

CHAPTER 7

The social perception of intervocalic /k/ voicing in Chilean Spanish

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In this study, we investigate what social meaning is attributed to a nascent change in progress in Chilean Spanish, examining whether intervocalic voicing of the phonologically voiceless stop /k/ affects listener judgments along several perceptual scales. Eight brief excerpts of spontaneous speech were digitally manipulated to vary only in voicing in tokens of /k/, and thirty listeners responded via an online experiment. We find that listeners are not sensitive to voicing along three of the measured scales and are not sensitive to voicing at all in female speech. We also determined that listeners are only sensitive to intervocalic voicing when assigning values of Chilean identity to male speakers, and that this effect is mitigated by headphone use. Some of listeners' insensitivity matches previous production data in this dialect, while we expected some sensitivity along other measures but found none. We posit that this mismatch is due to the salience of the variable: because listeners may be unfamiliar with intervocalic voicing of /k/, they have not yet indexed voicing of intervocalic /k/ with particular speaker features, aligning with Campbell-Kibler (2009).

1. Introduction

Chile represents a fascinating linguistic laboratory to explore social perceptions, as Chilean Spanish has been described as showing relatively high geographic uniformity with respect to pronunciation (e.g., Lipski, 1994). Sadowsky and Aninao (forthcoming) state that this is a result of a hyper-centralization of political, cultural, economic and social influence and power in the capital city of Santiago. However, while Chile lacks in geographical variation, it shows considerable levels of sociolinguistic complexity. Numerous studies have shown that this variety of Spanish is stratified along the lines of a number of sociolinguistic factors, such as age, gender, and socioeconomic status (e.g., Figueroa, Salamanca, & Ñanculeo, 2013; Rogers, 2016; Rogers & Mirisis, 2018; Sadowsky, 2012, 2015; Soto-Barba,

2007). On the other hand, Sadowsky (2015) observes that due to social progress and increased social mobility, especially post-dictatorship, variation is decreasing in some aspects via sociolectal leveling due to increased contact between different social demographics. Thus, this specific variety of Spanish provides an ideal opportunity to study speaker attitudes towards segments that have been shown to have complex and differing relationships with social variables.

Previous research has shown that a single phonetic variable can alter listener judgments of a speaker's social attributes (Chappell, 2016; García, 2015; Rohena-Madrazo, 2011; Walker, García, Cortés, & Campbell-Kibler, 2014). While quite a bit of research has been conducted on intervocalic /b, d, g/ lenition in Spanish (e.g., Eddington, 2011; Harris, 1969; Hualde, 2005; Martínez-Celdrán, 1984, 1991; Quilis, 1999; among many others), sociophonetic work on lenition of intervocalic /p t k/ is relatively scarce. Recent production work carried out in the Chilean dialect reveals that intervocalic voicing and spirantization, particularly of /k/, are most frequently realized by younger speakers, with younger females voicing more than their older counterparts, and younger males spirantizing more than older males and all females (Rogers & Mirisis, 2018). Assuming a close connection between individuals' speech production and perception, our aim in this paper is to determine whether listeners are sensitive to voicing of intervocalic /k/, and if so, whether their perceptions align with the variation found in speakers' production.

2. Literature review

2.1 Reduction and voicing as social variables in Spanish

Sibilant variation has been studied more than any other voiceless segment with regards to weakening and voicing, and studies have concluded that these segments are voiced and weakened according to a number of linguistic and social factors. For example, Schmidt and Willis (2011) showed that in Mexican Spanish, male speakers voiced /s/ more than female speakers, similar to how in different dialects males have been shown to reduce and elide /s/ more than females (e.g., Cepeda, 1995; Chappell & García, 2017; Klee & Caravedo, 2006; Valdivieso & Magaña, 1991). In Highland Ecuadorian Spanish, García (2015) found that intervocalic /s/ voicing was more likely in unstressed position, in faster speech, at word boundaries, before non-high vowels, and among young, male participants. In Costa Rican Spanish, Chappell and García (2017) explored whether physiology was better able to predict voicing of intervocalic /s/ than gender. If this were the case, they posit that males would be more prone to gradual than categorical voicing as a result of greater gestural overlap with the surrounding vowels due to anatomical

vocal fold differences. However, they found that female Costa Rican speakers voiced more gradiently than males, concluding that [z] is more socially motivated than the result of physiological differences in male and female vocal tracts in Costa Rican Spanish.

With specific regard to Chilean Spanish, most studies have examined voicing and articulatory reduction, or spirantization, as they relate to the intervocalic voiced stops /b d g/ (e.g., Figueroa & Evans, 2015; Pérez, 2007, Rogers, 2016), and have concluded that heavy articulatory reduction and elision of the voiced stops in intervocalic environments is the norm in Chilean Spanish. Likewise, Rogers (2016) found that voiced stop spirantization in and around the central-southern city of Concepción is primarily driven by young speakers, and to a lesser extent, males. The effects of voicing and spirantization on voiceless stops in Chilean Spanish have been much less studied. Prior to recent years, only Poblete (1992) and Cepeda (1991, 1994, 2001) had examined intervocalic /p t k/ voicing in Chile, in the southern city of Valdivia, with Poblete reporting that /p/ was voiced the most while /t/ was the most resistant to voicing and reduction. She also indicated that age and gender played varying roles in the levels of voicing and spirantization that the voiceless stops underwent and that these processes increased in the middle and lower socioeconomic strata. Likewise, she reported that while older males voiced /p/ and /t/ more than their younger counterparts, younger males voiced /k/ more.

Cepeda (1994) did not examine the social implications of voiceless stop voicing and spirantization but found that /p/ and /k/ both underwent greater voicing than /t/. Cepeda (2001) states that elision of /p/ and /k/ is common in the speech of both the higher and lower SES groupings in Valdivia, although it is most common among speakers of the lower stratum. She claims that in both groups spirantization and elision of /p/ and /k/ is an identity marker due to the flexibility for innovation afforded to both groups. Because lower-class speakers do not have to defend or uphold a “status quo” they are free to innovate. On the other hand, the upper-class speakers are afforded flexibility due to the low probability that their speech will be subject to negative social judgements.

These findings have not been supported by the broadest sociophonetic examination of this variable to date in Rogers (2017) and Rogers and Mirisis (2018). In these studies, researchers measured the voicing and reduction of intervocalic /p t k/ using three metrics: voicing, spirantization, and segmental duration. Voicing was measured as the percent of presence of voicing over the closure period of the obstruents, while spirantization (or articulatory reduction) was measured as the difference in intensity between an intervocalic voiceless stop and its flanking vowels. The researchers reported that primarily age and gender drove the articulatory reduction and voicing of intervocalic /p t k/ in Concepción, with males and

younger speakers spirantizing at higher levels than all other speakers. They found no significant relationship between voicing and socioeconomic stratification.

With specific regard to /k/, among the female speakers, significantly higher levels of voicing were documented among the youngest age group for /k/ when compared to the older female speakers, but there were no differences between age groups based on spirantization or duration of intervocalic /k/. The inverse was true for male speakers. In other words, there were no voicing differences between male speakers based on age, but the younger male speakers spirantized /k/ much more than the older males, demonstrating the most advanced intervocalic /k/ reduction of all speakers. That is, lenition of /k/ is essentially proceeding down two pathways, both led by young speakers: young females voice /k/, while young males spirantize /k/. In examining the sociophonetic perceptions of this variable, we follow Lewis (2001) in viewing lenition as a gradient process affecting these stops that may have multiple unordered outcomes that do not rely on one another. Specifically for this paper, we examine voicing as one step on a path toward lenition, leaving articulatory reduction for future studies.

2.2 Perception of intervocalic voicing in Spanish

Previous work on voicing in Spanish has focused almost exclusively on the voicing of fricatives, and production studies can help establish the diffusion of a change in progress throughout a given population. For instance, Rohena-Madrazo (2011) examined devoicing of /ʒ/ in Buenos Aires Spanish (BAS) and found that younger speakers in the middle-class group fully devoice this fricative, while devoicing in all other social groups remains variable. This finding suggests that devoicing change has reached completion in the younger, middle-class group.

However, production studies cannot speak to a population's awareness of variable voicing phenomena; perception studies are needed to address this question. In Loja, Ecuador, where speakers produce /s/ as [z] more frequently in word-final position, García (2015) conducted an online experiment, asking listeners to participate in a similarity rating task (with listeners rating stimuli as very similar or very different), and a discrimination task (in which participants heard the same pairs as in the first task and reported whether the tokens were the same or different.) García's results demonstrated that listeners were more likely to rate the pairs as most different when the [s] or [z] difference was in final position (as in *las ata*), and least likely to discriminate between [s] and [z] in word-medial position (e.g., *asa*), with word-initial discrimination falling between the two poles (e.g., *la saca*). This finding aligned with her production results, providing support for a close connection between speakers' production and perception.

A related question revolves around the relationship between phonetic variant production and the social perception of these variants. Chappell (2016), following the methodology of Campbell-Kibler (2009) and Walker et al. (2014), examined how socially meaningful information is conveyed through intervocalic /s/ voicing for Costa Rican listeners. Chappell found that males were more likely to produce voiced /s/ than women in this dialect, and aimed to determine whether the meaning of [z] differed based on the gender of the speaker or the listener by conducting an online experiment. Listeners were asked to evaluate matched-guise tokens of intervocalic /s/ voicing on scales of social characteristics often associated with /s/ variation. She found that overall, [s] is found to have more social prestige, but she also finds that listeners are more likely to rate [z] use among males more positively along scales of niceness, confidence, localness, and masculinity, demonstrating a covert prestige of [z] use among men not accessible to female speakers. In other words, men's greater production of [z] corresponds to a more populated indexical field (Eckert, 2008) in perception.¹

2.3 The present study

Though previous production research on /p t k/ in Spanish has attested variable voicing of these phonemes in intervocalic position, no study to our knowledge has explored how this voicing may be socially indexed for listeners. Additionally, as mentioned above, we aim to determine whether the results of this perception study will align with those of recent production studies. There is a general assumption that speech production and perception will match (Labov, Karen, & Miller, 1991: p. 36). For instance, Fowler and Galantucci (2005) suggest that the fit between the activities of talking and listening must be close, and that, “in fact, languages could not have arisen and could not serve their functions if the fit were not close” (26). This closeness is often demonstrated via categorical perception, as well as normalization of input from a variety of different speakers (cf. Johnson, 2005). Several instances of mismatch have been demonstrated, in which listeners do not perceive distinctions, but do produce them, termed *near-mergers* (Hall-Lew, 2013; Labov et al., 1991; Yu, 2007). The individuals who participate in these near-mergers, however, are usually isolated participants, rather than a whole group or even a whole population. We might also expect a mismatch in the other direction, or that listeners themselves do not produce a distinction, but

1. However, in a similarity rating and discrimination task, Costa Rican listeners were less successful at discerning the difference between [s] and [z] than other allophonic pairs, suggesting that even the least salient phonetic variants can become associated with social meaning (Chappell, 2017).

do perceive one. This perception may be subconscious, as demonstrated by the phenomenon of phonetic convergence, in which speakers modify their speech over time to align with their interlocutor (e.g., Pardo, 2013), but do not perceive their speech to be shifting.

Additionally, the relationship between production and perception may depend on the variable in question. Campbell-Kibler (2009) examined listeners' evaluations of English gerund (ING) produced either with the velar nasal or the alveolar nasal (-*ing* vs -*in*), and found both more ratings and larger effect sizes than that of another variable she had previously examined: /t/ release (Campbell-Kibler, 2005). She states that this could be due to (ING)'s status as a linguistic stereotype, "a linguistic variable that is culturally acknowledged to the extent of having a specific term to refer to it" (2009: p. 152), as opposed to /t/ release's less conscious cultural capital (2009: p. 152). However, she also notes that this distinction could be due to other, as-yet-unexplained factors.

Given that voicing of /k/ appears to be a nascent trend led by young women, we aim to determine whether this novel allophonic cue is detectable by listeners, and if so, whether listeners' perceptions of voicing of /k/ align with production findings. Therefore, in this paper, we answer the following questions:

1. Are listeners sensitive to differences in voicing in utterance-medial intervocalic position?
2. If so, how do listeners evaluate speakers who voice /k/ in this position along a variety of social measures?
3. Do the perceptual findings align with production findings from this dialect?

3. Experimental design

3.1 Matched-Guise Technique

As we are interested in social evaluations of this particular feature, we chose to utilize a pseudo Matched-Guise Technique (Lambert, Hodgson, Gardner, & Fillenbaum, 1960), following Walker et al. (2014) and Chappell (2016). In this research methodology, listeners hear utterances produced by the same speaker that are altered or manipulated in some way in order to control for anatomical, semantic, or prosodic differences that might cause unintended responses by listeners. Listeners are then asked to provide qualitative judgments about the samples. By using nearly identical utterances that differ according to only one feature, the goal is to tap into listeners' perceptions of one particular acoustic-phonetic cue.

Previous research has shown that even small phonetic differences across stimuli are enough to exert an influence on how listeners perceive social characteristics of the speaker. Listeners have been shown to be sensitive to perceptions of speaker sex (Lass, Almerino, Jordan, & Walsh, 1980; Traunmüller, Eriksson, & Ménard, 2003), ethnicity (Purnell, Idsardi, & Baugh, 1999; Thomas, Lass, & Lass, 2010), social class (Labov, 1966, 2006; Walker, 2007), education levels (Campbell-Kibler, 2005), region of origin (Bezooijen & Gooskens, 1999; Boomershine, 2006; Clopper & Pisoni, 2004; Labov & Ash, 1997; Preston, 1989; Schmidt, 2013; Wolfram, Hazen, & Schilling-Estes, 1999), age (Drager, 2011) and sexual orientation (Mack, 2011; Munson, McDonald, DeBoe, & White, 2006). We therefore aim to determine whether a small phonetic difference of voicing of /k/ in intervocalic position is detectable by listeners, and if so, how this phonetic difference affects how listeners perceive the speaker.

3.2 Stimuli selection and manipulation

In the present study, two to three-word excerpts with intervocalic /k/ were extracted from sociolinguistic interviews with four speakers and were digitally manipulated. In one token per person, the /k/ was the onset of the tonic syllable (as in /la 'kasa/ ⟨la casa⟩ ‘the house’), while the other token’s /k/ was the onset of a pretonic syllable (as in /la kare'tera/ ⟨la carretera⟩ ‘the highway’). The four speakers were young males and females from Santiago (Chile’s capital and largest city) between the ages of 18–25, belonging to the low-mid socioeconomic group and mid-mid socioeconomic group (following Sadowsky, 2012), providing a 2 X 2 X 2 experimental paradigm (2 stress patterns, 2 socioeconomic groups, and 2 sexes). Socioeconomic strata were determined using Sadowsky’s (2012) modified version of Esomar (Adimark, 2000), which determines an individual’s socioeconomic status (SES) specific to Chilean society, based on two factors that have historically been shown to play strong roles in sociolinguistic variation: level of formal education and profession.

In total, 8 utterances were extracted from the sociolinguistic interviews, as seen in Table 1.

The stimuli were manipulated to include a voiced /k/ guise and a voiceless /k/ guise. In contrast with previous studies that have spliced in the experimental sound or morpheme recorded in isolation by each stimuli speaker (cf. Chappell, 2016; Walker et al., 2014), we conducted our manipulations within the utterances themselves so as to control for the many cues potentially contained within an utterance. That is, we aimed to manipulate solely the voicing of the /k/, which enabled cues such as vowel transitions into and out of the intervocalic /k/, pitch of the surrounding vowels, intonation across the entire utterance, and intensity

Table 1. Content of stimuli utterances according to gender and SES of the speaker and prosodic position

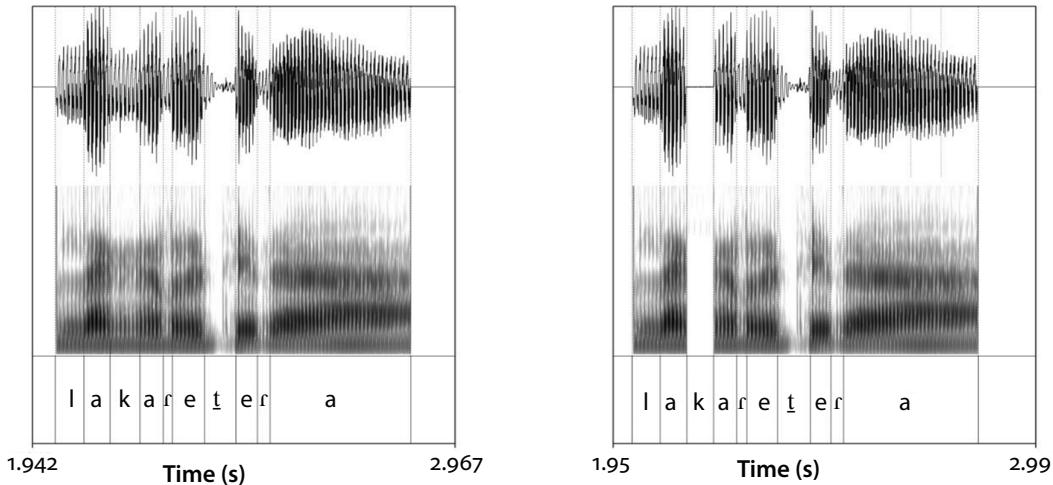
	Male		Female	
	Stressed	Unstressed	Stressed	Unstressed
Lower-Middle	la calle	la carretera	la casa	la carretera
Middle-Middle	nuestra casa	se casaban	como cosa	se casaron

to remain the same across both guises in order to ensure that only the voicing of the segments differed between guises. We acknowledge that use of spontaneous (sociolinguistic interview) speech for a Matched-Guise Task is slightly atypical. However, similarly to Campbell-Kibler (2007), we chose to sacrifice some control over the utterance content itself (which was then entered into the statistical models as a random effect) for the ability to utilize more naturalistic utterances that are more likely to approximate speech that listeners might hear on a daily basis. Additionally, as Campbell-Kibler (2009: p. 34) states, using this type of speech still enables us to answer our central question, since each listener will hear each stimulus twice, once per variant.

We also took potential duration differences into account. In English, voiced segments have been shown to be intrinsically shorter in duration than their voiceless counterparts (Klatt, 1976; Lehiste, 1970), and while to our knowledge no similar study exists in Spanish, we aimed to ensure that differences in duration would not be confounded with voicing. To do so, we first examined Rogers and Mirisis' (2018) data from Concepción to determine average duration of voiceless tokens of /k/, following Campos-Astorkiza's (2014) classification of voicing into 3 categories of 0–20% voiced, 20–90% voiced, and 100% voiced. Their data included a measure of voicing drawn from a modified version of Pablo Arantes' intensity measuring script (available at: <<https://code.google.com/archive/p/praat-tools/downloads>>). Of the 1,516 onset intervocalic /k/s in their data, only 182 of them were between 0–20% voiced (that is, considered voiceless according to Campos-Astorkiza's work). The mean duration of these 182 tokens was 67 milliseconds, with a standard deviation of 25 milliseconds. Therefore, all tokens of intervocalic /k/ manipulated for this experiment, whether voiced or voiceless, consisted of a 67-millisecond duration. By controlling for duration of the segment of interest and varying it only according to voicing, we ensured that the only difference between guises would be voicing, and that a shortened duration would not be a confound for listeners. This, of course, invites another confound: that listeners would *expect* a voiced segment to be shorter. We acknowledge that there are multiple cues to perception of voicing, and that this tradeoff may have affected listeners' perceptions of the experimental voicing target.

As mentioned, the original 8 tokens extracted from the sociolinguistic interviews were all at least partially voiced. In order to ensure a perceivable contrast, we added voicing in Praat (Boersma & Weenink, 2016) via a ‘cut and paste’ function so that all tokens were at least 90% voiced. That is, we took the voiced portion of the /k/ and pasted it until we reached 67 milliseconds’ worth of voiced /k/ duration. To create their experimental voiceless counterparts, we extracted the /k/ portion of the utterance from the original, unedited sound file, and used a high pass band filter to filter out noise under 750 Hz at a 20 Hz smoothing rate (following File-Muriel & Brown, 2011). We then spliced this completely devoiced segment back into the original sound file at the zero-crossing point (following Styler, 2013), and manipulated the duration of the segment to 67 milliseconds. All tokens were manipulated in duration to ensure the same length after the guises were created. Two seconds of silence were added in Audacity prior to the stimulus, and one second following the stimulus. Two linguists were asked to evaluate the stimuli to ensure that the voicing distinction could clearly be heard and that the stimuli were natural sounding, which they confirmed.

The figure below shows waveforms and spectrograms of the voiced (on left) and voiceless (on right) guises of *la carretera* as spoken by the lower-middle SES male speaker. The difference in voicing of /k/ can be clearly seen in the differing guises.



3.3 Experimental delivery

This study used an online experimental delivery in order to be able to tap into perceptions by a diverse group of Chilean participants, and to facilitate data collection and aggregation. Stimuli were delivered through Qualtrics, which requires audio to be uploaded to YouTube. For this reason, all the stimuli are accompanied by a visual consisting of a blue circle on a black background, and the stimuli are in

video format created via *iMovie* (2018). Videos were uploaded to YouTube via the “Unlisted” setting to ensure that no one but the authors and participants would be able to access the clips.

Following Walker et al. (2014) and Chappell (2016), listeners were asked to pay attention to each recording and evaluate the speaker according to a set of social characteristics previously used in other perception studies (Chappell, 2016; Walker et al., 2014). Listeners were asked to move a slider bar according to their perception of the speaker along 8 scales: social class (*de clase baja/de clase alta* ‘high/low class’), education (*menos educad@/muy educad@*, ‘less/more educated’), surety of oneself (*segur@/insegur@ de sí mism@*, ‘secure/insecure of him/herself’), pleasantness (*antipátic@/simpátic@*, ‘unkind/kind’), masculinity or femininity based on the sex of the speaker (*muy masculino/femenino* ‘very masculine/feminine’ or *menos masculino/femenino* ‘less masculine/feminine’), and Chilean identity (*muy chilen@/menos chilen@* ‘very Chilean/less Chilean’). The options on the slider bar ranged from 0–6.

Participants were also asked to rate speakers’ overt social status, by providing ratings of more/less *flaite* and *cuico*, Chilean-specific terms. *Flaite* typically refers to stereotypically low-class or uneducated individuals, and may also have a criminal connotation. *Cuico* stereotypically refers to high-class individuals, or those who may act as though they are high-class. Similarly, participants responded to how old they thought the speaker was, using the same age range options as Walker et al. (2014) and Chappell (2016) of 15–19, 20–24, 25–29, 30–34, 40–44, and 45 or older. Finally, listeners were asked to indicate (in a short-answer box) where they thought the speaker was from within Chile.

Listeners were told that they would hear a total of 16 different speakers and were asked to provide assessments of each speaker according to the above characteristics. Finally, we asked listeners to provide any other observations about the person via the question “¿Se te ocurre algo más de la persona?” On the penultimate screen of the experiment, listeners were prompted to provide their own age, gender, education level, occupation, and the city and neighborhood they lived in. They were also asked if they wished to enter their email to be considered to win one of three gift cards in a raffle, worth 30,000 Chilean pesos (approximately \$50 USD).

Finally, on the last screen, we asked if they had any final comments, and whether they used headphones to complete the experiment. Given that voicing is a distinction found in the low frequencies (approximately 100–300 Hz), information about whether they used headphones was included in the analyses below. No other information about their listening conditions (including ambient noise, computer version, etc.) was solicited.

3.4 Participants

Participants were recruited for this study via social media, relying primarily on Facebook, as well as personal emails sent to the researchers' contacts. To participate, an individual had to be a native speaker of Chilean Spanish currently residing in Chile. A total of 32 listeners participated in the study, but two of these 32 participants were excluded from the following analysis. One speaker was not a native speaker of Chilean Spanish as the experiment instructions had dictated, so this person was excluded on the basis that he did not fit the experimental criteria. Additionally, in spite of our best efforts to recruit a demographically diverse sample, only one listener from a lower SES group participated, as indicated by their designated SES (Sadowsky, 2012). In order to ensure that our sample was statistically valid (i.e., that this one speaker would not form an individual group with only one set of observations), we decided to exclude this individual from the analyses below. Participants' demographic information is provided in Table 2.

Table 2. Listeners' demographic information

Listeners' information	
Median/mean age in years	32/32
Age range in years	20–49
Male/female, <i>n</i>	16/14
Level of education	Technical degree incomplete (2), University incomplete or technical complete (4), University complete or more (24)
Profession	Currently unemployed (1), specialized worker (such as machine operator; 3); office worker (1); professional (13); professional with postgrad degree (10); student (2)
Origin (Santiago/other)	11/19
Total listeners	30

4. Analysis

Many of the scales on which listeners rated the speakers targeted similar elements, such as overt social status (as indicated by education and social class), or covert social prestige (as indicated by the niceness and confidence scales). However, if independent variables are correlated with one another, they are not independent and could result in multicollinearity, which would violate the assumptions of this statistical test. Therefore, we first explored our data, visualizing a correlation plot of the eight social measures (social class, education, self-confidence, niceness, gendered identity, *flaite*-ness, *cuico*-ness, and Chilean identity.) From initial data

exploration, we observed that social class and education were highly correlated with each other, and that not being ‘flaite’ and being ‘cuico’ were also strongly correlated with social class and education in the expected direction. That is, speakers rated highly on social class and education also tended to be rated as being both more *cuico* and less *flaite*. Gendered identity and self-confidence also mapped onto this overarching factor group. This was first confirmed via use of a Principal Components Analysis (PCA) in the *FactoMineR* package (Lê, Josse, & Husson, 2008) following Levshina (2015: pp. 354–361). According to this test, a single factor accounted for a majority of the variance, with an Eigenvalue of 2.76, and this single factor included all six of the measures. Each of the variables are significantly correlated with each other according to a correlation test (*dimdesc*) in the *dplyr* package (Wickham, Francois, Henry, & Müller, 2017), and Table 3 shows the correlation values and the accompanying *p*-values.

Table 3. Correlation values among social evaluation scales included in the status factor

	Correlation	<i>p</i> -value
Education	0.87	<.001
Social Class	0.86	<.001
Not Flaite	0.84	<.001
Cuico	0.77	<.001
Confidence	0.64	<.001
Gendered identity	0.56	<.001

Once we determined that these six related variables mapped onto the broader social status factor, we combined the measures of each of the variables into one numeric item to use as the dependent variable for a linear analysis via the *cfa* function in the *lavaan* package (Rosseel, 2012). We did not test these factors as individual dependent variables because the correlation test and the PCA showed them to be closely related to one another.

Niceness and Chilean identity were not correlated with the other measures, so these factors are analyzed separately below as dependent variables. Each of the continuous variables are centered and scaled, such that a positive coefficient indicates an increase in listener evaluation, and a negative coefficient signals a decrease in rating. Additionally, given the production findings that demonstrated that intervocalic voicing of /k/ in this dialect of Spanish is typically carried out by younger speakers, we ran a fourth linear model to determine whether voicing affected how listeners perceived speakers’ ages.

We built separate linear mixed models of status, niceness, Chilean identity, and perceived age using the *lmer* function in the *lme4* package in R (Bates,

Maechler, Bolker, & Walker, 2015) to establish whether /k/ voicing had an effect on the evaluations of the speakers. In each model, we tested whether stimuli voicing, gender of the stimuli speaker, gender of the listener, perceived speaker age, listener age, origin of the listener, SES of the stimuli, SES of the listener, and stress of the stimuli affected the evaluations provided by the listeners, and relevant interactions were tested. Presentation order was also included to examine whether ratings were influenced by the order in which the listeners heard the stimuli and whether the listener used headphones. Following Chappell (2016), we compared the models via the use of the analysis of variance function in R, to determine which of the predictors significantly improved the model, keeping only those predictors that did so.

Additionally, in each model, participant, utterance, and speaker were included as random effects, and they were retained in the models if an analysis of variance test confirmed that they accounted for a significant amount of variance.

5. Results

In this section, we present the results of each model individually. In each model, order of presentation did not significantly affect listeners' ratings, enabling us to analyze the entire dataset.

Status

The best fit mixed-effects model for the status factor is shown in Table 4. According to this model, only the gender of the stimuli speaker has an effect on listeners' ratings of the stimuli. That is, listeners rate all stimuli spoken by a female speaker as significantly higher on the status scale than all stimuli spoken by a male speaker. This effect can be visualized in Figure 1.

Table 4. Best fit mixed-effects model for the status factor: perceived social class, education level, not flaita, cuico, security, and gendered identity of the speaker

Fixed effect	Coefficient	Standard error	t-value	p-value
Intercept	.36	.07	5.50	<.001
Stimuli sex				
Female	Ref	–	–	–
Male	–.70	.07	–9.31	<.001
Random Effects	Variance Component	Degrees of Freedom	χ^2	p-value
Participant	.05	1	8.63	<.01

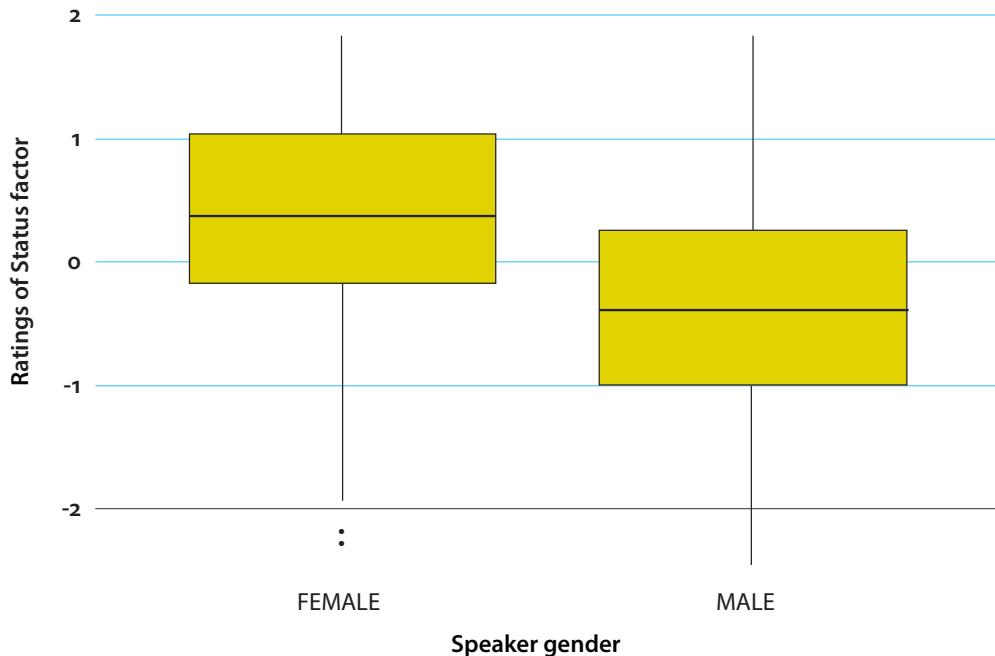


Figure 1. Listeners' ratings of status factor according to sex of the stimuli speaker

No other interaction terms or main effects were significant in this model.

Niceness

The best fit model taking niceness as the dependent variable is shown in Table 5.

Table 5. Best fit mixed-effects model taking the niceness measure as dependent variable

Fixed effect	Coefficient	Standard error	t-value	p-value
Intercept	-.19	.13	-1.42	.18
Stimuli sex				
Female	Ref	-	-	-
Male	.43	.12	3.47	<.01
Random Effects	Variance Component	Degrees of Freedom	χ^2	p-value
Participant	.16	1	48.47	<.001
Utterance	.05	1	8.54	<.001

Again, only the fixed effect of the gender of the stimuli is a significant predictor of niceness, as can be observed in Figure 2. That is, males are rated overall as nicer than females.

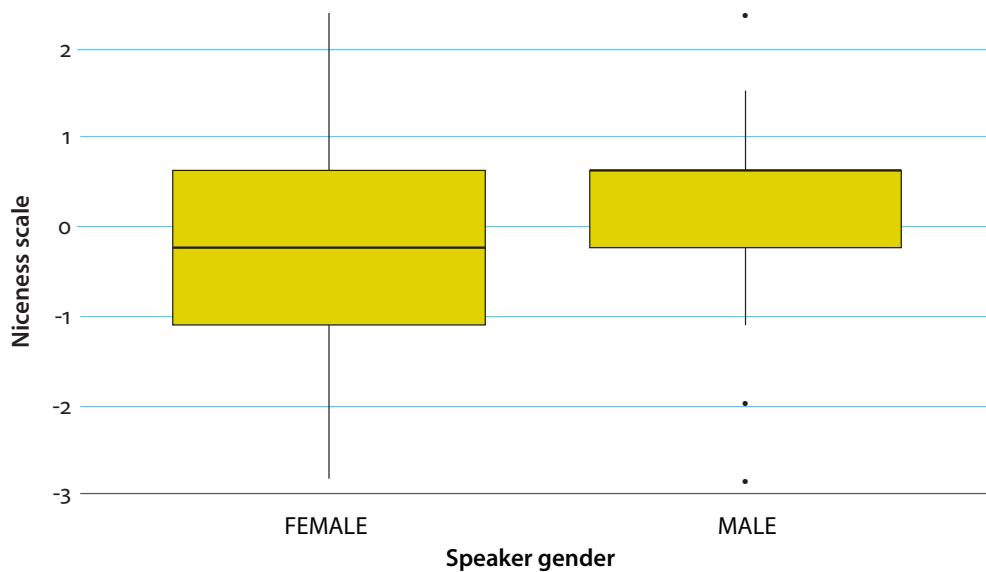


Figure 2. The effect of speaker gender on ratings of niceness

Chilean identity

We now turn to the third scale of evaluation, or evaluation of Chilean identity. No differences were found among ratings of female speakers for this variable, so in Table 6 below, we have subset the data to represent responses only to male stimuli speakers.

Table 6. Best fit mixed-effects model taking Chilean identity as dependent variable (responses to male stimuli speakers only)

Fixed effect	Coefficient	Standard error	t-value	p-value
Intercept	-.09	.14	-.61	.55
Stimuli voicing				
Voiceless	Ref	–	–	–
Voiced	.26	.10	-2.55	<.05
Headphones				
No	Ref	–	–	–
Yes	.46	.18	2.56	<.05
Random Effects	Variance Component	Degrees of Freedom	χ^2	p-value
Participant	.17	1	20.16	<.001

For the first time, we see a main effect for stimuli voicing. Specifically, voiced tokens spoken by male speakers are rated as more Chilean than voiceless tokens, as shown in Figure 3.

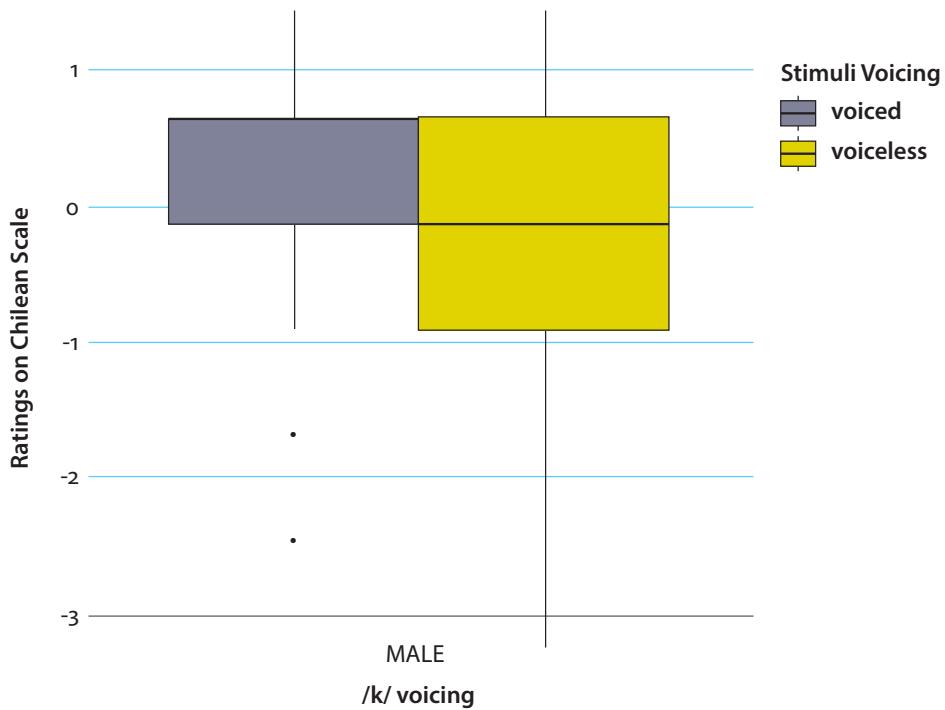


Figure 3. Effect of stimuli voicing on evaluations of male speakers' Chilean identity

A main effect for use of headphones was also found for this model: headphone users were more likely to rate speakers as higher on the Chilean identity scale overall. In the interest of ensuring that this variable did not impact our results, we subset the data into only those listeners who had used headphones ($N = 16$). Following the same procedure of analysis as in the previous model for Chilean identity, we found that listeners tended to rate male speakers as more Chilean when the stimulus was a voiced /k/, but this difference did not reach significance ($\beta = .28$, $SE = .15$, $t = 1.93$, $p = .06$). This suggests that the main effect found above is mitigated by headphone use, and therefore its strength is reduced. That is, when participants used headphones, they did not connect stimuli voicing to positive Chilean identity to a significant degree.

Perceived age

Finally, to test whether voicing conditioned listener perception of speaker age, we modeled perceived age as a function of the factors mentioned above. According to the results in Table 7, only the sex of the stimuli speaker affects how listeners rate the speaker's age. Intervocalic /k/ voicing does not affect listeners' perceptions of speaker age.

Table 7. Best fit mixed-effects model taking perceived age as dependent variable

Fixed effect	Coefficient	Standard error	t-value	p-value
Intercept	.18	.12	1.52	.14
Stimuli gender				
Female	Ref	–	–	–
Male	.48	.08	6.00	<.001
Random Effects	Variance Component	Degrees of Freedom	χ^2	p-value
Participant	.19	1	53.71	<.001

This is surprising given the production findings for this dialect. We expected listeners to be sensitive to age variation in intervocalic /k/ voicing, specifically for female speakers, but this hypothesis was not substantiated. We discuss each of these findings below.

6. Discussion

The objectives of the current chapter were to determine whether listeners were sensitive to differences in voicing in utterance-medial intervocalic position, and if so, how listeners evaluated speakers who voice /k/ in this position along a variety of social measures. We also aimed to examine whether the perceptual findings aligned with recent production findings from this dialect.

While not related to the voicing of /k/, listeners were overall more likely to assign significantly higher ratings of status but lower ratings of niceness to the female speakers. It appears as though male speech may be associated with a covert prestige (Trudgill, 1972), signaling their stronger social and linguistic flexibility, though unrelated to the voicing of /k/. Though this does not shed much light on the experimental variable of interest, it is important to keep in mind that listeners bring their own biases into an experiment. We cannot be sure whether it is these particular female speakers that garner these types of ratings on the experimental scales, or whether this is indicative of a broader social phenomenon in which females are evaluated as more prestigious but less nice (or contrastingly, that males overall are perceived to be nicer and belong to a lower status). This aligns with previous findings that other contextual information present in a stimulus may alter listener perceptions (cf. Campbell-Kibler, 2007; Pharao, Appel, Wolter, & Thøgersen, 2015).

With respect to intervocalic /k/ voicing, the results of this perceptual data indicate that voiced intervocalic /k/ may function as a type of identity marker, not for

age or gender, but for local identity. Specifically, males were rated as more Chilean (more local) when they produced a voiced /k/.² On the other hand, in spite of the tendency for young, female speakers to voice /k/ more than other groups (Rogers, 2017; Rogers & Mirisis, 2018), voicing was not a factor in the listeners' perception of female speakers' Chilean identity, status, age, or niceness.

In order to explore these mismatched findings, we return to the assumption of the close connection between speech production and perception described in Section 2. We posit that the lack of effects for young, female stimuli associated with /k/ voicing may be because this variation in production is newly emerging (as it is currently employed almost exclusively by young speakers in recent sociophonetic production data (e.g., Rogers, 2017; Rogers & Mirisis, 2018)) and, as such, is below the level of conscious perceptual access (Shattuck-Hufnagel, 2015: p. 437), similar to Campbell-Kibler's (2009) findings. This proposal is supported by the commentary provided by participants: none referred to the voicing distinction, or even to any differences in pronunciation.

A recent finding by Figueroa (2011) and Figueroa, Salamanca and Nanculeo (2013) provides further support for this hypothesis. These studies examined Chilean university students' social perceptions of use of variants of /tʂ/, /r/, /tʃ/, and /j/ in Concepción, demonstrating that the most fricated variants of each of these phonemes received evaluations of least prestige while the most occluded variants received evaluations of highest prestige. Though Figueroa (2011) did not directly compare the results of each phoneme, he found that listener reaction times were significantly longer for the /r/ and /j/ variants, which he posits is due to /tʃ/'s status as a linguistic stereotype (Labov, 1972) and /tʂ/'s as a linguistic marker. That is, listeners may have been surprised to hear variants of /r/ and /j/, and may not have had overt assumptions of speaker prestige related to the production of these variants, but given their familiarity with the variation of /tʂ/ and /tʃ/, were able to respond quickly with their opinions (M. Figueroa, personal communication, October 11, 2018).

Given the newly emerging status of /k/ voicing and its low perceptual salience, a similar tendency may be at work in our findings. We follow Campbell-Kibler (2009) in positing that close connections between production and social perceptions are more likely when production of the variant is more robust within the speech community. In other words, we propose that social evaluations are directly related to the robustness and saliency of a phonetic cue, in line with Agha (2003), Auer, Barden, and Grosskopf (1998), Barnes (2015), Campbell-Kibler (2009, 2012), Fridland, Bartlett, and Kreuz (2004), Kerswill and Williams (2002), and Rácz (2013), among others. Given that the voicing of /k/ was not particularly

2. This difference was not significant among headphone users.

salient for listeners in the present experiment, there appears to be a looser connection between social perceptions and production.

In making this claim, we acknowledge some potential limitations. First, a higher number of participants could increase the power of the statistical tests conducted in this analysis and allow for a more nuanced evaluation of the dataset, for example, to uncover a potential relationship between listener age and sensitivity to /k/ voicing. Additionally, it is possible that there are slight differences between the production results found in Concepción, Chile's third largest city, and Santiago, the origin of the speakers used in this study. However, no differences in evaluations were found according to listener origin. Further production research on voicing of /k/ in Santiago may uncover differences between these two cities that align more closely with the results of the present study. That is, it is possible that it is males who voice /k/ more in Santiago, while females voice /k/ more in Concepción. Finally, several listeners commented on the short length of the stimuli (2–3 word utterances), and stated that they would have been able to provide more accurate assessments of the speaker's social characteristics with more data. However, statistically significant results have been found by using short stimuli such as in forced-choice identification tasks (Janson & Schulman, 1983), and even just the single word “hello” (Purnell, Idsardi, & Baugh, 1999).

7. Conclusion

In this paper, we have aimed to determine whether listeners are sensitive to intervocalic /k/ voicing and whether listeners' social perceptions of intervocalic /k/ voicing aligned with previous production findings in this dialect. We found that while /k/ voicing is most likely among young, female speakers, listeners are not sensitive to this connection. That is, we found no differences in social evaluations for the female speakers based on voicing guise. However, we found a tenuous connection between stimuli voicing and Chilean identity: listeners were more likely to rate male speakers who voiced /k/ as more Chilean than male speakers who did not voice /k/. We argue that the mismatch between these production and perception findings relates to the saliency of this variant for listeners. Specifically, we posit that voicing of intervocalic /k/ is a newly emerging phenomenon among young, female speakers, and because of this novelty, listeners have not yet had sufficient exposure to this variant to associate it with the social group that produces it the most. The tendency to assign higher ratings of Chilean identity to male speakers who voice /k/ may be reflective of an overall tendency to link nonstandard variants to covert prestige in male voices.

An important issue that remains to be investigated is listeners' ability to distinguish between the /k/ lenition strategy most common among young women (voicing) and the /k/ lenition strategy most common among young men (spirantization) (cf. Rogers, 2017; Rogers & Mirisis, 2018). Spirantization of /k/ may be closer to the level of consciousness for Chilean Spanish speakers than voicing, and listeners in the present experiment may have been attuned to /k/ lenition in general rather than /k/ voicing in particular. Future research may be able to answer this question, providing more evidence for our hypothesis that a mismatch between production and perception results is related to saliency of the experimental variable.

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