Phonetic Analysis of /sr/ Clusters in Cochabambino Spanish

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1. Introduction

Rhotic sounds are known for the considerable phonetic variation they exhibit across languages (Ladefoged & Maddieson 1996; Ladefoged 2001). In the Spanish-speaking world, many of them have been reported and several phonetic studies have been conducted to analyze the variants occurring in different Peninsular and Latin American dialects. In particular, variation in the realization of the phonemic trill has long been identified as a defining feature of several of these dialects around the world (cf. Bradley (2006a,b); Colantoni (2001, 2006); Díaz-Campos (2008); Lastra & Butragueño (2006); Willis (2006, 2007); Navarro-Tomás (1956); Núñez-Cedeño (1989); etc.).

Traditionally, a good body of analyses has focused on Hispanic rhotic realizations; however, besides the early attempt by Quilis & Carril (1971) to study assibilated/fricative rhotics in some Latin American varieties, only more recently attention has been paid to specific dialects presenting such realizations (Colantoni 2001, 2006; Bradley 2006a,b). A dialect which presents these sounds, and which has long been unstudied, is Highland Bolivian Spanish. While the presence of assibilated/fricative rhotics is well known for this variety, and their existence has been reported in several Spanish phonological and dialectological manuals (Navarro 1980; Canfield 1981; Lipski 1994), almost no phonetic description has been provided for them.

One of the few works which touches on this topic is the one by Bradley (2006b), who presents some data on the assibilated rhotic realizations of three Highland Bolivian informants from Potosí and La Paz, among many other subjects originally from other Latin American countries. In that study, the author's main concern was to provide a general overview of Latin American realizations of rhotics in /sr/ clusters. One of the main points was supported by statistical results indicating that "rhotic stridency is dependant upon phonological context. Strident rhotics are most often favored after /s/ and less so postpausally, while non-strident rhotics are favored after /n/ and postvocally" (Bradley 2006b: 8).

Such a claim does not hold for Cochabambino Spanish, a variety of Highland Bolivian Spanish, in which, according to the present study, phonological context proved to affect only rhotic voicing significantly. Moreover, /r/ was almost never realized as a trill (just the 1% of the time), independently of the context.

The objective of the present work is to provide the first empirical phonetic examination of trill variation of urban high/middle class speakers in Cochabamba, Bolivia. In particular, this study analyzes /sr/ clusters in Cochabambino Spanish and compares the findings with those by Bradley (2006b) for Latin American dialects.

The rest of this paper is organized as follows: Section 2 presents the literature on trill variability among Spanish dialects; in particular it discusses Bradley's (2006b) findings. Section 3 illustrates the methodology employed to collect and analyze the data in the present work. Section 4 presents the results and statistics for the rhotic realizations encountered. Section 5 discusses the findings. Finally, Section 6 concludes.

[*] I would like to express my gratitude to two anonymous reviewers and to the audiences of the 2009 HLS at the Universidad de Puerto Rico for their comments. I also want to thank Professor Terrell Morgan and Professor Rebeka Campos-Astorkiza for their feedback and suggestions. This study would not have been possible without the support of several friends from Cochabamba; in particular I would like to thank Fernando, Mariel, Betty and América. Usual disclaimers apply.

2. Literature

Spanish descriptive manuals have long pointed out a number of distinct dialectal realizations of the Spanish phonemic trill (cf. Navarro-Tomás 1980; Canfield 1981; Lipski 1994; Hualde 2005). In recent years, several acoustic studies have further investigated these sounds in order to pin point the phonetic features characterizing such segments.

Hammond (1999) presented experimental data from 229 individuals speaking different varieties of Latin American and Peninsular Spanish. Informants were recorded performing a read-aloud task. Based on the findings of this experiment, Hammond argued that for many contemporary dialects of Spanish the multiple trill pronunciation of /r/ is overrated, and that it should be considered as an allophonic variation of the tap /ɾ/ (see also Hammond 2000). In support of such a claim, he has pointed out that the trill and the tap contrast only in intervocalic environments (1999: 135) and that trilled /r/ does not occur in speech for the vast majority of speakers (1999: 147).

On the other hand, several studies indicated that the trilled /r/ is clearly different from the tap /ɾ/ and for certain dialects it has been reported as the most common pronunciation; an example is Blecua (2001), who found that in Peninsular Spanish a trill with two closures is the most common realization. The reason for these contrasting findings is partially related to the definition of 'trill' itself. Hammond follows a very prescriptive definition of the trill given by the RAE and only counts as trills those tokens that have at least three closures. However, the most common realization of the trill has been found in other studies to be a pronunciation with two closures (e.g. Blecua 2001; Lewis 2004). For this reason, Hammond's work on /r/ has been the target of much criticism (cf. for example Willis & Bradley 2008:89). It is beyond the scope of this study to solve this argument; however we will keep this in mind when discussing our data.

Solé (2002) inspected the aerodynamic and phonetic characteristics of /r/ realizations in Catalan in a variety of phonological contexts. Data were extracted from the speech of three informants reading a list of meaningful sentences containing the target segments. Electropalatographic and spectrographic analyses revealed that a key requirement for multiple occlusion trill production is high oral pressure build-up (see also Recasens 1991) and that small changes in pressure can lead to no trilled or devoiced realizations. Findings also indicated that when /s/ preceded the trill at syllable and word boundaries the loss of /s/ was complete and categorical and the /r/ was pronounced as a trill in the majority of cases. On the other hand, this kind of consonant deletion was not encountered for other heterosyllabic clusters of the /Cr/ type; in such cases the preceding consonant was maintained and could present retroactive assimilating effects prompted by the following rhotic.

Lewis (2004) analyzes the coarticulatory effects on the production of /r/ in heterosyllabic clusters according to different preceding segments. Four informants from different Spanish speaking regions were asked to read a list of sentences containing the target segments. The subjects were from Spain, Argentina, Chile and Mexico. Tokens were classified in four different categories: (1) voiced trill, (2) voiceless trill, (3) voiced approximant, (4) voiceless approximant. Lewis' findings indicated that trill productions were favored post-vocalically and in absolute initial position; moreover, the largest percentages of voiceless trills were observed in post-voiceless contexts (i.e., following [s], and in absolute-initial position), indicating "a strong tendency toward voicing agreement between the pre-rhotic segments and the corresponding /ɾ/-allophones" (2004:120). In addition, even though for all informants the majority of the /r/ realizations were pronounced as trills, some dialectal differences could be identified. The Argentinean speaker presented the highest number of trills (98.3%), followed by the Spaniard (96.6%), the Chilean (78.3%) and the Mexican (56.7%).

Colantoni (2006) examined trill realizations in two Argentinean Spanish cities (Corrientes and San Juan). Her informants consisted of 8 male speakers; data were collected through means of sociolinguistic interviews. She indicates a range of variation going from fricatives to approximants to multiple-occlusion trills. Colantoni described fricative variants as acoustically similar to post-alveolar sibilants, while approximants were acoustically similar to trill realizations in terms of their degree of periodicity.

Willis (2006) presented data from ten educated urban young adults for two principal dialects of Dominican Spanish, namely, Cibaeño and Santo Domingo. Tokens were collected by asking the informants to narrate a children's picture book by Mercer Mayer, *Frog, Where Are You?* (1969). The most common trill variants found in these two Dominican dialects were classified as a pre-breathy

voice followed by a single tap [ɦɾ], and a pre-breathy voice followed by multiple closures [ɦr]; moreover, Willis reported trills [r], voiced glottal fricatives [ɦ], voiceless alveo-palatal fricatives [ʃ], taps [ɾ], as well as a few cases of post tap frication for which an IPA symbol was not provided.

Bradley's (2006) study was based on data extracted from a Spanish corpus including 25 different dialects. For the purpose of his work, as a preliminary step, he selected only certain varieties, those reported by Lipski (1994) as conservative, /s/-retaining dialects. Subsequently, Bradley verified by inspecting both aurally and spectrographically whether the informants met the criterion of /s/-maintenance. The result of this operation was a total of 24 speakers from seven different dialect areas, namely: Bolivia, Colombia, Costa Rica, Ecuador, Guatemala, Honduras and Mexico. Each informant had been recorded reading a text in which the following five phonological contexts were found: /VrV/, /Vn#rV/, /Vs##rV/, /V#rV/ and /Vs#rV/, for a total of 120 tokens (24x5)[1]. Of these 120 tokens, 5 were discarded for noise; therefore only 115 could be used. Results indicated a reduced number of trills, only 16%, versus a majority of non-trill realizations, mainly approximants and fricatives. The study suggested that stridency was highly dependent upon phonological context, with the following proportions of strident rhotics per phonological environment: /Vs#rV/, 83%; /Vs##rV/, 63%; /VrV/, 46%; /Vn#rV/, 35%; /V#rV/, 25%. In addition, following Solé (2002: 360-361), four different types of realizations (1,2,3,4) were identified for the environments /Vs#rV/ and /Vs##rV/. For the context /Vs#rV/ there were 0% of (1) (assimilated realization: no sibilant + trill); 58% of (2) (assimilated realization: no sibilant + non-trill); 38% of (3) (untrilled realization: sibilant + non-trill); 4% of (4) (unassimilated realization: sibilant + trill). For the context /Vs#rV/, the proportions were 0% of (1); 0% of (2); 92% of (3); 8% of (4). Therefore, while sometimes /s/ resulted deleted or assimilated in /Vs#rV/, the same did not hold for /Vs##rV/, where /s/ was always retained and /r/ was generally realized as a non-trill. The author concludes that a high rate of non-trill realizations after /s/ was not necessarily dependent upon such context, but rather it could be due to the no-trill underlying form of /r/ in the Latin American dialects analyzed[2]. Moreover, besides remarking the dependency of stridency on the phonological environment, for these varieties he refused the suggestion made by Solé for Catalan, that the assimilation of lingual fricatives to following trills is complete and categorical in the majority of cases across minor prosodic boundaries, resulting in the non-realization of the sibilant followed by a trill.

Bradley's general analysis on Latin American Spanish /sr/ clusters has important implications for the study of fricative + rhotic coarticulations in specific varieties, where /s/ and /r/ realizations may or may not show the general patterns that he identified. The current study will present and discuss the results encountered for Cochabambino Spanish, a dialect which behaves in this respect quite differently from the rest of the varieties analyzed in Bradley's study.

Among the works on Spanish rhotic realizations taking into account variation also in terms of external (social) factors, it is worth pointing out Lastra & Butragueño (2006) for Mexican Spanish and Díaz-Campos (2008) for Venezuelan Spanish.

Lastra & Butragueño (2006) inspected the external and internal factors affecting trill variants for Mexican Spanish. The tokens analyzed were extracted from sociolinguistic interviews and isolated words reading tasks conducted with 54 informants from Mexico City. Approximately, 65% of the tokens were produced as multiple occlusion trills, 19% consisted of fricatives, while 14% were classified as assibilated segments. The VARBRULE analyses indicated that old middle class women were the speakers favoring assibilation the most. Moreover, the overall levels of assibilation were significantly lower when compared to those reported for the same city three decades before by Perissinotto (1972, 1975). When discussing the results, researchers suggested the possibility of a change in progress, where the assibilated variant would be in the process of disappearing from the speech of the youngest generations.

Díaz-Campos (2008) carried out a VARBRULE analysis on the linguistic and social factors affecting trill realizations for Venezuelan Spanish. Data were elicited through hours of sociolinguistic interviews with informants from Caracas. He encountered approximant realizations 64% of the time and trill sounds 36% of the time, with two or more occlusions. The linguistic factors which were found

[1]Note that the '#' symbol is used to indicate a word boundary, while the '##' symbol indicates a pause.

[2]Even though this is Bradley's (2006b) conclusion, note that context can play an important role in affecting trill production. In fact, Lewis (2004) showed several coarticulatory effects on the production of Spanish trills resulting from varying degrees of stricture associated with the pre-rhotic segment.

to be significant were position within the word number of syllables, and grammatical category. The author suggested that these tendencies could demonstrate a pattern of lexical diffusion linked to frequency and usage. As far as the sociolinguistic variables were concerned, age, gender and socioeconomic class showed to affect the variation significantly. Given such results, Díaz-Campos proposed the existence of a possible change in progress, where the approximated variant would come to substitute the traditional Venezuelan trill in the speech of the youngest generation.

Besides providing a phonetic analysis of rhothic sound in Cochabambino Spanish, in the present article I will also test for potential correlations between the linguistic findings and two social variables, namely: gender and age.

3. Data and Methodology

3.1. Stimuli

In order to get comparable data with those presented by Bradley (2006b), I employed the text from which he extracted his tokens, as shown in his article (Table 1, sentences 1-5). I also added two fillers to the sentences reported by Bradley, one at the beginning (number 0), and one at the end (number 6).

Sentence(s) **Context**
0. *Ahora hablaremos un poco de la vida del campo* None 'Now we will talk a bit about countryside life'
1. *La hacienda y sus dependencias abarcaban un terreno muy extenso.* /VrV/ 'The ranch and its premises covered a very extensive terrain.'
2. *Estaban rodeadas de un enorme patio.* /Vn#rV/ 'They were surrounded by an enormous yard.'
3. *En los establos tenía magníficos bueyes. Recuerdo como si fuera ayer cuando los vi por* /Vs##rV/ *primera vez.* 'In the stables he had magnificent oxen. I remember as if it were yesterday when I saw them for the first time.'
4. *La casa, el patio, las dependencias y los campos que rodean la casa.* /V#rV/ 'The house, the yard, the premises, and the fields that surround the house.'
5. *Constan de las cuadras, los establos, los rediles, las pocilgas y los gallineros.* /Vs#rV/ 'They consist of blocks of houses, stables, sheep pens, pigsties, and henhouses.'
6. *El campo es el lugar mejor para olvidarse de la vida urbana* None 'The countryside is the best place to forged about urban life'

Table 1. Tokens of syllable-initial rhotics, number 1-5 were extracted from corpus recordings of a literary text reading by Bradley (2006b).

3.2. Speakers

A total of twelve informants from a residential high/middle-class neighborhood of Cochabamba (*Barrio Telefónico*) participated in the experiment. The speakers were equally divided for gender (male and female) and generation (generation a: 18-29; generation b: 45-57). The subjects were native speakers of their dialect. They were born and raised in Cochabamba, and had spent the majority of their life there. They did not speak other languages spoken in Bolivia such as Quechua or Aymara. The only foreign language some of them claimed to speak at a basic level was English.

3.3. Data collection

Data were collected in silent rooms in the homes of the informants[3]. All of them resided in two buildings facing each other. The speech was recorded directly onto a laptop computer using WaveSurfer 1.8.5 and a Plantronics DSP-400 microphone with a sampling rate of 44.1 kHz.

Each informant was asked to read the sentences of Table 1 four times. In this way, the recordings provided a total of 240 tokens, of which three were discarded due to noise (the three from the context /Vs#rV/).

In order to meet the /s/-maintenance criterion applied by Bradley, I inspected the speech of the informants both aurally and spectrographically to make sure there was no regular aspiration or deletion of coda /s/.

3.4. Data analysis

The remaining 237 tokens were segmented and phonetically transcribed based on acoustic analysis and auditory inspection using WaveSurfer 1.8.5. Six distinct rhotic allophones were observed. These realizations were further classified acoustically as [+strident], with substantial aperiodic noise visible in the upper spectra, or [–strident], with minimal or no such noise present; and [+voiced] with substantial periodic waves in the lower spectra, or [–voiced], with minimal or no such waves present. The symbols and their respective descriptions are reported in Table 2.

[+strident]		**[-strident]**	
[+voiced]	**[-voiced]**	**[+voiced]**	**[-voiced]**
Voiced fricative [ř]	Voiceless fricative[r̝̊]	Voiced trill [r]	Voiceless trill [r̥]
		Voiced approximant [ɹ]	Voiceless approximant [ɹ̥]

Table 2. Phonetic categorization of syllable-initial rhotic tokens.

Representative waveforms and spectrograms are provided in Figures 1 through 3 for the four most common categories[4].

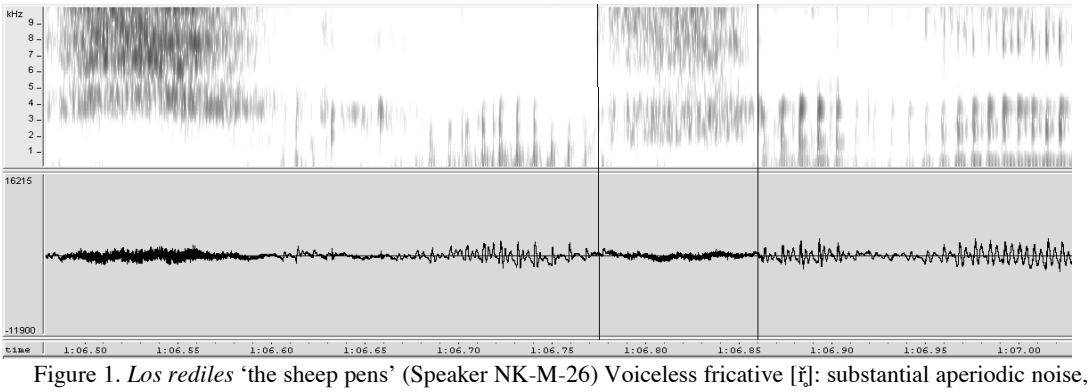


Figure 1. *Los rediles* 'the sheep pens' (Speaker NK-M-26) Voiceless fricative [r̝̊]: substantial aperiodic noise, glottal tone absent.

[3] An anonymous reviewer pointed out that a room in a regular house cannot be considered a silent room. I have to acknowledge that a sound proofed laboratory would have been a much better and more silent place to carry out a phonetic experiment of this kind; nevertheless, I did not have access to such a facility in Cochabamba. For this reason, I had to run my experiment in my informants' houses making sure that potentially interfering devices were switched off (radios, TVs, etc.) and that the room in which the recordings were taking place was not having windows on the street to avoid potential urban noise.

[4] In order to get comparable results, I adopted the categories that I encountered in other articles describing similar rhotic sounds (e.g. Lewis 2004 and Bradley 2006b). The description of stridency in terms of "substantial aperiodic noise visible in the upper spectra" is borrowed from Bradley (2006b: 5-7).

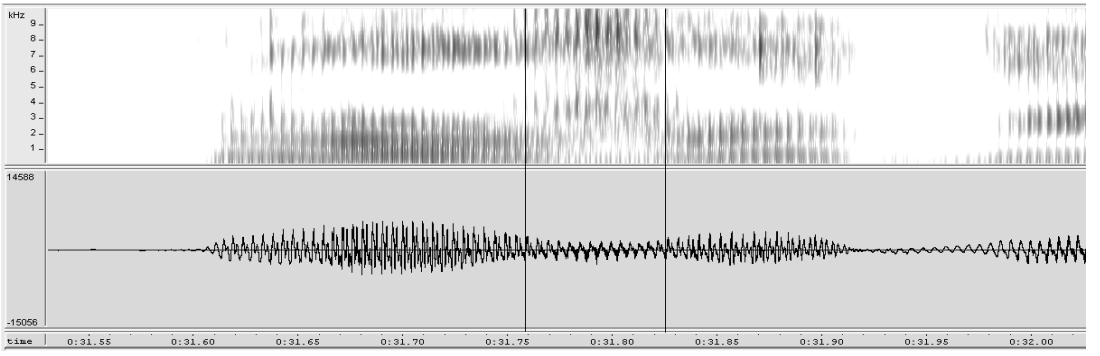


Figure 2. *Los rediles* 'the sheep pens' (Speaker HH-F-45) Voiced fricative [ř]: substantial aperiodic noise, glottal tone present.

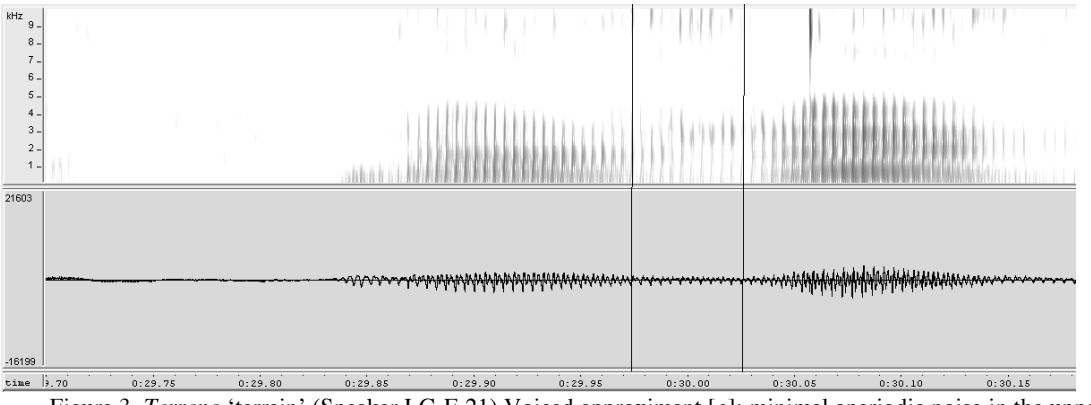


Figure 3. *Terreno* 'terrain' (Speaker LG-F-21) Voiced approximant [ɹ]: minimal aperiodic noise in the upper spectra, formant structure present, glottal tone present.

For reasons of space, I did not insert the figures of the less common allophones. Voiceless approximants [ɹ̥] are characterized by a minimal aperiodic noise in the upper spectra, formant structure present and absence of glottal tone. Voiced trills [r] show no aperiodic noise in the upper spectra, two constriction periods of lesser intensity with intervening period of vowel-like formant structure and presence of glottal tone. Voiceless trills [r̥] present the same characteristics encountered in voiced ones, but differ from them in that the glottal tone is absent.

4. Results

The frequency count for the nine categories identified is graphically represented in Figure 4. The most common realizations in my corpus are voiceless fricatives (57.8%), followed by voiced fricative approximants (27.0%), and voiced approximants (11.8%).

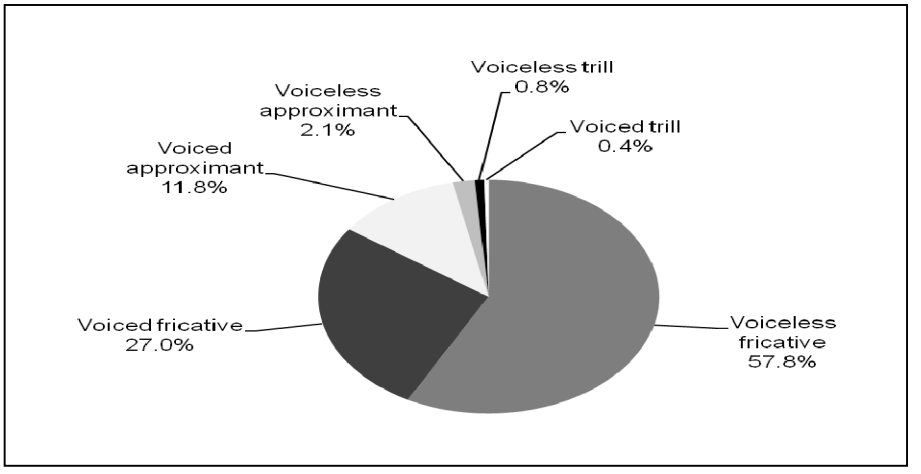


Figure 4. Overall frequency of syllable-initial rhotic allophones

Phonetic category	**N**
Voiceless fricative	137
Voiced fricative	64
Voiced approximant	28
Voiceless approximant	5
Voiceless trill	2
Voiced trill	1
Total	237

Table 3. Overall allophonic distribution of syllable-initial rhotics.

Cochabambino Spanish is different from the dialects investigated by Bradley for the noticeable presence of [+strident] rhotics (84%).

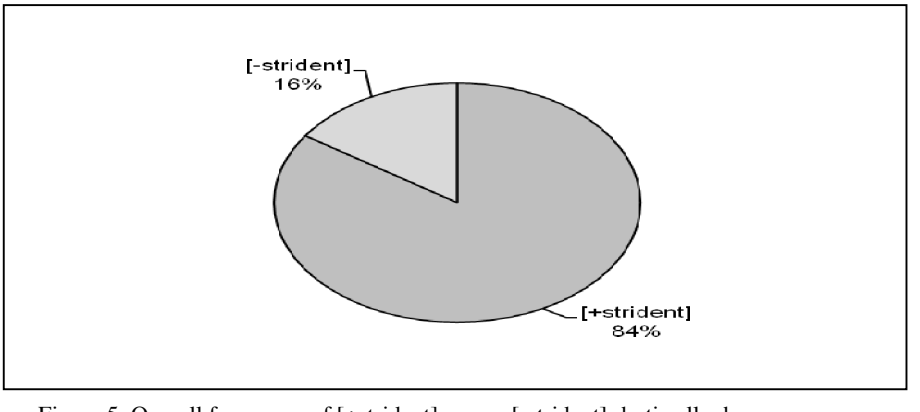
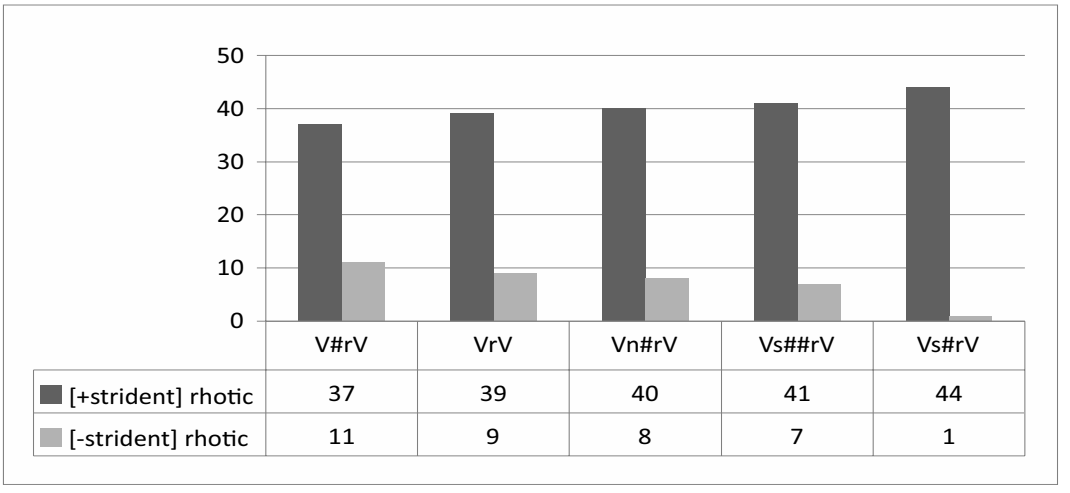


Figure 5. Overall frequency of [+strident] versus [-strident] rhotic allophones

In such a scenario, rhotic stridency cannot be considered significantly dependent upon phonological context. While a slight tendency toward a higher realization of [+strident] sounds after /s/ was observed, the Chi-square statistic based on stridency did not give any significant result for phonological environment ($\chi 2$ (df 4, n 237) = 8.67, p<.07). This suggests that, unlike the majority of the dialects analyzed by Bradley, in Cochabambino Spanish, stridency seems to characterize these rhotic sounds independently of the context in which they appear[5].

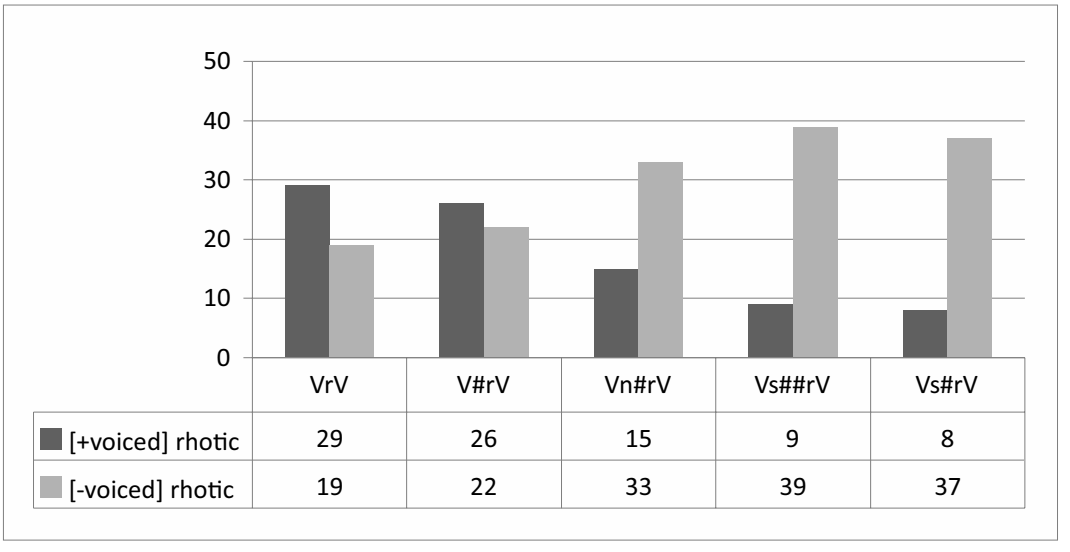


	V#rV	VrV	Vn#rV	Vs##rV	Vs#rV
[+strident] rhotic	37	39	40	41	44
[-strident] rhotic	11	9	8	7	1

Figure 6. Overall frequency of [+strident] versus [-strident] rhotic allophones by context

Trills, which were quite rare in Bradley's study (only 16%), are even fewer here, just three out of 237 tokens, indicating that such realization is quite exceptional. Moreover, all of the trill tokens encountered were produced by the same informant. This fact further suggests that they are completely absent from the speech of the majority of Cochabambino Spanish speakers.

If on one hand the phonological context did not prove to be significant for stridency, it was so for voicing. Chi-square statistics based on this feature indicated that [+voiced] rhotics are significantly favored when preceded by a vowel and disfavored otherwise ($\chi 2$ (df 4, n 237) = 32.13, p<.001).



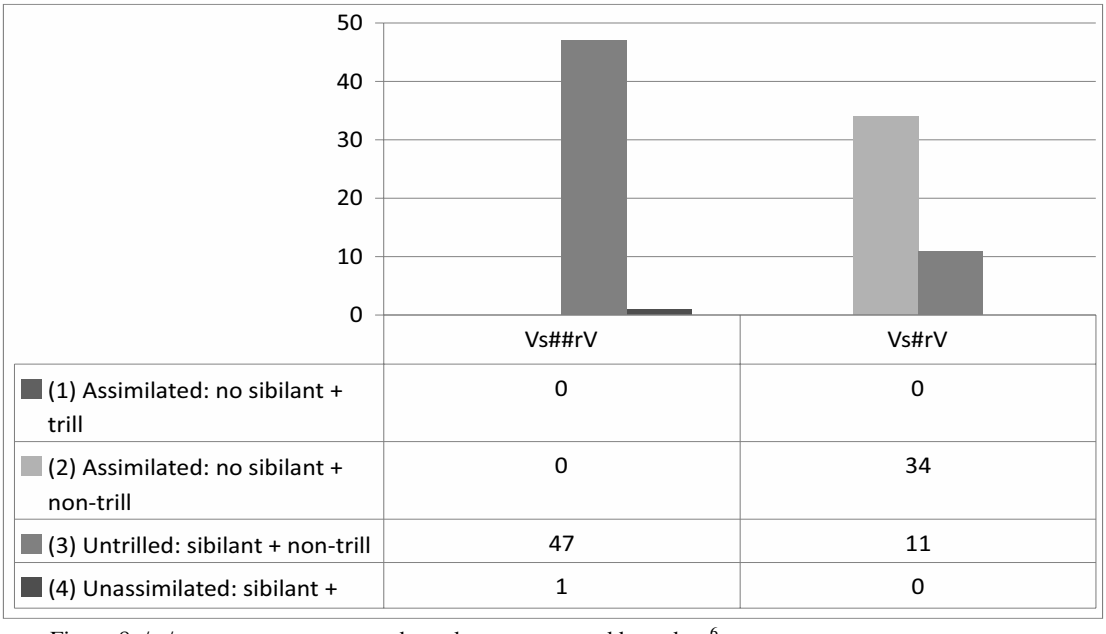
	VrV	V#rV	Vn#rV	Vs##rV	Vs#rV
[+voiced] rhotic	29	26	15	9	8
[-voiced] rhotic	19	22	33	39	37

Figure 7. Overall frequency of [+voice] versus [-voice] rhotic allophones by context

[5]An anonymous reviewer wondered whether any significant tendency could be encountered between token produced and utterance produced and between token produced and following vowel quality. Unfortunately, as the stimuli were directly taken from Bradley (2006b) and not created with the goal of testing these potential correlations, no specific control was set for these variables and no significant relation could be discovered.

As far as assimilation is concerned, the comparison between /Vs#rV/ and /Vs##rV/ contexts provides us with useful information. This time the results are closer to those encountered by Bradley, but not the same. As in Bradley (2006b), type 1, with a single trill and no remaining trace of /s/, was not found either in /Vs#rV/ or in /Vs##rV/. Type 2, with a non-trilled rhotic and loss of the sibilant, was the most common category observed in the word-boundary context, and as in Bradley's study, it was not encountered after an utterance boundary (consisting of a pause). However, it is interesting to see that while in Bradley's study only 58.0% of realizations in /Vs#rV/ belonged to type 2, here the percentage is higher, 75.6%.

Type 3, a sibilant followed by a non-trill, makes up 24.4% of the realizations for /Vs#rV/ and 99.5% for /Vs##rV/, while type 4, a sibilant followed by a trill, was not present in /Vs#rV/ and represents only 0.5% in /Vs##rV/. This last finding provides additional support to the trill distinction between Cochabambino Spanish and the other Latin American dialects studied by Bradley, where type 4 was encountered 4.0% and 8.0% of the times for /Vs#rV/ and /Vs##rV/, respectively.



	Vs##rV	Vs#rV
(1) Assimilated: no sibilant + trill	0	0
(2) Assimilated: no sibilant + non-trill	0	34
(3) Untrilled: sibilant + non-trill	47	11
(4) Unassimilated: sibilant +	1	0

Figure 8. /sr/ sequences at utterance boundary versus word boundary[6]

Results for fricative [ř] and [r̝] indicated that the /Vs#rV/ environment favors their realizations; however, their distribution across the rest of the phonological contexts (Figure 9) indicates that such realizations are not exclusive of such an environment. All cases of assimilated /s/ reported in figure 8 resulted in fricative rhotic realizations. The most common realization for the /Vs##rV/ environment was a lingual fricative [s] followed by a period of silence and a voiceless fricative [Vs## r̝V] (28 out of 48).

Another generalization derived from Figure 8 is the expected fact that the /Vs#rV/ environment favors /s/ deletion/assimilation, while /Vs##rV/ environment favors /s/ retention, thus replicating Bradley's findings.

[6] Note that following Bradley's (2006b:10) terminology, Category 1 'Assimilated: no sibilant + trill' indicates a case of "total assimilation", where /s/ is deleted and /r/ is pronounced as [r], (this would be the favored outcome for Catalan and Castilian Spanish as suggested by Solé (2002:381)).

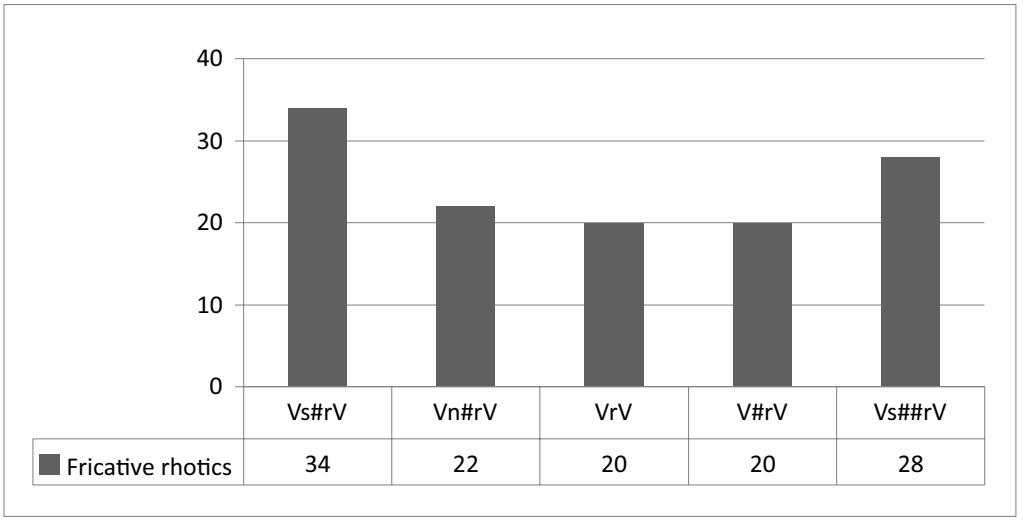


Figure 9. Frequency of fricative rhotic allophones by context

Extra linguistic factors did not play a crucial role in pattering the results. Neither age nor gender showed a significant effect on stridency and voicing. The results are presented in Table 4 and Table 5:

Stridency					
	[+strident]	[-strident]		[+strident]	[-strident]
Generation a (18-29)	99	21	Male	94	23
Generation b (45-57)	102	16	Female	107	13
$\chi 2$ (df 1, n 237) = 1.00, p<.316			$\chi 2$ (df 1, n 237) = 3.58, p<.058		

Table 4. Effects of gender and age on allophonic stridency.

Voicing					
	[+voice]	[-voice]		[+voice]	[-voice]
Generation a (18-29)	43	77	Male	49	68
Generation b (45-57)	44	73	Female	61	59
$\chi 2$ (df 1, n 237) = 0.80, p<.777			$\chi 2$ (df 1, n 237) = 2.28, p<.131		

Table 5. Effects of gender and age on allophonic voicing.

The present study cannot provide a sociolinguistic explanation for the patterns found in the distribution of rhotic voicing and stridency among the informants. The limited variation among the external factors selected could potentially be due to the relative internal homogeneity of the group selected; all the speakers, in fact, lived in two apartment buildings facing each other in the same neighborhood. This work does, however, set the empirical foundation upon which future sociolinguistic studies may build.

5. Discussion

In Bradley (2006b), an account of articulatory and aerodynamic factors in the pattering of /sr/ clusters is provided for several Romance languages. While for example in Italian the retention of /s/ before trills would be favored by the insertion of an epenthetic sound at consonant release, in Catalan, by contrast, the degree of overlap between the adjacent tongue tip gestures for fricative and trill would be total, resulting in a complete assimilation, 'no sibilant + (non-)trill' sound (2006b: 11). The reason

for such a phenomenon in Catalan, as well as in Castilian Spanish and in Portuguese, is dependant upon the constrained articulatory and aerodynamic manners required for the production of trills and fricatives. In fact, due to anticipatory movements for the trill, the pressure drop required for frication is not achieved, resulting in both "aerodynamic and acoustic lack of turbulence" (Solé 2002:381).

As far as the /sr/ cluster is concerned in Cochabambino Spanish, the principles applied to Castilian Spanish, Portuguese, and Catalan are not totally replicated here. In fact, as these sounds in Cochabambino Spanish seem to be pronounced as non-trill and with a strident component independently of the context, the anticipatory movements performed to produce such rhotics in /Vs#rV/ environment do not represent a constraint on the articulation of preceding lingual fricatives of the kind seen in those languages, where final /s/ is often deleted and no stridency is found for the following segment. In Cochabambino Spanish, on the other hand, such movements would often result in a unique fricative rhotic (75.6%), or when the timing of articulation allows it, in a lingual fricative [s], followed by a fricative approximant (24.4%). On the other hand, when the two sounds are separated by a pause (/Vs##rV/ environment), the result is often a lingual fricatives [s] followed by a period of silence and a voiceless fricative [r̝̊].

At the moment, no definitive explanation can be provided for this phenomenon as I do not possess enough data on the nature of utterance initial /r/. A highly speculative hypothesis, which should be further tested with more spectrographic data and, ideally, inspected also with electropalatographic analyzes, is that when the /r/ is found in word-initial position, it tends to be realized as [r̝].To test this hypothesis we would need a different set of stimuli, one in which /r/ appears in several phonological environments (e.g. /n##ra/, /s##re/, /V##ri/, /l##ro/, etc.). I leave this for future studies.

In line with Lewis' (2004) findings for several Spanish dialects, in Cochabambino Spanish the presence of preceding vowel significantly favored voicing in the folloving rhotic segment. In contrast to his study and to Blecua's (2001), but parallel to several other works (Hammond 1999, 2000; Willis 2006; Colantoni 2006 and Díaz-Campos 2008), the non-trilling production was the most common realization. In fact, as far as the debate on the nature of Spanish trills is concerned (Nuñez-Cedeño 1989; Hammond 1999, 2000; Blecua 2001; Lewis 2004; Willis & Bradley 2008), we can say that for the Cochabambino case only 3 out of 237 tokens could be classified as [r]. Moreover, if we consider that all of them were pronounced by the same informant, we can conclude that they appear to be quite exceptional in this dialect. However, contrary to Hammond's suggestion for several Latin American varieties, we cannot claim that we are dealing with a tap pronunciation. Indeed, even though these rhotic realizations are almost never trills, in Cochabambino Spanish they have a clear strident component, which clearly distinguishes them from [ɾ]. Bradley claimed that non-trill realization following /s/ could not be ascribed to the phonological context (but see Lewis 2004), because in the dialects studied "the underlying representation of the rhotic contains no specification for lingual trilling and the surface form is simply a faithful realization of the input" (2006:11). I am not in the position of making any statements about underlying forms and phonemic contrasts simply because this is a phonetic study and I did not collect phonological data capable of unveiling potential underlying contrasts; nevertheless, we can at least observe that trills are even less common in Cochabambino Spanish and that stridency seems to be a key characteristic of the rhotic sounds under analysis.

Differently from Lastra & Brutagueño (2006) for Mexican and Díaz-Campos (2008) for Venezuelan, in the case of Cochabambino Spanish gender and age were not significant factors affecting the variation. For this reason, in contrast with the aforementioned studies, the current work will not make any claim about potential changes in progress concerning rhotic realizations in Cochabambino Spanish.

6. Conclusion

The present study demonstrates that in Cochabambino Spanish phonological context does not have a significant effect on rhotic stridency ($\chi 2$ (df 4, n 237) = 8.67, $p<.070$), but rather only on their voicing ($\chi 2$ (df 4, n 237) = 32.13, $p<.001$). The results also indicate a minimal presence of rhotic trills, 1%, versus a 16% encountered by Bradley (2006b).

Such findings, added to the fact that 84% of the tokens analyzed were [+strident], suggests that differently from the majority of the dialects analyzed by Bradley (2006b), in Cochabambino Spanish trill realizations not only appear to be exceptional but also stridency seems to characterize these rhotic sounds independently of the context.

Due to the nature of these sounds, the only realizations encountered in /Vs#rV/ environment are type 2 (no-sibilant + non-trill) (75.6%) and type 3 (sibilant + non-trill) (24.4%), which in no case constrain the production of the /s/ fricative component, differently from what found for Catalan and Castilian Spanish (Solé 2002:381).

As far as non-linguistic factors are concerned, neither gender nor age significantly affected rhotic variation.

This work has provided an analysis of /sr/ clusters in Cochabambino Spanish and the first empirical look at Highland Bolivian Spanish rhotics, sounds which have been reported in several phonological and dialectological manuals, but for which almost no phonetic description has ever been provided. Moreover, it has set the empirical bases for further sociolinguistic studies. The sample of informants selected was homogeneous in that speakers belonged to the same socio-economical class and urban neighborhood, but at the same time, it was able to represent clearly gender and age variables. Future investigations should therefore include more informants, from different socio-economical strata, to verify to what extent extra-linguistic factors might play a role in rhotic realizations in this dialect.

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