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Research Article

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The state of Spanish /s/ variation in Concepción, Chile: Linguistic and social trends

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Abstract: The current study examines /s/ variation in the southern-central city of Concepción, Chile and its relation to a variety of linguistic and social factors. A proportional-odds mixed effects model, with the random factor of "speaker", was used to treat the categorically coded data on a continuum of acoustical variation ($[s] > [h] > \emptyset$). The results presented show that contrary to the previous assertions, heavy sibilant reduction, especially elision, in Concepción, Chile is the rule, rather than the exception, to the extent that it is no longer a marker of certain social demographics as has been reported previously. Furthermore, based on the trends reported, it is likely that this has been the case for several decades. Finally, the overall observed trends are indicative that the rates of /s/ elision will continue to increase across social demographics and different phonetic and phonological contexts in Concepción, Chile.

1 Introduction

The phenomenon of coda-final sibilant weakening is a phonetic process that has been well-documented both diachronically and synchronically in Spanish. Currently, it is one of the most extensively studied sociophonetic phenomena in Spanish, having been documented in numerous studies on the Spanish of the Caribbean, South America, Central America, and the United States (Terrell 1979, Caravedo 1983, 1990, Alba 1990, Klee and Caravedo 2006; Chappell 2016, among many others). Lipski (2011) indicates that over half of all Spanish speakers worldwide speak a variety of Spanish that to some level reduces /s/ and that sibilant reduction is "perhaps the most robust phonetic differentiator of regional and social dialects" (p. 73). While the linguistic factors that relate to this phenomenon are relatively consistent cross-dialectally, the social value that speakers assign it varies greatly both cross-dialectally and between sociolects of the same variety. Likewise, this social capital is not static either, as speakers' perceptions, along with different social changes, can alter both the productions and perceptions of speakers of /s/-weakening varieties (e.g., Sadowsky 2015).

Chilean Spanish, while relatively understudied, has been recognized as a variety that patterns strongly with a number of sociophonetic phenomena and processes of heavy phonetic reduction (e.g., Figueroa et al. 2013; Sadowsky 2015; Rogers 2016). While studies have shown that the sibilant is one of these segments that is frequently reduced in Chilean Spanish, these studies have indicated that this reduction mostly takes the form of aspiration while sibilant retention is still maintained at relatively high levels and elision is both infrequent and heavily stigmatized. However, a number of these studies have overlooked a range of social demographics and factors upon making these assertions. The current study examines /s/ variation in the southern-central city of Concepción, Chile and its relation to a variety of linguistic and social factors. Likewise, it explores whether /s/ weakening is more advanced than has been previously reported for Chilean Spanish.

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2 Literature review

2.1 History of sibilant weakening and variation in Spanish

As early as the fifteenth and sixteenth centuries, manuscripts offer circumstantial evidence that coda-final sibilant weakening was an active phonetic process in Spanish (Lipski 1984; Lloyd 1987). For example, Lloyd (1987) points to instances from the sixteenth century where *muestra* is written twice in a letter as muetra, as well as other later instances such as la puertas instead of las puertas, los maestrasgo for los maestrasgos, la casas for las casas, decanso for descanso, decisey for dieciséis, and los quale in place of los cuales. Based on these and other written examples, Lloyd postulates that rather than being a modern phenomenon, coda-final /s/ weakening is rooted more in earlier, medieval varieties of Spanish and that it is related to the simplification of the earlier, more robust Spanish sibilant inventory (Penny 2000). According to Lipski (1984), sibilant weakening could have been present in Latin centuries before Spanish could be considered a separate language from Latin. He posits that as sibilant weakening spread among different Spanish-speaking communities, it did so gradually, beginning in groups belonging to lower socioeconomic strata and in syllable-final position and when preceding consonants. Contemporary studies on coda sibilant weakening support Lipski's postulations, as they have indicated that /s/ reduction occurs at the highest rates in word-final phonetic contexts (e.g., Terrell 1979; Caravedo 1987; Soto-Barba 2011 among many others). Terrell (1979) also asserts that before speakers begin to elide sibilants, they aspirate. However, more recent studies (e.g., Erker 2012) argue that rather than being a categorical phenomenon, /s/ weakening exists on a continuum and is gradient. Likewise, aspiration and elision are not the only processes that Spanish /s/ can be subject to, as researchers have indicated that in different varieties /s/ can undergo voicing, albeit primarily in syllable-initial position (e.g., Schmidt and Willis 2011; Chappell 2016).

2.2 Factors associated with /s/ weakening in Spanish

As previously mentioned, Lipski (2011) indicates that /s/ weakening is common in a number of varieties of Spanish. Besides being a common phonetic process cross dialectally in Spanish, one of the reasons that sibilant weakening has been studied so extensively is likely due to its association with a number of linguistic and social factors.

2.3 Language internal factors

From a purely linguistic perspective, studies have examined different phonological and phonetic factors as well as physical correlates that condition or are involved in sibilant reduction in Spanish. With regard to phonological and phonetic factors, Terrell (1979) asserts that word final /s/ is more frequently reduced when followed by a consonant or a vowel instead of a pause. Furthermore, he states that sibilants preceding consonants in word-final position reduce and elide more than those preceding vowels. Numerous other studies support these findings (e.g., Mason 1994; Lipski 1995; Cepeda 1995; Cid-Hazard 2003; among others). Segments preceding /s/ in Spanish have not been shown to have as much impact on weakening processes, although Brown (2009) indicates that preceding high vowels can have an impact on the conservation of /s/, implying that the preceding mid and low vowels may have some influence on sibilant weakening.

Syllable quantity and stress have also been connected to /s/ variation in Spanish. A number of studies have indicated that /s/ is more frequently reduced in polysyllabic words as opposed to monosyllabic words (e.g., Terrell 1979; Cepeda 1995; Cid-Hazard 2003 among others). According to Guitart (1982, 1983),

this is due to the assumption that there is less available energy to speakers in longer words. However, other studies such as File-Muriel and Brown (2011) conclude that at least in Colombian Caleño Spanish, syllable quantity does not have a measurable effect on /s/ variation, thus implying that the number of syllables in a word is not universal in its impact on Spanish sibilant variation. With respect to stress, studies such as Hoffman (2001), Brown and Torres Cacoullos (2002, 2003), and File-Muriel and Brown (2011) have indicated that stress tends to facilitate sibilant retention as /s/ undergoes more weakening when in unstressed syllables. However, as is the case with mono- and polysyllabic words, these effects are not universal, as Alba (1990) and Cepeda (1995) report that unstressed syllables appeared to facilitate sibilant retention in Dominican and Chilean Spanish.

Spanish sibilant weakening has been linked to different physical and articulatory correlates as well. Terrell (1979) posits that aspiration is the result of the fortition of glottal frication as the overall stridency of the /s/ weakens. Guitart (1982, 1983) argues that one of the main physical factors that conditions Spanish sibilant weakening is the overall amount of energy afforded to a speaker based on a number of factors such as stress and word length. In other words, more energy is expended on stressed syllables, therefore, leading to higher levels of /s/ retention, while less energy is invested in unstressed syllables, resulting in the inverse effect. Likewise, according to Guitart, if a word has multiple syllables, by the final syllable, less energy will be available to the speaker, thus increasing the likelihood that /s/ will be aspirated or elided. Widdison (1995), on the other hand, argues that sibilant variation is the result of coarticulatory overlap and the overall perception of the speech signal by a given linguistic community.

2.4 Social factors

As stated by Lipski (2011), Spanish /s/ weakening has been shown to have a strong relationship with a number of social factors across a diverse number of varieties of Spanish. For example, in Spain, Momcilovic (2005) reports that in Madrid Spanish, younger males produced [h] more than female speakers and older male speakers. In the southern Spanish region of Murcia, sibilant reduction is seen as a marker of Murcian identity. However, due to the stigmatization of this variety, in certain social contexts, speakers sometimes become more conservative and attempt to assimilate to national Spanish norms (Hernández-Campoy 2010).

In Latin American, studies have shown that males reduce /s/ more in Panama (Cedergren 1978), Mexico (Lewis and Boomershine 2015), the Dominican Republic (Alba 2004), and Lima (Klee and Caravedo 2006; Klee et al. 2018).

Formal education has also been linked to /s/ variation. Lipski (1985) asserts that in the majority of phonetic environments, speakers with more formal education tend to weaken the sibilant less than those with less education. However, this tendency was not universal across all phonetic contexts as there were several contexts where the levels of elision among more educated speakers approached those of the less educated. Klee et al. (2018) report similar results for Limeño Spanish and indicate that in the Lima neighborhood of Los Olivos, higher education correlated with lower levels of /s/ weakening.

2.5 Sibilant weakening in Chile

Comparatively, Chilean Spanish is understudied. Despite this, sibilant weakening and variation are the most extensively studied phonetic processes in Chilean Spanish. Reduction and weakening of coda-final /s/ have been present in Chilean Spanish for several centuries. According to Contreras (2007), written colonial documents offer evidence that by the beginning of the sixteenth century, the process sibilant reduction had become generalized across what is now Chile. Thus, /s/ weakening in Chile is not limited by geography, as it is in countries such as Peru (e.g., Hundley 1983; Klee and Caravedo 2006) or Panama

(Cedergren 1978). This reflects, in part, the assertion of Lipski (1994) that in terms of geographical distribution, phonetically, Chilean Spanish exhibits a notable level of "uniformity". Generally, with the exception of Broś (2013) who documents generalized elision, the vast majority of Chilean /s/ studies report lower levels of elision and higher levels of aspiration and sibilancy.

Cepeda (1991) examined the issue of sibilant weakening in the southern city of Valdivia and reports notably higher levels of sibilance than aspiration (49.8% vs. 32%), with elision only reported in 18.1% of the cases she analyzed. While she reports that elision was more associated with male speech and lower socioeconomic strata, elision was the second most common production, followed by the sibilant. According to Cepeda, the sibilant was preferred by speakers from higher socioeconomic strata as well as female and older informants. She also notes that weakening in Valdivia occurs at higher levels than in the Concepción and the northern city of Valparaíso. However, despite this disparity between aspiration and the sibilant, she argues that both share the same level of prestige among speakers in the region. This is echoed, in part, by Sadowsky (2015), who says that [s] and [h] are generally considered socially neutral in coda position. However, he also states that [s] in word-interior codal position (e.g., 'lis.to/) has begun to acquire less favorable social capital and is more and more associated with speakers from lower social strata. With regard to linguistic factors that condition /s/ reduction in Valdivia, similar to what has been reported on other varieties of Spanish, Cepeda (1995) indicates that /s/ was reduced more in polysyllabic words, and that weakening decreases in word-final position when sibilants precede vowels and pauses.

Several studies have examined coda /s/ weakening in the capital city of Santiago. Valencia (1993) reports that the overwhelmingly most common variant in Santiago is [h] (82.5%), followed by elision (16.2%) and [s] (1.5%). More recently, Cid-Hazard (2003) also indicates that [h] is most frequently observed in Santiaguino speech followed by elision and then [s]. However, she reports much more elevated levels of elision (33.8%) than those previously reported by Valencia. She also reports slightly higher levels of [s] (7.6%). Similar to Cepeda (1995), she also shows that more sibilant reduction occurs in polysyllabic words and less before pauses and vowels. In fact, syllable quantity was the strongest factor in her analysis with respect to /s/ weakening or retention. Pérez (2007), who examined stylistic variation of /s/ in the speech of Chilean newscasters, found similar rates of aspiration, elision, and retention as Cid-Hazard (2003). While he indicates lower levels of elision than Cid-Hazard, he still observes notably more elision (25%) than Valencia. He also states that speech style plays a key role in different contexts with regard to /s/ reduction, with reduction increasing in faster and more fluid speech, reflecting similar results reported by Tassara (1991) in the northern city of Valparíso. Tassara and Duque's (1986) findings on coda /s/ reduction in Valparaíso are similar to those reported in Santiago with aspiration also being the preferred variant.

With specific regard to Concepción and the surrounding provinces, several studies have reported on /s/ weakening. Valdivieso and Magaña (1988) reported that in a reading task, male speakers preferred [h] over [s] and female speakers produced [s] more than [h]. Elision was the least frequent production for both groups. They conclude that in Concepción the sibilant was still slightly more prestigious than aspiration and that elision was the least prestigious of the three variants. However, several years later, Valdivieso and Magaña (1991) reported much higher levels of aspiration (72.3%) than [s] (10.2%) in spontaneous speech. In fact, the levels of elision they report (17.5%) were higher than [s]. As a result, they conclude that the preferred variant for all speakers in Concepción is [h]. To the northeast of Concepción, in the Province of Nuble, Soto-Barba (2011) examined /s/ variation in three different socioeconomic strata. While aspiration was the most frequently reported variant for all speakers, he notes that elision increased in the lower strata. He concludes that in all coda environments, aspiration is most frequently observed among speakers in Nuble.

The most recent study on /s/ variation in Chilean Spanish, Cerda-Oñate et al. (2015) examines the speech of four highly educated professionals from eight different cities throughout Chile: Iquique, La Serena, Valparaíso, Santiago, Concepción, Temuco, Coyhaique, and Punta Arenas. It must be noted that each of the four speakers from each city was rated by 50 university-educated raters as speaking the most "correct" Spanish of a larger corpus of 217 interviews. Thus, when generalizing the authors' results, these limitations must be considered. Overall, the authors report that in all eight cities, the most frequent

Table 1: Means by city from Cerda-Oñate et al. (2015)

City	# of speakers	[s]	[h]	Ø	Total N
Iquique	4	5.8%	52.5%	41.7%	120
La Serena	4	10.0%	65.0%	25.0%	120
Valparaíso	4	2.5%	86.7%	10.8%	120
Santiago	4	7.5%	72.5%	20.0%	120
Concepción	4	10.8%	67.5%	21.7%	120
Temuco	4	10.8%	75.8%	13.3%	120
Coyhaique	4	3.3%	92.5%	4.2%	120
Punta Arenas	4	10.8%	80.0%	9.2%	120

variant was aspiration. Elision was the highest in Concepción, Santiago, Iquique, and La Serana. With specific regard to Concepción, the rates of aspiration, elision, and sibilance they report closely mirror those of Valdivieso and Magaña (1991). With respect to language internal factors, similar to Tassara (1991) and Pérez (2007), weakening, especially aspiration, was most common in more spontaneous speech. Also, the sibilant was more conserved in word-final codal position as opposed to word-internal codal position. As a result, they conclude that Chilean Spanish is not an advanced /s/ weakening dialect, like other dialects, such as Dominican and Panamanian Spanish. The overall frequencies reported by the authors are illustrated in Table 1.

In summary, studies on Chilean Spanish /s/ weakening have generally shown a very low level of diatopic variation. Except for Cepeda (1991), every region and population studied thus far in Chile has tended to prefer aspiration to the other two variants. Generally, [s] and [h] have been shown to have similar social capital, although the data indicate that [h] is the most preferred, especially when taking into account Sadowsky's (2015) assertions that [s] in word-internal coda position is becoming stigmatized. Despite the fact that elision has been shown to be more frequent than the sibilant, the consensus has been that sibilant elision is not an advanced process in Chilean Spanish and that it is still stigmatized and associated generally with lower socioeconomic strata as well as younger speakers and males. Likewise, /s/ weakening in Chile is subject to the linguistic factors of syllable position, following segment, speech style, and syllable quantity.

With specific regard to the city of Concepción, despite the assertions of previous studies, the notable methodological limitations of these studies call into question the generalizability of their results. First, both Valdivieso and Magaña (1991) and Cerda-Oñate et al. (2015) rely on a limited social demographic from which to select speakers and only report the results of who they deem "professionals". Thus, a considerable number of social demographics are overlooked or simply assumed to exhibit the same phonetic behavior as the upper echelon of Concepción despite what previous studies on the phenomenon both inside and outside Chile report (e.g., Cedergren 1978; Cepeda 1991; Klee and Caravedo 2006; Soto-Barba 2011). The sociolinguistic methodology used to analyze /s/ variation in Concepcion up to the current juncture unnecessarily limits the demographic diversity of the respective sample sizes, and little is known and much is assumed about how the phenomenon manifests itself in demographics other than that of those deemed to be "professionals". Second, tokens of [s], [h], and elision have either been automatically evaluated using previously programmed and assigned acoustic "values" (Valdivieso and Magaña 1991) or have been impressionistically verified by the authors and then submitted to interrater reliability criteria for further verification (Cerda-Oñate et al. 2015). These methods are potentially problematic for several reasons. First, by assuming acoustic values, intercategorical and intracategorical acoustic variation is not considered, which can lead to potentially erroneous categorizations across categories (e.g., Erker 2012). Second, as shown by File-Muriel and Diáz-Campos (2003), different phonetic contexts can cause listeners to incorrectly classify /s/ as a sibilant, aspirated, or elided when categorizing /s/ impressionistically. Thus, the current study seeks to verify these previous findings on /s/ variation for a larger variety of demographics through acoustic verification of tokens of /s/ and an alternative statistical approach. Likewise, the present investigation examines linguistic factors and attempts to determine the current trajectory of /s/ variation in the city of Concepción and its surrounding neighborhoods.

3 Methodology

The following research questions guided the study:

RQ1: What is the relation between /s/ variation in Concepción, Chile, and the linguistic factors of word position, word type, previous segment, following segment, and stress?

RQ2: What is the current state of /s/ variation in Concepción, Chile with relation to the social factors of age, gender, socioeconomic stratification, and formal education?

RQ3: Based on the linguistic and social factors analyzed, is it possible to conclude that sibilant weakening is an advanced phonetic process in Concepción, Chile?

3.1 Speaker selection and classification

As part of a larger and ongoing corpus of spontaneous Chilean Spanish, a subset of 30 sociolinguistic interviews (15 females and 15 males) were analyzed. The speakers were from the city of Concepción, and the surrounding neighborhoods, or poblaciones, of Michaihue, Boca Sur, Candelaria, Lomas Coloradas, Hualpén, Talcahuano, and Villa San Pedro. The participants were recruited through the author's social networks and the social networks of their friends and family. Each interview lasted 15-37 min and all were carried out in the participants' homes, local church buildings, and recreation centers as well as office buildings. Speakers were divided into three different age-groups, based on Rogers (2016): 18-24, 25-44, and 44-54. Education was originally divided into six different levels based on Sadowsky's (2012) modified version of Esomar (Adimark 2000).1 The original six education levels were the following:

- 1. Without elementary education or elementary education incomplete
- 2. Elementary education complete
- 3. High school level technical/professional education finished or incomplete or high school education incomplete
- 4. High school education complete and/or superior technical/professional education incomplete
- 5. Superior technical/professional education complete or 4-year university education incomplete
- 6. Four-year university education complete.

After a number of preliminary mixed model ordinal regressions, the original six education levels were collapsed into three, based on similar behaviors exhibited in these preliminary statistical analyses; levels 1 and 2 were combined, 3 and 4 were combined, and levels 5 and 6 were combined. Sadowsky's version of Esomar (Adimark 2000) was also used to classify speakers into different socioeconomic strata. Originally, five levels were used: low, high-low, low-mid, mid-mid, high-mid, and low-high. Based on the results of the preliminary ordinal regressions, the original five levels were collapsed into three. The first level consisted of speakers from the original low and high-low strata. The second level combined low-mid, midmid, and high-mid speakers. The final level consisted only of low-high speakers.

3.2 Data measurement and instruments

In the majority of the interviews, data were taken after the 10-minute mark when speakers were generally more comfortable with speaking to the interviewer. A total of 201 tokens of /s/ at syllable-internal (['nues.tro]) and word-final (['fui.mos]) junctures were analyzed per participant. In the case of five of the

¹ Esomar is a system designed specifically to determine the socioeconomic strata of individuals in Chilean society based on a number of social and economic factors. Sadowsky's version modifies the methodology of Esomar to more effectively create socioeconomic strata for sociolinguistic research carried out in Chile using education and occupation as the primary determining factors.

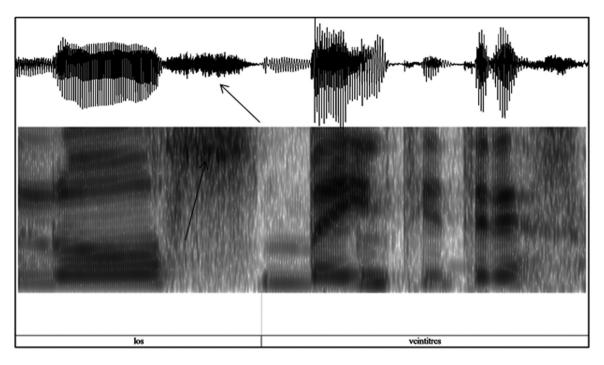


Figure 1: Example of the acoustic correlates of [s] (los veintitres).

speakers, a sample size of 201 tokens of /s/ after the 10-minute mark was not possible as a consequence of the shorter length of these interviews. In these cases, the author moved back from the 10-minute mark at 30-second intervals until the 201 tokens-per-speaker threshold was met.² Tokens were categorized as sibilants ([s]), aspirated ([h]), or elided (\emptyset) as has been done in numerous previous studies on /s/ variation in Spanish, primarily due to the greater level of perceptual saliency between categories (e.g., Hundley 1983; Cepeda 1990, 1995; Caravedo 1990; Soto-Barba 2011; Cerda-Oñate et al. 2015 among many others).

All tokens were coded and acoustically verified in Praat (Boersma and Weenink 2015) using several methods. First, sibilants were verified based on the turbulence and the aperiodicity present in both the spectrogram and the waveform. Aspirated productions were coded primarily based on the glottal turbulence observed in the spectrogram. It must be noted that the turbulence observed for [h] and [s] is distinct because of the differing manners of articulation. The sibilant is produced as the blade of the tongue partially approaches or makes complete contact with the alveolar ridge. This creates a greater amount of turbulence in the airflow from the lungs than when [h] is articulated. Also, when sibilants are produced, their stridency and energy outputs are particularly notable in the upper limits of the visible spectogram. When observing the voiceless glottal fricative [h], the smaller amount of oral constriction created by its articulation notably reduces the intensity and the stridency of the observable spectral turbulence. Likewise, glottal turbulence tends to be more evenly distributed throughout the visible spectogram. Finally, tokens were considered elided where there was no evidence of glottalization, aperiodicity, or stridency. Figures 1–3 illustrate how [s], [h], and elision were determined.

Inevitably, auditory cues were also used in conjunction with the acoustic correlates previously mentioned as a means to further confirm the classification of all tokens. Impressionistically, [s] is different from [h] and \emptyset as it sounds more strident and more constricted. The aspirated [h] is breathier than the sibilant, less strident, and sounds notably less constricted. Cases of elision lack any of the abovementioned features associated with the sibilant and the glottal fricative and at times were observed as brief glottal stops followed by nonsibilant segments.

² The furthest back I had to go was the 148 s (2.47 min) mark for one speaker.

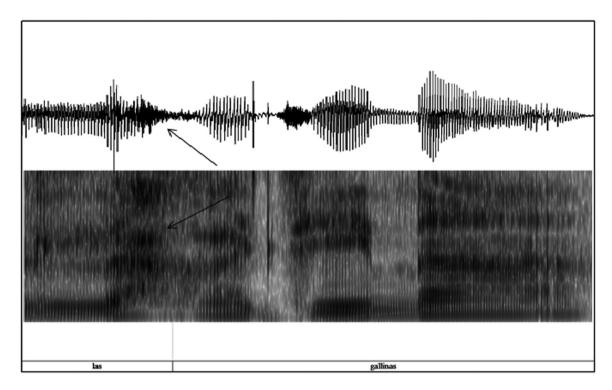


Figure 2: Example of the acoustic correlates of [h] (las gallinas).

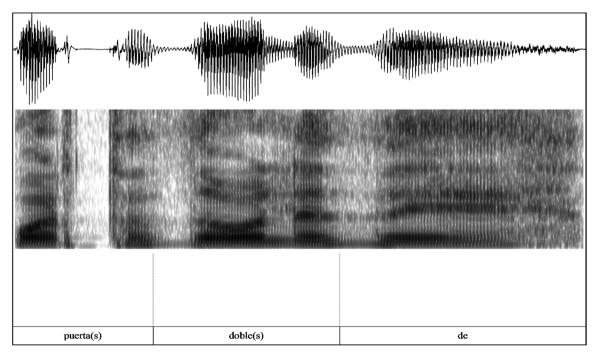


Figure 3: Acoustic example of elision (puertas dobles de.).

As previously mentioned, tokens of /s/ were placed in three different categories due to the traditional saliency of differences between categories. However, there was considerable phonetic variation in each category. Cepeda (1990a, 1990b, 1991), Valencia (1993), and Sadowsky and Salamanca (2011) have documented up to 13 different allophonic realizations of /s/ in Chilean Spanish, as shown in Table 2.

Table 2: Documented allophones of /s/ in Chilean Spanish

Allophonic symbol	Description	
[s]	Voiceless dorsoalveolar fricative	
[h]	Voiceless glottal fricative	
Ø	Elided segment	
[ts]	Voiceless dorsoalveolar affricate	
[ş]	Voiceless dorsoalveolar approximant	
[z]	Voiced dorsoalveolar fricative	
[θ]	Voiceless postdental fricative	
[0]	Voiceless postdental approximant	
$[\dot{\Phi}]$	Voiceless interdental fricative	
$[\stackrel{\bullet}{\mathbb{Q}}]$	Voiceless interdental approximant	
[s]	Voiceless dorsoalveolar sibilated (whistled) fricative	
[6]	Voiceless alveoprepalatal fricative	
[?]	Glottal stop	

For the present study, of the variants listed in Table 2, the data [s], [h], \emptyset , [z], [θ], and [?] were observed in the specific phonetic contexts analyzed. Additionally, [fi] (voiced glottal fricative i.e., ['mifi.mo]), [x] (voiceless velar fricative i.e., ['max.ke]), and [ʃ] (voiceless dorsopalatal affricate) preceding $[t_{ij}^{\circ}]$ (['maʃ. t_{ij}° a.xo]) were also observed as allophones for /s/. Tokens were considered sibilants when produced as any of the following allophones: [s], [θ], [ʃ], [z], [s] (weakened voiceless alveolar fricative), and [z] (weakened voiced alveolar fricative). Tokens were considered instances of aspiration when any of the following realizations were confirmed: [h], [fi], [h] (weakened voiceless glottal fricative), and [h] (weakened voiced glottal fricative). It must be noted that in instances of [z] and [fi], because these segments are generally mostly or fully voiced, the aperiodic oscillations present in voiceless productions were mostly absent in the waveform. As a result, the spectrographic turbulence patterns were relied on to confirm their presence. Tokens that were phonetically elided were those that left no acoustic evidence of a

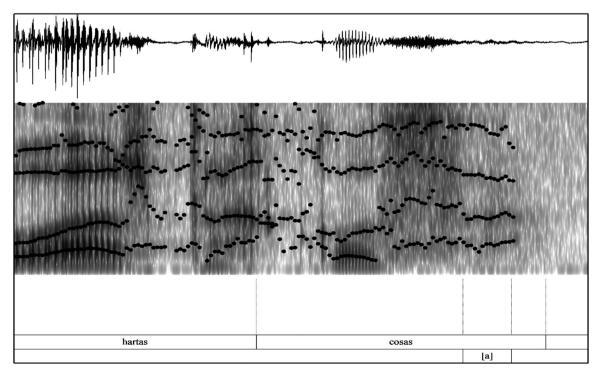


Figure 4: An example of acoustic correlates of voiceless vowel [a] ("hartas cosas").

sibilant or a glottal fricative. Additionally, in cases where words ended in a glottal stop without any subsequent acoustic evidence of aspiration or assibilation, /s/ was categorized as elided (e.g., ['ma?], ['ko.sa?], [lo?.we.'o.ne?]). Likewise, there were several cases where speakers produced [\phi] (voiceless bilabial fricative) before [p] where there was no clear way to distinguish between /s/ and /p/. These instances were excluded as well. Finally, consecutive orthographic representations of /s/ (e.g., {los sordos)) and instances of [h] followed by [x] (e.g., [loh.'xue.yos]) were also excluded.

Finally, a relatively underdocumented but frequent phenomenon in Chilean Spanish (see Lipski 1994) observed in the data was word-final vowel devoicing. At times, in cases where speakers produced words that ended in /s/ followed frequently by a pause, a devoiced or a voiceless vowel made it difficult to determine if the speaker was aspirating or simply devoicing a vocalic segment and eliding /s/. In cases where consistent and relatively stable formants were present throughout the entire segment with no subsequent evidence of aspiration or assibilation, /s/ was considered to be elided. In instances where the formants were less regular and stable and accompanied and/or followed by evidence of glottalization or sibilant stridency, /s/ was categorized appropriately as either [h] or [s]. Cases where it was impossible to determine if the formants belonged to a vowel or a weakly voiced glottal fricative were excluded. Figure 4 illustrates a case of a devoiced vowel, [a], in the sequence hartas cosas where the following /s/ was categorized as elided.

3.3 Statistical analysis

As previously established, the dependent variables were categorically coded. This follows previous methodology and recognizes the perceptual differences between categories. However, within each category, and across categories as well, there was notable variation. This is not unique to Chilean Spanish, as previous studies such as Erker (2012) have shown this to be the case in other varieties. Thus, it can be assumed that the true underlying acoustic value (ψ) can only be captured by way of observable ordinal categories. In other words, the sibilant undergoes gradual weakening within its category before it is considered [h]. The aspirated variant also must follow a trajectory of weakening before it is elided. To account for intra- and intercategorical variations, a mixed effects proportional-odds (ordinal regression) model was used.

To model the proportional odds, the *logit function*, also referred to as the log odds, models the cumulative distribution function (CDF), represented as $P[Y \le y]$. Therefore, with a matrix of covariates (X) for each observation recorded, the logit function models the CDF as a linear combination of a fixed effects vector $(\boldsymbol{\beta})$ and a random effects vector (\boldsymbol{U}) :

$$\operatorname{logit}(P[Y \leq y_j]) = \ln \left(\frac{P[Y \leq y_j]}{1 - P[Y \leq y_j]} \right) = \alpha_j - (X\beta + ZU).$$

Z is a random effects matrix that accounts for the correct random effect element of U for each of the individuals that make up the corresponding sample. The possible values of j are determined by the number of response categories; for the main analysis in the current study j is either 1 or 2 (sibilant or weakened). The model operates on the assumption that \boldsymbol{B} is constant over the various levels of the response. For the current study, $\boldsymbol{\psi}$ exists on an ordered continuum observable only at \emptyset , [h], and [s]. This situation requires a model with two break points, α_1 and α_2 . $Y = y_1 = \emptyset$ if $\psi < \alpha_1$, $Y = y_2 = [h]$ if $\alpha_1 < \psi < \alpha_2$, and $Y = y_3 = [s]$ if $\psi > \alpha_2$. The dependent variable was the acoustic manifestation of $s/([s], [h], \emptyset)$. The independent variables were divided into linguistic and social variables. The linguistic variables were word position (final or internal), word type (monosyllabic or polysyllabic), previous segment, following segment, and stress. The social variables were education, socioeconomic strata, gender, and age. Because there was considerable overlap between education and strata, they were run in separate models with the other social variables. Given that the goal of most studies, including the current investigation, is to generalize to the extent possible for a larger population, the random effect of "speaker" was included and random intercepts by speaker were included in the model. All models were fit with an iterative algorithm in *R* using *clmm{ordinal}* (Christensen 2015).

In summary, the model used is advantageous for several reasons. First, because repeated measures of each participant were taken, the data points are not independent of one another, rendering other analyses, such as multiple regressions, inappropriate. Therefore, the mixed effects portion of the analysis accounts for the dependence of the data (Klee et al. 2018). Second, while the dependent variables were coded categorically due to the salient differences between each category, the proportional odds portion assumes and recognizes that there is variation both within and across categories. In other words, it considers that the responses are ordered. Therefore, inherent in the analysis is the fact that the responses exist on a continuum, which more accurately reflects the reality of the production data. Finally, by establishing thresholds, the model calculates varying likelihood ratios for the different groups and independent variables included in the model. These ratios permit the analysis of diverse behaviors using probabilities and, to an extent, allow researchers to predict the trajectories of these behaviors.

4 Results

4.1 Overall results

A total of 6,030 tokens were analyzed. As can be seen in Table 3, the number of tokens produced as [s] (12%) is similar to what has been reported in previous studies. However, the current results diverge from previous studies on Chilean /s/ with regard to the frequencies of elision and aspiration. While previous studies have reported much higher levels of aspiration than elision, the current data show that speakers only produced [h] at a rate of 18.6%, while the overwhelming majority of cases were elision (69.5%). In fact, for every social factor analyzed, the overwhelming preference was elision.

While the prevailing tendency was elision, different patterns of weakening played out in different manners according to the different linguistic and social variables examined. The following estimates were generated on the logit (log-odds) scale. However, the model can also be utilized in a number of other manners to aid in the interpretation of the results. As a result, the threshold estimates were also converted to a cumulative probability scale for both the linguistic and the social variables. Also, in order to identify significant pairwise differences within each level of the factors examined, the odds scale, which exponentiates the logit scale difference estimates, was used.

4.2 Linguistic factors

The linguistic model was specified in the following way:

Linguistic model specification – for the *j*th response given by *i*th individual,

Table 3: Overall frequencies of [s], [h], and \emptyset

Production	Cases	Proportion
Ø	4,189	0.6946
[h]	1,119	0.1855
[s]	722	0.1197
Total	6,030	1.000

Table 4: LRT results for linguistic factors

Variable	LRT χ²	<i>P</i> value
Following segment	956.94	<0.0001
Word position	152.61	<0.0001
Word type	64.244	<0.0001
Previous segment	15.707	0.0034
Stress	8.378	0.0038

$$\begin{split} \log & \mathrm{it}(P(Y_{ij}\varnothing\varnothing)) = \alpha_1 - [\beta_1 \times \mathrm{word} \ \mathrm{position}_{ij} + \beta_2 \times \mathrm{word} \ \mathrm{type}_{ij} + \beta_3 \times \mathrm{previous} \ \mathrm{segment}_{ij} \\ & + \beta_4 \times \mathrm{following} \ \mathrm{segment}_{ij} + \beta_5 \times \mathrm{stress}_{ij} + u_i] \\ & \mathrm{logit}(P(Y_{ij}\varnothing)) = \alpha_2 - [\beta_1 \times \mathrm{word} \ \mathrm{position}_{ij} + \beta_2 \times \mathrm{word} \ \mathrm{type}_{ij} + \beta_3 \times \mathrm{previous} \ \mathrm{segment}_{ij} \\ & + \beta_4 \times \mathrm{following} \ \mathrm{segment}_{ij} + \beta_5 \times \mathrm{stress}_{ij} + u_i] \end{split}$$

The results of a likelihood ratio test (LRT) indicated that all the linguistic variables were significant to varying degrees as illustrated in Table 3. Table 4 illustrates the threshold estimates for the linguistic analysis (Table 5).

While the overwhelming preference was for elision, the probability of sibilant reduction varied in accordance with the different linguistic factors analyzed. The linguistic factors, are fixed coefficients in the model, and their logit scale estimates are included in Table 6. It must be noted that the logit scale estimates for the coefficients represent the difference from each category's baseline. Thus, the baseline for the category of word position is word-final position and the baseline for word type was monosyllabic words. High vowels were the baseline for both the categories of previous and following segment. Finally, for the variable of stress, the baseline was if /s/ was part of an unstressed syllable. In each case, a positive difference on the logit scale estimate signifies that the specific grouping shown was more likely to result in [s] than the baseline. Thus, the negative logit scale estimate of -0.39509 for when /s/ was produced after a

Table 5: Threshold estimates for linguistic factors

Threshold	Logit scale estimate (SE)	Cumulative probability scale estimate (95% CI)
$\alpha_1(\emptyset [h])$	1.0447 (0.2538)	0.740 (0.6335, 0.8238)
α_2 ([h] [s])	2.5686 (0.2562)	0.9288 (0.8876, 0.9557)

Table 6: Results for linguistic factors

Variables	Logit scale estimate (SE)	P value
Following segment: mid vowel	-0.53937 (0.24424)	0.02722
Following segment: low vowel	-0.29909 (0.23624)	0.20550
Following segment: glide	0.82216 (0.49397)	0.09603
Following segment: voiced stop	-2.12659 (0.30353)	< 0.0001
Following segment: voiceless stop	1.32336 (0.18056)	< 0.0001
Following segment: voiced nonstop consonant	-1.51626 (0.23227)	< 0.0001
Following segment: voiceless consonant	-0.20425 (0.28527)	0.47400
Following segment: pause	1.05931 (0.19156)	< 0.0001
Word position: internal	1.4142 (0.09352)	< 0.0001
Word type: polysyllabic	-0.72361 (0.09022)	< 0.0001
Previous segment: mid vowel	-0.39509 (0.11298)	0.00047
Previous segment: low vowel	-0.26095 (0.12827)	0.04191
Previous segment: glide	-0.04297 (0.19844)	0.82856
Previous segment: consonant	-0.39830(0.30490)	0.19652
Stress: within a stressed syllable	0.23787 (0.08215)	0.00379

Table 7: Likelihood ratio results for social factors

Variable	LRT χ ²	P value
Education	19.473	<0.0001
Gender	15.822	<0.0001
Age-group	8.458	0.015

mid vowel indicates that speakers were more likely to produce a reduced variant, either aspiration or elision, than the sibilant compared to when /s/ was preceded by a high vowel. There were several significant groupings. In agreement with previous studies on Chilean /s/ (e.g., Cepeda 1995; Cid-Hazard 2003; Cerda-Oñate et al. 2015 among others) and other dialects of Spanish (e.g., Terrell 1979; Caravedo 1990 among numerous others), sibilant productions, as opposed to aspiration or elision, were more likely to occur when /s/ was in word-internal position (1.4142) than in word-final position, and more likely to be reduced when in polysyllabic words (-0.72361) than when in monosyllabic words. When followed by a voiced stop (-2.12659) and a voiced consonant other than a stop (-1.51626), /s/ was more likely to be reduced than when followed by a high vowel, while /s/ was more likely to be produced as a sibilant when followed by a voiceless stop (1.32336) and a pause (1.05931). Finally, tokens of /s/ in stressed syllables (0.23787) were less likely to be reduced than when in unstressed syllables.

Pairwise Tukey comparisons were run to determine whether the differences between the categories in the fixed coefficients were statistically significant, as shown in Table 7. A positive difference on the logit scale indicates that the first member of the pairing is more likely to result in a sibilant pronunciation of /s/ than the second member of the pairing. There were a number of significant pairings for the linguistic analysis. The odds estimates indicate that when in word-final position, /s/ was 0.3194 times more likely to be reduced, and 2.062 times more likely to be produced as a sibilant when in monosyllabic words. Likewise, when /s/ was part of an unstressed syllable, it was 0.7883 times more likely to be reduced than to be produced as a sibilant; and when it was preceded by a high vowel, it was slightly more likely to be produced as [s] (0.0395) than when preceded by a mid vowel.

With regard to the following segment, a linguistic variable that has proven to be important in previous studies on /s/ (e.g., Caravedo 1990), there were a number of significant pairings. The overall pattern that emerges from the results on following segment is that following voiced stops and voiced nonstop consonants showed the overwhelming tendency to facilitate /s/ weakening. Some notable pairings were when followed by a voiced stop, /s/ was 8.386 times more likely to be reduced than when followed by a high vowel, 4.89 times more likely to weaken than when followed by a mid vowel, 6.218 times more likely to reduce than when followed by a low vowel, and 19.082 times more likely to be reduced to a degree than when followed by a glide. When followed by all other voiced consonants some notable pairings were /s/ was 4.555 times more likely to be reduced than when followed by a high vowel, 2.656 times more prone to reduction than when followed by a mid vowel, and 17.109 times more likely to be reduced than when followed by a voiceless stop.

Overall, while voicing appeared to be the most prevalent factor that facilitated weakening and elision, voiceless stops resulted in a much greater probability for sibilancy (17.109) when following /s/ than all other voiced consonants. With respect to vowels and glides, there were no significant pairings. Word type was also a strong factor in determining /s/ conservation or weakening, while word position and stress, although significant, were proven to be weaker factors. In fact, when the model was run for just aspiration and elision, stress was not significant, and speakers were not more likely to aspirate or elide solely based on syllable stress.

4.3 Social model with three variants: [s], [h], and \emptyset

Because education and stratum overlap in Esomar (Adimark 2000), two different social models were run for each combination of allophonic realizations of /s/. The social models were specified in the following way:

Table 8: Threshold estimates for social factors

Threshold Logit scale estimate (SE)		Cumulative probability scale estimate (95% CI)
$\alpha_1 (\emptyset [h])$	0.8261 (0.1949)	0.696 (0.6092, 0.77)
α_2 ([h] [s])	2.0578 (0.1969)	0.887 (0.8418, 0.9201)

Social model specification 1 – for the *j*th response given by *i*th individual,

$$\begin{aligned} & \text{logit}(P(Y_{ij} \leq \varnothing)) &= \alpha_1 - [\beta_1 \times \text{education/stratum}_{ij} + \beta_2 \times \text{age-group}_{ij} + \beta_3 \times \text{gender}_{ij} + u_i] \\ & \text{logit}(P(Y_{ij} \leq \varnothing)) &= \alpha_2 - [\beta_1 \times \text{education/stratum}_{ij} + \beta_2 \times \text{age-group}_{ij} + \beta_3 \times \text{gender}_{ij} + u_i] \end{aligned}$$

When stratum was included with age and gender, only one significant pairing resulted: males were 2.001 times more likely to reduce than female speakers. However, when education was included in place of stratum, there were notably more significant results. The results of the LRT for each of the social factors in this second social model are shown in Table 7 and indicate that there are significant differences in the predicted cumulative probability of the pronunciation of /s/ based on education (p < 0.0001), gender (p = 0.0001) 0.015), and age-group (p = 0.015). Table 8 illustrates the threshold estimates for the second social analysis.

For the social analysis that included education, there were several significant pairings, although it must be noted that despite these pairings, the overwhelming preference was for elision. However, the results show that /s/ still varied according to different social variables. Both education groups 2 and 3 were more likely to produce [s] than reduce when compared to the group with the least education (p < 0.0001 and p = 0.0001, respectively). Both the older age-groups were more likely to reduce than the youngest age-group, which contradicts previously reported results for Chilean /s/ (e.g., Cepeda 1991). Finally, male speakers were more likely to reduce /s/ than female speakers. The overall results are shown in Table 9.

Post hoc Tukey tests were run to determine if there were any significant pairings within each group, as shown in Table 10. Overall, age and gender were the two strongest social factors conditioning /s/ weakening, followed by education. However, among these two top factors, /s/ weakening followed different trajectories. Regarding gender, males were almost twice as likely (1.9725) as female speakers to

Table 9: Results for social factors

Variables	Logit scale estimate (SE)	<i>P</i> value
Education: level 2	0.8550 (0.1821)	<0.0001
Education: level 3	1.2558 (0.3253)	0.0001
Gender: male	-0.5688 (0.1488)	<0.0001
Age-group: 25-44	-0.4830 (0.1794)	0.0071
Age-group: 45–54	-0.7161 (0.2634)	0.0066

Table 10: Tukey comparisons for social factors

Pairing	Logit scale difference estimate (SE)	<i>P</i> -value	Odds estimate (95% CI)
Education: level 1-level 2	-0.855 (0.1821)	<0.0001	0.4253 (0.296, 0.612)
Education: level 1-level 3	-1.2558 (0.3253)	0.0003	0.2848 (0.149, 0.546)
Education: level 2-level 3	-1.8233 (0.5496)	0.0117	0.1615 (0.054, 0.485)
Gender: female-male	0.6793 (0.1496)	< 0.0001	1.9725 (1.463, 2.66)
Age-group: a (18-24)-b (25-44)	0.486 (0.1794)	0.0194	1.621 (1.132, 2.321)
Age-group: a (18–24)–c (45–54)	0.716 (0.2634)	0.018	2.046 (1.208, 3.466)

reduce /s/. However, with respect to age, although elision was the primary production, younger speakers were, respectively, 1.621 times more likely and 2.046 times more likely to produce [s] than weaken when compared to the 25- to 44-year-old and the 45- to 54-year-old groups. Finally, those with less education were slightly more likely to reduce /s/ than those with more education.

4.4 Gender-specific models for [s], [h], and \emptyset

The participants were divided into two subgroups by gender. The gender-exclusive social models were specified in the following manner:

Social model specification 2 – for the jth response given by ith individual,

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\begin{split} & \text{logit}(P(Y_{ij} \leq \varnothing)) &= \alpha_1 - [\beta_1 \times \text{education/stratum}_{ij} + \beta_2 \times \text{age-group}_{ij} + u_i] \\ & \text{logit}(P(Y_{ij} \leq \varnothing)) &= \alpha_2 - [\beta_1 \times \text{education/stratum}_{ij} + \beta_2 \times \text{age-group}_{ij} + u_i] \end{split}.
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Contrary to the assertions of previous studies on Chilean Spanish /s/ and specifically in the city of Concepción (e.g., Valdivieso and Magaña 1991; Cerda-Oñate et al. 2015), the prevalent production for both genders was elision with female speakers eliding in 63% of all cases observed, while males elided 76% of all their observed productions. When considering aspiration and elision together, overall, female speakers weakened /s/ at a rate of 84.7%, while males weakened 92.1% of all productions of /s/ to varying extents. Consistent with previous studies were the levels of [s] production, especially for female speakers. These results are illustrated in Table 11.

4.5 Female data

The first analysis included age and socioeconomic stratification as factors and no significant results were found. When the analysis was run for age and education, only age yielded significant results. This is indicative that across education and socioeconomic strata, /s/ production has potentially leveled among female speakers, with elision being the most probable and common variant across the different demographics. With regard to age, as previously reported, the youngest age-group was more likely to produce [s] than the two older age-groups. However, when Tukey comparisons were run, only the differences between the 18- to 24-year-old and the 25- to 44-year-old speakers were significant (p = 0.0051). According to the odds measurements, the younger females were 2.0877 times more likely to produce [s] than the 25- to 44-year-olds. The differences between the youngest speakers and the oldest age-group neared significance (p = 0.0708), with the younger females 1.8858 times more likely to produce the sibilant.

Table 11: Overall means for [s], [h], and \emptyset by gender

Gender	Production	Cases	Proportion
Female	Ø	1,900	0.630
	[h]	656	0.217
	[s]	459	0.152
	Total	3,015	1.000
Male	Ø	2,289	0.759
	[h]	463	0.162
	[s]	263	0.087
	Total	3,015	1.000

Table 12: Tukey results for social male data

Pairing	Logit scale difference estimate (SE)	P value	Odds estimate (95% CI)
Education: level 1-level 2	-1.232 (0.1812)	<0.0001	0.2917 (0.2030, 0.4191)
Education: level 1-level 3	-1.696 (0.3178)	< 0.0001	0.1834 (0.971, 0.3464)
Age-group: 1–3	1.1694 (0.3358)	0.0014	3.2201 (1.6453, 6.3024)

4.6 Male data

When stratum was run with age for male speakers, there were no significant results, indicating that for male speakers, as was the case for the female speakers, /s/ production is relatively uniform across different socioeconomic strata in that no stratum was more likely to reduce or produce the sibilant than the others. When education was run with age, both factors yielded significant results (p < 0.0001, 0.0072,respectively). Tukey post hoc comparisons were run for both factors, the results of which are illustrated in Table 12.

As the results indicate, those with less formal education were more likely to reduce /s/ than those in education groups 2 and 3. It must be noted that despite these differences, the odds estimates were small (0.2917 and 0.1834, respectively). Regarding age, the one significant pairing that the analysis yielded showed that although elision was the overwhelming production for all age-groups, the 18- to 24-year-old males were 3.22 times more likely than the 45- to 54-year-olds to produce /s/. In fact, elision was higher among this older age-group (85%) than in the younger age-group (77.5%). It must be noted, however, that there was only one speaker in the 45- to 54-year-old age-group, while there were five in the younger group. Thus, this difference is most likely due to the small sample size.

4.7 Summary of results

While elision was overwhelmingly the most observed variant for /s/, the probability for general weakening increased and decreased with different social and linguistic factors. Linguistically, the strongest factor that patterned with increased probabilities that speakers would produce [s] was if the following segment was a phonological voiceless consonant. Inversely, the probability for weakening was the greatest when the following segment was a phonologically voiced stop. Overall, the strongest social factors were age and gender, with males and older speakers weakening more than females and younger speakers. While education was significant in the overall analysis, the gender-specific analyses indicated that it was only a significant factor among male speakers, as the likelihood for weakening increased among male speakers with less formal education. Stratum was not significant in any of the social analyses, as likelihood and rates of weakening appear to have leveled across different socioeconomic strata in Concepción. Further leveling by level of formal education was also observed among female speakers.

5 Discussion

In general, the linguistic results reflected previous results on Chilean /s/ and those of other varieties of Spanish as well. When comparing weakening and the sibilant, the former was much more probable in word-internal codal position, polysyllabic words, and unstressed syllables. Of these factors, whether a word was mono- or polysyllabic was the strongest factor with relation to /s/ retention or weakening (e.g., Tassara and Duque 1990; Cepeda 1995; Pérez 2007). Likewise, similar to what Cepeda (1995) reports, when comparing only elision and aspiration, stress did not increase the likelihood of weakening or retention. Additionally, like Brown (2009), preceding high vowels were more likely to result in

conservation than mid vowels. This could be due to coarticulation and/or gestural overlap as the high vowels are produced with more constriction, creating articulatory conditions that are more favorable to the higher turbulence characteristic of sibilants. The high front vowel [i], by virtue of the forward position of the tongue, results in further gestural overlap and shared articulatory space with [s].

Following segment also played a significant role in /s/ variation as the processes of weakening and retention varied greatly depending on the type of segment that followed. The probability for weakening was greatest when /s/ was followed by voiced consonants and the least when followed by voiceless consonants, especially voiceless stops. These findings potentially support previous assertions by Guitart (1982, 1983) that /s/ weakening is connected to the amount of energy available to speakers at the moment of articulation. This idea follows Ohala's (1983) assertion that "the [human] speech production mechanism can be viewed as a device that converts muscular energy into acoustic energy" (p. 190). Thus, according to Guitart, different factors can reduce or conserve the energy available to a given speaker. It could be argued that because of the + voiced feature of voiced consonants, the anticipation of following voiced consonant inherently decreases the amount of energy available for a speaker when producing the preceding /s/ more than when a voiceless consonant follows. However, this argument is potentially problematic in the context of the current data, given that following vowels were not a factor in weakening or retention of /s/, contrary to Cepeda (1995). This could be the result of how advanced /s/ weakening is in Concepción, and that the effect of following vowels on /s/ has leveled off since Cepeda's study and been nullified by the high levels of elision that speakers exhibit.

The elevated likelihood of sibilant retention preceding voiceless consonants, and especially stops, is most likely due partly to coarticulation and/or overlap with the coronal stop [t]. When followed by the voiceless velar and bilabial stops, the behavior of /s/ was more varied, frequently presenting aspiration when followed by [k] and vacillating between [s], [h], [ϕ], and elision when followed by [p]. Another tendency that arose when /s/ preceded voiceless consonants was the production of attenuated sibilants, such as $[^s]$, before [t] in both word-internal and word-final contexts. Likewise, in numerous occasions speakers would produce /s/ before [t] as [hs] or [h^s] (Figure 5), aspirating at first, and finishing with a shortened sibilant as the tongue obstructed airflow to create the closure portion of [t].

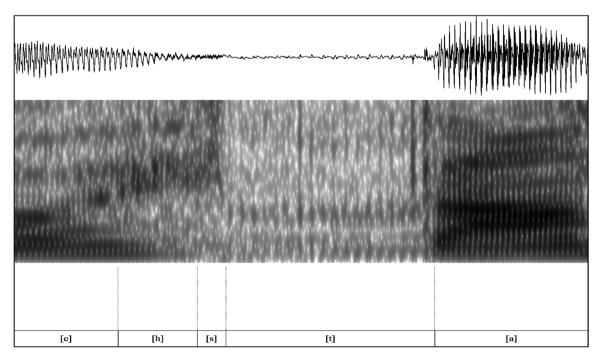


Figure 5: An example of [hs] from the current data.

What is not known at the current juncture is if this variation before [t] as a result of coarticulation is common enough to constitute an innovation of speakers in Concepción, thus adding to the already crowded sibilant allophony of Chilean Spanish, or if it is purely a sporadic phonetic phenomenon. Future studies should examine this and other potential variants in differing phonetic and even prosodic environments. It is quite possible that with the already robust sibilant variation documented in Chilean Spanish, simply analyzing /s/ in terms of [s], [h], and elision is insufficient.

With respect to the social factors analyzed, the data indicated the presence of several trends. The strongest social factors were gender and age. As reported by previous studies on /s/ variation in Chilean Spanish and other dialects, men were more likely than women to reduce /s/ and, in particular, to elide the sibilant. However, it must be noted that both groups overwhelmingly elided, and that the levels of elision among female speakers are higher than those reported for males in other dialects of Spanish, such as the Spanish spoken in Panama City (Cedergren 1978). Given that studies have shown that women tend to conserve /s/ more in Spanish than men (e.g., Cepeda 1995; Klee and Caravedo 2006, among others), the high rates of elision in the female population of the current study are indicative that /s/ reduction, especially elision, is more advanced in Concepción than in a number of other Spanish-speaking countries.

Age revealed a slightly different and somewhat surprising trend. While elision and aspiration were the most common variants overall, younger speakers were more likely than their older counterparts to produce [s], which runs contrary to Cepeda's (1995) and Soto-Barba's (2011) findings that /s/ weakening in Chile increased in younger age-groups. On a larger scale, this is also contrary to the findings for other processes of segmental reduction in Chilean Spanish, such as stop lenition and deletion as reported by Rogers (2016), which also showed increased reduction among younger speakers. A closer look at the data revealed that this trend is primarily driven by the young female speakers included in the current study (n = 3,603 tokens). As previously mentioned, Sadowsky (2015) observes that most likely due to hypercorrection, speakers from lower socioeconomic strata have begun to conserve [s] in word-internal contexts (e.g., ['lis.to]) despite increasing stigmatization within the Chilean Spanish linguistic community. Furthermore, when examining the predicted probabilities for /s/ weakening and retention with relation to age and the other linguistic factors analyzed, the younger female speakers were more likely to produce [s] than the older speakers in both polysyllabic and monosyllabic words, as well as in stressed and unstressed syllables. Additionally, all younger speakers were more likely than older speakers to produce [s] in the majority of the phonetic contexts examined.

Education played a weaker role overall, as those speakers from education groups 2 and 3 were slightly less likely to reduce /s/ than those with the least amount of formal education. When speakers were separated by gender, this trend was only observed among the male speakers. However, based on additional analyses of the male and female data for age, education, word position, syllable content, and stress, it was found that education was a significant factor for the female speakers (p = 0.021). A similar analysis was run for the male speakers, and education was significant as well – as more educated males were slightly more likely than their less educated peers to produce [s] (p = 0.0007). This held true for the factors of word-position, syllable number, and stress. There were no significant results for socioeconomic stratum in any of the gender-specific analyses. Thus, in a purely social context sans linguistic factors, education did not produce any significant differences among female speakers while it did for male speakers. However, there were significant differences for education for both genders when examining the speakers' productions within certain linguistic contexts.

Based on these findings, the current data set suggests that while reduction, especially elision, is the overwhelmingly most probable production of /s/ in Concepción, there is a slight trend toward an increase in sibilant production when compared to aspiration that is primarily driven by young and educated female speakers. To a lesser extent, this trend is observed in educated male speakers. This does not necessarily contradict Sadowsky (2015), but it is suggestive that age rather than socioeconomic stratum is a stronger motivator of the minor increase in sibilant production in Concepción. He postulates that the retention of [s], especially in word-internal codal position, could be due to either covert prestige or hypercorrection. If speakers are aware of the growing stigma attached to the sibilant in contexts that normally result in aspiration or elision, the spike in [s] observed in Concepción may be a change from above and a form of identity-based covert prestige that patterns more with age than with social stratum. However, given that education was a factor for both female and male participants, hypercorrection is the more viable possibility. Sadowsky (2015) indicates that in the Chilean educational system, and throughout Chilean society in more general terms, there is a prevailing idea referred to as *buen hablar* or *buena modulación* (proper speaking or proper pronunciation). Thus, those with more formal education are more exposed to this idea; and despite increased sibilant weakening in almost every other aspect of Spanish in Concepción, these speakers retain /s/ through hypercorrection as a form of prescriptivist resistance to the otherwise prevailing linguistic trends.

Nevertheless, it is not clear why age was a stronger factor among female speakers than education. One possibility is that it is an innovation among these speakers because of hypercorrection among more educated speakers. Another possibility is that due to the high number of allophones for /s/ documented in Chilean Spanish, not all cases of the sibilant observed in young females were [s]. It is possible that rather than being a case of sibilant retention, these speakers are producing alternate allophones that, due to the methodology of this and previous studies, treating them all as [s]. Future studies should examine potential motivators of this notable increase in sibilants among younger female speakers in Concepción through more detailed production data and perceptual analyses.

With respect to socioeconomic stratification, the lack of any significant differences between the different strata analyzed contradicts previous assertions on Chilean /s/. Studies, such as Cepeda (1995) and Soto-Barba (2011), have asserted that /s/ weakening, especially elision, increases among speakers from lower socioeconomic rungs. However, in every analysis run in the current study, socioeconomic stratification did not result in greater or lesser probabilities for /s/ weakening. When viewed from a quasilongitudinal perspective with the rest of the data, these findings suggest that /s/ variation may have undergone sociolectal leveling between socioeconomic strata among speakers of Concepción. Milroy (2002) defines sociolectal leveling as the elimination of previously marked sociolinguistic differences as the result of geographic and social mobility as well as the increase in contact between different sociolects. According to Sadowsky (2015), due to economic and social progress, at least five different phonemes $(\sqrt{tf})/\sqrt{tr}/\sqrt{r}/\sqrt{r}/y/j)$ are undergoing different degrees of sociolectal leveling throughout Chile. Based on the data of the current study, /s/ is also potentially undergoing a certain degree of sociolectal leveling in Concepción, as contact between different social demographics has increased and elision has become commonplace. As a result, /s/ is no longer a marker of socioeconomic strata among speakers of Concepción and its immediate surrounding neighborhoods. To a lesser extent, this leveling may be occurring between age-groups and education levels, given that despite observed differences, elision was still overwhelmingly more common than aspiration and [s]. Perceptual data are needed to confirm whether the production data reflect the reality of speakers' attitudes and perspectives.

As previously stated, the general consensus, with the exception of Broś (2013), up to the current juncture has been that while Chilean Spanish does exhibit a notable amount of /s/ weakening, this weakening mainly manifests itself in the form of aspiration. In fact, Cerda-Oñate et al. (2015) state that Chilean Spanish should not be considered a variety in which /s/ weakening, especially elision, is advanced, unlike varieties such as that spoken in Panama City and the Dominican Republic. The few studies on /s/ variation in Concepción (Valdivieso and Magaña 1988, 1991; Cerda-Oñate et al. 2015) have all concluded that aspiration is the most common variant and that elision, while it occurs, is low-frequency limited in scope.

The current data stand in stark contrast to these previous findings. Overall elision rates neared 70%, while neither [h] nor [s] reached 20%. In every linguistic context analyzed, despite varying probabilities of sibilant production, the overwhelming variants observed were weakened variants, especially elision. Elision was also the overwhelming variant for every social group analyzed. In fact, the rates of elision reported in the current study exceed those reported by Cedergren (1978) and Alba (1990) for the Spanish of Panama City and the Dominican Republic, respectively. An examination of the social factors suggests that these elevated levels of elision are not a recent phenomenon, rather, elision in Concepción has been occurring at much higher levels than what has been reported potentially for several generations. This notion is especially supported by the data related to socioeconomic stratification and age. First, the lack of

any significant differences between the different socioeconomic levels is indicative of leveling that is the potential result of prolonged sociolectal contact. Likewise, the fact that even in the older speakers elision rates were elevated supports the idea that high levels of /s/ elision have been a part of the Spanish of the region for a number of decades. Thus, based on the data and the overwhelming trends toward elision over aspiration and [s], sibilant weakening as a phonetic process in Concepción has achieved levels comparable to those in other varieties in which heavy /s/ reduction has been reported and is considered an "advanced" phonetic process.

6 Conclusions

The results presented show that contrary to previous assertions, sibilant elision in Concepción, Chile is the rule, rather than the exception. Based on the trends reported, it is likely that this has been the case for several decades. In more general terms, the data analyzed is also indicative that despite /s/ variation being a widely documented phonetic process in the Spanish-speaking world, it is anything but static. While certain trends, such as heavier levels of reduction in male and less educated speakers, were present as in other varieties, it would be erroneous to assume that those trends and patterns remain largely unchanged over time. This was borne out in the age-group data of the current study, which showed that despite overwhelming preferences for elision and aspiration, certain social groups may be consciously or unconsciously resisting the prevailing trends of their larger linguistic communities. It is likely that in other Spanish-speaking varieties, despite long-established linguistic trends with respect to /s/ variation, in certain smaller portions of the population, some speakers' productions of /s/ run contrary to these

One of the strengths of the current study was that all tokens of /s/ were verified acoustically to avoid perceptual errors and potential biases. While many studies have relied on impressionistic verification and interrater reliability measures to verify sibilant productions, recent studies (e.g., File-Muriel and Díaz-Campos 2003) have shown that these methods can be problematic and lead to erroneous classifications. An additional strength was the statistical model that was employed. One advantage of the proportional odds model is that it recognizes continuity and variation within categorical data, which better reflects the phonetic reality of data set. Previous methods, such as linear and logistical regressions, do not account for this. Also, the use of likelihood ratios not only allows for the observation of current trends, but to an extent they can be used to make more informed predictions of future trends based on the data. Based on the overall observed trends, it is most likely that rates of /s/ elision will continue to increase across social demographics and different phonetic and phonological contexts in Concepción.

Finally, despite sibilant reduction being one of the more studied phonetic and sociolinguistic processes of Chilean Spanish, it is possible that elision is much more common than what has been reported across a larger geographical portion of Chile. If the assertion of Lipski (1994) that Chilean Spanish shows high levels of geographic unity at the phonetic level is reliable, then it is possible that in other urban centers of Chile, such as in cities like Santiago, and Valparaíso, sibilant elision is just as common. Future studies comparing with larger sample sizes for multiple geographical areas of Chile are needed to verify this possibility.

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