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Phonetic sensitivity does not condition variant-based social sensitivity

The case of intervocalic /s/ voicing in Costa Rican Spanish

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Abstract

This chapter explores intervocalic /s/ voicing in Costa Rican Spanish, for example, *cosa* 'thing' as ['ko.sa] or ['ko.za]. To determine whether listeners' greater sensitivity to /s/ variants results in more extreme social evaluations, I compare the same 106 listeners' responses in two discrimination tasks to their evaluations in a matched-guise test. The results of multiple mixed-effects linear regression models fitted to 20,352 data points show that while certain participants perceive [s] and [z] to be more distinct than other listeners, their greater phonetic sensitivity does not significantly condition their social evaluations of the variants. This finding indicates that the individuals most sensitive to phonetic variation are not leading or diffusing their social meaning throughout their community. On the contrary, I contend that all native speakers of a particular speech community are equally good at hearing the local social meaning of sounds, regardless of their ability to consciously discriminate between phonetic variants.

Keywords: intervocalic /s/, voicing, Costa Rican Spanish, sociophonetic perception, phonetic discrimination

Este capítulo investiga la /s/ intervocálica en el español costarricense, p. ej., *cosa* como ['ko.sa] o ['ko.za]. Para determinar si la sensibilidad de los oyentes hacia las variantes resulta en evaluaciones sociales más extremas, comparo las respuestas de 106 oyentes en dos tareas de discriminación con sus evaluaciones en una prueba de par oculto. Los resultados de varios modelos de regresión lineal con 20,352 puntos de datos demuestran que, aunque ciertos participantes perciben [s] y [z] como variantes más distintas que otros, su mayor sensibilidad fonética no conlleva evaluaciones sociales más matizadas. Este hallazgo sugiere que los individuos más sensibles a la variación fonética no generan ni propagan el significado social por su comunidad. Por el contrario, sostengo que todos los hablantes nativos de una comunidad de habla perciben

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el significado social de las variantes fonéticas con el mismo éxito, independientemente de su capacidad para discriminar conscientemente entre dichas variantes.

Palabras clave: /s/ intervocálica, sonorización, español costarricense, percepción sociofonética, discriminación fonética

1 Introduction

This chapter explores intervocalic /s/ voicing in Costa Rican Spanish, for example, *cosa* 'thing' as ['ko.za]. Unlike the realization of /s/ as [z] before a voiced consonant, for example, *más lindo* 'prettier' as [maz.'liⁿ.do], which is often described as a standard phonological rule in Spanish (Schwegler, Kempff, & Ameal-Guerra, 2010; Whitley, 2002), the voicing of /s/ between vowels is generally considered a nonstandard, dialectal phenomenon. However, the extensive geographic distribution of the phenomenon calls into question this reputation. Studies have documented intervocalic [z] in Costa Rican Spanish (Chappell, 2016; Chappell, 2017; Chappell & García, 2017), Highland and Coastal Ecuadorian Spanish (Calle, 2010; Chappell, 2011; García, 2015, 2019; Lipski, 1989; Robinson, 1979; Schmidt, 2016; Strycharczuk, Van'T Veer, Bruil, & Linke, 2014), Central Peninsular Spanish (Hualde & Prieto, 2014; Torreblanca, 1986; Torreira & Ernestus, 2012), and Catalonian Spanish (Davidson, 2014, 2019; McKinnon, 2012). Intervocalic /s/ voicing is clearly widespread, emerging in both contact (e.g., Highland Ecuador and Catalonia) and monolingual dialects (e.g., Central Spain and Costa Rica) of Spanish.

Why would such disparate varieties of Spanish all participate in the same nonstandard voicing phenomenon? While additional factors may be at work in contact varieties (Davidson, 2020, 2021), gestural blending can account for its emergence in non-contact varieties (Quilis & Fernández, 1985), as the vocal fold vibration of the preceding and following vowel overlaps with the intervening fricative. As discussed more fully in Section 3, such gestural blending may initially be more common in male speech due to physiological factors: vocal fold cessation between two vowels is particularly challenging for speakers with larger vocal tracts (Nadeu & Hualde, 2013), that is, men, resulting in higher rates of [z]. Then, over time, members of a speech community may begin to link intervocalic [z] with social meaning, associating the variant with the qualities of the speakers who tend to produce it most frequently (Chappell & García, 2017). In fact, recent studies have shown that listeners in Ecuador and Costa Rica all associate intervocalic [z] with gendered social meaning (Chappell, 2016; García, 2019).

The present chapter seeks to elucidate the role of individual listeners' phonetic sensitivity in the social meaning-making process. Do select individuals drive the interpretation of the social meaning of [z] in Costa Rican Spanish, or is the linking of [z] with social meaning a community-wide process? To answer this question, I compare the same Costa Rican participants' phonetic sensitivity to intervocalic [z] in an AX (same-different) discrimination (i.e., the subject has to determine whether the two stimuli are the same or different) and a similarity rating task to their social evaluations of local speakers who employ intervocalic [z] in a matched-guise test. In doing so, this study aims to clarify whether listeners' sensitivity to [s] ~ [z] variation is predictive of their ability to link social properties with [z], which will shed light on how social meanings emerge and spread throughout a speech community.

2 Background literature

A phonemic distinction between /s/ and /z/, a contrast that still persists in Romance languages like Portuguese and French, existed in Spanish prior to the 16th century (Penny, 1993). A massive

simplification of the fricative inventory in Spanish resulted in the merger of /s/ and /z/, and sibilant sonority is no longer contrastive in Modern Spanish (Bradley & Delforge, 2006). Rather, the sole sibilant phoneme, /s/, is said to have two allophones, [s] and [z], which are conditioned by following phonological environment. The voiced variant tends to appear when followed by a voiced consonant as the result of a regressive assimilation process, and the voiceless variant is said to occur in other contexts (Morgan, 2010, p. 249; Navarro Tomás, 2004). However, it should be noted that this phonological rule involves gradient rather than categorical voicing, and percent voicing varies based on numerous conditioning variables (Campos-Astorkiza, 2014).

The voiced variant also appears between vowels across several dialects (see García [2015] for a more complete discussion), and in these varieties, intervocalic /s/ voicing can be divided into two related but distinct processes. First, nearly categorical voicing of a phonological nature occurs in word-final position in both Quito and Cuenca (Chappell, 2011; Lipski, 1989; Robinson, 1979), for example, *má*[z] *ancho* 'wider.'[1] While some voicing variation emerges (Schmidt & Willis, 2011; Schmidt, 2016; Strycharczuk et al., 2014), intervocalic /s/ voicing occurs at high frequencies in predictable contexts. For example, Chappell (2011) found that 92% of word-final tokens of intervocalic /s/ in Quito were voiced, but only 10% of word-medial or second-word initial tokens of intervocalic /s/ were voiced, which is indicative of the distinction between voicing as a phonological process and a coarticulatory phenomenon.

Second, many other varieties exhibit more variable, gradient voicing of intervocalic /s/, which can be considered the result of coarticulation or, within the articulatory phonology framework, gestural overlap (Browman & Goldstein, 1989, 1991, 1995). Falling somewhere between these two poles is the case of /s/ voicing in Catalonia, where both word-final /s/ and /z/ are neutralized to [z] in Catalan, and this phonological rule may, to some extent, bleed into the Spanish spoken in the region (see Davidson [2014] and McKinnon [2012]). Gestural blending has been shown to increase word-finally, in faster speech, and in unstressed syllables (e.g., Cole, Hualde, & Iskarous, 1999; Cooper, 1991; Hardcastle & Hewlett, 1999), and several studies have confirmed that rates of intervocalic [z] tend to increase in these environments as well (Chappell & García, 2017; García, 2015; Hualde & Prieto, 2014; Strycharczuk et al., 2014; Torreira & Ernestus, 2012).

3 Social and contextual factors

While the origin of modern intervocalic /s/ voicing in Spanish is rather murky, a physiological source could provide a unified explanation for the emergence of the variant in non-contact varieties. As noted in the introduction, Nadeu and Hualde (2013) have proposed that larger vocal tracts inhibit rapid vocal fold cessation between vowels, which would result in higher rates of voicing of intervocalic voiceless consonants. Chappell and García (2017) quantitatively explore this issue in Costa Rican Spanish, where they find that measurements associated with vocal tract size and vocal fold thickness (F2 and F0, respectively) do significantly condition the voicing of intervocalic /s/, but other observations complicate this picture.

The first complicating factor is the statistical significance of sex in addition to F2 and F0. As men tend to have larger vocal tracts and thicker vocal folds, all three measurements overlap substantially and, in separate models, all reach similar levels of significance ($p < 0.001$). The second and even more problematic issue revolves around gradient voicing. If speakers with larger vocal tracks, that is, men, experience greater difficulty when attempting to stop vocal fold vibration between vowels, they would be expected to voice more gradiently. However, the opposite pattern was observed in the data set: men were found to produce more categorical realizations of intervocalic /s/ than women, with higher rates of both 0% and 100% voiced tokens. Based

on these results, the authors conclude that while physiology may be the origin of intervocalic voicing, it ceases to be the driving factor of [z] production when the variant becomes linked with social meaning often attributed to men, such as masculinity or confidence. As [z] becomes imbued with local social meaning, moving from what Silverstein (2003) has called a first-order index to a second-order index, men behave more categorically to approximate social targets.

Intervocalic [z] has become a social target in several varieties of Spanish, although it appears to be a low-salience variant. For example, intervocalic [z] evoked higher in-group solidarity scores among Catalonian listeners in a matched-guise test, with listeners linking the variant to higher levels of friendliness, niceness, and pleasantness than intervocalic [s] (Davidson, 2019). In this same study, guises with /l/ velarization, a highly salient feature of Catalan Spanish, were also linked with solidarity along with several other social properties, including Catalan–Spanish bilingualism, accented speech, and a rural identity. In other words, listeners appeared to have stronger evaluations of /l/ velarization than intervocalic /s/ voicing, and metalinguistic commentary supports this assessment. While 65% of listeners commented on the *ele catalana* 'the Catalan l,' only 7% of listeners described intervocalic /s/ voicing, which indicates that /l/ velarization is a stereotype (Labov, 1971) for local listeners in a way that intervocalic [z] is not.

García (2019) shows that, in Ecuador, intervocalic /s/ is evaluated differently in male and female voices. In her study, women were viewed as significantly lower status, less pleasant, and older when they produce intervocalic [z], while men did not receive these negative evaluations in their [z] guises. Listeners also associated intervocalic [z] with a Quiteño or Cuencano origin. In spite of these social evaluations, García (2015) finds that speakers from Loja, Ecuador, make no explicit mention of intervocalic [z] across a series of experiments testing allophonic discrimination, and while they did rate [s] ~ [z] pairs as more different than identity pairs, for example, [s] ~ [s], the listeners classified [s] ~ [z] as the same or similar more frequently than they classified them as distinct.

Finally, in the variety of particular interest for this study, Chappell (2016) finds that Costa Rican listeners associated intervocalic [z] with lower class and lower education levels, but men who produced intervocalic [z] were also perceived as more masculine, confident, nice, and local, demonstrating the in-group solidarity intervocalic [z] can signal to listeners. However, in spite of their strong social evaluations of intervocalic [z], these listeners struggled to explicitly distinguish between intervocalic [s] and [z] in allophonic discrimination tasks (Chappell, 2017), which suggests that intervocalic [z] is not salient in Costa Rican Spanish, existing below the level of consciousness.

4 Methods

To shed light on the relationship between individuals' phonetic sensitivity and the way in which they assign social meaning to phonetic variants, this study explores the same Costa Rican Spanish speakers' performances across different tasks, including two discrimination tasks and a sociophonetic perception study. These experiments have been analyzed separately (see Chappell [2017] and Chappell [2016], respectively), but a comparison between them will elucidate the role of the individual in creating and diffusing social meaning. The individual participants and the tasks in which they engaged are described in detail below.

4.1 Participants

One hundred and six Costa Ricans participated in the experiments, the majority of whom were college students at the Universidad Latina in Heredia, Costa Rica. More demographic information about the participants is provided in Table 9.1.

Table 9.1 Age, sex, and regional background of the participants

Participants' demographic information	
Mean age	30 years
Median age	19 years
Age range	18–60 years
Women: Men (*n*)	37:69
Region of origin (*n*)	Heredia (36), San José (32), Alajuela (22), Cartago (4), Unidentified or other (12)
Total participants (*n*)	106

4.2 Matched-guise test

After answering a series of demographic questions, each participant first completed a matched-guise test (Lambert, Hodgson, Gardner, & Fillenbaum, 1960) that involved 24 target audio files[2] organized in SurveyGizmo (Vanek & McDaniel, 2006). These audio files featured the voices of six different Costa Rican Spanish speakers (three women and three men) who were recorded with a Zoom H2 Handy Recorder as they provided directions in two map tasks (see Chappell [2016] for a full description). These speakers also performed an imitation task in which they repeated the targeted pronunciation of the author to elicit cases of both intervocalic [s] and [z] in a variety of contexts. Two short baseline audio files were extracted from the map tasks for each speaker and used to create two manipulated guises per recording: one guise in which all cases of intervocalic /s/ were spliced to [s] and another in which all cases of intervocalic /s/ were spliced to [z]. An example is provided here, including the baseline audio file that indicates the target variable between parentheses and the two manipulated guises.

Baseline audio file: *Vamo(s) a doblar en la esquina cru(s)ando por en frente de mi ca(s)a y (s)oda la U y al lado derecho está el ca(s)ino y al lado izquierdo la po(s)ada.*
'We're going to turn at the corner, crossing in front of my house and Soda la U, and the casino is on the right and the inn is on the left.'
[s] guise: *Vamo[s] a doblar en la esquina cru[s]ando por en frente de mi ca[s]a y [s]oda la U y al lado derecho está el ca[s]ino y al lado izquierdo la po[s]ada.*
[z] guise: *Vamo[z] a doblar en la esquina cru[z]ando por en frente de mi ca[z]a y [z]oda la U y al lado derecho está el ca[z]ino y al lado izquierdo la po[z]ada.*

Listeners automatically heard an audio file on each page of the experiment, and they used a six-point scale to evaluate several social qualities. These qualities were previously identified as relevant in other /s/-perception experiments (Walker et al., 2014), and they included socioeconomic class, education, confidence, pleasantness, sexual orientation, heteronormativity (using scales of femininity for female voices and masculinity for male voices), and localness. Listeners also identified the approximate age of each speaker and were able to write an optional comment on each voice if they had additional thoughts on the speaker. A screenshot of the task is shown in Figure 9.1.

4.3 Discrimination tasks

Following the matched-guise test, listeners participated in a similarity rating task and an AX discrimination task to determine how they perceived the distinction between intervocalic [s]

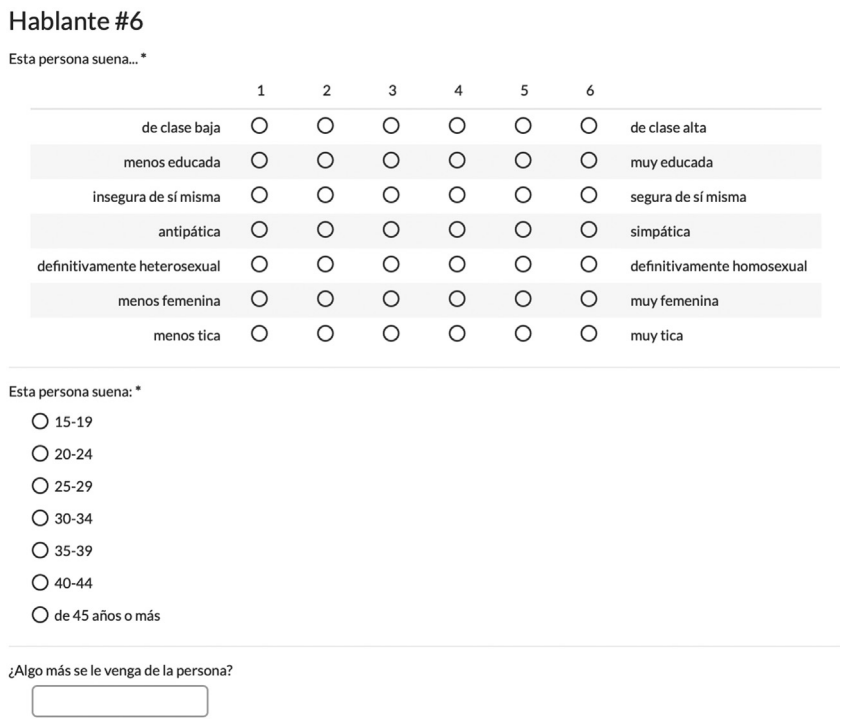

Figure 9.1 Example screenshot of the matched-guise task

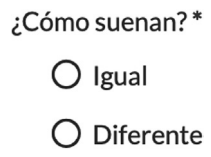

Figure 9.2 Example screenshot of the AX discrimination task

and [z] (see Chappell [2017] for a full description). On each page, listeners heard a single male speaker produce word pairs in isolation that included phonemic contrasts (e.g., ['a.ɾa] *ara* 's/he plows' ~ ['a.ða] *hada* 'fairy'), allophonic differences (['a.sa] ~ ['a.za] *asa* 's/he grills'), and no difference (['a.sa] ~ ['a.sa] *asa* 's/he grills'). The similarity rating task featured a six-point scale of difference (*muy similar – muy diferente* 'very similar – very different'), and the AX discrimination task involved a binary distinction between *igual* 'same' and *diferente* 'different.' Screenshots of each task are given in Figures 9.2 and 9.3, and the way in which these tasks were analyzed in this paper is described in Section 5.

In the matched-guise test, 20,352 target evaluations were collected in total, with 2,544 evaluations of each social property. These were complemented by 1,166 total [s] ~ [z] ratings across the other tasks, including 530 target evaluations in the similarity rating task and 636 target evaluations in the AX discrimination task. As [s] ~ [z] pairs serve as the focus of this chapter, all non-target evaluations were excluded from the analysis.

5 Quantitative analysis

Two approaches were used in this data analysis, one focusing on individual responses and another focusing on group behavior. In the individual analysis, I established each participant's 1) mean evaluation of difference in the similarity rating task (1 = always evaluated [s] ~ [z] pairs as very similar, 6 = always evaluated [s] ~ [z] pairs as very different) and 2) proportion of "different" ratings in the AX task (0 = always evaluated [s] and [z] as the same, 1 = always evaluated [s] and [z] as different).[3]

I then created multiple mixed-effects linear regression models with the packages lme4 (Bates, Maechler, Bolker, & Walker, 2014) and lmerTest (Kuznetsova, Brockhoff, & Christensen, 2015) in R (R Core Team, 2017). Listeners' evaluations of a specific social property served as the dependent variable in each model, and individual models were constructed for evaluations of perceived class, education, niceness, confidence, Costa Rican–ness, age, homosexuality, and heteronormativity along with joint factors identified by a factor analysis, namely, status and positive social features (see Chappell [2016] for more details on the factor analysis). The voice heard was included as a random effect, and the interaction between two independent variables, mean evaluation of difference in the similarity rating task (continuous variable) and variant heard (levels: [s] and [z]), was tested to determine if individuals who are more sensitive to phonetic variants also provide more extreme evaluations of the social properties linked to [s] and [z]. After running these models, I then followed the same procedure with proportion of difference ratings in the AX discrimination task in an interaction with variant. Finally, the entire model-fitting process was repeated only for male voices, as Chappell (2016) found more nuanced evaluations of intervocalic [z] for male speakers.

Next, I employed an analysis based on group, in which the participants were divided based on their behavior in the discrimination tasks. First, participants' responses to the [s] ~ [z] distinction in the similarity rating task were explored using conditional inference trees (Hothorn, Hornik, & Zeileis, 2006). Conditional inference trees perform recursive partitioning, executing binary splits of the independent variables that are most predictive of the dependent variable. Using the 530 total evaluations in this task, two behavioral patterns were identified in the similarity rating task: the first group of participants gave higher evaluations of difference to [s] ~ [z] pairs (235 total evaluations; mean/median evaluation = 2.987/3.0) than the second group (295 total evaluations; mean/median evaluation = 1.67/1.0). Figure 9.4 highlights this distinction.

A conditional inference tree was created using the AX discrimination data to bin participants' behavior in the categorical task. The binary division of the 636 total evaluations is shown in Figure 9.5, with Group 1 evaluating [s] and [z] pairs as more different (342 total evaluations; "different" evaluations = 65.2%, or 223/342) than Group 2, which evaluated these pairs as the same with higher frequency (294 total evaluations; "different" evaluations = 15%, or 44/294). While the distribution of participants in Group 1 and Group 2 is not identical across the similarity rating task and the AX task, the same participants tend to cluster together. For example, when Group 1 in the similarity rating task is compared to Group 1 in the AX discrimination task, 70.2% (33/47) of the individual listeners overlap. Such a high degree of overlap suggests that participants exhibited similar behaviors in both the categorical and the more gradient

Figure 9.3 Example screenshot of the similarity rating task

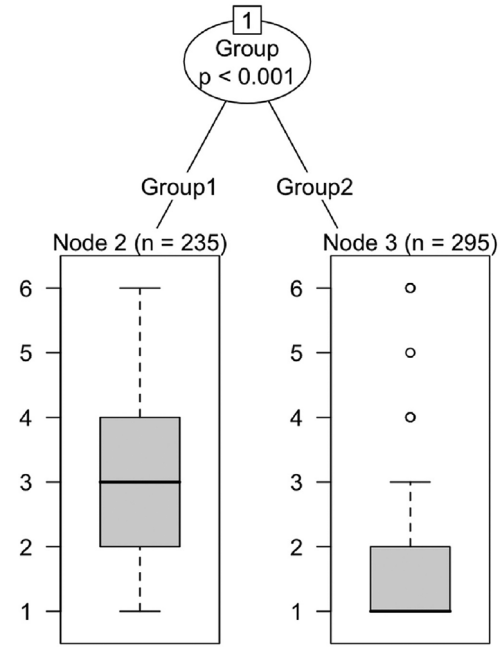

Figure 9.4 Behavior of two binary participant groups in the similarity rating task (1 = very similar, 6 = very different)

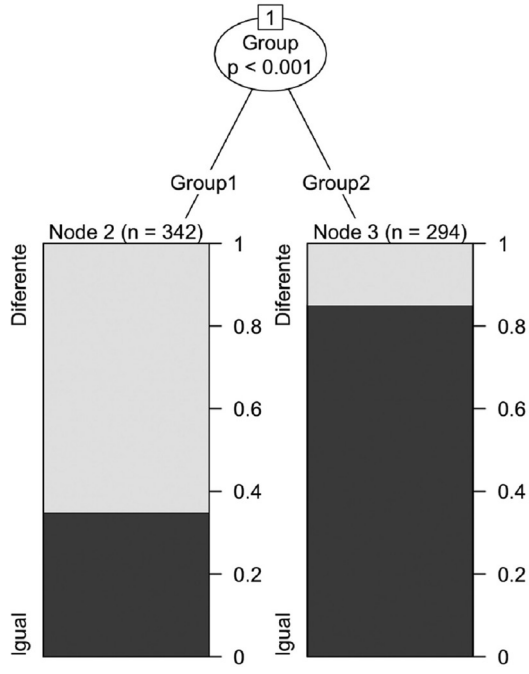

Figure 9.5 Behavior of two binary participant groups in the AX discrimination task (*igual* 'the same' vs. *diferente* 'different')

evaluation tasks, and those who tended to give higher evaluations of difference in one task also gave higher evaluations of difference in the other.

Following the binning of the participants, the same model-fitting procedure outlined earlier was followed, with the only difference being the independent variables included in the model. In this case, I first constructed models using the Group 1/Group 2 division established in the similarity rating task as an independent variable, and I later reran these models using the Group 1/Group 2 division identified in the AX discrimination task. As before, the model-fitting process was repeated with a subset of the data including only male voices.

In each model, the interaction between group and variant did not reach significance. In other words, the listeners' phonetic sensitivity to [s] and [z] in the similarity rating and AX discrimination tasks did not condition how they socially evaluated local speakers based on these variants. The broader significance of this finding will be discussed in Section 6.

6 Discussion

This chapter questioned whether listeners' ability to discriminate between [s] and [z] in a categorical AX task and a gradient similarity rating task influences the way in which those listeners assign social meaning to speakers based on their use of these variants. However, the analysis presented in Section 5 shows no clear relationship between phonetic sensitivity to [s] and [z], on the one hand, and variant-based social evaluations on the other. That is, it is not the case that the individuals most attuned to phonetic variation are driving the interpretation of its social meaning. This finding suggests that a speech community largely shares social evaluations of linguistic variation below the level of consciousness, irrespective of an individual listener's ability to consciously perceive it.[4]

A feasible explanation for this community-wide understanding of social meaning may lie in the intersection of indexical order (Silverstein, 2003) and exemplar model of phonological representation (cf. Bybee, 2001). Within exemplar theory, specific linguistic variants are stored in the memory as exemplars, and each exemplar can be tagged for acoustic, phonetic, social, semantic, pragmatic, and contextual details (Johnson, 1997). Unlike coda /s/ reduction, for example, *níspero* 'loquat' as ['nih.pe.ɾo], which generally involves broad social and stylistic stratification (Chappell, 2021), the voicing of intervocalic [z] in Costa Rica is more evenly distributed across the population, with men across classes and age ranges frequently producing a voiced variant (Chappell & García, 2017). As a result, most members of the speech community would be expected to have similar linguistic and social exposure to intervocalic [s] and [z], and it stands to reason that all Costa Rican speakers would develop similar exemplars tagged with similar linguistic and extralinguistic information.

Additionally, this theory can help explain why intervocalic /s/ voicing appears to be linked with masculinity across multiple non-contact varieties of Spanish that are not in close contact. If men produce higher rates of intervocalic [z] than women as a result of their larger vocal tracts and thicker vocal folds, different Spanish-speaking communities will independently develop exemplars of intervocalic [z] tagged with the additional social information that men produce the variant most frequently. Then, the variant may be reinterpreted with an n + 1st value (Silverstein, 2003), acquiring social meanings related to masculinity that are relevant to the local community. In this way, intervocalic /s/ voicing may be linked to masculinity across monolingual varieties of Spanish but still develop somewhat different local meanings through continual social construal and reinterpretation.

Throughout this meaning-making process, intervocalic [z] can acquire positive local meanings like friendliness, niceness, and pleasantness (Davidson, 2019) or confidence, niceness,

localness, and masculinity (Chappell, 2016). Alternatively, if [z] becomes entwined with masculine speech and masculine identities, it can elicit negative social evaluations in female speech (García, 2019), where it may be viewed as inappropriate. Importantly, the present study suggests that the entire process of building exemplars based on exposure and experience, tagging those exemplars with social meaning, and extending the social meaning linked to said exemplars through indexicality does not depend on phonetic sensitivity at the level of the individual. In other words, an entire community can house a plethora of shared linguistic and social knowledge without any conscious awareness of it.

7 Conclusions

This chapter has explored the role of individual listeners' phonetic sensitivity in the evaluation of social meaning. To determine whether those who are most sensitive to phonetic variation would also drive variant-based social evaluations, I compared the same listeners' evaluations of intervocalic [s] ~ [z] difference in two discrimination tasks to their responses in a matched-guise test that featured both [s] and [z] guises. While certain Costa Rican participants did perceive [s] and [z] to be more distinct than other listeners, their greater phonetic sensitivity did not significantly condition their social evaluations of the variants. This finding indicates that the individuals most sensitive to phonetic variation are not leading and diffusing their social meaning throughout their community. On the contrary, it appears that all native speakers of a particular speech community are equally good at hearing the local social meaning of sounds, regardless of their ability to distinguish between phonetic variants. As a result, I have contended that intervocalic [z] may share an origin story across non-contact varieties of Spanish rooted in physiology, but its mental representations and social meanings have evolved in somewhat different ways across varieties, reflecting the shared values and social evaluations of each community.

Notes

1 The same phenomenon can appear word medially at a morpheme boundary in Cuenca (Robinson, 1979; Toscano, 1953, p. 79), for example, *de*[z]*ayuno* 'breakfast.'
2 One filler audio file was included halfway through the experiment, and participants were told the speakers were members of three local families to distract from and potentially account for the similar sounding voices.
3 These continuous variables were also tested after being centered and standardized.
4 The present study has focused on the poles of the intervocalic /s/-voicing continuum: voiceless [s] and voiced [z], respectively. Future studies should also explore perceptions of partial /s/ voicing, as the production of intervocalic /s/ voicing is often gradient.

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