Heritage Speakers and their Language Use: A Phonetic Approach to Code-Switching

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1. Introduction

Heritage speakers have been a population of interest for linguistic research for the unique insight they offer on various topics such as of native language acquisition, second language acquisition, distinctions between native and first languages, language dominance and proficiency, language transfer and bilingualism. In particular, those that codeswitch (see below for definition and references) as a form of communication are integral to understanding much of the underlying linguistic information present within the minds of bilinguals. Production data can be especially useful in myriad ways, including to examine syntactic realizations, grammaticality, phonological and phonetic phenomena, and morphological constructions utilized by bilinguals, for example. This project will make use of this invaluable population through recordings of spontaneous, semi-spontaneous and non-spontaneous speech to closely examine the extent to which phonetic convergence (discussed below) exists in the speech of bilinguals.

This paper first reports on the previous literature regarding the topics of code-switching, heritage speakers, linguistic convergence, and bilingual phonetic systems. There have been no studies to date that examine a population of English-dominant Spanish heritage speakers in the scope of phonetic linguistic convergence during code-switching. We therefore aim to fill this gap by examining whether there is an occurrence of phonetic convergence in the code-switching speech of English-dominant Spanish heritage speakers.

2. Literature Review

2.1. Code-switching

Code-switching has been defined by various past studies (e.g., Myers-Scotton, 1993; Zentella, 1997; Backus, 2005; Bullock & Toribio, 2012, among others) as the mixing of two or more languages by a speaker during conversation, especially by embedding a phrase, sentence or a sequence of either into a different matrix language environment. It is often noted that the manner in which a bilingual code-switches is generally contextually appropriate, in that speakers will only code-switch in the presence of other bilinguals who understand both languages. Furthermore, code-switching is described as being an economic way in which bilinguals are able to construe information to an interlocutor. The motivations behind switching between languages are diverse, and the frequency at which a bilingual or multilingual speaker chooses to code-switch also varies widely.

Past scholars have investigated code-switching from varying vantage points (e.g. language transfer, usage of specific grammatical constructions, situational contexts for switching from one language to another, socio-cultural influences and effects, etc.). Some scholars have turned to grammaticality judgements, behavioral studies and other such experimental methods to

try and understand the ways in which code-switching works and the underlying mechanisms utilized by these speakers when doing so (MacNamara & Kushnir, 1979; Lipski, 1985). It is generally concluded that code-switching works in a systematic and logical manner, and that a speaker will almost always code-switch in a way that is efficient and beneficial to the context (Seliger 1996).

A few recent studies have begun to look at a *linguistic convergence* effect in the speech of code-switchers (Antoniou et al., 2011; Balukas and Koops, 2015; Bullock & Toribio, 2009; Grosjean & Miller, 1994; MacSwan & Colina, 2005; Olson, 2012, 2013; Toribio et al., 2005). Linguistic convergence refers to the phenomenon whereby the two languages used by the speakers begin to resemble each other. The aforementioned studies investigated whether or not this phenomenon would occur in controlled, laboratory environments, and while some found that this phenomenon did occur (e.g. Toribio et al., 2005), others were not able find conclusive evidence of convergence (Grosjean & Miller, 1994). Balukas and Koops (2015), however, examined spontaneous code-switching speech from the New Mexican Spanish English Bilingual Corpus, and found that there is a tendency for these Spanish-dominant speakers to produce English stop consonants in a manner more similar to that of Spanish stop consonants (i.e. recorded VOT times were much shorter than prototypical English VOT measurements).

As will be discussed in the forthcoming sections, this project will focus on the acoustic production of Spanish heritage speakers (to be defined in section 1.3) during code-switching.

2.2. **Acoustics of English Vowels and Spanish Vowels**

This project will focus specifically on the phonetics of the production of speech sounds while speakers are code-switching. Few past studies have investigated code-switching from a phonetics viewpoint, and the amount to which one language's phonetic system influences another in the context of code-switching (Bullock & Toribio, 2009). This study, therefore, aims to help fill this gap and provide more insight into the phonetic realizations of code-switching speech.

Acoustically speaking, speech sounds are a result of a few key factors both within and aided by the human body. Air is pushed from our lungs as we produce speech (referred to as a pulmonic egressive mechanism) and it is this motion that is primarily responsible for all the speech sounds of English and Spanish (as well as the majority of other languages). This outwards airflow is manipulated by our articulatory organs, both within the oral cavity and the nasal cavity, to create different sound segments. The variations in the manipulation of the articulatory organs leads to a certain configuration of resonating chambers, allowing energy to be released at certain frequencies, which then yields a specific sound. Vibration is a second mechanism that is utilized to create speech sounds. Vowels—as well as voiced consonants—are auditorily perceptible sounds resulting from both the air pushed from our lungs and the vibration that is created by the vocal folds as they open and close at certain frequencies. The specific frequency varies from speaker to speaker and are contingent upon factors such as the speaker's sex, vocal tract length, thickness of the vocal folds, size of the skull cavity, etc.

The acoustic differences between vowels arise from the manipulations made within the oral cavity (and in some cases, the nasal cavity, for nasal vowels) that result in the aforementioned resonating chambers. The chambers let energy out at certain frequencies known as formants. In other words, the differences in formants is what gives way to audible differences

in the way vowels are perceived, or the *phonetic quality* of the vowels. Formants can be physically represented and charted when using a speech analysis program such as PRAAT, which was used for this project. There are generally four to five formants visible on the spectrogram of a given signal, ranging from the fundamental frequency (F0) to a fourth frequency (F4). The fundamental frequency is representative of the carrier frequency, or the pitch of the individual speakers' voice. For the purposes of this study, only the first and second formants (F1 and F2, respectively) will be measured and analyzed as these divulge the most crucial information about each vowel sound. In other words, the way in which the first and second formants are realized can determine how *prototypical* a certain vowel is perceived. For this study, as will be discussed in the methods section below, the vowel /u/ will be analyzed. The reasoning behind this selection lies in the fact that although it exists in both languages, the acoustic realizations of the /u/ in both languages are quite distinct.

2.3. Heritage Speakers and Language Dominance

The population that will be investigated for this project are Spanish heritage speakers. A *heritage speaker* has been described as an individual that speaks a language at home that differs from that of the community or environment at large (Valdés, 2000). Spanish heritage speakers, more specifically, are individuals who speak Spanish at home—and in most cases, as their first language—and that acquired English at a later point in their childhood. The acquisition and eventual dominance of English is generally due to the prevalence of English within the context of the United States.

This study will specifically look at code-switching of Spanish heritage speakers that have, over time, become more dominant in English. The main motivation for selecting this group of speakers is to assess the degree to which an individual's second language (L2)—in this case, English—can affect their first language (L1)—in this case, Spanish. Past studies in second language acquisition and bilinguals has shown that individuals are usually only able to fully acquire their L1, while their L2 is inevitably influenced in some way by their first language (see Gass & Selinker,1992 and MacWhinney, 1992, among others). Nevertheless, many heritage speakers contradict this conclusion made by some scholars in that, due to the influence of the main language used by the community in which they live, the speakers ultimately become more fluent and accurate in their second language. Past studies (Silva-Corvalán, 1996, 2003; Polinsky, 1997; Toribio, 2001; Montrul, 2002) have shown that a transfer can be evident in syntactic structures, definite article usage, and in other morpho-syntactic spheres. It is becoming increasingly difficult for some Spanish heritage speakers in the United States to maintain a native-like or monolingual-like grasp of Spanish due to the dominance of English used in the surrounding environment (Lipski, 1993; Silva-Corvalán, 1996; Bullock & Toribio, 2012). Additionally, being that Hispanophones are still a minority within the United States, English tends to become the most commonly used language between peers and even within families over time. Gradually, English becomes the more accessible language to use for many speakers, regardless of the fact that it is their second language (Bullock & Toribio, 2012).

Though many studies have shown that there is an L1 transfer effect into a speaker's L2, especially if the L2 was acquired after the critical period, one major aim of project is to shine a light onto the inverse occurrence of this phenomenon. That is, once an L2 becomes more

dominant for the speaker than the L1, there may also be a reverse transfer effect whereby a person's first language begins to show similarities with their second. Transfer effects, as they are realized phonetically have also been investigated in the past. A recent study by Balukas and Koops (2015) looked at the phonetics of the speech of Spanish-English bilinguals who were dominant in Spanish (their L1), and showed that Spanish influenced English for these speakers. Their spoken Spanish, however, was not affected by English. The authors measured the durations of Voice Onset Times (VOT) of the speakers' consonants and found that their English consonants were more similar to Spanish consonants. Additionally, this study aimed to make the argument that code-switching is a trigger for phonetic convergence, and that it happens more often in the presence of codeswitching. Other past studies (Grosjean & Miller, 1994; Toribio et al., 2005; Bullock & Toribio, 2009) have also discussed the phonetic realizations of language convergence. Some showed little evidence of convergence on the phonetic level, while others showed that bilinguals actually hyper-articulate the sounds of each language to emphasize the distance between the phonetic systems. As mentioned by Balukas and Koops (2015), most of the previous studies examining phonetic convergence and code-switching were done in laboratory settings, potentially lowering the relevance for spontaneous and natural speech. Similar to the study done by Balukas and Koops (2015), this study will also utilize methods aimed to elicit more spontaneous speech in order to understand the degree to which phonetic convergence occurs in the most natural setting possible.

3. Research Questions and Hypotheses

The imminent question at hand is whether bilinguals are able to completely switch from one phonological system to the next during code-switching. More specifically for this context, do Spanish heritage speakers that are dominant in English show phonetic convergence or phonological preservation when code-switching? Is the convergence effect stronger in Spanish or in English? Finally, are more advanced or native-like heritage speakers (in reference to Spanish) able to suppress this effect more in Spanish? The hypotheses in response to these questions are as follow: 1) There will likely be evidence from the Spanish produced during code-switching that shows an effect of phonetic convergence. In other words, when in a bilingual or code-switching mode, these heritage speakers will likely show some phonetic influence of English on their production of Spanish vowels as a result of becoming dominant in English over time; 2) precisely because these speakers are more dominant in English than in Spanish, there will not likely be a phonetic convergence effect upon their English. That is to say, their production of English vowels will be acoustically analogous to prototypical vowels produced by monolingual English speakers; 3) additionally, as the levels of proficiency of Spanish will differ from speaker to speaker, there is also likely be a difference in the degree of phonetic convergence that is evident in their speech. Heritage speakers who have maintained a more native-like grasp on Spanish will likely show less of an effect of convergence in the production of their Spanish vowels. Conversely, heritage speakers who are less proficient in Spanish will probably produce Spanish vowels that are acoustically more English-like.

4. Methods

For this study, twenty undergraduate students from the University of Florida were recruited. These students were all heritage speakers from varying heritage countries of origin in Central America, South America, and the Caribbean. Their ages ranged from 18 to 23 years of age and all of them used or were exposed to both Spanish and English before the age of 5. Five of the participants were eliminated; four were eliminated due to their nonuse of code-switching, while the fifth participant was eliminated due to not being a heritage speaker of Spanish. The participants were recorded in a quiet room with a standard microphone and were asked to complete three tasks for the experiment, in addition to a language background questionnaire. The language background questionnaire was given at the cessation of the experiment and was used to determine the heritage country of origin, the self-rated proficiencies in both languages, and the participants' attitudes towards code-switching, among other information.

The initial task of the experiment was an informal interview. The researcher aided in allowing the participants to switch into a bilingual mode by using code-switching when asking questions. The researcher also divulged personal information relating to the questions asked to the participants in an attempt to make the participants feel more comfortable. As discussed in Valdés' book (2000), code-switching will more often than not transpire in conversations occurring in informal contexts, and so it was best if the participants felt they were not in a very formal setting during the experiment. As the participants had no prior knowledge of the questions to be asked, their responses were considered by the researcher to be spontaneous speech.

The second task completed by the participants was a retelling task. They were shown an approximately two-minute clip of a Charlie Chaplin movie ("Modern Times"). Past sociolinguistic experiments (see Paulasto, Riionheimo, and Merilainen, 2015, for example) have made use of videos such as this as they are mostly void of conversation, allowing the participants to create their own descriptions of what occurred. The resulting retelling was considered by the researcher to be semi-spontaneous speech as participants knew what they would be describing.

The final task completed by the participants was a reading of a paragraph-long story written using code-switching. As participants were reading rather than producing sentences on their own, this was considered non-spontaneous speech. After having read the paragraph aloud, the participants were asked a series of questions by the researcher. As participants already knew what the questions would be addressing, the responses recorded in this portion were considered to be semi-spontaneous speech as well.

Due to the limited instances of code-switching, relatively small number of participants and the fact that many instances of code-switching were incomplete or occurred within unfinished phrases, proximity to the code-switching point was not able to be determined and therefore was not used as a differentiating variable for measurements. Language environment was therefore used instead. There were two possible environments considered. The instances in which participants spoke strictly in one language or the other were considered *monolingual environments*, whereas the responses or utterances which included code-switching were considered *bilingual environments*. Although past researchers limited code-switching to not include instances of borrowings (e.g. "…en la *factory* había…") and/or word-coinages (e.g. "…estaban *work*eando…"), these were considered to be *bilingual environments* for the purpose of this study due to the mixing of the two phonetic systems.

Diverging from past research that relied on voice onset time measurements (VOTs) as a main indicator of convergence, this study used the vowel /u/ as the main measure upon which to determine degree of convergence. Often times, what individuals perceive as a foreign accent or a deviation from standard speech is caused by a realization of the first and second formants of a vowel that is inconsistent with a standard or *prototypical* realization of the first and second formants of that vowel. Spanish and English vowel inventories are quite different overall. The reasons for choosing the vowel /u/ in particular are as follow: (i) it is the only vowel, apart from /i/ to be frequently present in both languages; (ii) although it is present in both languages, the prototypical F1 and F2 values are quite different, according to the measures found in past studies, such as in Bradlow (1995) and Labov, Ash and Boberg (2006) (see Figure 1 below). Specifically, the realization of the /u/ in English is far more fronted than that in Spanish, resulting in a much higher F2 in English than in Spanish. Additionally, the /u/ in Spanish is lower in terms of tongue height, resulting in a lower F1 value than in English.

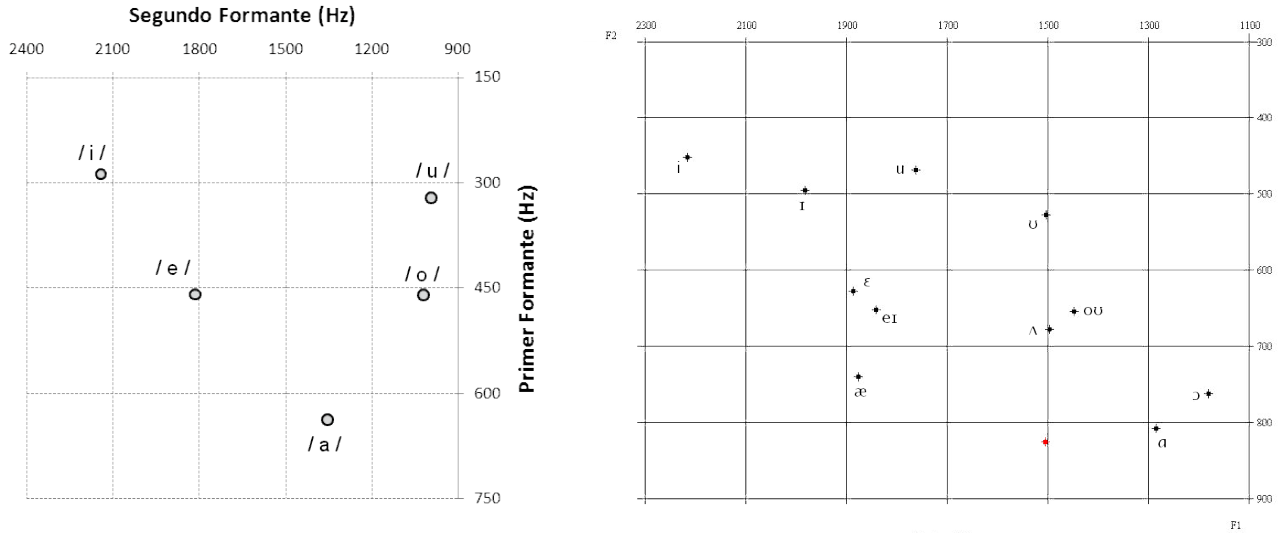

Figure 1: Charts showing standard F1 (y-axis) and F2 (x-axis) distributions in vowel inventories of Spanish (Bradlow 1995) and English (Labov 2005)

5. **Results**

Analysis of all the instances of the vowel /u/ present in all the recordings reveal that there is noticeable difference between the realizations of /u/ in a monolingual environment versus in a bilingual environment. The average F1 value for Spanish vowels in a monolingual context is 467.5 Hz; the average F2 value for the Spanish /u/ in a monolingual environment is 1512.1 Hz. The average F1 and F2 values for the English /u/ are 450.4 Hz and 1609.7 Hz, respectively. The aforementioned monolingual context formant values were taken as the standards for the speakers, with which the bilingual measurements would be compared.

When the speakers were code-switching, Spanish F1 and F2 values both decreased, resulting in an F1 of 415.8 Hz and an F2 value of 1438.7 Hz. The English F1 value in the bilingual context also fell, to 410.5 Hz, while the F2 value increased to 1800.1 Hz. While there seems to be a slight divergence effect occurring in the formant values of both languages in the

bilingual context, the durations measured converged when the speakers were code-switching. More specifically, when code-switching, the Spanish /u/ lengthened, while the English /u/

Monolingual	F1	F2	Duration
Spanish	467.5	1512.1	56.4
English	450.4	1609.7	79.1

Bilingual	F1	F2	Duration
Spanish	415.8	1438.7	66.2
English	410.5	1800.1	58.0

shortened in duration. This can be seen in the chart below:

Figure 2: Tables showing the recorded average formant and duration values

To better visualize these results, formant frequency values were plotted on the charts shown above (see Figure 3). As can be observed in the two charts below, the speakers produced more 'standard' /u/ vowels (in terms of vowel quality) when code-switching compared to when speaking only in one language or another.

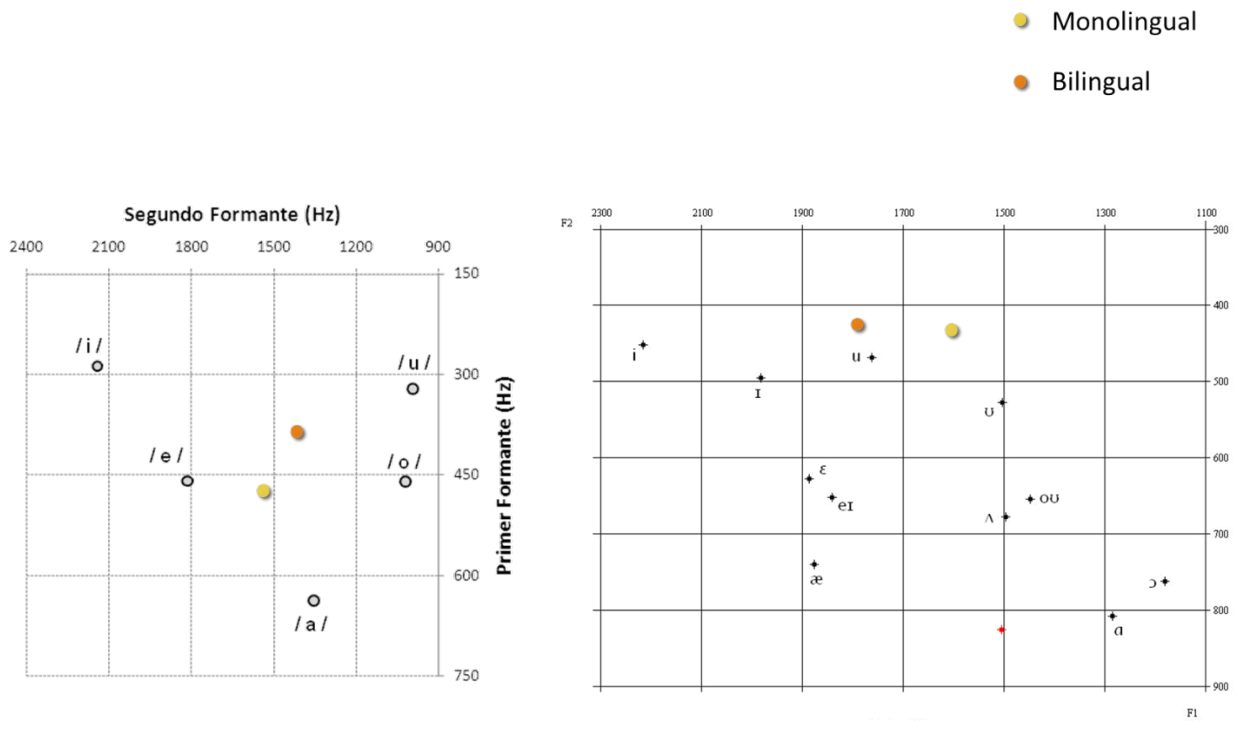

Figure 3: Average Spanish and English /u/ values uttered within both monolingual and bilingual contexts plotted to compare with previously attested 'standard' values

After having recorded overall averages of all participants, the researcher split participants into two groups according to their self-rated degree of code-switching: 1) regular code-switchers and

2) non-code-switchers. The first group consisted of participants that indicated that they regularly use code-switching on a daily basis, while the second group consisted of participants that indicated they would not code-switch under normal conditions; in other words, they would only ever use one language or the other even if speaking with other bilinguals proficient in both English and Spanish. The charts below show the differences between the average values taken

	Code-switcher	Language	F1	F2	Duration
Monolingual	Yes	Spanish	504.3	1471.9	64.2
	Yes	English	443.4	1608.1	77.7
	No	Spanish	435.1	1547.5	49.5
	No	English	462.9	1612.5	81.5

	Code-switcher	Language	F1	F2	Duration
Bilingual	Yes	Spanish	419.1	1436.0	72.6
	Yes	English	410.1	1826.5	58.4
	No	Spanish	408.9	1444.3	53.2
	No	English	411.0	1780.0	57.2

from each group of speakers:

Figure 4: Charts showing average F1, F2 and duration values for both regular and non-code-switchers in both monolingual and bilingual contexts

As with the previous results, these values were plotted to be compared with previously attested standard values of both Spanish and English:

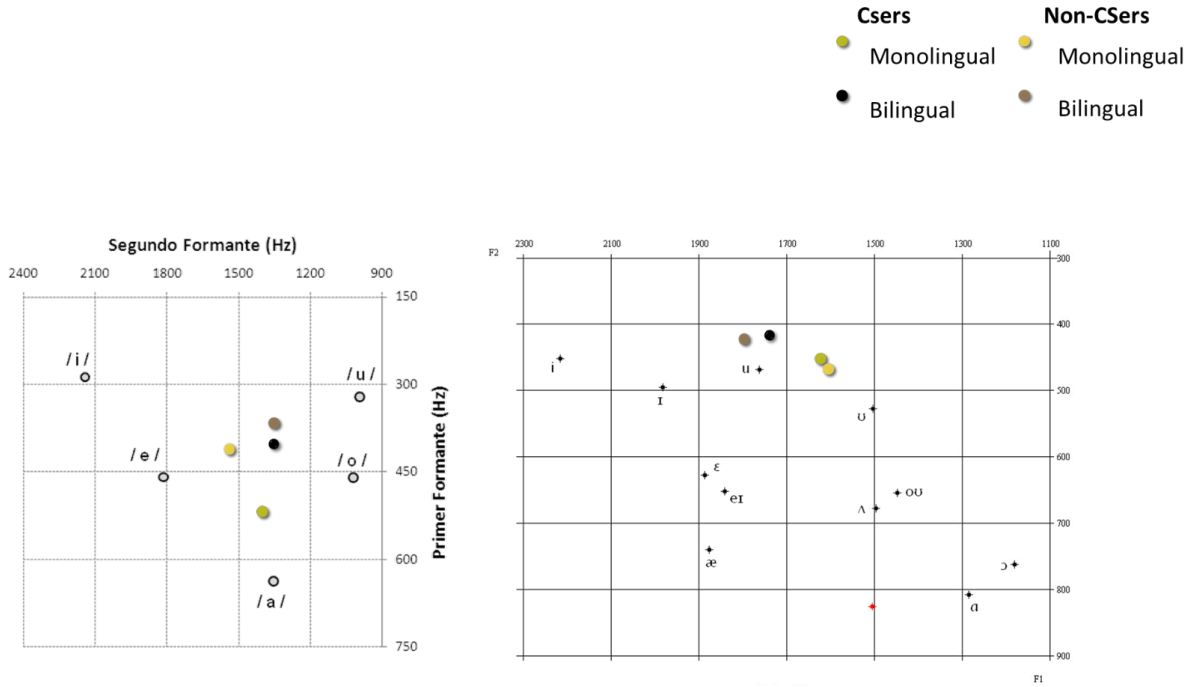

Figure 5: Average values used to plot /u/ produced in both monolingual and bilingual contexts by regular and non-code-switchers

As can be seen by the vowel plotting above, regardless of whether or not the speakers regularly use code-switching in their daily lives, the act of code-switching during the experiment allowed for a more standard production of the /u/, in both Spanish and in English. Speculation regarding this, as well as implications, are further discussed in the conclusion section below.

6. Conclusion

In sum, there was not a convergence effect found for the overall values recorded for vowel quality when the speakers were code-switching. Rather, there was a divergent effect in terms of vowel quality, in that the Spanish /u/ and English /u/ became more similar to previously attested 'standard' values for each respective language. Moreover, when the speakers were in a monolingual mode, only using one language or another, the recorded values for the vowel /u/ in both languages were more similar to each other. This is similar to the results found in Bullock and Toribio's (2009) study, in which there was an exaggeration in the distance of the different phonetic categories by the participants. It could be that the act of code-switching acts as a trigger by which the speakers are able to pay more attention or take note of their production more so than when they are only using one language. In this way, they are able to make a clearer distinction between the two phonetic systems and use the switching as a tool to guide the production of the respective languages.

On the other hand, there was a convergence effect in terms of the duration of the /u/ in both English and in Spanish. When in the monolingual context, the /u/ was well within standard ranges of durations for each language. However, when the speakers began code-switching, the duration of the Spanish /u/ lengthened, becoming more 'English-like' and the duration of the English /u/ shortened becoming more 'Spanish-like.' Therefore, although there was a divergence effect found in terms of vowel quality, there was a convergence effect in the vowel durations for both languages.

One of the most interesting findings lies within the fact that all the participants became more 'standard' in their productions of both the Spanish and the English /u/ when code-switching. Even the participants who claimed to not use code-switching under normal circumstances produced more standard vowels when code-switching. As mentioned above, it may be the case that the act of code-switching itself is almost like a crutch that can lead speakers to more 'standard' pronunciation. When the speakers are producing both languages, they are more aware of their production of the sounds of each; on the other hand, when they are only speaking one language, their bilingual system may suppress their other language and therein the clear distinction between the two (albeit not completely, of course), in turn causing them to produce more intermediate vowels. Nevertheless, the speakers were still producing more standard durations when in monolingual mode. This may be an indication of a hierarchy of vowel quality and duration. When only speaking one language, duration may be a more salient trait to bilinguals, allowing the speakers to better maintain standard durations when only using one language. When code-switching, on the other hand, it may be that vowel quality is more important, causing speakers to both exaggerate the distance between the formant values of the two vowels and digress in terms of maintaining standard durations. More research is needed to

better understand the relationship between vowel quality and duration, as well as to understand whether speakers do indeed favor one over the other when in different language modes.

This study was not without several limitations. First, although the participants recruited were all university students and fell within a similar age range, they did not come from similar backgrounds in terms of their heritage countries of origin. Although the participants were all heritage speakers of Spanish, their heritage countries of origin spanned throughout the entirety of Latin America. As the variations in both the phonology and phonetic systems of the Spanishes used throughout the region can vary quite widely, this may have had an effect on the collected values. In terms of the analysis, more succinct results may have been found if the speech rates of the participants were normalized to account for potential vast differences causing changes in duration data. There were also not enough tokens to measure the vowels in relation to their proximity to code-switching points. Past studies have utilized such measures as number of syllables and/or intonational units to guide distances from a code-switching point; had there been more instances of the vowel /u/ throughout the data, examining the proximity to the code-switching point may have revealed further information about the exact timing of changes in both vowel quality and duration. Another key factor that was not taken into account that may have had an effect on the data collected was the phonetic environment in which the vowel /u/, both in Spanish and in English, was present. This includes, but is not limited to, the effects of syllable structure (closed versus open), position within the word (word-initial, -medial or -final), prosody, and stress.

Nevertheless, the data collected can be utilized for many potential future directions. First, the aforementioned factors, including speech rate and phonetic environment, among other factors, should be examined more closely to determine whether or not they may have effects on the values recorded. Taking the current findings further, the advantage that the bilingual environment seems to give the speakers in terms of producing more ‘standard’ like /u/ vowels in both Spanish and in English should be investigated. Along these lines, it can also be investigated to better understand why non-code-switchers also seem to produce more ‘standard’ vowels when in bilingual mode, even though it is not a natural speech mode for them. Finally, because the first task included qualitative questions regarding topics such as the participants’ childhoods, connections to their heritage countries, their upbringing, cultural and personal identities, etc., sociolinguistic investigations can be done to shed more light upon heritage speakers, both in terms of social and linguistic perspectives.

Further additional research can also be done to expand this study and compare the data collected to other speaker data. Spanish-dominant heritage speakers can be recorded to see if opposite effects are found in terms of vowel productions. Additionally, data can be collected from both L2 Spanish and English learners to see how these speakers may compare to heritage speakers. Monolinguals of both Spanish and English can also be tested to both establish new standards for vowel qualities and durations, and to compare with these and other results, including first generation heritage speakers, for example. Overall, more research is needed to better understand heritage speakers and their language use, a relatively understudied population and phenomenon.

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