

Article

The Influence of Social Information on Speech Intelligibility within the Spanish Heritage Community

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Abstract: Previous research in speech perception has shown that perception is influenced by social factors that can result in behavioral consequences such as reduced intelligibility (i.e., a listeners' ability to transcribe the speech they hear). However, little is known about these effects regarding Spanish speakers' perception of heritage Spanish, Spanish spoken by individuals who have an ancestral and cultural connection to the Spanish language. Given that ideologies within the U.S. Latino community often equate Latino identity to speaking Spanish "correctly" and proficiently, there is a clear need to understand the potential influence these ideologies have on speech perception. Using a matched-guise methodology, we analyzed the influence of speaker social background information and listener social background information on speech perception. Participants completed a transcription task in which four different Spanish heritage speakers were paired with different social guises to determine if the speakers were perceived as equally intelligible under each guise condition. The results showed that social guise and listener social variables did not significantly predict intelligibility scores. We argue that the unique socio-political culture within the U.S. Latino community may lead to different effects of language ideology and social expectation on speech perception than what has been documented in previous work.



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1. Introduction

Speech perception is heavily influenced by social factors that prompt assumptions about standard language, prestige, and social expectations of language production (Hay and Drager 2010; Kutlu 2020; Rubin 1992). Listeners exploit both linguistic and paralinguistic information—information regarding the speaker themselves rather than acoustic information—in the speech signal, which can ultimately trigger both implicit and explicit biases that can alter speech processing (Babel and Russell 2015; Chappell 2020). Many studies to date have focused on the interaction between language ideologies, social expectations, and paralinguistic information in the perception of varieties of English, including nonstandard and non-native varieties. This body of literature has shown that implicit biases do trigger some cognitive mechanism that can result in reduced intelligibility, although there is debate regarding the underlying mechanism—whether it be reduced listening effort (Rubin 1992) or a mismatch in expectation (McGowan 2015).

While these findings are relatively well-established in the literature dedicated to English and its varieties, fewer studies have analyzed the influence of ideologies and social expectations within the United States Latino community, including how they may play a role in shaping listeners' judgements about and perception of the speaker. Furthermore, even less is known about these effects with regard to the perception of Spanish heritage language, that is, Spanish produced by heritage *speakers* and *learners* who were born in the United States and have an ancestral and cultural connection to the Spanish language (Fishman 2001). Spanish heritage speakers in the United States often find themselves in

what has been described as a “double bind” resulting from being marginalized by both their Anglophone peers for speaking “impure” English and for their connection to Hispanic/Latino culture, and by their Hispanophone peers for their Spanish proficiency, or lack thereof (Leeman 2012). For example, the usage of non-native pronunciation patterns and nonstandard language often contributes to a sense of othering and may lead to attitudes related to languagelessness (Rosa 2016). This creates a complicated balancing act where heritage speakers must navigate the social pressures from the English-speaking and Spanish-speaking communities, both of which are integral to their lives. Therefore, it is important that researchers not only study English speakers’ perceptions of Spanish-accented English, but also Spanish speakers’ perception of Spanish produced by heritage Spanish speakers, to better understand both sides of the double bind.

To address this gap, we investigated how giving listeners information about the socio-cultural background and upbringing of the speaker influences their perception of that individual’s speech. In this study, we generated descriptions targeting heritage backgrounds, making a special effort to better encapsulate the heterogeneity of the Spanish heritage community by distinguishing between *speakers* (i.e., individuals who acquired Spanish as a first language but underwent a shift in language dominance from Spanish to English during primary school) and *learners* (i.e., individuals who have an ancestral and cultural connection to Spanish but acquired most of their skills in a foreign or world languages course). The terms “bilingual” and “heritage” have often been employed monolithically, rendering a static portrait of a diverse group of individuals. Such a characterization fails to acknowledge the variability in both their social lives and linguistic experiences; we therefore developed the *speaker* and *learner* guises to explicitly address a portion of this variability. In the sections that follow, we describe the current state of research on the role of ideology and expectation in speech perception, as well as the language ideologies and attitudes that exist within the U.S. Latino community.

1.1. The Role of Ideology and Expectation in Speech Perception

Language exists within an inherently social world and as a result, the sociocultural reality that speakers inhabit is known to play a role in speech perception (Kang and Rubin 2009; Kutlu 2020; McGowan 2015; Niedzielski 1999; Rubin 1992). Previous research has shown that listeners exploit socio-indexical cues in the speech stream to make higher level linguistic and social judgments. These judgments have, in turn, been found to lead to linguistic profiling and perceptions of heightened accentedness and reduced intelligibility (Giles and Trudgill 1983; Williams et al. 1999), demonstrating that “our beliefs about accents have social consequences for how we hear others and judge them as authentic speakers of the language” (Levis 2020, p. 18).

Early studies focusing on the role of social information on speech perception were grounded in theories of language ideology and bias in communication between native and non-native speakers of English. For instance, Rubin (1992) found that when listeners were presented with an Asian face, they perceived the speech as more accented and transcribed it less accurately than when presented with a Caucasian face. Overall, Rubin argued that social information can influence the amount of effort listeners invest in decoding the speech signal. This early work was the basis of theories of reverse linguistic stereotyping, according to which social factors related to a speaker’s group membership lead to altered perceptions of their language style and proficiency. For instance, listeners often develop expectations about the speaker based on their nationality, and these expectations have been shown to influence listeners’ processing of the speech and their perception of the speaker (Kang and Rubin 2009). These findings have been corroborated in research on a range of varieties of English. Niedzielski (1999) determined that speakers’ perceived nationality was crucial to whether they were perceived as speaking standard American English or Canadian English by listeners from Detroit, MI. The role of implicit racial bias has also been found to be influential in speech perception and accentedness judgements, with minority visual stimuli (i.e., minority faces) and minoritized varieties of English being viewed as more accented

regardless of the actual speech stimuli presented (Kutlu 2020). Running through this body of work is the idea that socioindexical information can activate biases that affect listeners' perception of speech.

Other researchers have argued that the degree of congruence between listener expectation and reality can lead to increased or decreased processing demands, which could account for the effect of socioindexical information on speech perception—however, as described, this finding is not consistently agreed upon in the literature. In other words, according to these researchers, listeners are not subconsciously rejecting their end of the communicative burden due to the activation of implicit bias, but rather they experience increased processing demands when exposed to stimuli that run counter to their expectations (Walker and Hay 2011; Van Engen and Peelle 2014). Babel and Russell (2015) investigated the effects of paralinguistic information on speech perception by analyzing social associations between speech and ethnicity in a multicultural, multilingual, urban context. The results from this study showed that even in a diverse area where the Asian community is prominent, Chinese Canadian voices were perceived as more accented and less intelligible. Furthermore, this effect was even stronger when the audio stimuli were paired with visual information. To explain these findings, the authors suggested that there was a greater processing cost in incongruent audio–visual conditions—conditions where an Asian face was presented with audio from a White Canadian speaker or conditions where a White face was presented with audio from an Asian Canadian speaker—than in congruent conditions. In short, there are two explanations that could account for the effect of social information on speech processing: implicit bias shaping perceptual processing, and a mismatch in expectations driving differential processing costs. Although there is a lack of clear consensus in this area, it seems likely that both ideology and expectation affect perception.

1.2. *Language Ideologies and Attitudes in the Spanish Heritage Community*

The Spanish heritage community in the United States is heterogeneous, insofar as it encompasses individuals with vastly different linguistic abilities who come from a range of sociocultural backgrounds. Some heritage speakers have relatively strong productive and receptive skills, others have weak productive skills (or none at all) but strong receptive skills, and still others have limited or no ability in both skills. Despite such variability, the common factor that connects heritage speakers is that they identify culturally and emotionally with their heritage language (Fishman 2001).

Language ideologies develop around a set of constructed beliefs with the purpose of furthering social objectives in both language communities (Martínez 2006), and, as a result, heritage speakers struggle to find acceptance in either community. Because of the situated, contextually defined nature of language ideologies, it is necessary to focus specifically on the ideologies that exist within the U.S. Latino community, rather than the Spanish-speaking community more generally, because such situated, local ideologies are most likely to influence the perception of Spanish as a heritage language in the United States.

Heritage speakers, along with other bilinguals, are confronted with ideologies that often conflate issues related to language proficiency and language variety (e.g., who speaks the “correct” variety of Spanish) with social issues such as ethnic identity (Potowski 2012; Showstack 2017). Given the dynamism of the U.S. Spanish-speaking community, where second-generation Latinos are beginning to outnumber Spanish-speaking immigrants (Abdi 2011), it should come as no surprise that language ideologies are in flux. For example, U.S.-born Latinos seem to place less importance on proficiency than Latinos who have immigrated to the U.S. (Potowski 2012). Despite this potential change in attitudes and ideologies, the relationship between language and identity remains complex. Proficiency in Spanish is still found to contribute to a personal sense of ethnic identity, but even advanced proficiency in Spanish does not guarantee community acceptance (Rosa 2016). For this reason, heritage speakers face conflicting circumstances. On the one hand, they feel connected to their heritage through their acquisition process, but on the other, they feel

compelled to achieve a certain linguistic standard in Spanish to gain community acceptance. As [Rosa \(2016\)](#) explained, heritage speakers are often viewed as having a linguistic deficit in both languages and as a result are susceptible to accusations of languagelessness from both their Anglophone and Hispanophone peers, further reinforcing the double bind that these individuals face. In fact, heritage speakers face scrutiny and judgment toward their Latino identity by other Latinos simply for speaking English and having a connection to it ([Rosa 2019](#)). Researchers are currently exploring these complex dynamics, but more work is needed to better understand the role they play in speech perception.

As previously described, listeners have certain expectations about the way a speaker “should” speak or sound that are formed based on external factors such as speaker appearance or identity. Furthermore, it is often the case that “... listeners’ immediate reactions to speaker Hispanicity can trigger linguistic assumptions, prompting differential expectations ... [and] these unconscious biases can result in the proliferation of linguistic violence toward heritage speakers, regardless of the phonetic variants they employ” ([Chappell 2020](#), p. 49). Simply put, heritage speakers face judgment based on both their linguistic production in Spanish and the way they are perceived by the listener, which is rooted in notions of identity, belonging, etc. In one illuminating study, [Chappell \(2020\)](#) investigated the extent to which listeners’ perceptions of speakers’ Hispanicity, intelligence, confidence, and other social attributes may be altered based on how the speaker produces the orthographic <v> and the orthographic in Spanish, which are both graphemes of the phoneme /b/ and can be realized as either [v], [b], or [β], depending on the phonological environment and dialectal characteristics. Overall, their findings indicated that ideologies and attitudes differentially affected each speaker and prompted different sets of judgements and attitudes based on both speaker realization of the variant and listener assumptions of speaker Hispanicity. Such results indicate the need to analyze the extent to which these expectations may impact speech processing, especially the extent to which the differential assumptions that listeners develop based on the information they receive about the speaker influence their perception.

In this study, we therefore distinguished between heritage *speakers* and *learners*. We defined heritage *speakers* as “asymmetrical bilinguals who learned language X—the ‘heritage language’—as an L1 in childhood, but who as adults, are dominant in a different language” ([Benmamoun et al. 2014](#), p. 260). For the purposes of this study, the key difference between *speakers* and *learners* is related to the role of education in the acquisition of primary productive skills. Heritage *learners*, like heritage *speakers*, have a cultural and ancestral connection to the heritage language; however, as the term suggests, most of their productive skills in the heritage language were acquired in an academic setting, whether that be through language classes or bilingual education ([Montrul 2010](#)). We further narrowed the heritage *learner* definition to describe individuals who are either third- or fourth-generation Latinos, who are most susceptible to language loss and thus tend to be either receptive bilinguals or have limited receptive and productive abilities. We also included individuals who may not fall within these groups but still align in terms of their language skills (e.g., second-generation Latinos who, despite being expected to have strong skills in the heritage language, actually have limited receptive and productive skills). Thus, the primary distinction between *speakers* and *learners*, as conceptualized in this study, is that certain factors have led heritage *learners* to rely on external resources to acquire most of their heritage language skills.

1.3. The Current Study

In this study, we examined the effect that social information has on speech intelligibility, as well as how the listeners’ own identity may impact their perception of the speaker. We manipulated social and linguistic stimuli using a matched-guise methodology to better understand how different Latino social guises may prompt certain expectations on the part of the listener that can, in turn, affect speech processing. We aimed to understand

how social variables—both attributed to the speaker and the listener—may impact speech intelligibility. This study was therefore driven by the following questions:

1. Do social expectations influence whether heritage Spanish speakers are perceived as more or less intelligible when paired with different social guises (i.e., heritage *speaker* vs heritage *learner* guise)?
2. Do listener background variables affect the intelligibility of heritage Spanish speech, and do these variables moderate any potential guise effects?

We expected social guise to influence participants' intelligibility scores, potentially leading to the heritage *speaker* guises receiving higher scores and heritage *learner* guises receiving lower scores regardless of the audio stimulus. This hypothesis is driven both by the results from our validation study (reported below) indicating that U.S. Latinos may expect heritage *speakers* to be more fluent, native-sounding, and Latino than *learner* guises, and previous findings showing that social guise can affect speech processing depending on the extent to which the speech characteristics match listeners' expectations—which are rooted in a preexisting concept of how each guise “should” sound when speaking Spanish. Thus, we reasoned that speaker intelligibility might not be as objective as one might expect, but rather could be influenced by social factors. We also developed an exploratory hypothesis that the listener's own identity could moderate the guise manipulation, such that, for instance, listeners who identified Spanish as their L1 might exhibit a stronger guise effect than listeners who identified Spanish as their L2.

2. Guise Validation

Before analyzing the influence of the social guises on speech intelligibility, we first conducted a study to determine the effectiveness of the social guises we designed. These results serve as an initial comparison of participants' expectations for heritage *speakers* and heritage *learners* and help inform the results described in this paper.

2.1. Materials and Methods

2.1.1. Stimuli

The stimuli used for this study were developed to highlight the key social and language background differences between the two guise types. Both *speakers* and *learners* have a cultural and ancestral connection to the Spanish language; however, they differ with respect to when and where they acquired their heritage language. For the purpose of this study, heritage *speakers* are asymmetrical bilinguals who underwent a shift in language dominance from Spanish to English in early childhood, often around the time they entered primary school. Heritage *learners*, on the other hand, acquired most of their Spanish skills in the classroom through foreign or second language classes, often later in life than heritage *speakers*. Some heritage *learners* may enter the classroom as receptive bilinguals—they can understand Spanish, but they do not speak it—whereas others enter the classroom with some exposure to Spanish, but lack both productive and receptive skills in the language. These characteristics were used to guide the creation of the guises for this study (Appendix A).

2.1.2. Participants

We used the online platform Prolific to recruit 35 raters who were (1) U.S. citizens, (2) identified as Latino/Hispanic, and (3) claimed English as one of their early or first languages. All participants reported being born in the United States, with the exception of one participant who was born in Chile and moved to the United States prior to entering primary school. To shed light on the social and linguistic environment in which the participants were raised, participants were asked to provide information on their parents' birthplace and languages spoken. Parents were from the United States (23), Mexico (37), El Salvador (4), Chile (2), Guatemala (1), Cuba (1), Honduras (1), and Brazil (1). Most were Spanish–English bilinguals (39), but some spoke only Spanish (19) or English (10). One

parent was bilingual in Spanish and Portuguese, and another was trilingual in English, Spanish, and Portuguese.

2.1.3. Procedures and Analysis

Participants were asked to complete an online survey where they rated their expectations for heritage *speaker* and *learner* guises on three questions. First, participants were presented with a short biographical description providing information about a fictional individual's language background, including their family and upbringing. After reading the description, participants were asked to rate on a 9-point Likert scale how fluently they expected the person to speak Spanish (1 = *beginner/non-native* and 9 = *advanced/native-like*)¹ and how accented they expected the person to sound (1 = *sounds non-native* and 9 = *sounds native*), based only on the information provided. Participants were also asked to rate their perception of the individuals' relationship to the Latino identity (1 = *not of Latino descent/no relation* and 9 = *of full Latino descent*). After rating each of the eight social guises, participants completed a language background questionnaire, language experience questionnaire, and language attitudes questionnaire. Although the survey was entirely in English and a specific level of Spanish proficiency was not required, we collected self-reported proficiency scores. Participants reported their abilities in Spanish and English speaking, listening, reading, and writing using the scale 1 = *poor*, 2 = *needs work*, 3 = *good*, 4 = *very good*, and 5 = *native speaker command*. Participants reported on average that listening was their strongest skill in Spanish ($M = 3.86$, $SD = 1.29$) and writing was their weakest skill ($M = 2.77$, $SD = 1.21$).

3. Intelligibility Task

3.1. Materials and Methods

3.1.1. Stimuli

The pre-recorded audio stimuli used for the task were taken from the Archive of L1 and L2 Scripted and Spontaneous Transcripts and Audio Recordings Corpus (ALLSTAR) developed at Northwestern University. The Spanish heritage speakers in this corpus were between the ages of 18 and 22 and were born in the United States, and each reported Spanish as their first language and English as their second language, acquired between the ages of 5 and 8. They also reported a distinct shift in language dominance from 100% use of Spanish to less than 20% use after early childhood, and none reported taking Spanish language courses. For a detailed description of the participants who recorded the audio stimuli, see [Blasingame \(2018\)](#).

We selected four Spanish heritage speakers, two male and two female, from the Corpus: Speaker 100, Speaker 101, Speaker 105, and Speaker 107. The ALLSTAR corpus provides self-reported proficiency scores for reading, writing, speaking, and listening. The scale was 0 = *none* to 10 = *perfect*. Speaker 100 reported a 9 for both speaking and listening ability in Spanish, and Speaker 101 reported an 8 for both skills. Speaker 105 reported the lowest scores, with a 5 for speaking and a 7 for listening, and Speaker 107 reported the highest, with a 10 for both skills.

While there is no information on the dialects of Spanish spoken by the speakers, there are metadata on the languages spoken by each speaker and the country/countries they have lived or spent a significant amount of time in. Speaker 100 reported speaking Spanish, American English, and Portuguese, with Spanish and English being their familial languages and the languages they used with friends and at school, while Portuguese was used only with classmates and teachers. They did not report spending a notable amount of time in a country other than the United States. Speaker 101 reported speaking Spanish with family, friends, and co-workers, and Quechua mostly while in Peru with extended family. They reported speaking English while in the United States with siblings, co-workers, classmates, and teachers. Speaker 105, a speaker of Spanish, French, and American English, did not report spending a significant amount of time in a country other than the United States. They reported using Spanish and English with family, coworkers, and roommates and French

with their spouse and friends. Finally, Speaker 107 reported speaking American English, Spanish, French, and Italian. They used English with coworkers, friends, classmates, and teachers and Spanish with family, extended family, and housemates, and at school. They also indicated that they used French and Italian at school and Italian with extended family. Speaker 107 reported spending a significant amount of time in Argentina.

We sampled 30 sentences per speaker from a total of 120 hearing noise test (HINT) sentences provided in the ALLSTAR corpus. HINT sentences were initially designed to be of similar length and syntactic structure and roughly equal intelligibility (Nilsson et al. 1994); however, it should be noted that these stimuli were not developed expressly for use with talkers from a variety of language backgrounds. In spite of this, we do not believe there are any stimuli that are notably more or less difficult. We masked each sentence in speech-shaped noise at SNR level -5 to simulate a real-world listening scenario, which often includes moderate background noise. Each speaker was presented once with a *speaker* guise and once with a *learner* guise for a total of 8 guises, 4 *learner* and 4 *speaker*.

3.1.2. Participants

For this study we recruited 50 new listeners (i.e., listeners who did not participate in the guise validation study) using Prolific. Participants were pre-screened to ensure that they (1) identified as Hispanic and/or Latino, (2) were born in the United States or had lived most of their life in the United States, and (3) had strong enough receptive abilities in Spanish to be able to listen to the Spanish stimuli and complete the study. Receptive skills for each of the listeners were confirmed through the language background questionnaire where participants self-reported their Spanish abilities in listening, speaking, reading, and writing on a scale of 1 = *very low proficiency* to 9 = *native/native-like proficiency*. Although the scales used for self-reported proficiency were not identical, we still compared listeners' scores with raters' scores from the guise validation study. Overall, we can see that raters and listeners compare, with Spanish listening being their strongest skill ($M = 7.96$, $SD = 1.33$) and writing being their weakest ($M = 6.40$, $SD = 2.18$), which is common in the heritage community. Prolific pre-screening allowed us to restrict the participant pool by current country of residence, ethnicity, first language, and fluent languages. We instructed participants to use headphones for the entirety of the study, which we verified by asking them to indicate whether or not they had done so upon completion of the task. After excluding participants who did not use headphones during the task ($n = 5$), data from 45 participants were available for analysis.

3.1.3. Procedure and Analyses

Participants completed a matched-guise transcription task. The task was structured such that participants were presented first with the social guise followed by 15 sentences from a single speaker. Each set of 15 sentences varied across talkers; that is, each talker was presented producing a unique set of 15 sentences. Each sentence was presented to participants only once, after which they were immediately prompted to transcribe the entire sentence. Participants were not constrained for time while transcribing.

Upon completion of the transcription and ratings tasks, participants were asked to respond to a language background questionnaire and language attitudes questionnaire to gain insight into their beliefs regarding the relationship between the Spanish language and Latino identity. Participants were asked to share information such as the age at which they began speaking English and Spanish; their self-reported proficiency in reading, writing, speaking, and listening in both English and Spanish; their comfort level speaking English and Spanish; the extent to which they thought speaking Spanish is integral to the Latino identity; and so on.

As part of a larger study on social information and speech perception, we also collected scalar, listener-based ratings on speaker proficiency, accentedness, and relationship to the Latino identity. In this manuscript, we focus on the intelligibility data.

4. Results

4.1. Guise Validation

As a first step, we computed descriptive statistics for each guise type for the fluency, accentedness, and identity constructs. As shown in Table 1, participants expected the speaker guise to be more fluent, less accented (higher scores indicate less accent), and to have a stronger connection to the Latino identity than the learner guise.

Table 1. Descriptive statistics by guise type for each construct.

| Construct | Speaker Guise | Learner Guise |
|-----------------|---------------|---------------|
| Fluency | 5.01 (2.05) | 3.33 (1.75) |
| Accentedness * | 4.57 (2.37) | 3.01 (1.96) |
| Latino Identity | 5.99 (2.12) | 4.59 (2.10) |

* Accentedness was found to be the only variable that varied significantly across guise types.

To determine if these differences were statistically significant, we fit separate linear mixed-effects models, one per construct, with guise type as a fixed effect (contrast-coded; learner = -0.50 , speaker = 0.50) and by-listener and by-item random intercepts. We used a likelihood ratio test to compare these models against a baseline, intercept-only model that did not include guise type. For fluency and Latino identity, adding guise type did not significantly improve model fit: for fluency, $\chi^2(1) = 2.91$, $p = 0.088$, and for Latino identity, $\chi^2(1) = 2.94$, $p = 0.086$. The estimated mean difference for fluency was 1.69 (95% CI = $[-0.35, 3.73]$), and the estimated mean difference for Latino identity was 1.40 (95% CI = $[-0.26, 3.06]$). In contrast, adding guise type to the accentedness model significantly improved fit: $\chi^2(1) = 4.93$, $p = 0.026$. For accentedness, the estimated mean difference was 1.56 (95% CI = $[0.24, 2.88]$). Overall, then, from a descriptive standpoint, the guise type manipulation seemed to generate differential expectations for the *speaker* and *learner* guises. However, this difference only reached statistical significance for accentedness.

4.2. Intelligibility Task

Next, we evaluated the effect of guise type on intelligibility, which we operationalized as the proportion of words that were transcribed correctly (i.e., intelligibility = correctly transcribed words/total words in the utterance). Descriptively, intelligibility was high overall, but the mean for the *learner* guise ($M = 0.74$, $SD = 0.29$) was slightly higher than the mean for the *speaker* guise ($M = 0.72$, $SD = 0.31$). We followed the same procedure to assess significance. We fit models with and without guise type and used a likelihood ratio test to compare them. These models contained by-listener and by-item random intercepts. It was not possible to model by-talker random effects because only four talkers were included in the study. Therefore, to control for the effect of talker, we created a contrast-coded control covariate, which we integrated into the models as a fixed effect. As in the previous models, we contrast-coded guise type. Adding guise type to the intelligibility model did not improve model fit, $\chi^2(1) = 1.00$, $p = 0.318$, and the estimated difference between *speakers* and *learners* was very small, *estimate* = -0.03 (95% CI = $[-0.08, 0.03]$). Thus, guise type did not affect the accuracy with which listeners transcribed speech.

We hypothesized that listener demographic variables could modulate the effect of guise type on intelligibility; that is, that guise type might only affect certain types of listeners, or listeners who show certain characteristics. To test this exploratory hypothesis, we fit a series of models focusing on the potential impact of three listener background variables: (1) whether listeners identified Spanish as their L1 or L2, (2) the extent to which they felt it was important for Latinos to speak and maintain their Spanish, and (3) the extent to which they felt that someone who identifies as Latino should know Spanish. The first variable was a binary response, whereas the latter two variables (speak and maintain Spanish) were scalar ratings given on a 7-point Likert scale (1 = *strongly disagree* and 7 = *strongly agree*). There were 20 listeners who identified Spanish as their L1, and descriptively, the mean rating listeners gave to both Likert-type items was high, indicating

moderate overall agreement: maintain Spanish, $M = 6.11$ ($SD = 0.99$), and know Spanish, $M = 5.11$ ($SD = 1.39$). We followed the same modeling procedure, fitting three models, one per listener variable, to the intelligibility scores. As in the guise type model, these models included by-listener and by-item random effects and a contrast-coded control covariate for talkers. The primary effect of interest was the interaction between the listener background variable and guise type, which, if significant, would suggest that the listener background variable mediated the effect of the guise manipulation. We compared each model to a baseline, intercept model without fixed effects for guise type, the listener variable, and the interaction term.

For the listener L1 variable, the model with the listener L1 by guise type interaction was a significantly better fit than the baseline model, $\chi^2(3) = 10.41$, $p = 0.015$. However, estimates showed that the improvement in fit was due to the main effect of listener L1. Listeners who indicated Spanish as their L1 transcribed the stimuli significantly more accurately than listeners who self-identified as L2 speakers (*estimate* = 0.11, $p = 0.003$, 95% CI = [0.04, 0.19]). The interaction term with guise type did not reach significance (*estimate* = 0.01, $p = 0.314$, 95% CI = [−0.01, 0.04]). To confirm that listener L1 did indeed affect intelligibility, we respecified the model without the interaction term. This model, which included guise type and listener L1 but not their interaction, was a significantly better fit than the baseline model, $\chi^2(2) = 9.40$, $p = 0.009$. The model with the Likert item focusing on the importance of maintaining Spanish did not improve fit significantly, $\chi^2(3) = 3.67$, $p = 0.299$, nor did the model focusing on the importance of knowing Spanish, $\chi^2(3) = 7.60$, $p = 0.055$. For the sake of completeness and parity, we fit one additional model for each predictor, again without the interaction term, to test the relationship between the listener background variable and intelligibility. These models confirmed the findings reported above: integrating the background variables related to the importance of maintaining and knowing Spanish did not significantly improve model fit, $\chi^2(2) = 2.76$, $p = 0.251$ and $\chi^2(2) = 3.05$, $p = 0.217$, respectively. Taken together, these results suggest that other than listeners' self-reported L1 or L2 status, the listener variables had little impact on intelligibility, and none of them moderated the relationship between guise type and intelligibility.

5. Discussion

Regarding our first research question, guise type did not affect intelligibility, despite the fact that the guise validation showed a descriptive trend toward a difference in expectations concerning heritage *speakers'* and *learners'* Spanish ability, a trend that reached significance for accentedness. This finding runs counter to [Babel and Russell \(2015\)](#), who reported that the presence of social information alone triggered differences in intelligibility. Listener sampling practices could account for these differences. Unlike previous research, our target population encompasses individuals who, on the whole, have much more experience with the accent in question than participants in previous studies. [McGowan \(2015\)](#), for example, compared groups of listeners based on prior experience with and exposure to the target non-native accent and found that increased experience with the accent significantly predicted performance on the intelligibility task. The participants in our task likely have had a substantial amount of experience with Spanish speakers in the U.S. who demonstrate varying degrees of fluency and accentedness; thus, listeners in our study likely performed well on the task due to high experience levels with "heritage accented" speech—a variety of Spanish being further investigated for systematic productive differences in phonetic and phonological features ([Benmamoun et al. 2010](#)). Increased exposure to a "heritage accent" would allow for less listening effort to be exerted because as listeners acquire more experience throughout their lifetime with a given accent, they become increasingly able to understand it. This improved understanding has also been documented for predictive language processing, where experienced listeners face fewer processing demands related to lexical access when processing non-native speech than unexperienced listeners ([Porretta et al. 2020](#)).

With respect to our second (exploratory) research question related to listener background variables, we did not find that the importance listeners ascribed to knowing and maintaining Spanish affected their ability to understand heritage Spanish, nor did it mediate the effect of guise type. This null finding is not especially surprising given that, as outlined above, listeners in this study were arguably accustomed to processing a range of heritage Spanish accents. In addition to any benefit listeners may have derived from their previous exposure to heritage Spanish, it is also important to consider the greater socio-political factors that may be at play. For example, listeners in this study may feel more connected to the specific social guises used here than those in previous research settings and may be aware of the difficulty that Latino families in the U.S. face to maintain their language. Given that language loss is common in Latino families, listeners' possible knowledge of the challenges that heritage speakers face may have mitigated any potential links between their personal beliefs and the guise manipulation. Thus, although listeners clearly valued maintaining Spanish and saw Spanish as central to the Latino identity, those attitudes did not appear to shape their ability to transcribe speech as robustly as is seen when native speakers perceive unfamiliar non-native speech (Rubin 1992). At the same time, it is important to acknowledge that additional social factors related to language ideologies and attitudes within the Spanish-speaking community could also influence results. Spanish, as is the case with many languages, has a hierarchical social structure, such that certain Hispanic countries and varieties are regarded as more prestigious than others (Zentella 2017). For the purposes of our study, we chose to include a variety of Spanish-speaking backgrounds when designing the social guises to encapsulate multiple heritage identities. However, we recognize that listeners' attitudes may have triggered a variation of biases that could have influenced results. Future studies may benefit from analyzing in further detail the relationship between speaker and listener backgrounds and the potential effect this may have on intelligibility and overall speech processing.

In addition to the data presented here, we collected accentedness ratings and other subjective measures from the same listeners. A future direction is to directly compare these subjective measures to the objective measures reported in this manuscript. It is likely that subjective and objective measures may be differentially affected by social guise information. By comparing these subjective ratings with intelligibility scores, we can understand how each guise type may affect different aspects of speech perception and to what extent these perceptual factors interact with each other. Furthermore, future research would benefit from investigating the effect of social information on comprehensibility given that research has shown that high intelligibility does not entail the ability to comprehend the speech well (Munro and Derwing 1995; Nagle and Huensch 2020; Schmid and Yeni-Komshian 1999). Comprehensibility differs from intelligibility in that intelligibility is a measure of actual understanding, irrespective of the effort involved, whereas comprehensibility reflects the individual's subjective evaluation of processing effort (Munro and Derwing 1995). Research investigating the potential influences on comprehensibility could benefit heritage programs as enrollment in courses across the country becomes more common (Beaudrie 2012). As described, the Spanish heritage community is inherently heterogeneous, with a key difference being the variety of Spanish that speakers are exposed to in the home. Differences in home varieties combined with the influence of English make the heritage classroom a linguistically rich setting; however, this may have certain effects on speech processing other than intelligibility. For this reason, integrating comprehensibility into this line of research could help shed light on the overall impact of expectation and ideology on processing effort. To that point, one recent study showed that listeners are sensitive to a social bias manipulation when evaluating L2 speech, and that the strength and even the direction of that effect interact with listener background characteristics such as age (Taylor Reid et al. 2019). It is important to note that the failure to find an influence of guise on transcription ability in the current study may suggest that either intelligibility may be less susceptible to the influence of social information or that different populations of listeners

may show different influences of social information during perception. Both possibilities should be investigated in detail in future work.

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Appendix A

Social Guises

Speaker Guise 1: The speaker you are about to hear was born in the United States to Mexican immigrant parents. Their first language is Spanish, and they began acquiring English during primary school. They still frequently use Spanish at home and with members of the community; however, English has become their dominant and most used language.

Speaker Guise 2: The speaker you are about to hear was born in the United States. Their father is a second-generation Cuban American, and their mother moved to North Carolina from Puerto Rico at age 10. Their father speaks very limited Spanish but can understand very well and their mother has maintained fluency since her move from Puerto Rico. The speaker acquired some Spanish speaking skills from their mother and grandparents, but can understand Spanish much better than they can speak. Their dominant language is English.

Speaker Guise 3: The speaker you are about to hear was born in the United States to a non-Latina mother and a Cuban American father. Their parents spoke only Spanish in the home during their first 7 years; however, the speaker began to lose some fluency in Spanish after starting primary school. They now claim to speak mostly English with their parents but continues to use some Spanish.

Speaker Guise 4: The speaker you are about to hear is a second-generation Cuban American. Their mother was raised mostly speaking Spanish with her parents; however, their father was raised to speak only English. As a result, the speaker grew up with stronger listening skills from listening to their mother and grandparents, but they lacked proficiency in their speaking abilities and have begun taking university Spanish courses to strengthen them.

Learner Guise 1: The speaker you are about to hear is a third-generation Mexican American. Their parents mostly understand Spanish and have limited speaking abilities. The speaker's speaking and listening abilities in Spanish are limited; however, they had some exposure growing up from their grandparents. The speaker tried to strengthen their skills in Spanish by enrolling in university courses; therefore, most of their abilities have been acquired in the classroom.

Learner Guise 2: The speaker you are about to hear was born in the United States to a U.S.-born mother and a Guatemalan immigrant father. The family primarily spoke English in the home, but the speaker was still exposed heavily to their father's cultural background.

The speaker acquired most of their abilities from Spanish classes in high school and during their university studies.

Learner Guise 3: The speaker you are about to hear was born in the United States to Puerto Rican parents who moved to Arizona in their early adolescence. Their parents became English-dominant speakers after moving to Arizona and as a result, the speaker did not speak Spanish in the home. They grew up with some exposure to Latino pop culture, but it was limited. They began acquiring Spanish in high school.

Learner Guise 4: The speaker you are about to hear was born in the United States to a second-generation Mexican American mother and non-Latino, U.S.-born father. They grew up with some Spanish exposure from their mother's parents, but overall, their Spanish skills were limited growing up prior to enrolling in Spanish language learning courses in high school and university.

Appendix B

Self-reported proficiency scores.

Table A1. ALLSTAR Corpus heritage speakers *.

| | Spanish Speaking | Spanish Listening | Spanish Reading | Spanish Writing | English Speaking | English Listening | English Reading | English Writing |
|-------------|------------------|-------------------|-----------------|-----------------|------------------|-------------------|-----------------|-----------------|
| Speaker 100 | 9 | 9 | 8 | 7 | 9 | 9 | 8 | 7 |
| Speaker 101 | 8 | 8 | 9 | 9 | 9 | 9 | 9 | 8 |
| Speaker 105 | 5 | 7 | 6 | 6 | 8 | 8 | 8 | 8 |
| Speaker 107 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

* The numbers in each column represent the actual score reported by each speaker.

Table A2. Guise validation raters *.

| | Mean | SD |
|-------------------|------|------|
| Spanish Speaking | 3.20 | 1.39 |
| Spanish Listening | 3.86 | 1.29 |
| Spanish Reading | 3.29 | 1.32 |
| Spanish Writing | 2.77 | 1.21 |
| English Speaking | 4.91 | 0.28 |
| English Listening | 4.94 | 0.24 |
| English Reading | 4.94 | 0.24 |
| English Writing | 4.91 | 0.28 |

* The scale for the raters was different from the scale used for the intelligibility study listeners. This study's scale was 1 = poor, 2 = needs work, 3 = good, 4 = very good, and 5 = native speaker command.

Table A3. Intelligibility study listeners *.

| | Mean | SD |
|-------------------|------|------|
| Spanish Speaking | 7.27 | 1.85 |
| Spanish Listening | 7.96 | 1.33 |
| Spanish Reading | 7.49 | 1.66 |
| Spanish Writing | 6.40 | 2.18 |
| English Speaking | 8.82 | 0.53 |
| English Listening | 8.87 | 0.55 |
| English Reading | 8.91 | 0.42 |
| English Writing | 8.80 | 0.81 |

* The scale used for this study was 1 = very low proficiency to 9 = native/native-like.

Note

¹ An anonymous reviewer noted that the proficiency scale may be limited given that advanced proficiency is often lower on the scale than "native-like" proficiency. Although this is true, we chose to combine these two for the purposes of our study but we acknowledge that a more detailed scale could have been used instead.

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