Regional Variation in the Perception of Sociophonetic Variants of Spanish /s/

Lauren B. Schmidt
University of Missouri-St. Louis

1. Introduction

Weakening of syllable- and word-final /s/ (e.g., *español* [eh.pa.ɲol] or [e.pa.ɲol]) is one of the most studied phenomena in the field of Hispanic sociolinguistics. Present in up to 50% of the world's varieties of Spanish (Hammond 2001), /s/-weakening has been shown to be socially, geographically, stylistically, and linguistically variable. Despite the abundance of studies on variable production of Spanish /s/, however, very little is known regarding the role that /s/-weakening plays in speech *perception*. For example, are the weakened variants perceived and processed differently than the full sibilant variant? How do Spanish speakers from varieties in which /s/ is not weakened perceive the variable forms? Does perception of weakened-/s/ vary according to different sociolinguistic factors as it does with production?

More recently researchers are recognizing the value of introducing tools and theories of speech perception into sociolinguistic research (e.g., Drager 2010, Foulkes, Scobbie & Watt 2010, Thomas 2002). Drager, for example, describes several benefits of speech perception experimentation in variation research, including that of a further understanding of language change, stereotype formation, storage of linguistic variation, and of cognitive processes involved in language use (2010: p. 473). Indeed, this growing body of work has contributed to a more thorough understanding of variation. For example, research on English variation has revealed regional differences in the perception of English sociophonetic variants (e.g., Thomas 2000, Walker 1976, Willis 1972), as well as variation in speech perception according to perceived social characteristics of the speaker (e.g., Hay, Warren & Drager 2006, Niedzielski 1999, Strand & Johnson 1996). Remarkably, however, these research methods have not of yet been sufficiently capitalized for understanding variation in Spanish.

The objective of the current study is to contribute further to the understanding of variable /s/-weakening in Spanish through an investigation of how sociolinguistic variants of /s/ are *perceived* (categorized) by Spanish speakers from different dialectal regions (weakening vs. maintaining varieties). Furthermore, in light of the social, stylistic, and linguistic variation present in /s/-weakening at the level of production, this study investigates the role of social and language background factors on perception of weakened-/s/. Specifically, the study addresses the questions of whether there exists cross-dialectal variation in the perception of sociophonetic variants of Spanish /s/, and, furthermore, if perception of weakened-/s/ also varies according to social factors (sex) and linguistic background (dialect contact) of the listeners. The following section (Section 2) continues with an overview of Spanish /s/-weakening and of perception of weakened-/s/. Section 3 presents the research methodology employed, including participants, tasks, and data analysis. The findings are then presented in Section 4 and discussed in Section 5. Final conclusions of the study are provided in Section 6 of the paper.

2. Background

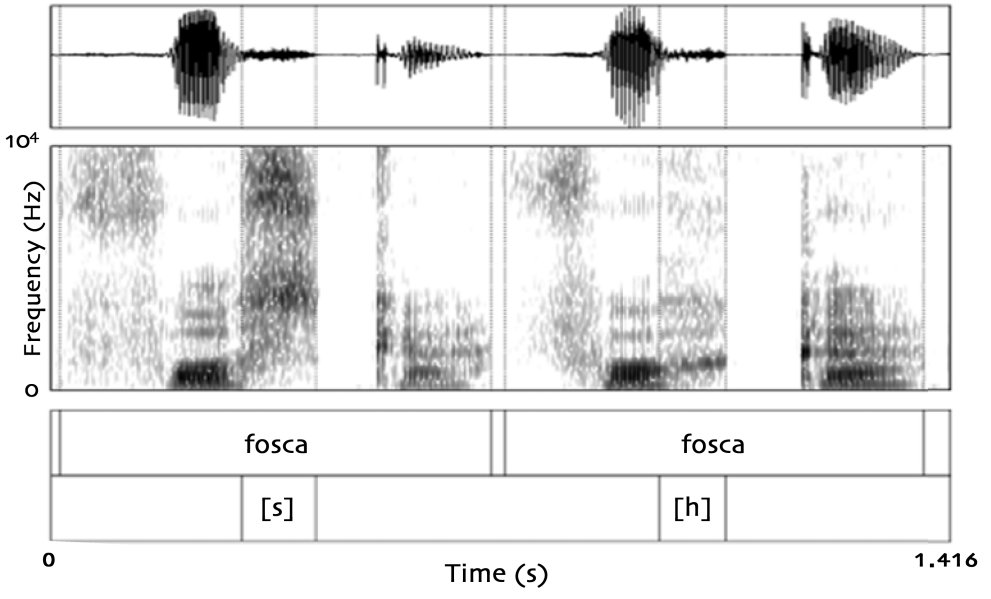
2.1. Spanish /s/-weakening

The Spanish sibilant /s/ may be weakened in syllable- and word-final position, resulting in a continuity of degrees of lenition (File-Muriel & Brown 2010). Despite this gradiency of lenition,

[*]I give thanks to Kimberly Geeslin, Isabelle Darcy, Erik Willis, and Manuel Diaz-Campos for their instrumental input at all stages of this project, to Andy Johns for his assistance in running the experiment, and to the students at the Universidad Distrital (Bogota), La Javeriana, and the Universidad La Rioja for their participation in the study.

however, the variants of /s/ have traditionally been grouped into three categories: (1) [s], high frequency sibilance, as in [lis.to] (*listo,* 'smart'), (2) [h], a period of glottal frication, or aspiration, as in [lih.to]), and (3) Ø, total deletion of the sibilant, as in [li.to] [1]. Weakening of /s/ may occur word-internally before a consonant (e.g., *mismo* [mih.mo]) and word-finally before a consonant, pause, or vowel (e.g., *comes mucho* [ko.meh.mu.tʃo]). Examples of the two sociophonetic variants tested in the current study, sibilance [s] and aspiration [h], are shown below in Figure 1. While both variants are characterized by a period of voiceless (aperiodic) frication, the dark band of high-frequency sibilant energy between 6 and 10 kHz that is present in the spectrogram of the coronal [s] variant is notably absent in the debuccalized [h] variant.

Figure 1. Examples of the full sibilant [s] and aspirated [h] variants in *fosca* (nonce word), Venezuela



Broadly speaking, /s/-weakening is geographically distributed throughout southern Spain, the Caribbean, many Central American dialects, the Southern Cone, and the Pacific coast of South America, while it is not typical of those varieties spoken in the highlands of Mexico and Central America nor in the Andean regions of South America (Hualde 2005, Lipski 1994). Weakened variants of /s/ are favored by different social groups, corresponding to different social factors such as *sex* (e.g., Dohotaru 2004, Terrell 1981), *age* (e.g., Cedergren 1973, Samper Padilla 1990), and *socio-economic level* (e.g., Calles & Bentivoglio 1986). Moreover, retention of /s/ tends to be associated with more formal or prestigious speech than the weakened forms (Lafford 1986, Terrell 1981). Linguistic factors also appear to be at play in patterns of variation of /s/, such as *phonetic context* and *lexical frequency* (e.g., Brown 2009, File-Muriel 2009, Terrell 1978).

As weakening of Spanish /s/ varies according to a complexity of different linguistic, social, regional, and stylistic factors, it is possible that perception of the weakened variants also corresponds to these – or other – factors. Indeed there is some previous evidence of small – yet systematic – differences in perception of sociophonetic variants according to social characteristics (age, sex) of the listener (De Decker 2010, Janson 1986). The current study considers, thus, the possibility of variation in identification of the sociophonetic variants of Spanish /s/ according to the social factor of *sex* of the listener, as sex has been found to be a predictor of sociolinguistic variation of syllable-final /s/ in

[1] Other lenited variants of /s/ have also been reported, such as vowel laxing (e.g., Mondéjar 1991), vowel lengthening (Hammond 1978; however, see Figueroa 2000 & Torreira 2006), and longer VOTs and stop closures of following voiceless stops (Torreira 2006).

speech production in many varieties, with a tendency for higher frequency of use of the sibilant variant [s] by females and of the weakened variants by males (e.g., Dohotaru 2004, Fontanella de Weinberg 1973, Terrell 1981). In addition to the possibility of variation in perception according to social factors, there is evidence that exposure to other dialects may influence speech perception and processing (e.g., Evans & Iverson 2004, Sumner & Samuel 2009). As such, the study additionally examines perception of the sociophonetic variants of /s/ according to reported dialect exposure of the listeners through social contacts to determine if linguistic background has an effect on categorization of the weakened variants.

2.2. Studies of perception of /s/-weakening

Few previous studies have examined perception of weakened variants of Spanish /s/. Hammond (1978) and later Figueroa (2000) investigated the perception of syllable- and word-final weakened-/s/ in Caribbean Spanish in order to determine whether Caribbean speakers use some additional acoustic cue(s) to identify a deleted-/s/. Twenty Miami Cuban listeners hearing Miami Cuban speakers (Hammond 1978) and 20 Puerto Rican listeners hearing Puerto Rican speakers (Figueroa 2000) were asked to identify the presence or absence of /s/ in stimuli with a weakened (elided) /s/ (e.g., *pescado* [peØ-ka-ðo] 'fish'). Three syllable-final positions were targeted: word-internal, word-final within the phrase, and word-final at the end of the phrase. These studies found that Miami Cuban and Puerto Rican listeners could indeed distinguish between minimal pairs with word-internal implosive elided-/s/ and with no /s/ (as in *pastilla* [paØ.ti.ja] 'pill' versus *patilla* [pa.ti.ja] 'sideburn'). However, the Caribbean listeners did not distinguish between elided-/s/ and no /s/ in word-final position (as in *hagas* [a.ɣaØ] versus *haga* [a.ɣa]). That is, the Caribbean /s/-weakening listeners could distinguish between weakened (elided)-/s/ and no /s/ within the word but not at the end of the word. The authors further found from an acoustic analysis that the vowel plus elided-/s/ sequences were longer in duration than the vowels in open syllables (i.e., without syllable-final /s/, as in ***pa****tilla*)[2].

In a study on the effects of Spanish sociophonetic variants on speech perception and processing, Boomershine (2005, 2006) tested the effect of weakened-/s/ along with two other features, velar-/n/ and lateralized-/ɾ/, on performance on three tasks: a repetition (naming) task, a lexical decision task, and a dialect identification task. Boomershine found that of the three sociophonetic variants tested, weakened-/s/ had the greatest effect on speech processing for the (/s/-maintaining) Mexican and (/s/-weakening) Puerto Rican listener groups tested, as reflected in the longest reaction times for responses on the naming task and lexical decision task. Moreover, significant differences were observed in the naming task according to listener gender: females were slower than males in repetition of those stimuli heard with the weakened-/s/ variant. With respect to the dialect identification task, Boomershine found that listeners were most accurate in determining whether a speaker was a member of their same or of a different dialect for those items that had coda /s/. This finding led her to suggest that "the realization of syllable-final /s/ seems to be a distinguishing marker of these two dialects of Spanish" (2006: p. 71).

2.3. Research questions

Findings from the few previous studies discussed above suggest an important role of /s/-weakening in perception and processing speech, and furthermore show that this feature may be used by listeners as an index of social characteristics of the speaker (geographic region). Moreover, the studies provide evidence that Spanish speakers from /s/-weakening varieties – at least from the two Caribbean varieties included in Hammond (1978) and Figueroa (2000) – can distinguish between /s/-weakened forms (here, deletion of /s/ coupled with vowel lengthening) and forms with no /s/, at least in word-internal position. It is unclear, however, whether Spanish speakers from varieties where /s/ is not weakened use the acoustic cues from the weakened variants in speech perception and word recognition in the same way as do speakers from weakening varieties. Furthermore, these previous studies did not consider possible variation in perception according to those different social, stylistic, and linguistic factors that play a role in /s/-weakening in speech production. The following research questions are

[2] A duration difference was observed for both word-internal and word-final environments for the Puerto Rican speakers (Figueroa 2000), but only for the word-internal context for the Cuban speakers (Hammond 1978).

posited, thus, to direct preliminary study of variation in perception (categorization) of sociophonetic variants of Spanish /s/:

1. How are sociophonetic variants of /s/ (sibilance, aspiration) categorized by speakers of Spanish from dialects that vary in the realization of syllable-final /s/? Are cross-dialectal differences found in categorization of weakened-/s/?

2. What are the effects of the listener *sex* and *dialect contact* on categorization of the sociophonetic variants of Spanish /s/?

3. Methodology

3.1. Participants

The study was carried out in two regions in South America, La Rioja, Argentina, and Bogotá, Colombia. The first dialect group, from La Rioja, the capital city of the western Argentine province of La Rioja, represents a dialect in which syllable- and word-final /s/ is weakened. Part of the Northwest Argentina dialectal group (Vidal de Battini 1964), this variety is characterized by aspiration – and deletion amongst speakers of lower socioeconomic level – of word- and syllable-final /s/ (Rojas 2000). Aspiration of /s/ is also prevalent throughout much of Argentina, including the capital and cultural center, Buenos Aires, and even amongst speakers of the "educated classes"[3] (Vidal de Battini 1964). Twenty university students attending a public university in La Rioja (12 female, 8 male) completed the study (mean age = 21.5, *SD* = 4.19). All Argentine listeners had lived exclusively in La Rioja province or had spent part of their childhood in a neighboring northwestern province or in Buenos Aires.

The second group, from Bogotá, Colombia, represents a dialect in which syllable- and word-final /s/ is not weakened but is conserved in its full sibilant form, [s] (Lipski 1994: p. 209). Bogotá, the capital city of the largest Spanish-speaking country in South America, is also the political and economic center of the country. Although syllable-final weakened-/s/ is not characteristic of this variety, it is noted that weakening of /s/ does occur in other regions of the country, particularly along the Caribbean and Pacific coasts (Lipski 1994: pp. 210-212). Twenty-seven university students attending public and private institutions in Bogotá (17 female, 10 male) completed the study (mean age = 20.0, *SD* = 2.66). All Colombian listeners had lived exclusively in Bogotá or in other /s/-maintaining regions of Colombia.

3.2. Identification task

In order to examine how weakened-/s/ is perceived by Spanish speakers from the weakening and maintaining dialects, listeners from the two dialectal groups completed an Identification Task with the objective of determining how these listeners categorize syllable-final aspirated-/s/ (e.g., *loste* [loh.te]). In this task type, listeners are asked to classify, or categorize, targeted sounds into one of several categories provided and represented by a Spanish letter (here, "s, f, l, r, n, ∅ [no coda]" and "none of the above"). If it is assumed, then, that each of these letters is representative of a different Spanish phonemic category, listeners should assign (categorize) all *legitimate* variants within that phonemic category to the same letter[4]. For example, the variants [s] and [h] would be classified as the Spanish letter <s> for speakers who produce both forms, as both are legitimate variants of the same phonemic category, /s/. The targeted variants were limited to word-internal position based on the results from Hammond (1978) and Figueroa (2000), who found Caribbean listeners to distinguish between words with elided /s/ and words with no /s/ for word-internal position only (see Section 2.2).

The 158 auditory stimuli for the task were extracted from recordings of two university-educated speakers from aspirating varieties of Spanish, a male from Caracas, Venezuela, and a female from

[3] "*las clases cultas*" (Vidal de Battini: pp. 76, 102-103) [author's translation]

[4] It was pointed out by an anonymous reviewer that responses from such a task may be best interpreted as sound-to-letter mappings rather than measures of perception, *per se*. These and other limitations of this task type (categorization task) are addressed in the discussion of the results (Section 5).

Buenos Aires, Argentina, reading a list of nonce words invented for the task[5]. The word lists were spoken several times in two different conditions in order to achieve both the aspirated and full sibilant variants. For the first elicitation, the two speakers were asked to read the items aloud as if chatting with a friend from home (weakening condition). They were then instructed to read the items as if they were newscasters on a news program or speaking with a group of non-native speakers (maintaining condition). Using Praat software (Boersma & Weenink 2010), the researcher then selected representative productions of both variants for the different nonce items, based on the presence of high energy sibilant frication (sibilant [s] variant) or a period of aspirated frication without high energy sibilance (aspirated [h] variant), as determined through observations in the spectrogram. Only nonce carrier words – forms that reflect Spanish phonotactic patterns and sounds but that do not exist as lexical items in the language – were used in the task in order to ensure (as much as possible) that the listeners were relying strictly on information in the speech signal rather than using other listening strategies. No single nonce carrier was repeated for any of the target or control stimuli.

The stimuli were disyllabic with stress on the penultimate syllable and of the form [CVC.CV] or [CV.CV] and included 28 target stimuli, 50 control stimuli, and 80 distractors. The target stimuli targeted word-internal syllable-final [s] (N=14) and [h] (N=14). These two variants of /s/ were always followed by a voiceless stop /p, t, k/ (e.g., [foh.ka], [mis.pa]) to reflect the most frequent phonotactic patterns in Spanish for internal /s.C/ sequences (File-Muriel 2007). The control stimuli targeted other phonotactically possible Spanish sounds in the word-internal syllable-final position and were included in order to establish that any difficulties in identifying the variants of /s/ were due to acoustic characteristics of the sounds themselves and not to general difficulties in perception of sounds in the syllable-final position. Ten tokens of each of five control coda conditions were created: coda [f, n, l, ɾ] and [V] (vowel, or absence of a coda consonant). Finally, the distractor stimuli targeted other positions within the disyllabic word and other sounds in order to draw attention away from the targeted word-internal coda position and to conceal the focus of the experiment. Examples of each stimulus type are presented in Table 1.

Table 1. Types and examples of stimuli (N=158 stimuli)

	Description	N	Examples
Target	coda aspirated-/s/	14	ba[h]pe, fo[h]ca
(N=28)	coda sibilant-/s/	14	le[s]te, mi[s]po
Control	coda liquid	10	ni[l]to, do[l]ga
(N=50)	coda rhotic	10	do[ɾ]te, ga[ɾ]da
	coda nasal	10	bi[n]co, ta[n]de
	coda labiodental fricative	10	pe[f]pa, lo[f]ta
	no coda ([V])	10	daØpe, leØga
Distractor	word-initial C	30	[l]inco, [r]inco
(N=80)	word-internal V	10	d[i]ca, d[o]ca
	word-internal C onset	30	de[n]o, de[f]o
	word-final V	10	fap[e], fap[i]

The auditory stimuli were presented one at a time, in randomized order by the computer program. After hearing an individual stimulus, participants selected one of six possible nonce word identification responses presented on the computer screen and which differed in one grapheme; they were also given a choice for none-of-the-above. All response options were also nonce words and were

[5] It is recalled that speakers from /s/-weakening varieties typically produce both the full sibilant ([s]) and the weakened forms (e.g., [h]) in everyday speech, with variable use of these forms by the same speaker according to different social, stylistic, linguistic factors.

presented in standard Spanish orthography. Participants could choose to listen to each stimulus a second time if desired. For the target and control stimuli, the possible responses differed in the grapheme used in the word-internal syllable-final position: "f, s, r, l, n", or no consonant. The experiment was completed through Praat software (Boersma & Weenink 2010) on individual computer stations using Sony MDF-V150 headphones on a university campus in the home dialectal region. Participants completed a short training exercise before beginning the task in order to familiarize themselves with the task instructions and format. While the same speakers were heard, none of the experimental stimuli were included in the practice session. All instructions were given in Spanish. The perception task took on average thirty minutes to complete but ranged from twenty-five minutes up to one hour as there was no time limit.

3.3. Language background questionnaire

Following the Identification Task, participants completed a written Language Background Questionnaire that targeted extralinguistic social information (age, sex, profession), linguistic experience (languages spoken and levels of proficiency), and types and degrees of exposure to Spanish speakers from other (dialectal) regions. Specifically, participants were asked to indicate the origin (city and country) of any Spanish speaker contacts – family, friends, and colleagues – from external geographic regions with whom they have had frequent contact in the last five years. The questionnaire took on average twenty minutes to complete.

3.4. Analysis

For each participant, identification accuracy scores were calculated based on the percentage of correctly identified[6] stimuli for each of the target ([s, h]) and control contexts ([f, l, ɾ, n] and [V]). In order to examine cross-dialectal differences in perception as well as possible effects of the social variable *sex* and linguistic background of *dialect contact*, participants were coded according to home dialect region (/s/-weakening Argentina, /s/-maintaining Colombia), sex (male, female), and contact with /s/-weakening speakers (contact, no contact).

The dialect contact variable was defined by the regions of origin of personal contacts reported in the Language Background Questionnaire. Those participants who reported one or more friends, family members, or colleagues from /s/-weakening regions were coded as having /s/-weakening dialect contact, while those who reported contacts only from /s/-maintaining regions were coded as no /s/-weakening dialect contact. Only the Colombian participants were coded according to this variable, as all Argentine participants were assumed to have contact with weakening as it is characteristic of their local variety.

General linear mixed models were run on the data along with Bonferroni *post hoc* comparisons (*p*-value = .05) to determine if differences observed in perception of the target and control stimuli were significant according to listener dialect group, sex, and dialect contact. While *speaker* (male from Caracas, female from Buenos Aires) was originally included in the mixed models as well, it was later removed for the final models as it was not found to have a significant effect in any analysis. All statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS), Version 20.

4. Results

4.1. Cross-dialectal perception

Table 2 shows the mean identification accuracy percentages for each coda condition for the aspirating dialect (Argentina) and the conserving dialect (Colombia). Overall, categorization of the different sounds in word-internal coda position was high (93-100% accuracy), with the exception of

[6] It is noted that throughout the paper the terms "correctly identified" and "accuracy" are used solely to facilitate presentation of the results, while recognizing that there are no correct or incorrect identifications as nonce words were used. A "correct" response, then, is one that matches what the two speakers were instructed to produce.

the aspirated-/s/ ([h]) stimuli. The Argentine group identified word-internal coda [h] as /s/ 82.5% of the time, while the Colombian group identified the [h] variant as /s/ only 43.7% of the time.

Table 2. Mean identification accuracy scores (in percentage) for each coda condition according to listener dialect group (*SD*)

Coda condition	Argentina		Colombia	
[l]	100.0	(.00)	99.3	(.09)
[ɾ]	100.0	(.00)	98.5	(.12)
[n]	99.5	(.07)	100.0	(.00)
[V]	99.5	(.07)	98.1	(.14)
[s]	94.3	(.23)	95.0	(.22)
[f]	94.0	(.24)	93.0	(.26)
[h]	82.5	(.38)	43.7	(.50)

A general linear mixed model was run to determine if differences observed between the dialect groups and in identification of the different coda conditions were significant. IDENTIFICATION ACCURACY (0.0-100.0) was used as the dependent variable, with DIALECT and CODA CONDITION as fixed effects and SUBJECT as a random effect. The model revealed significant main effects of DIALECT [$F(1, 315)=19.19$, $p<.001$] and CODA CONDITION [$F(6, 315)=53.13$, $p<.001$], and a significant interaction between DIALECT and CODA CONDITION [$F(6, 315)=15.79$, $p<.001$].

Bonferroni *post hoc* pairwise comparisons revealed between-group (cross-dialectal) and within-group (cross-condition) differences. The two groups differed from one another only in identification of the aspirated [h] stimuli; the aspirating Argentine group had significantly higher rates of identification of the [h] variant as a form of /s/ than did the maintaining Colombian group, $p < .001$. No additional cross-dialectal differences were found for any of the other six coda conditions. Within-group comparisons further found lower identification accuracy of the [h] condition than of the other conditions within each dialect group. Within the Argentine group, [h] was identified at significantly lower rates than [V] (no coda), [n], [l], and [ɾ], with all comparisons $p < .001$[7]. Within the Colombian group, identification of coda [h] was significantly lower than identification of each of the other six conditions, with all comparisons $p < .001$.

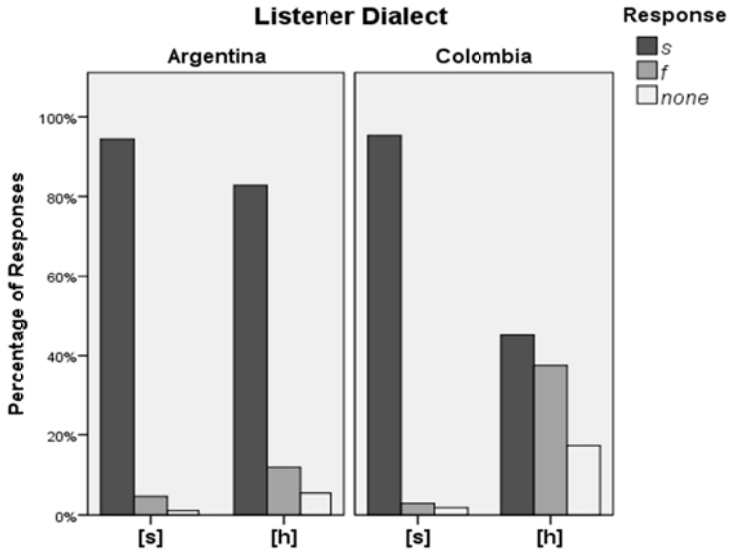
4.2. Identification of aspirated-/s/

Figure 2 presents the distribution of identification responses according to the listener dialect group and the variant of word-internal syllable-final /s/. While the Colombian group clearly had more misidentifications of the [h] stimuli, both dialect groups overwhelmingly limited categorization of the [h] stimuli to <s>, <f>, and <none of the above>. The remaining four response options, <l, r, n> and no coda, were not selected by either group for more than 2.5% of the data and are not included in the figure.

The Argentine listener group favored identification of both the coda sibilant [s] and the coda aspiration [h] as <s>, thus, accepting both variants as legitimate forms of Spanish /s/. The Colombian group followed the same pattern for identification of the coda sibilant [s] only; Colombian responses were much more varied in identification of the aspirated variant and were more evenly distributed across <s>, <f>, and <none of the above> responses (representing 44%, 36%, and 17% of the responses for the aspirated stimuli, respectively).

[7] Differences between identification of [h] and the other two voiceless fricative conditions [s, f] were not significant for the Argentine group, but did approach significance ($p = .058$ and $p = .074$, respectively).

Figure 2. Distribution of response types according to dialect group and variant of /s/



4.3. Social variation in perception of variants of /s/

Next, the effects of the social and linguistic experience variables on categorization of the sociophonetic variants of Spanish /s/ are considered. Two characteristics were examined, *sex* of the listener and *personal contact* with /s/-weakening speakers. It is recalled that all participants were of similar age (M = 20.7 years old) and life stage (university students). Results for the two dialect groups are presented separately.

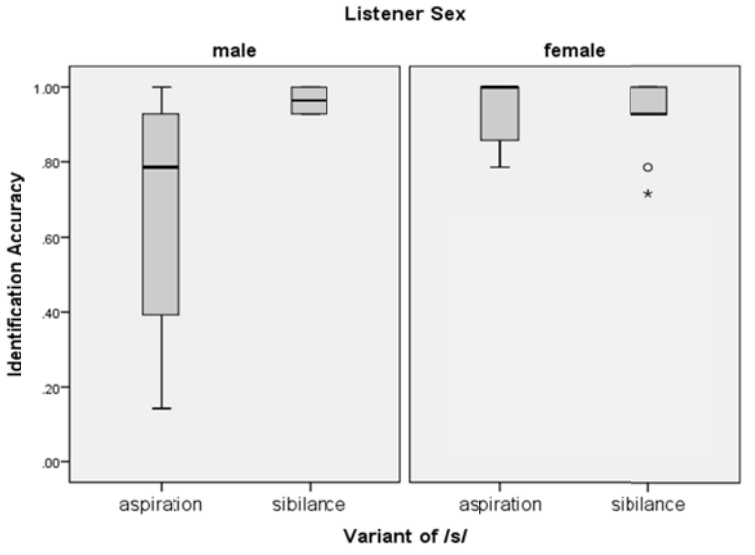
4.3.1. Variation according to social factors: Aspirating group

The distribution of the individual identification accuracy percentages according to variant of /s/ and to listener sex is displayed in Figure 3 for the Argentine group. Only listener sex was included as it is assumed that all Argentine participants have contact with /s/-weakening speakers as /s/-weakening is characteristic of their local dialect. As noted in the figure, all female Argentine listeners highly identified both the [s] and the [h] variants as /s/, while the male Argentine listeners displayed greater variation in identification of the [h] variants, with some male listeners failing to identify coda [h] as /s/.

A mixed model analysis was run for the Argentine data with IDENTIFICATION ACCURACY as the dependent variable, SUBJECT as a random effect, and LISTENER SEX and VARIANT of /s/ as fixed effects[8]. Significant main effects of LISTENER SEX [$F(1, 36) = 4.743$, $p = .036$] and VARIANT [$F(1, 36) = 8.265$, $p = .007$] were revealed, as well as a significant interaction between LISTENER SEX and VARIANT [$F(1, 36) = 8.265$, $p = .007$]. Bonferroni *post hoc* tests found that the male and female Argentine listeners significantly differed from one another in identification of the [h] variant (M=67% for males, 93% for females), $p = .001$, but not of the [s] variant (M=96% for males, 93% for females). Moreover, the difference in identification of the two variants was significant for the male listeners only, $p = .001$.

[8] Initial analyses of the Argentine and Colombian groups included *speaker* as a fixed effect in the mixed model. However, as this variable was not found to be significant for either group, it was removed. Both groups, thus, performed equally well overall in identification of the variants of /s/ for both the male voice from Caracas and the female voice from Buenos Aires.

Figure 3. Boxplots of identification accuracy of variants of /s/ for Argentine group according to listener sex (significant factor)



While a significant difference in identification of aspirated-/s/ according to listener sex is found for this /s/-weakening dialect group, it is stressed that this difference is not consistent across all males but rather reflects the divergent behavior of 3 of the 8 male participants, who had low identification accuracies of the aspirated variant (14%-43%)[9]. Upon further examination of the backgrounds of these 3 participants, it becomes clear that they have less contact with other varieties of Spanish. All had lived exclusively in La Rioja, and their travel experience was limited to nearby provinces; none had been outside of the country or to the capital region. Also, the contact reported with speakers from other regions was somewhat more limited than that reported for many of the other Argentine participants. As such, the sex difference observed should be interpreted cautiously as other factors (e.g., degree of contact with other dialects) may also be at play.

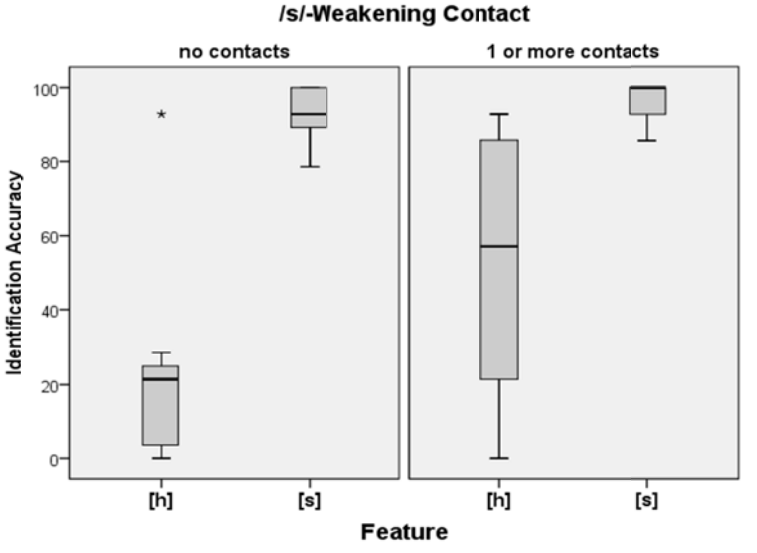
4.3.2. Variation according to social factors and linguistic experience: Maintaining group

Lastly, effects of the social and linguistic experience variables of listener sex and dialect contact are explored for the /s/-maintaining dialect group. Again a mixed model was run, with IDENTIFICATION ACCURACY as the dependent variable, VARIANT of /s/, LISTENER SEX, and DIALECT CONTACT (/s/-weakening contacts, no /s/-weakening contacts) as fixed effects, and SUBJECT as a random effect. The model revealed significant main effects of VARIANT of /s/ [$F(1, 46) = 32.890$, $p < .001$] and DIALECT CONTACT [$F(1, 46) = 4.268$, $p = .045$]. No significant interactions were found.

Boxplots of the identification accuracies of the variants of /s/ according to the significant variable of dialect contact are presented in Figure 4 for the Colombian group. Those Colombian listeners who reported one or more contacts from /s/-weakening dialects were significantly higher in identification of the variants of /s/ (M=96% for [s], 52% for [h]) than those without any /s/-weakening contacts (M=93% for [s], 24% for [h]).

[9] When the mixed model analysis was run again with these 3 participants removed, identification of coda [h] was no longer significantly lower than identification of the other coda contexts.

Figure 4. Boxplots of identification accuracy of variants of /s/ for Colombian group according to reported contact with /s/-weakening speakers (significant factor)



Listener sex did not have a significant effect on identification of the variants of /s/ by the Colombian group. While the mean identification accuracy of the aspirated variant was greater for the male Colombian group than for the female Colombian group (*M*=59% for males, 35% for females), the two groups did not significantly differ from one another. Moreover, it is pointed out that almost all of the males reported /s/-weakening contacts (N=9 of 10), while only slightly more than half of the females reported such contacts (N=10 of 17).

5. Discussion

5.1. Regional variation in speech perception

While the two dialect groups of South American Spanish included in the current study patterned similarly in the categorization of those targeted Spanish sounds not subject to regional variation (i.e., [s, f, n, l, ɾ, V]), cross-dialectal differences were found in categorization of the regionally, socially, linguistically, and stylistically variable aspirated-/s/ ([h]). Those Spanish speakers from a dialectal region where aspiration of /s/ is present in speech production (La Rioja, Argentina) tended to identify word-internal, syllable-final [h] as <s>. As Hammond (1978) and Figueroa (2000) found for Cuban and Puerto Rican speakers, the /s/-weakening Argentine speakers used the acoustic cues of the word-internal lenited-/s/ (here, aspiration) to recognize the presence of a variant of the /s/ category; for these listeners, both the full sibilant [s] and the aspirated fricative [h] are legitimate forms of /s/. That is not to say, however, that both variants carry identical social or stylistic meaning for the Argentine listeners. Future research should test how the /s/-weakened variants might play a role in the assignation of sociolinguistic evaluations and perceptions of speakers who produce those variants.

Those speakers from a dialectal region where /s/ is maintained in its full sibilant form in syllable-final position (Bogotá, Colombia) showed greater variation in categorization of the aspirated variant, frequently "misidentifying" (see Footnote 6) [h] as <f> or selecting <none of the above>. The listeners may have associated [h] with <f> due to the acoustic and articulatory similarity of the labiodental fricative [f] and the aspirated glottal fricative [h], as both share the same manner of articulation and voicing. Moreover, [h] has been observed as a lenited form of /f/ in other languages – and even in earlier varieties of Spanish[10]. The <none of the above> response was chosen over three times as frequently by the Colombian group than the Argentine group. While it is not clear what this response

[10] In earlier varieties of Spanish, the Latin labiodental fricative, [f], was weakened to an aspirated consonant, [h], and later deleted: Latin [fumu] > old Spanish [humo] > modern Spanish [umo] (*humo* 'smoke') (Quilis 1999).

represents for the listeners (one possibility is that [h] does not make up a legitimate variant for that listener for any of the six categories provided), this result does further support the interpretation that the weakening dialect group (Argentina) was confident – and the maintaining dialect (Colombia) was uncertain – in associating the aspirated variant [h] with /s/.

Finally, the implications of perceptual misidentification of the regional variants are considered. One might hypothesize that the presence of the non-local weakened-/s/ slows or even impedes lexical access and leads to miscommunications between speakers of maintaining and weakening dialects. Indeed, Boomershine (2006) found listeners from both /s/-maintaining and /s/-reducing varieties (Mexico and Puerto Rico) to be slower in processing speech with /s/-weakened forms. Future research should investigate effects of unfamiliar dialectal variants on comprehension of speech and should identify those listening strategies and mechanisms used by language users to recuperate the intended message in the presence of unfamiliar sounds.

5.2. Variation in perception according to social factors and linguistic experience

An analysis of the variation in perception of aspirated-/s/ found within the two dialect groups revealed significant differences in categorization of [h] according to social characteristics and linguistic experience of the listeners. *Sex* was a significant variable for the /s/-weakening group (but not for the /s/-maintaining group, discussed below), with Argentine females displaying a higher tendency to identify the aspirated variant as /s/ than Argentine males. These results corroborate those findings reported by De Decker (2010) of variation in perception according to listener sex, as well as listener age, in perception of the English vowels /a/ and /ae/, and the findings of Boomershine (2005), who found the presence of /s/-weakened variants to slow speech processing to a greater degree for female listeners than male listeners.

Why would male Argentine listeners have lower identification accuracy of the aspirated-/s/ than female listeners? One possibility is that for those male listeners who did not associate [h] with /s/, other variants of /s/ (such as deletion) are those forms most frequently used. It is recalled that deletion of syllable- and word-final /s/ is also found in this region, particularly amongst speakers of low socioeconomic level (Rojas 2000). Furthermore, these listeners shared additional social characteristics and experiences, specifically limited contact with dialects outside of their local variety. Thus, if these speakers have limited contact with the aspirated variant in their own use (production) as well as in exposure to external aspirating speakers, the Buenos Aires and Caracas aspirated forms used in the experiment may not be legitimate variants of /s/ for these participants. However, due to the relatively small number of participants in the current study, future research should include a larger sample size to confirm or reject the effect of listener sex on categorization of the sociophonetic variants observed in this preliminary study. Moreover, future investigation might include both a production and a perception component to the experiment to determine if there is indeed such a relationship between individual speaker-listeners' production and perception of sociophonetic variants characteristic of their local dialect.

While listener sex accounted for a significant amount of the variation found in categorization of aspirated-/s/ for the /s/-weakening group (Argentina), it did not play a significant role in perception for the /s/-maintaining group (Colombia). Weakening of syllable- and word-final /s/ is not a feature of the Bogotá dialect, and thus Bogotá speakers have not acquired the complex interplay of social, stylistic, and linguistic factors associated with the weakened variants of /s/. It is perhaps not surprising, thus, that perception of the non-local variants also does not vary according to the social factor tested here (*listener sex*).

Dialect contact, however, was found to have a significant effect on the categorization of aspirated-/s/ by the Colombian group. Overall, the group of maintaining listeners who reported one or more friends, family members, or colleagues from /s/-weakening geographic regions displayed a higher tendency to associate the aspirated variant [h] with /s/. This finding is striking given that /s/ is not aspirated in syllable-final position in their local dialect (i.e., an apparent perception-production mismatch), and it underscores the effect of social contacts on an individual language use. Interestingly, a similar effect of dialect contact through social contacts was also observed by Diaz-Campos and Navarro-Galisteo (2009) in a dialect categorization study of different varieties of Spanish by Venezuelan and Peninsular Spanish listeners. The authors found that those listeners who reported a family member or friend from certain regions were better at identifying talkers from those areas. Such

a clear effect on dialect identification was not observed, however, according to travel experience as defined by one month or more travel abroad. Future study might investigate how different types and degrees of exposure to non-local variants (e.g., social contacts, travel, Media) might influence perception of those variants.

Finally, some limitations of the current study are considered. First, as mentioned previously in Footnote 4, due to the nature of the task employed in the current study, care must be taken in interpretation of the findings. The categorization task involves explicit labeling of the targeted sounds with Spanish orthographic symbols. It is assumed that this labeling reflects perceptual associations of the variants to specific phonemic categories; however, we can only be certain that the results reflect how sounds are mapped to Spanish letters. Furthermore, as the task is untimed, listeners have time to think in making their responses and may use some degree of explicit knowledge – such as of sociolinguistic principles – in categorization of the sounds. Future research that employs other measures of perception of the sociophonetic variants of Spanish /s/ are needed, such as discrimination tasks (i.e., AXB task) or speech priming experiments.

6. Conclusions

In conclusion, this preliminary study of the categorization of weakened variants of Spanish syllable-final /s/ found cross-dialectal variation in categorization of aspirated-/s/, with an advantage in identification of word-internal syllable-final aspirated-/s/ for listeners from a dialectal region in which /s/-weakening occurs. An analysis of the identification response patterns revealed that syllable-final [h] was often misidentified as /f/ or not associated with any of the provided responses (none of the above) by the /s/-maintaining dialect group. Nonetheless, the study also found that although syllable-final /s/-weakening does not occur in the speech of the maintaining group tested, some maintaining speakers were still successful in mapping the [h] variant to Spanish "s". *Dialect contact* through personal social contacts (friend, family, or colleague) accounted for a significant part of the variation observed amongst the maintaining group, with those Colombian speakers who reported one or more personal contacts from /s/-weakening regions displaying a greater tendency to identify the [h] variant as /s/. Finally, variation in categorization according to social characteristics, *listener sex*, was found for the /s/-weakening group but not for the /s/-maintaining group. As this study provides preliminary evidence of a role of regional, social, and linguistic experience factors in how sociolinguistic variants of Spanish are categorized (here, /s/-weakening), future research is needed to determine what other social, stylistic, and linguistic factors might correspond to perception of the sociophonetic variants of Spanish /s/, as well as to explore how other Spanish sociolinguistic features might be likewise subject to variation in speech perception.

References

Boersma, Paul & David Weenink. 2010. Praat: Doing phonetics by computer [Computer program]. Version 5.1.31, retrieved 30 April 2010 from http://www.praat.org.

Boomershine, Amanda R. 2005. Perceptual processing of variable input in Spanish: An exemplar-based approach to speech perception. Unpublished doctoral dissertation, The Ohio State University.

Boomershine, Amanda R. 2006. Perceiving and processing dialectal variation in Spanish: An exemplar theory approach. In Timothy L. Face & Carol A. Klee (Eds.), *Selected proceedings of the 8th Hispanic Linguistics Symposium*, pp. 58-72. Somerville, MA: Cascadilla Proceedings Project.

Brown, Earl K. 2009. The relative importance of lexical frequency in syllable- and word-final /s/ reduction in Cali, Colombia. In Joseph Collentine et al. (Eds.), *Selected proceedings of the 11th Hispanic Linguistics Symposium*, pp. 165-178. Somerville, MA: Cascadilla Proceedings Project.

Calles, Ricardo & Paola Bentivoglio. 1986. Hacia un perfil sociolingüístico del habla de Caracas. In José Moreno de Alba (Ed.), *Actas del II Congreso Internacional sobre el Español de América*, pp. 111-114. México: Universidad Nacional Autónoma de México.

Cedergren, Henrietta. 1973. The interplay of social and linguistic factors in Panama. Unpublished doctoral dissertation, Cornell University.

De Decker, Paul. 2010. Sounds shifty: Gender and age differences in perceptual categorization during a phonetic change in progress. *University of Pennsylvania Working Papers in Linguistics*, 15, 2, 50-60.

Diaz-Campos, Manuel & Inmaculada Navarro-Galisteo. 2009. Perceptual categorization of dialect variation in Spanish. In Joseph Collentine et al. (Eds.), *Selected proceedings of the 11th Hispanic Linguistics Symposium*, pp. 179-195. Somerville, MA: Cascadilla Proceedings Project.

Dohotaru, Puica. 2004. Variación de -/s/ en la habla de habaneros universitarios: Condicionamiento lingüístico y social. In Sergio Valdés Bernal (Ed.), *Pensamiento lingüístico sobre el Caribe insular hispánico*, pp. 68-110. Santo Domingo: Academia de Ciencias de la República Dominicana.

Drager, Katie. 2010. Sociophonetic variation in speech perception. *Language and Linguistics Compass*, 4, 7, 473-480.

Evans, Bronwen G. & Paul Iverson. 2004. Vowel normalization for accent: An investigation of best exemplar locations in northern and southern British English sentences. *Journal of the Acoustical Society of America*, 115, 1, 352-361.

Figueroa, Neysa. 2000. An acoustic and perceptual study of vowels preceding deleted post-nuclear /s/ in Puerto Rican Spanish. In Hector Campos, Elena Herburger, Alfonso Morales-Front & Thomas J. Walsh (Eds.), *Hispanic linguistics at the turn of the millennium. Papers from the 3rd Hispanic Linguistic Symposium*, pp. 66-79. Somerville, MA: Cascadilla.

File-Muriel, Richard J. 2007. *The role of lexical frequency and phonetic context in the weakening of syllable-final lexical /s/ in the Spanish of Barranquilla, Colombia*. Unpublished doctoral dissertation, Indiana University.

File-Muriel, Richard J. 2009. The role of lexical frequency in the weakening of syllable-final lexical /s/ in the Spanish of Barranquilla, Colombia. *Hispania*, 92, 2, 348-360.

File-Muriel, Richard J. & Earl K. Brown. 2010. The gradient nature of s-lenition in Caleño Spanish. *University of Pennsylvania Working Papers in Linguistics*, 16, 2, 46-55.

Fontanella de Weinberg, Maria Beatriz. 1973. Comportamiento ante -s de hablantes femeninos y masculinos del español bonaerense. *Romance Philology*, 50-58.

Foulkes, Paul, James M. Scobbie & Dominic Watt. 2010. Sociophonetics. In William J. Hardcastle, John Laver & Fiona E. Gibbon (Eds.), *Handbook of phonetic sciences*, pp. 703-754. Oxford: Blackwell.

Hammond, Robert. 1978. An experimental verification of the phonemic status of open and closed vowels in Caribbean Spanish. In Humberto López Morales (Ed.), *Corrientes actuales en la dialectología del caribe hispánico*, pp. 33-125. Hato Rey: Editorial Universitaria, Universidad de Puerto Rico.

Hammond, Robert. 2001. *The Sounds of Spanish: Analysis and Application (with special reference to American English)*. Somerville, MA: Cascadilla.

Hay, Jennifer, Paul Warren & Katie Drager. 2006. Factors influencing speech perception in the context of a merger-in-progress. *Journal of Phonetics*, 34, 458-484.

Hualde, Jose Ignacio. 2005. *The Sounds of Spanish*. New York: Cambridge U Press.

Janson, Tore. 1986. Sound change in perception: An experiment. In John Ohala & Jeri J. Jager (Eds.), *Experimental Phonology*, pp. 253-260. Orlando: Academic.

Lafford, Barbara.1986. Valor diagnóstico-social del uso de ciertas variantes de /s/ en el español de Cartagena, Colombia. In Rafael A. Núñez Cedeño, Iraset Páez Urdaneta & Jorge M. Guitart (Eds.), *Estudios sobre la fonología del español del Caribe*, pp. 53-75. Caracas: La Casa de Bello.

Lipski, John. 1994. *Latin American Spanish*. New York: Longman

Mondéjar, José. 1991. *Dialectología andaluza: Estudios, historia, fonética, fonología, lexicología, metodología, onomasiología, comentario filológico*. Granada: Editorial Don Quijote.

Niedzielski, Nancy. 1999. The effect of social information on the perception of sociolinguistic variables. *Journal of Language and Social Psychology*, 18, 1, 62-85.

Rojas, Elena M. 2000. El español en el noroeste. In Maria Beatriz Fontanella de Weinberg (Ed.), *El español de la Argentina y sus variedades regionales,* pp. 139-161. Buenos Aires: Edicial.

Samper Padilla, José Antonio. 1990. *Estudio sociolingüístico del español de Las Palmas de Gran Canaria.* Las Palmas de Gran Canaria: La Caja de Canarias.

Strand, Elizabeth A. & Keith Johnson. 1996. Gradient and visual speaker normalization in the perception of fricatives. In Dafydd Gibbon (Ed.), *Natural language processing and speech technology: Results of the 3rd KONVENS conference*, pp. 14-26. Berlin: Mouton.

Sumner, Meghan & Arthur G. Samuel. 2009. The effect of experience on the perception and representation of dialect variants. *Journal of Memory & Language*, 60, 4, 487-501.

Terrell, Tracy. 1978. Aspiration and deletion of syllable and word final /s/ in Puerto Rican Spanish. *Nueva Revista de Filología Hispánica*, 27, 1, 24-38.

Terrell, Tracy. 1981. Diachronic reconstructions by dialect comparison of variable constraints: s-aspiration and deletion in Spanish. In David Sankoff & Henrietta Cedergren (Eds.), *Variation Ombibus*, pp. 115-124. Carbondale, IL: Linguistic Research Inc.

Thomas, Erik R. 2000. Spectral differences in /ai/ offsets conditioned by voicing of the following consonant. *Journal of Phonetics*, 28, 1-25.

Thomas, Erik. R. 2002. Sociophonetic applications of speech perception experiments. *American Speech*, 77, 2, 115-147.

Torreira, Francisco. 2006. Coarticulation between aspirated-s and voiceless stops in Spanish: An interdialectal comparison. Nuria Sagarra & Almeida Jacqueline Toribio (Eds.), *Selected proceedings of the 9th Hispanic Linguistics Symposium*, pp. 113-120. Somerville, MA: Cascadilla Proceedings Project.

Vidal de Battini, Berta. 1964. *El español de la Argentina*. Buenos Aires: Ministerio de Educación y Justicia.

Walker, Laurence. 1976. Auditory discrimination and nonstandard dialect: A Newfoundland example. *The Alberta Journal of Educational Research*, 22, 2, 154-163.

Willis, Clodius. 1972. Perception of vowel phonemes in Fort Erie, Ontario, Canada, and Buffalo, New York: An application of synthetic vowel categorization. *Journal of Speech and Hearing Research*, 15, 246-255.

Selected Proceedings of the 6th Workshop on Spanish Sociolinguistics

edited by Ana M. Carvalho and Sara Beaudrie

Cascadilla Proceedings Project Somerville, MA 2013

ISBN 978-1-57473-456-0 library binding

Ordering information

Orders for the library binding edition are handled by Cascadilla Press.
To place an order, go to www.lingref.com or contact:

Cascadilla Press, P.O. Box 440355, Somerville, MA 02144, USA
phone: 1-617-776-2370, fax: 1-617-776-2271, sales@cascadilla.com

Web access and citation information

This entire proceedings can also be viewed on the web at www.lingref.com. Each paper has a unique document # which can be added to citations to facilitate access. The document # should not replace the full citation.

This paper can be cited as:

Schmidt, Lauren B. 2013. Regional Variation in the Perception of Sociophonetic Variants of Spanish /s/. In *Selected Proceedings of the 6th Workshop on Spanish Sociolinguistics*, ed. Ana M. Carvalho and Sara Beaudrie, 189-202. Somerville, MA: Cascadilla Proceedings Project. www.lingref.com, document #2868.