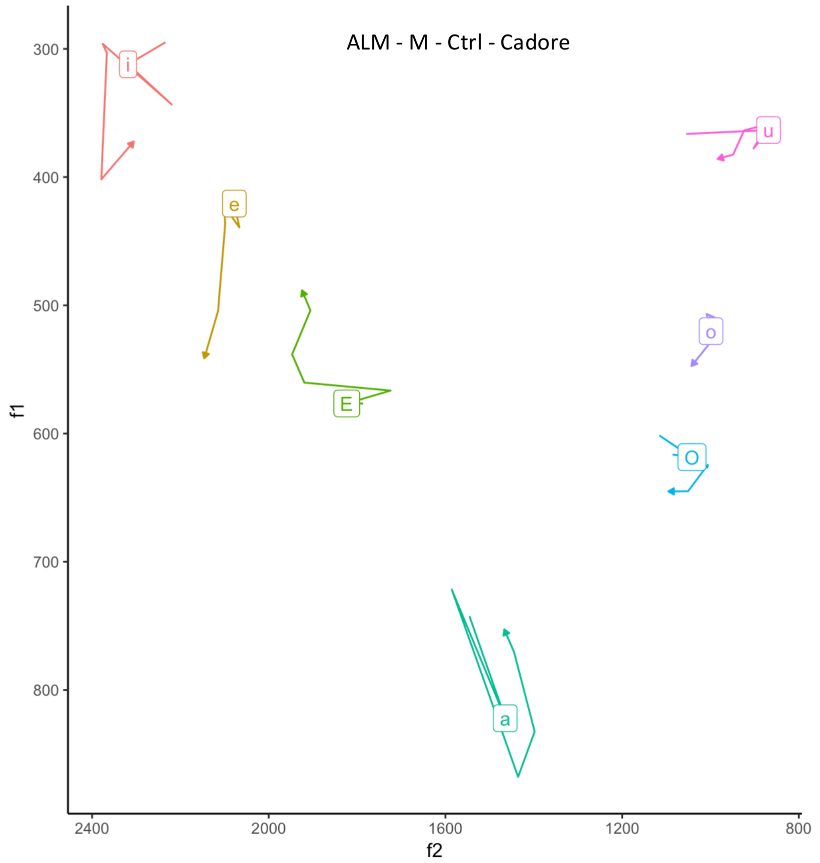

Fig. 24*: Vectors in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (ALM, male, control group, Cadore)*

Vectors show that F1 values for the high-fronted vowel [i] tend to fluctuate between approximately 300 Hz and 400 Hz, while its F2 values are attested between 2200 and 2400 Hz. and that is center-oriented. Differently, F1 values for [e] appear to rise from 380 Hz to 550 Hz, deviating from the center of the vowel space, whereas its F2 values range from 2000 to 2200 Hz, approximately. F1 for [ɛ], on the other hand, seems to advance towards a higher and closer position, fluctuating between about 600 Hz to 500 Hz; at the same time, its F2 tends to rise from 1800 Hz to 2000 Hz, thusly approximating that of [e]. The pattern for [a], on the other hand, is quite different from the other vowels', as we already pointed out. Namely, its F1 oscillates between 700 Hz and 1000

Hz and its F2 oscillates between 1300 Hz and 1600 Hz. Also, [a] shows an upward orientation towards the center. Although they are directed downwards, all the back vowels [ɔ, o, u] are oriented towards the center, as well. In particular, we observe that F1 values for [o] show an increasing trend from 500 Hz to 600 Hz, approaching those of [ɔ]. Conversely, their F2 are comparable, being both comprised - approximately - between 1000 and 1100 Hz.

Next, we illustrate in **Figure 25** the vowel space calculated for SPR (male, control group, Feltre):

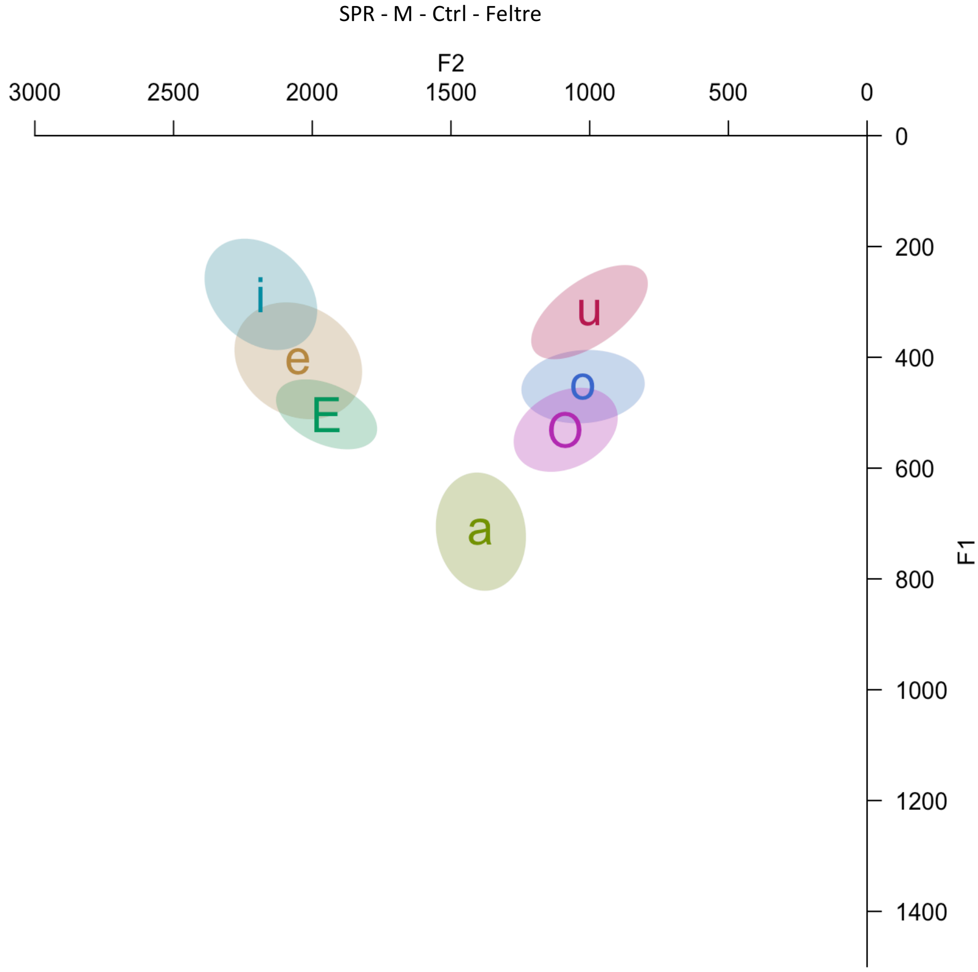

***Fig. 25**: Dispersion ellipses in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (SPR, male, control group, Feltre)*

The ellipse plot for SPR indicates that F1 values for [i] are slightly lower than for [u], and that they significantly overlap F1 values for [e], as also shown in ALM. Some visible overlapping is also encountered between [e] and [ɛ]. For what concerns back vowels, almost no overlapping is present between [u] and [o]. On the contrary, a noticeable overlapping occurs around 500 Hz and 600 Hz between the close-mid vowel [o] and the open-mid vowel [ɔ]. As already observed for ALM, [a] is visibly distant from the other vowels and shows the greatest dispersion within the vocalic space. Its position is low-centered, as well, and appears to be closer to [ɔ] than to [ɛ]. The orientation of the dispersion ellipses is given by the vectors shown in **Figure 26**:

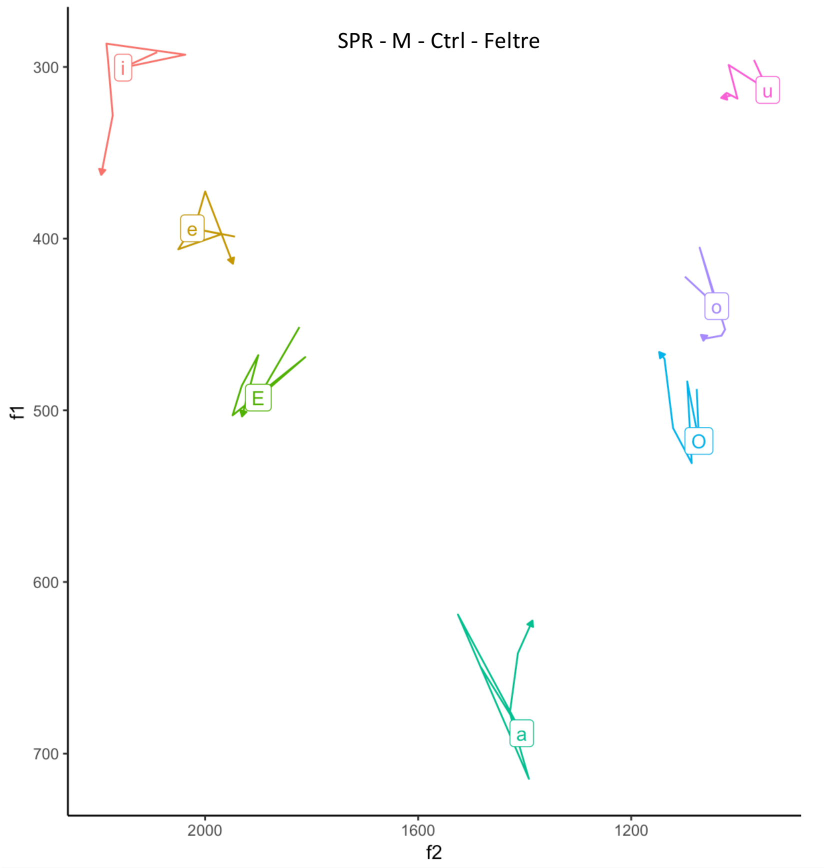

***Fig. 26**: Vectors in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (SPR, male, control group, Feltre)*

The graph shows that F1 values for [i] in SPR spoken productions mainly tend to fluctuate downwards, from approximately 300 Hz to 350 Hz, following a similar pattern compared to productions of ALM, whereas its F2 values are attested between 2000 and 2100 Hz. F1[e]values are comprised - approximately - between 350 Hz and 450 Hz, showing a downward trend towards the center. On the other hand, F1 values for [ɛ] appear to deviate from the center and to approach the same F2 values displayed by [e] (i.e. in the range between 1900 Hz and 2100 Hz). As for ALM, [a] is oriented upwards to the center of the vocalic space, its F1 ranging from about 600 Hz to 750 Hz and its F2 leaning towards lower values (from 1500 Hz to 1300 Hz). Concerning back vowels, [o] and [u] are oriented towards the center, as well. F1 values for [o] show a slightly rising trend from 400 Hz to 450 Hz, approaching those of [ɔ], which are attested around 450-500 Hz. Also, F2 values are noticeably comparable for what concerns [o] and [ɔ], both comprised - approximately – in the range between 1000 and 1100 Hz, similarly to ALM.

Based on the observations so far carried out, we can argue that the male control-group speakers (ALM from Cadore and SPR from Feltre, respectively) generally show a comparable pattern for what concerns the central point identified for vowels' first formants, yet with some exceptions. Detailed results for F1 values for [i, e, ɛ, a, ɔ, o, u] are shown in the following graph[190]:

[190] In the following graphs vowels will be identified through SAMPA coding.

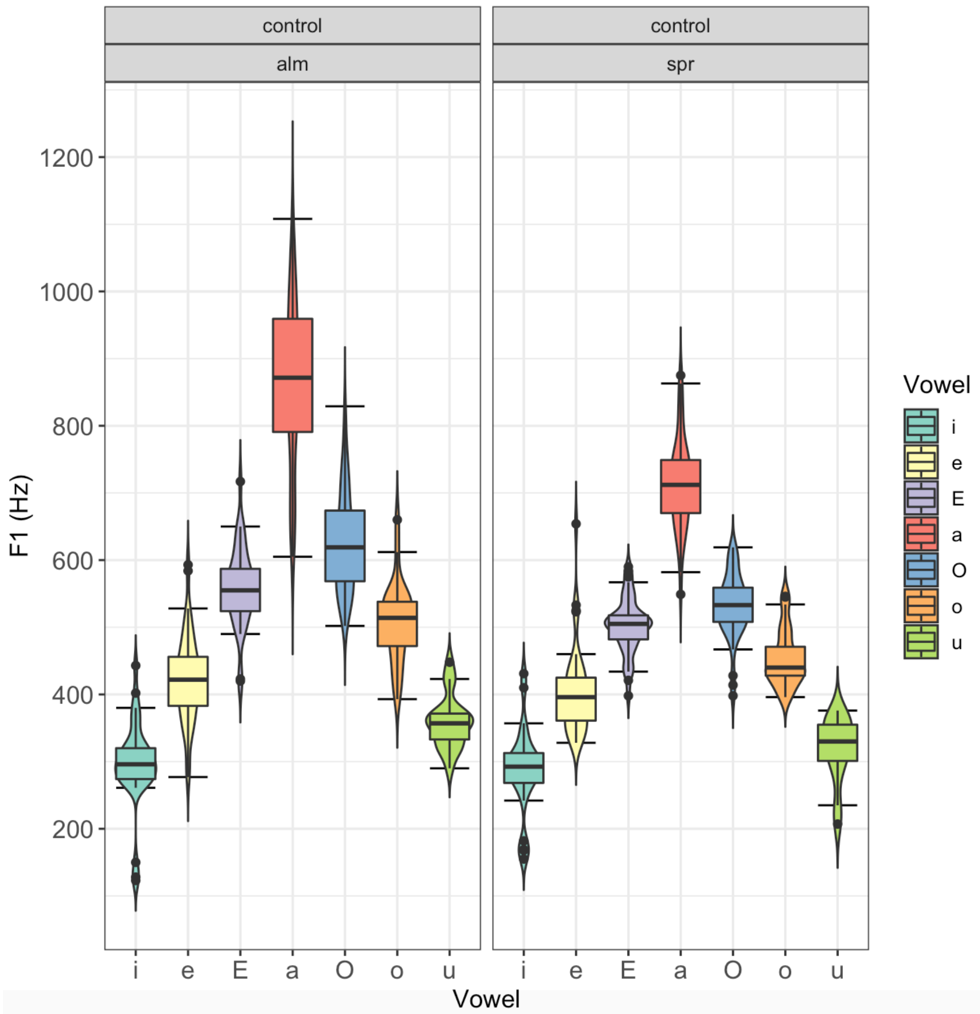

Fig. 27*: Values in Hz computed at 50% of F1 trajectory for [i, e, ɛ, a, ɔ, o, u] for control-group male speakers (ALM-Cadore and SPR-Feltre)*

Specifically:

- [i] ranges from a minimum of 123 Hz to a maximum of 443 Hz for ALM, and from a minimum of 155 Hz to a maximum of 431 Hz for SPR. For both speakers, the graph indicates median values around 300 Hz.
- [e] shows a slightly different range of variation between the two speakers. For ALM, it ranges from approximately 280 Hz to 600 Hz, while for SPR it ranges from 350 Hz and 450 Hz. Median is attested, respectively, at 420 Hz and 400 Hz.
- The minimum value for [ɛ] is about 400 Hz for both speakers. However, SPR show median values at 500 Hz and a maximum value at 596 Hz, while F1 values

of ALM are slightly higher: their median is attested around 550 Hz

- Concerning [a], we observe a notable difference between the two speakers. Within productions of ALM, [a] shows the highest degree of variability with respect to the other vowels. The inter-quartile range goes from 800 Hz to 960 Hz, and the overall range is from 466 Hz to 1108 Hz. On the other hand, productions of [a] for SPR display an inter-quantile range between 680 Hz to 750 Hz, and the overall range from 549 Hz to 875 Hz. Median values are, respectively, at 880 Hz and 700 Hz.
- Similarly, first formant values for [ɔ] are noticeably sparser in ALM than in SPR. For the speaker from Cadore, they are comprised in the inter-quartile range from 580-680 Hz. On the other hand, SPR shows lower (and less sparse) values for the open-mid vowel, with a minimum at 400 Hz and a maximum at 619 Hz. For the speaker from Feltre, the inter-quartile range goes from 500 Hz and 580 Hz. Median values are 600 Hz for ALM and 540 Hz for SPR.
- The minimum F1 value for [o] is around 400 Hz for both male control-group speakers. However, while ALM's median is attested at 550 Hz, SPR's median is around 450 Hz.
- As far as [u] is concerned, for both ALM and SPR F1 values are comprised in an overall range between 300 and 350 Hz. However, once again ALM tokens present a slightly higher frequency, hitting a minimum at 290 Hz and a maximum at 448 Hz, whereas SPR values for [u] are comprised between 207 Hz and 376 Hz. Median values are, respectively, 350 Hz and 340 Hz.

Also for what regards the steady state of second formants, ALM and SPR exhibit an overall similar pattern, as shown in the following graph:

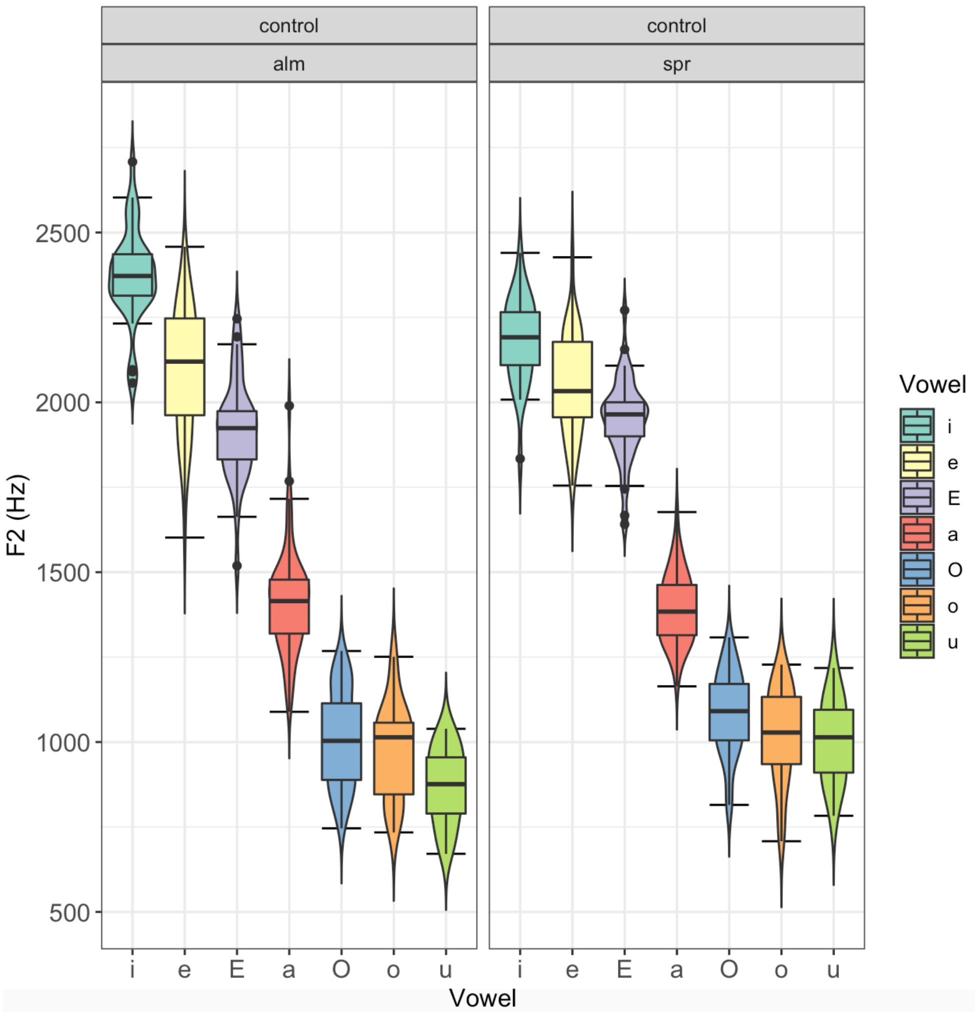

***Fig. 28**: Values in Hz computed at 50% of F2 trajectory for [i, e, ɛ, a, ɔ, o, u] for control-group male speakers (ALM-Cadore and SPR-Feltre)*

From the graph, we observe that:

- As far as [i] is concerned, values for ALM show a rather consistent dispersion, extending from 2057 Hz to 2708 Hz. Nonetheless, it is observable that the inter-quartile range goes from 2200 Hz to 2400 Hz. F2 values for SPR are slightly lower, yet similar for what regards their variability: they overall range from 1834 Hz to 2440 Hz, and their inter-quartile range goes from 2150 Hz and 2500 Hz.
- F2 values for [e] are visibly similar for the two speakers. Specifically, tokens for both ALM and SPR fall between approximately 1750 Hz and 2450 Hz. Their

median values are roughly similar, respectively 2150 Hz for ALM and 2050 Hz for SPR.

- Also, F2 values for the open-mid vowel [ɛ] exhibit a significantly similar behavior in both informants. More precisely, for ALM F2 frequencies range from a minimum of 1519 Hz to a maximum of 2458, while for SPR they are overall comprised between a minimum of 1641 Hz and a maximum of 2427 Hz. At the same time, for both ALM and SPR the inter-quartile range goes from approximately 1800 Hz and 2000 Hz.
- It is quite noticeable that [a] displays similar values across the two male informants from Veneto. Namely, its tokens fall in the inter-quartile range between 1260 Hz and 1500 Hz in both speakers, with a minimum of 1089 Hz in ALM and a minimum of 1164 Hz in SPR. The median is attested at 1400 Hz for both speakers.
- Regarding [ɔ], the F2 pattern indeed appears to be similar in ALM and SPR, with a maximum in both speakers attested around 1400 Hz and a minimum at about 750 Hz and 800 Hz, respectively. Yet, although ALM tokens' second formant values are comprised in the inter-quartile range between 850 Hz and 1100 Hz, values for SPR tokens fall in the inter-quartile range between 1000 Hz and 1150 Hz.
- F2 patterns of [o] are noticeably similar in the two informants, being comprised between a minimum of 734 Hz and a maximum of 1268 Hz for ALM and between a minimum of 708 Hz and a maximum of 1308 Hz for SPR. At the same time, we also discern a visible similarity across F2 single steady states of [o] and [ɔ] in both speakers, since median values are attested in both cases at 1000 Hz. The acoustical correspondence encountered in F2 values for these two vowels, however, is not observable in their F1.
- Concerning [u], its F2 values are slightly lower in ALM (between a minimum of 671 Hz and a maximum of 1139 Hz) than in SPR (between a minimum of 783 Hz and a maximum of 1318 Hz). For the informant from Cadore, the inter-quartile range for second formant values extends from 800 Hz to 950 Hz, while for the

informant from Feltre it extends from 900 Hz to 1050 Hz.

After discussing results for male Veneto informants' vowel utterances, we will henceforth illustrate results for the acoustic analysis performed on male Italo-Australian speakers. In the following **Figure 29**, we provide the representation through dispersion ellipses of GPZ's vocalic space:

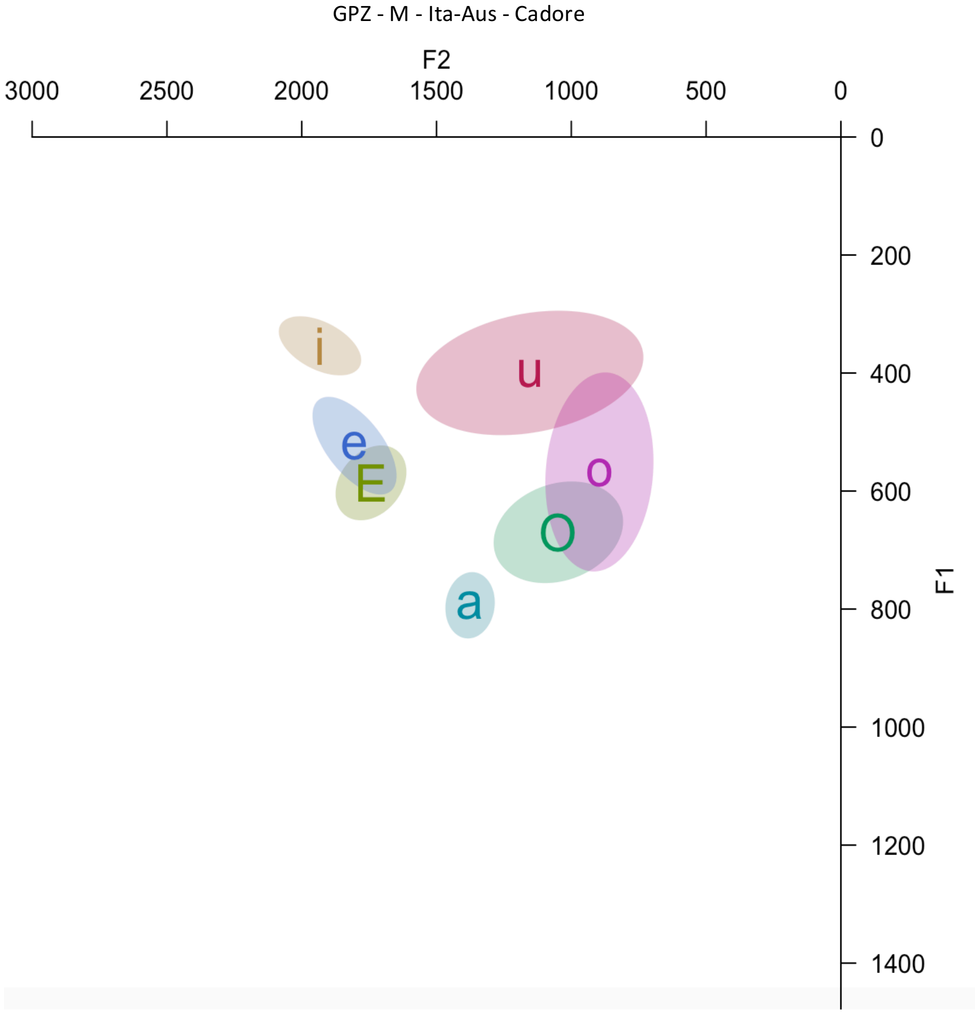

Fig. 29: *Dispersion ellipses in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (GPZ, male, Ita-Aus, Cadore)*

From the ellipse plot, it is evident that the vocalic space of GPZ is rather asymmetric, and indeed not comparable with the space so far identified for Italian vowels. Specifically, the graph indicates that F1 values for [i] are concentrated around 300-350 Hz and that they do not show any area of overlap with [e]. On the other hand, some visible overlapping is encountered between [e] and [ɛ]. Regarding back vowels, [u] presents a marked range of variation, especially in its F2 values: the ellipse is in fact extended along the x-axis, covering a large area between 700 Hz and 1700 Hz, approximately. A partial overlapping is observable also between [u] and [o] around 400 Hz, while a noticeable overlapping of F1 values occurs instead around 600 Hz and 700 Hz between [o] and [ɔ]. [a] is low-centered and presents the smallest dispersion within the vocalic space. Also, it shows no area of contact with other vowels' ellipses, although it is visibly closer to [ɔ] than to [ɛ]. In general, we can claim that the acoustic behavior of GPZ's vowels is indeed thought-provoking, since it does not resemble that of the other speakers so far described. The orientation of the dispersion ellipses is given by the vectors shown in the following graph:

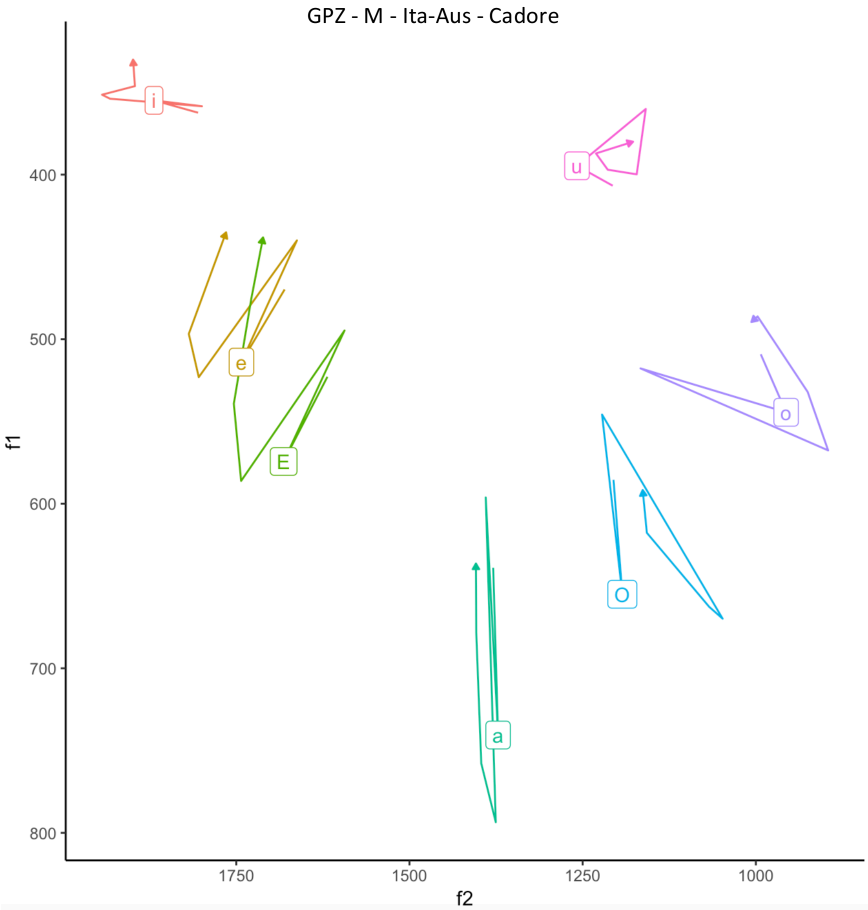

Fig. 30*: Vectors in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (GPZ, male, Ita-Aus, Cadore)*

From the vectors in **Figure 30**, we observe that [i] is well-separated from the close-mid front vowel, showing a trend upwards to lower F1 values. On the other hand, vectors confirm the overlapping described in the previous graph between [e] and [ɛ], which involves F2 values around 1750 Hz. Both vowels are mainly oriented towards lower first formant frequencies. [a] is oriented towards the center of the vocalic space, and fluctuates between 800 and 600 Hz. [ɔ] tends to lower F1 values displayed by [o], while [o] tends to the lower F1 values displayed by [u].

Next, we illustrate in **Figure 31** the vowel space calculated for MZN:

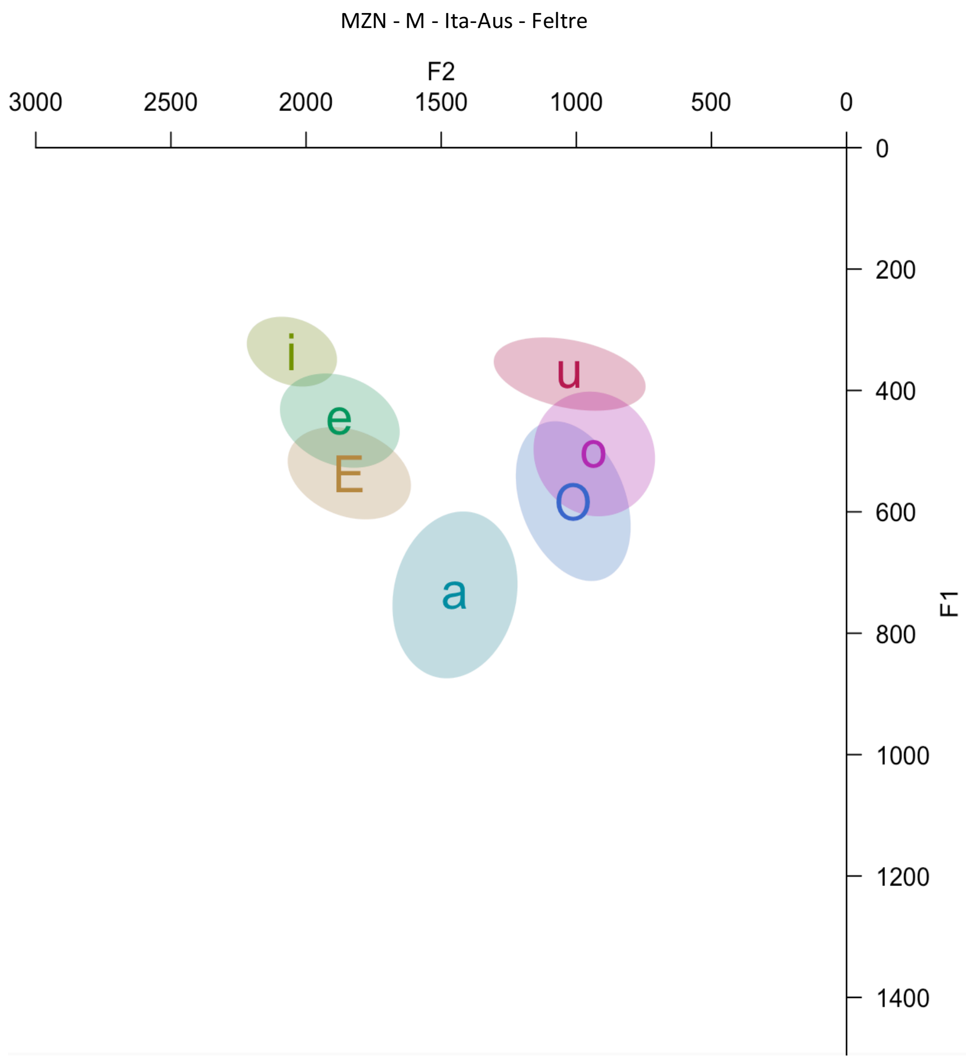

Fig. 31: *Dispersion ellipses in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (MZN, male, Ita-Aus, Feltre)*

With respect to the Italo-Australian male informant from Cadore, the vocalic space computed for MZN shows a more symmetric configuration. The graph indicates that F1 values for [i] are condensed around 300-350 Hz and that they show a very circumscribed area of overlap with [e]. On the other hand, some visible overlapping is encountered between [e] and [ɛ]. For what concerns back vowels, little contact is observable between [u] and [o] around 400 Hz, while a noticeable overlapping of F1 values occurs instead around 500 Hz and 600 Hz between [o] and [ɔ]. [a] is low-centered and shows no area of contact with other vowels' ellipses – yet it appears to be closer to [ɔ] than to [ɛ]. The orientation of the dispersion ellipses is given by the vectors shown in the following graph:

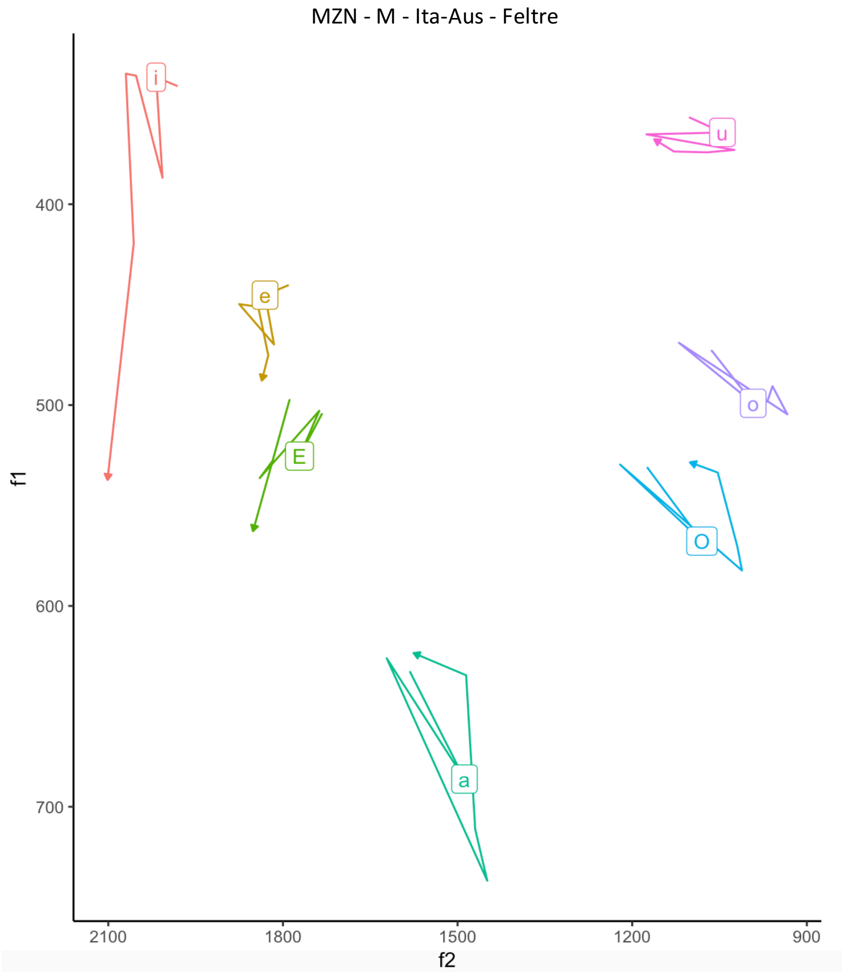

Fig. 32*: Vectors in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (MZN, male, Ita-Aus, Feltre)*

In **Figure 32** we notice a different pattern of dispersion for [i] with respect to the correspondent ellipse plots. Namely, while ellipses show a homogeneous pattern and an evident separation of [i] from [e], vectors clearly show a significant variation for the high vowels' first formant: the orientation is towards higher values. At the same time, [e] is oriented downwards, i.e. towards higher F1 values (from 450 Hz to 500 Hz. approximately): as a result, we notice an overlapping of first formant values between [e] and [ɛ]. [a] is oriented upwards and fluctuates between 800 and 600 Hz. [ɔ] tends to lower F1 values exhibited by [o], with their first formant frequencies overlapping at about 500 Hz. and their second formant frequencies overlapping at around 1000 Hz. Also [u] exhibits increasing F2 values, approximately from 1000 to 1100 Hz. Graphs illustrating values computed at 50% of F1 trajectories for GPZ and MZN are shown below:

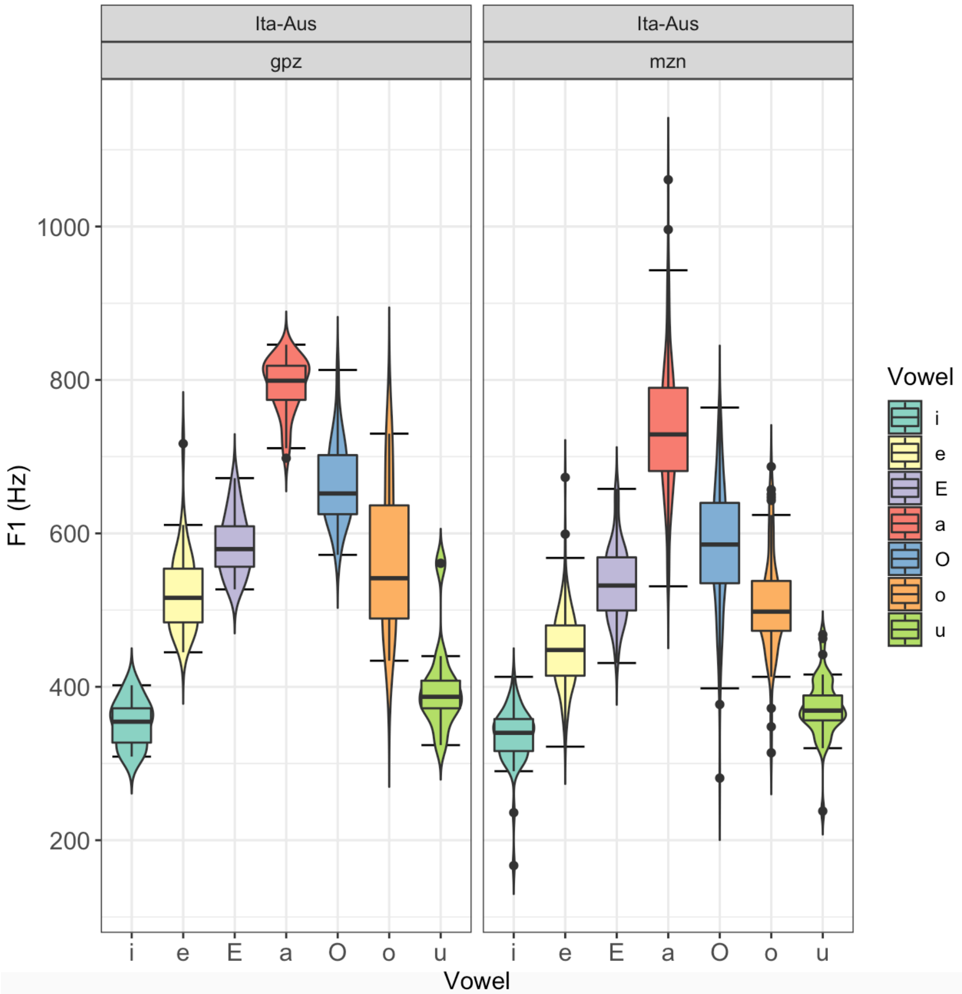

Fig. 33*: Values in Hz computed at 50% of F1 trajectory for [i, e, ɛ, a, ɔ, o, u] for Italo-Australian male speakers (GPZ-Cadore and MZN-Feltre)*

From the graph, we notice that:

- As far as [i] is concerned, values for GPZ are visibly homogeneous, since first formant frequencies concentrate between 320 Hz and 380 Hz. A roughly similar pattern is encountered in MZN. Although in MZN productions we observe the presence of some outliers, the distribution of F1 values for [i] is indeed comparable across the two speakers.
- Regarding F1 values for [e], productions of GPZ are comprised between approximately 490 Hz and 550 Hz, and MZN (median: 510 Hz), while productions of MZN fall in the range between 450 Hz and 480 Hz (median: 450 Hz).
- F1 values for [ɛ] exhibit slightly higher values for GPZ, i.e. between 570 Hz and 600 Hz. For MZN, on the other hand, they are comprised between 500 Hz and 580 Hz. Median values are, respectively, 580 Hz and 530 Hz.
- F1 values for [a] displays more variation in MZN than in GPZ[191]. We observe in fact that for GPZ, values fall between 780 Hz and 820 Hz, while for MZN values spread from 680 Hz to 790 Hz. Median values are, respectively, 800 Hz and 730 Hz.
- Similarly, F1 values computed for [ɔ] appear to be sparser for MZN than for GPZ. For the Italo-Australian informant from Cadore, they display an inter-quartile range from 620 Hz and 700 Hz; differently, for the Italo-Australian informant from Feltre they overall range from a minimum of 314 Hz to a maximum of 687 Hz and concentrate in the inter-quartile between 540 Hz and 640 Hz.
- On the contrary, F1 values for [o] are sparser in GPZ than in MZN. The former exhibits an F1 comprised from 490 Hz to 620 Hz, while the latter exhibits a F1 minimum at 314 and a maximum at 687. For GPZ, median is attested at 500 Hz, while for MZN median is attested at 540 Hz.
- Regarding [u], we observe that F1 values are rather comparable across GPZ and

[191] As we already claimed, for the purposes of this work we did not consider the vowel prosodic context, which instead could be one of the reasons behind such dispersion in F1 values in *all* our speakers (for instance, F1 values for an accented /a/ are generally higher than for an /a/ which instead bears on only lexical stress). This is indeed one of the "drawbacks" of dealing with spontaneous utterances.

MZN. For GPZ, the inter-quartile range goes extends from 380 Hz to 405 Hz, while for MZN it extends from 350 Hz and 390 Hz. Median values are therefore roughly similar (around 380 Hz and390 Hz, respectively).

In the following graph, we will instead compare values computed at 50% of F2 trajectories for GPZ and MZN:

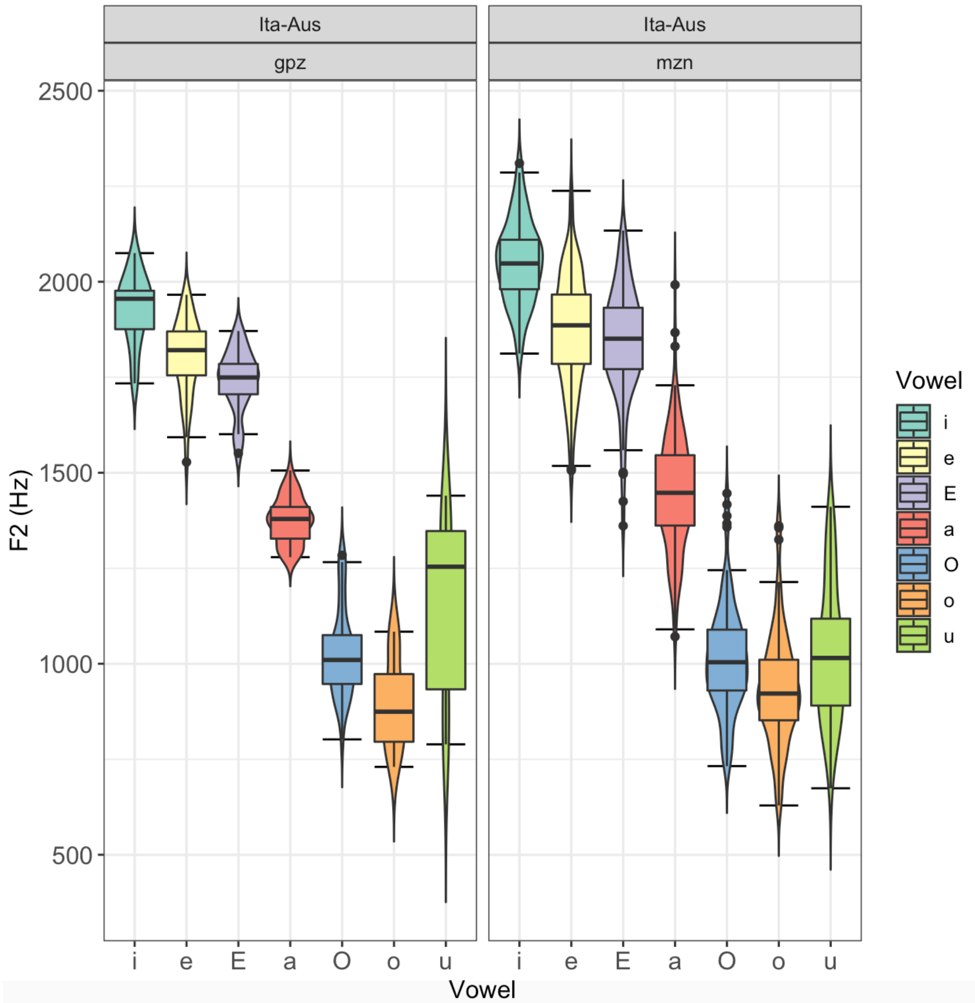

Fig. 34: *Values in Hz computed at 50% of F2 trajectory for [i, e, ɛ, a, ɔ, o, u] for Italo-Australian male speakers (GPZ-Cadore and MZN-Feltre)*

The graph above indicates that:

- Regarding F2 values for [i], most values concentrate between a minimum of 1734 Hz and a maximum of 2077 Hz for GPZ, while more dispersion in encountered in MZN. For the Italo-Australian informant for Feltre, they range in fact from a minimum of 1812 Hz to a maximum of 2310 Hz. Medians are attested at 1900 Hz and 2100 Hz, respectively.

- F2 values for [e] exhibit in MZN productions an inter-quartile range from 2000 Hz to 2200 Hz, for GPZ they are comprised between 1850 Hz and 1950 Hz. Median values are 1900 Hz for GPZ and 2100 Hz for MZN.
- Again, more variability is encountered in F2 values for [ɛ] in productions of MZN with respect to those of GPZ. For GPZ, they range from 1740 Hz to 1761 Hz (median at, while for MZN they are comprised between 1760 Hz and 1950 Hz (median at 1850 Hz).
- As already shown in the previous graphs, F2 values for [a] are indeed condensed for GPZ, being comprised between 1300 Hz and 1400 Hz. Differently, MZN shows a visible variation, with an inter-quartile range from 1370 Hz to 1530 Hz.
- Concerning [ɔ], instead, F2 values of the two speakers appear comparable. For both male Italo-Australian informants, medians are attested at 1000 Hz.
- Likewise, F2 values detected for [o] are slightly sparser in MZN than in GPZ, yet they reproduce the same pattern. F2 is comprised from 800 Hz to 950 Hz for GPZ, while for MZN it ranges from 850 Hz to 1000 Hz. Medians are in both cases around 900 Hz.
- Regarding [u], F2 values are quite sparse GPZ. For this speaker, F2 minimum and maximum are attested, respectively, at 789 Hz and 1440 Hz, while for MZN they are attested at 674 Hz and 1411 Hz. Median values are attested at 1250 Hz for GPZ and at 1000 Hz for MZN.

From the graphs described above, we observe that GPZ presents an overall asymmetry in his vocalic system, with respect either to the male control-group speakers, and to MZN. In particular, [a] and [u] display a thought-provoking pattern. Namely, F1 and F2 values for the low central vowel show very little dispersion, as already observed in the ellipse pattern. This could be due to (at least) one of the following factors, according to the hypotheses so far formulated:

- Unbalanced number of tokens. As shown in **Table 15**, we retained far fewer tokens produced by GPZ with respect to tokens produced by MZN. Accordingly, it is conceivable that the higher the number of tokens, the higher the dispersion of values would be. Also, we remind that the prosodic context might be unbalanced[192]. In order to overcome data skewness, we carried out specific statistical analyses, which we will present in the following paragraph.

- Cross-linguistic influence occurring from AusEng to NVen dialect. Another possibility is that this acoustic behaviour could be an effect of regressive transfer from AusEng, as hypothesised in Chapter 6. Specifically, the presence of a phonetic/phonological category in low-back position ([ɐ]) in the L3 inventory would prevent values for [a] from "expanding" backwards. In other words, a greater dispersion of values would hinder the inter-category variation. In account to this, we can formulate a more general prediction: in order to maintain maximal distance between vowels, trilingual speakers' phonetic realizations of a single class of tokens might be more precise with respect to those of Italian speakers. Correspondingly, greater variability could be encountered within a single class of a given Italian vowel, since the smaller number of elements would allow intra-category variation without violating the sufficient contrast criterion. In account to this, we remind the crucial contribution of the Dispersion Theory and of its further developments (DT: Liljencrants & Lindblom, 1972; Lindblom, 1986) in developing the criterion of "maximal perceptual contrast" for vowel systems: according to DT, speech sounds must be *easy to distinguish* in order to allow phonological contrasts[193];
- Idiosyncratic behaviour of the speaker. Also, it is plausibile that the pattern encountered in GPZ productions could represent the peculiarity of a single speaker, rather than a general trend. It follows that, in this case, such little dispersion for [a] could be unrelated to phenomena of CLI occurring from AusEng on NVen.

[192] Namely, GPZ could present stressed rather accented vowels.

[193] See also Marusso, 2016 for a discussion on DT in late bilinguals' vowel inventories.

On the other hand, [u] exhibits a wide range of variation for what concerns second formant frequencies. In this respect, it is worth recalling that literature reports the following mean F2 values for [u] in SI and AusEng[194], respectively: 789 Hz for male speakers of SI; 1736 Hz for male speakers of AusEng. As reported in **Appendix**, instead, mean and median for GPZ are, respectively, 1153 Hz and 1250 Hz. Also, the AusEng inventory shows [ʊ] in mid-high back position, with a mean value of 991 Hz (Elvin, Williams & Escudero, 2016).

As already observed for [a], the interesting pattern of [u] exhibited by GPZ could be either due to numerically unbalanced data with respect to MZN, or to an idiosynchratic behaviour of the speaker. Yet, data suggest an alternative scenario, since dispersion is encountered mainly in the front-back dimension. Accordingly, we can postulate that L1 [u] in productions of GPZ might have undergone CLI from the correspondent categoris existing in AusEng, namley: [ʉ] and [ʊ], which instead display higher F2 values (Elvin, Williams & Escudero, 2016). Moreover, as hypothesized in Chapter 6, another possibility is that subtle changes in L1 [u] uttered by HS could undergo the influence of the diphthongization process typical of the Broad variety of AusEng. In this case, formant values for [u] would mirror a fronting to [əːʉ], which would result in a progress of F2 from lower to higher values. This pattern has been already observed at preliminary level in the description of the vector graph in **Figure 30**. Eventually, this possibility will be explored by comparing graphical representations of HS' vowel trajectory to that of control-group male informants, and through statistical analyses.

In the following graphs, we will instead illustrate acoustic values of first and second formants for female control-group speakers. In the following **Figure 35**, we find the representation of BCL's vocalic space (control female from Cadore):

[194] As already reported in Chapter 6, in the phonological description given by Mitchell & Delbridge (1965), this category is represented as /u/, while subsequently Wells (1982), Clark (1989) and Cox & Palethorpe (2001) introduced the diacritic /ʉ/.

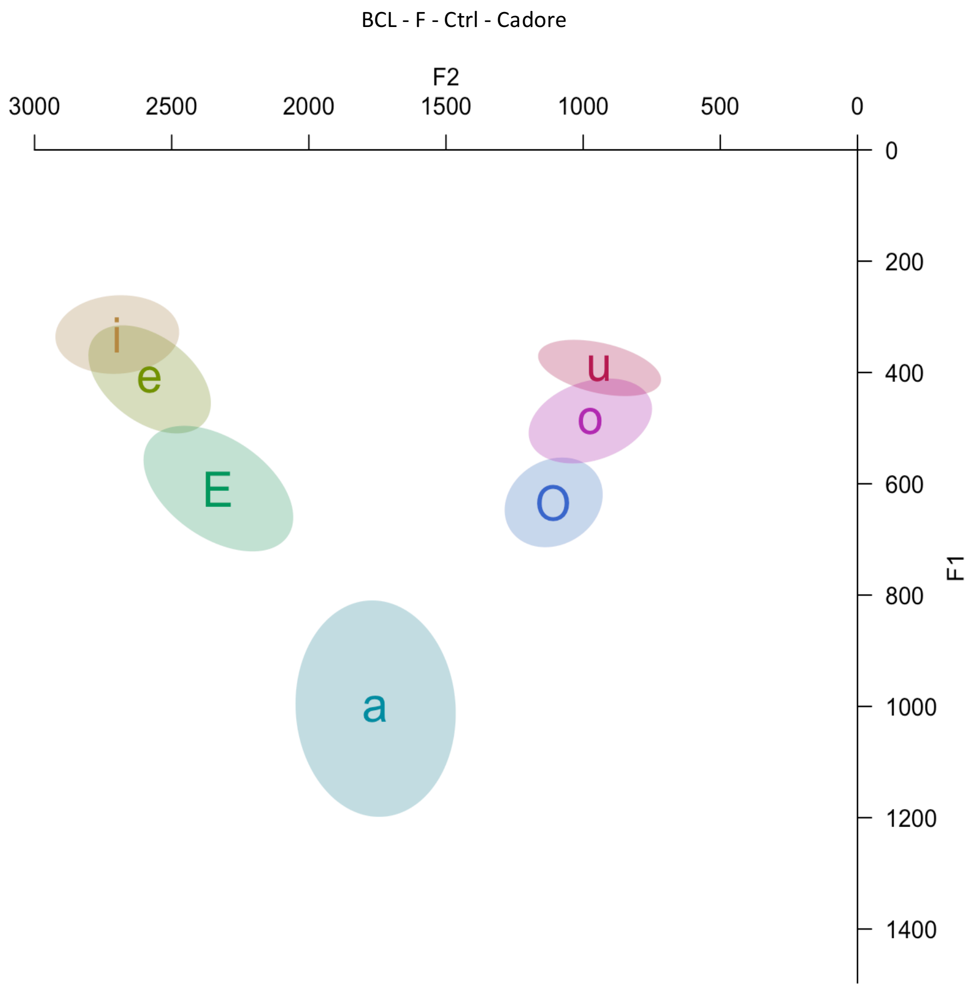

Fig. 35*: Dispersion ellipses in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] BCL (female, control group, Cadore)*

The ellipses show that F1 values for [i] appear to be slightly lower with respect to [u]. Some overlapping occurs between [i] and [e], and we also observe some areas of contact around 400 Hz between [u]and [o]. Front vowels [e] and [ɛ] do not present any overlapping, although they are adjacent; similarly, back vowels [o] and [ɔ] are contiguous, yet visibly distinguishable. Additionally, close-mid vowels [e] and [o] do not present overlapping with mid-open [ɛ] and [ɔ], respectively. [a] is visibly distant from the other vowels and shows the greatest dispersion. Its position is low-centered and equally distant from open-mid [ɛ] and [ɔ]. In general. vocalic space of BCL appears to be quite symmetric. The orientation of the ellipses is given by the vectors shown in **Figure 36**:

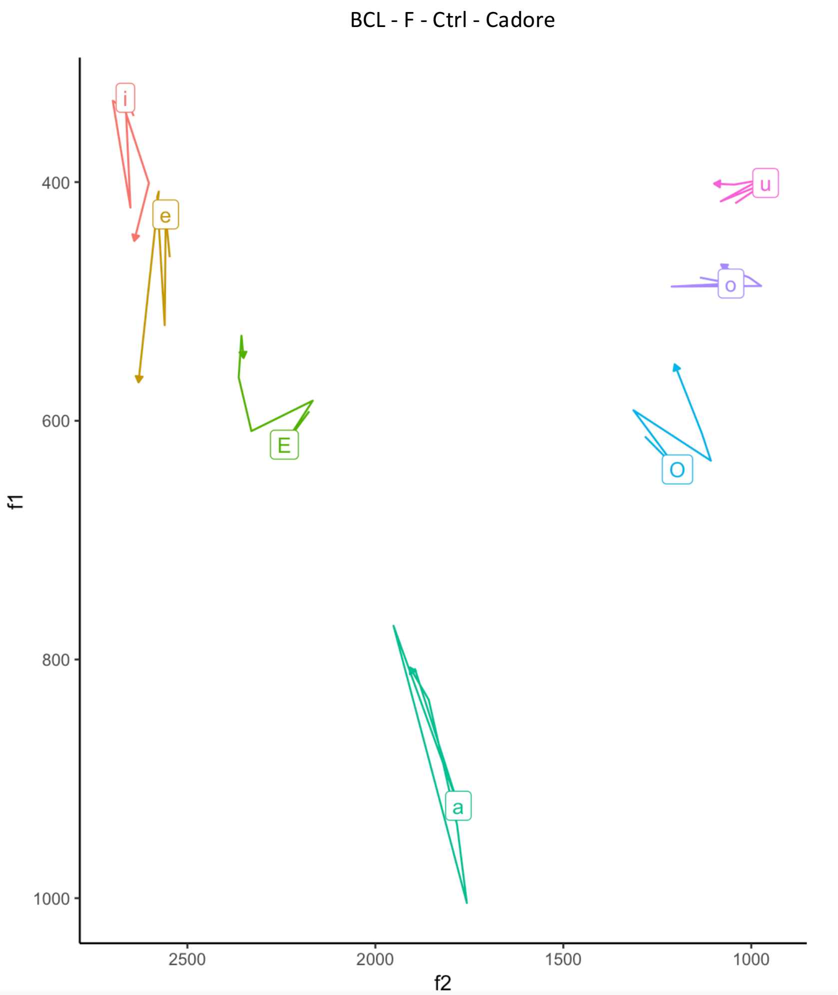

Fig. 36: *Vectors in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] BCL (female, control group, Cadore)*

The graph shows that F1 values for [i] in BCL spoken productions are mainly oriented downwards and tend to increase from approximately 350 Hz to 450 Hz, while F2 values are attested between 2500 and 3000 Hz. F1 values computed for [e] are visibly close to those of [i], as it has been already pointed out in the ellipse description, yet they show a downward trend. On the other hand, F1 values for [ɛ] are oriented towards center and show clearly lower F2 values with respect to the close-mid vowel (2000-2500 Hz *vs* 2500-2750 Hz. respectively). [a] is oriented upwards to the center of the vocalic space. Its F1 ranges from about 800 Hz to 1000 Hz. while its F2 is comprised between 1750 Hz and 2000 Hz). Concerning back vowels, [o] and [u] are oriented towards the center and show a direction towards higher F2 values (approximately from 800-900 Hz towards 1200 Hz). On the other hand, F1 values for [ɔ] show a slight decrease in F1 values (from 700 Hz to 600 Hz): it means that this vowel tends to approach values displayed by [o].

Next, we illustrate in **Figure 37** the vowel space calculated for RDP (control female from Feltre):

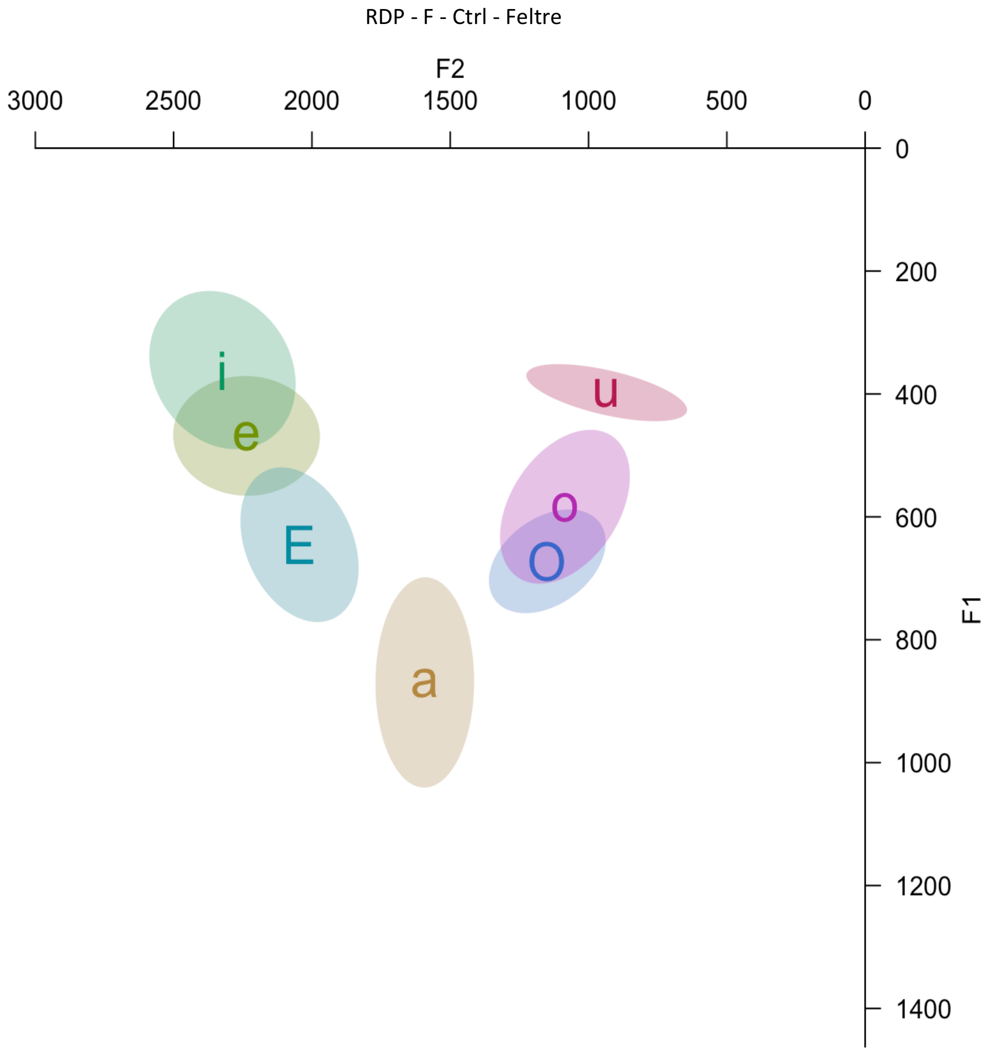

Fig. 37: *Dispersion ellipses in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (RDP, female, control group, Feltre)*

The ellipses drawn in **Figure 37** show that F1 values for [i] are noticeably lower with respect to [u]. A considerable overlapping occurs between [i] and [e], and we also observe some areas of contact between [e] and [ɛ], around 500 Hz. [u] does not display a remarkable variation along the y-axis, while its tokens are sparser for what concerns F2 values. Also, no area of contact is identified between [u] and [o]. Conversely, [o] and [ɔ] display a significant overlapping between 600 Hz and 700 Hz. As it has been observed for BCL, [a] is clearly distant from the other vowels. Its position is low-centered and equally distant from open-mid [ɛ] and [ɔ]. In general, we can claim that RDP presents a smaller vocalic space with respect to the other female control-group informant, resulting in more overlapping. The orientation of the ellipses is provided by the vectors shown in the following **Figure 38**:

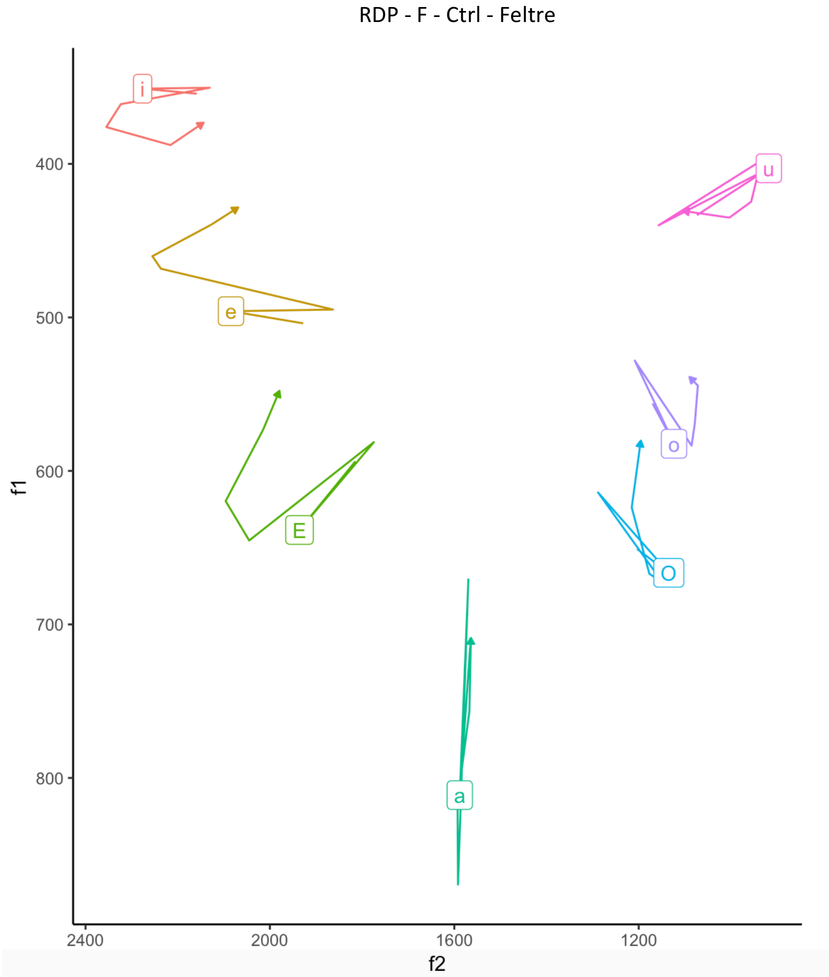

Fig. 38*: Vectors in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (RDP, female, control group, Feltre)*

Vectors show that F1 values for [i] in RDP spoken productions are mainly oriented towards the center and towards values exhibited by [e]. At the same time, [e] converges towards higher F2 values (from 2000 Hz to 2300 Hz): this trend results in an overlapping of F2 values with the high-front vowel. Some proximity is also identified between [e] and [ɛ]. Vectors of both these vowels are directed towards lower values of F1 and to higher values of F2: at articulatory level, this corresponds to an overall orientation towards the front. [a] is oriented upwards to the center of the vocalic space and does not show variation along the x-axis, while its F1 ranges from about 1000 Hz to 700 Hz. As far as back vowels are concerned, [u] clearly shows a direction towards higher F2 values (approximately from 700 Hz towards 1300 Hz), similarly to what has been identified for BCL. Finally, it is evident that ellipses' overlapping is due to the tendency of [ɔ] to resemble values exhibited by [o]. This corresponds to a decrease in F1 values (from 700 Hz to 600 Hz): such pattern is indeed comparable to the one identified for back vowels in BCL.

Based on the description of these graphs, it is possible to claim that female control-group speakers (BCL from Cadore and RDP from Feltre, respectively) show a comparable pattern for what concerns the central point identified for vowels' first formants and the direction of the dispersion ellipses. Nonetheless, we expect a noticeable variation in productions of [a] with respect to the other vowels. Detailed results for F1 values for [i, e, ɛ, a, ɔ, o, u] are shown in the following graph:

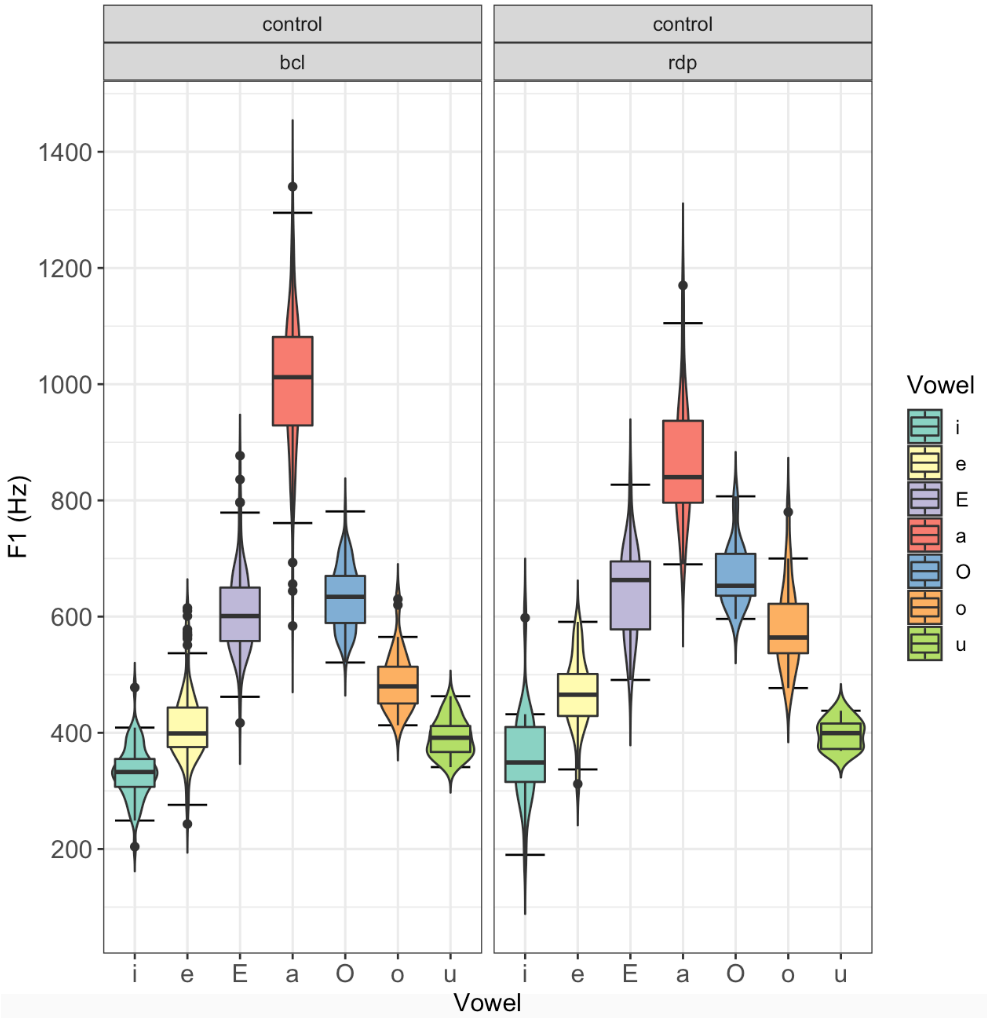

Fig. 39*: Values in Hz computed at 50% of F1 trajectory for [i, e, ɛ, a, ɔ, o, u] for control-group female speakers (BCL-Cadore and RDP-Feltre)*

From the violin plots. we can observe that:

- [i] ranges from a minimum of 200 Hz to a maximum 478 Hz for BCL, and from a minimum of 190 Hz to a maximum of 598 Hz for RDP. For BCL, the inter-quartile range goes from 300 Hz to 350 Hz, while for RDP it extends from 300 Hz to 400 Hz. Median is attested at 320 Hz and 340 Hz, respectively.
- Patterns of variation for [e] are similar across the two speakers, although there are some differences for what concerns the concentration of values. For BCL, F1 ranges from a minimum of 243 Hz to a maximum of 615 Hz, with median attested at 400 Hz, while for RDP it ranges from 312 Hz to 591 Hz, with median attested

at 450 Hz.

- Concerning [ɛ], the pattern displayed by female control-group informants is indeed comparable. The minimum values exhibited by BCL and RDP are 417 and 491, respectively, while their maximum values are attested at 877 Hz and 827 Hz. Median values are, respectively, at 600 Hz and 680 Hz, respectively.
- [a] is the vowel that shows the highest degree of variation across the two subjects. Specifically, in BCL it ranges from 584 to 1340, resulting in a consistent extension of the ellipse in the vocalic space, as underlined above. Differently, it shows less sparseness in RDP, since it ranges from 690 Hz to 1170 Hz. Concerning medians, they are attested, respectively, at 1000 Hz and 850 Hz.
- Similarly to what has been illustrated for the front open-mid vowel, first formant values for [ɔ] are comparable across the two informants. For the female speaker from Cadore, tokens display an inter-quartile range between 600 Hz and 680 Hz. For the female speaker from Feltre, tokens are included in an inter-quartile range from 640 to 700 Hz. In both cases, median is attested at 650 Hz.
- The minimum F1 value for [o] is attested at 413 Hz for BCL and at 477 Hz for RDP. However, while BCL's values exhibit an inter-quartile range from 450 Hz and 500 Hz, RDP's values are concentrated between 550 and 620 Hz. As it has been highlighted in the descriptions of both ellipses and vectors, RDP's productions of [o] are more similar to values displayed by the open-mid vowel than those of BCL.
- As far as [u] is concerned, F1 values in both speakers are homogeneous and concentrated in an inter-quartile range between 350 and 40 Hz. It is evident that their configurations show a very high degree of similarity.

Graphs illustrating values computed at 50% of F2 trajectories for BCL and RDP are shown below:

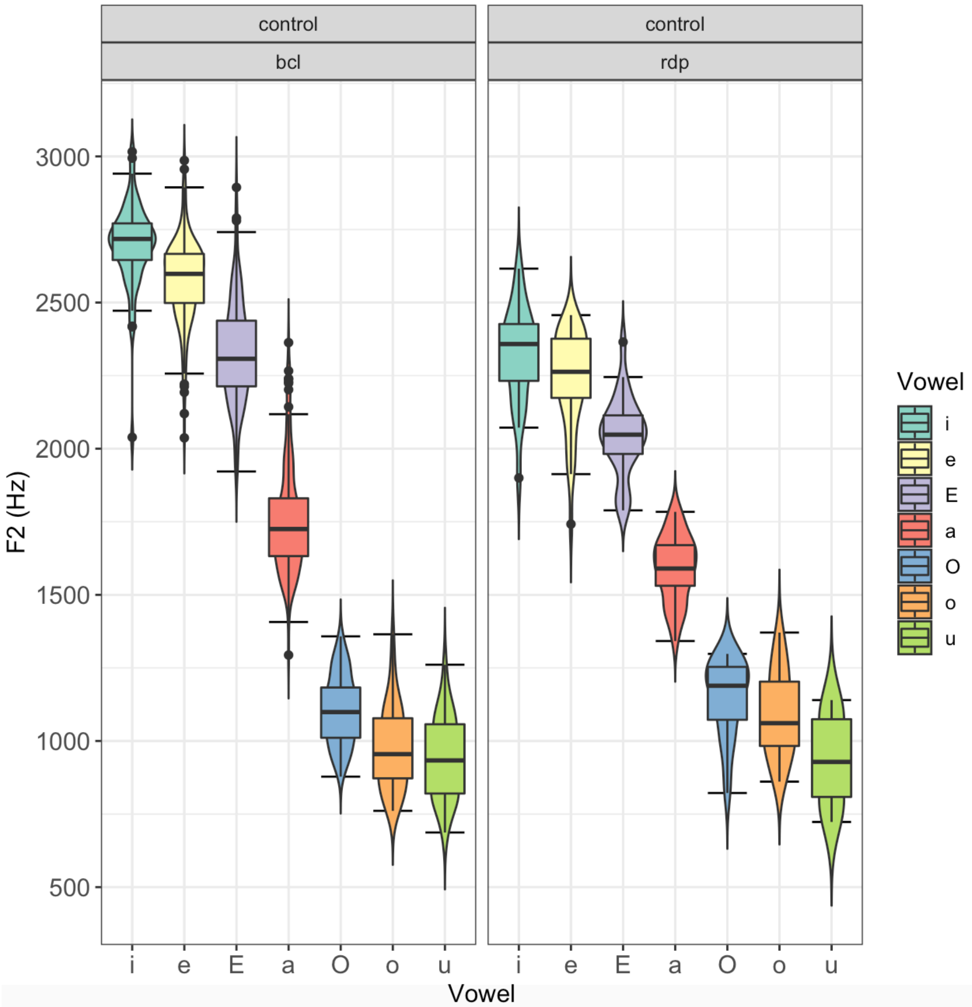

Fig. 40: *Values in Hz computed at 50% of F2 trajectory for [i, e, ɛ, a, ɔ, o, u] for control-group female speakers (BCL-Cadore and RDP-Feltre)*

From the violin plots. we can extrapolate the following considerations:

- [i] shows higher frequencies in productions of BCL than in those of RDP, since its median is attested at 2750 Hz for the informant from Cadore and at 2400 Hz for the informant from Feltre.
- F2 values for [e] generally resemble those of [i] for both speakers. Specifically: in BCL they exhibit and inter-quartile range from 2500 to 2700 Hz; in RDP, on the other hand, they concentrate between approximately 2200 Hz and 2450 Hz. Median values are, respectively, 2600 Hz and 2250 Hz.
- Concerning [ɛ], we notice some discrepancy across the two informants for what regards its distribution, especially in high frequencies. More precisely, for BCL F2 frequencies cover a range of approximately 1000 Hz (i.e. from a minimum of

1922 Hz to a maximum 2894 Hz), while for RDP they fall between a minimum of 1789 Hz and a maximum of 2365 Hz. Respectively, they exhibit an inter-quartile range from 2250 Hz and 2450 Hz and between 2000 Hz and 2100 Hz.

- F2 values for [a] in BCL's productions display an inter-quartile range between 1650 Hz and 1800 Hz, while in RDP they are concentrated between 1500 Hz and 1650 Hz.
- Regarding [ɔ], the F2 pattern of the two speakers appears to be similar. Lowest values for BCL and RDP are 878 Hz and 822 Hz, while highest values are attested at 1358 Hz and at 1298 Hz, respectively. For the speaker from Cadore, median is attested at 1100 Hz, whereas for the speaker from Feltre it is attested at 1200 Hz.
- F2 patterns of [o] are also quite similar in the two informants, being comprised in an inter-quartile range between 900 Hz and 1100 Hz for BCL and between 1000 Hz and 1200 Hz for RDP. As we already pointed out above, values for [o] and [ɔ] present significant overlapping in the female speaker from Feltre. Median is attested at 950 Hz and 1100 Hz, respectively.
- Regarding [u], we observe that its F2 values, as well, are very similar in BCL and RDP. In both cases, median values are at 950 Hz.

In the following graphs we will instead illustrate acoustic values of first and second formants for female Italo-Australian speakers. In **Figure 41**, we provide the representation of CZM's vocalic space (Ita-Aus from Cadore):

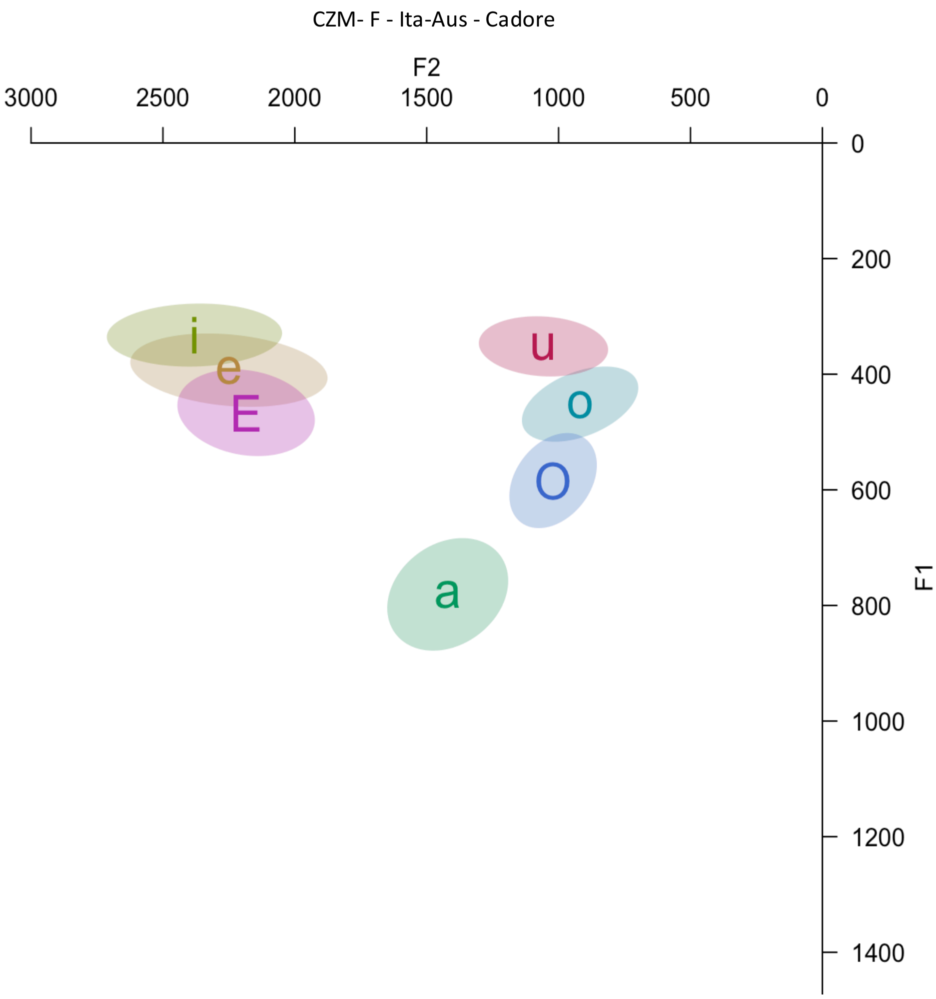

Fig. 41: *Dispersion ellipses in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (CZM, female, Ita-Aus, Cadore)*

The ellipse plot indicates that F2 values for [i] show evident variation, ranging from 2000 Hz to 2750 Hz, approximately, whereas F1 fall between 250 Hz and 350 Hz. We observe overlapping between [i] and [e], and [e] and [ɛ], respectively. Also, F1 values for all the three vowels are condensed in a relatively small area, i.e. from 250 Hz to 500 Hz; overall, they are quite distant from [a]. Consequently, the central vowel is closer to [ɔ]. Concerning back vowels, no overlapping occurs, either between [u] and [o] or between [o] and [ɔ]. In the following graph, we will illustrate the orientation of dispersion ellipses through vectors, as follows:

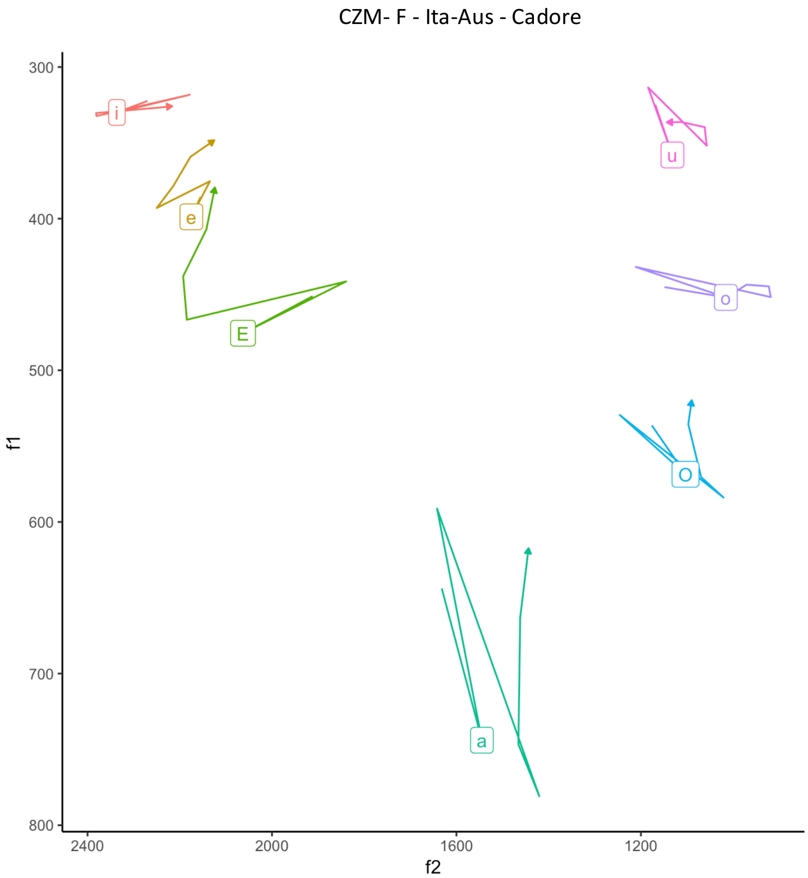

Fig. 42: *Vectors in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (CZM, female, Ita-Aus, Cadore)*

As already observed, [i] shows more variation along the x-axis than along the y-axis. Namely, its F2 values tend to vary more than F1 values: they mainly tend to decrease, being oriented towards the center of the vocalic space. Also, F1 values for [e] tend to decrease and approximate those of [i]; similarly, F1 values for [ɛ] are oriented towards those of [e]. [a] is oriented upwards, towards F1 and F2 values exhibited by back vowels. Its F1 mainly oscillates between 800 and 60 Hz. Regarding back vowels, [u] and [o], their orientation is not easily identifiable. [ɔ], on the other hand, is visibly oriented towards F1 values displayed by [o].

In the following **Figure 43,** we find the representation of ACS's vocalic space (Ita-Aus from Feltre):

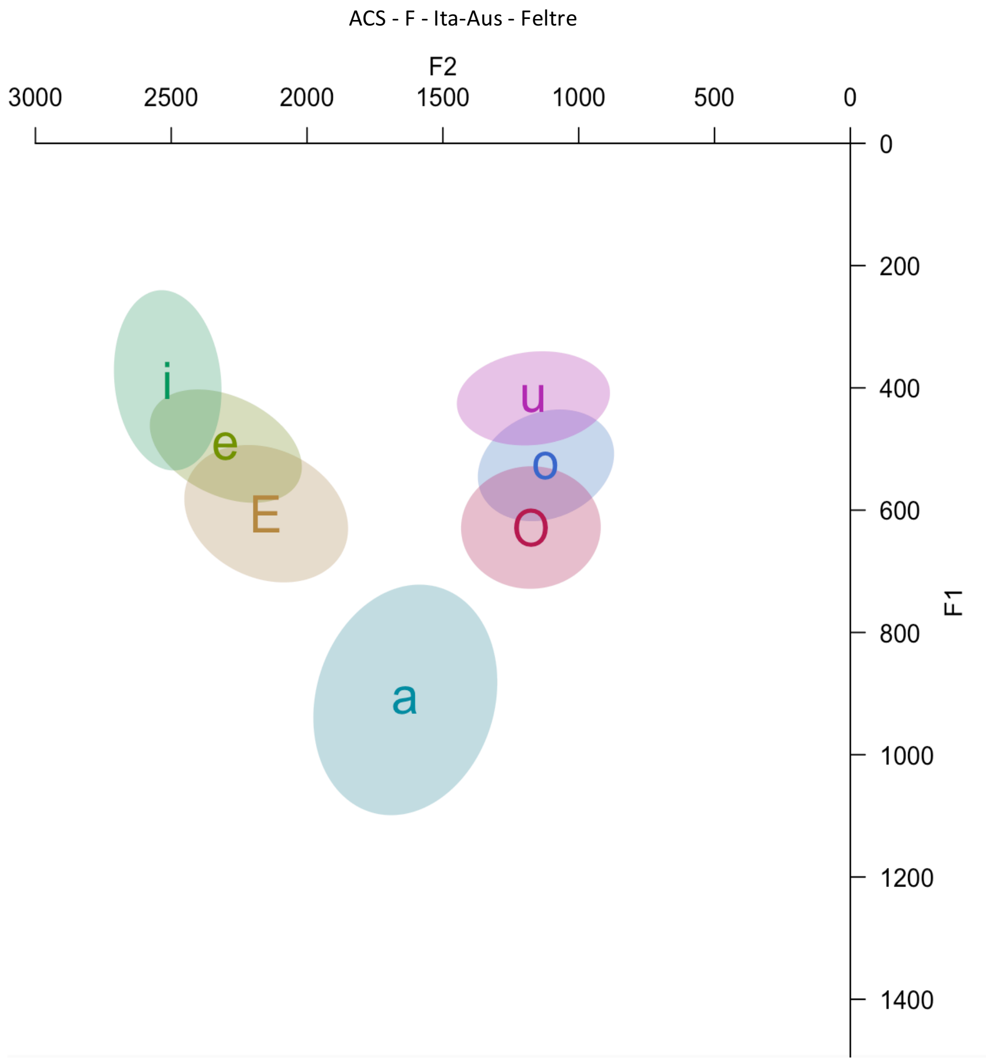

Fig. 43: *Dispersion ellipses in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (ACS, female, Ita-Aus, Feltre)*

The ellipse plot drawn for ACS illustrates that F1 values for [i] are visibly more dispersed along the y-axis with respect to control-group female speakers, with an F1 ranging from 200 Hz 500 Hz. Also, [i] significantly overlaps F1 and F2 values for [e], respectively around 500 Hz and 2500 Hz. Evident overlapping is also present between [e] and [ɛ]. Regarding back vowels, overlapping occurs both between [u] and [o] and between [o] and [ɔ]. Differently, the low-centered vowel [a] shows no area of contact with the other elements, neither with front nor with back vowels. Its position is equally distant from [ɔ] and [ɛ]. The orientation of the dispersion ellipses is given by the vectors shown in **Fig. 44** below:

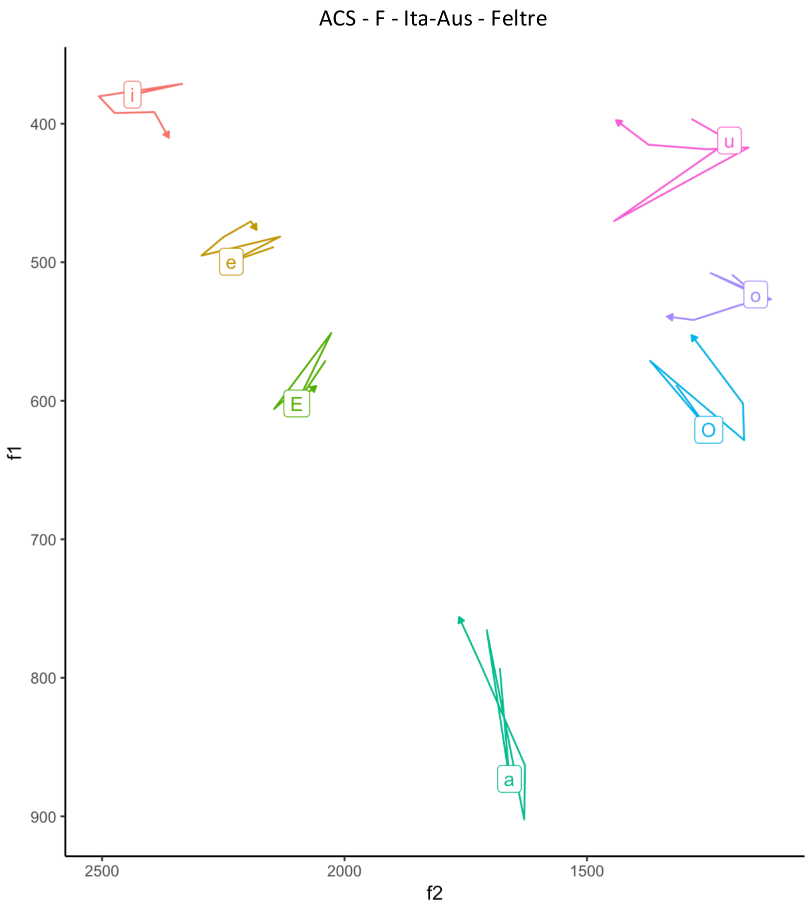

Fig. 44*: Vectors in an F1xF2 space for [i, e, ɛ, a, ɔ, o, u] (ACS, female, Ita-Aus, Feltre)*

Regarding the dispersion of F1 values for [i], vectors show that values are mainly oriented downwards, i.e. towards values exhibited by the high-close vowel [e]. At the same time, F2 computed for [i] tends to lower from 2500 Hz and 2250 Hz. [e] is orientated towards the open-mid vowel. while [a] is oriented upwards. Its F1 mainly oscillates between 900 and 750 Hz. As far as back vowels are concerned, [u, o, ɔ] show a direction towards higher F2 values, similarly to what has been identified for Italian females in Veneto. Again, it is noticeable that ellipses' overlapping is due to the trend of [ɔ] to resemble values exhibited by [o]. This corresponds to a decrease in F1 values (from 600 Hz to 500 Hz), as already observed for back vowels in female control-group speakers.

Values computed at 50% of F1 trajectories for CZM and ACS are shown in the following graph:

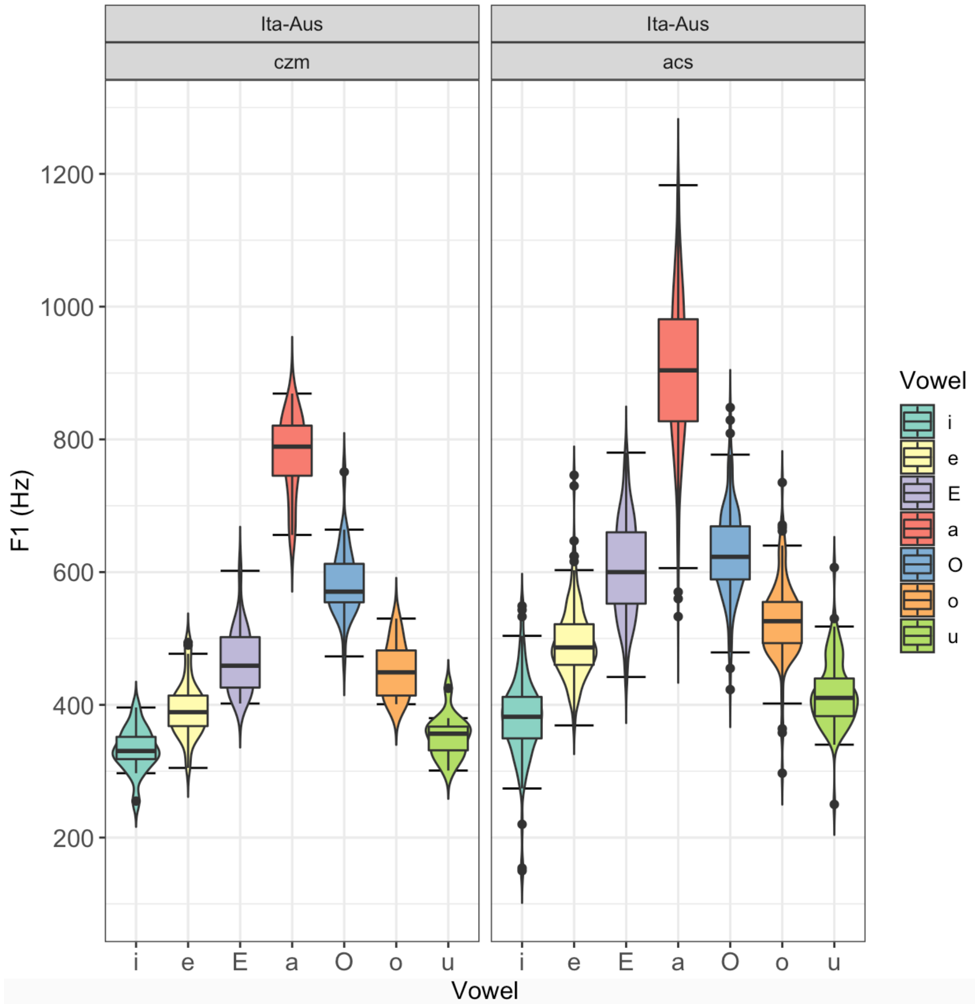

Fig. 45*: Values in Hz computed at 50% of F1 trajectory for [i, e, ɛ, a, ɔ, o, u] for Italo-Australian female speakers (CZM-Cadore and ACS-Feltre)*

From the violin plot, we observe that:

- As far as [i] is concerned, values for CZM are visibly homogeneous: the inter-quartile range indicates that first formant frequencies concentrate between 320 Hz and 350 Hz, with the median attested around 330 Hz. Differently, F1 values for ACS are comprised between 300 Hz and 500 Hz, with the median at 400 Hz. The sparseness of F1 values for [i] is greater for ACS.
- F1 values for [e] are quite condensed for CZM: they are comprised between 300 Hz and 500 Hz. The central tendency is attested at 400 Hz, while for ACS it is

attested at 500 Hz. Again, F1 values for [e] are sparser for ACS than for CZM.

- Regarding [ɛ], median values are rather different across the two speakers. Namely, median values are 450 Hz for CZM and 600 Hz for ACS.
- Similarly, [a] presents lower median values for CZM (around 800 Hz) with respect to ACS (900 Hz). Also, productions for ACS are visibly sparser.
- F1 values for [ɔ] are comprised between 550 Hz and 610 Hz for CZM. Also, and their central tendency attested at 580 Hz. Differently, for ACS they display an inter-quartile range from 595 Hz to 640 Hz. Median is attested at 620 Hz.
- For what concerns [o], the inter-quartile range for CZM extends from 420 Hz to 480 Hz, while that of ACS goes from 490 Hz to 550 Hz. Median values are, respectively, 450 Hz and 540 Hz.
- The inter-quartile range for [u] is attested between 330 Hz to 380 Hz for CZM, and between 390 Hz and440 Hz for ACS. Median values for [u] are, respectively, 370 Hz and 410 Hz.

Graphs illustrating values computed at 50% of F2 trajectories for CZM and ACS are provided below:

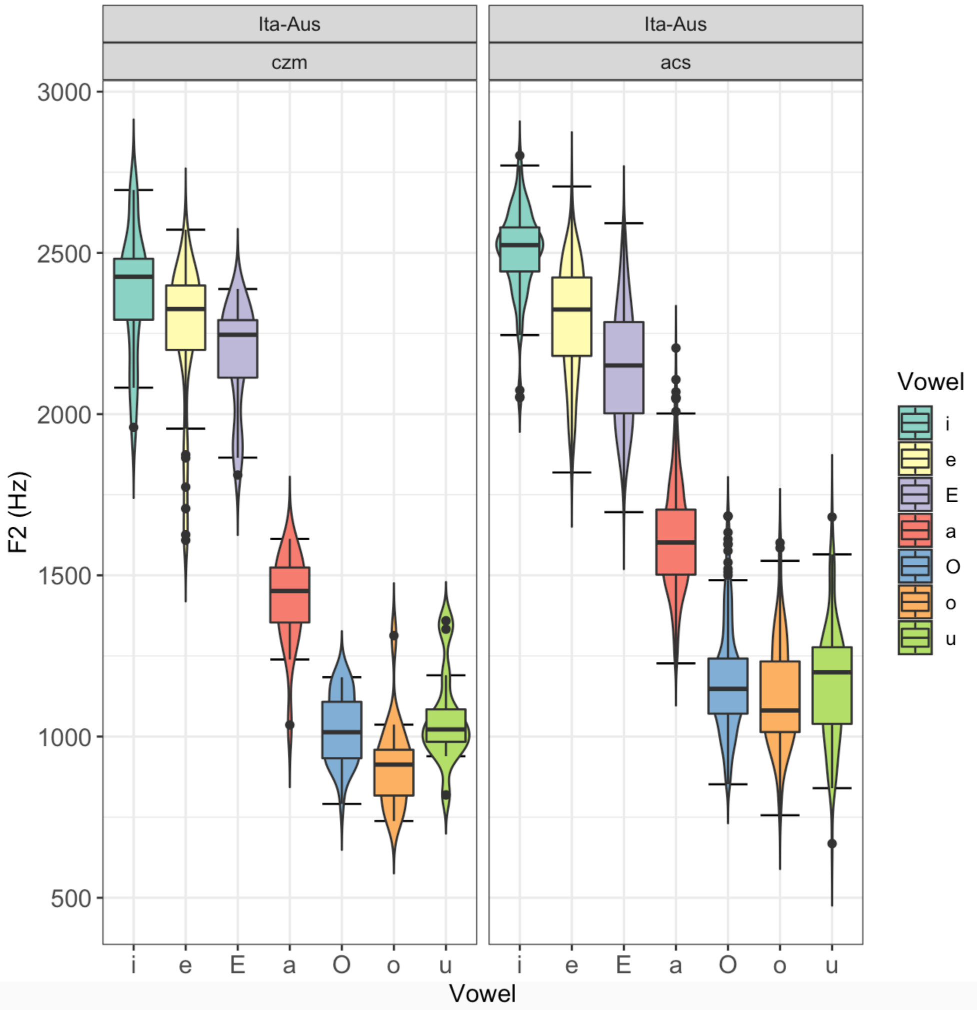

Fig. 46: Values in Hz computed at 50% of F1 trajectory for [i, e, ɛ, a, ɔ, o, u] for Italo-Australian female speakers (CZM-Cadore and ACS-Feltre)

From the violin plot, we observe that:

- F2 values for [i] are more dispersed in CZM than in ACS. For the Italo-Australian speaker from Cadore, the inter-quartile range extends from 2300 Hz and 2500 Hz, with the median attested around 2450 Hz. On the other hand, F1 values for ACS are comprised between 2450 Hz and 2600 Hz, with the median at 2500 Hz.
- Similarly, F2 values for [e] are sparser for CZM, yet the inter-quartile range is roughly the same for the two speakers (between around 2200 Hz and 2400 Hz). The median is attested at 2300 Hz for both speakers.
- On the other hand, ACS show more dispersion for [ɛ] with respect to CZM.

Namely, the inter-quartile range extends from 2150 Hz to 2300 Hz for CZM, while for ACS it goes from 2000 to 2300 Hz. Median F2 values are attested, respectively, at 2250 and at 2150 Hz.

- [a] presents lower median F2 values for CZM (around 1450 Hz) with respect to ACS (1600 Hz). As already observed, productions for ACS are visibly sparser.
- F2 values for [ɔ] are comprised between 950 Hz and 1150 Hz for CZM: their median is attested at 1000 Hz. Differently, for ACS they display an inter-quartile range from 1100 Hz to 1250 Hz. Median is attested at 1150 Hz.
- Regarding [o], the inter-quartile range for CZM extends from 800 Hz to 950 Hz, while that of ACS goes from 1000 Hz to 1250 Hz. Median values are, respectively, 900 Hz and 1100 Hz.
- The inter-quartile range for [u] is attested between 1000 Hz to 1100 Hz for CZM, and between 1050 Hz and 1300 Hz for ACS. Median values for [u] are, respectively, 1050 Hz and 1200 Hz.

Overall, we observe that dispersion of formant values is visibly higher for ACS than for CZM, presumably due to the larger number of tokens. Despite this, the vocalic space identified for ACS appears to be more symmetric than that of CZM, and more similar to those computed for control-group females. Specifically, front vowels [i, e, ɛ] for the IRIAS female speaker from Cadore show visible overlapping and display a lower dissimilarity for what concerns F1. Also, they are considerably distant from the central vowel [a], which is instead oriented towards back vowels (see vectors in **Fig. 42**). On the other hand, both control-group female speakers - and ACS, to some extent - show a balanced vocalic space, in which [a] is low-centered.

After describing graphs obtained from single-steady-state values, we will henceforth integrate such observations within a broader perspective on formant trajectories. As illustrated in Chapter 6, we extracted with the help of an *ad-hoc* Praat script a series of temporal points along each vowel's trajectory (respectively at 5%, 10%, 25%, 50%, 75%, 90%, 95% of overall duration)[195]. With the aim to give a more precise visualization of vowels' acoustic behavior in both controls and heritage speakers, we created the graphs shown in **Figure 47**, which compares Italian males with Italo-Australian males, and **Figure 48**, which compares Italian females with Italo-Australian females. In order to avoid coarticulation effects, we dropped here the first (5%) and last (95%) time points, as following:

[195] The following observations based on the formant trajectory graph should be understood as merely explorative. Future more in-depth analyses will take into account the GAMMs approach (see Sóskuthy, 2017). Generalised which specifically aims to detect formant dynamics through the creation of smooth random slopes.

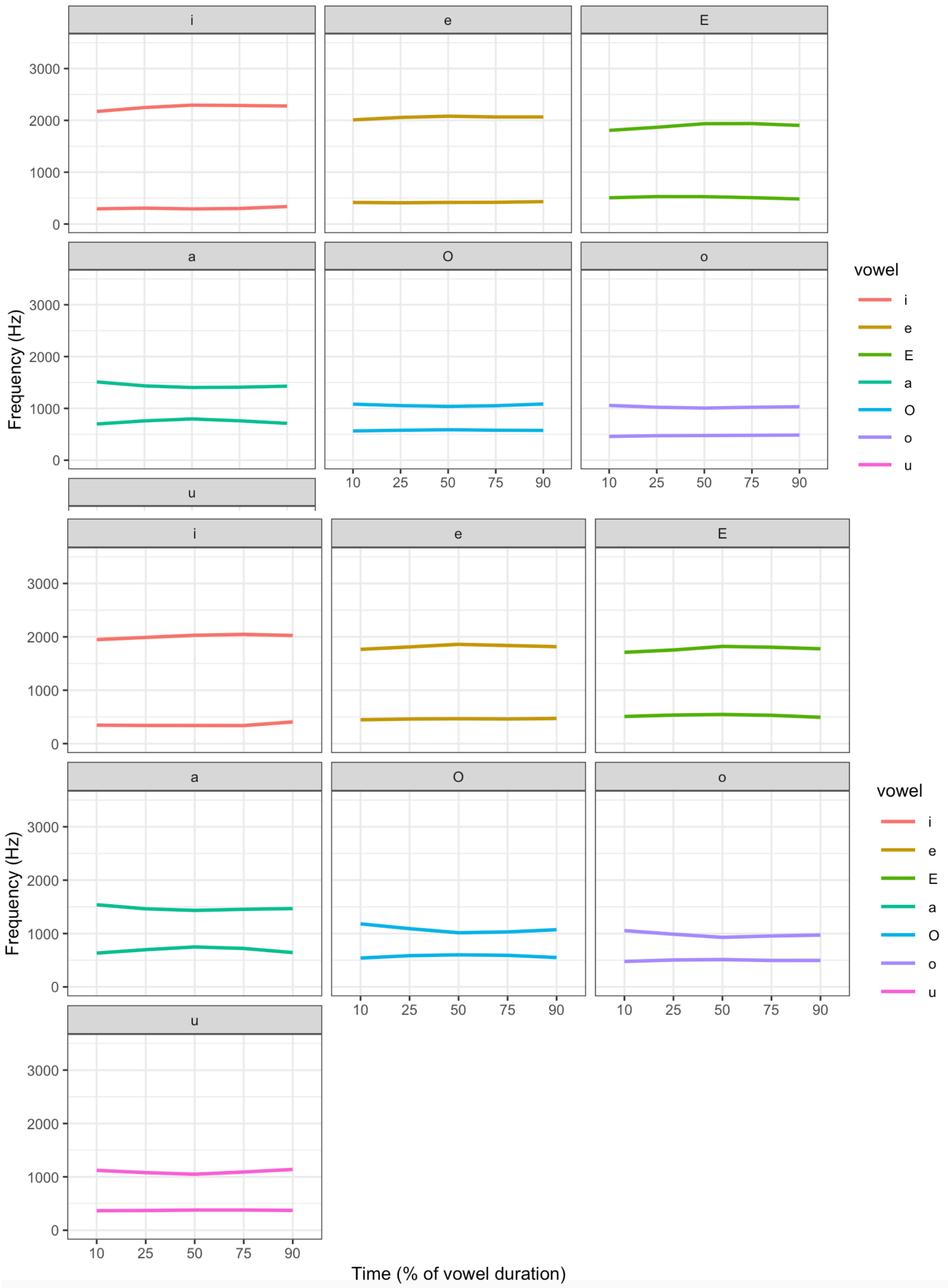

Fig. 47*: mean F1 and F2 trajectories for [i, e, ɛ, a, ɔ, o, u], respectively for control-group male speakers (above) and for Ita-Aus male speakers (below)*

From the graph, we see that mean trajectories for males exhibit the following characteristics:

- F1 values are overall comparable across the two groups, for all the target vowels:

no discrepancies along the trajectories are attested. On the other hand, some differences are noticed for F2 patterns;

- F2 values for [i] are overall higher in controls, oscillating between 2000 Hz and 2500 Hz, with respect to Italo-Australians, for which they are stable around 2000 Hz;
- F2 values for [ɔ] show a higher onset at 10% for Italo-Australians (around 1200 Hz), while they do not vary along the trajectory for control speakers;
- F2 values for [e] and [ɛ] are lower (both between 1500 Hz and 2000 Hz) for Italo-Australians: for controls, [e] is stable along the trajectory at 2000 Hz, while [ɛ] presents a lower onset at 10% (around 1800 Hz), then reaches a plateau at 2000 Hz.

In **Figure 48**, formant trajectories for control-group and Italo-Australian females are presented:

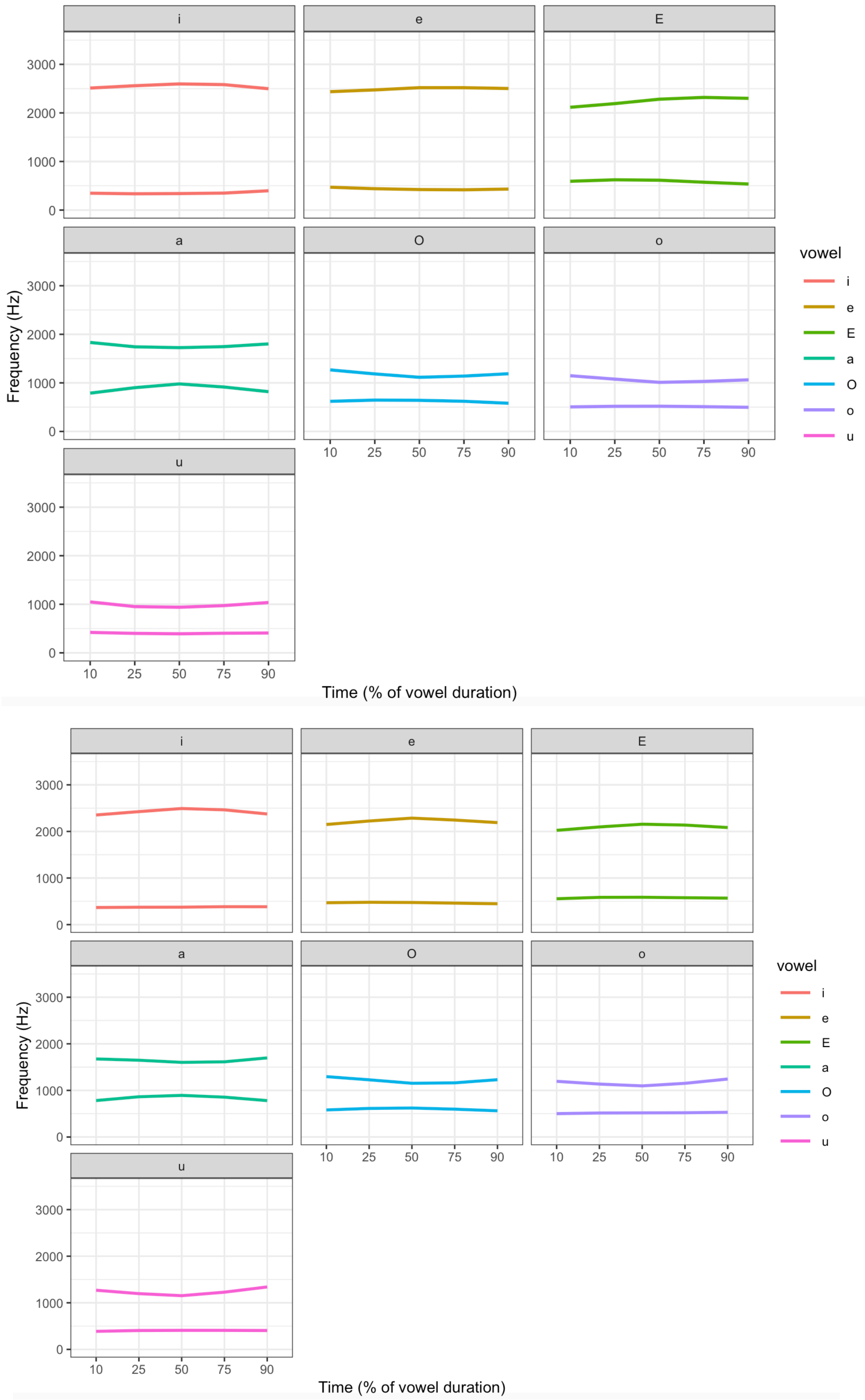

***Fig. 48**: mean F1 and F2 trajectories for [i, e, ɛ, a, ɔ, o, u], respectively for control-group female speakers (above) and for Ita-Aus female speakers (below)*

From the graph, we observe that mean trajectories for females show the following characteristics:

- As observed for males, F1 values along the trajectories are overall comparable across the two groups. On the other hand, some differences are noticed for F2 patterns;
- [a] shows overall lower F2 values for Italo-Australian females (between 1500 Hz and 1700 Hz) compared to Italian females (between 1800 Hz and 1900 Hz);
- For female controls, F2 for [e] is stable along the trajectory at 2500 Hz, while for Italo-Australians it fluctuates between 2100 Hz and 2300 Hz, with a peak at 50%.
- F2 for [ɛ] presents a lower onset at 10% (around 2000 Hz) for controls, then an increase up to 2300 Hz. Differently, Italo-Australians present a peak at 2100 Hz for single-steady-state values.
- The mean F2 trajectory for [u] is attested at higher frequencies for Italo-Australians: both onset at 10% and offset at 90% are around 1250 Hz, while we observe a slight decrease to 1100 Hz at 50%. On the other hand, it is stable around 1000 Hz for control-group females.

From these representations, we therefore notice some dissimilarities across Italian and Italo-Australian speakers. In order to give a clearer interpretation of each speaker's vowel quality, we computed the area of each speaker's F2 x F1 vowel space, respectively. Specifically, either as the area of a polygon connecting vowel formant means through the function *poly.area*, and the area of a convex hull encompassing all tokens through the function *hull.area,* both from the *phonR* package. Results are reported below:

Males	*Poly area*	*Hull area*
ALM	421325.3	1199122.5
SPR	303567.0	893237.5
GPZ	259279.4	558514.5
MZN	262526.6	1004815.5

Table 16*: polygon and hull areas computed for male speakers*

Females	*Poly area*	*Hull area*
BCL	618952.4	1689500.0
RDP	414197.3	1141240.5
CZM	369351.2	752530.5
ACS	387395.2	1680525.5

Table 17*: polygon and hull areas computed for female speakers*

As we can observe, the area of the polygon connecting formant means for each vowel (i.e. *poly area*) is larger for females. This result is not surprising: it has been already acknowledged in literature (see e.g. Ferrero, Magno Caldognetto & Cosi, 1996; Zmarich & Bonifacio, 2003) that females present greater expansion of the vocal perimeter (indexed by the position of the centers of the areas of existence), together with an increase in variability in the realization of vocal types (indexed by the size of the areas of existence). Also, we notice the *poly area* is wider in control-group male speakers with respect to Italo-Australian male speakers. Nonetheless, we observe greater dispersion in the *hull area* (i.e. the area encompassing all tokens) for MZN with respect both to GPZ and to SPR, which could be to some extent due to a greater number of tokens. Overall, the smallest values for both *poly area* and *hull area* are displayed by the Italo-Australian speaker from Cadore (GPZ), whereas the highest values for both parameters are exhibited by the Italian speaker from Cadore (ALM). Concerning females, as well, we find higher values for *poly area* in control speakers than in Italo-Australian speakers. Specularly to males from Cadore, females from Cadore – BCL as control and CZM as IRIAS informant – exhibit, respectively, the highest and the lowest values for both parameters. According to these preliminary results, we could posit that the smaller vocalic space encountered in Italo-Australian speakers may correspond to: one the one hand, a lower variability/sparseness in productions; on the other hand, an effect of CLI exerted from the L3 system, as hypothesized above. Namely, the trilingual speaker's phonetic realizations of a single class of tokens might be more precise with respect to those of Italian speakers, in order to maintain sufficient contrast with nearby phonetic categories. However, the computation of both vowel space and vowel dispersion should be intended as purely descriptive, as it aims to give a general insight on the behavior of each vocalic space in its wholeness. Also, in the present work, we did not include the measurement of both poly area and hull area as dependent variables in the statistical model; further analyses could take into consideration to include these parameters to assess tokens' dispersion. In thsis respect, we should bear in mind the difference in the number of tokens for each vowel category across groups, which to some extent could influence the computation of data dispersion. In order to verify the afore-presented assumptions on maintenance or change of single sound categories, and to overcome problems in the interpretations caused by data skewness, we carried out statistical analyses solely on vowel formants, either for males and for females. These will be presented in §7.2.4.

7.2.3 Vowel duration

As presented in §7.1, we also extracted duration values for each target vowel in L1 utterances. It is worth reminding that, as argued by Calamai (2005:214):

> *«Vowel duration is a temporal variable that could affect vowel classification, even in languages such as Italian where vowel duration by itself is not a phonological marker».*

For this reason, the computation of this parameter was added to the spectral measurements with the aim to improve the description of vowel quality across groups and to detect other possible effects of regressive CLI in HSs' productions. Raw duration values in ms (see §7.2) were subjected to a normalization procedure, according to the following formula[196]: "Vowel duration/speaker's speech rate". This choice was due to the fact that we had to cope with semi-spontaneous productions. As we did not deal with read speech, phonation time at intra-speaker and inter-speaker level varied considerably across 2 hours of recordings. Also, we could not obtain target occurrences within prosidically comparable utterances. Hence, as it was not possible to control all the suprasegmental variables which could have an impact of vowel duration, such as presence/absence or of a nuclear pitch accent and so on, we believed it was necessary to perform this type of normalization to factor out significant sources of variability impacting on vowel duration across our sub-set of speakers.

In the following graphs, we will first provide mean duration values expressed in ms and, following, normalized duration values calculated for control-group females and IRIAS females[197].

[196] We adapted to our purposes the formula provided by Marotta, Molino & Bertini (2012): Vowel duration/ (duration of the entire utterance/N° of syllables), in which the denominator indirectly corresponds to the speaker's speech rate.

[197] Complete mean and standard deviation values are reported separately for each speaker in **Appendix 4.**

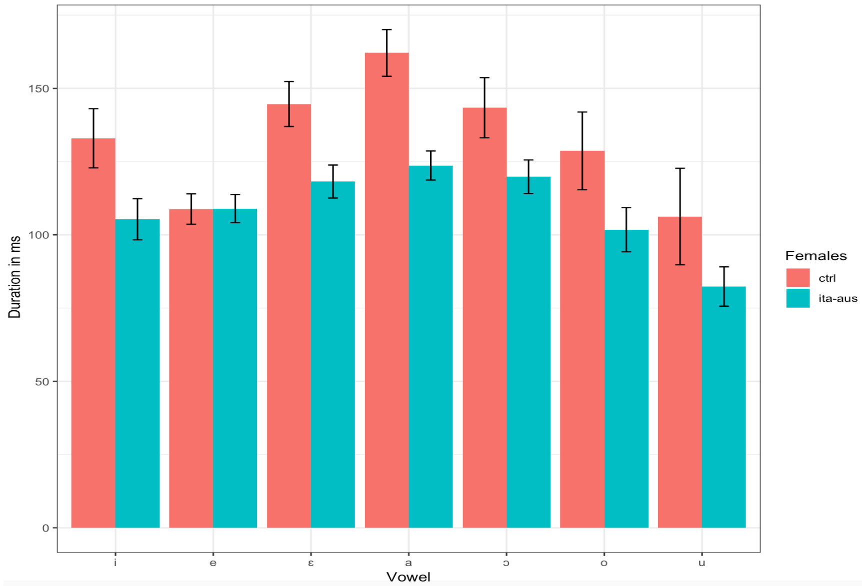

Fig. 49: *mean duration values (ms) for Italian females and Italo-Australian females*

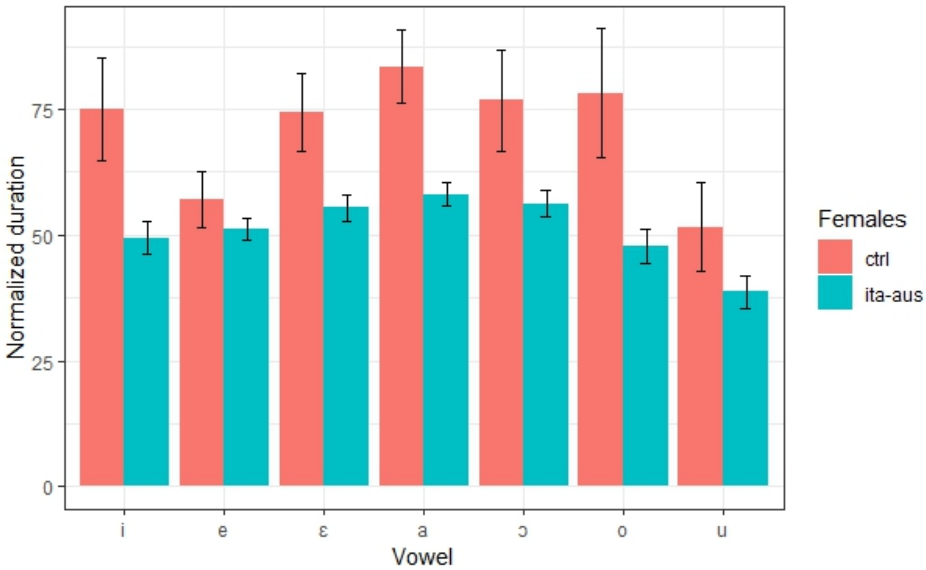

Fig. 50: *Normalized duration values for Italian females and Italo-Australian females (vowel duration/speaker's speech rate)*

From both raw and normalized values, we clearly note that duration of stressed vowels is overall higher – and more variable – in Italian females with respect to Italo-Australian females. The only exception is the vowel [e], for which duration – either raw and normalized – does not vary across the two groups.

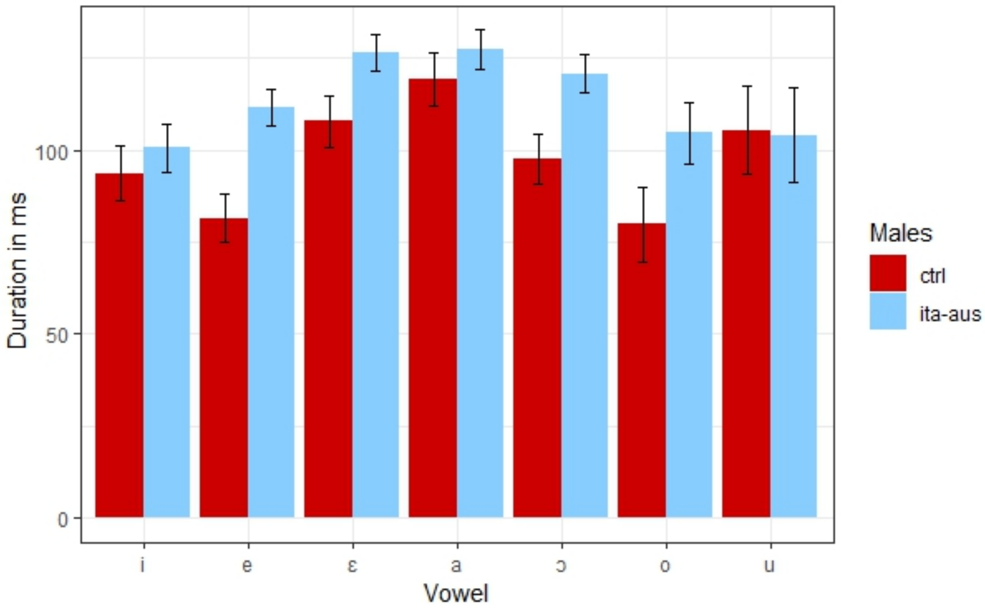

Fig. 51: *mean duration values (ms) for Italian males and Italo-Australian males*

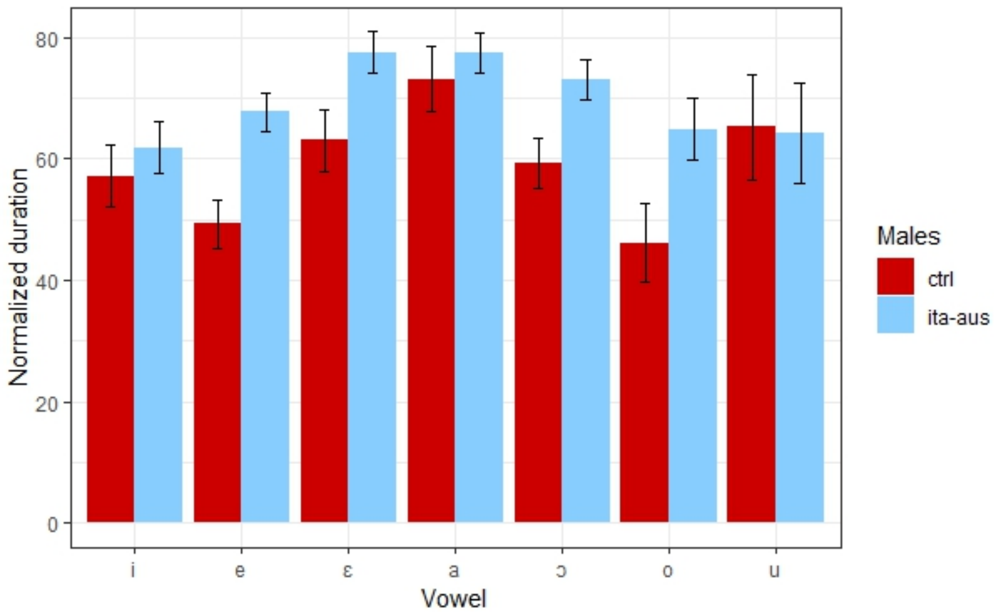

Fig. 52: *Normalized duration values for Italian males and Italo-Australian males (vowel duration/speaker's speech rate)*

The situation is quite different if we consider male informants. While cardinals [i], [a] and [u] do not show meaningful differences in duration values – either raw and normalized – across Italians and Italo-Australians, open-mid and close-mid vowels are visibly shorter in the controls. Interestingly, although «*close vowels tend to be briefer than open vowels, since the jaw is a sluggish articulator*» (Calamai, 2005: 214), duration for [u] in controls is higher with respect to all the other vowels, except for [a].

Below, we discuss results and considerations based on predictions formulated in Chapter 6:

- a possibile effect of backward CLI is that the native [i] in IRIAS speakers would show longer duration due to the influence of the correspondent AusEng category [iː]. Results reported by Elvin *et al.* (2016: 577) for AusEng vowels (see **Table 10**) show instead that mean duration for [iː] is attested at 168 ms for males and at 174 ms for females. The hypothesis of a vowel lenghtening is not validated if we look at females' behavior, as mean duration for Italians is attested at around 130 ms, while for Italo-Australians is around 110 ms. Regarding males, on the other hand, values for controls are slightly lower than that for IRIAS speakers (around 90 ms vs 100 ms), yet still quite similar. These proportions are maintained also after the normalization procedure. Interestingly, though, we note that the values we obtained for both heritage male and female speakers resemble those reported by Elvin *et al.* (2016) for the close L3 category [ɪ], respectively: average 101 ms for males and 112 ms for females. This observation, however, should be taken cautiously. On the one hand, because our analysis focuses on a limited number of speakers; on the other hand, because, in this case, the data available for AusEng are not directly comparable to the data we processed. Namely, Elvin *et al.* (2016) computed average duration on vowels (12 tokens for each vowel) uttered in isolation or within carrier sentences, and coped with young adult informants, while we processed a larger – and skewed – set of vowels uttered by old informants spontaneously – that is, with no direct control on vowels' position/context within the utterance. Limitations deriving from the different nature of our corpus therefore hinder from assessing whether

HSs' [i] might have undergone CLI from the – intrinsically shorter – lax counterpart [ɪ]. Such remarks should be considered when reading through the following points, as well.

- Concerning [e], our hypothesis was that this L1 category would be maintained through the perceptual link with the similar category [e] occurring in L3. Since this element is shared by the two systems in contact, we assumed that the pressure of the corresponding non-native category would reinforce the maintenance of the mid-close vowel in the NVen and SI vocalic system. This hypothesis is indeed confirmed for what regards duration of [e] in women, whose average in ms in both groups is around 110 ms[198]. Conversely, control males show an average duration of approximately 80 ms, while IRIAS males exhibit 115 ms. Normalized data computed for males comply with the picture given by raw duration values. In the case of [e], the duration value for males is close to the one reported for AusEng by Elvin *et al.* (2016), i.e. 117 ms (while for females it it attested at 129 ms). Discrepancy between males and females is also encountered if we look at duration for [ɛ] in ms (F ita = 145, F ita-aus = 120; M ita = 110; M ita-aus = 125) and after normalization. Based on these results, we could carefully argue that no lenghenting has occurred for [ɛ] after the contact with the closest L3 category [ɜː], as this sound is reported to be significantly longer (M = 195 ms; F = 205 ms).
- It had been posited that a longer duration of /ɐː/, in phonological opposition with /ɐ/, could affect Italo-Australians' utterances of /a/, resulting in vowel lenghtening. From **Fig. 49**, we observe that duration in ms for [a] in IRIAS females and control females is aroud 125 and 160, respectively. Such difference is reflected in **Fig. 50** with normalized data. Italian males, on the other hand, show an average duration of 120 ms, while IRIAS males show a slightly higher value (around 125 ms), which also surfaces in normalized data. As for [i]-[iː], hypothesis of a significant vowel lengthening as a consequence of CLI was not confirmed. However, it is worth recalling the average duration values for AusEng

[198] We note, however, that ormalization reveals slightly higher values for control women. In this case, as well, a larger number of subjects is required to propose more solid observations.

vowels, respectively for females and males: F [ɐ] = 132; M [ɐ] =125, F [ɐː] =216; M [ɐː] = 217 (Elvin *et al.*, 2016). Despite the differences noted above between the two corpora, it is interesting to note that AusEng [ɐ] and L1/L2 [a] as uttered by IRIAS speakers indeed match for their duration values. On the other hand, it appears that the longer duration of [ɐː] has not exerted a significant influence on native [a].

- Across group, average duration in ms of [o] is approximately: F ita = 125; F ita-aus = 100; M ita = 80; M ita-aus = 110, while in AusEng it is reported to be at a significantly higher value, i.e. at 200 ms for both males and females. Overall, as for [a], no significant changes in vowel duration have occurred in HS as possible effect of CLI. For [ɔ], average duration in ms is slightly higher for all informants, approximately: F ita = 145; F ita-aus = 120; M ita = 100; M ita-aus = 120. We noted that Elvin *et al.* (2016) do not provide average duration and formant frequencies for [ɔ], so we are not allowed to propose any cross-linguistic comparison for this sound. In both vowels, again, the pattern across males and females is specular, as the highest values for duration are found in the Italian females and the Italo-Australian males. Moreover, concerning females, we note that the normalization procedure emphasizes the separation between the two sub-groups, and, at the same time, reduces the differences between [o] and [ɔ] for the Italian subjects.
- Concerning [u], we notice that while duration in ms is again slightly higher for Italian females with respect to the IRIAS females (approximately 110 ms and 80 ms, respectively), values are basically identical across Italian males and IRIAS males (approximately 105 ms). In both cases, normalization confirms this pattern. Therefore, at least for males, we could argue that no alterations have occurred for what concerns duration of [u], as the correspondent AusEng category [u] is visibly longer (148 ms for males and 166 ms for females).

Overall, we are conscious that such results are undoubtedly influenced by each speaker's idiosyncratic behavior[199], and should thus be taken carefully. Still, as already contended in the previous paragraphs, we hope that these purely explorative and preliminary observations could pave the way for future research on a wider number of subjects.

7.2.4 Statistical results

For what concerns the statistical analysis on vowel data, we considered the acoustic values computed for the first two formants[200] and followed the same procedure illustrated in §7.1.3 for coronal fricatives. We fitted linear mixed-effects models (LMM) using the *lmer* function of the *lme4* package (Bates *et al.,* 2015) and the *lmerTest* package (Kuznetsova *et al.*, 2017) in R. In order to test the overall main effects and interactions we built up the full model by adding one predictor at a time from a baseline model which solely included the intercept ([a] for the control group). The baseline model was fitted for both the dependent variables (F1 and F2) by entering the factor *speaker* as random effect with *vowel* ([a] vs [e] vs [ɛ] vs [i] vs [o] vs [ɔ] vs [u]) nested within *speaker,* to account for the repeated measures design. The predictors entered in each model are the following: *vowel* ([a] *vs* [e] *vs* [ɛ] *vs* [i] *vs* [o] *vs* [ɔ] *vs* [u]); *group* (Control group (control) *vs* Italo-Australians (Ita-Aus)). As for consonants, we also added the predictor *dialect* (Cadorino *vs* Feltrino) in order to test whether possible differences could be related to the local sub-variety spoken by our informants, and three two-way interaction terms *vowel*group, vowel*dialect* and *group*dialect*. We fitted additive models through R's *update()* function by adding potential predictors as fixed effects and their interactions; models were subsequently compared with the *anova()* function from the package *stats4*. For vowels, too, goodness of fit of each model was evaluated by means of Akaike's Information Criterion (AIC), while *p*-values of overall effects were determined using Likelihood Ratio Tests (L.Ratio) within the *anova()* function. We additionally ensured the goodness of fit of each model through the

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[199] In particular, the Italian female from Feltre show particularly longer vowels, as reported in **Appendix 4**.

[200] In the present work, we did not include in the model poly area/null area and vowel duration as dependent variables.

function *r.squaredGLMM()* of the *MuMIn* package (Burnham & Anderson, 2002). Both baseline and additive models were fitted and compared using maximum likelihood (ML) method; the same fitted model was employed to explore both the dependent variables. After re-fitting models to the data using residual maximum likelihood (REML), we further explored our data with a pairwise post-hoc analysis (Tukey adjusted) using the *emmeans* package (Lenth, 2018) with a 95% confidence level and Kenward-Roger correction of degrees-of-freedom. As for consonants, for the post-hoc analysis we will provide the estimated marginal mean and the associated standard error (±SE). In **Table 19**, we report the results of each model fitted for the two dependent variables: F1 and F2 for male speakers:

	Dependent variables	
	F1	*F2*
Intercept	839.563***	1388.928***
	(18.651)	(69.642)
group Ita-Aus	-21.324	10.564
	(21.663)	(80.568)
dialect Feltrino	-101.864***	26.722
	(21.678)	(80.573)
Observations	1434	1434
Log Likelihood	-8020.733	-9034.318
Akaike Inf. Crit.	16089.470	18116.640
Bayesian Inf. Crit.	16215.900	18243.070
Note: *p<0.05; **p<0.01; ***p<0.001		

Table 18: *Results of the four LMMs fitted for the dependent variables F1 and F2 (male speakers) with b estimates and standard errors in parentheses and significance level p for significant predictors in the analysis*

Concerning F1 for males, we encountered significant effects for *vowel* – as expected[201] – (p<0.001) and for *dialect* (p < 0.001) (goodness of fit: R^2m = 0.71; R^2c = 0.83). Undoubtedly, however, the overall significance of the *vowel* effect is not sufficiently explanatory to describe differences across single class of tokens. For this reason, we performed a Tukey-adjusted pairwise comparison, which revealed that across the two groups (Control *vs* Ita-Aus) none of the target vowels [a], [e], [ɛ], [i], [ɔ], [o], [u] statistically differs in F1 values from their counterpart. As far as *dialect* is concerned, significance is found only for [a], whose F1 is higher in the Cadorino speakers compared to the Feltrino speakers ($a_{Cadorino}$ = 839.563±18.651; $a_{Feltrino}$ = 737.699±21.678; p = .0025). On the other hand, no significant effect was found neither for *group*, nor for the

[201] Obviously, the significance of this effect is not *per se* useful for a statistic comparison, as it does not indicate which specific vowel differs from the other(s). With respect to target coronal fricatives, vowels indeed would show greater variation, as already pointed out in Chapter 6. For this reason, we only reported significant pairwise comparisons between single categories.

*group*vowel*, *vowel*dialect* and *group*dialect* interactions. Concerning F2, we found a significant difference for *vowel* (p < 0.001) and *group* (p = 0.026) and a marginal effect for *group*vowel* (p = 0.08) (goodness of fit of the model: R^2m =0.87; R^2c =0.90). However, the pairwise comparison revealed that values for [a], [e], [ɛ], [i], [ɔ], [o], [u] do not statistically differ from their counterparts across control and Italo-Australian speakers. No significant effect was found for *dialect* and for *vowel*dialect* and *group*dialect* interactions. With some exceptions, results suggest that vowels as produced by male immigrant speakers do not statistically differ from vowels produced by male control-group speakers: specifically, F1 for [a] is higher in the speakers from Cadore compared to speakers from Feltre.

In **Table 19**, we report the results of each model fitted for the two dependent variables: F1 and F2 for female speakers:

	Dependent variables	
	F1	*F2*
Intercept	939.809***	1674.904***
	(40.663)	(95.646)
group Ita-Aus	-96.985	-154.823
	(57.741)	(135.750)
Observations	2196	2196
Log Likelihood	-12622.990	-14298.620
Akaike Inf. Crit.	25279.980	28631.240
Bayesian Inf. Crit.	25376.790	28728.040
Note: *p<0.05; **p<0.01; ***p<0.001		

Table 19: *Results of the four LMMs fitted for the dependent variables F1 and F2 (female speakers) with b estimates and standard errors in parentheses and significance level p for significant predictors in the analysis*

For females' F1, we solely found a significant *vowel* effect (p<0.001) within the re-fitted model (goodness of fit: R^2m = 0.78; R^2c = 0.85), yet the pairwise comparison indicated that [a], [e], [ɛ], [i], [ɔ], [o], [u] uttered by female Italo-Australian speakers do not differ from the very same sounds produced by female control-group speakers. The *dialect* predictor and the *vowel*group* and *vowel*dialect* interactions are non-significant. For F2 values, as well, we solely obtained a significant *vowel* effect ($p<0.001$) within the re-fitted model (goodness of fit: $R^2m = 0.87$; $R^2c = 0.92$). As for F1, we did not find statistic differences in the very same vowels uttered by Italian and Italo-Australian females, respectively.

Overall, we observe that ether in males and in females, the non-significance of the factor *group* in both dependent variables denotes that overall there is no difference in terms of “open-closed” opposition (as indexed by F1), nor in “front-back” opposition (as indexed by F2) in the target vowels as spoken by the Italian and the Italo-Australian speakers. The significance of the factor *dialect* solely concerns [a] in terms of vowel opening (F1) for males, as it is produced by Cadorino speakers as more open with respect to Feltrino speakers[202]. Regarding Cadorino speakers, we already observed that the control ALM shows the highest values for *poly area* and *hull area* for the *entire* vocalic space, while the Italo-Australian GPZ shows the lowest values. Such a difference is particularly evident for what concerns the dispersion of [a], which is visibly smaller for GPZ. So, interesting trends have been observed in terms of acoustic results – also for GPZ’s [u] (see **Figure 29**); arguably, one could expect that this variation would surface in the statistical analysis. However, we remind that the analysis of variance maintains that inter-speaker variation should be greater than intra-speaker variation in order to be considered statistically relevant. Based on our results, we infer that vowels’ acoustic features were not sufficiently different from speaker to speaker (for instance, from ALM to GPZ) to overcome the degree of variation encountered *within* the same speaker. Also, as the *poly area* and *hull area* parameters were calculated only for descriptive purposes and were not included as predictors in the mixed model, they do not allow to formulate interpretations on statistical basis. In this respect, it is worth recalling that the number of vowel occurences was unbalanced across the speakers, and that this aspect might

[202] Nonetheless, the interaction *vowel*dialec*t did not reveal significant effects.

have affected the tokens' distributional features in the vocalic space[203]. As already mentioned, we thus opted for a repeated-measure statistical design to better cope with such data skewness. Keeping in mind these observations, we can eventually posit with caution that the AusEng vocalic system has not exerted a significant, large-scaled and systematic effect of regressive transfer on the native vocalic system of our sub-sets of speakers.

7.3 Discussion

In this paragraph, we will draw general observations on sound maintenance or change (both for consonants and for vowels) based on the results so far presented, and discuss our assumptions in light of the theoretical frameworks presented in Chapter 3. As already remarked in Chapter 3, we will refer to the Speech Learning Model (Flege, 1995) as the principal model of reference, since it takes into account *acoustic* properties of sounds in contact. Extending its L2-predictions to involve also L3, we posit that the phonetic elements of all languages of our multilingual speakers (L1 dialect, L2 Veneto Italian and L3 Australian English) exist in a common phonological space and are related to one another on an allophonic basis. Also, we will employ its postulations on non-native perception based on the mechanism of *equivalence classification*. Before going more in depth with our discussion, it is worth reminding that *equivalence classification* activates in case a non-native sound is perceived as the same sound or as similar to an existing sound in the native system (i.e. a more or less deviant exemplar of a L1 phone). As a result, *«a single phonetic category will be used to process perceptually linked L1 and L2 sounds»* (Flege, 1995: 239). Accordingly, a ''merged'' category will be developed, leading properties of the native and non-native phones to combine one another.

As far as coronal fricatives are concerned, we observe that [θ] is produced and perceived by the group immigrant speakers (*as a whole)* as equivalent to the voiceless interdental occurring in the native system. This result complies with what has been

[203] Specifically, for ALM we retained a total of 281 tokens (of which 133 for [a]), whereas for GPZ we retained a total 174 tokens (of which 67 for [a]) (data are extracted from **Table 14**).

postulated in Chapter 4 and 6 regarding the conservation of the phonetic/phonological features of the HL. Specifically, in terms of SLM, the extended contact with English would reinforce the *maintenance* of the dental fricative in the NVen system, as it is a shared consonant: instances of the L3 category [θ] have hence continued to be identified as instances of an L1 category (Flege *et al*., 2003). Also, we can posit that interdentals have not experienced any CLI from Veneto regional Italian, since all speakers have conserved the landmark consonant [θ] of their native dialectal system in target contexts: dialect as L1 is preserved and maintained with its target phonetic features in an attenuated form of *diglossia* with respect to L2-Italian in Australia (see Avesani *et al*., 2015). At the same time, it is worth noticing a marginal difference induced by the dialectal subvariety to which our speakers belong. Specifically, both acoustic and statistical analyses reveal that the group of control informants from Cadore overall exhibit higher CoG values with respect to the correspondent Italo-Australian group. Also, the analysis revealed a difference between the Cadorino controls and Feltrino controls, with CoG values globally higher in the fricatives of the informants from Cadore. As already argued, this result is due to the presence of significantly higher CoG values displayed by the interdental fricative [θ].

As for [s], results confirm the general hypothesis based on SLM (presented in Chapter 6) that Veneto immigrants would fail to create a new L3 phonetic category for English [s], as the two sounds are not perceived as sufficiently dissimilar from one another. Namely, if they had formed a new L3 category due to category dissimilation/polarization between the native [s] and the Australian English [s], the Bellunese dialect [s] would be pronounced even more backward in the vocal tract than in the native dialect, i.e. with even lower CoG values than those shown by Italian speakers[204]. According to the SLM, having failed to create a new L3 phonetic category could be due to one of the following situations:

1) L3 alveolar fricative [s] is perceived by HS as the same L1 sound [s];
2) L3 [s] is perceived by HS as slightly deviant but not sufficiently dissimilar with

[204] In this respect, it is worth reminding that L1 [s] does not differ in its spectral properties from the fricative release of [tʃ], as indicated in §7.1.3. This point will be further discussed below.

respect to the L1 sound [s].

In case 2), we expect that the L3 phone would undergo the *equivalence classification* effect, and the immigrant speakers would hence merge the native and non-native categories. If this hypothesis holds true, the acoustic properties of [s] in the dialectal productions of HS would be intermediate between those of the native category and those of English, since in time they would have diverged from the L1 norms and would have approximated the L3 phonetic norms. At articulatory level, [s] of the multilingual speakers would be in this case be *less* retracted than in the speech of monolingual Veneto speakers living in Veneto. Instead, results show that HS have not assimilated their native [s] to the Australian English [s] (which exhibits higher CoG values): on the one hand, CoG values of Italo-Australian [s] are not intermediate between the native and the corresponding Australian English phonetic category; nor, on the other hand, they are closer to the Australian English values as we could have expected if they had approximated the L3 norm. Hence, we witness a type 1) case: the phonetic properties of the native [s] have been maintained as such by the Italo-Australian speakers, and no merge has occurred.

Differently, both acoustic and statistical analyses reveal that a merging both in place of articulation and in degree of laminality of [s] and the fricative release of the obstruent [tʃ] occurs in the native NVen dialect of the Italian speakers. Based on this evidence, we can hence claim that the spectral moment analysis – despite the limitations recently shown by Spanu & Lilley (2016) – remains a valid tool to study the spectral properties of fricative sounds, as in our data SDev successfully separates the sibilant from the non-silbilant fricatives.

As reported in Chapter 6, /s/-retraction a typical feature of the Veneto Italian and Veneto regional *koinè*, as illustrated by Canepari (1984: 102): i.e., while coronal [s, z] are produced as dental fricatives (or lamino-alveolar, according to Loporcaro & Bertinetto, 2005) in SI, they are generally uttered as apical-alveolar [ʂ, ʐ] along the Veneto regional continuum, namely with a more posterior place of articulation, and as non-laminal sounds. As a result, the articulatory retraction involving the alveolar fricative [s] makes this sound perceptually similar to the postalveolar [(t)ʃ]. In this respect, it is worth mentioning that, although a long tradition of studies on the Veneto dialect indicates the presence of the perceptual similarity between [s] and (t)[ʃ], this merge had been so far identified solely through accurate auditory descriptions. Our fine acoustic analysis confirms these assumptions and at the same time suggests that the origin of such retraction takes place in dialect and further spreads into Veneto regional Italian. Moreover, our results interestingly show that such feature is maintained in the dialect of the Italo-Australians even after more than 50 years of contact with Australian English.

As far as vowels are concerned, the acoustical results presented in §7.2. suggest a different configuration of Italo-Australians' vocalic space with respect to that of Italians – which is instead rather homogeneous across the informants, and in line with values identified in literature (see Chapter 6). We will hence discuss effects of contact-induced change or maintenance of native vowels' features, mainly based on both the SLM and L2LP model (Escudero, 2005), the latter being focused on vowel perception and production by learners with a smaller L1 vowel inventory with respect to that of L2/L3. Before going more in depth with our observation, we remind that the Australian English phonemic inventory presents the short vowels /ɪ, e, æ, ɐ, ɔ, ʊ/ and the long vowels /iː, ɐː, ɜː, ʉː, oː/.

Summarizing the results, for [i] we postulated that: 1) on the one hand, we could observe a maintenance of the native category. In fact, L3 displays a similar sound [iː], which could be perceived as phonetically similar to the existing sound [i] in L1[205]. According to the predictions of the SLM, such pressure of the corresponding non-native category is supposed to reinforce the maintenance of the target vowel in native productions. At segmental level, this would result in no differences in the formants' configuration of native [i]; 2) on the other hand, that Italo-Australians' productions could undergo the influence of the diphthongization process typical of the AusEng Broad variety, which could result in a transition from lower to higher F2 values along the trajectory, i.e. from [i] to [əɪ]; 3) in third place, the presence of the nearby high-

[205] In terms of L2LP model, this could be defined as a "similar scenario".

fronted unrounded lax [ɪ] in AusEng could drive changes in the segmental features of native productions of [i] in the speech of IRIAS speakers, compared to the control group's utterances: namely, a possible influence of the AusEng lax vowel on the dialect tense one could lead to an increase of F1 values in native [i], due to a shift to a lower articulatory position. Based on our results, we can claim that the first hypothesis is confirmed for both males and females. Presumably, the presence of the L3 category [iː] has favored the maintenance of the native sound [i]: no diphthongization effect from [əɪ] to [i][206], neither a substantial increase in F1 are attested. As confirmed by the statistical pairwise comparison, formant features for [i] are not dissimilar across the control group and the IRIAS group: it means that this sound continues to be produced as native-like in all the four IRIAS speakers. Preliminary results on duration also do not show that values for native [i] have shifted towards those of L3 [iː], which is visibly longer. We witness no CLI occurring from L3 to L1: in this specific case, the hypothesis of a possible regressive transfer is disproven.

According to the L2LP model (Escudero, 2005, 2009), we have for [e] a case of "similar scenario", in which a non-native category (/e/ in AusEng) and a native category (/e/ in NVen and SI) are phonologically equivalent at cross-linguistic level, but may present phonetic differences. According to Escudero (2009: 29), in the case of a similar scenario, the learners' segmental features (i.e. formants and/or duration) of that native category could shift in the direction of the features displayed by the L2 category. Based on these postulations, we posited that: 1) either L1 category would maintain the native segmental quality and formant values, or 2) it would adjust its formants' configuration towards L3 norms for [e]; or, alternatively, 3) its productions in Italo-Australians' speech would resemble productions of L3 [ɜː]: in this case, possible effects of centralization would appear at a segmental level trough the lowering of F2 values, with respect to control group's productions. Interestingly, the acoustic analysis revealed that in both males and females, F2 values for [e] are lower in Italo-Australians' productions (between 1500 Hz and 2000 Hz for males and between 2100 Hz and 2300 Hz for

[206] Conversely, F2 values for [i] are stable around 2000 Hz for Italo-Australian males, while they are overall higher in control males, oscillating between 2000 Hz and 2500 Hz.

females), with respect to controls, whose [e] is stable along the trajectory at 2000 Hz for males and 2500 Hz for females, respectively. Nonetheless, the hypothesis of a centralization trend from [e] to [ɜː] is not statistically confirmed: pairwise comparisons - based on *group*vowel* interaction - within mixed models show that the difference between Italians' and Italo-Australians' formant features for [e] is non-significant. In other word, the analysis of both formant features and duration for native [e] compared to those of the phonologically equivalent non-native [e] demonstrated that their segmental features are similar at a cross-linguistic level[207] (i.e., across the NVen/SI and AusEng inventories). Hence, we can assert that, despite marginal changes, the native category [e] has been substantially maintained with native-like values by HS in Australia. Coherently with what has been observed by Best (1995) and Kuhl (1992, 1993) (see Chapter 3), we claim that such SIMILAR scenario has not posed any perceptual learning challenge, thanks to the presence of L3 phonetic features in the L1: the learner acts as a native-like perceiver, since categories are identical in L1 and L3.

For [ɛ], we suggested that: 1) either F1 values of [ɛ] would increase and F2 values would decrease, resembling productions of the nearby L3 category [æ]; 2) or, if [ɛ] and [æ] are perceived are sufficiently dissimilar from one another, Italo-Australians' productions of [ɛ] would show no effects of CLI. Acoustic data show that no substantial difference is attested for F1 values across the eight speakers. However, as far as F2 is concerned: among males, values for [ɛ] are overall lower for Italo-Australians (between 1500 Hz and 2000 Hz), while for controls, [ɛ] presents a lower onset at 10% (around 1800 Hz), then reaches a plateau at 2000 Hz; among females, values for [ɛ] are attested around 2000 Hz for Italo-Australians (with a peak at 2100 Hz at 50%), while for controls they increase from 2000 Hz up to 2300 Hz. Nonetheless, dissimilarities found at acoustic level between productions of [ɛ] of Italians and Italo-Australians were not confirmed by statistical analyses. Pairwise comparisons demonstrated that the difference between Italians' and Italo-Australians' [ɛ] is non-significant, neither for F1 nor for F2. It follows that, although L1/L2 [ɛ] does not have a counterpart in AusEng which would

[207] At least as far as formant frequencies are concerned. Nonetheless, it is worth mentioning that, although results are not statistically significant, a centralization trend could still be in progress.

favour its maintenance, no effects of CLI due to the long-standing contact with nearby L3 category [æ] are attested. Nor, on the other hand, the long AusEng vowel [ɜː] has presumably beared any influence on duration, which could have provoked a lengthening of native [ɛ].

Concerning [a], we posited that: 1) a regressive transfer from L3 to L1 might cause a shift of [a] to a more posterior position - i.e. towards L3 [ɐ][208] - with respect to the control group's productions, which would correspond to a lowering of F2 values; 2) an influence on NVen/SI low central vowel might be exerted by the nearby open-mid [æ] L3, inducing a lowering of F1 and a raising of F2 values in Italo-Australians' productions, with respect to Italian speakers. Both acoustic and statistical data do not show differences in F1 values across groups, either for males or females. Concerning F2 values, on the other hand, marginal acoustic differences are encountered among females: IRIAS speakers overall exhibit lower values with respect to control speakers, as shown from both the trajectory graph and **Table 19** reporting results based on the intercept [a]. Yet, as we already pointed out, F1 and F2 values for GPZ's (male, Ita-Aus, Cadore) low central vowel show very little dispersion as compared to the other speakers. In this respect, we wondered whether this interesting acoustic behaviour could be an effect of regressive transfer from AusEng: in our hypothesis, the presence of low-back [ɐ] in the later-acquired L3 inventory could limit inter-category variation and prevent values for native [a] from expanding backwards. In particular, we observed this phenomenon in one speaker (GPZ) as shown by the dispersion ellipses and the *poly area* parameter. However, the measure of dispersion was not included as dependent variable in our LMM, as we solely considered formant quality (F1 and F2). Overall, none of the dissimilarities found at acoustic level has been confirmed by the post hoc tests. In terms of SLM, we might be facing a case of *category dissimilation* occurring from [a] to [ɐ], which would explain the low degree of dispersion for [a] in GPZ's vocalic space. Namely, the late-established L3 phonetic category [ɐ] has presumably shifted away from the closest L1 [a] because «*bilinguals strive to maintain phonetic contrast between all of the elements in their combined L1-L2 phonetic space in the same way that*

[208] We remind that AusEng also exhibits /ɐː/ in phonological opposition with /ɐ/.

monolinguals strive to maintain phonetic contrast among the elements making up their (L1-only) phonetic space» (Flege *et al.*, 2003: 470).

For [ɔ] and [o], we assumed that these categories would be maintained through the contact with the similar categories [ɔ] and [oː] occurring in L3. Similarly to what has been observed for [e], we witness a "similar scenario", in which L3 sounds are phonemically equivalent but may be phonetically different from L1 sounds. The analysis of F1 and F2 configuration for [ɔ] and [o] as uttered by Italian speakers compared to those as uttered by Italo-Australian proved that their segmental features are similar at a cross-linguistic level. For both vowels, no significant differences emerge across groups, neither for males nor for females. Duration, on the other hand, shows remarkable gender differences in both vowels, yet no lengthening has been found in any case for [o] towards the long L3 vowel [oː].

As for [u], we proposed the following hypotheses: productions of IRIAS speakers could either 1) undergo the influence of both nearby categories [ʊ] and [ʉ] occurring in AusEng L3, which are reported to show a subtle fronting progression. According to the SLM, this would lead to the creation of a "merged" category, which would combine both L1 and L3 acoustic properties: in this case F1 values would remain native-like, while F2 values are expected to increase, approximating L3 norms[209]; or 2) undergo the influence of the diphthongization process typical of the Broad variety of AusEng spoken by low class workers and immigrants. If the second hypothesis holds true, [u] would show a shift to [əːʉ]: in the vowel's spectral configuration, it would result in an onglide in the formant trajectories, from a more central to a higher position. Acoustic data reveal that F1 values are rather similar across groups. On the other hand, concerning F2, we observe that: among males, GPZ interestingly shows a raising trend, which suggests a more fronted articulation for [u] with respect to the other speakers' productions; among females, mean F2 trajectory for [u] is attested at higher frequencies for Italo-Australians, oscillating between 1250 Hz and 1100 Hz, while it appears stable

[209] This can be defined as a NEW scenario in the L2LP model, as two non-native sounds in a contrast [ʊ] and [ʉ] might be perceived as one single native sound [u]. Such scenario is also known as SINGLE-CATEGORY ASSIMILATION in PAM and PAM-L2, for which a high degree of discrimination difficulty is predicted.

around 1000 Hz for control-group females. However, despite acoustic analyses indicated a subtle fronting trend as indexed by higher F2 values, post-hoc comparisons show that [u] as uttered by Italo-Australians do not statistically differ from those of Italian speakers in Veneto. Accordingly, the above-mentioned hypotheses are proven wrong: no merge between the L1 and the L3 categories has occurred neither in formant quality, nor in duration (particularly, average duration for [u] is identical across males).

Bearing in mind the manifestations of a slight inter-speaker variation (see above), it is possible to propose that hypotheses about maintenance of native phonetic features have been *overall* so far confirmed. In fact, first generation HS seem to have not experienced significant restructuring in the L1 as a consequence of L3 experience at a phonetic level; that is, no merged categories were found that have subsumed the phonetic properties of the perceptually linked L1 and L3 speech sounds. In other words, first-generation HS have not approximated L3 norm (Flege *et al.*, 2003), as far as both coronal fricatives and vowels are concerned, even after decades of immersion in an English-speaking environment.

It follows that the prediction of SLM according to which L1, L2 and L3 sounds coexist in a shared perceptual space within each speaker's mind cannot be applied to our data, since the L3 development has not resulted in native categories adjustment. Rather, our results suggest that L2/L3 learners exhibit separate systems for perceiving their two languages, as postulated by the L2LP model. According to Escudero (2005, 2009), we therefore expect that the L2-L3 learner can reach optimal L1 and L2/L3 perception because they are handled by two separate systems.

At the same time, we are conscious that the limited number of subjects involved in the present study is not sufficient to allow further – and more in-depth – assumptions about HL maintenance in a non-native environment. Also, we are aware that the nature of our data cannot be fully representative of the linguistic repertoire exhibited by Italian HSs in Australia. Indeed, analyzing a rich spoken dataset in L3 as realized by the same speakers would have enhanced the comprehension of such a complex setting. Nevertheless, we remind that the main purpose of the IRIAS project was to allow investigations on *attrition*, i.e. cross-linguistic influence in the form of *regressive* transfer (from L3 to L1), rather than *progressive transfer* (from L1 to L3). As a result, we processed a corpus which had purposely included a smaller number of spontaneous utterances in English, compared to a large amount of spoken data in local dialect and regional Italian.

Thus, we could not systematically compute acoustic values for either coronal consonants and vowels within the few English utterances, due to scarcity of tokens[210]. Also, numerous hesitations frequently interrupted productions in L3; at the same time, we noted an overwhelming code-switching to either dialect or Italian, which in most cases prevented from classifying the utterance as "English". To give an example, we report both orthographic transcription of the Italo-Australian female informant from Cadore (CZM), whose spontaneous productions in English were more conspicuous with respect to those of the other speakers:

> *I think I speak / Itàlian better the Italiàn / the Italian the / than Englisss / because the §l'italiano§ / the Italian I can speak / I now I've to use the §i verbiiii il passato il presente§ / §con l'inglese delle volte§ / §dopo parliamo anca si§ / I speak more well I think the §Italiano§ because with my frien' I speak /§eh dipe -- l'italiano come lo sappiamo eh perché non è un italiano italiano propio / why why? §perchè no§ / sometime <<ehm>> I forgot / how to say / the word // eh but I notice sometime I no <<ehm>> doesn't <<ehm>> the word doesn't come straightaway sooo I switch / §eh no quando§ / when I speak with English pe -- people I cannot / no <<ehm>> I don't soppress my Italian when I speak with the English because they / they like it <<ehm>> they say I like your accent.*

To make the reader more aware of the issue, we ultimately show the phonetic transcription of one of these utterances in English:

[210] For example, the Italo-Australian male informant from Cadore (GPZ) refused to speak English in the last session of the interview.

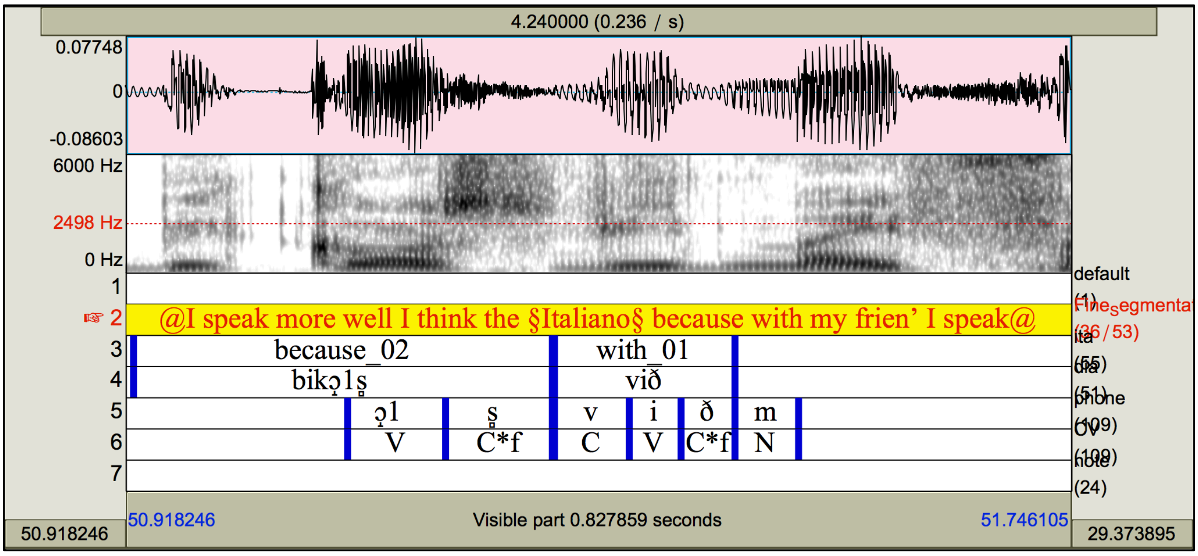

Fig. 53: *A screenshot of the phonetic transcription performed on English utterances by CZM (Ita-Aus female from Cadore)*

In conclusion, we recognize that a bidirectional analysis which takes into account *both* L1 and L3 productions should be of great support to further assess phenomena of inter-language influence in heritage speakers' repertoires. Yet, as noted above, we do not display enough spoken productions by IRIAS informants to build up a contrastive study. For these reasons, the picture so far illustrated should be therefore understood as *one* of the multiple sides of a composite panorama.

Conclusions

The specific aim of this research was to test if and to which extent the fine phonetic properties of the native language can resist the attrition of a later-acquired language when these two systems partially share a comparable phonological inventory but differ for the phonetic content of the target sounds in common. In order to verify hypotheses on either the maintenance of native sounds or the influence exerted by late-acquired L3 English on the native dialect, we investigated dialectal productions of four first-generation Italo-Australian speakers from Northern Veneto (specifically from the areas of Feltre and Cadore, Belluno province), who moved to Sydney in the mid-late 1950s.

In this work, we employed speech data extracted from the IRIAS corpus, and followed a socio-phonetic method to explore phenomena of maintenance, loss, and restructuring in spoken features of first-generation Italo-Australians, who exhibit local dialect as their L1, regional Italian as L2, and Australian English as L3. This thesis presents an unprecedented approach, as spoken characteristics of Italo-Australian speakers have been significantly under-studied with respect to other linguistic domains (such as morphology, lexicon, syntax, pragmatics, etc.). Yet, we believe that these elements are substantial components which contribute to the identification of both heritage speakers' linguistic identity and foreign accent.

Specifically, we acoustically investigated properties of L1 coronal fricatives:/θ/, shared with Australian English L3 but absent in the phonological inventory of their Standard Italian (SI) L2; /s/, and [ʃ] as the fricative release of the obstruent /(t)ʃ/, present in all the three repertoires; as well as L1 vowels: /i, ɛ, e, a, ɔ, o, u/, which are in common with the Standard Italian, but only partially with the Australian English inventory (as we in-depth illustrated in Chapter 6). To assess whether target sounds have undergone cross-linguistic influence from L3 to L1, dialectal productions were compared to those of four ad-hoc-recorded Italian control informants, who were born and currently live in the same areas of origin of the four first-generation Italo-Australian speakers.

As far as the experimental procedure is concerned, we performed both an orthographic and a semi-automatic narrow phonetic transcription on both IRIAS and control-group speakers, and subsequently carried out acoustic analyses on both target consonants and vowels, respectively based on spectral moments (Center of Gravity, Standard Deviation, Skewness and Kurtosis), and on first and second formants. To interpret our results and to give a more in-depth insight into dynamics of contact and cross-linguistic influence in heritage communities, we considered both internal (linguistic) and external (sociolinguistic) factors.

As for linguistic factors, we based our predictions about either phonetic maintenance or restructuring of first language speech features on the cross-language phonetic distance between each native and non-native speech category in contact, complying with the theoretical frameworks of Speech Learning Model (SLM: Flege, 1987, 1995); Perceptual Assimilation Model (PAM and PAM-L2: Best, 1995; Best & Tyler, 2007); Native Language Magnet Model theory (NLM: Kuhl, 1992, 1993, 1997); Second Language Linguistic Perception model (L2LP: Escudero, 2005). In particular, we chose the Speech Learning Model (Flege, 1995) as the main model of reference, since it allows to draw observations on maintenance/phonetic restructuring based on the *acoustic* properties of sounds in contact in bilingual/multilingual adult speakers. For vowels, we based our observations also on the L2LP model, as it is specifically focused on vowel perception and production by learners with a smaller native vowel inventory - such as the NVen system - with respect to that of the non-native language - such as the Australian English system.

With no exceptions, we observed that: a) no merge has occurred between phonemically equivalent sounds which present phonetic differences at cross-linguistic level (for example: NVen apical-alveolar [s] *vs* AusEng alveolar [s]; NVen/SI high-back [u] *vs* AusEng high-back [ʊ] and [ʉ]); b) on the other hand, the persistent contact between the L1 and L3 categories that have equivalent phonetic realizations in the two systems has favored the maintenance of target sounds in L1-dialect. Globally, no significant effects of cross-linguistic regressive influence have been detected. Results of mixed-model statistical analyses on both coronal fricatives' and vowels' acoustic characteristics reveal that the immigrants have overall maintained target sounds after more than five decades of residence in Australia. Nonetheless, there are some fine-grained differences induced by the local sub-variety which will be further discussed below.

To evaluate the sociolinguistic nature of such evident maintenance, we also took into account the following external factors: age of arrival in the host country, length of residence, amount, frequency, type of input and exposure to L3. As illustrated in Chapter 5, we observed that such factors are overall comparable across our subset of heritage speakers, as all of them were dialectal speakers who: a) migrated to Australia in the post-adolescence/early-adulthood; b) received formal education in Italian, in Italy, before their departure; c) subsequently acquired English as third language, almost exclusively by immersion; d) received more than 50 years of input of English. Also, we considered the type of social interactions entwined by heritage speakers within and outside the communities. In both oral interviews and socio-linguistic questionnaires, informants involved in the present study unanimously describe their social networks as generally circumscribed to their families and other members of the immigrant community, with limited external interactions. Besides, both males and females report to feel more comfortable in employing their native dialect, rather than English, in everyday communication. This confirms what has been observed in previous studies (see e.g. Bettoni, 1981; Tosi, 1991), according to which Italian immigrants who settled in urban areas mostly developed personal kinships and social contacts with people from the same region, and hence predominantly used the local dialect - rather than English - both at home and outside with close members of their community. We hence observe that HSs can be understood as trilingual social actors living in highly cohesive communities characterized by one dense and hyper-connected network. Accordingly, as predicted in Chapter 1, actors who built family, kinship and friendship ties with individuals speaking their very same dialectal variety has almost exclusively employed their dialect L1 to communicate with members of their social network: entropy hence reveals to be minimal. Nonetheless, this sociolinguistic picture suggests that the local dialect L1 will quickly decay in the competence of the speakers, as: the number of people with whom it can be spoken diminishes, and, at the same time, the situations in which the individual is required/forced to employ English (both within and outside his community) increase (see Avesani *et al.*, 2015).

In conclusion, we observe that the co-occurrence of numerous factors has led to a substantial limitation in the amount of L3 to which Italian immigrants have been exposed through the years, and, in parallel, to a significant degree of maintenance of their native dialect, which is still predominantly employed in everyday communicative settings. Taking into consideration the hypotheses formulated in Chapter 4 about maintenance or attrition/restructuring of Italo-Australians' native speech features, we therefore see that only the first one has been confirmed, i.e. the hypothesis *conservation of the phonetic/phonological features* of dialect as heritage language. We can claim that Bellunese HSs from the areas of Cadore and Feltre have *preserved* their linguistic heritage, as:

1. we observed no vertical *advergence* from L1-dialect towards L2-Italian: concerning coronal fricatives, HSs have maintained the landmark dialectal consonant [θ] in target contexts (despite some inter-group differences), and a more retracted place of articulation for dialectal [s] with respect to the Standard Italian [s], which is typical of their Veneto regional Italian, as described by Canepari (1984). As well, vowels are maintained in the same contexts and with the same acoustic values attested for the Italian control group in Veneto.

2. at the same time, we did not find phenomena of *convergence* toward a regional dialectal *koinè*, since Italo-Australians have not lost the specificity of their L1 speech features, as compared to the control group's productions. Nonetheless, both acoustical and statistical analyses revealed a difference induced by the local sub-variety (Cadorino vs Feltrino) on the spectral properties of [θ] in particular. Specifically, we observed that the interdental fricative of speakers originating from Cadore (both ALM and BCL) displays higher values of CoG, both with respect to speakers originating from Feltre and to Cadorino speakers in Australia. Accordingly, we hypothesized that such dissimilarity at acoustic level could be related to the difference in age of

these speakers both compared to Feltre controls and to the HS from the same area. In light of these data, we posited that either the local dialect spoken by Italians in Cadore has undergone a subtle change in the last decades, after the Italo-Australians left the region, or that we are more likely to be encountering individual differences.

Overall, results suggest that dialect as L1 is preserved and maintained by our Italo-Australian informants in an attenuated form of diglossia with respect to L2-Italian, as it was before their departure (Avesani *et al.*, 2015). Namely, as reported in the sociolinguistic questionnaires as well as in the interviews, Italian is employed with Italians from other regions and in more formal situations (for example with other casual acquaintances within the immigrant community). However, although Italian is still perceived by HSs as somehow higher with respect to dialect, we must consider that AusEng is commonly understood as the H variety, being the host country's official language (Gallina, 2011).

Moreover, we observe that:

3. despite averagely 50 years of persistent contact with Australian English L3, the immersion in a non-native language environment has not exerted any significant influence on HS' local dialect. Although acoustic analyses suggest possible preliminary cues of merging with segmental properties of L3 categories – at least in one speaker (GPZ), statistical analyses reveal that such evidence is not significant enough to prove the presence of regressive transfer.

Based on this evidence, the second hypothesis about possible *effects of attrition/restructuring either* from Italian and/or from Australian English is disproven. Overall, we are aware that the limited number of subjects involved in this study allows only for very cautious considerations about HLs maintenance in a non-native environment. Nonetheless, experimental analyses have clearly demonstrated a homogeneous pattern for the conservation of native speech features, which is indeed not fortuitous. Such findings indeed encourage new possible directions of research, which could involve:

- a larger number of first-generation heritage speakers migrated from the same areas in Northern Veneto;
- second-generation Italo-Australians from Northern Veneto, to evaluate the effects of a (presumably) greater phonetic influence exerted by Australian English, with respect to the one experienced by our first-generation subjects;
- both first- and second-generation speakers originating from other areas of Veneto, such as the province of Rovigo. In fact, as it has been illustrated in previous promising works (Avesani *et al.*, 2015; Avesani *et al.*, 2017), their native dialectal sub-system (i.e., Central Veneto) shows phonetic differences compared to the Northern Veneto system. Accordingly, such inherent dissimilarities at the level of sound structure could possibly generate a different scenario of cross-linguistic influence with respect to the one so far depicted for IRIAS speakers from NVen. Comparing manifestations of either sound maintenance or change across these two groups would thusly allow to obtain a wider and more representative picture of the Veneto heritage communities in Australia.

Overall, we believe that the present work could represent an important contribution, not only within the area of "heritage linguistics" studies, but also within the – still – less-explored phonetic aspects of multiple-language interference; besides, the accurate methodology we employed for a detailed acoustic and socio-phonetic analysis could be useful for future studies within this domain.

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Appendix 1

List of target words

Italian lexeme	Target coronal	Latin lexeme[211]	Latin > Dialect	IPA transcription of the Dialectal lexeme
BISCIA	θ	bīstia	stj > ʃ	'bi:ʃa / karbo'naθ
BRACE	θ	prūnĭceus	ke > ʧ	'broɳθe
BURRO	t	butȳrum	t	bu'ti:ro
CASSA	s	căpsa	ps > s	kasa'paŋka
CATENA	ð	catēna	t (> d) > ð	ka'ð̞e:na
CAVEZZA	θ	capĭtia	tj > θ	ka'ʋe:θa
CAZZUOLA	θ	Mediev. Lat. cattia	tj > θ	ka'θɔ:la
CENERE	θ	cĭnerem	ki > ʧ > θ	'θe:ɳere
CENTO	θ	centum	k (> ʧ) > θ	'θeɳto
CENTRO	θ / ʧ	centrum	k (> ʧ) > θ	'θeɳtro
CEPPO	θ	cĭppum	ki > ʧ > θ	'θo:ka
CESTA	θ	cĭsta	ki > ʧ > θ	'θest(a)
CHIAVE	ʧ	clāvem	kl > kj > ʧ	'ʧa:ʋe
CHIESA	ʧ	ecclēsiam	kl > kj > ʧ	'ʧe:za
CHIODI	ʧ	clāvum	kl > kj > ʧ	'ʧɔ:ð̞i
CILIEGIA	θ / s	Vulg. Lat. *ceresea	ke > ʧ > θ	θa'rje:za
CIMICE	θ	cīmice	ki > ʧ > θ	'θi:mes
CIMITERO	θ	cimitēriu	ki > ʧ > θ	θimi'tɛ:ro
CIPOLLA	θ	cepùllam	ke > ʧ > θ	'θeola
CUCCHIAIO	ʧ	cochleārium	kl (> kj) > ʧ	ku'ʧa:ro

[211] From Sabatini F. & Coletti V. (2008). DISC: Dizionario italiano Sabatini Coletti. Firenze: Giunti.

DADO	ð	datum	t (>d) > ð	da:ð̞o
DAMIGIANA	ð	NA	d > ð	(la) ð̞ami'ʥ:ana
DENTE	ð	dĕntem	d	deɳt
DIGA	ð	NA	d > ð	(la)'ð̞iga
DITALE	ð	Late Lat. digitale	t (> d) > ð	di'ð̞jal / de'a:e
DOGA	ð	Late Lat. dōga	d > ð	'ð̞ɔ:ɣ̞a
FAZZOLETTO	θ	Vulg. Lat. faciolu	ts > θ	faθo'l̞et
FOSSO	s	fŏssa	s	'fɔ:sa
GIACCA	t	NA	t	(la) ɟa'ke:ta
INCUDINE	ð	incudĭnem	d > ð	iɳ'ku:ð̞eɳ
LACCIO	θ	lăqueum Vulg. Lat. *laceu	k (> ʧ) > θ	'laθ:
MESTOLO	θ	Mediev. Lat. cattia	tj > θ	ka'θɔ:lo
ORECCHIE	ʧ	aurĭculam Vulg. Lat. oric(u)la	k > ʧ	o're: ʧe
OSSO	s	ŏs > ossum	s	'ɔ:so
PATATA	t	NA	t	pa'ta:ta
PETTINE	t	pĕctinem	kt > t	'pɛ:teɳ
PEZZA	θ	Vulg. Lat. pettia	kt > tj > θ	'pɛ:θa
PIDOCCHIO	ʧ	Vulg. Lat. peduclum	kl (> kj) > ʧ	peð̞'ɔ:ʧo
PRESINE (CIAPIN)	ʧ	NA	ʧ	ʧa'pin
RICCIO	θ	(> ēr) erīcium	ʧ > θ	'ɾiθ:
ROSSO	s	rubeus	s	'ɾo:so
REDINI	ð	Late Lat. retĭnam	t (> d) > ð	le 'ɾe·ð̞ene
RUOTA	ð	rŏtam	t (> d) > ð	'ɾɔ:ð̞a:
SALICE	s	sălicem	ke > ʧ	'sale:θ
SALAME	s	Late Lat. salamen	s	sa'la:me
SCODELLA	ð	scūtellam	t > d > ð	sku'ð̞ɛ:la

SECCHIO	s + ʧ	Vulg. Lat. *sitlu	s	'se:ʧa
SEGA	s	Vulg. Lat. *seca	s	'se:ɣ̞a
SELLA	s	sĕllam	s	'sɛ:la
SIEPE	s	sǣpem	s	'θje:za
SOTTANA	s / t	subtanum	s	'kɔ:tola
SPECCHIO	s + ʧ	spĕculum	s + ʧ	'spɛ:ʧo
TAVOLA	t	tăbulam	t	'tɔ:la
TEGLIA	t	tēgŭla	t	'te:ʧa
TELAIO	t	Vulg. Lat. telariu	t	te'lɛ:ɾ
TINO	t	Late Lat. tinum	t	ti:na
TORCHIO	t + ʧ	tŏrculum	t + ʧ	'tɔɾʧo
TORO	t	taurum	t	'tɔ:ɾo
TOPO (SORCIO)	θ	sōricem	ke > ʧ > θ	'so:ɾθ
TRECCIA	θ	Vulg. Lat. trichia	kj	'dɾe:θa
ZAPPA	θ / s	Late Lat. sappam	s > θ	'θa:pa
ZOCCOLI	θ	sŏccum Vulg. Lat. sòcculu	s (> dz) > θ	(i) 'θɔ:koj
ZOPPO	θ	clŏppus	kl (> dz) > θ	'θɔ:t
ZUCCHERO	θ	NA	dz > θ	'θu:kero

Appendix 1: *Target words in Italian in alphabetical order; codification of the target coronal; reference to the Latin derivation; consonant sound change from Latin to Veneto Dialect; IPA transcription of the target word in Dialect*

Appendix 2

Sociolinguistic questionnaire

Data: _____________   Numero Partecipante: _____________

Informazioni socioculturali

1. Età: _____

2. Che mano usi per scrivere? *(cerchia la risposta)*: **Sinistra** **Destra** **Entrambe**

3. Genere: **Maschio** **Femmina**

4. Hai avuto recentemente problemi di udito? **Sì** **No**

- *Se sì, descrivi il disturbo.*

5. Hai dei problemi visivi che non sono corretti con occhiali o lenti a contatto? **Sì** **No**

- *Se sì, descrivili.*

6. Tu o i tuoi famigliari piu stretti (*genitori, fratelli*) avete avuto/avete problemi particolari nello sviluppo linguistico (es: *dimenticanza del linguaggio imparato, serie difficolta ad imparare parol nuove e, o a ricordare il nome degli oggetti*)?

- *Se sì, chi ha/aveva il problema e di che natura era?*
  A che età? È stato necessario l'intervento di un logopedista?

Sì **No**

7. Tu o i tuoi famigliari piu stretti (*genitori, fratelli)* avete avuto/avete problemi con il linguaggio parlato? *(es: balbuzie, "lisca", etc.)*?

- *Se sì, chi? Che tipo di problema?*
  A che età? È stato necessario l'intervento di un logopedista?

Sì **No**

8. Tu o i tuoi famigliari piu stretti (*genitori, fratelli)* avete avuto/avete particolari problemi nell'apprendimento del linguaggio (*es: confondete certi suoni o lettere, dislessia)*?

- *Se sì chi? Che tipo di problema?*
  A che età? È stato necessario l'intervento di un educatore alla lettura?

Sì **No**

9. Quanti anni avevi quando hai iniziato a sentire parlare l'italiano *(es: dalla nascita; 2 anni; 5 anni)*?

____

10. Venivano parlate altre lingue, in casa, oltre l'italiano mentre crescevi?

Sì **No**

- *Se sì, elenca ogni lingua, indicando il tuo livello di abilita di parlare, comprendere, leggere e scrivere quella stessa lingua, indicando se consideri te stesso un parlante nativo di quella lingua, e indica I membri della tua famiglia che la parlano (es, mamma, papà, nonni, fratelli e sorelle).*

Lingua	**Indica il tuo livello di abilità cerchiando il numero** ***1****= molto poco* ***5****= molto bene*				Sei un parlante nativo?	Membri della famiglia che la parlano
	Parlata	Compresa	Letta	Scritta		
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	SI NO	
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	SI NO	
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	SI NO	
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	SI NO	

11. Elenca altre lingue che hai appreso al di fuori della famiglia *(es, studiate a scuola, lunghe permanenze in altri paesi)*, quanti anni avevi quando hai iniziato a studiare quella lingua, e quanto bene la parli, comprendi, leggi, e scrivi ognuna di esse?

Lingua	Età in cui hai iniziato a studiare ogni lingua *(e per quanti anni se l'hai studiata a*	**Indica il tuo livello di abilità cerchiando il numero** ***1****= molto poco* ***5****= molto bene*			
		Parlata	Compresa	Letta	Scritta
		1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
		1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
		1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

12. Fai una lista dei posti in cui hai vissuto, indicando per ognuno di essi che età avevi quando vivevi lì.

Citta, Regione, Stato	**Che età avevi quando vivevi lì?**
Sono nato a: ______________________	______________________
Ho vissuto a: ______________________	______________________
______________________	______________________
______________________	______________________

13. Dove sono cresciuti tua mamma e tuo papa'? Inserisci le informazioni piu dettagliate possibili

Madre *Città, Regione, Stato*	**Padre** *Città, Regione, Stato*
______________________	______________________

Grazie per la Tua collaborazione!

Appendix 3

Tables of spectral values for control-group and IRIAS speakers

1. *CONTROL-GROUP speakers*

Center of Gravity						
speaker	phone	Min	Max	Mean	SD	Median
ALM - M - Ctrl - Cadore	θ	2985.27	7633.03	5226.27	1261.4	5101.71
ALM - M - Ctrl - Cadore	s	2205.02	5292.45	4248.93	594.32	4253.65
ALM - M - Ctrl - Cadore	ʃ	3019.98	5131.43	3791.23	370.04	3758.35
SPR - M - Ctrl - Feltre	θ	646.25	3981.58	2223.96	889.38	2231.36
SPR - M - Ctrl - Feltre	s	1430.64	5292.85	3601.46	812.34	3700.2
SPR - M - Ctrl - Feltre	ʃ	2563.8	5394.57	3866.11	620.32	3821.28
BCL - F - Ctrl - Cadore	θ	552.76	9010.95	5376.99	2455.94	6355.58
BCL - F - Ctrl - Cadore	s	4048.65	6998.89	5457.92	627.87	5380.06
BCL - F - Ctrl - Cadore	ʃ	3241.53	7158.44	5585.65	808.56	5613.59
RDP - F - Ctrl - Feltre	θ	1417.85	7941.64	4203.62	1815.59	4387.98
RDP - F - Ctrl - Feltre	s	3519.14	5970.7	4916.4	749.83	5074.59
RDP - F - Ctrl - Feltre	ʃ	2821.36	7063.73	4848.45	961.57	4797.21

Standard Deviation						
speaker	phone	Min	Max	Mean	SD	Median
ALM - M - Ctrl - Cadore	θ	1360.83	4273.9	3113.84	531.05	3226.48
ALM - M - Ctrl - Cadore	s	1116.76	2392.5	1682.36	293.48	1610.69
ALM - M - Ctrl - Cadore	ʃ	1177.97	1859.68	1539.47	174.86	1562.22
SPR - M - Ctrl - Feltre	θ	740.09	3373.35	1963.89	557.42	2042.59
SPR - M - Ctrl - Feltre	s	1441.7	2987.2	2112.28	320.91	2073.67
SPR - M - Ctrl - Feltre	ʃ	1137.36	3378.09	2133.11	479.9	2085.76
BCL - F - Ctrl - Cadore	θ	451.49	4401.88	2791.13	722.13	2813.67
BCL - F - Ctrl - Cadore	s	1340.74	2680.79	2052.14	258.44	2024.04
BCL - F - Ctrl - Cadore	ʃ	1556.98	3169.68	2274.63	333.3	2271.32
RDP - F - Ctrl - Feltre	θ	1895.5	3980.37	2947.73	602.02	3009.75
RDP - F - Ctrl - Feltre	s	808.35	2687.2	1627.29	504.62	1582.18
RDP - F - Ctrl - Feltre	ʃ	874.7	2855.35	1828.93	549.73	1900.15

Skewness						
speaker	phone	Min	Max	Mean	SD	Median
ALM - M - Ctrl - Cadore	θ	-1.08	2.67	0.56	0.7	0.52
ALM - M - Ctrl - Cadore	s	-0.83	2.98	1.07	0.85	0.93
ALM - M - Ctrl - Cadore	ʃ	0.42	3.89	1.78	0.68	1.76
SPR - M - Ctrl - Feltre	θ	1.05	15.95	2.88	2.64	2.06
SPR - M - Ctrl - Feltre	s	0	2.89	1.15	0.57	1.06
SPR - M - Ctrl - Feltre	ʃ	0.15	2.58	1.05	0.54	1
BCL - F - Ctrl - Cadore	θ	-2.19	18.33	0.80	2.88	-0.1
BCL - F - Ctrl - Cadore	s	-0.46	1.93	0.59	0.44	0.57
BCL - F - Ctrl - Cadore	ʃ	-1.46	1.14	0.04	0.62	0.23
RDP - F - Ctrl - Feltre	θ	-1.33	3.02	0.93	1.14	0.89
RDP - F - Ctrl - Feltre	s	-0.2	5.86	1.81	1.55	1.6
RDP - F - Ctrl - Feltre	ʃ	-0.73	3.06	1.08	1.06	1.05

Kurtosis						
speaker	phone	Min	Max	Mean	SD	Median
ALM - M - Ctrl - Cadore	θ	-1.5	13.98	0.98	2.62	0.28
ALM - M - Ctrl - Cadore	s	-0.96	24.74	5.24	5.3	3.17
ALM - M - Ctrl - Cadore	ʃ	-0.07	31.51	8.08	5.64	7.2
SPR - M - Ctrl - Feltre	θ	0.68	336.38	20.8	54.95	6.66
SPR - M - Ctrl - Feltre	s	-0.82	13.79	2.99	2.66	2.35
SPR - M - Ctrl - Feltre	ʃ	-0.94	11.52	3.08	3.18	2.5
BCL - F - Ctrl - Cadore	θ	-1.26	473.91	11.96	62.31	1
BCL - F - Ctrl - Cadore	s	-0.94	9.26	1.82	2.1	1.3
BCL - F - Ctrl - Cadore	ʃ	-1.04	7.1	1.28	1.5	0.91
RDP - F - Ctrl - Feltre	θ	-1.53	11.77	2	3.47	0.75
RDP - F - Ctrl - Feltre	s	-1.01	70.88	12.41	17.58	7.76
RDP - F - Ctrl - Feltre	ʃ	-0.53	20.62	5.56	5.83	5.32

2. IRIAS speakers

Center of Gravity						
speaker	phone	Min	Max	Mean	SD	Median
GPZ- M - Ita-Aus - Cadore	θ	885.38	5818.7	2622.05	1519.25	2279.16
GPZ- M - Ita-Aus - Cadore	s	2822.4	4768.06	3511.35	396.86	3472.86
GPZ- M - Ita-Aus - Cadore	ʃ	1848.16	4439.15	3513.46	461.62	3429.47
MZN - M - Ita-Aus - Feltre	θ	1058.13	6864.55	3532.89	1404.84	3589.47
MZN - M - Ita-Aus - Feltre	s	2502.89	6480.06	4113.63	679.92	4039.43
MZN - M - Ita-Aus - Feltre	ʃ	2729.67	5061.59	3908.06	510.17	3883
CZM - F - Ita-Aus - Cadore	θ	2114.3	7626.76	5234.86	1707.71	5383.84
CZM - F - Ita-Aus - Cadore	s	2794.61	4894.77	4172.84	489.38	4305.76
CZM - F - Ita-Aus - Cadore	ʃ	3383.48	5026.27	4081.3	431.63	4037.05
ACS - F - Ita-Aus - Feltre	θ	1622.79	7094.8	4199.97	1083.22	4009.94
ACS - F - Ita-Aus - Feltre	s	3949.25	8241.02	5608.25	1072.77	5435.2
ACS - F - Ita-Aus - Feltre	ʃ	3531.54	7700.97	5064.58	929.05	4771.82

Standard Deviation						
speaker	phone	Min	Max	Mean	SD	Median
GPZ- M - Ita-Aus - Cadore	θ	993.83	4035.11	2484.08	892.63	2575.80
GPZ- M - Ita-Aus - Cadore	s	836.13	1973.52	1189.88	262.61	1131.26
GPZ- M - Ita-Aus - Cadore	ʃ	703.35	2967.43	1263.95	389.62	1185.04
MZN - M - Ita-Aus - Feltre	θ	1746.22	4344.71	3008.69	610.96	3042.98
MZN - M - Ita-Aus - Feltre	s	942.39	2948.58	1881.96	442.54	1880.45
MZN - M - Ita-Aus - Feltre	ʃ	995.52	2683.58	1783.97	429.2	1773.98
CZM - F - Ita-Aus - Cadore	θ	2150.07	4599.38	3338.30	626.49	3370.17
CZM - F - Ita-Aus - Cadore	s	1039.84	2226.72	1645.05	330.76	1708.57
CZM - F - Ita-Aus - Cadore	ʃ	1066.3	2344.36	1687.87	392.66	1638.81
ACS - F - Ita-Aus - Feltre	θ	1630.36	4357.98	3090.26	569.32	3083.28
ACS - F - Ita-Aus - Feltre	s	1194.18	3645.51	2147.80	536.81	2026.16
ACS - F - Ita-Aus - Feltre	ʃ	1191.32	3605.09	2292.98	463.42	2308.71

Skewness						
speaker	phone	Min	Max	Mean	SD	Median
GPZ- M - Ita-Aus - Cadore	θ	-0.19	6.92	2.53	1.96	2.15
GPZ- M - Ita-Aus - Cadore	s	1.04	8.71	4.33	2.12	4.20
GPZ- M - Ita-Aus - Cadore	ʃ	0.71	7.95	3.83	1.54	3.76
MZN - M - Ita-Aus - Feltre	θ	-0.28	4.92	1.47	1.13	1.21
MZN - M - Ita-Aus - Feltre	s	-0.16	4.01	1.93	0.85	1.88
MZN - M - Ita-Aus - Feltre	ʃ	0.47	6.42	2.33	1.08	2.15
CZM - F - Ita-Aus - Cadore	θ	-1.74	2.9	0.4	1.18	0.36
CZM - F - Ita-Aus - Cadore	s	-0.34	2.9	1.34	0.78	1.36
CZM - F - Ita-Aus - Cadore	ʃ	0.22	4.86	1.43	0.99	1.18
ACS - F - Ita-Aus - Feltre	θ	-0.41	4.6	1.2	0.71	1.14
ACS - F - Ita-Aus - Feltre	s	-0.81	3.74	0.79	0.92	0.63
ACS - F - Ita-Aus - Feltre	ʃ	-0.59	2.81	0.77	0.67	0.69

Kurtosis						
speaker	phone	Min	Max	Mean	SD	Median
GPZ- M - Ita-Aus - Cadore	θ	-1.3	82.68	15.16	22.12	4.14
GPZ- M - Ita-Aus - Cadore	s	1.23	131.68	42.08	37.6	31.82
GPZ- M - Ita-Aus - Cadore	ʃ	5.78	93.81	32.23	24.49	24.08
MZN - M - Ita-Aus - Feltre	θ	-1.44	29.13	3.47	6.45	1.18
MZN - M - Ita-Aus - Feltre	s	-0.79	28.56	8	6.65	6.73
MZN - M - Ita-Aus - Feltre	ʃ	-0.32	59.71	11.66	10.94	7.99
CZM - F - Ita-Aus - Cadore	θ	-1.47	11.68	1.01	3.29	-0.45
CZM - F - Ita-Aus - Cadore	s	1.5	25.18	9.17	7.1	6.81
CZM - F - Ita-Aus - Cadore	ʃ	0.46	62.77	9.71	11.25	6.41
ACS - F - Ita-Aus - Feltre	θ	-1.33	23.07	2.42	3.96	1.27
ACS - F - Ita-Aus - Feltre	s	-0.92	28.03	3.76	4.99	2.02
ACS - F - Ita-Aus - Feltre	ʃ	-1	18.88	2.79	3.99	1.55

Appendix 4

Tables of F1 and F2 values for control-group and IRIAS speakers

1. ALM - M - Ctrl - Cadore

ALM - M - Ctrl - Cadore							
[i]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	124	124	123	123	179	150	118
Max	978	477	836	443	503	1343	1181
Mean	343.5	294.9	312.1	296.1	303.2	344	363.2
SD	161.56	72.77	106.67	63.32	72.13	188.76	201.59
Median	294	292	292	296	287	323	325
ALM - M - Ctrl - Cadore							
[i]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1721	1856	1954	2057	1924	1736	1650
Max	2725	2449	2607	2708	2621	2709	2797
Mean	2220	2234	2319	2367	2367	2356	2305
SD	231.04	160.13	135.98	134.22	153.66	225.36	257.59
Median	2295	2449	2317	2372	2372	2371	2340

ALM - M - Ctrl - Cadore							
[e]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	287	257	179	277	281	239	184
Max	986	624	580	593	1019	1607	1650
Mean	416	427.2	420.6	422.9	436.6	470.7	509.3
SD	123.87	71.99	63.26	64.57	101.91	174.20	171.62
Median	439.3	417	429	422	419	406	414
ALM - M - Ctrl - Cadore							
[e]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1450	1481	1610	1602	1693	1535	1575
Max	2554	2547	2648	2458	2669	3291	2999
Mean	2067	2052	2078	2101	2099	2109	2134
SD	271.06	237.34	205.72	185.62	217.86	317.73	359.27
Median	2091	2082	2091	2120	2087	2080	2076

ALM - M - Ctrl - Cadore							
[ε]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	367	367	484	420	387	302	151
Max	828	921	765	717	717	634	895
Mean	566.5	576.6	576.5	560.3	538.3	504	488.3
SD	93.37	96.14	63.20	58.98	71.85	78.66	119.85
Median	543	559	571	555	542	517	499
ALM - M - Ctrl - Cadore							
[ε]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1176	1424	484	1519	1521	1506	1577
Max	2251	2323	2141	2246	2321	2210	2414
Mean	1724	1786	1824	1920	1947	1906	1925
SD	251.65	188.72	152.23	145.68	164.9	175.86	190.83
Median	1737	1791	1825	1924	1935	1935	1958

ALM - M - Ctrl - Cadore							
[a]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	287	415	543	605	592	533	495
Max	986	1032	1170	1115	1202	1107	1147
Mean	718	739.9	820.6	865.3	832	770.9	753.1
SD	121.50	112.48	119.65	127.56	127.75	117.13	1361
Median	714	731	828	873	827	741	717
ALM - M - Ctrl - Cadore							
[a]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	878	907	1040	1089	930	923	922
Max	2395	2272	1948	1990	2428	2558	2570
Mean	1574	1533	1459	1411	1398	1444	1459
SD	325.54	285.75	209.51	149.65	192.30	274.2	298.42
Median	1554	1493	1456	1415	1395	1389	1402

ALM - M - Ctrl - Cadore							
[ɔ]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	420	751	513	502	454	396	377
Max	811	745	796	829	781	630	751
Mean	601.8	616.4	618.4	626.5	624.4	523.9	547.4
SD	63.50	619	646	75.72	728	92.58	95.88
Median	602.5	611	610	619	613	502	559
ALM - M - Ctrl - Cadore							
[ɔ]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	648	751	725	746	652	748	772
Max	1773	1399	1339	1268	1288	1374	1461
Mean	1115	1086	1041.9	1006.9	1006.1	1050.9	1095.5
SD	191.78	153.56	135.35	139.61	138.66	151.03	154.63
Median	1140	1107.5	1035.5	1003.5	1000	1067.5	1099

ALM - M - Ctrl - Cadore							
[o]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	430	433	369	393	402	396	377
Max	599	591	686	660	686	630	751
Mean	506.7	508.4	520.1	510.9	514.8	523.9	547.4
SD	57.69	35.71	62.65	62.32	77.85	72.40	828
Median	505	506	516	514	492	502	559
ALM - M - Ctrl - Cadore							
[o]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	623	691	728	734	786	724	780
Max	1286	1526	1575	1251	1504	1289	1242
Mean	1009	1002	998.8	982.1	1012	988.4	1043
SD	196.87	190.87	190.39	137.08	180.46	143.48	120.74
Median	1066	968	984	1014	997	975	1065

ALM - M - Ctrl - Cadore							
[u]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	312	230	230	290	230	292	290
Max	600	494	416	448	491	444	484
Mean	377.7	366.4	363.3	359.1	363.2	384.3	385.9
SD	65.16	58.5	39.66	39.33	635	51.42	51.53
Median	371	367	367	357	364	404	391
ALM - M - Ctrl - Cadore							
[u]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	789	771	686	671	694	673	416
Max	1080	1555	1172	1039	1118	1105	1195
Mean	902.5	1055	880.4	871.7	918.4	936.9	986.9
SD	93.10	403.24	126.68	110.18	119.27	116.49	178.58
Median	854	969	857	876	948	965	1033

2. SPR- M - Ctrl - Feltre

SPR - M - Ctrl - Feltre							
[i]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	197	197	131	155	128	155	134
Max	501	498	482	431	405	1320	2117
Mean	292.9	291.4	300	286.4	249.9	328.3	362.9
SD	71.68	68.78	67.84	63.63	71.10	206.65	351.86
Median	267	278.5	298	292.5	313.5	303.5	311
SPR - M - Ctrl - Feltre							
[i]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1117	1406	1726	1834	1849	1754	1756
Max	2419	2408	2431	2440	2586	2913	3172
Mean	2037	2090	2154	2185	2183	2173	2195
SD	347.69	247.53	154.02	128.55	157.9	209.29	257.77
Median	2131	2145	2161	2192	2203	2160	2128

SPR - M - Ctrl - Feltre							
[e]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	149	274	131	328	274	268	197
Max	752	642	667	654	597	550	851
Mean	397	398	394	406	389.1	372.5	414.6
SD	123.48	71.5	93.19	67.45	63.94	66.74	376.14
Median	363	382	385	396	392	367	357
SPR - M - Ctrl - Feltre							
[e]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1454	1281	1715	1755	1610	1516	1262
Max	2453	2449	2463	2427	2375	2793	2291
Mean	1969	1944	2024	2050	2015	2000	1948
SD	227.06	226.87	161.79	147.19	159.55	232.34	229.8
Median	1960	1955	2030	2033	2001	1976	1946

SPR - M - Ctrl - Feltre							
[ɛ]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	149	230	413	398	204	195	254
Max	954	590	612	590	604	615	1445
Mean	469	451.5	492	502.9	485.7	467.9	503.6
SD	132.4	72.19	43.63	40.68	68.41	81.61	196.67
Median	454.5	460	488	505	487.5	470.5	467.5
SPR - M - Ctrl - Feltre							
[ɛ]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1256	1442	1607	1641	1572	1542	1518
Max	3258	2173	2237	2271	2306	2297	2534
Mean	2767	1823	1900	1948	1931	1900	1931
SD	216.66	163.96	121.3	117.49	142.07	174.66	243.95
Median	2759	1816	1896	1964	1943	1862	1892

SPR - M - Ctrl - Feltre							
[a]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	199	480	557	549	522	484	457
Max	1106	1072	817	875	859	1046	1046
Mean	619	649.5	688.1	714.7	676.3	640	622.5
SD	124.83	86.16	60.16	68.96	58.35	84.45	86.49
Median	618	653	695	712	678	641.5	627
SPR - M - Ctrl - Feltre							
[a]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	958	954	1033	1164	1168	1143	1096
Max	2856	2315	1989	1677	3007	2470	1975
Mean	1525	1482	1405	1392	1428	1413	1385
SD	355.31	296.49	183.3	105.3	243.21	215.88	179.6
Median	1521	1494	1405	1382	1407	1400	1377

SPR - M - Ctrl - Feltre							
[ɔ]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	345	390	405	398	400	357	283
Max	583	588	638	619	624	623	664
Mean	483.2	487.6	517.9	530.8	510.3	470	466.1
SD	52.24	50.94	46.31	48.82	52.12	67.96	80.69
Median	488	476	511	533	498	481	449
SPR - M - Ctrl - Feltre							
[ɔ]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	770	842	841	815	802	775	754
Max	1538	1432	1304	1308	1433	1710	1825
Mean	1095	1077	1073	1086	1122	1138	1148
SD	164.88	141.89	118.89	120.68	144.36	188.6	211.54
Median	1110	1069	1070	1091	1147	1161	1144

SPR - M - Ctrl - Feltre							
[o]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	328	341	364	396	378	358	350
Max	500	560	522	546	549	658	699
Mean	405.3	422.2	439.3	452.9	456.5	458	459.5
SD	44.50	45.34	40.98	421	43.29	63.79	71.26
Median	403	419	433	440	453	452	458
SPR - M - Ctrl - Feltre							
[o]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	591	591	625	708	732	689	703
Max	1498	1446	1265	1228	1288	1747	1743
Mean	1072	1099	1040	1024	1031	1064	1065
SD	238.36	207.24	167.82	140.94	142.13	194.55	202.91
Median	1056	1094	1049	1028	1026	1097	1028

SPR - M - Ctrl - Feltre							
[u]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	146	167	241	207	207	252	205
Max	538	456	390	376	416	421	420
Mean	298.8	295.9	313.4	318.5	315.2	316.6	318
SD	87.35	66.71	425	50.92	58.16	46.91	56.81
Median	289	298	313	330	320	314	315
SPR - M - Ctrl - Feltre							
[u]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	775	792	713	783	811	757	824
Max	1592	1160	1166	1218	1180	1208	1216
Mean	1017	969.5	943.7	1001	1021	1012	1031
SD	207.07	103.69	109.82	125.96	109.98	115.98	117.57
Median	1014	966	945	1014	1050	1018	1021

3. GPZ- M - Ita-Aus - Cadore

GPZ - M - Ita-Aus - Cadore							
[i]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	273	288	277	309	301	314	231
Max	412	411	406	402	403	403	399
Mean	358.4	362.4	354.9	353.9	351.4	346.2	330.1
SD	38.22	34.52	32.37	30.2	33.22	27.15	46.42
Median	360.5	361	359.5	354.5	352.5	339	332
GPZ - M - Ita-Aus - Cadore							
[i]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1614	1679	1722	1734	1727	1602	1543
Max	2021	1998	1971	2075	2061	2053	2154
Mean	1800	1805	1869	1932	1944	1896	1899
SD	121.95	99.55	74.35	92.24	115.72	133.42	161.8
Median	1797	1814	1891	1956	1980	1912	1900

GPZ - M - Ita-Aus - Cadore							
[e]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	310	341	409	445	390	377	377
Max	836	789	783	783	705	663	680
Mean	440	469.8	513.9	523.1	496.8	454.4	435
SD	87.86	71.26	59.64	53.13	60.78	57.44	61.77
Median	432	455	517	516	494	445	422
GPZ - M - Ita-Aus - Cadore							
[e]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1393	1420	1527	1528	1608	1474	1464
Max	1981	1908	1960	1966	2013	2012	2032
Mean	1662	1680	1743	1804	1826	1782	1765
SD	148.13	126.28	104.24	100.08	94.24	125.93	134.69
Median	1631	1664	1745	1821	1826	1796	1769

GPZ - M - Ita-Aus - Cadore							
[ε]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	378	413	518	527	451	305	224
Max	612	606	633	672	649	622	603
Mean	494.7	522.9	574.3	586.1	539.2	474.9	438.1
SD	64.5	55.8	32.43	39.66	58.69	85.14	94.18
Median	502.5	536.5	582.5	579.5	536	485.5	449.5
GPZ - M - Ita-Aus - Cadore							
[ε]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1452	1484	1535	1551	1522	1474	1453
Max	1761	1773	1804	1871	1940	1896	1891
Mean	1594	1618	1682	1743	1754	1728	1711
SD	86.34	79.46	72.68	82.16	109.5	128.45	135.76
Median	1592	1603	1686	1750	1774	1770	1756

GPZ - M - Ita-Aus - Cadore							
[a]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	432	494	622	698	600	485	383
Max	798	768	826	846	849	810	782
Mean	596.2	638.9	740.6	793.6	757.8	678.4	636.3
SD	80.96	65.37	46.79	36.01	61.47	89.69	101.97
Median	604	634	741	799	774	675	630
GPZ - M - Ita-Aus - Cadore							
[a]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1057	1086	1142	1279	1270	1123	1088
Max	1813	1594	1644	1506	1579	1627	1661
Mean	1390	1379	1372	1375	1396	1404	1404
SD	178.95	141.03	102.9	58.72	79.45	126.71	152.19
Median	1439	1413	1380	1379	1393	1405	1394

GPZ - M - Ita-Aus - Cadore							
[ɔ]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	432	470	568	576	430	428	409
Max	757	819	856	813	810	843	844
Mean	545.8	585.5	655	669.9	662.6	617.7	591.6
SD	82.02	85.57	71.37	55.08	88.95	109.96	120.4
Median	548	568	637	659	661	590	546
GPZ - M - Ita-Aus - Cadore							
[ɔ]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	909	850	955	783	711	777	821
Max	1640	1626	2528	1652	1536	2353	2040
Mean	1222	1206	1193	1048	1067	1157	1163
SD	188.79	177.9	257.44	153.61	175.8	269.47	260.96
Median	1199	1164	1129	1012	1028	1114	1120

GPZ - M - Ita-Aus - Cadore							
[o]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	406	450	428	434	411	372	384
Max	647	651	702	730	723	624	626
Mean	517.8	509.2	544.4	567.6	532.1	486.2	489.6
SD	69.31	59.19	87.36	100.08	88.07	65.84	70.46
Median	516.5	512	511.5	541.5	511.5	477	475.5
GPZ - M - Ita-Aus - Cadore							
[o]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	861	678	747	730	735	703	801
Max	1608	1268	1310	1084	1086	1364	1459
Mean	1166	509.2	956.3	895.7	925.2	997.5	1006.5
SD	230.05	200.74	186.41	118.96	109.81	184.15	188.47
Median	1154	960	915	874.5	913	1024.5	953.5

GPZ - M - Ita-Aus - Cadore							
[u]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	287	325	347	324	287	252	264
Max	441	577	457	561	495	434	522
Mean	360.1	406.7	394.6	399.8	397	365.5	380.9
SD	42.53	66.68	36.32	61.86	67.23	50.81	63.86
Median	361	398	383	387	387	359	383
GPZ - M - Ita-Aus - Cadore							
[u]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	701	706	835	789	871	833	822
Max	1616	1601	1482	1440	1592	1594	522
Mean	1158.9	1207	1222	1154	1177	1185	1177.2
SD	312.79	281.28	207.27	247.09	228.26	279.67	279.91
Median	1035	1264	1278	1254	1202	1320	1306

4. MZN- M - Ita-Aus - Feltre

MZN							
[i]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	122	198	237	167	243	205	212
Max	1226	726	405	413	413	982	922
Mean	386.8	341.2	336.8	336	335	419.7	537.3
SD	247.74	170.3	118.87	108.07	129.59	321.59	382.04
Median	353.5	343	335	340	334.5	347	361
MZN - M - Ita-Aus - Feltre							
[i]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1181	1620	1715	1812	1814	1317	1369
Max	2891	2665	2255	2310	2347	3595	3538
Mean	2007	1981	2018	2052	2070	2056	2101
SD	198.27	73.01	38.85	37.24	38.03	342.22	478.84
Median	1984	1981	2020	2310	2090	2030	2025

MZN - M - Ita-Aus - Feltre							
[e]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	269	250	241	322	208	207	184
Max	1568	1328	768	673	1059	824	1095
Mean	469.8	440.3	445.3	449.7	451.1	475.3	487.8
SD	166.97	96.06	64.11	50.87	146.91	245.09	289.07
Median	433.5	438	447	448	443	425	421

MZN - M - Ita-Aus - Feltre							
[e]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1195	1185	1316	1506	1377	1192	1209
Max	2629	2279	2214	2238	2572	3968	3523
Mean	1815	1790	1831	1875	1843	1825	1836
SD	221.13	181.09	157.40	145.04	173.06	270.48	327.95
Median	1796	1796	1831	1886	1838	1790	1770

MZN - M - Ita-Aus - Feltre							
[ε]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	232	366	406	431	381	315	309
Max	1185	1222	632	658	816	662	1007
Mean	502.9	504.1	525.4	536.4	527.7	497.5	562.8
SD	133.14	93.73	43.44	49.52	68.04	77.18	315.54
Median	481.5	493	522.5	532	532	499	496.5

MZN - M - Ita-Aus - Feltre							
[ε]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1169	1216	1314	1361	1333	1325	1320
Max	2898	2504	2140	2134	2206	2270	3694
Mean	1738	1733	1771	1840	1818	1789	1851
SD	243.13	181.28	140.99	148.55	154.64	166.99	370.28
Median	1714	1736	1768	1851	1844	1807	1778

MZN - M - Ita-Aus - Feltre							
[a]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	233	394	440	531	479	311	155
Max	1477	1497	970	1061	1218	1355	1523
Mean	626	632.5	686.2	686.2	711.2	634.5	623.5
SD	344.43	314.15	210.93	151.51	243.63	303.87	412.12
Median	584	607	679.5	729	705	636.9	599
MZN - M - Ita-Aus - Feltre							
[a]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	839	927	1038	1071	915	855	1046
Max	2954	2998	2320	1992	2552	2868	3237
Mean	1622	1582	1488	1449	1470	1485	1576
SD	186.86	143.65	101.87	90.01	105.56	143.37	196.28
Median	1590	1555	1480	1448	1424	1440	1466

MZN - M - Ita-Aus - Feltre							
[ɔ]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	312	331	361	281	357	311	225
Max	881	735	763	764	782	898	919
Mean	529.6	530.9	567.8	582.4	570.2	533.6	528.5
SD	220.67	173.59	153.19	138.90	199.75	180.65	236.87
Median	511.5	520.5	567.5	585.5	572.5	526.5	527
MZN - M - Ita-Aus - Feltre							
[ɔ]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	791	797	560	732	679	670	660
Max	1854	1763	1554	1446	2643	1592	2185
Mean	1221	1175	1080.3	1011	1019.6	1053	1101
SD	83.31	68.38	76.38	86.04	87.20	102.05	112.51
Median	1206	1182	1086.5	1004	999.5	1040	1078

MZN - M - Ita-Aus - Feltre							
[o]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	252	304	312	314	301	298	295
Max	666	654	739	687	680	680	679
Mean	469	472.6	499.1	504.6	490.6	498.4	497.1
SD	65.13	58.40	69.83	66.87	66.49	75.34	75.73
Median	467	466	494	498	485	490	527
MZN - M - Ita-Aus - Feltre							
[o]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	637	723	647	629	590	654	620
Max	1734	1597	1422	1361	1865	1582	1621
Mean	1120	1064	992.2	933.5	959	968.1	1011.2
SD	216.25	181.64	157.58	146.30	179.93	174.56	204.94
Median	1104	1062	998	922	936	953	999

MZN - M - Ita-Aus - Feltre							
[u]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	275	253	284	238	226	252	226
Max	539	428	467	468	701	758	780
Mean	365.2	356.7	364.3	373	374.2	373.8	351
SD	50.64	40.54	34.68	38.86	67.93	77.92	93.02
Median	351	359.5	361.5	369	366	359.5	527
MZN - M - Ita-Aus - Feltre							
[u]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	754	728	564	674	755	794	714
Max	1703	1634	1589	1411	1380	1503	1869
Mean	1176	1102.5	1045.1	1024.6	1071	1128.4	1162.3
SD	232.19	231.56	232.95	180.98	165.21	194.69	227.97
Median	1209	1097.5	1043	1015	1068	1134.5	1164

5. BCL- F - Ctrl - Cadore

BCL							
[i]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	182	119	127	204	190	229	89
Max	674	1093	497	478	692	668	1327
Mean	421.4	334.6	329.4	331.9	339	400.9	449.3
SD	428.87	122.74	58.17	45.77	70.33	315.69	346.38
Median	325	332	328.5	332.5	338.5	342.5	359
BCL - F - Ctrl - Cadore							
[i]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1814	1848	2252	2039	2185	1770	1894
Max	2748	3152	3017	3016	3324	3411	2958
Mean	2652	2643	2665	2698	2667	2602	2641
SD	317.17	216.32	141.72	146.18	175.23	264.23	383.86
Median	2635	2662	2672	2718	2672	2627	2606

BCL - F - Ctrl - Cadore							
[e]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	150	289	236	243	192	256	176
Max	654	1017	1054	615	639	1107	2613
Mean	519.9	462.9	472.1	412.3	408	430.5	567.8
SD	399.22	305.63	148.28	63.65	74.48	196.56	476.41
Median	401	399	405	399	390	386	390
BCL - F - Ctrl - Cadore							
[e]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1580	1636	1908	2037	1849	1983	1398
Max	3434	3680	2918	2986	3014	3684	3485
Mean	2560	2547	2558	2580	2576	2583	2630
SD	303.56	261.55	163.38	146.34	162.51	220.12	364.56
Median	2577	2571	2598	2598	2591	2592	2599

BCL - F - Ctrl - Cadore							
[ɛ]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	316	355	423	417	373	205	225
Max	1545	851	870	877	852	1127	1926
Mean	583.2	592.1	620	608.6	563.7	528.8	547.4
SD	133.25	75.19	65.23	73.80	92.57	138.34	211.92
Median	570.5	591	620	601	570	517.5	517
BCL - F - Ctrl - Cadore							
[ɛ]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1531	1541	1756	1922	1919	1803	1747
Max	2983	2647	2724	2894	2866	2832	3128
Mean	2167	2176	2242	2330	2364	2356	2351
SD	221.77	199.75	163.91	178.43	196.22	240.89	291.98
Median	2143	2172	2248	2308	2359	2388	2359

BCL - F - Ctrl - Cadore							
[a]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	458	429	486	584	414	581	448
Max	1245	1298	1278	1340	1449	1271	1316
Mean	807.3	807.3	922.6	1004	838.7	833.8	806.6
SD	143.78	142.53	128.91	127.32	152.21	139.09	160.84
Median	763	806.5	924	1012	939	829	790.5
BCL - F - Ctrl - Cadore							
[a]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1331	1362	1195	1294	1183	1003	1020
Max	2560	2601	2429	2363	2446	2550	2842
Mean	1952	1895	1779	1757	1783	1858	1908
SD	287.92	262.67	198.12	191.22	202.42	274.14	324.48
Median	1980	1898	1774	1725	1788	1864	1886

BCL - F - Ctrl - Cadore							
[ɔ]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	415	487	508	521	488	443	320
Max	721	738	800	781	746	765	780
Mean	591.1	613.1	640.8	633.4	610.6	570.2	552.6
SD	50.03	50.19	52.74	52.54	53.77	65.24	78.72
Median	588	610	645	634	611	564	546
BCL - F - Ctrl - Cadore							
[ɔ]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	805	1009	952	878	776	857	808
Max	1747	1688	1494	1358	1538	1679	1797
Mean	1314	1283	1196	1107	1131	1182	1204
SD	200.92	169.66	121.30	116.59	141.64	166.14	190.82
Median	1311	1269	1196	1099	1131	1170	1185

BCL - F - Ctrl - Cadore							
[o]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	358	390	422	413	391	372	291
Max	714	738	618	630	618	622	621
Mean	487.5	480	485	487	480	473.4	469
SD	62.88	45.75	38.81	49.01	52.55	62.85	79.96
Median	476	474.5	479.5	480	476.5	467	467
BCL - F - Ctrl - Cadore							
[o]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	790	810	778	761	718	725	703
Max	1745	1410	1377	1365	1327	1396	1522
Mean	1212	1137	1054	973.8	1005.5	1058.6	1080.3
SD	227.61	186.42	157.23	144.44	154.24	182.85	199.05
Median	1194	1134	1072	955	1001	1040.5	1075

BCL - F - Ctrl - Cadore							
[u]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	339	341	346	341	338	267	267
Max	673	676	492	463	523	624	653
Mean	416.1	417.8	400.7	391.8	398.4	402.1	401.3
SD	66.37	63.48	35.05	32.09	40.96	65.77	72.16
Median	404.5	408	398	391.5	393.5	400.5	379.5
BCL - F - Ctrl - Cadore							
[u]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	732	656	647	687	746	655	860
Max	1687	1441	1267	1261	1303	1339	1372
Mean	1081	1042	961.8	940.2	977.7	1045	1099
SD	226.83	182.75	160.38	142.34	134.76	169.40	143.21
Median	1068	1037	964	933.5	972	1072	1116

6. RDP- F - Ctrl - Feltre

RDP							
[i]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	245	248	250	190	349	259	220
Max	592	505	423	598	547	591	525
Mean	350.4	354.3	351	361.1	376	387.7	373.1
SD	68.59	50.07	39.70	80.74	95.19	97.59	97.24
Median	343	347	351	349	365	377	370
[i]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1562	1658	1967	1900	1840	1273	1234
Max	2525	2594	2594	2616	3183	2615	2633
Mean	2131	2276	2276	2323	2355	2216	2144
SD	219.12	196.49	141.80	165.82	281.14	324.36	325.15
Median	2189	2277	2277	2358	2348	2309	2214

RDP - F - Ctrl - Feltre							
[e]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	312	360	345	312	198	186	210
Max	667	675	658	591	620	694	668
Mean	494.9	503.9	496	468.3	460.1	439.7	428.4
SD	85.73	79.03	66.52	62.27	84.40	104.20	108.02
Median	484	488	491.5	465.5	470	428.5	427
RDP - F - Ctrl - Feltre							
[e]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1371	1471	1704	1742	1766	1577	1443
Max	2247	2321	2457	2457	2564	2431	2482
Mean	1863	1928	2084	2236	2255	2128	2069
SD	228.09	219.15	188.57	169.64	173.61	210.53	216.53
Median	1822	1910	2110	2263	2299	2176	2067

RDP - F - Ctrl - Feltre							
[ε]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	401	429	528	491	509	428	428
Max	743	744	780	827	781	708	693
Mean	581.3	593.8	638.5	645.3	619.7	573.1	547.8
SD	77.40	81.59	67.36	79.25	64.33	67.83	74.89
Median	570.5	602	640	663	620	583	538
RDP - F - Ctrl - Feltre							
[ε]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1470	1492	1657	1789	1816	1649	1578
Max	2199	2186	2259	2365	2494	2415	2426
Mean	1775	1815	1936	2045	2096	2015	1979
SD	190.40	174.66	145.81	134.54	171.23	198.04	221.41
Median	1766	1814	1950	2048	2126	2029	1985

RDP - F - Ctrl - Feltre							
[a]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	407	306	568	690	579	507	408
Max	1103	1142	1029	1170	1100	1005	990
Mean	670.7	710.2	811.2	869.5	815.1	756.6	708.8
SD	139.71	152.31	112.64	109.07	110.51	119.62	165.92
Median	634	716	794	840	794	743	713
RDP - F - Ctrl - Feltre							
[a]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1076	1065	1184	1342	1233	1124	1106
Max	2178	2127	1957	1784	1862	1905	2291
Mean	1569	1564	1588	1592	1593	1567	1564
SD	289.42	265.59	190.17	113.63	134.16	181.94	239.61
Median	1639	1532	1605	1590	1625	1603	1579

RDP - F - Ctrl - Feltre							
[ɔ]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	410	521	577	596	490	409	230
Max	699	748	825	807	816	800	790
Mean	614	650.9	666.4	672.3	667	623.9	580.3
SD	66.30	57.55	55.49	52.88	81.21	98.36	132.51
Median	626	655	666	653	667	626	599
RDP - F - Ctrl - Feltre							
[ɔ]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	983	801	804	822	1024	910	734
Max	1725	1678	1378	1298	1350	1460	1569
Mean	1288	1203	1135	1149	1177	1215	1195
SD	208.33	194.34	177.74	132.29	86.72	114.87	162.83
Median	1222	1208	1188	1189	1159	1231	1199

RDP - F - Ctrl - Feltre							
[o]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	311	476	491	477	446	402	372
Max	630	705	618	780	792	727	681
Mean	528.1	556.1	485	564.5	569.4	544.4	538.8
SD	74.81	55.74	60.47	78.10	89.58	88.78	96.91
Median	534	543	479.5	564	556	544	545
RDP - F - Ctrl - Feltre							
[o]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	850	828	850	861	803	648	635
Max	1724	1508	1365	1371	1388	1554	1560
Mean	1209	1170	1123	1061	1078	1054	1090
SD	248.92	210.60	159.82	146.41	176.14	220.10	246.93
Median	1162	1153	1114	1085	1039	1072	1143

RDP - F - Ctrl - Feltre							
[u]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	339	341	346	341	338	267	267
Max	673	676	492	463	523	624	653
Mean	416.1	417.8	400.7	391.8	398.4	402.1	401.3
SD	106.85	103.99	45.65	25.70	51.95	90.03	109.32
Median	404.5	408	398	391.5	393.5	400.5	379.5
RDP - F - Ctrl - Feltre							
[u]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	819	768	781	723	746	655	938
Max	1687	1479	1372	1140	1161	1194	1266
Mean	1156.9	1073.6	917.8	934.2	956	1003.2	1104.1
SD	312.46	275.23	197.19	160.73	155.27	173.68	136.05
Median	1071.5	1035.5	861.5	928.5	953	1031.5	379.5

7. CZM- F - Ita-Aus - Cadore

CZM							
[i]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	260	255	273	255	249	255	236
Max	385	389	386	396	395	381	375
Mean	318	322.4	329.9	332.3	330.4	326.8	325.8
SD	36.21	40.01	31.97	33.34	34.54	32.43	36.64
Median	313.5	313.5	322	330.5	326	323.5	329
CZM - F - Ita-Aus - Cadore							
[i]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1928	1953	1853	1959	1935	1794	1679
Max	2508	2579	2630	2695	2733	2827	2859
Mean	2178	2270	2336	2380	2381	2245	2216
SD	273.79	238.49	45.21	47.73	52.52	85.73	76.85
Median	2198	2300	2360	2426	2454	2242	2154

CZM - F - Ita-Aus - Cadore							
[e]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	295	325	322	305	264	284	208
Max	441	454	489	494	465	444	481
Mean	375.3	385.8	398.8	392.9	378.5	359.2	348.3
SD	37.75	35.74	38.05	40.78	39.85	38.45	51.69
Median	377	381	392	389	378	359	344
CZM - F - Ita-Aus - Cadore							
[e]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1.529	1239	1067	1609	1419	1366	1341
Max	2.651	2665	2581	2572	2505	2509	2518
Mean	2.135	2155	2175	2250	2214	2177	2125
SD	234.36	247.79	38.05	40.78	39.85	38.45	51.69
Median	2140	2167	2245	2326	2267	2252	2181

CZM - F - Ita-Aus - Cadore							
[ɛ]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	307	302	328	402	369	294	245
Max	542	569	593	602	561	691	561
Mean	441.4	451.1	475.6	466.6	438	407.1	379.4
SD	37.81	47.19	45.21	47.73	52.52	85.73	76.85
Median	432	445	473	459	423	390	376

CZM - F - Ita-Aus - Cadore							
[ɛ]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1120	1255	1668	1811	1727	1443	1770
Max	2443	2419	2467	2388	2464	2446	2398
Mean	1839	1912	2063	2185	2193	2142	2124
SD	37.81	47.19	45.21	47.73	52.52	85.73	76.85
Median	1868	1967	2096	2246	2205	2186	2123

CZM - F - Ita-Aus - Cadore							
[a]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	406	500	566	656	573	301	357
Max	800	845	872	869	882	882	778
Mean	591.2	643.9	743.9	780.9	746.7	663	617.3
SD	107.62	102.10	76.13	60.07	76.58	125.65	113.47
Median	584	645.5	745	789	753	696.5	638.5

CZM - F - Ita-Aus - Cadore							
[a]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1207	1292	1311	1036	1225	1208	1090
Max	1890	1791	1698	1613	1690	1696	1740
Mean	1642	1632	1545	1420	1466	1462	1444
SD	171.25	129.54	76.13	60.07	76.58	125.65	113.47
Median	1650	1652	1546	1452	1690	1490	1489

CZM - F - Ita-Aus - Cadore							
[ɔ]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	379	413	448	473	469	417	375
Max	934	714	751	869	681	728	726
Mean	529.5	536.3	568.6	583.9	570.4	535.5	519.7
SD	101.20	60.24	57.68	52.37	52.70	72.10	81.95
Median	525	533.5	565	570.5	562	539	525.5
CZM - F - Ita-Aus - Cadore							
[ɔ]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	822	820	867	791	854	897	759
Max	2014	1511	1400	1184	1409	1624	1666
Mean	1246	1176	1103.3	1020	1069.5	1097.3	1090
SD	101.20	60.24	57.68	52.37	52.70	72.10	81.95
Median	1234	1146	1111	1013.5	1041.5	1033	1040

CZM - F - Ita-Aus - Cadore							
[o]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	329	353	396	401	373	348	282
Max	610	614	529	530	528	530	610
Mean	431.8	445.1	451.9	451.7	444.6	443.5	451.9
SD	62.05	60.85	42.97	39.95	43.50	59.24	79.89
Median	423	442	442	449	445	447	456
CZM - F - Ita-Aus - Cadore							
[o]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1002	835	829	738	713	687	676
Max	1627	1550	1346	1313	1285	1311	1494
Mean	1212	1149	1016	918.5	922.7	970.8	1015
SD	62.05	60.85	42.97	39.95	43.50	59.24	79.89
Median	1181	1052	999	913	896	868	944

CZM - F - Ita-Aus - Cadore							
[u]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	255	287	306	301	272	248	241
Max	383	375	435	425	428	424	432
Mean	313.5	324.9	358	351.9	339.6	336.3	336.4
SD	41.99	31.28	36.33	31.43	50.27	56.26	57.19
Median	305	326.5	353	356.5	335.5	326	318
CZM - F - Ita-Aus - Cadore							
[u]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	767	824	790	819	824	753	751
Max	1767	1676	1516	1359	1533	1584	1585
Mean	1184	1169	1132	1057.3	1061.6	1112	1143.8
SD	41.99	31.28	36.33	31.43	50.27	56.26	57.19
Median	1186	1218	1139	1022	1049	1101	1136

8. ACS- F - Ita-Aus - Feltre

ACS - F - Ita-Aus - Feltre							
[i]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	145	145	154	150	237	154	98
Max	757	546	542	543	1372	1285	1760
Mean	369.1	369.8	375.5	376.6	389.5	389.4	410.3
SD	82.04	62.53	61.59	61.18	111.81	132.80	224.32
Median	358.5	367.5	375	380.5	387.5	375	375.5
ACS - F - Ita-Aus - Feltre							
[i]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1793	1822	2050	2054	1946	1799	1731
Max	2926	2848	2842	2802	3176	2853	3749
Mean	2340	2370	2443	2510	2477	2395	2365
SD	225.65	195.74	145.10	127.01	183.86	227.77	305.07
Median	2364	2400	2459	2524	2514	2448	2414

ACS - F - Ita-Aus - Feltre							
[e]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	227	305	364	369	314	231	199
Max	832	725	788	845	888	2362	1890
Mean	480.4	488.2	497.9	493.5	481.3	471.7	479.8
SD	74.99	53.39	53.72	61.50	65.82	165.18	190.58
Median	476.5	486	492	486	475	449.5	451

ACS - F - Ita-Aus - Feltre							
[e]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1686	1725	1722	1761	1170	1467	1563
Max	2647	2551	2649	2898	2913	4008	3246
Mean	2134	2148	2238	2297	2251	2196	2184
SD	204.98	191.29	192.92	186.07	218.26	264.76	293.04
Median	2144	2152	2234	2324	2267	2172	2126

ACS - F - Ita-Aus - Feltre							
[ɛ]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	358	418	427	442	415	202	200
Max	843	753	838	780	839	1933	1739
Mean	550.4	569.5	600.2	604.6	594.5	595.2	593.5
SD	74.83	64.98	65.87	72.25	88.99	200.87	191.10
Median	546	566	600.5	596	581.5	572	577.5

ACS - F - Ita-Aus - Feltre							
[ɛ]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1483	1641	1681	1696	1495	1360	1440
Max	2680	2809	2637	2592	2776	2912	3020
Mean	2023	2034	2095	2145	2122	2077	2066
SD	203.85	183.71	177.89	182.73	210.18	242.20	254.82
Median	2012	2022	2083	596.0	2101	2038	2024

ACS - F - Ita-Aus - Feltre							
[a]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	422	311	139	533	472	302	241
Max	1182	1232	1240	1183	1383	1500	1603
Mean	763.6	790.9	871.7	899.4	860.8	785.7	751.1
SD	135.18	128.96	122.94	114.11	128.45	143.61	157.45
Median	778	800.5	877	904	850.5	782.5	745

ACS - F - Ita-Aus - Feltre							
[a]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	1055	1078	1135	1240	930	1052	942
Max	2828	13040	2900	2623	2625	3249	3711
Mean	1703	1676	1661	1632	1631	1716	1761
SD	288.72	264.10	209.09	210.36	241.20	389.03	440.39
Median	1666	1652	1640	1604	1596	1630	1644

ACS - F - Ita-Aus - Feltre							
[ɔ]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	341	357	457	423	252	283	164
Max	1009	846	783	848	836	1582	1552
Mean	571.1	588.7	620.9	628.4	602	567.2	552.5
SD	83.81	69.46	60.91	65.74	72.72	112.87	128.62
Median	563	586	620	623	602	560	541

ACS - F - Ita-Aus - Feltre							
[ɔ]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	848	868	917	852	772	871	806
Max	2301	1731	1711	1684	2128	3570	3414
Mean	1370	1316	1249	1176	1178	1253	1285
SD	231.01	189.85	165.14	168.71	171.66	308.23	325.25
Median	1381	1319	1228	1148	1149	1201	1217

ACS - F - Ita-Aus - Feltre							
[o]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	274	365	367	297	314	224	215
Max	845	663	699	735	754	1663	1703
Mean	507.9	508.8	523.3	526.7	530.7	541.7	539.2
SD	69.81	56.36	53.46	59.73	72.72	149.78	171.67
Median	509	510	518	526	529	532	520
ACS - F - Ita-Aus - Feltre							
[o]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	695	757	764	756	757	751	685
Max	2026	1679	1626	1601	2362	3149	3203
Mean	1245	1201	1152	1121	1182	1280	1335
SD	252.57	215.76	175.89	164.09	205.95	305.85	349.27
Median	1227	1170	1117	1081	1163	1257	1298

ACS - F - Ita-Aus - Feltre							
[u]	f1_5	f1_10	f1_25	f1_50	f1_75	f1_90	f1_95
Min	267	231	277	250	205	198	196
Max	1654	535	545	607	638	963	1378
Mean	470.3	396.5	412.1	417.1	418.4	415.2	397.4
SD	232.42	57.61	45.33	50.22	68.05	112.20	143.74
Median	405.5	392	404.5	410.5	413	398	378.5
ACS - F - Ita-Aus - Feltre							
[u]	f2_5	f2_10	f2_25	f2_50	f2_75	f2_90	f2_95
Min	928	585	646	668	753	778	816
Max	2888	1814	1712	1681	2488	3085	3245
Mean	1444	1284	1206	1167	1252	1373	1440
SD	329.27	207.75	187.47	183.85	249.27	349.90	411.81
Median	1364	1296	1214	1200	1248	1308	1348

Appendix 5

Tables for raw and normalized duration values

vowel	speaker	gender	group	mean_dur	sdev_dur	mean_dur_ normalized	sdev_dur_ normalized
i	bcl	female	ctrl	128	46,06	51,87	18,67
i	rdp	female	ctrl	146	47,18	137,15	44,17
i	czm	female	ita-aus	118	34,35	55,34	16,05
i	acs	female	ita-aus	103	40,36	48,55	18,95

vowel	speaker	gender	group	mean_dur	sdev_dur	mean_dur_ normalized	sdev_dur_ normalized
e	bcl	female	ctrl	103	32,89	41,57	13,33
e	rdp	female	ctrl	138	43,91	129,08	41,11
e	czm	female	ita-aus	108	37,06	50,67	17,32
e	acs	female	ita-aus	109	36,08	51,22	16,94

vowel	speaker	gender	group	mean_dur	sdev_dur	mean_dur_ normalized	sdev_dur_ normalized
ɛ	bcl	female	ctrl	138	45,04	55,93	18,26
ɛ	rdp	female	ctrl	178	47,98	167,00	44,92
ɛ	czm	female	ita-aus	109	19,72	50,93	9,21
ɛ	acs	female	ita-aus	120	41,26	56,12	19,37

vowel	speaker	gender	group	mean_dur	sdev_dur	mean_dur_ normalized	sdev_dur_ normalized
a	bcl	female	ctrl	159	52,72	64,48	21,37
a	rdp	female	ctrl	175	53,84	163,80	50,42
a	czm	female	ita-aus	146	42,76	67,99	19,98
a	acs	female	ita-aus	122	43,10	57,40	20,23

vowel	speaker	gender	group	mean_dur	sdev_dur	mean_dur_ normalized	sdev_dur_ normalized
ɔ	bcl	female	ctrl	134	52,44	54,30	21,26
ɔ	rdp	female	ctrl	183	58,32	171,59	54,61
ɔ	czm	female	ita-aus	127	36,89	59,13	17,24
ɔ	acs	female	ita-aus	119	44,28	55,72	20,79

vowel	speaker	gender	group	mean_dur	sdev_dur	mean_dur_ normalized	sdev_dur_ normalized
o	bcl	female	ctrl	120	56,14	48,49	22,76
o	rdp	female	ctrl	147	40,27	137,42	37,71
o	czm	female	ita-aus	113	45,04	52,72	21,05
o	acs	female	ita-aus	100	46,15	47,09	21,66

vowel	speaker	gender	group	mean_dur	sdev_dur	mean_dur_ normalized	sdev_dur_ normalized
u	bcl	female	ctrl	114	49,88	46,29	20,22
u	rdp	female	ctrl	77	40,96	71,63	38,35
u	czm	female	ita-aus	80	32,63	37,52	15,25
u	acs	female	ita-aus	83	36,09	38,81	16,94

vowel	speaker	gender	group	mean_dur	sdev_dur	mean_dur_ normalized	sdev_dur_ normalized
i	alm	male	ctrl	93	31,80	64,73	22,11
i	spr	male	ctrl	94	27,23	47,14	13,61
i	gpz	male	ita-aus	95	26,97	48,21	13,68
i	mzn	male	ita-aus	102	28,83	65,03	18,40

vowel	speaker	gender	group	mean_dur	sdev_dur	mean_dur_ normalized	sdev_dur_ normalized
e	alm	male	ctrl	72	33,75	50,06	23,47
e	spr	male	ctrl	96	23,59	48,12	11,79
e	gpz	male	ita-aus	119	27,14	60,11	13,76
e	mzn	male	ita-aus	109	36,07	69,81	23,02

vowel	speaker	gender	group	mean_dur	sdev_dur	mean_dur_ normalized	sdev_dur_ normalized
a	alm	male	ctrl	122	48,45	85,10	33,69
a	spr	male	ctrl	115	29,88	57,45	14,94
a	gpz	male	ita-aus	137	27,52	69,69	13,95
a	mzn	male	ita-aus	125	37,54	79,51	23,96

vowel	speaker	gender	group	mean_dur	sdev_dur	mean_dur_ normalized	sdev_dur_ normalized
ɔ	alm	male	ctrl	89	36,11	62,20	25,11
ɔ	spr	male	ctrl	109	33,90	54,67	16,95
ɔ	gpz	male	ita-aus	127	19,54	64,42	9,91
ɔ	mzn	male	ita-aus	119	35,74	75,73	22,81

vowel	speaker	gender	group	mean_dur	sdev_dur	mean_dur_ normalized	sdev_dur_ normalized
o	alm	male	ctrl	76	41,10	53,08	28,58
o	spr	male	ctrl	82	32,12	41,14	16,06
o	gpz	male	ita-aus	115	32,69	58,23	16,57
o	mzn	male	ita-aus	103	41,11	65,81	26,24

vowel	speaker	gender	group	mean_dur	sdev_dur	mean_dur_ normalized	sdev_dur_ normalized
u	alm	male	ctrl	108	34,45	75,10	23,96
u	spr	male	ctrl	102	32,53	50,85	16,27
u	gpz	male	ita-aus	87	32,63	44,12	16,54
u	mzn	male	ita-aus	108	50,60	68,96	32,29