# Language contact and sociophonetic variation

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## Abstract

The main objective of the study is to propose feasible methods for the analysis and modelling of those phonetic variations that are the result of language contact. To this end, I report here the results of two empirical examinations conducted on rhotacism when Italian comes in contact with the Tyrolean dialect, a German dialect in the area of Bolzano (Alto Adige region, Italy). The first experiment intends to describe the main features of the sociolinguistic variation of /r/. The second experiment shows an example of articulatory sociophonetic analysis conducted on an early bilingual speaker.

## 1. Introduction

The main purpose of this exploratory study is to describe the main dimensions of the linguistic variation of /r/ in Alto Adige Italian (i.e. South Tyrol Italian, STI), as spoken by Italian-dominant and German-dominant sequential bilinguals. In addition, this variation will be correlated to sociolinguistic factors. These factors relate mainly to the type of bilingual speaker, namely, the parents' language and the language of primary and secondary schooling.

Hence, the theoretical perspective adopted in this study is essentially based on two research approaches. On the one hand, I will be making use of a sociolinguistic (variationist) approach to contact [1], [2]. On the other hand, I will present data from an instrumental-phonetic analysis of bilingual speech [3], [4].

The present study aims at shedding new light on the question of how social information is processed and associated to linguistic information in a context of language contact.

What follows is a critical summary of the results obtained from two experiments. The first experiment makes use of a sociolinguistic approach (§ 2) and it seeks to outline the main factors of /r/ variation in the Italian of monolingual and bilingual speakers. The second study offers an example of articulatory sociophonetic analysis conducted on one early bilingual speaker (§ 3).

Before proceeding, it is worth remarking that this research has been carried out in South Tyrol, an Italian bilingual region where Italian and Germanic languages (both regional standard German and Tyrolean dialect) have been in contact since 1919 [5]. This geographical area is often described as a societal bilingualism with two quite separate linguistic communities, German (Bavarian) and Italian, even if the actual degree of overlapping between the two speech communities seems to be increasing [5].

## 2. Contact-induced phonetic variation

### 2.1. Data and methods

Table 1 offers an overview of the sample of informants that took part in the sociolinguistic study [6]. It comprises 11 individuals that live and work in Bolzano.

| Speaker | Age | Gender | Education | Parents' language | Primary school |
|---|---|---|---|---|---|
| MS | 33 | M | University | Tyrolean dialect | German |
| AP | 35 | F | University | Tyrolean dialect | German |
| VG | 25 | F | High school | Tyrolean dialect | German |
| HS | 38 | F | High school | Tyrolean dialect | German |
| UU | 26 | F | High school | Tyrolean dialect | German |
| VW | 31 | F | High school | Tyrolean dialect | German |
| LV | 34 | M | High school | Tyrolean dialect | German |
| MB | 27 | M | University | Italian | Italian |
| EG | 38 | F | University | Italian | Italian |
| CM | 33 | F | University | Italian | German |
| MP | 32 | F | High school | Italian/ Tyrolean dialect | German |

Table 1: *Sociolinguistic profile of the bilingual informants.*

By parents' language we refer to the language predominantly used by both parents at home during child first language acquisition [7].

Besides, it is worth remarking that the sample investigated here is not representative of the multifaceted universe of bilingual subjects this study concentrates on. Hence, the discussion that follows should be considered in the perspective.

The STI data collection sessions were designed so as to include a diverse set of communication tasks (reading list, map task) and a biographical interview to collect sociolinguistic background data. These tasks aimed to elicit various types of spoken stimuli and, at the same time, they seek to retrieve social information about the speakers (e.g. biographical interview). The data analyzed in the following paragraphs involve reading a word list that has been previously adapted from the CLIPS (*Corpora and Lexicon of Spoken Italian*) protocol [8].

The data collected via this experiment have been acoustically examined by means of the Praat software. This procedure allows to categorise each rhotic sound according to distinct allophone classes.

### 2.2. Linguistic variation

The application of a multiple correspondence analysis (MCA) [9] helps to identify the distribution patterns of distinct allophones of /r/ according to two variables, namely phonetic context and stress position. The first variable refers to the phonetic contexts where the allophones can occur. The contexts have been classified into five categories: intervocalic (VRV), beginning of word (#RV), end of word (VR#), preceding consonant (CRV), following consonant (VRC) and

geminate (VRRV). Stress position is a binomial variable whose values depend on whether or not /r/ belongs to a stressed or unstressed syllable.

As for the allophones of /r/, I will be considering here 10 sounds grouped according to their place of articulation: (i) Uvulars (trill, tap, approximant, fricative); (ii) Alveolars (trill, tap, flap, approximant); (iii) Labiodental (approximant); (iv) Retroflex tap [ɽ].

Besides, since the aim of the research is to define the basic characteristics of variation, the deletion of /r/ will also be counted as a possible allophone of /r/.

Figure 1 displays the results of this distributional analysis based only on the reading task (e.g. word list). The map should be interpreted as a geometrical representation of the similarity/dissimilarity of the objects-points, in most respects analogous to the principal component analysis (PCA). The analytical meaning of the two dimensions could be inferred only *a posteriori* through a careful inspection of the more peripheral objects-points on each axis. In addition, the frequency of occurrence of the objects-points is not overtly represented in the map, but it could be approximately deduced by the position of the points in the space: the closer the points to origin of the plane, the higher their frequency in the matrix.

Therefore, the phones that are more similar in terms of distribution within the phonetic contexts considered here are gathered in the centre of the map and along Dimension 1. Interestingly, the most relevant feature that these phones seem to share is the manner of articulation, thus Dimension 1 seems to approximately correspond to manner of articulation. For instance, uvular and alveolar approximants appear to have very similar values as far as Dimension 1 is concerned. Furthermore, they tend to occur mostly in intervocalic contexts as well as in unstressed syllables.
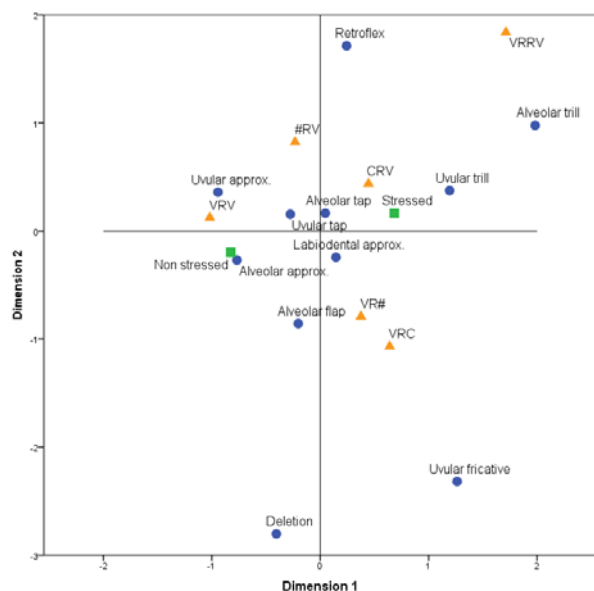
dependent as they are placed towards the right end of Dimension 1, in proximity of VRRV context.

It is however worth noting that the MCA mapping displays some points that do not fit the general distribution pattern and lie on peripheral areas of the map. The allophones that are part of this group are: (i) retroflex [ɽ], which is likely to be a sign of interference of the regional Italian spoken in Veneto, a bordering region [10]; (ii) the uvular fricative, which is a phone characterizing those varieties of Italian spoken by German-dominant speakers; (iii) deletion of /r/, which appears to be extremely rare.

This preliminary examination has shown the existence of a variety of South Tyrolean Italian (STI), which is shared by both the Italian and German-dominant speaking communities. Evidence of this shared variety is given by the presence of a stable set of allophones that have different places of articulation. Yet, they share the same manner of articulation and distribution in terms of phonetic contexts. Interestingly, all the peripheral elements seem to demonstrate the influence of other varieties of Italian, which are characterised by distinct allophones that are governed by specific distributional rules.

According to this preliminary account, it may be possible to suggest that the MCA technique offers only a simplified version of a much more complex phenomenon. In other words, it seems possible to propose that two separate language varieties are hidden behind the common distributional pattern: on the one hand, a regional variety of Italian, which is likely to be the result of internal migration from Veneto during the twentieth century; on the other hand, a German variety of Italian, which could be the effect of a stronger influence of German over Italian (and/or also a consequence of a lower language competence in Italian).

### 2.3. Sociolinguistic map of language contact

Figure 1 displayed an investigation of the allophonic variation of /r/ according to linguistic factors. Things are even more complicated when other extra-linguistic variables are considered. These variables relate mainly to the speaker's sociolinguistic biography, namely, the parents' language and the language used during primary and secondary school education.

Figure 2 shows the results of the application of the MCA technique to the sociolinguistic factors mentioned above.

A concise account of the most relevant results allows to point out the marked distinction between the Italian family and schooling environment and their German counterparts, which are reported on Dimension 1 in the map. The most prototypically Italian allophones (i.e. retroflex tap and alveolar flap) gather on the left end of Dimension 1. They are also marked variants on a diatopic dimension because they belong to the regional Italian spoken in Veneto. In contrast, those allophones that are marked as more German or peculiar of German speakers (i.e. fricative and uvular approximant) are placed on the right end of Dimension 1.

It seems extremely interesting to note that uvular and alveolar taps and trills are placed on the centre of the map, which seems to demonstrate that they are less dependent on sociolinguistic variables as well. These phones seem to lie in a sociolinguistic borderline area that includes the variety of Italian shared by the Italian and German communities. Hence, the hypothesis put forward here is that these allophones are not directly dependent on the sociolinguistic factors; this hypothesis might be supported by the fact that they cannot be



Figure 1: *Distribution of the allophones (circle) according to phonetic contexts (triangle) and lexical stress (square).*

Uvular and alveolar taps are close to the centre of the map, thus indicating both their high frequency in the corpus and, possibly, their independence from a single phonetic context (as they are close to #RV, CRV and VR# on Dimension1). Consequently, it may be possible to define them as prototypical categories of /r/: they are more frequent and less context-dependent. In contrast, trills seem to be more context-

easily distinguished according to acoustic and perceptual criteria [11].

By looking at Figure 2, it is possible to suggest that those sounds that are placed in the most peripheral areas of the map are more sociolinguistically marked. Therefore, they are also more likely to contribute to the understanding of the social influence over language production.
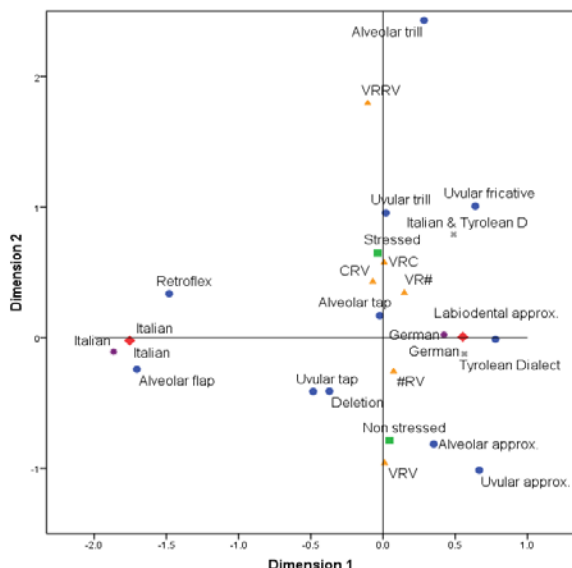


Figure 2: *Distribution of the allophones (circle) according to phonetic contexts (triangle), lexical stress (square), parent's language (cross), primary (star) and secondary school language.*

# 3. An articulatory study of a simultaneous bilingual

As mentioned earlier, the investigation of variation on a sample of 11 speakers has been integrated by a case study involving an early bilingual speaker (see also [12] and [13]). The examination of rhotic production by this speaker has been carried out by means of a Ultrasound Tongue Imaging (UTI) technique. The main purpose of this experiment has been to determine whether simultaneous bilingual speakers can produce different phonemic categories for similar phones such as rhotics in Italian and German.

### 3.1. Data and methods

The informant (AS) is a 24 years-old simultaneous bilingual in Italian and Tyrolean dialect who was born and lives in Bolzano. The recording sessions have involved the simultaneous recording of audio and ultrasound data. Data were collected while the speaker was reading two word lists in Italian and Tyrolean dialect (i.e. 107 tokens in Italian and 67 token in the Tyrolean dialect; cf. Figure 3). These words have not been selected according to their phonetic contexts.

The corpus has been collected at the Speech Science Research Centre of Queen Margaret University (Edinburgh, UK), using the following tools and technical specifications: Merlin Ultrasound Scanner Type 1101; End Fire Transducer Type 8561; Centre frequency: 5 MHz; Image field: 120 degrees; Frame rate: 30 fps; Aluminium head stabilisation helmet.

The collected data have been examined acoustically via the Praat software and articulatorily by means of the Articulate Assistant Advanced software (Articulate Instruments).

According to their spectrographic features, rhotics have been grouped into five categories: uvular trills, uvular taps, uvular fricatives, uvular approximants and vocalised /r/.
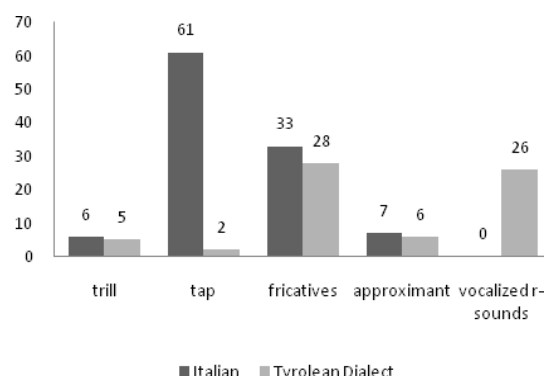


Figure 3: *Frequency of uvular variants in Italian and Tyrolean dialect by speaker AS.*

### 3.2. Macro and micro-effects of language contact

The examination of /r/ in Italian and /R/ in the Tyrolean speech reveals two sets of allophones that markedly differ in terms of both place/manner of articulation (an exception to this are trills) (cf. Stage 1 in Figure 4) and phonotactic distribution (as in [14], [15]).
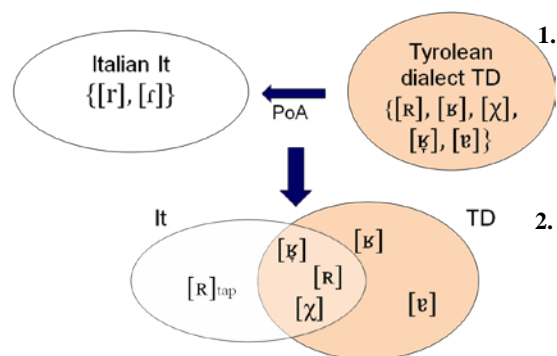


Figure 4: *Macro effects of language contact.*

Since both phonetic categories are part of the bilingual speaker's linguistic repertoire, it seems safe to suggest that (a) either both phonetic systems are mutually interfering with each other or (b) the two systems are merging, thus producing a single allophone set [3].

By looking at Stage 2 in Figure 4, it becomes evident that AS's spoken Italian is the result of a transfer of various phones proceeding from the Tyrolean dialect into Italian. On the one hand, the uvular place of articulation and the approximant and fricative manners are transferred from Tyrolean dialect to Italian. On the other hand, the rhotic variants are still kept separate in each language as far as their manner of articulation (e.g. the production of an uvular tap, which is a hybrid phone) and relative frequency (cf. Figure 3) are concerned. Therefore, the most peculiar features of the /R/ in the Tyrolean dialect are not entirely transferred into Italian; rather they are integrated into the speaker's phonological competence.

In order to further verify the effect that contact has on both languages, the whole set of tokens of the voiceless uvular

fricative produced in Italian and in the Tyrolean dialect (29 and 17 respectively) have been examined by means of a UTI articulatory analysis. The purpose of this testing is to establish whether this phone, which AS produces in both languages, is differently produced according to the language.

|  | Italian | Tyrolean D. | t | df | p |
|---|---|---|---|---|---|
| **Intensity** | 62.11 | 58.19 | 0.01 | 44 | 0.99 |
| **Centre of gravity** | 826.85 | 942.68 | 0.56 | 44 | 0.58 |
| **Dispersion** | 1220.98 | 1369.03 | 0.44 | 44 | 0.66 |
| **Skewness** | 4.64 | 5.43 | 0.45 | 44 | 0.66 |
| **Kurtosis** | 39.39 | 62.60 | 0.18 | 44 | 0.86 |

Table 2: *Spectral moments values of [χ] (FFT 40-ms Hamming, aligned in time with UTI frames) and two-tailed t-test values.*

Tables 2 shows the analysis of the spectral moments of fricatives [16] produced in both Italian and Tyrolean speech and demonstrates that the difference in the acoustic output is not statistically significant (with the exception of intensity).
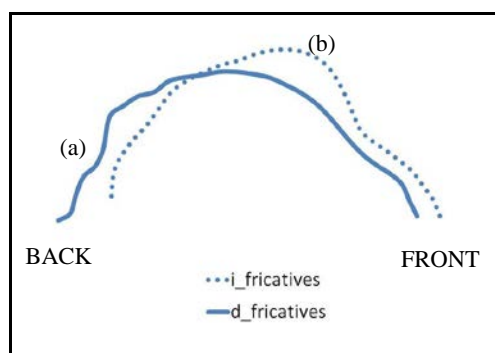


Figure 6: *Mean tongue configurations for uvular fricatives in Italian (i) and Tyrolean Dialect (d).*

Figure 6 reports a preliminary analysis of the bilingual speaker's mean tongue configurations for uvular fricatives in Italian (i) and in the Tyrolean dialect (d) by means of UTI images. Points (a) and (b) on the figure show how the speaker's tongue changes position while producing uvular fricatives in Italian and in the Tyrolean dialect respectively. It also clearly shows an extremely marked difference in terms of tongue configuration. When producing uvular fricatives in the Tyrolean dialect, the speaker's tongue root displays an highly marked retraction (cf. point (a)). The production of uvular fricatives in Italian does not match the position of the tongue root and, at the same time, it displays a post-dorsum bunching of the tongue around the velum-uvular region (cf. point (b)) [9].

## 4. Preliminary conclusions

The stable and continuous process of language contact such as the one involved in Alto Adige constitutes an interesting domain for the study of linguistic and social identity creation and maintenance. Such processes can also be supported via the production of competing phonetic features (both acoustic and articulatory). Similarly, they may result in merging phenomena.

This pilot study has shown a picture of complex interactions among dimensions, which are:

(i) cognitive, i.e., related to a given speaker's learning process;
(ii) phonetic, i.e., related to the non linear relation between articulation and acoustic outputs (e.g. fricatives in the speaker AS);
(iii) phonological, i.e., related to the structure of the bilingual speaker's phonological categories;
(iv) sociolinguistic, i.e., related to the social results of contact.

The study reported here offers two feasible approaches to the investigation of this complex and multifaceted phenomenon. The use of multivariate techniques for data analysis such as multiple correspondences has brought about the distinctive features of linguistic and social variation. The MCA approach becomes a complementary tool that can be associated to the logistic regression model as it appears to be more adequate to deal with multidimensional phenomena that have not been thoroughly investigated.

Finally, the application of the UTI articulatory analysis to a bilingual speaker's productions has resulted in a detailed observation of different articulatory realisations of phones that are acoustically very similar.

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