

ASPIRATION OF THE VOICELESS
ALVEOLAR FRICATIVE /S/ IN
RIOPLATENSE SPANISH: A
PHONOLOGICAL PERCEPTION
EXPERIMENT



UNIVERSITEIT VAN AMSTERDAM

PAULA PELS
12370371

UNDER THE SUPERVISION OF DR. MARIJN VAN 'T VEER

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Abstract

This study investigated /s/-aspiration perception in two different Spanish dialects; One with /s/-aspiration (also known as /s/-weakening) and one with /s/-retention. In this case, Rioplatense Spanish speakers represented the /s/-aspirating dialect and Madrid Spanish speakers represented the /s/-retaining one. It was hypothesized that Rioplatense Spanish speakers would be able to perceive the aspiration to a higher degree than Madrid Spanish speakers.

For this experiment, ten pairs of continua between /s/-weakening words and their minimal pair with no /s/-sound were synthesized with 9 steps, creating a slow transition from one word to the other. Participants were then asked to select on-screen which word they heard. After analyzing the results with two-tailed t-tests it cannot be concluded whether /s/-weakening dialects perceive /s/-aspiration to a higher degree than /s/-retaining dialects. However, there is a trend within the participant groups, so further research with a larger number of participants is encouraged.

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1. Introduction

As one of the most spoken languages in the world with over 406 million first and second language speakers in the world and being the official language in almost 18 different countries around the world, Spanish is deemed to have a large variety of dialects (Bradley 2014). Some of these dialectal variations are due to patterns of Spanish colonization, periods of isolation, and language contact (Lipski 1994). Crystal (2003: 136) defines a dialect as “a regionally or socially distinctive variety of language, identified by a particular set of words and grammatical structures”. Sumner and Samuel (2009) mention that a dialect is additionally a representation of a regional and/or social group that encompasses all aspects of language use, such as production, perception, representation, and processing. Moreover, dialects can differ in almost all levels of the language, including its phonological rules, lexicality, and intonation contours.

Many of these Spanish dialects realize an underlying voiceless alveolar fricative /s/ as an /h/ depending on the position of this phoneme. However, whether it will be aspirated or not varies according to each dialect’s phonological system. This phenomenon is known as the aspiration or weakening of the /s/. Most of these aspirations occur when the /s/ is found in the coda of a syllable. However, as Kaisse (1999: 197) states, “there are significant differences among dialects as to which /s/’s end up aspirating and these have to do with the interaction of the phonology with morphology”. One of the most prominent /s/ aspirating dialects is Rioplatense Spanish.

Rioplatense Spanish (RPS), also generally known as Argentine Spanish or *Porteño* Spanish (as people born in Buenos Aires are called), is spoken in the Rio de la Plata area in South America, including primarily Buenos Aires, Argentina, and Montevideo, Uruguay (Staggs 2019). Canfield (1981: 88) stated that the “phonology of Uruguayan Spanish is virtually identical to that of the *Porteño* region of Argentina”, which is why the Spanish spoken in both of these regions is studied under the same dialect. It is generalized that roughly 70% of the Argentine population speak this dialect (i.e., in the city of Buenos Aires, and in the provinces of Entre Ríos, Santa Fe, Buenos Aires, La Pampa, Neuquén, Río Negro, Chubut, Santa Cruz, Tierra del Fuego and the southern part of Córdoba) (Hualde 2005).

Taking these different dialectal variations into account and previous research in phonological perception, the question arises of whether the speakers of these dialects perceive the differing phonemes differently. The present study aims to expand the current

limited understanding of the difference in perception between native Spanish speakers of dialects that produce an aspiration of the voiceless alveolar fricative /s/ and those who do not. More specifically, native Rioplatense Spanish speakers will be compared to native Madrid Spanish speakers, in representation of an /s/-retaining dialect.

2. Literature Review

2.1. History of Rioplatense Spanish and Language Contact

When studying Rioplatense Spanish, it is essential to first understand its history and how it has become such a particular variety of Spanish. Originally populated by Incan people, the Rio de la Plata region was colonized in 1580 by a Spanish settlement led by Juan de Garay, by which the Spanish language was established. Although Castilian Spanish was considered to be more prestigious, due to the settlers coming mostly from Andalucía, the latter variety took a hold of the region (Tello 2006).

In 1816, Argentina gained independence from Spain, leading to financial, cultural, and linguistic freedom. With the Argentinian new government also came an open immigration policy, which encouraged immigrants to move to Argentina, including offering subsidies. Between 1870 and 1910, Argentina had its first major European immigration wave, mostly coming from Spain and Italy (Devoto 1989). Italian immigrants settled primarily in Buenos Aires, which led them towards becoming some of the most powerful groups of immigrants, and therefore the biggest linguistic force in the region. Italian heavily influenced Rioplatense Spanish, from its intonation to its lexicon, and there are currently 1.5 million Italian speakers in the country (Lewis et al. 2014). Argentinians are famously known for using words such as *birra* ‘beer’ as opposed to *cerveza*, *mattina* ‘morning’ instead of *mañana* or *madrugada*, and so on. Regarding intonation, Rioplatense Spanish has also been heavily influenced by the Neapolitan dialect of Italian.

One of the defining features of Rioplatense Spanish is *yeísmo rehilado*, which as will be mentioned later in more detail, is the loss of /ʎ/ and its merging with /j/ (Martinez Guillem 2010). It is stipulated that this also came from the strong language contact with Italian since the Toscano dialect had already undergone a sound change which was the morphing of the /j/ or /ʎ/ sounds into the /j/ (Cassano 2016). Although this is likely not the only reason for this phonological change since there are many other factors involved, it is likely to have accelerated it since many of the Italian immigrants were from Tuscany.

On the other hand, there are many other Spanish variants within Argentina that have been influenced by other forms of language contact, such as Andean Spanish, which is

spoken in northwestern provinces of Argentina, such as Jujuy, Salta, and Catamarca. Andean Spanish has had strong contact with Quechua. This contact has mostly influenced this variety's lexicon, and as controversially discussed in the literature, vowel variability and reduction, and nasalization (Zúñiga 2018). The most commonly discussed phonological feature regarding language contact in this variety's case is the retention of the /k/-/j/ contrast; however, in Andean Spanish, it is found with some a slight phonetic variation: /k/-/j/ (Zúñiga 2018). It is important to mention Quechua's lexical influence in other Argentinian varieties including Rioplatense Spanish. For example, the words *cancha* 'sports field', *palta* 'avocado', *pucho* 'cigarette', *chacra* 'farm' or 'field', and so on (Escobar 2011).

2.2 Important Phenomena in Rioplatense Spanish

As mentioned previously, one of the most important phonological phenomena found in Rioplatense Spanish (RPS) is the use of yeísmo rehilado (Canale & Coll 2016), as can be seen in example 1, and the aspiration of the /s/, otherwise known as /s/-weakening (Schmidt 2011), as shown in example 2.

Example 1

- a. *playa* 'beach' /'pla.ʃa/ (cf. Castilian (CS) /'pla.ja/)
- b. *cebolla* 'onion' /se.'βo.ʃa/ (cf. CS /θe.'βo.ja/)

(Baker & Wiltshire 2002: 34)

Example 2

- a. *comes mucho* 'you eat a lot' /ko.'meh.'mu.tʃo/ (cf. CS /'ko. mes.'mu.tʃo/)
- b. *listo* 'ready' or 'smart' /'lih.to/ (cf. CS /'lis.to/)

(Schmidt 2011: 8)

The former phenomenon mentioned involves the voiceless postalveolar fricative /ʃ/ phoneme in Rioplatense Spanish, used in words with “ll” and “y” interchangeably. *Yeísmo* consists of “the loss of the palatal lateral phoneme /k/ and its merging into the palatal fricative phoneme /j/” (Martinez Guillem 2010: 2). In the Rio de la Plata region, *yeísmo* goes one additional step forward into *rehilamiento*, which consists of the additional fricative

sound. This means that apart from not distinguishing between /ʎ/ and /j/, as many other Spanish varieties still do, this phoneme becomes a voiceless postalveolar fricative /ʃ/ in RPS.

However, the phenomenon that will be investigated in this paper is the aspiration of the voiceless alveolar fricative /s/, otherwise known as debuccalization (Gradoville et al 2022); Debuccalization is the loss of place of articulation. It should also be noted that /s/-weakening and aspiration of the /s/ will be used interchangeably throughout this paper. Although aspiration is found throughout many other Spanish dialects, including other Argentinian varieties, what makes Rioplatense Spanish unique is that the aspiration is limited to the position of the /s/, since it must be placed in a coda position and it must be followed by a consonant, disregarding whether the /s/ starts a new syllable, a new morpheme, or a new word (Kaisse 1999).

Other varieties of Spanish, such as Puerto Rican Spanish and Western Andalusian Spanish, might also have /s/ aspiration in phrase-final position (*¡Caminamos!* /ca.mi.'na.moh/ 'we're walking') or in prevocalic environments (*sí* /'hi/ 'yes') in a limited number of dialects (Lipski 1986). Other varieties within Argentina also have a different usage of the /s/-weakening, such as the one spoken in the northern Patagonia province of Rio Negro (RN). In this case, RN produces /s/ aspiration in word-final position, even if not followed by a consonant, as seen in example (b), and between vowels when the /s/ has become an onset of the following syllable (c) (Gelormini-Lezama 2017). However, RN does not produce aspiration if the /s/ is before a stem-initial vowel, like in the word *desigual* "unequal", which is pronounced as /de.si.'gwal/ or the word *deshecho* "undone", pronounced as /de.'se.tʃo/ (d), in both varieties (Kaisse 1999).

Example 3

	RPS	RN
(a) mismo 'same'	/mih.mo/	/mih.mo/
(b) dos 'two'	/dos/	/doh/
(c) dos amigos 'two friends'	/do.sa.mi.gos/	/do.ha.mi.goh/
(d) deshecho 'undone'	/de.se.tʃo/	/de.se.tʃo/

(Gelormini-Lezama 2017: 350)

In RN, there is aspiration in (c) because of outer word syllabification, whereas this does not occur in (d) because aspiration only applies once the /s/ has become an onset following the resyllabification process. However, RPS disregards the difference between

word or morpheme boundaries and does not apply aspiration in either of these examples due to there not being a consonant following the /s/. The RPS aspiration phenomenon that will be highlighted in this paper can be summarized as shown in (1):

(1) s → h/ _C

2.3 Previous Research on Perception and /s/-aspiration

Poeppl (2015) states that speech perception refers to “the suite of (neural, computational, cognitive) operations that transform auditory input signals into representations that can make contact with internally stored information: the words in a listener’s mental lexicon” (p. 429). Differences in perception of Spanish phoneme variation have been previously reported by Schmidt (2011). Schmidt’s dissertation investigated the perception of the /s/-aspiration in Spanish but largely focused on L2 speakers and the effects of exposure to certain dialects. She also investigated /s/-aspiration perception between native Spanish speakers of /s/-aspirating dialects (La Rioja, Argentina) and sibilant retaining /s/ dialects (Bogotá, Colombia). Schmidt did so by presenting audio recordings of nonce words with word-internal coda aspirated /s/ to participants and then asking them to select which word they heard from a selection of seven words. This dissertation concluded that there were indeed differences in perception between these two groups. However, Schmidt points out that the results revealed that production of the aspiration itself was not necessary in order to accurately perceive perception: “some /s/-conserving speakers identified aspirated-/s/ as did the /s/-weakening speakers. Reported *exposure* to speakers of other dialects who produced the variants was found to help facilitate this pattern.” (Schmidt 2011; page 178). Therefore, Schmidt concludes that it may not be needed to incorporate a certain dialectal variant in their own speech in order to correctly perceive this variation.

On the other hand, Del Saz (2019) conducted a similar study, in which L2 Spanish speakers’ perception was examined. Participants were presented with recordings from Western Andalusian Spanish with /s/-final aspiration; however, the recordings were presented with (and without) background noise, to see whether this would have a significant effect on perception. The study concludes that perception of L2 regional speech does suffer in adverse conditions, such as noise, as opposed to standard speech depending on the participant’s length of exposure to the L2.

Ganong (1980) sets on to investigate “the interaction in speech perception of auditory information and lexical knowledge” (Ganong 1980: page 110). He accomplishes this by creating acoustic continua that vary in voice onset time, creating a word and non-word continuum. By testing this, he was able to prove that the participants in his experiment were completing the ambiguous phoneme with a phoneme that would turn the non-word into a real word, rather than a non-word. This phenomenon has been coined the term “Ganong effect”.

Moreover, previous studies by Flanigan (2008) and Scott & Cutler (1984) have found that ‘the perception of sociophonetic variants differs according to the dialect of the listener’ (Schmidt 2011: page 25), although these two majorly focused on researching English perception. Speakers of different dialects might also use perceptual cues in variable magnitude, or even make use of completely different cues, in speech perception. Kirby (2010) reports this regarding Vietnamese tones and studied the effects of Vietnamese dialectal experience on listeners’ prelinguistic perception of tone by comparing Northern and Southern Vietnamese. His results supported his claim of low-level perceptual similarity being influenced by primary dialect experience.

In conclusion, not much research has been carried out on L1 Spanish speakers’ phonological perception in comparison to research regarding L2 speakers. In the current study, the acoustic continua method used in Ganong’s research will be used to further corroborate Schmidt’s findings and see whether there is indeed a difference in perception depending on the speaker’s native Spanish variety.

2.4 Sociolinguistic Aspect

It is interesting to note the heavy sociolinguistic impact that the /s/-weakening may have in different societies. As Rakić et al. (2011) state, speech differences may be indicative of belonging to different social groups, since a variety of information is inferred directly from speech. Much like many other language variations traditionally studied by dialectology, this phonetic phenomenon can be considered a social and stylistic marker. In accordance with this, Núñez-Méndez (2022) establishes that the use of /s/-weakening might establish a speaker’s socioeconomic class, region, or level of education. However, these social perceptions are closely attached to each area since these stigmas and stereotypes can widely vary across the globe and across different regions and dialects. The aspiration of the /s/ is typically associated with a lower social class, and in some areas with the speech of men and younger speakers (Mason 1994).

Fontanella de Weinberg (1973) studied the sociolinguistic aspect of the aspiration of the word-final /s/ in Bahía Blanca, a city 700 kilometers south of the city of Buenos Aires where Rioplatense Spanish is spoken. Fontanella de Weinberg analyzed the speech of sixty natives and divided them into six occupational groups, including (1) domestic service personnel, (2) qualified workers, (3) unskilled workers, (4) highly skilled employees, (5) personnel of intellectual, technical, or university backgrounds, and lastly (6) administrative positions of the highest level. She then analyzed four different types of speech, including spontaneous speech, formal speech, reading, and word lists. She concluded that her data supports her hypothesis of there being a general preference for prestigious features, which in this case would be /s/ retention, in female speech more than in male speech. Fontanella de Weinberg also includes in her discussion that this not only applies to phonetic features but also grammatical and lexical ones. In 1990, Fontanella de Weinberg carried out another diachronic analysis of the /s/ in Rioplatense Spanish, in which she compared the presence or absence of final /s/, according to the speaker's gender, age, and educational level. She concluded that less-educated speakers deleted the /s/ 70% of the time, whilst more educated speakers only did so 20% of the time. She also concluded that women retained /s/ more often than men and that there was no significant difference regarding age.

Moreover, Fontanella de Weinberg (1974) utilized the same corpus from her 1973 study previously mentioned and maintained the same six occupational groups and the four different speech types. She found a strong correlation between the use of /s/ and speech style, and with the level of occupation. The strongest difference that was found between the different speech styles was between the reading and the word list. She concluded that the more education the participant had, the more likely they were of retaining the /s/. The participants in groups with lower strata aspirated the /s/ more in all four speech styles, whilst the participants in the upper strata were more likely to retain it.

Therefore, it has been found that aspiration of the /s/ has a significant impact on sociolinguistic perception in Rioplatense and that the speaker's level of education might be assumed from this phenomenon.

2.5 Why Madrid Spanish

A large number of Spanish Varieties can be rated relatively high or low on the prestige continuum according to their relative closeness to the 'standard norm' identified by the Royal Spanish Academy (Real Academia Española, RAE) prescribed norm. In ranking variants, native speaker judgment is based predominantly on pronunciation features and, on a

small scale, on differences in lexicon and syntactic structure (López Morales 1989). In the following experiment, a group of /s/-retaining Spanish speakers will also be tested as a means of comparison to the Rioplatense Spanish speakers. In this case, Madrid Spanish has been selected for the following reasons.

Many research papers regarding Spanish and its different phonological varieties refer to the idea of ‘prestige’ (Momcilovic 2009). However, what exactly is seen as a prestigious, or rather a standard form? For many native Spanish speakers and certainly for researchers, this is typically associated with the Spanish dialect spoken in Castile, Spain, or more specifically in the Spanish capital of Madrid, which is where the Real Academia Española happens to be established (Momcilovic 2009). It is important to understand this idea of ‘prestige’ since most research papers on this topic refer to a ‘prestigious linguistic form’ when referring to /s/ retention.

Moreover, Momcilovic (2009) mentions that due to the influence of Madrid being the Spanish capital and the administrative, cultural, and political center, people perceive the Spanish variant spoken there “as one of power and prestige so high that it has been rarely questioned” (2009, page 3). However, due to Madrid being a large urban center, it’s attracted a big wave of immigrant population from less developed regions such as La Mancha, Extremadura, and Andalusia, which have caused an influx in the current non-standard Madrid Spanish; more particularly with those varieties associated with low economic status and low educational level. Momcilovic investigates in her 2009 study whether there is in fact /s/ aspiration in Madrid Spanish. She concludes that approximately 25% of speakers did *not* use a standard /s/ and that only 9,9% of speakers produced the /s/ as an aspiration. Although Momcilovic concludes that Madrid Spanish is possibly evolving, the number of speakers who have been shown to produce aspiration is still quite low, and in the following research, we will still utilize Madrid Spanish as the /s/ retaining dialect.

2.6 Hypothesis and Research Question

There has been very little research done regarding native Spanish speakers’ perception of the aspirated /s/, which is why the present study was developed, in hopes of expanding further knowledge on this subject and bringing further clarity to this phonological phenomenon. Moreover, due to /s/-weakening having an important sociolinguistic impact in both dialects, it is important to study this phenomenon in order to support future research.

Based on the research mentioned in the previous sections, it is hypothesized that the Rioplatense Spanish speakers will be able to perceive the presence of the aspiration to a

higher degree than Madrid Spanish speakers. Due to Rioplatense speakers producing and perceiving aspiration on a daily basis, it is hypothesized that they will have a higher sensitivity to this phoneme even when it has been partially removed. Madrid Spanish speakers, on the other hand, are expected to be less sensitive to the aspiration as the continuum slowly transitions to the /s/-deleted word.

The research question that will be addressed in this study can be summarized as follows: Do /s/-aspirating dialect speakers perceive the aspiration to a higher degree than /s/-retaining dialect speakers? More specifically, regarding Rioplatense Spanish speakers and Madrid Spanish speakers.

4. Method

3.1 Participants.

In the following experiment, native Spanish speakers representing two dialectal regions were recruited; In this case, native speakers of Rioplatense Spanish from Buenos Aires (N=10) were recruited to represent the /s/-weakening dialect, and native speakers of Castilian Spanish from Madrid (N=11) were recruited in representation of a dialect which does not produce this phenomenon. Participants were recruited by word of mouth and via the website Reddit (<https://www.reddit.com>). All participants were presented with a background questionnaire, in which they were asked about their age, their gender, their nationality, how many languages they speak, and their level of education. All participants signed a consent form (Appendix G) and confirmed that they did not have a specific language disorder such as dyslexia. Moreover, good vision and hearing were also confirmed by all participants.

3.2 Stimuli.

As mentioned previously, this experiment will use similar methods to those mentioned in Ganong's (1980) paper. Therefore, ten pairs of continua between /s/-weakening words and their minimal pair with no /s/-sound were synthesized by using a script coded with Praat software (Boersma & Weenink 2022). All of the stimuli word can be found in Appendix D. To achieve syllabic and phonetic consistency throughout the stimuli presented to participants, both real and non-words were used, all of which were disyllabic with stress initial, an aspirated /s/ in coda first-syllable position followed by a plosive. A native Rioplatense speaker provided the raw material for the construction of the stimuli and was asked to record the words with /s/ aspiration. A continuum was then created, so that one end of the continuum would be the word with an aspirated /s/, e.g. *vasca*, voiced by the

Rioplatense speaker as /'vah.ka/, and the other end of the continuum was its minimal pair with no /s/, e.g. *vaca*, voiced as /'va.ka/. Each continuum counted with nine steps/recordings in-between both ends of the continuum, with a slow transition from one /s/-weakening word to the word with /s/-deletion; to create this, the aspiration of the /s/ was slowly deleted from the initial recording, resulting in the word's minimal pair. Moreover, three initial VOT continua with 8 steps each were created as distractor stimuli (i.e. *temo* /'te.mo/ and *demo* /'de.mo/, *faso* /'fa.so/ and *vaso* /'βa.so/, and so on. Appendix E). The data collected from these continua were not analyzed.

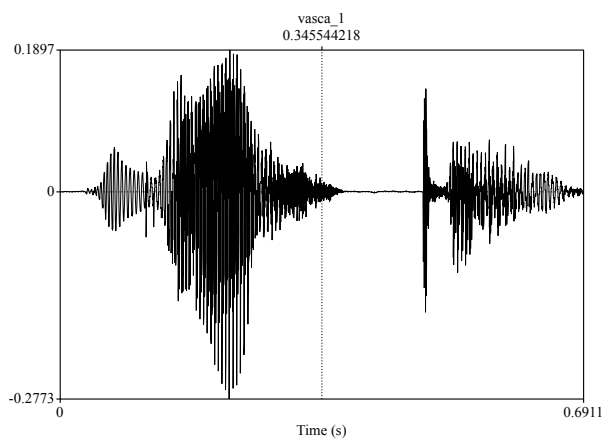


Figure 1. Visual of the original recording of ‘vasca’, which was used as step 1, with /s/-aspiration still completely present, voiced as /'vah.ka/.

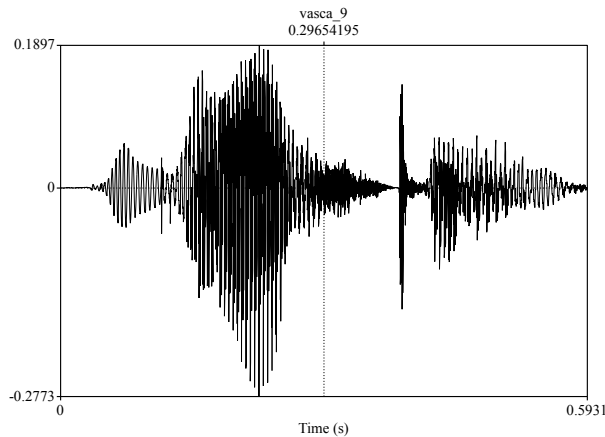


Figure 2. Visual of the original recording of ‘vasca’, which was used as step 9, with full /s/-deletion, voiced as /'va.ka/.

3.3 Procedure.

A total of twenty-one participants took part in the experiment. Since the experiment took place online, participants were asked to use headphones throughout the whole study in order

to assure uninterrupted and high-quality audio. The subjects were asked to click the screen whenever they were ready to hear an audio recording. When the audio was played, a white screen with a plus ‘+’ sign was shown. They were then presented with the corresponding minimal pairs from each continuum. They were then asked to select which word they were hearing. Each audio was only played once, and all recordings were randomized. Participants listened to a total of 90 recordings for the continua regarding the /s/, and 24 recordings regarding the VOT distractor continuum. Therefore, there were a total of 114 clicks per participant. However, only the 90 clicks regarding the continua with /s/-weakening and deletion will be considered. Once the experiment was done, a sign stating that the experiment was finished was presented on-screen. Additionally, all instructions and communication with participants were done in Spanish. Since all communication was done via writing in standard European Spanish, no bias is expected from this.

4. Results

The results from this experiment were maintained separated according to the dialect spoken. The results were interpreted by the number of times each participant clicked on the left button, which was the /s/-containing word, and each of the nine steps was compiled with each of the participant’s responses, leading to the averages found in Table 1 for both Madrid Spanish speakers and Rioplatense Spanish speakers. Appendix A and B shows a more detailed table per participant for each group.

From the Madrid speakers (N = 11), seven participants were female and four were male. Participants were between the ages 24 and 66, with an average of 37,2. Regarding the highest level of education achieved, six of these participants have attended university, three attended a higher education institution and two of them attended high school.

Group	Average Left Click per Continuum Step								
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9
Madrid	8,9	8,9	9	8,8	8,6	8,1	7,8	7,3	6,3
RPS	9,9	9,9	10	9,9	9,7	9,7	9,5	9,4	8,6

Table 1. Average amount of left clicks, therefore selecting the /s/-containing word, compiled into each step for each dialect group.

For the Rioplatense participants (N=10), eight of these participants were female and two of them were male. Ages ranged from 25 to 86, with an average of 42,9. Out of these participants, seven of them attended university, whilst the remaining three participant's highest level of education is secondary school.

The results were analyzed with two-tailed t-tests, which were carried out by comparing the number of left clicks for each step between the two groups, which lead to a total of nine tests. All of these tests which were carried out were above $p > 0.05$, which means that they were not significant. Figure 3 and 4 represent a graph of the average number of left clicks selected by each group for each step. All of the results from the t-tests can be found in Appendix C.

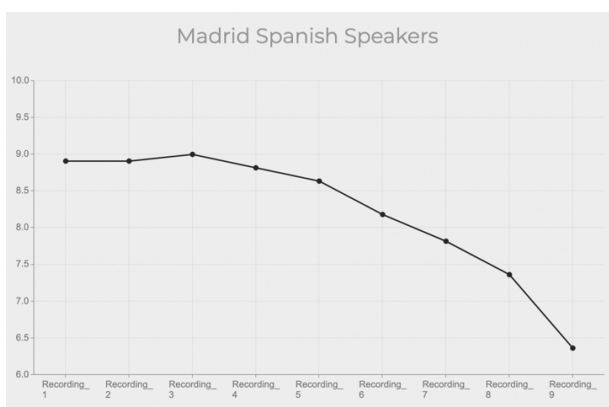


Figure 3. The average number of left clicks made by Madrid Spanish speakers, which indicate the number of times that the listener selected the /s/ containing word for each step.

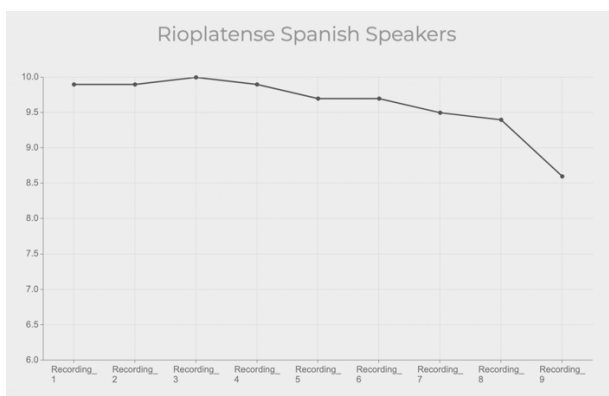


Figure 4. The average number of left clicks made by Rioplatense Spanish speakers, which indicate the number of times that the listener selected the /s/ containing word for each step.

5. Discussion and Conclusion

According to the data above, since all t-tests were not significant, it could be concluded that speakers of an /s/-weakening dialect do not perceive this specific phenomenon to a higher degree than /s/-retaining speakers. However, there does indeed seem to be within-group variation and a clear trend.

From the Madrid group, participants 5 and 10 answered quite inconsistently in comparison to the other participants and could therefore be considered outliers. It is unclear why they answered this way, but it can be hypothesized that it was due to selecting randomly due to boredom or perhaps due to participant bias. These outliers explain why there is a noticeable difference between Figures 3 and 4 in regard to step/recording 8 and 9, and yet this difference is not significant. This is likely due to the standard deviation between both groups.

Moreover, when looking at individual participants' results, there does seem to be a clear difference in perception between the two groups. For example, participants 9 and 8 from the Madrid group did click left *less* as the continuum progressed, which is a clear contrast with participants 8, 9, and 5 from the Rioplatense group, which consistently clicked left throughout the entirety of the experiment, which means they heard /s/-aspiration consistently. There seems to be a clear trend in the data, and it is likely that with a larger pool of participants, the significance could be reached. Therefore, further research with a larger number of participants is highly encouraged.

Although age, gender, and level of education might also have an influence on perception, due to the small pool of participants in this experiment, it is not possible to take these factors into consideration. For further research with more participants, it would be important to see whether either of these factors has an impact on the results, as it was noted in the sociolinguistic literature mentioned previously that there seems to be a strong correlation between these factors.

Despite these limitations, this study brings further insight into the perception variation between two different dialects and, although it cannot be concluded whether /s/-weakening dialects perceive /s/-aspiration to a higher degree than /s/-retaining dialects, there does seem to be a clear trend. Due to this, further research is highly encouraged with a larger pool of participants in order to account for any outliers and see whether this trend can become a significant result for differences in perception.

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7. Appendix

7.1 Appendix A

Amounts of left clicks per participant from the Madrid Spanish group.

Participant	Step of Continuum								
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9
P1	10	10	10	10	10	10	10	10	9
P2	9	10	9	9	10	10	10	9	8
P3	10	10	9	9	9	9	10	10	9
P4	10	10	10	10	10	9	10	10	9
P5	6	5	8	7	6	2	2	0	0
P6	10	10	10	10	10	10	10	10	10
P7	10	10	10	10	10	10	10	10	9
P8	10	10	10	10	10	10	7	6	3
P9	10	10	9	9	8	8	7	6	6
P10	3	3	4	3	3	2	3	4	2
P11	10	10	10	10	9	10	7	6	5

7.2 Appendix B

Amounts of left clicks per participant from the Rioplatense Spanish group.

Participant	Step of Continuum								
	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9
P1	9	9	10	9	9	8	9	9	5
P2	10	10	10	10	9	9	8	7	6
P3	10	10	10	10	10	10	10	10	9
P4	10	10	10	10	9	10	10	10	10
P5	10	10	10	10	10	10	10	10	10

P6	10	10	10	10	10	10	9	9	10
P7	10	10	10	10	10	10	10	10	8
P8	10	10	10	10	10	10	10	10	10
P9	10	10	10	10	10	10	10	10	10
P10	10	10	10	10	10	10	9	9	8

7.3 Appendix C

Table with the results of every t-test for each step.

	Mean	Std. Deviation	P-value
Step 1			
Madrid	8,9	2,3	0,19
Rioplátense	9,9	0,3	
Step 2			
Madrid	8,9	2,3	0,22
Rioplátense	9,9	0,3	
Step 3			
Madrid	9	1,7	0,09
Rioplátense	10	0	
Step 4			
Madrid	8,8	2,1	0,13
Rioplátense	9,9	0,3	
Step 5			
Madrid	8,6	2,2	0,15
Rioplátense	9,7	0,4	
Step 6			
Madrid	8,1	3,1	0,14
Rioplátense	9,7	0,6	
Step 7			
Madrid	7,8	2,9	0,09
Rioplátense	9,5	0,7	
Step 8			
Madrid	7,3	3,2	0,07
Rioplátense	9,4	0,9	
Step 9			
Madrid	6,3	3,4	0,08
Rioplátense	8,6	1,8	

7.4 Appendix D

Table with the stimuli presented in the experiment.

Beginning of Continuum	IPA of Audio	End of continuum	IPA of Audio
Mosca	/'moh.ka/	Moca	/'mo.ka/
Vasca	/'vah.ka/	Vaca	/'va.ka/
Vasco	/'vah.ko/	Vaco	/'va.ko/
Pesca	/'peh.ka/	Peca	/'pe.ka/
Busco	/'buh.ko/	Buco	/'bu.ko/
Buscar	/'buh.kar/	Bucar	/'bu.kar/
Astas	/'ah.tas/	Atas	/'a.tas/
Gaspar	/'gah.par/	Gapar	/'ga.par/
Casco	/'kah.ko/	Caco	/'ka.ko/
Caspa	/'kah.pa/	Capa	/'ka.pa/

7.5 Appendix E

Table with the control stimuli presented in the experiment.

Beginning of Continuum	IPA of Audio	End of continuum	IPA of Audio	Beginning of Continuum
Temo	/'te.mo/	Demo	/'de.mo/	Temo
Buzo	/'bu.so/	Puso	/'pu.so/	Buzo
Vaso	/'βa.so/	Faso	/'fa.so/	Vaso

7.6 Appendix F

Praat script designed to create the continua.

```
strings = Create Strings as file list: "list", "*.wav"
numberOfFiles = Get number of strings

#parameters
steps = 9

for ifile to numberOfFiles
  selectObject: strings
  name$ = Get string: ifile
```

```

filename$ = name$ - ".wav"
sound = Read from file: filename$ + ".wav"
tg = Read from file: filename$ + ".TextGrid"
intervals = Get number of intervals: 1
for interval to intervals
    selectObject: tg
    word$ = Get label of interval: 1, interval
    if word$ = "h"
        startTime = Get start time of interval: 1,
interval
        endTime = Get end time of interval: 1, interval
        midPoint = startTime + endTime / 2
        duration = endTime - startTime
        chunk = duration / steps
        for i to steps
            newStart = midPoint + 0.5 * chunk * i
            selectObject: sound
            View & Edit
            editor: sound
            Select: midPoint - 0.5 * chunk * i,
midPoint + 0.5 * chunk * i
            Cut
            endeditor
            Save as WAV file: "results/" + filename$ + "_"
+ string$(i) + ".wav"
            removeObject: sound
            sound = Read from file: filename$ + ".wav"
        endfor
    endif
endfor
removeObject: sound, tg
endfor

removeObject: strings

```

7.7 Appendix G

Formulario de consentimiento informado

Por la presente declaro que he sido informado claramente sobre el estudio *Aspiración de la /s/ en el español rioplatense*, que se realiza bajo la supervisión de Marijn van 't Veer, en el contexto de la tesis final de la Licenciatura en Lingüística en el Universidad de Ámsterdam como se describe en el folleto informativo. Mis preguntas han sido respondidas a mi entera satisfacción.

Doy mi consentimiento para participar en esta investigación de forma totalmente voluntaria. Me reservo el derecho de revocar este consentimiento sin tener que proporcionar ningún motivo para mi decisión. Soy consciente de que tengo derecho a suspender la investigación

en cualquier momento y puedo retirar mi participación después de que la investigación haya finalizado. Si decido detener o retirar mi consentimiento, toda la información recopilada hasta ese momento se eliminará de forma permanente.

Si los resultados de mi investigación se usan en documentos de estudiantes o se hacen públicos de cualquier otra manera, se harán completamente anónimos. Mi información personal no puede ser vista por terceros sin mi permiso expreso.

Si necesito más información sobre la investigación, ahora o en el futuro, puedo contactar a Paula Pels (phone number: +31 65595 8630 email: 12370371@uva.nl; Spuistraat 134, 1012 VB Amsterdam).

Si tengo alguna queja con respecto a esta investigación, puedo contactar al secretario del Comité de Ética de la Facultad de Humanidades de la Universidad de Ámsterdam; correo electrónico: commissie-ethiek-fgw@uva.nl; número de teléfono: +31 20 - 525 3054; Kloveniersburgwal 48, 1012 CX Ámsterdam.

Doy mi consentimiento para:

- participar en esta investigación sí / no
- mis datos personales se almacenarán durante un período de 10 años sí / no

Firmado por duplicado:

.....
Nombre del participante Fecha Firma

‘He explicado la investigación con más detalle. Por la presente declaro mi voluntad de responder cualquier otra pregunta sobre la investigación lo mejor que pueda ’

.....
Nombre del investigador Fecha Firma