Examining the (mini-) variable swarm in the Spanish of the Southeast

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0. Abstract

The present investigation aims to facilitate our understanding of Spanish in the Southeastern United States – a region that despite its rapid growth over the last two decades, has received little attention in the literature. Analyses of four linguistic variables indicated that while second generation heritage speakers produced significantly more English discourse markers than first generation immigrants, realization of phonetic variables was similar across groups. An examination of the overall patterns across the four variables (i.e., “variable swarm”), however, suggests that heritage speakers are beginning to integrate contact-induced characteristics into their speech faster than immigrants. By examining multiple variables simultaneously, the present study therefore offers important insight into the processes of new dialect formation, convergence, and leveling in an understudied region.

Keywords: Variable swarm, new dialect formation, forced-alignment, heritage speakers, discourse markers, phonetics

1. Introduction

Over the past two decades, the Southeastern United States has witnessed a vast increase in the Hispanic population. In many ways, North Carolina is representative of this increase in the entire region. According to the U.S. Census Bureau, North Carolina’s Hispanic population increased by 111% between the years 2000 and 2010, and a more recent report by the Pew Research Center documents that roughly 9% (890,000) of the state’s total population is of Hispanic descent. A closer examination of the statistics indicates that 44% of Hispanics residing in the state are foreign-born, while 56% were born in the United States. Regarding demographics, 60% are of Mexican origin while the remaining 40% are from other Spanish-speaking regions. Immigrants from Central America, and more specifically El Salvador and Guatemala, comprise the second-largest group in the state (Mann, 2012).

Although there is no shortage of linguistic research on Spanish in the U.S., the majority of investigations have focused on well-established, long-standing urban communities in regions such as the Northeast, Southwest, and upper-Midwest (c.f. Otheguy & Zentella, 2012; Poplack, 1978; Silva-Corvalán, 1994, among others). Spanish in the Southeast has received considerably less attention, despite the rapidly increasing population of Hispanics in the region.¹ Thus, one of the primary goals of the present study is to analyze the speech of both foreign-born immigrants (generation 1; hereafter IMs) and heritage speakers (generation 2; hereafter HSs) residing in central North Carolina (Raleigh-Durham). By analyzing multiple variables, as will be described below, we aim to provide an initial characterization of the Spanish spoken in this region and better understand the processes of cross-linguistic influence at the earliest stages of language contact.

Of additional importance in this present study is the concept of the “variable swarm.” Many sociolinguistic investigations include the analysis of one particular linguistic trait and aim to assess the relationships between that specific characteristic and one or more sociolinguistic factors. As pointed out by Thomas (2015, p. 3), however, “[e]ven if one variable shows noteworthy patterns that provide clues about social identities of speakers, it cannot provide a complete picture of the intersecting identities that individuals exhibit. Each linguistic variable may reveal new social meanings and patterning. What is needed is inquiry that compares a large number of diverse variables.” Following Thomas’s suggestion, this study includes analyses of four distinct variables that are known to vary based on speakers’ linguistic experience (i.e., bilingual versus monolingual), as well as across dialects: realization of intervocalic /bdg/ (Carrasco, Hualde, & Simonet, 2012; Rao, 2015), Spanish vowels (Alvord & Rogers, 2014; Chládková, Escudero, & Boersma, 2011), prosodic rhythm (Shousterman, 2014; Carter & Wolford, 2016), and bilingual discourse markers (Torres, 2002, 2011; Torres & Potowski, 2008). Examining linguistic variation through multiple variables simultaneously allows for the formation of a more nuanced and complete understanding of the structure and trajectory of Spanish in the region. Crucially, such a wide-ranging lens also provides the opportunity to observe processes of new dialect formation, convergence, and leveling as they progress (Kerswill & Williams, 2000).

Examination of such a diverse range of variables is made possible by the utilization of developing methodologies in speech recognition and computational linguistics. Specifically, the project represents the first use of a novel forced alignment system for Spanish data (*FASE*) to automatically generate time-aligned phone and word boundaries from an orthographic transcript, greatly increasing the efficiency and scope of the current analyses. The specifics of model construction and application are described below.

Prior to discussing each of the variables in the swarm, a description of the overall methodology will be presented. Subsequent sections include a description of the previous literature, data analysis, and results of each of the four variables in the swarm, namely /bdg/,

¹ While linguistic research in the Southeast has been conducted recently, most studies focus on Latino English (see, for example, Carter, 2005; Wolfram, Kohn, & Callahan-Price, 2011).

vowels, prosodic rhythm, and bilingual discourse markers. Discussion of the variable swarm will be described next, followed by some general closing remarks.

2. Overall methodology

2.1. Participants

Twenty four participants (11 men and 13 women) were included in this study and were subdivided into two groups: immigrant speakers (IMs) and heritage speakers (HSs). The IMs were foreign-born first generation immigrants and the HSs were second generation speakers who were either born in the United States or arrived by the age of three.² Seventeen of the participants were of Mexican heritage, whereas 7 were from Central America (Guatemala and El Salvador). Ages ranged from 20 to 53 years, with an average age of 27.3 years (see Appendix A for additional demographic information)

2.2. Data collection

The data for this investigation were obtained from sociolinguistic interviews conducted with each participant. Each interview lasted between 30 and 60 minutes and included general questions about experiences living in the United States and abroad (e.g., similarities and differences, customs, etc.). Interviews were recorded with Zoom H2 digital recorders (44.1 kHz, 16 bit). Quiet locations were selected to ensure ambient noise was reduced as much as possible.

2.3. Aligner

Interviews were orthographically transcribed and then force-aligned using the *Forced Alignment System for Español (FASE)* (Wilbanks, 2015). Drawing on technology from speech recognition, *FASE* utilizes 5-state, continuous density, 4-mixture Gaussian Hidden Markov Models (HMMs) to model individual phones. Orthographic representations are converted to a linear series of phone HMMs and phone and word boundaries are automatically generated. As will be described in greater detail in the following sections, acoustic measures of specific segments were extracted from the forced-aligned textgrids using the appropriate automated procedures (i.e., intensity, vowel formants, segment duration) in Praat (Boersma & Weenink, 2016). The application of *FASE* to the current data set has greatly increased the amount of data that can be analyzed for each variable by orders of magnitude (see Labov, Rosenfelder, & Fruehwald, 2013).

² The G2 participants in this study fit traditional descriptions of heritage speakers. For additional definitions, see Escobar & Potowski (2015).

3. Lenition of /bdg/

3.1. Previous research

In contrast to English, where /bdg/ are produced as stop consonants almost exclusively, Spanish /bdg/ can be realized with either the occlusive allophones [bdg] or approximants [βðɣ] depending on surrounding phonetic context. In many dialects of Spanish, the allophones are in complementary distribution, with the stop allophones occurring after pauses and homorganic consonants (i.e., nasals, and in the case of /d/, also /l/) and the approximants in all other contexts (Hualde, 2005, among many others). Investigations examining the acoustic properties of /bdg/ have revealed that lenition is a gradient phenomenon that is influenced by a variety of linguistic and extralinguistic factors (Carrasco et al., 2012; Eddington, 2011; Hualde, Simonet, & Nadeu, 2011).

The present investigation focuses specifically on addressing questions of dialectal variation in the production of /bdg/ and how HSs and IMs might differ with regard to the magnitude of weakening. Regional variation in the production of voiced obstruents is well-documented, indicating that some Central American and Highland varieties exhibit a greater tendency for stop realizations after glides and all consonants when compared to other varieties (Lipski, 1994). Stop-like productions in intervocalic position – the context in which these sounds are most subject to weakening – have also been documented in some Central and South American varieties, although in some cases the greater degree of constriction may be attributed to contact with indigenous languages (Lipski, 1994). Acoustic and quantitative analyses have confirmed these trends, highlighting the gradient nature of lenition and revealing that degree of weakening may not be consistent across all dialects of Spanish (Carrasco et al., 2012; Colantoni & Marinescu, 2010; Eddington, 2011).

Research examining bilingual speakers' pronunciation of /bdg/ has revealed that HSs, including those who overheard but did not speak Spanish actively during childhood, closely approximate monolingual norms regarding lenition (Au, Knightly, Jun, & Oh, 2002; Knightly, Jun, Oh, & Au, 2003). In addition, Rao (2015) noted that HSs produced a higher rate of pure approximants (i.e., most weakened variants) in comparison to tense approximants and stops, as well as reported a similar influence of stress, word position, and task as has been documented in monolingual varieties.

The inclusion of HSs and IMs from two different regions will permit further examination of the influence of generation and dialect on the realization of /bdg/ in the Hispanic community under study.

3.2. Methodology

To assess the degree of lenition of intervocalic /bdg/, the intensity difference (*IntDiff*; Hualde et al., 2011) was calculated by subtracting the minimum intensity of the consonant from the maximum intensity of the following vowel. Small differences in intensity suggest weakened

productions, whereas larger differences indicate more occlusive-like productions. The intensity difference between the /bdg/ token and the following vowel was measured and extracted using a Praat script for all intervocalic /bdg/ instances in the aligned interviews. A total of 15,828 were analyzed (5,046 /b/; 8,527 /d/; 2,255 /g/). The difference measures were then submitted to a Linear Mixed model in R/Rbrul(R Core Team, 2008; Johnson, 2009) with *IntDiff* as the dependent variable and consonant (i.e., /b/, /d/, /g/), following vowel, generation (HS or IM), region of origin (Central America or Mexico,) and speaker gender as independent variables. Speaker was included as a random effect to control for individual variation.

3.3. Results

The statistical analyses revealed that the main effects of region of origin, generation, and gender failed to reach statistical significance (generation: $t = 0.719$; region: $t = -1.246$; gender: $t = -0.034$, respectively), indicating that averaging across all contexts, all groups produced intervocalic /bdg/ with similar degrees of lenition. Figures 1 and 2 present the mean values for each generation and region, respectively.

Figure 1. Mean intensity difference for HSs and IMs.

Figure 2. Mean intensity difference by region (Central America and Mexico).

Although there were no significant main effects of generation or region, additional tests revealed a significant interaction between consonant and region/generation ($p = 5.08e-06$), suggesting that the intensity difference of specific consonants depended on both the generation and the region of origin of the speaker. The significant interaction can be best understood by examining the conditional inference tree presented in Figure 3. Conditional inference trees provide a visual representation of where significant divisions occur in the data, with those splits represented as a binary branching tree. The boxes at the bottom include the total number of tokens and mean intensity difference for each branch (see Tagliamonte & Baayen, 2012).

Figure 3. Conditional inference tree including all variables. Values after “y =” represent mean intensity differences.

As shown in Figure 3, consonant place of articulation (node 1) significantly influenced the realization of intervocalic voiced obstruents, in that /d/ was characterized by more weakening than /b/ and /g/ regardless of region or generation. Within each branch of nodes 2 and 13, however, the interaction between region of origin, generation, and consonant becomes evident. Regarding region, Mexican informants’ productions of /b/, /d/, and /g/ were more lenited overall than those produced by Central Americans. However, examining nodes 3 and 14 (Central American speakers) and nodes 8 and 17 (Mexican speakers) reveals that the HSs and IMs from each region exhibited opposite patterns of lenition: While Central American HSs’ productions of /b/, /d/, and /g/ were more occlusive (i.e., larger intensity difference) relative to those produced by the Central American IMs, the opposite pattern was observed for the Mexican speakers. Furthermore, /b/ was produced with a significantly smaller intensity difference than /g/ (nodes 5 and 9), but only among the IM speakers. The latter finding is not unexpected given previous studies have documented less lenition of /g/ than /b/ and /d/ in other monolingual varieties (see Carrasco et al., 2012). In summary, although there was no overall effect of generation or region of origin on the degree of lenition, the interaction between the variables suggests that HSs and IMs from different regions are producing these sounds differently and that the place of articulation of the consonant is more influential for IMs. Further exploration of this trend will be presented in section 7.

4. The vowel system

4.1. Previous research

In contrast to the English vowel system, which is characterized by a larger number of vowels that exhibit a wide range of variation across geographic regions, the Spanish vowel system consists of the five phonemic vowels /a e i o u/ that have traditionally been described as relatively stable both in terms of their timbre and their pronunciation across dialects (Hualde, 2005; Navarro Tomás, 1918, among others). Although cross-dialectal comparisons have revealed some minor quality and quantity differences (Chládková et al., 2011, Quilis & Esgueva, 1983), research examining bilinguals – both L2 learners of Spanish and HSs – suggests substantial variation in distribution and organization. One of the most salient differences concerns the position of /u/, which is often fronted (i.e., higher F2) in bilingual speech relative to monolingual norms (Alvord & Rogers, 2014; Cobb & Simonet, 2015; Grijalva, Piccinini, & Arvaniti, 2009; Menke & Face, 2010; Ronquest, 2012; Willis, 2005; among others). With specific reference to HSs, Ronquest (2012) found that /e/ was produced farther back in the acoustic space than traditionally depicted, and that the back vowel space was much more condensed relative to the front vowel space. Willis (2005) also noted that /a/ was more anterior in bilingual speech, more closely approximating English /æ/. In conjunction, the differences in the acoustic distribution of specific vowels often result in a somewhat more condensed vowel space for L2 learners and some bilinguals when compared to monolingual norms (see, for example, Menke & Face, 2010). The present study will further explore the potential for cross-dialectal and generational differences in vowel production in NC Spanish.

4.2. Methodology

A total of 125,640 monophthong vowels (32,270 /a/; 37,839 /e/; 19,356 /i/; 27,807 /o/; 8,368 /u/) were delimited with *FASE* and included in the analyses. Semivowels and those in contact with other vowels across word boundaries were excluded. The first and second formant frequencies (F1 and F2, respectively) were measured at the midpoint of each vowel using a Praat script, normalized with the *Lobanov* method with the *vowels* package in R, and analyzed via a series of statistical models.³ Separate Linear Mixed models for each vowel were run with normalized F1 and F2 as the dependent variables and generation, region, and gender as independent variables. Vowel duration was included as a covariate and speaker was included as a random effect in all models.

As previous research has established that bilinguals' vowel spaces are often condensed relative to monolingual systems (Menke & Face, 2010), the overall area of the vowel space

³ The Lobanov method of normalization was selected because it is one of the most efficient (vowel-extrinsic) methods in eliminating variation in vowel formants due to physiology while preserving sociolinguistic differences (see Adank, Smits, and van Hout, 2004).

(Convex Hull Area, hereafter CHA) for each speaker was calculated using the *convexHullArea* function in the *phonR* package for R. An ANOVA that included CHA as the dependent variable and generation, region of origin, and gender as independent variables was conducted. The interaction between generation and region was also included in order to assess potential generational differences across dialects.

4.3. Results

The mean values of the five Spanish vowels produced by each group of speakers are presented in Figure 4.

Figure 4. Overall vowel space of IMs (black) and HSs (gray).

As depicted in Figure 4 the vowels produced by the IMs and HSs were distributed relatively similarly in the acoustic space. Statistical analyses confirmed consistency in vowel production across groups, in that only /e/ exhibited a significant height difference ($t = -2.450$): IM speakers' /e/ was higher (lower F1) in the acoustic space than that produced by the HSs. A similar trend was observed for /i/, although the difference only approached significance ($t = -1.947$). No other comparisons of vowel height or backness across regions or generations reached statistical significance.

To gain a more holistic view of the vowel systems of both groups of speakers, the CHA for each speaker was calculated, as described in section 4.2. Comparisons across generations ($p = 0.546$), across regions ($p = 0.931$), and the interaction between generation and region ($p = 0.287$) failed to reach statistical significance. The similarity in the overall size and shape of the space is evident in Figure 4 based on the positions of the lines connecting each vowel. Further insight into the CHA for each group can be gained via examination of Figure 5.

Figure 5. Boxplot of Convex Hull Area (CHA) for HSs and IMs.

As depicted in Figure 5, IM speakers' CHA was slightly larger and also characterized by less variation than that of the HSs. This result is in line with previous studies that have reported a more condensed vowel space for bilinguals (learners) relative to monolinguals. Nevertheless, the lack of statistical differences across groups and regions indicate that HSs and IMs in this study are producing the Spanish vowels very similarly.

5. *Rhythm*

5.1. *Previous research*

Traditionally, languages have been divided into rhythm classes, based on their differential treatment of stressed vs. non-stressed syllables (Pike, 1945; Abercrombie, 1967). Languages that tend to show equal treatment of tonic and atonic syllables, where all syllables have approximately the same duration, are classified as syllable-timed languages. Most of the Romance languages, including Spanish, are generally considered to fall into this category. At the other extreme are stress-timed languages, where the rhythm is determined by the number of stressed syllables. In prototypically stress-timed languages the distance between stressed syllables is maintained through tonic vowel lengthening and atonic vowel reduction. Germanic languages, including English, show a stress-timed pattern (see Thomas & Carter, 2006; White & Mattys, 2007; Low & Grabe, 1995, among others).

Instead of being a binary distinction between rhythm classes, more recent research has found that rhythmic timing is gradient, and languages exist on a continuum between more or less stress/syllable-timed. As a result, several rhythm metrics based on duration measurements have been developed that allow rhythm to be quantified and compared across languages and dialects (Ramus, Nespor, & Mehler, 1999; White & Mattys, 2007; Low & Grabe, 1995). Here we follow recent literature on Spanish in contact with English and use the Pairwise Variability Index (PVI) (Low & Grabe, 1995; Grabe & Low, 2002) to examine possible rhythmic changes across generations in NC Spanish.

Previous research has found evidence of converged PVI values among bilingual speakers of English and Spanish. Carter (2005) shows the influence of Spanish on the Latino English of bilinguals in NC, as their PVI values were between those of Spanish and Anglo English. Likewise, Shousterman (2014) finds Spanish-like PVI values for Puerto Rican English in Harlem, again showing the influence of Spanish on their English. Shousterman notes that while more residents in Spanish Harlem are shifting to English as the dominant language, the substrate influence from Spanish is maintained since the dominant variety of English in the community is from speakers for whom English is not the first language. Finally, Carter and Woldford (2016) prove that English can also affect the Spanish rhythm of bilinguals in Texas, as their Spanish PVI values converge with their (already converged) Latino English values over time. Here we investigate the potential for rhythmic convergence during the early stages of language contact in NC Spanish.

5.2. Methodology

Using the aligned transcriptions from *FASE*, an additional script was run that converted each phoneme into either C(onsonant) or V(owel), allowing for a total of 59,311 vocalic comparisons. The values for nPVI were calculated using Correlatore (Mariano, 2014). To calculate PVI, the difference in duration of adjacent values is compared, producing a score that ranks the language or dialect on a scale. Higher vocalic PVI values reveal greater variability among vocalic intervals, indicative of a more typical stress-timed pattern. Conversely, more syllable-timed patterns show lower PVI values. Since vowel duration is affected by speech rate, PVI values are normalized by dividing the absolute difference between adjacent vowels by the mean duration, producing normalized PVI (nPVI) (Grabe & Low, 2002).

$$nPVI = \frac{\text{Absolute value of } V1-V2 \text{ (diff in interval length)}}{\text{Mean of } V1+V2 \text{ (controls for speech rate)}}$$

Figure 6. nPVI formula.

In order to account for final lengthening effects, all prepausal intervals were excluded. Fixed effects linear regression analyses were run on overall mean nPVI values. Independent variables were speaker gender, generation, and region.

5.3. Results

The mean nPVI values for each speaker are presented in Figure 7. Each point represents the mean value for one speaker, faceted by generation. The results for region are presented in Figure 8.

Figure 7. nPVI by speaker and generation.

Figure 8. nPVI by Region.

Linear regression analyses found no significant effects of generation ($p = 0.755$) or of region ($p = 0.913$). Still, some tendencies are evident. As seen in Figure 7, there is a great deal of variability in nPVI values, particularly among the HSs. Previous research has shown that HSs, with vastly different linguistic backgrounds and levels of proficiency in each language, often show increased variation as they undergo processes of leveling and koineization (Escobar & Potowski, 2015; see Trudgill, 1986; Kerswill, 2002). It is due to this variability that, in spite of the evident tendencies, results for generation fail to achieve statistical significance. At the same time, there is a trend for HSs to produce higher, more English-like nPVI values in comparison with the IMs. Of the seven speakers that produced mean nPVI values over 60, five of them are HSs.

6. Bilingual discourse markers

6.1. Previous research

Bilingual Discourse Markers (DMs) have received increased interest in recent years, in particular because of their “multifunctional” nature and high frequency that make DMs one of the first and most frequent type of lexical borrowing in situations of language contact (Torres, 2011). Among Spanish-English bilinguals in the United States, one may find Spanish DMs, such as *entonces* or *pues*, being used alongside their English counterparts, *so* or *well*. Bilingual DMs may coexist, with or without differing functions, or the DMs from the dominant language may replace those in the subordinate language (Torres, 2011). In this way, the frequency of English

DMs can be taken as an indicator of the level of cultural integration of bilingual speakers (Torres 2011, following Lipski, 2005; see also Torres, 2002). Research also demonstrates that English DMs are acquired and used subconsciously, even among Spanish-dominant individuals, and as such can provide an important ‘gateway’ through which further borrowings and code-switches can enter the speech of bilinguals (see Lipski, 2005).

Studies of bilingual DMs in more established Hispanic communities in the United States demonstrate the wide acceptance of English DMs in the speech of bilinguals across generations (G1 IMs as well as G2 and G3 HSs). Torres (2002) found 50% English DMs among NYC Puerto Ricans, with higher rates occurring among Chicago Mexican/Puerto Rican/MexiRican communities (65%; Torres & Potowski, 2008) and in New Mexican Spanish (68% English DMs; Aaron, 2004). While these studies show an increase in English DMs across generations, with U.S.-born HSs producing higher rates, importantly they also show relatively high rates of English DM use among G1 immigrants, at least for some DMs in some contexts. Finally, DMs are not adopted wholesale, but rather enter into bilingual speech at differing rates. For example, *so* is described as a “core borrowing,” used even by monolingual Spanish speakers in NYC (Torres, 2002) and Los Angeles (Silva-Corvalán, 1994), while other DMs, such as *like*, may be less common and more dependent on social group. Here we examine the rate of adoption of English DMs in NC Spanish, as a point of comparison with other, more-established communities.

6.2. Methodology

Following previous research (Torres, 2002), we examined pairs of bilingual DMs that demonstrate relative semantic equivalency across the two languages. The included bilingual DM pairs are: *You know* ~ *Tú sabes*, *I mean* ~ *O sea*, *So* ~ *Entonces*, *Like* ~ *Como* (used as a filler, as in English *like*), and *Well* ~ *Pues*. The dependent variable was the language used in each instance of the pair, resulting in a bilingual variable *English* ~ *Spanish*. Discourse pair was included as an independent variable, along with speaker gender, generation and region. Only tokens that were clearly DMs were included in the analysis (for example, comparative uses of *como* and *like* as a verb were excluded).

Every bilingual DM in each interview corresponding to the pairs outlined above was extracted and coded for the independent variables, resulting in a total of 1660 tokens. Data was analyzed using Mixed Effects Logistic Regressions in R, with speaker as a random factor.

6.3. Results

The regression analysis found a significant effect of Discourse Pairs ($p < 0.001$) and Generation ($p < 0.001$). Gender approached significance ($p = 0.08$), with women producing more English DMs. The overall rate of English DMs in the data was 11.9%, much lower than in previous studies of more established areas (see above; compare 65% English DMs in Chicago,

Torres & Potowski, 2008), suggesting important differences between the nascent Hispanic community in NC and more established populations elsewhere.

The DM pair that showed the highest rate of English DM use was *You know ~ Tú sabes*, with 97% realized in English. It must be noted, however, that this DM pair had few tokens, and was used almost exclusively by HSs (see Figure 9). Following this pair is *So ~ Entonces* with 17% English, *I mean ~ O sea* with 16%, *Like ~ Como* with 6%, and finally *Well ~ Pues* with less than 1% English. The wide range in the use of English DMs across pairs provides further evidence that not all DMs are accepted equally by the bilingual community.

Figure 9. Discourse Marker Pairs by language and generation.

HSs produced significantly more English DMs than did IMs (29% vs. 1% overall). This result is similar to the findings of Flores-Ferrán's (2014) study of New York and Puerto Rican-born speakers in NYC (23% vs. 1% English DMs). If we can assume that U.S.-born HSs are likely more integrated (linguistically and otherwise) into the dominant culture, this result lends further support to the hypothesis that the amount of English-language DMs at least partially indicates the level of acculturation of the speakers. As seen in Figure 9, HSs produced more English DMs for each pair except *Well ~ Pues*, a variable pair that was produced only marginally in English. While the overall result indicates similarities between NC and some other regions, the surprisingly low rate of *so* use among NC Spanish speakers suggests important differences as well. The overall rate of English *so* (as opposed to Spanish *entonces*) in the data is 17%. This overall frequency is quite low in comparison to some other regions, for example Torres and Potowski (2008) found 55% *so* among G1 and G2 speakers in Chicago, and Aaron (2004) found between 52-85% *so* in New Mexican Spanish. The difference between regions is less for G2 speakers - compare 50% *so* in Chicago with 38% in NC, a result which makes the discrepancy between G1 immigrant speakers in both regions all the more striking. G1 speakers in Chicago actually showed higher rates of *so* than did G2 speakers (60% *so*). This contrasts sharply with the

less than 1% *so* produced by NC IMs in the present study. If *so* is indeed a “core borrowing” (Torres, 2002; Torres & Potowski, 2008) in more established varieties of U.S. Spanish, occurring at high rates even among G1 speakers, then the surprising lack of use of English *so* among IMs in NC suggests that, as a newly-forming Hispanic community, NC Spanish may represent an earlier stage of U.S. Spanish development than NYC, Chicago, LA or New Mexico.

7. Discussion: The “swarm”

To summarize briefly, with the exception of DMs, for which the HSs produced a significantly higher percentage of English DMs in their speech compared to the IMs, on the phonetic level, both HSs and IMs produced /bdg/ with similar degrees of lenition, exhibited very few differences in vowel production, and did not differ significantly with respect to nPVI overall. Thus, in isolation, it may appear as though the phonetic/phonological systems of the HSs and IMs included in this study are indistinct.

Additional insight, however, can be gained by examining individual speaker patterns across the four variables -- that is, instead of characterizing the linguistic system based on one analysis alone, the “swarm” permits a more holistic view by analyzing individual trends in the aggregate. Following Drager and Hay (2012), who pointed out that random effect intercepts are useful tools when making speaker comparisons, the individual speaker coefficients obtained from the statistical models were examined to determine which speakers statistically favored (positive coefficient) or disfavored (negative coefficient) a specific realization. The random effects intercepts were examined for /bdg/ and DMs, whereas the fixed effects intercepts were utilized for those variables with only one value per speaker (i.e., nPVI and CHA). A positive coefficient indicated that the individual favored a more occlusive /bdg/, higher nPVI, and a higher percentage of English DMs, all of which might be considered “less monolingual” or more “contact-induced.” Regarding CHA, a negative coefficient indicated a smaller vowel space area, which may suggest less peripheral vowels and/or less consistency in vowel production when compared to native speaker norms.⁴ After examining the coefficients, each speaker was ranked by the number of favoring estimates. Table 1 presents the ranking, where a check mark indicates that the speaker favored the contact-induced pattern. To facilitate comprehension of the table, speaker 2011-21 (first row) favored higher nPVI, greater intensity difference, higher percentage English DMs, and a smaller vowel space, therefore trending toward the contact-induced pattern for all four variables.

⁴ Although larger vowel systems have been argued to occupy a larger portion of the acoustic space (Liljencrants & Lindblom, 1972), Bradlow’s (1995) comparison of English and Spanish vowel systems revealed similar areas for the two languages for vowels produced in open syllables. Combined with the tendency of L2 learners to produce a condensed vowel space relative to proficient bilinguals possibly as a consequence of unstressed vowel reduction, we determined that a smaller vowel space was more representative of the contact-induced pattern.

Table 1

The variable swarm

<u>Speaker</u>	<u>Generation</u>	<u>Region</u>	<u>DMs</u>	<u>nPVI</u>	<u>/bdg/</u>	<u>CHA</u>
2011-21	HS	CAm	✓	✓	✓	✓
2013-19	HS	Mex	✓	✓	✓	✓
2014-10	HS	CAm	✓	✓		✓
2015-08	HS	Mex	✓	✓		✓
2012-15	HS	CAm		✓	✓	✓
2012-22	HS	CAm	✓	✓		✓
2013-18	HS	Mex	✓	✓		✓
2012-01	IM	Mex	✓	✓	✓	
2013-21	IM	Mex		✓	✓	✓
2011-05	IM	Mex	✓	✓		✓
2013-03	IM	Mex		✓	✓	
2012-09	IM	Mex	✓	✓		
2013-15	IM	Mex	✓		✓	
2014-19	HS	Mex		✓		
2013-28	HS	Mex	✓			
2012-08	HS	CAm			✓	
2013-24	IM	Mex		✓		
2013-23	IM	Mex			✓	
2014-13	IM	CAm		✓		
2013-02	HS	Mex				
2014-05	HS	Mex				
2010-16	IM	CAm				
2011-18	IM	Mex				
2013-26	IM	Mex				

Note. A check mark indicates the speaker favored the contact-induced realization for that specific variable.

Inspection of the ranking indicates that the two participants who favored the contact-induced pattern for all four variables are both HSs. Eight additional speakers showed favoring estimates for three variables, five of which are HSs and three are IMs. Examining the trends of each speaker across the four variables studied therefore suggests that in this community, HSs tend to precede IMs in favoring contact-induced realizations. On the phonetic level especially, however, we observe considerable variation in that not all speakers have integrated the same number of contact-induced changes into their speech, nor do they appear to do so in the same order.

Nevertheless, based on statistical outcomes and the number of speakers trending toward contact-induced realizations on the phonetic level, we are able to make some general hypotheses concerning order of integration. During the initial phases of language contact, we would expect

that lexical variables such as English DMs would be the first to be incorporated (Torres, 2011). The fact that DMs were the only variable that showed a significant effect of generation reinforces the idea that DMs are clearly the first in-road of English influence among the variables studied here. Regarding nPVI, more than half (15) of the participants exhibited favoring estimates, indicating that they are trending toward a more English-like rhythm. Given that prosodic characteristics are acquired very early in the first language and modified speech rhythm is well-documented among bilingual children and adults (see Bunta & Ingram, 2007; Carter & Wolford, 2016; Shousterman, 2014) variations on the prosodic level might be some of the first phonetic changes to take effect in bilingual systems during the early stages of language contact. Rhythmic changes could subsequently feed modifications in the vowel system, as greater durational variability in vowel productions might result in more unstressed vowel reduction, target undershoot, and a smaller vowel space. The relationship between nPVI and vowel space area is somewhat supported by the results of our study, as nine of the 15 bilinguals who trended toward higher nPVI values also trend toward a smaller vowel space.

As a roughly equal number of HSs and IMs (4 HSs, 5 IMs) trended toward more occlusive-like productions of /bdg/, the interpretation of this particular variable is more complex, and further complicated by the opposite patterns exhibited by the HSs from the two regions: While Mexican HSs produced weaker variants of /bdg/ relative to the IMs from the same region, the Central American HSs produced more occlusive variants. Although larger intensity differences might be suggestive of English-like pronunciations, the average intensity difference was greater for Central American speakers of both generations than for Mexican speakers overall. Larger intensity differences produced by the Central American HSs could therefore represent the enhancement of a characteristic already present in their variety as opposed to the influence of English, or possibly a combination of the two. The possibility that some Central American speakers are emphasizing the existing dialect patterns from their region of origin as a marker of identity should be examined in future research with a larger speaker pool.

In conjunction, the variable swarm permits a more comprehensive view of how changes in the linguistic system might emerge during the early stages of language and dialect contact. For many of the variables, NC Spanish shows a less-advanced stage of contact-induced change than some more established regions. The recency of the community in the Southeast in comparison to other U.S. regions has likely not permitted sufficient time for a critical mass of bilingual speakers - the leaders in integrating transfer from English into Spanish - to form. Still, results indicate that speakers of the second generation especially are beginning to show the early signs of linguistic change regarding both lexical and phonetic variables. In this way, NC Spanish may reflect earlier stages of dialect development in places like NYC or Chicago. The variable swarm, facilitated by the forced-alignment and automated analysis permitted by *FASE*, allows us to observe trends that would have been missed had the analysis focused on only one variable.

8. Conclusions

To conclude, the present study offers a preliminary analysis of Spanish in the Southeast – an understudied U.S. region which provides a unique opportunity to observe some of the initial outcomes of language contact and new dialect formation as they occur in real time. While only one variable on its own (i.e., use of English DMs) differed significantly across generations, assessment of patterns across all variables (the “swarm”) indicated that HSs in particular are beginning to exhibit variation in their speech on both the lexical and phonetic levels that are suggestive of contact-induced change. In all, our study demonstrates the utility and importance of examining the realization of multiple variables produced by the same speakers, as well as offers insight into how linguistic change might begin and progress during the early stages of language and dialect contact.

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Appendix A

Participant Demographic Information

<u>Participant</u>	<u>Gender</u>	<u>Birth year</u>	<u>Generation</u>	<u>Region</u>	<u>Years in U.S.</u>
2010-16	F	1957	IM	CAm	25
2014-13	M	1985	IM	CAm	19
2012-01	F	1957	IM	Mex	33
2013-21	F	1983	IM	Mex	1
2011-05	F	1988	IM	Mex	10
2013-03	M	1993	IM	Mex	10
2012-09	F	1992	IM	Mex	9
2013-15	M	1962	IM	Mex	35
2013-24	M	1984	IM	Mex	2
2013-23	M	1981	IM	Mex	2
2011-18	M	1992	IM	Mex	3
2013-26	M	1982	IM	Mex	1
2015-08	F	1992	HS	Mex	20
2011-21	F	1989	HS	CAm	since birth
2014-10	F	1992	HS	CAm	since birth
2012-15	F	1988	HS	CAm	since birth
2012-22	F	1992	HS	CAm	since birth
2012-08	F	1989	HS	CAm	since birth
2013-19	M	1989	HS	Mex	since birth
2013-18	F	1993	HS	Mex	since birth
2014-19	F	1992	HS	Mex	since birth
2013-28	M	1991	HS	Mex	since birth
2013-02	M	1992	HS	Mex	since birth
2014-05	M	1992	HS	Mex	since birth

Note. All HSs were U.S-born to first generation parents except for participant 2015-08, who was born in Mexico but arrived to the United States at the age of three.