VOICE ONSET TIME FOR VOICED AND VOICELESS STOPS ACROSS ENGLISH PROFICIENCY LEVELS FOR SIXTEEN PUERTO RICAN SPANISH SPEAKERS AT THE UNIVERSITY OF PUERTO RICO AT MAYAGÜEZ.

By

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A thesis submitted in partial fulfillment of the requirements for the degree of

MASTERS OF ARTS
in
ENGLISH EDUCATION

UNIVERSITY OF PUERTO RICO
MAYAGÜEZ CAMPUS

2007

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Abstract

This thesis examined Voice Onset Time (VOT) for voiced and voiceless stops across four English proficiency levels for sixteen Puerto Rican Spanish speakers at the University of Puerto Rico at Mayagüez. It used a Production Task to find out whether VOT values of voiceless and voiced stops in the Spanish and English of eight students varied across English proficiency levels and found that VOT values did not vary in Spanish but varied in English. High English proficiency students produced stops within the VOT range for American English; low proficiency students did not. The VOT production of the high proficiency students was consistent with an external target for English; that of the low proficiency students was consistent with inter-language and transfer. It used an Identification Task to examine whether eight students from the proficiency levels could identify the productions from the Production Task and found that identification did not match production.

Resumen

Este proyecto de tesis examina Voice Onset Time (VOT) en las consonants sordas y sonoras en Inglés producidas por dieciseis estudiantes puertorriqueños matriculados en los cuatro niveles de proficiencia de inglés ofrecidos en la Universidad de Puerto Rico Recinto de Mayagüez. Esta tesis incluye una tarea de producción de estas consonantes para descubrir si los valores de VOT de las consonantes sordas y sonoras producidas por ocho estudiantes matriculados en dichos niveles de proficiencia varian através de estos. Esta tesis demuestra que para la producción de estas consonantes producidas en español su VOT no varía a través de estos niveles de proficiencia, pero que sí varía en la producción de estas consonantes producidas en inglés. Esta tesis además incluye una tarea de indentificación que pretende demostrar si otros ocho estudiantes matriculados en los niveles de proficiencia en inglés pueden identificar estas consonante lo cual demostró que no fué así.

Acknowledgments

I would to acknowledge all the people who in one way or another helped this thesis project come through. I would like to specially thank my thesis advisor, Dr. Elizabeth Dayton, without whom this thesis project would have not been made possible. I would also like to thank the members of my thesis committee, Dr. Ellen Pratt, and Prof. Joan Baker, who had helped me shape this thesis project into what it is today. Also, I would like to thank Prof. Joan Baker for her help in learning and understanding the acoustic phonetics software, PRAATLAB, which is the core of this thesis project.

In addition I would like to thank my fellow peers, Janet Hermina, Damaris Echevarría, Aleida Ferrer, Jeniffer Gómez, Melissa Pérez, and all of the T.A.'s and professors who gave me support throughout these thesis, and helped me in one way or another with the data collection process. Finally, I would like to thank Dr. Betsy Morales who in had helped instruct me since my early childhood in the ways of the English language.

I thank God for giving me the strength, patience, fortitude and, support to achieve one of my first milestones into my academic career.

Dedication

I would like to dedicate my thesis to my parents, Clovy and Mirta Maldonado, and my sister Mirla Maldonado.

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CHAPTER I: INTRODUCTION

Within the World Englishes framework, English-using societies are viewed in terms of the role of English in the society. In English as native language (ENL) societies, such as the United States, Canada, and Britain, English functions as a native language for the majority of the speakers in the society. In English as second language (ESL) societies, such as India, Nigeria, and Singapore, which are characterized by a high degree of multilingualism, English functions as a *lingua franca* within the society and also has widespread institutional uses in the domains of government, media, business, technology, and education. In English as foreign language societies (EFL), which are characterized by a high degree of monolingualism in languages other than English, such as Colombia and Japan, English functions as a foreign language which is learned in school from native speakers of English as an international *lingua franca*.

In Puerto Rico, Spanish is the first language of the vast majority of the population and English is a second language. In their attempt to characterize Puerto Rico as an English-using society, Blau and Dayton (1997) point out that Puerto Rico appears to have characteristics which make it difficult to characterize as either an ESL or an EFL English-using society. On the one hand, different from an ESL society, Puerto Rico is not characterized by a high degree of multilingualism. On the other hand, different from a monolingual EFL society, Puerto Ricans give English a more important role in Puerto Rico than it plays in other EFL societies. For example, English is widely used in the domains of government, technology, business, media, and education within Puerto Rico.

Although English is widely used in a number of domains, different from ESL societies, English is learned, on the island, through formal instruction, not through the social interaction that comes about through exposure to native speakers on a daily basis. In general, Puerto Rican university students have had twelve years of English by the time they reach the university. The twelve years of English are taught, for the most part, not by non-Puerto Rican native speakers of English, but by Puerto Ricans who have learned their English on the island. Thus, similar to ESL societies, there is an endo-normative target for English on the island. When students learn English, they aim toward an internal target, as in an ESL society, not toward an external target, as in an EFL society.

Finally, at the University of Puerto Rico at Mayagüez (UPRM), where this study takes place, there are students from all over the Spanish-speaking world. The experience of these students further underscores the in-between ESL/EFL status of Puerto Rico. The stereotype that other Spanish speakers, particularly from Latin America, hold towards Puerto Ricans on the island, is that most Puerto Ricans are bilingual and function equally well in Puerto Rico in both English and Spanish. When graduate students from Colombia and Peru come to study at the UPRM, they believe that they will need to be fairly strong in English in order to survive in the academic environment of the university and on the island. They are surprised to find out that they need less English, both academically and otherwise, than they originally thought. They are also surprised to find that students at the UPRM are far less bilingual than they believed.

On entering the UPRM, all students are required to enroll in one of four English proficiency levels. Students enter on these proficiency levels based on their scores on either an English as a Second Language Achievement Test (ESLAT) or the Advanced

Placement (AP) English Exam offered by the College Entrance Examination Board. On the ESLAT the scores range from 200 to 800 points; on the AP scores range from 1 to 5. Students who obtain scores of 4 or 5 points on the AP are placed in Advanced English. Students who do not take the AP but score between 570 and 800 points on the ESLAT are placed in Intermediate English. Students who score between 470 and 569 are placed in Basic English. Students who score 469 or less are placed in Pre-Basic English.

According to Berko–Gleason (1998), the field of psycholinguistics, or the psychology of language, "is concerned with discovering the psychological process by which humans acquire and use language" (p.3). According to Gass and Selinker (2001), second language acquisition (SLA), "refers to the process of learning another language after the native language has been learned" (p.5). Anyone who examines psycholinguistic and second language texts may form the impression that most psycholinguistic studies of English speakers, both monolingual and bilingual, and most studies in SLA involving the second language acquisition of English have been carried out within ENL English-using societies such as the United States or Britain. In fact, the World Englishes framework for the description of English-using societies does not seem to have provided a context for either psycholinguistic or SLA study. The present study, which represents the intersection of a topic usually considered within psycholinguistics, on the one hand, and SLA, on the other, fills this gap in two ways. First, it was carried out in a non-ENL society, Puerto Rico, and, second, it used Puerto Rico, as an English-using society in-between an ESL and an EFL society, as a social context for the study.

Voice Onset Time (VOT), the focus of this study, has been studied within both psycholinguistics by researchers interested in a one-to-one match between acoustic cues

and physical speech sounds and within SLA by researchers interested in the area of inter-language phonology, which involves the acquisition of a second language sound system. As Tarone (1987) points out, the phonology of inter-language has been neglected by SLA researchers and by practitioners in the second language classroom. First, SLA researchers have been more interested in finding support for the creative construction of inter-language theory of SLA than they have been in transfer. Since the sounds of a second language are thought to be influenced by the negative transfer of sounds from a first language, researchers have not paid as much attention to pronunciation as they might have. Second, neither teachers nor students have viewed the pronunciation of a second language as a very important area of study. At the UPRM, where, as mentioned, students enter on one of four proficiency levels, Pre-Basic, Basic, Intermediate, and Advanced, the phonology and pronunciation of English and English inter-language has been similarly neglected both as an object of classroom interest and instruction and as an object of study. This study, which focused on one area of inter-language phonology, VOT, aimed to fill this gap by examining VOT as an inter-language phenomenon of interest and by putting forth pedagogical recommendations for the study.

Speech production, how people produce language, and speech comprehension, how people understand spoken and written language are studied within the domain of psycholinguistics. Similarly, speech perception, how speech signals are interpreted by listeners, is of interest to psycholinguists, as evidenced by the fact that discrimination and identification tasks form the foundation of psycholinguistic research, In contrast, within SLA, as researchers such as Ioup and Weinberger (1987) point out, there has been relatively little work done to determine differences in perceptual and production

difficulties. For example, in their discussion of VOT, Gass and Selinker discuss the production aspects of VOT but not the perception aspects of identification and discrimination. This thesis aimed to fill this gap by examining the production of VOT and by creating an Identification Task for the discrimination of VOT.

Finally, the instrumental study of inter-language phonology has not, to my knowledge, been previously undertaken within Puerto Rico. Apart from Schnitzer and Krasinski (1994), who examined one bilingual child, I am not aware of any other study that has examined the inter-language system of a bilingual at the level of phonology. To fill this gap, this study examined VOT in the word initial bilabial stops of college students with Spanish as a first language (L1) and English as a second language (L2) across four English proficiency levels at the UPRM. The study focused on word initial stops in English and in Spanish instead of stops in word final and word medial position. because, as Yeni-Komshian (1998) points out, "listeners pay more attention to beginnings of words rather than the ends of words" (p. 142). The study examined bilabial, alveolar, and velar stops. Bilabial stops were of interest because, as Schnitzer (1997) points out, the especially long VOTs of English /p/ and /b/ in initial position are especially interesting for Spanish speakers. Alveolar stops were of interest because Spanish /t/ and /d/ are dentals whereas English /t/ and /d/ are alveolars, and there may be an interaction between place of articulation and VOT.

Chapter II of this thesis is a literature review. Chapter III focuses on Production of VOT of voiced and voiceless stops in English and Spanish and addresses research questions #1 and #2. This chapter involves a Production Task for which there were four groups of student participants, one group for each of four English proficiency levels; each

group contained two students, for a total of eight. Chapter IV focuses on Identification of voiced and voiceless stops in English and Spanish and addresses research questions #3 and #4. This chapter involves an Identification Task for which there were four groups of student participants, one group for each of four English proficiency levels; each group contained two students, for a total of eight. Although the eight students for the Identification Task for Chapter IV identified the productions made by the eight students for the Production Task for Chapter III, the eight students for the Identification Task were not the same students as those for the Production Task. Chapter V concludes and addresses pedagogical implications, limitations of the student, and directions for future research. The research questions that guided this thesis were as follows:

1.
a.
Do VOT values of voiced and voiceless stops in the Spanish of UPRM college students with L1 Spanish and L2 English vary across four English proficiency levels?
b.
Do VOT values of voiced and voiceless stops in the English of UPRM college students with L1 Spanish and L2 English vary across four English proficiency levels?
2.
Do the VOT values of voiced and voiceless stops of the four groups of UPRM college students who participated in the production task represent inter-language, an interim state, or do they represent attainment of the target L2 English?
3.
Are four groups of UPRM college students who participate in an identification task able to identify the production of voiceless and voiced stops in English and Spanish produced by four groups of UPRM college students who participate in a production task?
4.
a.
Taking the results of the production task from research question #1a and #1b together with the results of the identification task from research question #3, does the identification of voiced and voiceless stops in Spanish match the production of voiced and voiceless stops in Spanish?

b.
Taking the results of the production task from research question #1a and #1b together with the results of the identification task from research question #3, does the

identification of voiced and voiceless stops in English match the production of voiced and voiceless stops in English?

CHAPTER II: LITERATURE REVIEW

Voice Onset Time within linguistics

The first linguists to focus on voice onset time (VOT) were Lisker and Abramson (1964). In their study, they examined the "phonetic basis for our ability to distinguish between phonemic categories" (p. 384). These phonemic categories are classified as either voiceless or voiced. The voiceless category indicates the absence of glottal pulsation and the voiced category the presence of glottal pulsation. According to Lisker and Abramson, there are three dimensions that can be used to distinguish between phonemic categories. These dimensions are voicing, aspiration, and one of articulatory force, fortis/lenis.

According to Lisker and Abramson, the dimensions of voicing, aspiration, and fortis/lenis do not provide the best single measure that allows the listener to distinguish between voiceless and voiced phonemic categories. This is because there is no certainty that these three dimensions are "mutually independent coordinate dimensions of description" (p. 385). In other words, there exists the possibility that either dimension can be co-dependant with the other. However, as they point out, if there is a way to determine through spectrograms where exactly the instant of the release of the stop closure and the abrupt change in amplitude or frequency occurs, then there might be a possibility of finding an acoustic measure that distinguishes phonemic categories. This is best known as voice onset time, "the timing relation between voice onset and the release of the occlusion" (p. 387). VOT indicates a difference in voicing that enables speaker-listeners to distinguish not only between voiceless or voiced categories, but also between aspirated and unaspirated stops. Therefore, Lisker and Abramson proposed VOT as the

best single acoustic measure to distinguish between voiceless and voiced phonemic categories.

The purpose of the Lisker and Abramson study was to test VOT as a single acoustic dimension which could be used to distinguish phonemic categories across languages. Lisker and Abramson focused on stop consonants in word initial position before vowels and on stop consonants embedded in words in sentences. They looked at data from 11 different languages. These languages fell into three groups according to the number of stop categories they had. The first group had two stop categories: American English, Cantonese, Dutch, Hungarian, Puerto Rican Spanish and Tamil. The second group had three stop categories: Korean, Eastern Armenian, and Thai; the third, and last group, had four stop categories: Hindi and Marathi. The first group, which included American English and Puerto Rican Spanish, is of relevance for this thesis.

The procedure that Lisker and Abramson followed was to examine 11 languages and 17 speakers, one speaker for each language, two speakers for Puerto Rican Spanish and four speakers for American English. The speakers were all educated speakers of standard varieties of their languages. In order to conduct the study, they asked their participants to produce a set of words "chosen to include a sampling of all prevocalic stops;" in other words examples of all the stops in initial position followed by a vowel in their language. Then they asked the participants to create two sentences using these words. One of the two sentences would show the use of the word in initial position; the other sentence would show the use of the word in non-initial position. Lisker and Abramson asked the participants to produce these words and sentences as naturally and

fluently as they would produce them in a normal conversation. The participants produced the words and the sentences two times. Lisker and Abramson recorded each production.

Lisker and Abramson made wide-band spectrograms with the recordings using a spectrograph in order to analyze the data. They measured VOT by "marking off the interval between the release of the stop and the onset of glottal vibration, that is, voicing" (p. 389). They located the point of voicing onset by "locating the first of the regularly spaced vertical striations which indicate glottal pulsing" (p. 389). They found the instant of release by "fixing the point where the pattern shows an abrupt change in overall spectrum" (p. 389). They point out that oral closure is marked spectrographically by "the total or almost total absence of acoustic energy in the formant frequency range" (p. 389) whereas oral release is marked by "the abrupt onset of energy in the formant frequency range" (p. 389).

To measure VOT, Lisker and Abramson adopted the convention of assigning zero-time to a reference point, the instant of release. They then observed that there were three common conditions of VOT. For the first, voicing begins before the release of the stop, and is voiced and unaspirated. Measurements of VOT before the release may be stated as negative numbers and called voicing lead. For the second, voicing begins just after the release of the stop and is voiceless and unaspirated. . For the third, voice onset "lags considerably behind the release" (p. 389) and is voiceless and aspirated. Measurements of VOT after the release may be stated as positive numbers and called voicing lag. Lisker and Abramson measured VOT to the nearest five milliseconds.

Lisker and Abramson displayed the results for the stops in words in terms of average, range, and frequency of VOT. For Puerto Rican Spanish, there were two stop

consonant categories. The first category contained voiceless bilabial stop [p], voiceless dental stop [t], and voiceless velar stop [k]. The second category contained voiced bilabial stop [b], voiced dental stop [d] and voiced velar stop [g]. Table 1 displays the VOT averages, ranges, and number of tokens from the two speakers of Puerto Rican Spanish. As shown in the table, the voiceless stops were produced with lag time while the voiced stops were produced with lead time. For the voiceless stops, the average measurement of VOT in terms of milliseconds increased with place of articulation. The voiceless bilabial stops had the shortest VOT whereas the velar stops had the longest VOT. For the voiceless stops, the range of the bilabial stops overlaps with the range of the alveolar stop. For the voiced stops, the average measurement of VOT in terms of milliseconds decreased with place of articulation. The voiced bilabial stops had the longest VOT whereas the velar stops had the shortest VOT. For the voiced stops, there is an overlap in the range of all the stop categories with each other.

Table 1. VOT averages, ranges, and number of tokens of stop consonants for two speakers of Puerto Rican Spanish (from Lisker and Abramson, 1964)

Spanish						
	p	t	k	b	d	g
AVG	4	9	29	-138	-110	-108
Range	0:15	0:15	15:55	"-235:-60	"-170:-75	"-165:-45
N	20	16	20	17	16	14

For American English, there was one voiceless stop consonant category which contained voiceless bilabial stop [p], voiceless dental stop [t], and voiceless velar stop [k]. Table 2 displays the VOT averages, ranges, and number of tokens for the four speakers of American English. As shown in the table, the voiceless stops were produced with lag time. For the voiceless stops, the average measurement of VOT in terms of

milliseconds increased with place of articulation. The voiceless bilabial stops had the shortest VOT whereas the velar stops had the longest VOT. For the voiceless stops, there is an overlap in the range of all the stop categories with each other. In comparing and contrasting the VOT of the Puerto Rican Spanish and the American English voiceless stops, we see that the VOT for the Puerto Rican voiceless stops is shorter that the VOT for the American English voiceless stops. This is consistent with fact that the Puerto Rican Spanish voiceless stops are unaspirated whereas the American English voiceless stops are aspirated.

For the American English voiced stops, Lisker and Abramson give two sets of values for the voiced bilabial, alveolar, and velar stops. As shown in table 2, the first set has values which are positive values with lag time; the second set of values are negative values with lead time. For the voiced stops with lag time, the average measurement of VOT in terms of milliseconds increased with place of articulation. The voiced bilabial stops had the shortest VOT whereas the voiced velar stops had the longest VOT. For the voiced stops with lag time, there is an overlap in the range of all the stop categories with each other. Similar to the speakers of Puerto Rican Spanish, the American English speakers also produced voiced stops with negative values with lead time. For the voiced stops with lead time, the average measurement of VOT in terms of milliseconds slightly decreased with place of articulation. The voiced bilabial and the voiced alveolar stops have longer VOT than the voiced velar stop. For the voiced stops with lead time, there is an overlap in the range of all the stop consonants with each other. According to Lisker and Abramson, there are two sets of values in American English because two of the speakers produced voiced stops with lead time, and two of the speakers produced voiced

stops with lag time. In other words, the four speakers did not randomly produce voiced stops with positive (lag) or negative (lead) VOT values; instead, each speaker produced a single kind of voiced stop, either positive (lag) or negative (lead).

Table 2. VOT averages, ranges, and number of tokens of stop consonants for four speakers of American English (from Lisker and Abramson, 1964)

English						
	p	t	k	b	d	g
AVG	58	70	80	1/-101	5/-102	21/-88
Range	"20:120	30:105	50:135	0:5/-130:-20	0:25/-155:-40	0:35/-150:-60
N	102	116	84	51/17	63/13	53/13

Lisker and Abramson considered the results for the stops in sentences, or running speech, in terms of average, range, and frequency of VOT. They found that "by and large the sentence data are congruent with the word data" (p. 413). They also found that VOT of stops embedded in sentences, produced with both lead and lag, seemed to be a bit compressed in comparison with the values measured in the words. Finally, Lisker and Abramson found certain uncontrollable variables that could have affected VOT values in the sentence data. Since they told their participants to say the sentences naturally, they had no control over rate of utterance, and did not control for vocalic environments or occasional loss of contrasts. These variables could account for differences in the production of VOT of stop consonants in words embedded in sentences. In other words, the differences between VOT values in isolated words and words embedded in sentences could be due to these uncontrolled variables.

To conclude, Lisker and Abramson express an interest in finding out if the dimension of VOT is perceptually relevant, They propose experiments to test three hypotheses in the future. The three hypotheses are as follows:1) "perceptual boundaries

between phoneme categories will fall along the voice onset time dimension," 2) "the phoneme boundaries will vary from language to language in general accord with the measurements obtained from real speech, " 3) best synthesis will require that voicing onset be represented acoustically by the simultaneous starting of both periodic pulsation (buzz) and the first formant" (p. 421). They conclude that VOT is "highly effective as a means of separating phonemic categories" (p. 422).

Another author who focuses on the VOT of stop consonants in American English and Puerto Rican Spanish is Schnitzer (1997). In his book on Spanish-English contrastive phonology he explains the difference between the production and perception of the VOT of stop consonants in American English and Puerto Rican Spanish. According to Schnitzer "it turns out that for English aspirated [p] there is an extremely long VOT compared to the unaspirated English [p] or Spanish [p]" (p. 37). In other words, aspiration is produced and perceived with considerably long VOT. Because English [p] has such a long VOT in word initial position, it may leave the English [b] in a position where it may approach the VOT of Spanish [p]. This may establish a direct contrast between the Spanish and the English [p]. For example, an English speaker may interpret Spanish [p] as English [b].

Voice Onset Time within psycholinguistics

Lisker and Abramson (as cited in Yeni-Komshian, 1998) defined VOT as "the time between the release of air pressure (the burst) and the onset of vocal fold vibration (voicing) for the adjacent vowel" (p.129). According to Yeni-Komshian, acoustic cues are "aspects of the complex sound patterns necessary for the identity of a given phoneme" (p. 123). Similar to Lisker and Abramson, she considers that VOT is the "the

best single measure for signaling the difference between voiced and voiceless stop consonants in syllables such as [ba] versus [pa]" (p 128). As the best single measure, VOT can be considered as an acoustic cue that signals the voicing of stop consonants. Speaker-hearers use VOT to distinguish contrastive sounds such as voiced and voiceless stop consonants.

Yeni-Komshian and LaFontaine (1983) (as cited Yeni-Komshian, 1998) performed a study in which they examined VOT as a relevant perceptual acoustic cue for the voicing of alveolar stops. They used seven stimuli along a continuum. For each stimulus, they used an experimental syllable, such as [di] and [ti], which started with a burst and had three formant transitions leading into the vowel [i]. They measured the VOT values of each of the seven stimuli in milliseconds. For the first syllable, the voicing of the vowel was of zero milliseconds; in other words, the voicing of the vowel and the articulation of the alveolar stop consonant were simultaneous. They repeated this pattern for the rest of the stimuli, except that they added 10 milliseconds from one stimulus to the other. To see if the acoustic representations of [di-ti] matched subjects' perceptions, Yeni-Komshian and LaFontaine constructed an identification test and a discrimination test using the seven stimuli.

To conduct the identification test, Yeni-Komshian and LaFontaine presented subjects with the seven stimuli along the [di-ti] continuum in random order ten times, for a total of seventy trials. The subjects listened to the stimuli and identified hearing either [d] or [t]. The idealized results for an experiment such as this showed that the subjects perceived the first three stimuli along the [di-ti] continuum as [da], while they perceived

five, six and seven as [ta][1]. The results for stimulus four were mixed; fifty percent of the subjects identified the stimulus as [da], and the other fifty percent identified the stimulus as [ta]. According to Yeni-Komshian and LaFontaine, this phenomena can be attributed to a perceptually unstable, or a cross-over, stimulus.

A cross-over stimulus serves as a boundary between phonemes and their categories. For example, it will allow the listener to distinguish the phoneme [d] from the phoneme [t]. The identification test also showed that there is perceptual continuity present in the subjects' responses. The subjects perceived stimuli one, two and three as [d] regardless of their different phonemic categories. By the time the subjects reached stimulus four, they had started to distinguish the different physical characteristics of the stimuli, so they placed stimuli five, six and seven in a different category [t].

Yeni-Komshian and Lafontaine believed, based on the results, that there was a need to find out whether or not the subjects' responses were perceived categorically. Therefore, they used the seven-stimuli along the [di-ti] continuum to construct a discrimination test. The results of the discrimination test showed that all of the subjects were able to discriminate whether the stimuli pairs were the same or different. Thus, Yeni-Komshian and LaFontaine were able to identify a discrimination peak, or the trials that contained a stimuli pair with phonemes of different categories. The results showed that the discrimination of the seventy trials placed the discrimination peak in the area that separates the two phoneme categories. Overall, the results showed that the identification test allowed the researchers to establish a boundary between phonemic categories while

[1] Yeni-Komshian and LaFontaine referred to both [di-ti] and [da-ta]. They used [di-ti] when they referred to their actual study, and they used [da-ta] when they referred to idealized results.

the discrimination test helped to clarify the subjects' categorical perception of phonemic categories.

The results of the study conducted by Yeni-Komshian and LaFontaine showed that VOT can be used as a perceptual acoustic cue within the voiceless and voiced phonemic categories. In other words, the subjects were able to discriminate between categories of the continuum of [da-ta]. They describe this ability to discriminate between categories as categorical perception, which takes place when there is a phonological representation that enables the speaker to discriminate between sounds. Yeni-Komshian and LaFontaine used adult subjects in their study and, thus, showed that adults can perceive categorically. Eimas, Siqueland, Jusczyk, and Vigorito (1971) (as cited in Field, 2003, p. 76) performed an experiment in which they tried to find out if infants also perceive categorically.

To conduct their study, Eimas, et al. conducted an experiment in which they used the High Amplitude Sucking Procedure, which is based on the observation that infants react to outside stimuli by increasing their sucking rate. The researchers gave four-month-old infants dummies to suck on and then observed them. Once the infants started to suck on the dummies, the researchers presented them with an auditory stimulus within the voiced and voiceless phonemic category from the [ba-pa] continuum. Since they were presented with a new stimulus that captured their attention, the infants responded by increasing their sucking rate. Once the auditory stimulus was played several times, the infants lost interest in it, and their sucking rate returned to normal. Once the sucking stabilized, the researchers played a different stimulus from the same phonemic category as the first one; this caused no change in the sucking rate of the infants. In other words,

their sucking rate did not change because the stimulus itself was from the same phonemic category as the first one the second time it was presented to them. Then they played a different stimulus from a different phonemic category as the first one. This caused an increase in the sucking rate of the infants. These results, which showed that the change in the infants' sucking rate occurred as a response to the different phonemic categories, demonstrated that four-month-old infants perceived categorically.

The experiment of Eimas et al. raised the question of whether or not categorical perception is innate to humans. In order to test this idea, Khul and Miller (1978) (as cited in Field, 2003, p. 77) performed a study similar to that of Eimas, et al. In this study, the researchers used chinchillas because their auditory apparatus is similar to that of the human. Khul and Miller used as a stimulus a voicing continuum ranging from 0-80 milliseconds, where [b] was approximately less than 25 milliseconds and [p] was no more than 80 milliseconds. The researchers trained the chinchillas to respond differently to the stimuli at the extreme ends of the [ba-pa] continuum. When the researchers played the stimulus, the chinchillas showed that they were able to identify the stimulus by changing their behavior. For example, the researchers gave the chinchillas water to drink while presenting them with the stimuli. The chinchillas would continue drinking while they were exposed to the first stimulus like the infants from the Eimas, et al study. However, as the stimuli changed, the chinchillas changed their behavior as well. They would start running across the cage when they were exposed to the second stimulus which represented a different phonemic category from the first stimulus. These behavioral changes occurred from 0-25 milliseconds, which represent one phonemic category, and from 25-80 milliseconds, which represent another phonemic category. These results

show that categorical perception is not innate only to humans, unless chinchillas have an innate capacity for human language. Both humans and chinchillas can perceive categorically. Thus, language specific phoneme categories of human language may develop according to exposure to a specific language.

Voice Onset Time and second language acquisition

When a speaker is trying to acquire a second language, there might be a mismatch between the constraints of the speaker's native language and the constraints of the target language. Sound system inventories are not the same in every language. Some of these inventories may contain features that are described as marked, or less frequent, or features that are described as unmarked, or more frequent. According to Gass and Selinker (2001) "a speaker of a language with a more marked native language structure than that which occurs in the target language will have an easier time learning the target language structure than a speaker whose language structure is less marked than the target language" (p.160). If the latter is the case, then speakers might develop rules that are adapted from either their native language or from a combination of both their native language and their target language.

One study within second language acquisition (SLA) that focuses on VOT was Eckman, (1981) (as cited in Gass and Selinker, 2001, p. 151-154). In this study Eckman explored non-native English voiced and voiceless stops in word final position elicited from native Spanish and Mandarin speakers. The study dealt with the fact that voiced stops do not occur in word final position in Spanish and the fact that neither voiced nor voiceless stops occur in word final position in Mandarin. The results showed that when native Spanish speakers speak English, they tend to devoice voiced stops in word final

position. When Mandarin speakers speak English, they tend to add a non-stressed vowel, or schwa, following word final voiced stops. The devoicing of voiced stops in word final position is found in many languages of the world. Since this tendency is unmarked, the devoicing of word final stops on the part of Spanish speakers with English as a second language is part of a general tendency and not something specific to the Spanish speakers themselves. However, the Mandarin speakers had a different strategy than devoicing. They adapted a rule that comes from attempting to avoid violation of their native language constraints. Instead of producing English CVC syllables with either voiced or voiceless stops in the coda, they added a schwa to the voiced and voiceless stops and created a CV syllable structure that did not violate their native language constraints.

In SLA, voicing contrasts have generated an interest with respect to typological universals in SLA; they have also stimulated an interest in research on VOT. Flege (1980) was one of the first researchers to be interested in VOT in second language acquisition. Flege used three groups of male subjects, one group of Americans and two groups of Saudi-Arabians. All three groups lived in the United States (US) during the course of this study. The Saudi-Arabians were distinguished by the amount of time they had lived in the US. One group of Saudi-Arabians had lived in the US for eight months; a second group of Saudi-Arabians had lived in the US for 39 months.

In order to conduct the study, Flege (1980) recorded the subjects while they were seated in front of a microphone in a soundproof booth at the Phonetics Laboratory at the University of Indiana. He used a high quality model Revox A 700 tape recorder to collect the data. In order to elicit the production of monosyllabic English words, he asked the Saudi Arabian participants to fill in the blank of the carrier sentence, *I say*

_____ *again to Bob* ,with words such as ***b****at,* ***p****at,* ***b****ag* and ***b****ad,* all of which were monosyllabic words with CVC closed syllable structure. To examine phonetic approximation, he wanted to examine the Saudi Arabian production of voiced and voiceless stops in word initial and word final position in English words in order to see the phonetic contrast between English and Arabic. In word initial position, voiced and voiceless stop consonant closure duration depends on the presence or absence of glottal pulsing. In word initial position, the Arabic closure duration of voiceless stop consonants is longer than the closure duration of voiced stop consonants. In contrast, English closure duration of voiced stop consonants is longer than the closure duration of the voiceless stop consonants.

After Flege tape-recorded the subjects, he did instrumental analysis of the spectrograms of six samples of each word from the subjects. He measured the spectrograms of the words by hand to the nearest five milliseconds and focused on vowel duration, stop-closure duration, and VOT. He also performed tests of analysis of variance in order to see the differences in the production of sounds by the three subject groups. The measurements of stop voicing produced in the English of the Saudis showed values which were intermediate between the measurements of stop voicing produced in the English of the Americans and produced in the Arabic of the Saudis. This suggests that the Saudi learners of English were approximating the phonetic norms of English. The Saudis' elicited English data showed sounds, including mispronunciations that are usually produced quite constantly in the same phonetic context by language learners. In other words these participants' attempts to produce English-like sounds did not always succeed. In these cases the sounds produced by Saudis were common mispronunciations

that are shared by English second language learners. The study also showed that individual learners may adopt different phonetic strategies to produce sounds that aim to approach those of their second language and that the production of English-like values for VOT was independent of the amount of time that a Saudi had resided in the US.

Other studies have measured VOT production of English by speakers of other languages. Similar to the Flege, Khattab (2002) chose Arabic speakers to measure VOT English production. He posed the following research questions: 1) Do English-Arabic bilinguals acquire separate VOT patterns for each of their languages? 2) Are their patterns of production in each language similar to those of monolinguals in the study? 3) Are the patterns for the monolingual subjects similar to the ones normally described in the literature and therefore expected for each language? 4) Are there signs of influence from one language to the other in the bilinguals' production and what are the factors that affect such influence?

In order to answer the research questions, Khattab chose to analyze children who were trying to acquire the sound patterns of both English and Arabic simultaneously. The subjects consisted of three age-based groups of children: age 5, age 7, and age 10 living in Yorkshire, England. Each age-based group consisted of one English-Arabic bilingual child, one English speaking monolingual child, and one Arabic speaking monolingual child, for a total of three children in each age-based group. The bilingual children came from Lebanese families. The monolingual English-speaking children were close friends of the bilingual children. The monolingual Arabic-speaking children did not know either the English-speaking or the bilingual children but had parents from the same area of Lebanon as the bilingual children.

The data consisted of tape-recorded tokens of [**b d g**] and [**p t k**] in isolated words in word-initial prevocalic position. To elicit the data, Katthab used pictures that represented items with words containing voiced and voiceless stop consonants. After he collected the tape-recorded data, he did auditory analysis to identify the tokens as voiced or voiceless. Then he measured the tokens and analyzed them instrumentally by digitalizing them and using acoustic software (Sensimetrics Speech Station 2) to convert the tokens and the words in which they occurred into wideband spectrograms and waveforms. He used the instrumental analysis to confirm if the tokens were voiced or voiceless. He then measured the VOT of the tokens. He measured the VOT of the voiceless stops "from the beginning of the release burst to the point at which the waveform departs from the baseline in forming the first periodic cycle" (p. 100). He measured the VOT for pre-voiced stops from the "onset of the first periodic cycle in the closure period to the beginning of the release burst" (p. 100). He measured and analyzed 200 tokens for each bilingual child and 100 tokens for each monolingual child. He calculated the mean VOT and standard deviations for the tokens in each language for each subject.

Khattab answered all four of his research questions. For question #1, Khattab reported that the subjects acquired separate patterns of VOT for each of their respective languages. For question #2, Khattab reported that the bilingual speakers' productions of both Arabic and English were different from those of the monolingual subjects in the study "but more so with respect to their production of Arabic" (p. 119). For question #3, Khattab reported that the patterns for monolingual subjects were similar to the ones expected for each language, and it seems that the participants showed "progression

towards adult patterns" (p.119). Finally, for question #4, Khattab reported that the bilingual subjects acquired certain features that were similar to those of the monolingual subjects and others that could be attributed to their bilingual background.

The production of sounds of a target language sometimes implies transfer of patterns of the first language onto the production of the second language. However, speakers may create inter-language constructs that do not belong to either the native language or the second language. These inter-language constructs are not necessarily associated with language transfer. Hodne (1985) performed a study to find evidence that would support the idea that inter-language phonology can be influenced by factors that are not related to language transfer. This study built on a similar study that provided evidence for the influence of preferred open syllables (CV) in inter-language. The aim of the study on which Hodne built was to find out whether or not this preference for open syllabic patterns could be directly attributed to language transfer (Tarone 1980 as cited in Hodne 1985). In this study, Hodne focused on Polish and one group of Polish speakers.

Hodne included in her study two Polish women who had emigrated to Minnesota from Poland. One of the participants was 24 years old and had been living in the United States (US) for a year and ten months before the study was conducted. She didn't know any English before leaving Poland, so when she arrived in the US, she enrolled in an English as a Second Language (ESL) class through the public school system. The other woman who participated in the study was 29 years old and had been living in the US for five months before the study was performed. Similar to the first participant, she did not know any English before leaving Poland and enrolled in an ESL class upon arrival. Both participants were placed according to their English proficiency by an ESL teacher. The

first participant was placed in the lower intermediate range in listening and speaking, and in the upper beginning range in grammar. The second participant was placed in an upper beginning range in all three areas of listening, speaking, and grammar.

In order to carry out the study, Hodne recorded the participants with "prominent" desk microphones while they performed two tasks. For the first task Hodne asked the participants to answer two questions taken from the IIlying Oral Interview [2]. These questions involved elicitation of statements regarding the habits and routines of a fictional character named Tom by showing the participants pictures of Tom's daily activities. For the second task, the participants were asked to watch a video tape (Tarone and Yule 1983). The short film presented two students in a classroom that were involved in a very compromising situation. One of the students stood up at the board, taking advantage of the teacher's absence, and began to write derisory comments about the teacher on the board. The other student stood up to the first student and tried to erase the board. At that precise moment, the teacher came in to the classroom and put the blame on the second student. After watching the video, the participants were asked to describe the events of the film to another person who had not seen it previously. The analysis of the data collected was used to find out if "evidence in support of the hypothesized universal preference for the open CV syllable can be found in the pronunciation of consonant clusters in the inter-language of the learners whose native language features the same consonant clusters and similar syllable structures?"(p. 407).

Hodne phonetically transcribed the interview and the narration from the tape. The study focused on consonant clusters as well as insertion of glottal stops and epenthetic

[2] A test developed to determine English comprehension and speaking ability in non-native speakers.

vowels (voiceless vowels included). It is also important to mention that even though strong release and aspiration of consonants were not necessarily relevant to the study, they were reported on the transcription. The stop consonants followed by a voiceless vowel created an aspirated effect in the production of the cluster, which raised the question of whether or not epenthetic vowels should only be fully voiced instead of voiceless vowels. However, the production of aspirated stops in the English language does not occur in every language. For a speaker whose native language does not have this kind of phonetic feature, it is said that aspiration creates an effect in the speech flow of the speaker which is similar to the effect that voiceless vowels have. Hence, the tokens for non- native aspiration in the participants' transcriptions were considered to be examples of epenthesis. The study also included the insertion of glottal stops because they have a similar effect in speech flow. Similar to non-native aspiration, it disturbs already expected rhythm and mixed patterns. The instances of syllables used by each participant were tallied along with the instances of target language modifications either by consonant deletion, epenthesis, or insertion of glottal stops.

After analyzing the data, Hodne reported that most of the modifications of syllabic structure could be attributed to language transfer. However, Hodne also found evidence from the results of modification of syllabic structure that could not be attributed to transfer. Thus, these modifications are part of constructs of an inter-language that do not belong to either the speaker's native language or the target language. Non-transferred errors were less frequent than transferred errors, which made it difficult to conclude that there was support for the hypothesized universal preferences for open syllables by the participants. The results also showed that fifty percent of the syllabic modifications

produced by the speakers were aimed towards open syllable structure where glottal stops were inserted in more complex syllable structures.

Felbaum (1996) is another study that examined the inter-language of second language learners. The hypothesis of this study was that (1) American speakers would not have difficulties suppressing aspiration in Spanish unaspirated stops and (2) Spanish speakers would have difficulties producing aspiration required in English aspirated stops. This study built on Eckman's Markedness Differential Hypothesis (MDH) [3] which accounted for the fact that the presence of aspirated stops (marked) implies the presence of unaspirated (unmarked) stops. However, the presence of unaspirated (unmarked) stops does not imply the presence of aspirated (marked) stops.

In order to carry out the study, Felbaum chose eight native speakers of American Midwestern English and seven native speakers of Spanish. The American English speakers had previous knowledge of Spanish and were in their fifth, and final, quarter of Spanish at the University of Minnesota where they were enrolled in a Spanish Second Language program at the intermediate level. They had also received Spanish education in high school for four years. They had also lived in the United States for six months.

To elicit the data, Felbaum gave the participants carrier sentences. There were two carrier sentences with their respective words or tokens. One of the carrier sentences was in Spanish: *Diga la palabra ____ otra vez.* She asked the participants to fill the blank in this sentence with words such as such as ***p****ago,* ***t****aza,* ***c****ada* (p.1), all of which were disyllabic words with CVCV open syllable structure. The other carrier sentence was in English: *Say the word _____ again*. She asked the participants to fill the blank in

[3] This hypothesis was formulated by Eckman in 1977. It predicts that aspirated stops will be more difficult to acquire than unaspirated stops in a language, but not vice-versa.

this sentence with words such as ***p****osit, **t****oddy, and **c****opper* (p.1). She focused on voiceless stops in word initial position in all three places of articulation placed in a stressed syllabic structure in order to find out if Spanish speakers learned English aspirated voiceless stops. Her study focuses, thus, on the production of aspiration in English voiceless stop consonants. She included in her study words with stop consonants in word initial position followed by a low back vowel [a]. She chose a low back vowel as a following vowel because it is a common vowel shared by both languages. In order to conduct the study, Felbaum presented the participants with randomized tokens of the words that appeared three separate times in both their first (English) and second (Spanish) language. Then she asked the participants to read out loud both sets of sentences.

After collecting the data, Felbaum measured and analyzed VOT tokens by digitalizing the tokens into a DAT tape with a speech acoustic program called Entropic Waves+ Software 5.0. She measured VOT from the beginning of the burst in the onset to where the voicing occurs on the spectrogram.

The results were not as consistent as Felbaum hoped. It was impossible to distinguish the two groups of learners on the basis of the analyzed data. After organizing the results and putting them together according to measurements, Felbaum realized that the use of group means was not useful to account for the acquisition of aspirated and unaspirated stops. Therefore, she could not attribute the acquisition of the stops to markedness relations.

Another study that focuses on acoustic cues as keys to distinguish between phoneme categories are Zampini's studies (1998 a&b as cited in Zampini and Green, 2001). This study explores the role of acoustic signals, such as VOT and voiceless

closure interval, in the acquisition of distinct phonemic categories for each language that a speaker-listener acquires. According to Zampini, English voiceless and voiced stops are produced with different lag. English voiceless stops are produced with VOT values that exceed 30-35 milliseconds (long-lag), whereas English voiced stops are produced with VOT that are less than 35 milliseconds (short-lag). Since both voiceless and voiced stops are produced with VOT values within the VOT lag categories, phonetically speaking, both categories of stops can be considered as voiceless even though phonologically there is a distinction between the two phonemic categories. In the case of Spanish, voiceless stops are produced with VOT values that are less than 35 milliseconds, whereas the voiced stops are produced with VOT with negative values or pre-voiced. Therefore, Zampini emphasizes that "although English and Spanish show the same phonological contrast for the voiced and voiceless stops, the contrast is realized differently at the phonetic level" (p. 24). In the case of Zampini's study, Zampini examined these two acoustic signals in the production and perception of bilabial English and Spanish stop consonants from English-Spanish bilinguals, and late second language learners.

The purpose of the Zampini study was to find out if English-Spanish bilingual speakers were able to control timing signals of stop consonants just like monolinguals do in speech production. In addition, Zampini's study explored the relationship of time lag between the two languages; in other words, if the short lag category of English voiced stop affects the acquisition of the short lag category of the Spanish voiceless stops or not. Furthermore, Zampini's study also tried to find out if bilingual listeners' perception of stop consonants is as sensitive to VOT and closure interval as that of monolingual

listeners. Finally, Zampini attempted to find out if accurate production relies on accurate perception in second language learning.

The Zampini study included 14 participants who were enrolled in an advanced undergraduate Spanish class. All 14 participants participated in two tasks, a production task and a perception task. Both tasks were performed in three different times during the semester (week 3, week 6, and week 15).

For the Production Task, the participants were recorded while reading short passages, word lists, and sentences that contained a target word with English and Spanish bilabial stop consonants. The English data was recorded during the second or third week of the semester. The Spanish data was recorded during the sixth and fifteenth week of the semester. After the data was collected, it was digitized into a computer in order to measure VOT and closure interval. The results of the production of English bilabial stop consonants were as expected. Although phonologically English bilabial stops are placed in either a voiced or voiceless category, phonetic evidence showed that both English bilabial stops overlap within the short lag continuum. Thus, phonetically speaking, English stop consonants are said to be voiceless (Zampini 2001). The results also showed that English-Spanish speakers produced Spanish /p/ with VOT values that were significantly shorter than the English /p/. Therefore, these speakers did acquire a distinct category for each language. The results indicated as well that the variation of the Spanish data collected in the three different times during the semester was not significant. Moreover, the difference of VOT means between the Spanish /b/ and the English /b/ was not significant. Then, the study focused on closure interval as a distinctive signal of phonemic category. The results showed that the closure intervals of English /p/ and /b/

were almost the same, as expected. In addition, the results showed that the closure interval mean of Spanish /b/ was significantly lower than that of Spanish /p/. Therefore, closure interval showed more phonetic difference between phonemes.

For the perception task of the Zampini study, the participants (same participants as in the Production Task) performed a Spanish perception task during the same weeks as in the Production Task. In addition to these 14 participants, there were two control groups: monolingual speakers of English and late Spanish-English bilinguals. During the task, Zampini tried to set a Spanish environment by doing the task in Spanish. The perception task included a stimuli that consisted of two natural speech continua of the stop consonants /p/ and /b/ in the nonsense words ***b****ada* and ***p****ada* produced by an English-Spanish bilingual. Both words were produced in two different accents, a Spanish accent and an English accent. The tokens produced in the Spanish and English accents were randomly organized and presented to the participants. The participants identified each token's first stop consonant in the non-sense word as either /p/ or /b/. The results indicate that there was a significant difference in the perception boundaries in both accented version of the tokens. The VOT of the Spanish accented tokens produced a shorter boundary than the VOT of the English accented tokens. Therefore, the results showed that second language listeners have two perceptual boundaries, one for each language. In addition, these boundaries became more distinct with language exposure.

The literature reviewed here deals with issues concerning the production and perception of VOT in first and second language. It was my purpose to extend what previous researchers have done to the context of Puerto Rico focusing on university students with Spanish as a first language and varying degrees of proficiency in English as

a second language. Since VOT serves as an acoustic cue for the study of voiced and voiceless stop consonants, I focused on voicing contrasts of English and Spanish stops in word initial position. The objectives of this thesis were as follows:

1.
a.
To find out if VOT values of voiced and voiceless stops in the Spanish of UPRM college students with L1 Spanish and L2 English vary across four English proficiency levels.
b.
To find out if VOT values of voiced and voiceless stops in the English of UPRM college students with L1 Spanish and L2 English vary across four English proficiency levels.
2.
To find out if the VOT values of voiced and voiceless stops of the four groups of UPRM college students who participated in the production task represent inter-language, an interim state, or if they represent attainment of the target L2 English.
3.
To find out if four groups of UPRM college students who participate in an identification task are able to identify the production of voiceless and voiced stops in English and Spanish produced by four groups of UPRM college students who participate in a production task.
4.
a.
Taking the results of the production task from research question #1a and #1b together with the results of the identification task from research question #2, to find out if the identification of voiced and voiceless stops in Spanish matches the production of voiced and voiceless stops in Spanish.
b.
Taking the results of the production task from research question #1a and #1b together with the results of the identification task from research question #2, to find out if the identification of voiced and voiceless stops in English matches the production of voiced and voiceless stops in English.

CHAPTER III: THE PRODUCTION TASK

This chapter first addresses the methods of data collection, data analysis, and the results for research questions #1a and #1b. Research question #1a reads as: Do VOT values of voiceless and voiced stops in the Spanish of UPRM college students with L1 Spanish and L2 English vary across four English proficiency levels? Research question #1b reads as: Do VOT values of voiceless and voiced stops in the English of UPRM college students with L1 Spanish and L2 English vary across four English proficiency levels? After addressing research question #1, it addresses research question #2 which reads as: Do the VOT values of voiced and voiceless stops of the four groups of UPRM college students who participated in the production task represent inter-language, an interim state, or do they represent attainment of the target L2 English?

Research Question #1a and Research Question #1b

Data collection methodology

Participants

The data on which the Production Task for this study is based were collected from participants (n=8) who were students at the University of Puerto Rico at Mayagüez (UPRM), where freshmen enter on one of four English proficiency levels: Pre-Basic level, Basic level, Intermediate English and Advanced English. [4] There were, thus, four groups of participants, two students from each of the four proficiency levels. To obtain the students, I asked a professor from each of the levels to recommend two students who

[4] Students enter on the proficiency levels based on their scores on either an English as a Second Language Achievement Test (ESLAT) or an Advanced Placement (AP) English Exam offered by the College Entrance Examination Board. On the ESLAT the scores range between 200 and 800. The AP scores range between 1 and 5. Students who obtain scores between 4 and 5 on the AP are placed in Advanced English. Students who do not take the AP but score between 570 and 800 on the ESLAT are placed in Intermediate English. Students who score between 470 and 559 on ESLAT are placed in Basic level. Students who score under 469 are placed in Pre-Basic level.
`

might be willing to participate. After agreeing to participate, the students signed a consent form (Appendix A)

Instrument for socio-demographic description of participants

To describe the participants and to find out if there was anything related to their socio-demographic backgrounds and individual histories with the English language that could provide an explanation, other than ESLAT and AP scores, for their placement in their respective proficiency levels and for their performance on the Production Task, I created a Socio-Demographic and English Use Questionnaire (SDEUQ) (Appendix B) which had three parts. The first part asked for socio-demographic information about the students and their parents. Thus, questions 1-10 asked for the students' gender, hometown in Puerto Rico, place of birth, native language of the students and their parents, whether or not the students had lived outside Puerto Rico, and if the students spoke English at home. The second part, questions 11 and 12, asked the students to evaluate their use of spoken English and their ability to understand spoken English. The third part, questions 13-18, asked the students how much they used English with the media, specifically they asked whether or not the students listened to music in English, watched television in English, or chatted on Microsoft service Network (MSN) in English. All eight students filled out the SDEUQ.

Description and instructions to the participants for the Production Task

The task of the Production Task was to produce voiced and voiceless stops in English and Spanish. Since this was the task, I told the participants that I was going to record them while they read two word lists, one word list in English (Appendix C) and one word list in Spanish (Appendix D). Each word list had 15 items. I asked the

participants to read the word lists out loud and to repeat each of the 15 items on each word list three times and to try to wait for 3 seconds between repetitions. The participants read the English word list first and the Spanish word list second.

Recording of the word lists

I recorded the word lists in an isolated, quiet room in an office at the UPRM. To record the participants' reading of the two word lists, I asked the participants to read the word lists into an omni-directional ATR35s microphone which was attached to a HP Pavilion Ze4400. I used PRAAT Lab to record the reading of the word lists. Each item, together with its three repetitions, was recorded, or written, into a single, separate sound file using acoustic phonetics software from PRAAT Lab (Appendix E gives the procedure for recording the word lists).

Construction of the word lists

The list of 15 items in English for the English word list that I created for the Production Task included nine monosyllabic English words (**b***op, **b**aps, **d**ot, **g**ot, **p**ast, **p**ot, **t**ads, **t**op,* and ***c**ot*) and six monosyllabic nonsense syllables (***b**a, **d**a, **g**a, **p**a, **t**a,* and ***k**a*). The monosyllabic English words had CVC(C) closed syllable structure; the nonsense syllables had CV open syllable structure. I was interested in voiced and voiceless stops in word initial position for the monosyllabic words and in syllable initial position for the nonsense syllables. The 15 items included a set with voiceless stops [p] [t] [k]; this set included three items with [p] (***p**a, **p**ast,* and ***p**ot*), three items with [t] (***t**a, **t**ads, a*nd ***t**op*), and two items with [k] (***k**a,* and ***c**ot*). They also included a set with voiced stops [b] [d] [g]; this set included three items with [b] (***b**a, **b**aps* and ***b**op*), 2 items with [d] (***d**a,* and ***d**ot*), and two items with [g] (***g**a,* and ***g**ot*). There is no particular reason why [p], [b], and

[t], and not the other stops, were repeated three times. For the nine monosyllabic words, six had initial stop consonants followed by a low back vowel [a] (***p****ot, **t**op, **c**ot, **b**op, **d**ot,* and ***g****ot*) and three had initial stop consonants followed by a low front vowel [a] (***p****ast, **t**ads,* and ***b****aps*). Three of the nine monosyllabic words had consonant clusters in word final position ((***p****ast, **t**ads,* and ***b****aps*); the rest did not. All six monosyllabic nonsense syllables had initial stop consonants followed by a low back vowel [a].

The list of 15 items in Spanish for the Spanish word list that I created for the Production Task included both Spanish words and nonsense syllables. Since Spanish does not have monosyllabic words with CVC closed syllable structure with a stop consonant in initial position, I used nine disyllabic words with CVCV open syllable structure (***b****ata, **d**ata, **g**asa, **g**ata, **p**apa, **p**ata, **t**aza, **c**apa,* and ***c****ava*) and the same six monosyllabic nonsense syllables with CV open syllable structure (***b****a, **d**a, **g**a, **p**a, **t**a, **k**a*). I was interested in voiced and voiceless stops in word initial position for the disyllabic words and in syllable initial position for the nonsense syllables. The 15 items included a set with voiceless stops [p] [t] [k]; this set included three items with [p] (***p****a, **p**apa,* and ***p****at*), two items with [t] (***t****a,* and ***t****aza*), and three items with [k] (***k****a*, ***c****apa*, and ***c****ava*). They also included a set with voiced stops [b] [d] [g], this set included two items with [b] (***b****a,* and ***b****ata*), two items with [d] (***d****a* and ***d****ata*), and three items with [g] (***g****a, **g**ata,* and ***g****asa*). There is no particular reason why [p], [k], and [g], and not the other stops, were repeated in three items. All voiced and voiceless stops in word initial position for the disyllabic words and in syllable initial position for the nonsense syllables were followed by the low back vowel [a].

There are similarities between the two word lists. The stops in which I was interested all occur in word initial, or, in the case of nonsense syllables, syllable initial position. I examined stops in initial position so they would not show influence from preceding sounds. I was interested in words that occurred in isolation, not in carrier sentences in connected speech. According to Lisker and Abramson (1964), the examination of VOT in normal, connected speech introduces uncontrolled variables in sentence data. To minimize the number of uncontrolled variables, I decided to examine the words and nonsense syllables in which the stops occurred in isolation. Lisker and Abramson examined VOT production in native speakers; I examined the production of VOT in non-native speakers. Thus, another reason why I examined the production of VOT in words and nonsense syllables in isolation is that I wanted to draw the participants' attention to speech so that they would activate the monitor in their second language and do the best they could do on the production of the word lists. Both the English word list and the Spanish word list contained items with stop consonants followed by a low back vowel [a]. A low back vowel [a] is present in both English and Spanish (Schnitzer, 1997, p.4). In her study of the acquisition of voiceless stops in the interlanguage of Spanish speakers learning English, Felbaum (1996) included words with stop consonants in initial position followed by low back vowel [a], which she chose because it is a vowel that English and Spanish have in common. Following Felbaum, I included items with stop consonants followed by a low back vowel on both the English and the Spanish word lists. As mentioned, some items on the English word list contained the low front vowel, not the low back vowel.

There were also differences between the two word lists. The items in the English and the Spanish word lists had different word syllabic structures. In the English word list all of the 15 items were monosyllabic with different structures. Some of the items were monosyllabic words with CVC closed syllable structure; others were monosyllabic with CVCC closed syllable structure, and, finally, there were nonsense monosyllables with CV open syllable structure. In the Spanish word list, of the 15 items, nine are disyllabic words with CVCV open syllable structure, and six are non-sense monosyllables with CV open syllable structure. The reason why there were items with different syllable structures in both languages is because both languages contain different syllable coda. Since there are no monosyllabic words with CVC closed monosyllabic structure or monosyllabic words with CVCC closed syllable structure in Spanish, I made the decision to include items with disyllabic words with stop consonants in the initial position of the first syllable. In addition, I included some CV nonsense syllables such as ***p****a,* ***t****a,* ***k****a,* ***b****a,* ***d****a,* and ***g****a* in the word lists of both languages where consonants occur in the same environment for comparative and contrastive purpose. I examined the VOT of stop consonants that occurred only in stressed syllables. For both English and Spanish, VOT was examined in consonants that occurred in initial position of stressed syllables.

Data analysis methodology: The measurement of voice onset time (VOT)

Lisker and Abramson (as cited in Yeni-Komshian, 1998) defined VOT as "the time between the release of air pressure (the burst) and the onset of vocal fold vibration (voicing) for the adjacent vowel" (p.129). According to Lisker and Abramson (1964), voice onset time has three common conditions. "In the first, voicing begins before the release of the stop; in the second, just after the release; in the third, voice onset lags

considerably behind the release"(Lisker and Abramson, 1964, p. 389). According to Lisker and Abramson, the first stop is voiced and unaspirated; measurements of VOT before the release are called voicing lead and are stated as negative numbers. The second stop is voiceless and unaspirated and the third is voiceless and aspirated; measurements of VOT after the release are called voicing lag and are stated as positive numbers. VOT values for voiceless, unaspirated stops that fall within the short lag condition are represented by positive values that do not exceed the 35 milliseconds. VOT values for voiceless, aspirated stops that fall within the long lag condition are also represented by positive values, but they exceed the 35 milliseconds. I measured VOT from the time between the burst (the release of air pressure) and the onset of voicing (vocal old vibration) as durations in milliseconds. To measure duration in milliseconds, I used PRAATLAB acoustic software (Appendix F gives instructions on how to measure VOT using PRAATLAB).

Results: The Socio-Demographic and English Use Questionnaire

In the next section, I will describe the two student participants from each of the four proficiency levels in terms of their socio-demographic characteristics. To describe them, I will examine the results from the Socio-Demographic and English Use Questionnaire (SDEUQ) that I administered to the eight students.

The first group of students to be described are the two students in the Pre-Basic level. An examination of the SDEUQ shows that they were born in and that neither of them had ever lived outside of Puerto Rico. Both participants' four parents were born in Puerto Rico. Both participants reported that Spanish was their native language and that Spanish was the native language of their parents. Neither reported that they had plans to

go to the United States in the future. Neither reported that they spoke English at home, and neither reported that they had a friend who was a native speaker of English. In addition, neither reported that they spoke English among their friends at the university. In evaluating their own English, both reported that they didn't speak English very well, and both reported that they didn't understand spoken English very well. In evaluating their use of English with the media, neither reported that they listened to music in English, watched television in English, or chatted on MSN in English.

The second group of students to be described are the two students in the Basic level. An examination of the SDEUQ shows that they were born in Puerto Rico and that they had never lived outside of Puerto Rico. Both participants' four parents were born in Puerto Rico. Both reported that Spanish was their native language and that Spanish was the native language of their parents. Both said that they had plans to go to the United States in the future, but these plans were for vacation, not for relocation. Neither reported that they spoke English at home, and neither reported that they had a friend who was a native speaker of English. In addition, neither of them reported that they spoke English among their friends at the university. In evaluating their own English, one of the two reported that he spoke English well; the other reported that he didn't speak English very well, and one of the two reported that he understood spoken English while the other reported that he didn't understand spoken English well. In evaluating their use of English with the media, neither reported that they listened to music in English, watched television in English, or chatted on MSN in English.

The third group of students to be described are the two students in the Intermediate level. An examination of the SDEUQ shows that they were born in Puerto

Rico and had never lived outside of Puerto Rico. Both of the four participants' parents were born in Puerto Rico. Both reported that Spanish was their native language and the native language of their parents. One of the two of the participants had plans to go to the United States for vacation, but not for relocation, and the other had plans to go to the United States to explore the possibility of relocation. Neither of the participants reported that he spoke English at home; one of the two participants reported that he had a friend who was a native speaker of English and that he sometimes spoke English with his native speaker friend. Neither reported that they spoke English among friends at the university. In evaluating their own English, both reported they could speak English well, and both reported that they understood spoken English well. In evaluating their use of English with the media, both reported that they listened to music in English and Spanish, watched television in English and Spanish, and chatted on MSN in English and Spanish.

The fourth group of students to be described are the two students in the Advanced level. An examination of the SDEUQ shows that only one of the two participants had been born in Puerto Rico and had never lived outside of Puerto Rico. The other participant had been born in the United States and had lived in the United States but had moved back to Puerto Rico at an early age. Two of the participants' parents were born in the United States; the other two were born in Puerto Rico. Both of the participants reported that Spanish was their native language. Two of the participants' parents had English as their native language; the other two had Spanish. One of the participants had plans to go to the United States for vacation, but not for relocation; the other participant had plans to go to the United States to explore the possibility of relocation. Both participants reported that they spoke English at home and reported that they had a friend

who was a native speaker of English who they sometimes spoke with in English. Both participants reported that they spoke English among their friends at the university. In evaluating their own English, both reported that they could speak English very well, and both reported that they could understand spoken English very well. In evaluating their use of English with the media both reported that they listened to music in English, watched television in English, and chatted on MSN in English.

Results: Research questions #1a and #1b

To address research questions #1a and #1b, I measured the VOT of the items from the Production Task for the two participants from each of the four proficiency levels, Pre-Basic English (PBP1 and PBP2), Basic English (BP1 and BP2), Intermediate English (IP1 and IP2), and Advanced English (AP1 and AP2). This section presents the VOT measurements in the following order: voiceless stops in Spanish, voiced stops in Spanish, voiceless stops in English, voiced stops in English. For all tables, VOT is reported in milliseconds.

Voiceless stops in Spanish

Table 3 presents the VOT measurements for the three repetitions of each of the eight voiceless items in Spanish across the four English proficiency levels. According to Lisker and Abramson, the range of VOT for the voiceless bilabial stop is 0:15msec, for the voiceless dental stop 0:15msec, and for the velar stop 15:55msec. An examination of Table 3 shows that of the 192 productions (24 productions per item multiplied by eight items), 94% (180/192) of the productions are within the range of VOT values proposed by Lisker and Abramson for voiceless stops in Puerto Rican Spanish. On the table, the numbers in bold show the 12 tokens with VOT values that fall out of the range of VOT

values for voiceless stops in Puerto Rican Spanish. Of the 12 tokens, three occur at the Pre-Basic level, one occurs at the Basic level, six occur at the Intermediate level, and two occur at the Advanced level. Thus, the VOT values of the 12 tokens that fall out of the range of VOT values for voiceless stops in Puerto Rican Spanish do not seem to be determined by the four English proficiency levels; instead, they seem to be determined by the speaker and by the individual item. For example, of the 12 tokens that are out of range, eight (67%) occur in one item, *ta*, three produced at the Pre-Basic level by PB2, four produced at the Intermediate level by IP1 and IP2, and one at the Advanced level by AP1. One of the 12 tokens is the first repetition of *pata*, produced at the Basic level by BP2; two of the tokens are the first and third repetitions of *taza* produced at the Intermediate level by IP2, and one of the tokens is the third repetition of *pa* produced at the Advanced level by AP1.

Table 3. VOT for three repetitions of eight items in Spanish with voiceless initial stops for two participants at each of four proficiency levels: Pre-Basic (PBP), Basic (BP), Intermediate (IP), and Advanced (AP)

	PBP1	PBP2	BP1	BP2	IP1	IP2	AP1	AP2
Pa								
VOT 1	8	7	7	11	11	15	15	7
VOT 2	4	9	12	9	7	12	13	12
VOT 3	6	5	11	12	7	11	**17**	11
Papa								
VOT 1	8	8	8	9	10	5	10	8
VOT 2	5	11	8	10	10	6	13	7
VOT 3	12	11	6	7	9	7	11	10
Pata								
VOT 1	15	15	5	**20**	11	14	13	14
VOT 2	7	13	6	14	10	14	13	13
VOT 3	8	15	15	11	11	12	12	11
Ta								
VOT 1	12	**42**	15	14	**30**	14	10	9
VOT 2	9	**29**	14	15	**24**	15	11	8
VOT 3	15	**29**	15	12	**36**	**21**	**16**	7
Taza								
VOT 1	12	11	13	15	11	**16**	12	8
VOT 2	14	8	15	11	14	15	13	10
VOT 3	13	15	12	12	10	**16**	10	12
Ka								
VOT 1	26	22	23	25	19	35	30	19
VOT 2	28	15	25	18	22	26	32	22
VOT 3	34	16	32	16	15	28	19	18
Capa								
VOT 1	25	21	23	24	23	49	33	32
VOT 2	26	25	26	29	22	44	30	22
VOT 3	29	24	30	22	24	32	30	30
Cava								
VOT 1	22	26	30	26	24	40	34	18
VOT 2	49	20	27	24	18	40	26	24
VOT 3	35	22	31	24	29	38	24	30
Total of out of range tokens	0	3	0	1	3	3	2	0

Table 4 shows the average VOT measurements for the three repetitions of each of the eight voiceless items in Spanish across the four English proficiency levels. An examination of Table 4 shows that of the 12 averages (four proficiency levels for each item multiplied by three items), 83% (10/12) are within the range of VOT proposed by Lisker and Abramson (1964). The only two that are out of range are the Pre-Basic and the Intermediate averages for the voiceless dental stop. Only one item, *ta*, is responsible for the VOT productions of the voiceless dental stop tokens that are out of range and were produced by one Pre-Basic participant. This item influences the average. Without this item, the average VOT measurements for the Pre-Basic participant would be in the range of the voiceless dental stop, 0:15.

Table 4. Average VOT for three repetitions of eight items in Spanish with voiceless initial stops for four proficiency levels (Lisker and Abramson,1964)

		[p]	[t]	[k]
Pre-Basic	AVG	9	**17**	26
Basic	AVG	10	14	25
Intermediate	AVG	10	**19**	29
Advanced	AVG	12	11	26
L&A (1964)	AVG	4	9	29
Total of out of range AVG		0	2	0

Voiced stops in Spanish

Table 5 shows the VOT measurements for the three repetitions of each of the seven voiced items in Spanish across the four proficiency levels. According to Lisker and Abramson, the range of VOT for the voiced bilabial stop is -235:-60, the voiced dental stop is -170:-75, and the voiced velar stop is -165:-45. An examination of Table 5 shows that of the 168 productions (24 productions multiplied by seven items), 95%

(159/168) of the productions are within the range of VOT proposed by Lisker and Abramson for voiced stops in Puerto Rican Spanish. On the table, the numbers in bold show the nine tokens with VOT values that fall out of the range of VOT values for voiced stops in Puerto Rican Spanish. In addition to not falling within the range of VOT values for voiced stops in Puerto Rican Spanish, none of the tokens fall within the range of VOT for voiced stops in American English either. Even though six of the nine tokens (67%) that fall out of the range of VOT were produced by BP1 and BP2, the tokens that fall out of range do not seem to be determined by the proficiency level of the participants as one token (11%) was produced by IP1 while two tokens (22%) were produced by AP1.

Table 5. VOT for three repetitions of eight items in Spanish with voiced initial stops for two participants at each of four proficiency levels: Pre-Basic (PBP), Basic (BP), Intermediate (IP), and Advanced (AP)

	PBP1	PBP2	BP1	BP2	IP1	IP2	AP1	AP2
Ba								
VOT 1	-139	-175	-158	-114	-159	-137	-203	-142
VOT 2	-119	-116	-144	-126	-152	-141	-176	-170
VOT 3	-133	-75	**-59**	-109	-154	-85	-227	-208
Bata								
VOT 1	-69	-116	-125	-60	**-30**	-129	-139	-105
VOT 2	-63	-124	-134	**-26**	-151	-138	-103	-127
VOT 3	-111	-94	-130	**-28**	-92	-96	-124	-130
Da								
VOT 1	-142	-148	-134	-101	-125	-102	-123	-128
VOT 2	-112	-110	-90	-83	-102	-92	-134	-132
VOT 3	-148	-138	-68	-118	-92	-91	-189	-98
Data								
VOT 1	-115	-114	-105	**-33**	-83	-90	-97	-102
VOT 2	-102	-87	-139	**-49**	-101	-160	-93	-98
VOT 3	-118	-50	-105	**-39**	-92	-84	-115	-90
Ga								
	-127	-77	-126	-124	-82	-78	-146	-137
VOT 2	-91	-76	-72	-65	-72	-82	**-168**	-71
VOT 3	-63	-49	-76	-94	-78	-73	-146	-140
Gasa								
VOT 1	-162	-97	-138	-64	-81	-127	-108	-147
VOT 2	-109	-79	-61	-151	-59	-60	-103	-105
VOT 3	-78	-77	-125	-111	-76	-107	-178	-69
Gata								
VOT 1	-116	-90	-109	-82	-91	-87	-91	-121
VOT 2	-110	-82	-132	-54	-75	-69	-121	-102
VOT 3	-97	-60	-125	-82	-69	-127	**-176**	-48
Total of out of range tokens	0	0	1	5	1	0	2	0

Table 6 shows the average VOT measurements for the three repetitions of each of the seven voiced items in Spanish across the four English proficiency levels. An examination of Table 6 shows that all of the 12 averages (four proficiency levels for each item multiplied by three items) are within the range of VOT for voiced stops in Puerto Rican Spanish proposed by Lisker and Abramson (1964).

Table 6. Average VOT for three repetitions of eight items in Spanish with voiced initial stops for four proficiency levels and (Lisker and Abramson , 1964)

		[**b**]	[**d**]	[**g**]
Pre-Basic	AVG	-111	-115	-91
Basic	AVG	-101	-89	-100
Intermediate	AVG	-122	-101	-83
Advanced	AVG	-154	-117	-121
L&A (1964)	AVG	-138	-110	-108
Total of out range AVG		0	0	0

Voiceless stops in English

Table 7 presents the VOT measurements for the three repetitions of each of the eight voiceless items in English across the four English proficiency levels. According to Lisker and Abramson, the range of VOT for the voiceless bilabial stop is 20:120, for the voiceless alveolar stop 30:105, and for the velar stop 50:135. An examination of Table 7 shows that of the 192 productions (24 productions per item multiplied by eight items), 74% (142/192) of the productions are within the range of VOT values proposed by Lisker and Abramson for voiceless stops in American English. On the table, the numbers in bold show the 50 tokens with VOT values that fall out of the range of VOT values for voiceless stops in American English. Of the 50 tokens, 41 (82%), bolded with an asterisk, fall in the range of VOT for voiceless stops in Puerto Rican Spanish. The other nine tokens (18%) are not in the range of either American English or Puerto Rican Spanish

voiceless stops. Of the 41 tokens that are out of the range of VOT for voiceless stops in English but are within the range of VOT for voiceless stops in Puerto Rican Spanish, 46%(19/41) occur at the Pre-Basic level and 49% (20/41) occur at the Basic level; thus, a total of 95% (39/41), all but two, of the tokens that fall out of the range of VOT for voiceless stops for American English but within the range of voiceless stops for Puerto Rican Spanish were produced by participants in the two lowest proficiency levels. Of the 50 tokens that fall out of the range, 42% (21/50) involve items that begin with voiceless bilabial stops; 26% (13/50) involve items that begin with voiceless dental stops, and 32% (16/50) involve items that begin with voiceless velar stops.

Table 7. VOT for three repetitions of eight items in English with voiceless initial stops For two participants at each of four proficiency levels: Pre-Basic (PBP), Basic (BP), Intermediate (IP), and Advanced (AP)

	PBP1	PBP2	BP1	BP2	IP1	IP2	AP1	AP2
Pa								
VOT 1	36	**16**	***15**	***14**	88	33	66	74
VOT 2	20	***6**	39	***15**	52	46	77	92
VOT 3	***15**	***11**	***12**	***15**	66	50	51	84
Past								
VOT 1	***4**	***8**	24	22	54	53	28	61
VOT 2	***8**	***10**	***14**	20	57	41	52	58
VOT 3	***14**	***7**	***13**	***12**	52	**18**	58	22
Pot								
VOT 1	28	31	47	**19**	60	29	32	83
VOT 2	22	20	75	25	49	35	42	52
VOT 3	27	25	71	***14**	29	65	64	81
Ta								
VOT 1	54	34	85	21	40	**16**	64	30
VOT 2	21	38	58	21	42	**18**	53	45
VOT 3	47	26	101	21	61	27	59	19
Tads								
VOT 1	***14**	**25**	86	89	75	34	64	72
VOT 2	***16**	**24**	67	69	53	35	68	72
VOT 3	***10**	**19**	57	50	44	49	56	52
Top								
VOT 1	66	38	74	**17**	59	40	61	74
VOT 2	41	***24**	82	***23**	57	41	60	82
VOT 3	39	***22**	84	***21**	77	40	65	97
Ka								
VOT 1	***31**	64	***25**	***38**	75	76	89	81
VOT 2	***33**	***36**	***27**	***20**	92	84	82	70
VOT 3	55	59	***31**	***33**	71	***48**	84	74
Cot								
VOT 1	52	59	89	***32**	55	154	51	88
VOT 2	***47**	***30**	91	***29**	83	122	***48**	99
VOT3	57	34	77	***30**	66	119	66	96
Total of out of rane tokens	10	13	7	15	0	4	1	0

Table 8 shows the average VOT measurement for the three repetitions of each of the eight voiceless stops in English across the four English proficiency levels. An examination of Table 8 shows that of the 12 averages (4 proficiency levels for each item multiplied by three items), 75% (9/12) of the averages are within range of VOT for voiceless stops in American English. The three averages that are out of range for the production of VOT for voiceless stops in American English occur at the Pre-Basic and Basic levels, where, as we have seen, speakers produced many stops with VOT values that are within the range of VOT for voiceless stops for Spanish. The three averages that are out of range also involve items that begin with voiceless bilabial stops and voiceless dental stops, which as we have seen, together account for 74% of the 50 tokens that fall out of the range for the production of VOT for voiceless stops in Puerto Rican Spanish.

Table 8. Average VOT for three repetitions of eight items in English with voiceless initial stops for four proficiency levels (Lisker and Abramson, 1964)

		[**p**]	[**t**]	[**k**]
Pre-Basic	AVG	**17**	31	**46**
Basic	AVG	26	57	**44**
Intermediate	AVG	49	45	87
Advanced	AVG	60	61	77
L&A (1964)	AVG	58	70	80
Total of out of range AVG		1	0	2

Voiced stops in English

Table 9 presents the VOT measurements for the three repetitions of each of the seven voiced items in English across the four English proficiency levels. According to Lisker and Abramson, the range of VOT for the voiced bilabial stop is lag VOT = 0:5; lead VOT -130:-20, the range of VOT for the voiced alveolar stop is lag VOT 0:25; lead VOT -155:-40, and the range of VOT for the voiced velar stop is lag VOT 0-35; and lead-150:-60. An examination of Table 9 shows that of the 168 productions (24 productions per item multiplied by seven items), 93% (156/168) of the productions are within the range of VOT proposed by Lisker and Abramson for voiced stops in American English. On the table, the numbers in bold show the 12 tokens with VOT values that fall out of the range of VOT values for voiced stops in American English. Of the 12 tokens, 11 (92%), bolded with an asterisk, fall in the range of VOT for voiced stops in Puerto Rican Spanish. Only one token has a VOT that is not in the range of VOT for voiced stops in either American English or Puerto Rican Spanish. Of the 11 tokens that are out of the range of VOT for voiced stops in American English but in the range of VOT for voiced stops in Puerto Rican Spanish, 36% (4/11) occur at the Pre-Basic level and 45% (5/11) occur at the Basic level; thus, a total of 82% (9/11) of the tokens that fall out of the range of VOT for voiced stops for American English but within the range of voiced stops for Puerto Rican Spanish are produced by the participants from the two lowest proficiency levels. Sixty-seven percent (8/12) of the tokens that fall out of the range of VOT for voiced stops in American English involve items that begin with voiced bilabial stops.

Table 9. VOT for three repetitions of eight items in English with voiced initial stops For two participants at each of four proficiency levels: Pre-Basic (PBP), Basic (BP), Intermediate (IP), and Advanced (AP)

	PBP1	PBP2	BP1	BP2	IP1	IP2	AP1	AP2
Ba								
VOT 1	***-166**	***-153**	-111	-83	-124	-118	-141	-120
VOT 2	***-159**	-67	***-138**	***-134**	-61	-125	***-168**	-114
VOT 3	-123	-124	-130	-118	-97	-140	-98	-114
Baps								
VOT 1	-109	-108	-102	-73	-77	-86	-110	-35
VOT 2	-82	-121	-118	-54	-56	-79	-50	-26
VOT 3	-82	-110	-125	-33	-41	-108	-66	166
Bop								
VOT 1	-115	-109	-141	-76	-80	***-150**	-101	4
VOT 2	-103	***-136**	***-136**	-47	-51	-125	-95	10
VOT 3	-99	-124	-174	-61	-41	-55	-60	8
Da								
VOT 1	-148	-137	-112	-110	-75	-144	-103	12
VOT 2	-111	-149	-146	-95	-92	-132	-132	14
VOT 3	-126	-110	***-199**	-41	-71	18	-100	14
Dot								
VOT 1	-134	-125	-81	-129	-58	11	11	17
VOT 2	-126	-130	-108	-103	-63	14	8	9
VOT 3	-134	-108	-96	-62	-69	14	7	10
Ga								
VOT 1	**-171**	-125	***-152**	-130	-88	18	22	17
VOT 2	-112	-103	-136	-118	-71	17	13	14
VOT 3	-138	-87	-173	-95	-51	22	15	22
Got								
VOT 1	-130	-105	-148	-75	20	26	31	31
VOT 2	-132	-87	-152	-73	11	29	25	22
VOT3	-121	-102	-72	16	15	20	24	34
Total of out of range tokens	3	2	4	1	0	1	1	0

Table 10 shows the average VOT measurement for the three repetitions of each of the seven voiced items in English across the four English proficiency levels. An examination of Table 10 shows that of the 12 averages (four proficiency levels for each item multiplied by thee items), all are within the range of VOT proposed by Lisker and Abramson (1964).

Table 10. Average VOT for three repetitions of eight items in English with voiced initial stops for four proficiency levels (Lisker and Abramson, 1964)

		[b]	**[d]**	**[g]**
0Pre-Basic	AVG	-116	-128	-118
Basic	AVG	-103	-106	16/-120
Intermediate	AVG	-90	14/-88	20/-70
Advanced	AVG	-62	11/-112	23
L&A (1964)	AVG	1/-101	5/-102	21/-88
Total of out of range AVG		0	0	0

Summary of results and discussion for research questions: #1a and #1b

Research question #1a read as follows: Do VOT values of voiceless and voiced stops in the Spanish of UPRM college students with L1 Spanish and L2 English vary across four English proficiency levels? In summary, 94% (180/192) of the voiceless stops and 95% (159/168) of the voiced stops in Spanish had VOT values that fall into the Lisker and Abramson range of VOT in Puerto Rican Spanish, for a total of 94% (339/360) of the tokens within range. Only 6% (21/360) of the tokens had VOT values that fall out of the Lisker and Abramson VOT range for Puerto Rican Spanish. None of these 21 tokens had VOT values that fall within the Lisker and Abramson VOT range for voiceless or voiced stops in American English. In addition, all 21 of these tokens are out of the VOT range for Puerto Rican Spanish by no more than 10 milliseconds. The vast majority of the tokens of voiceless and voiced stops in Spanish fall within, or are just a

little bit out of, the Lisker and Abramson range of VOT for voiceless and voiced stops in Puerto Rican Spanish. The 21 tokens that fall outside of the range of VOT for voiceless and voiced stops in Puerto Rican Spanish were not produced by the students in any one proficiency level; thus, as shown in this chapter, the VOT values of the voiceless and voiced stops in the Spanish of these UPRM college students with L1 Spanish and L2 English did not vary across four English proficiency levels.

Other studies such as Lisker and Abramson (1964) and Zampini (as cited in Zampini & Green, 2001) examined VOT values of monolingual speakers of Spanish. The results of both studies showed that there is a difference between VOT values for voiceless and voiced stops in Spanish. The difference between VOT values for Spanish voiceless and voiced stops is found in the difference in lag time in the production of these stops. Similar to these studies, the results from the Production Task in this study for the voiceless and voiced stops in Spanish show this distinction between these two phonemic categories.

Lisker and Abramson and Zampini examined the VOT production of monolingual speakers. Neither Lisker and Abramson nor Zampini reported tokens produced by monolingual speakers of Spanish that were out of the range of VOT in Spanish. Different from these two studies, this study reported 12 tokens that were out of the range of Puerto Rican Spanish. The participants in this study who produced these 12 tokens have a range of proficiencies in English and enter UPRM with 12 years of previous English instruction. Although they may not be bilinguals, they are certainly not monolinguals, as they have had a lot of influence of English in their lives. Perhaps this English influence

led to the occurrence of the 12 out of range tokens they produced during the Production task in Puerto Rican Spanish.

Research question #1b read as follows: Do VOT values of voiceless and voiced stops in the English of UPRM college students with L1 Spanish and L2 English vary across four English proficiency levels? In summary, there were three results for research question #1b. First, 93% (156/168) of the voiced stops but only 74% (142/192) of the voiceless stops in English had VOT values that fall within the Lisker and Abramson range of VOT for voiced and voiceless stops in American English. Second, of the 12 tokens of voiced stops and the 50 tokens of voiceless stops that fall out of the range of VOT for voiced and voiceless stops, 92% (n=11) of the tokens of voiced stops and 82% (n=41) of the tokens of voiceless stops had VOT values that fall within the Lisker and Abramson range of VOT for voiced and voiceless stops in Puerto Rican Spanish. Only one token of a voiced stop and nine tokens of the voiceless stops, for a total of ten tokens, did not fall in the range of voiced or voiceless stops for either American English or Puerto Rican Spanish. Third, 82% (9/11) of the tokens of voiced stops that fall out of the range of VOT for American English but within the range of VOT for Puerto Rican Spanish and 95% (39/41) of the tokens of voiceless stops that fall out of the range of VOT for American English but within the range of VOT for Puerto Rican Spanish, for a total of 92% (48/52) of the tokens, were produced by participants from the two lowest proficiency levels, the Pre-Basic and the Basic speakers. Thus, as shown in this chapter, the VOT values of voiceless and voiced stops in the English of UPRM college students with L1 Spanish and L2 English did vary across four English proficiency levels but not in a continuous way. Instead, the participants in Intermediate and Advanced English

produced voiced and voiceless stops with VOT values that fall within the range of VOT values for American English whereas the participants in Pre-Basic and the Basic English produced voiced and voiceless stops with VOT values that 1) fall within the range of VOT for American English and 2) fall outside of the range of VOT for American English but inside of the range of VOT for Puerto Rican Spanish.

With respect to voiceless stops in English, in Khattab (2002), the monolingual Arabic-speaking participants produced English VOT values that were different from those of the monolingual speaker of English "but more so with respect to their production in Arabic" (p.119). Similar to the speakers studied by Kattab, the Pre-Basic and Basic participants in this study produced VOT values in English within the Lisker and Abramson range of the voiceless stop consonants for Puerto Rican Spanish. In a different study, Flege (1980), Saudi participants produced VOT measurements that approximated the phonetic norms of English. Similar to the speakers studied by Flege, the Intermediate and Advanced participants in this study produced VOT values in English within the Lisker and Abramson range of the voiceless stop consonants for American English. With respect to the voiced stops in English, participants from all proficiency levels approximated the VOT values for voiced stops in American English.

Gass and Selinker (2001) explore the role of differences in languages features in the acquisition of a second language. They describe language inventories as marked or unmarked in relation to other languages. For example, Spanish voiceless stops have VOT values that are represented by short lag values, whereas English voiceless stops have VOT values that are represented by long lag. The latter is due to the aspiration of voiceless stops in English, which could be considered as a marked feature for Spanish

speakers acquiring English. The results from the Production Task show that the participants were more able to produce voiced stops with VOT values within range of American English than they were able to produce voiceless stops with VOT values within range of American English. Perhaps when Spanish speakers acquire the English voiceless stops in initial position, they have to acquire a marked feature which is absent in Spanish.

Finally, 92% of the tokens of voiced stops and 82% of the tokens of voiceless stops in English that fall of the range of VOT for voiceless and voiced stops in American English had VOT values that fall within the range of Lisker and Abramson VOT values for voiced and voiceless stops in Puerto Rican Spanish. Following Hodne (1995), it seems possible that these tokens reflect second language transfer.

Socio-demographic data and the results for research questions #1a and #1b

A possible explanation for why there is a difference between the participants from Pre-Basic and Basic English, on the one hand, and Intermediate and Advanced English, on the other, with respect to the production of VOT for voiced and voiceless stops in English could rest in the role that English plays in the lives of these participants and the socio-demographic data collected from the SDQEU. Table 11 summarizes the socio-demographic data for the eight speakers, ranging from Pre-Basic to Advanced.

As shown in table 11, English does not play a role in the lives of the participants from Pre-Basic and Basic English. The Pre-Basic and Basic participants produced nine of the 11 tokens of voiced stops with VOT out of the range of American English but within the range of Puerto Rican Spanish. The Pre-Basic participants produced four of the nine while the Basic participants produced five of the nine. The Pre-Basic and the Basic

participants produced 39 of the 41 tokens of voiceless stops with VOT out of the range of American English but within the range of Puerto Rican Spanish. The Pre-Basic participants produced 19 of the 39 while the Basic participants produced 20 of the 39.

PBP1 and PBP2 each produced two of the four Pre-Basic tokens with VOT that were out of range for American English voiced stops but within range for Puerto Rican Spanish voiced stops. PBP1 produced 10 and PBP2 produced nine of the 19 Pre-Basic tokens with VOT that were out of the range for American English voiceless stops but within range for Puerto Rican voiceless stops. Thus, PBP1 (n=12) and PBP2 (n=11) produced more or less the same number of tokens of stops with VOT that were out of the range of American English but within the range of Puerto Rican Spanish, which is in line with the fact that PBP1 and PBP2 have the same socio-demographic and English use profiles. BP1 produced four and BP2 produced one of the five Basic tokens with VOT that were out of range for American English voiced stops but within range for Puerto Rican Spanish voiced stops. BP1 produced seven and BP2 produced 13 of the 20 Basic tokens with VOT that were out of the range for American English voiceless stops but within range for Puerto Rican voiceless stops. Thus, BP1 (n=11) and BP2 (n=14) produced more or less the same number of tokens of stops with VOT that were out of the range of American English but within the range of Puerto Rican Spanish, which is in line with the fact that PBP1 and PBP2 have similar socio-demographic and English use profiles. The only difference between BP1 and BP2 is that BP2 reported that he did not speak and understand English very well while BP1 reported that she spoke and understood spoken English very well. It could be of interest that BP2 produced three

more tokens of stops with VOT that were out of range of American English but within range of Puerto Rican Spanish than BP1. To summarize, the two Pre-Basic participants (PBP1 and PBP2) and the two Basic Participants (BP1 and BP2) produced more or less the same number of tokens of stops with VOT that were out of range of American English but within range of Puerto Rican Spanish, for a total of 48 tokens, 92% of the data, and they share very similar socio-demographic and English use profiles which show little that English plays little or no role in their lives.

By contrast, as shown in table 11, English does play a role in the lives of the participants from Intermediate and Advanced English. The Intermediate and the Advanced participants produced two of the 11 tokens of voiced stops with VOT out of the range of American English but within the range of Puerto Rican Spanish. The Intermediate and Advanced participants each produced one of the two tokens. The Intermediate and Advanced participants produced two of the 41 tokens of voiceless stops with VOT out of the range of American English but within the range of Puerto Rican Spanish. The Intermediate and the Advanced participants each produced one of the two tokens.

One participant from Intermediate English (IP2) produced the one token with a VOT value that was out of range for American English voiced stops but within range for Puerto Rican Spanish voiced stops and the one token with a VOT value that was out of the range for American English voiceless stops but within the range for Puerto Rican Spanish voiceless stops. Interestingly, this Intermediate participant (IP2) reported that he did not have an English speaking friend to whom he talked often whereas the other Intermediate participant (IP1) reported that he did have an English speaking friend to

whom he talked often. One participant from Advanced English (AP1) produced the one token with a VOT value that was out of range for American English voiced stops but within range for Puerto Rican Spanish voiced stops and the one token with a VOT value that was out of the range for American English voiceless stops but within the range for Puerto Rican Spanish voiceless stops. Interestingly, this Advanced participant (AP1) reported that Spanish was his native language whereas the other Advanced participant (AP2) reported that English was his native language. To summarize, one Intermediate participant (IP2) and one Advanced participant (AP1) produced the four tokens of stops, 8% of the data, with VOT that were out of the range of American English but within the range of Puerto Rican Spanish; both these participants differed, although slightly, in terms of their socio-demographic and language use profile from the other two, IP1 and AP2. Overall, as shown in table 11, English played a stronger in the lives of the Intermediate and Advanced participants than it did in the lives of the Pre-Basic and Basic participants.

In summary, 92% of the tokens with VOT out of range of VOT for American English but within range of VOT for Puerto Rican Spanish were produced by the Pre-Basic and Basic participants with little English in their lives and little exposure to English while 8% of the tokens with VOT out of range of VOT for American English but within range of VOT for Puerto Rican Spanish were produced by the Intermediate and Advanced participants with much English in their lives and much exposure to English.

Table11.Socio-demographic and English use profiles for eight participants for the Production Task, two at each of four proficiency levels: Pre-Basic (PBP), Basic (BP), Intermediate (IP), and Advanced (AP)

Participant	PBP1	PBP2	BP1	BP2	IP1	IP2	AP1	AP2
Place of Birth	PR	PR	PR	PR	PR	PR	PR	US
Native language	Spanish	Spanish	Spanish	Spanish	Spanish	Spanish	Spanish	English
Father's place of Birth and native language	PR, Spanish	PR, Spanish	PR, Spanish	PR, Spanish	PR, Spanish	PR, Spanish	US, English	US, English
Mother's place of Birth and native language	PR, Spanish	PR, Spanish	PR, Spanish	PR, Spanish	PR, Spanish	PR, Spanish	PR, Spanish	PR, Spanish
Speaks English at home	No	No	No	No	No	No	Yes	Yes
Has a native speaker of English with whom he speaks often	No	No	No	No	Yes	No	Yes	Yes
Speaks and understands English	not very well	not very well	Well	not very well	very well	very well	very well	very well
Language of choice for media (Music, TV, and Internet chat services such as MSN	Spanish	Spanish	Spanish	Spanish	English/ Spanish	English/ Spanish	English	English

Research Question #2

This section presents the results for research question #2 which read as follows: Do the VOT values of voiced and voiceless stops of the four groups of UPRM college students who participated in the production task represent inter-language, an interim state, or do they represent attainment of the target L2 English?

Table 12 shows the number and percent of tokens in Spanish with VOT values that fall within the Lisker and Abramson VOT range for voiceless and voiced stops in Puerto Rican Spanish as they were produced by the Intermediate and Advanced level participants, on the one hand, and the Pre-Basic and Basic level participants, on the other. As the table shows, all participants produced roughly the same percent of voiced and voiceless stops within the Lisker and Abramson range for Puerto Rican Spanish, and there is very little difference between the Intermediate/Advanced participants and the Pre-Basic/Basic participants.

Table 12. Number and percent of token of voiceless and voiced stops with VOT within Lisker and Abramson range for Puerto Rican Spanish produced by Intermediate/Advanced participants and Pre-Basic/Basic participants

Proficiency levels	Voiceless stops	Voiced Stops	Total
Intermediate/Advanced levels	88/96 92%	81/84 96%	169/180 94%
Pre-Basic/Basic levels	92/96 96%	78/84 93%	170/180 94%
Total	180/192 94%	159/168 95%	339/360 94%

Table 13 shows the number and percent of tokens in English with VOT values that fall within the Lisker and Abramson VOT range for voiceless and voiced stops in American English as they were produced by the Intermediate and Advanced level participants, on the one hand, and the Pre-Basic and Basic level participants, on the

other. As shown on the table, 96% of the tokens produced by the Advanced/Intermediate participants fall within the Lisker and Abramson range for American English. Within a world Englishes framework, the fact that 96% of the tokens fall within the range of American English is consistent with an external target, American English. As also shown on the table, only 69% of the tokens produced by the Pre-Basic/Basic participants fall within the Lisker and Abramson range for American English. Within a Second Language Acquisition framework, consistent with an external target, such as American English, it seems reasonable to conclude that the production of these participants represents inter-language, an interim state. In addition, as previously shown, these Pre-Basic/Basic participants produced 82% (9/11) of the tokens of voiced stops and 95% (39/41) of the tokens of voiceless stops that fall out of the range of VOT for American English but within the range of VOT for Puerto Rican Spanish. Thus, it seems to be the case that these participants show language transfer and, in addition to exhibiting an inter-language state, are transferring Puerto Rican Spanish VOT values to English.

Table 13. Number and percent of token of voiceless and voiced stops with VOT within Lisker and Abramson range for American English produced by Intermediate/Advanced participants and Pre-Basic/Basic participants

Proficiency levels	Voiceless stops	Voiced Stops	Total
Intermediate/Advanced levels	91/96 95%	82/84 98%	173/180 96%
Pre-Basic/Basic levels	51/96 53%	74/84 88%	125/180 69%
Total	142/192 74%	155/168 92%	298/360 83%

CHAPTER IV: THE IDENTIFICATION TASK

This chapter discusses the methods of data collection, data analysis, and the results for research questions #3 and #4. Research question #3 read: Are four groups of UPRM college students who participate in an identification task able to identify the production of voiceless and voiced stops in English and Spanish produced by four groups of UPRM college students who participate in a production task? Research question #4 asked if the identification of voiced and voiceless stops in Spanish matched the production of voiced and voiceless stops in Spanish and if the identification of voiced and voiceless stops in English matched the production of voiced and voiceless stops in English.

Research Question #3

Data collection methodology

Participants

Similar to the participants for the Production Task described in Chapter III, the data on which the Identification Task is based were collected from participants (n=8) who were students at the University of Puerto Rico at Mayaguez (UPRM). The Identification Task involved two students from each of the four proficiency levels: Pre-Basic, Basic, Intermediate, and Advanced who, similar to the participants for the Production Task, filled out the Socio-demographic and English Use Questionnaire (SDEUQ) described in Chapter III. The participants for the Production Task and the participants for the Identification Task came from the same proficiency levels and filled out the same questionnaire, but they were not the same students; in other words, the Production Task and the Identification Task each used a different group of eight participants. To obtain the

participants for the Identification Task, I asked a professor from each of the levels to recommend two students who might be willing to participate. After agreeing to participate, the students signed a consent form (see Appendix A)

Description of the Identification Task and instructions to participants

The Identification Task was a listening task which asked participants to listen to the productions produced during the Production Task described in Chapter III. The productions were in the form of ten digital folders with digital sound files (analogous to ten recorded cassette tapes). Each digital folder contained 15 items, the same 15 items in the same order as they occurred on the Word Lists in English and in Spanish for the Production Task. Each item was repeated three times in the same way as it was repeated during the Production Task so that a participant was asked to identify each item on the basis of three repetitions of the item. For example, the participant heard [ba] [ba] [ba] and then identified the initial stop as voiced or voiceless. The instructions the participants received asked the participants to listen to a digital folder, to pay attention to the first sound of each word in the folder, and to place an X next to the letter on the Identification Task Answer Sheet that represented the first sound of the word they heard.

The instrument

The instrument for the Identification Task had two parts, the Identification Task digital folders and the Identification Task Answer Sheet (Appendix G and H). I created four versions of the Identification Task in English and four versions of the Identification Task in Spanish, for a total of eight non-native speaker digital folders, from the productions of the eight student participants on the Production Task. Each digital folder

in English corresponded to one of the four English proficiency levels; each digital folder in Spanish also corresponded to one of the four English proficiency levels.

To create each digital folder, I used a combination of the productions that I elicited during the Production Task from the two participants at a given English proficiency level. For example, to create the Pre-Basic version of the digital folder in English, I used a combination of the 30 items, each with its three repetitions, I elicited in English from the two speakers (15 items each) at the Pre-Basic proficiency level, for a total of 15 items and 45 productions. To create the Pre-Basic version of the digital folder in Spanish, I used a combination of the 30 items, each with its three repetitions, I elicited in Spanish from the two speakers (15 items each) at the Pre-Basic proficiency level, for a total of 15 items and 45 productions. I tried to balance the items so that each speaker at a given proficiency level contributed roughly half (n=7) of the items, each with its three repetitions, to the 15 items and 45 productions in the digital folder.

I also created two versions of the Identification Task using native speakers of American English and Puerto Rican Spanish, for a total of two native speaker digital folders. To create the version of the digital folder in American English, I used the production of a native speaker of English reading the English word list used for the Production Task. To create the version of the digital folder in Puerto Rican Spanish, I used the production of a native speaker of Puerto Rican Spanish reading the Spanish word list for the Production Task.[5]

[5]The native speaker of American English was a female who had been teaching at the UPRM for several years. She described herself as a non-Spanish speaker even though she showed an interest in trying to learn and speak Spanish. The native speaker of Puerto Rican Spanish was a female who worked as a social administrative officer in public housing buildings in San Juan, Puerto Rico. She described herself as a non-English speaker.

The Identification Task answer sheet

The Identification Task answer sheet formed the second part of the Identification Task. There were two versions of the answer sheet, one for the digital folders in English and one for the digital folders in Spanish. Each answer sheet contained instructions for the task and 16 items. The instructions were written in English for the Word List in English and in Spanish for the Word List in Spanish. The instructions asked the participants to listen to a digital folder, to pay attention to the first sound of each word, and to place an X next to the letter that represented the first sound. Each answer sheet contained 16 items, one practice item and 15 test items. Each item had two options. One option was a letter that represented a voiceless stop consonant, for example p [**p**], t [**t**], k [**k**]; the other option was a letter that represented a voiced stop consonant, for example b [**b**], d [**d**], g [**g**].

Administration of the Identification Task

I carried out the Identification Task with each individual participant in an isolated, quiet room in an office at the UPRM. In order to carry out the Identification Task, I used PRAAT Lab running on an HP Pavilion Ze4400. I played the recordings from the digital folders to the students, and the students listened to them through a set of COBY Cv220 headphones. I provided the participants with 10 Identification Task answer sheets, one for each digital folder.

To administer the Identification Task, for each digital folder, I read the instructions to the participants, explained to the participants what I wanted them to do, and did the practice item with them. I then had them do the Identification Task by themselves. Each participant listened to the eight digital folders created from the

participants' productions on the Production Task for a total of 120 items (eight tapes multiplied by 15 items) and to the two digital folders created from the native speaker productions for a total of 30 items (two tapes multiplied by 5 items). They listened to the English digital folders first and the Spanish digital folders second. For both the English and the Spanish set of digital folders they listened to the digital folders in the following order: native speakers, Pre-Basic, Basic, Intermediate, and Advanced. I began with the English digital folders because I thought that the participants' Spanish would have less influence on their English if they moved from English to Spanish not from Spanish to English. It took 35 to 40 minutes for each participant to complete the Identification Task.

Data analysis methodology

Voice onset time (VOT) is perceived as an acoustic cue that signals categorical perception. According to Yeni-Komshian VOT is "the best single measure for signaling the difference between voiced and voiceless stop consonants" (p. 128). Listeners are able to categorize phonemes according to their phonetic patterns which allow them to place them in voiced or voiceless categories. According to Yeni-Komshian and LaFontaine an Identification Task consists of a test in which "subjects are usually given two alternatives, for example ***d****a* or ***t****a*, and are asked to indicate which they have heard" (p. 113). The Identification Task that I created departed from the definition of an Identification Task given by Yeni-Komshian and LaFontaine in that I wanted to create a task to find out if the voicing of the stops consonants that the students from different proficiency levels heard matched up with the voicing of the stop consonants that the students from different proficiency levels tried to produce.

In order to analyze the data for the Identification Task, I defined a correct identification as one in which what the student participant for the Identification Task heard matched what a native speaker would produce; for example, if a participant indicated hearing [b] in the production of *ba*, this was a correct identification; if the participant indicated hearing [p] in the production of *ba*, this was an incorrect identification. I counted the number of items that each participant from each proficiency level identified correctly and the number of items that the student participants did not identify correctly from the 15 items on each sheet. For example, if the first participant correctly identified 5 items out of 15, I calculated the percent correct to obtain 33%. In other words, the results for the Identification Task indicated that the first participant from the Pre-Basic level correctly identified 33 % of the items on the Identification Task and incorrectly identified 67% (10/15) of the items on the Identification Task. I used the same process to obtain the data results from the second participant from the Pre-Basic level. I then combined the number and percentages of correct and incorrect for both speakers from the same proficiency level to obtain the results by proficiency level.

Results and discussion: Research Question #3

Research question #3 asked if four groups of UPRM college students who participate in an identification task are able to identify the voiceless and voiced stops in English and Spanish produced by four groups of UPRM college students who participate in a production task. To address this question, I examined the results of the Identification Task. (The tables of correct and incorrect identifications for each participant in each proficiency level for each of the items are shown in Appendix I 1-16) For the Identification Task, the participants made 1200 identifications, 300 at each of the four

proficiency levels. Within the four proficiency levels, each of the two participants made 150 identifications, 80 identifications were identifications of the voiceless stops, 40 in Spanish and 40 in English. Seventy of the identifications were identifications of the voiced stops, 35 in Spanish and 35 in English.

Table 14 shows the number and percent of correct identifications that the two participants at each of the four proficiency levels made. As shown in Table 14, overall, 79% of the identifications made by the participants were correct. There was a proficiency effect so that, in general, the higher the English proficiency level of the participant, the higher the percent of correct identifications. One hundred percent of the identifications made by the two participants (AP1 and AP2) at the Advanced proficiency level were correct; 80% of the identifications made by the two participants (IP1 and IP2) at the Intermediate proficiency level were correct; 58% of the identifications made by the participants (B1 and B2) at the Basic proficiency level were correct, and 80% of the identifications made by the participants (PB1 and PB2) at the Pre-Basic proficiency level were correct.

Table 14. Number and percent of correct identifications made by two participants for Each of four English proficiency levels: Pre-Basic (PBP), Basic (BP), Intermediate (IP) Advanced (AP)

Proficiency Levels	Number of Correct Identifications	Percent of Correct Identifications
AP1	150/150	100%
AP2	150/150	100%
Total	300/300	100%
IP1	150/150	100%
IP2	80/150	53%
Total	240/300	80%
BP1	84/150	56%
BP2	89/150	59%
Total	173/300	58%
PBP1	150/150	100%
PBP2	93/150	62%
Total	240/300	80%
Grand total	953/1200	79%

As Table 14 also shows, there were individual differences between the participants within the four proficiency levels. For example, at the Advanced level, both participants made 100% correct identifications; at the Intermediate level, one participant (IP1) made 100% correct identifications, but the other participant (IP2) made 53% correct identifications; at the Basic level one participant (BP1) made 56% correct identifications while the other (BP2) made 59% correct identifications; and a the Pre-Basic level, one participant (PB1) made 100% correct identifications while the other participant (BP2) made 62% correct identifications. The individual differences between the participants seem to correspond to individual differences with respect to socio-demographic histories and English language use as reported by the participants on the SDEUQ. An examination

of the responses to the SDEUQ (Appendix J) shows that all the participants who made 100% correct identifications reported English language use in their lives and had exposure to English in their socio-demographic histories.

An examination of the SDEUQ for the two participants (AP1 and AP2) from the Advanced English proficiency level, both of whom, as shown on Table 14, made 100% correct identifications, shows that both were born in the United States and had lived in the United States but had moved back to Puerto Rico at an early age. One reported Spanish as the native language; the other reported English. One of the participants' parents was born in the United States and spoke English as a native language; the other parents were born in Puerto Rico and spoke Spanish as a native language. Both participants had plans to go to the United States to explore the possibility of relocation. Both participants reported that they spoke English at home and reported that they had a friend who was a native speaker of English with whom they sometimes spoke in English. Both participants reported that they spoke English among their friends at the university. Both participants reported that they could speak English very well, and both reported that they could understand spoken English very well. Both reported that they listened to music in English, watched television in English, and chatted on Microsoft Service Network (MSN) in English.

An examination of the SDEUQ for the two participants (IP1 and IP2) from the Intermediate English proficiency level, one of whom (IP1), as shown on Table 14, made 100% correct identifications and one of whom (IP2), as shown on Table 14 , made 53% correct identifications shows similarities and differences in terms of exposure to English and English language use between the two participants. Although both participants

reported that they were born in Puerto Rico and had never lived outside of Puerto Rico, IP1 reported that one of his parents was born in the United States and reported that English was his native language. IP1 also reported that he spoke English at home and reported that he had a friend who was a native speaker of English with whom he sometimes spoke English. IP1 had plans to go to the United States to explore the possibility of relocation. By contrast, IP2 reported that both of his parents were born in Puerto Rico and reported that Spanish was his native language. He reported that he did not speak English at home and did not have a friend who was a native speaker of English. IP2 had plans to go to the United States for vacation, but not for relocation. Neither IP1 nor IP2 reported that they spoke English among their friends at the university, but both IP1 and IP2 reported that they could speak English and understand spoken English very well. Both also reported that they listened to music, watched television, and chatted on MSN in both English and Spanish.

An examination of the SDEUQ for the two participants (BP1 and BP2) from the Basic English proficiency level, both of whom, as shown on Table 14**,** made a little higher than 50% correct identifications shows many similarities in terms of little exposure to English in their socio-demographic histories and little use of English in their lives. Both BP1 and BP2 reported that they were born in Puerto Rico and that they had never lived outside of Puerto Rico. Both had parents who were born in Puerto Rico and reported that Spanish was their native language and the native language of their parents. Both had plans to go to the United States in the future, but for vacation, not for relocation. Neither reported that they spoke English at home, and neither reported that they had a friend who was a native speaker of English. In addition, neither of them

reported that they spoke English among their friends at the university. Neither BP1 nor BP2 reported that he listened to music, watched television, or chatted on MSN in English. The only difference between the two participants was that BP1 reported that he spoke English and could understand spoken English very well while BP2 reported that he did not speak and did not understand spoken English very well.

An examination of the SDEUQ for the two participants (PB1 and PB2) from the Pre-Basic English proficiency level, one of whom (PB1), as shown on Table 14**,** made 100% correct identifications and one of whom (PB2), as shown on Table 14, made 62% correct identifications shows many similarities and only one difference in terms of exposure to English and English language use between the two participants. Both participants reported that they were born in, and had never lived outside, of Puerto Rico. Both reported that Spanish was their native language and the native language of their parents. Neither reported that they had plans to go to the United States in the future. Neither reported that they spoke English at home, and neither reported that they had a friend who was a native speaker of English. In addition, neither reported that they spoke English among their friends at the university. Both reported that they didn't speak English very well, and both reported that they didn't understand spoken English very well. Neither reported that he listened to music, watched television, or chatted on MSN in English. The only difference between PB1 and PB2 was that PB1 reported that one of his parents had been born in the United States while both parents of PB2 had been born in Puerto Rico.

Table 15 reports the number and percent of correct identifications for the 16 participants across the four proficiency levels together and shows the number and percent

of correct identifications of voiceless and voiced stops and the number and percent of correct identifications of the stops in Spanish and the stops in English. As shown in the table, overall, there was a difference in percent correct identification for the stops in Spanish (82%) and the stops in English (77%); there was also a difference in percent correct identification of the voiceless stops (81%) and the voiced stops (78%). The participants made a higher percent of correct identifications for Spanish stops than for English stops and a higher percent of correct identification for the voiceless stops than for the voiced stops. The percent of correct identification followed the order: voiceless stops in Spanish (84%), voiced stops in Spanish (79%), voiceless stops in English (78%) and voiced stops in English (78%).

Table 15. Number and percent of correct identifications for stops in Spanish and in English and for voiceless and voiced stops.

	Voiceless Stops	Voiced Stops	Total
Spanish	268/320 84%	221/280 79%	489/600 82%
English	250/320 78%	214/280 76%	464/600 77%
Total	518/640 81%	435/560 78%	953/1200 79%

In summary, research question #3 asked if four groups of UPRM college students who participate in an identification task are able to identify the voiceless and voiced stops in English and Spanish produced by four groups of UPRM college students who participate in a production task. As shown in this chapter, overall, the participants were able to correctly identify 79% of the productions. The percent of correct identification varied according to proficiency level and socio-demographic differences of the

participants within the proficiency levels. The percent of correct identification also varied according to whether the stop was voiceless or voiced or Spanish or English.

Finally, as the tables of correct and incorrect identifications for each participant in each proficiency level for each of the items show (Appendix I), some of the items in both Spanish and English, regardless of the proficiency level of the participant who produced the item during the Production Task, were more difficult than others for the participants to identify during the Identification Task. For example, in Spanish, the stops in the following item were difficult for the participants to identify: *pa, ba, ta*; in English, the stops in the following items were difficult for the participants to identify: *ta, da, cot, got*.

Research Question #4

Research question #4 asked if the identification of voiced and voiceless stops in Spanish matched the production of voiced and voiceless stops in Spanish and if the identification of voiced and voiceless stops in English matched the production of voiced and voiceless stops in English. In other words, did the Identification Task match the Finally, another way to examine the relationship between The Production Task and the Identification Task is to compare what the participants did on The Production Task from Chapter III

Table 16 shows the production results from the Production Task in Spanish and the identification results from the Identification Task in Spanish for the Advanced and Intermediate participants, on the one hand, and the Pre-Basic and Basic participants, on the other. It shows the percent of production of voiceless and voiced stops that were within the Lisker and Abramson range for VOT in Puerto Rican Spanish that were

produced by the participants for the Production Task and the percent of correct identification of the voiceless and voiced stops that were within the Lisker and Abramson range for VOT in Puerto Rican Spanish that were identified by the participants for the Identification Task. As shown in the table, both groups did better on the Production Task than on the Identification Task, and the results on the Production Task did not match the results on the Identification Task. .

Table 16. Results for the Production Task and the Identification Task for Spanish for two proficiency groups: Intermediate/Advanced and Pre-basic/Basic

Proficiency Levels	Production Task	Identification Task
Intermediate/Advanced levels	169/180 94%%	265/300 88%
Pre-Basic/Basic levels	170/180 94%	217/300 72%
Total	339/360 94%	482/600 80%

Table 17 shows the production results from the Production Task in English and the identification results from the Identification Task in English for the Advanced and Intermediate participants, on the one hand, and the Pre-Basic and Basic participants, on the other. It shows the percent of production of voiceless and voiced stops that were within the Lisker and Abramson range for VOT in American English that were produced by the participants for the Production Task and the percent of correct identification of the voiceless and voiced stops that were within the Lisker and Abramson range for VOT in American English that were identified by the participants for the Identification Task.

Similar to Table 16, Table 17 shows that both groups did better on the Production Task than on the Identification Task, and the results on the Production Task did not match the results on the Identification Task. Different from Table 16, Table 17 also shows that the

Intermediate/Advanced group did much better than the Pre-Basic/Basic group on both the Production Task and the Identification Task in English, so that the Production Task and the Identification Task match in the sense that higher proficiency in English on the Production Task matches higher proficiency in English on the Identification Task while lower proficiency in English on the production task matches lower proficiency in English on the Identification Task.

Table 17. Results for the Production Task and the Identification Task in English for two Proficiency groups: Intermediate/Advanced and Pre-basic/Basic

Proficiency Levels	Production Task	Identification Task
Intermediate/Advanced Levels	173/180 96%	265/300 88%
Pre-Basic/Basic levels	125/180 69%	194/300 65%
Total	298/360 83%	459/600 77%

Finally, as shown in Chapter III, in Spanish, the vast majority, 94% (180/192) of the tokens of voiceless and voiced stops produced by the participants in the Production Task fall within, or are just a little bit out of, the Lisker and Abramson range of VOT for voiceless and voiced stops in Puerto Rican Spanish. The VOT values of the voiceless and voiced stops in Spanish did not vary across four English proficiency levels.

Taking the 16 participants for the Identification Task as a whole, Table 18 shows the number and percent of correct identifications that the participants made during the Identification Task of the Spanish voiced and voiceless stops produced during the Production Task by the participants in the four English proficiency levels. Even though 94% of these productions fall within the range of VOT for voiceless and voiced stops in Puerto Rican Spanish, only 82% of them were correctly identified by the participants for

the Identification Task. The percent which were correctly identified did not vary across the English proficiency levels of the participants who produced them during the Production Task; in addition, only 82% of the productions produced by the native speaker of Puerto Rican Spanish with little influence from English were correctly identified. Overall, a higher percent of the Spanish voiceless stops (84%), for all proficiency levels and the native speaker, than the Spanish voiced stops (79%) were correctly identified. As the 82% correct identification on the Identification Task did not match the 94% production of voiceless and voiced stops with VOT within range of Puerto Rican Spanish, the Identification Task did not match the Production Task. In general, the participants were able to successfully produce stops in Spanish with VOT within range of Puerto Rican Spanish but were less able to successfully identify them.

Table18. Percent correct identification on the Identification Task of Spanish voiceless and voiced stops produced by participants from four English proficiency levels during the Production Task

Digital Proficiency Folder	Voiceless Stops	Voiced Stops	Total
Advanced	54/64 84%	45/56 80%	99/120 83%
Intermediate	54/64 84%	44/56 79%	98/120 82%
Basic	54/64 84%	44/56 79%	98/120 82%
Pre-Basic	52/64 81%	44/56 79%	96/120 80%
Native Speaker of Spanish	54/64 84%	44/56 79%	98/120 82%
Total	268/320 84%	221/280 79%	489/600 82%

In addition, as shown in Chapter III, the VOT values of voiceless and voiced stops in the English of the participants for the Production Task varied across the four English

proficiency levels but not in a continuous way. Instead, the participants in Intermediate and Advanced English produced voiced and voiceless stops with VOT values that fall within the range of VOT values for American English whereas the participants in Pre-Basic and the Basic English produced voiced and voiceless stops with VOT values that 1) fall within the range of VOT for American English and 2) fall outside of the range of VOT for American English but inside of the range of VOT for Puerto Rican Spanish. Taking the 16 participants for the Identification Task as a whole, Table 19 shows the number and percent of correct identifications that the participants made during the Identification Task of the English voiced and voiceless stops produced during the Production Task by the participants in the four English proficiency levels. For the Production Task, as shown in Chapter III, 93% of the English voiced stops and 74% of the English voiceless stops had VOT values that fall within the Lisker and Abramson range of VOT for voiced and voiceless stops in American English. As shown in Table 19, only 76% of the voiced stops and 78% of the voiceless stops were correctly identified by the participants for the Identification Task. The percent which were correctly identified did not vary across the English proficiency levels of the participants who produced them during the Production Task; in addition, only 78% of the productions of the native speaker of American English with little influence from Spanish were correctly identified. Overall, a slightly higher percent of the English voiceless stops (78%), for all proficiency levels and the native speaker, than the English voiced stops (76%) were correctly identified. As the 76% correct identification of the voiced stops did not match the 93% production of voiced stops with VOT within range of American English, the Identification Task, with respect to the voiced stops, did not match the Production Task.

In general, the participants were able to successfully produce voiced stops with VOT within range of American English but were less able to successfully identify them. Taking only the percents into account, we see that although the 78% correct identification of the voiceless stops did seem to match the 74% production of voiceless stops with VOT within range of American English, in general, as the relatively low percents show, the participants were much less able to successfully produce voiceless stops than voiced stops with VOT within range of American English but they were as able to identify the voiceless stops they were to produce them.

Table 19. Percent correct identification on the Identification Task of English Voiceless and voiced stops produced by participants from four English Proficiency levels during the Production Task

Digital Proficiency Folder	Voiceless Stops	Voiced Stops	Total
Advanced	50/64 78%	42/56 75%	92/120 77%
Intermediate	50/64 78%	43/56 77%	93/120 78%
Basic	50/64 78%	42/56 75%	92/120 77%
Pre-Basic	50/64 78%	43/56 77%	93/120 78%
Native Speaker of Spanish	50/64 78%	44/56 79%	94/120 78%
Total	250/320 78%	214/280 76%	464/600 77%

To conclude, overall, the participants for the Identification Task seemed to have problems identifying the voiceless and voiced stops in both Spanish and English and their performance on the Identification Task did not match their performance on the Production Task. .

CHAPTER V: CONCLUSION

To conclude, the results for Research Question #1a and #1b show that the VOT values of the voiceless and voiced stops in the Spanish of the UPRM college students with L1 Spanish and L2 English who participated in the Production Task did not vary across four English proficiency levels. The results also showed that the VOT values of the voiceless and voiced stops in English produced by these participants did vary across the four English proficiency levels. The participants from the Intermediate and Advanced levels produced more tokens with VOT values within the Lisker and Abramson VOT range for American English than the participants from the Pre-Basic and Basic levels. The participants from the Pre-Basic and Basic levels produced more tokens for voiceless and voiced stops in English with VOT values that fall out of the Lisker and Abramson range for VOT in American English, but within the range for VOT in Puerto Rican Spanish, than the participants from the Advanced and Intermediate levels. In addition, in general, all of the participants produced more tokens with voiced stops than voiceless stops with VOT that fall within the Lisker and Abramson range for American English.

The results for Research Question #2 show that all participants from the four English proficiency levels produced almost the same percent of voiced and voiceless stops within the Lisker and Abramson range for Puerto Rican Spanish. In addition there is very little difference between the Intermediate/Advanced participants and the Pre-Basic/Basic participants' productions of the voiceless and voiced stops in Puerto Rican Spanish. However, the majority of the tokens of voiceless and voiced stops that fall within the range of the Lisker and Abramson VOT range for American English were

produced by the participants from the Intermediate and Advanced participants. Within a world Englishes framework, the fact that a majority of the tokens that fall within the range of American English, as they were produced by these participants, is consistent with an external target, American English. In contrast, the participants from the Pre-Basic and Basic level produced the majority of the tokens of English voiceless and voiced stops that fall out of the Lisker and Abramson range for VOT in American English but within the Lisker and Abramson range for VOT in Puerto Rican Spanish. Within a second language acquisition framework this is consistent with inter-language, an interim state, and transfer from the first language, Spanish.

The results for Research Question #3 showed that the participants were able to correctly identify 79% of the productions. The percent of correct identification varied according to proficiency level and socio-demographic differences of the participants within the proficiency levels. The percent of correct identification also varied according to whether the stop was voiceless or voiced or Spanish or English. Overall, the participants were able to make more correct identifications of the voiceless and voiced stops in Spanish than in English, although the difference was small. In addition, all of the participants made more correct identification for the voiceless than the voiced stops in English. Finally, the results for Research Question #4, showed that, in general, the eight participants for the Identification Task seemed to have problems identifying the voiceless and voiced stops in both Spanish and English and that identification on the Identification Task did not match the production of the eight participants on the Production Task.

Limitations of the study

This study had limitations. The English part and the Spanish part for both the Production Task and the Identification Task were done on the same day. Perhaps one language could have influenced the other. Another limitation is the fact that the participants who performed the Production Task were a different group of participants than the group of participants who performed the Identification Task. Furthermore, the Identification task was not a conventional one. In a conventional Identification Task participants are instructed to listen to one production for identification. In the Identification Task used in this study, the participants identified the voiced and voiceless stops on the basis of listening to three repetitions. Finally, the participants were not given the option on the answer sheet for the Identification Task of indicating that they heard something different that the two options that were provided. .

Directions for future research

One direction for future research is to include more participants for the Production Task in order more data from each proficiency level. With more data, it might be easier to make generalizations about the productive abilities in English of the students in the different proficiency levels at the University of Puerto Rico at Mayagüez. A second direction for future research is to make sure the same participants participate in both the Production Task and the Identification Task and to look more closely at the match between production and identification. It would also be of interest to make sure that the tasks in English and the tasks in Spanish were done on different days to reduce the possibility of language interference. Third, the Identification Task should be brought in

line with other identification tasks in the literature where participants are asked to make an identification on the basis of one production, not on the basis of three.

Pedagogical implications

The results from this study showed that there is a strong proficiency effect at the strong and the weak two ends of the English proficiency levels at the UPRM. The participants from the Intermediate and Advanced levels showed better performance than the participants from the Pre-Basic and Basic levels in producing and identifying English voiceless and voiced stop consonant sounds. Therefore, oral communication and listening should be given more emphasis at the Pre-Basic and Basic levels. Pronunciation of sounds should be targeted differently for the different ends of the proficiency continuum. In addition, if oral communication is targeted in a successful way, students' phonemic awareness could be improved. Finally, the use of acoustic phonetic tools in the classroom could motivate the students to learn more about their sound productions by giving concrete representation to their speech. Acoustic phonetic software, such as PRAAT LAB, could be incorporated into the English classroom, not only as a motivational tool in low English proficiency levels like Basic and Pre-Basic English, but also as a powerful tool in more advanced classes like Introduction to Linguistics and Phonetics.

Reference List

Blau, E. and Dayton, E. (1997). Puerto Rico as an English – using society. *Linguistic Studies in Honor of Bohdan Saciuk*, 137-148.

Eimas, Siqueland, Jusczyk, and Vogorito. (1971). Categorical Perception. In Field, J. (2003) *Psycholinguistics: A resource book for students*. London: Routledge. 76.

Fellbaum, Marie (1996): "The acquisition of voiceless stops in the interlanguage of second language learners of English and Spanish", In *ICSLP-1996*, 1648-1651.

Flege, J.E. (1980). Phonetic approximation in second language acquisition. *Language Learning* 30(1), 117-134.

Gass, S. & Selinker, L. (2001). *Second language acquisition: An introductory course*. London: Lawrence Erlbaum.

Gleason, J.B. and Ratner, N. (1998), *Psycholinguistics*.2nd ed. Orlando, FL: Harcourt Brace.

Hodne, B. (1985). Yet another look at interlanguage phonology: The modification of English syllable structure by native speakers of Polish. *Language Learning*, 35 (3), 405-417.

Ioup, G. and Weinberger, S. (eds.). 1987. Interlanguage Phonology: the Acquisition of a Second Language Sound System. Rowley, Mass.: Newbury House.

Khattab, G. (2002). VOT production in English and Arabic bilingual and monolingual children. *Perspectives on Arabic Linguistics. XIII-XIV*, 1-38.

Khul and Miller. (1978). Categorical Perception. Field, John (2003) *Psycholinguistics: A resource book for students*. London: Routledge. 77.

Lisker, L & Abramson, A. (1964). A cross-language Study of Voicing in Initial stops: Acoustical Measurements. *Word*. 20, #3: 385-422.

Schnitzer, M. (1997) *Fonología contrastiva: Español-Inglés*. San Juan: Piedras Press, Inc.

Tarone, E. (1987). The Phonology of Interlanguage. In Ioup, G. and Weinberger, S. *Interlanguage Phonology: The Acquisition of a Second Language Sound System*. . Rowley, Mass.: Newbury House. 70-85.

Yeni-Komshian, G. (1998). Speech Perception. In Gleason, J.B. and Ratner, N.B. *Psycholinguistics*. 2nd ed. Orlando, FL: Harcourt Brace.128-139.

Yeni-Komshian, G. and LaFontaine. (1983). Categorical Perception of Voicing Contrast. In Gleason, J.B. and Ratner, N.B. *Psycholinguistics*. 2nd ed. Orlando, FL: Harcourt Brace. 130-133.

Zampini, M. (1998). The Relationship between Perception and Production and Perception of L2 Spanish stops. In Nicol, J. (Ed.). One mind, Two Language: Bilingual Language Processing. (pp. 23-48). University of Arizona.

Appendix A: Consent Form

Mirta Maldonado
University of Puerto Rico
Mayaguez campus Ch-408

To whom it may concern

My name is Mirta Maldonado, and I am currently on my third year in the master's degree program from the English Department at the University of Puerto Rico Mayaguez campus. Since I already have finished with my course load, I will begin to conduct my research for my thesis this semester. My thesis will explore pronunciation features of the English of college students at the University of Puerto Rico, Mayaguez. I will select two students from each of the different freshman courses according to proficiency level (Pre-Basic, Basic, Intermediate and Advanced English courses). In order to collect my data I will need to record the participants' voices while they perform pronunciation tasks. Participation in this research will be anonymous and confidential. If you're willing to participate in this research, please sign the consent below.

_____ I consent to participate in the thesis research of Mirta Maldonado. I understand that the research will be anonymous and confidential.

Appendix B: Socio-demographic and English use Questionnaire

Demographic Investigation

The purpose of this investigation is to collect data from students of English at the University of Puerto Rico at Mayagüez (UPRM) about their socio-demographic information in relation to language exposure and competence. This study is carried out by a graduate student, Mirta Maldonado, from the English department for the master's degree thesis investigation. I must assure you that your answers will not be judged, nor will they be classified as right or wrong. Furthermore, your answers will remain confidential and anonymous. I appreciate your participation in this study.

Check the option that applies to you or provide the answer to the following questions.

1- Sex

____female
____male

2- What is your hometown in Puerto Rico?

_____

3- Where were you born?

____Puerto Rico
____ United States
____ other _____

4- What is your native language?

____Spanish
____ English
____ other _____

5- Where was your mother born?

____ Puerto Rico
____ United States
____ other _____

6- What is your mother's native language?

____ Spanish
____ English
____ other _____

7- Where was your father born?

____ Puerto Rico

____ United States
____ other _____

8- What is your father's native language?
____ Spanish
____ English

____ other _____

9- Do you speak English at home?
____ yes
____ no

If "yes",
to whom? _____

10- Have you ever lived outside Puerto Rico?
____ yes
____ no

If "yes",
for how long? _____

11- Do you plan to go to the United States in the future?

____yes
____ no

If "yes",
what was the reason?_____

Finish the sentence by checking one of the options that applies to you

12- I understand native spoken English_____
____a) very well
____b) well
____c) not very well
____d) I don't understand spoken English at all.

13- I speak English:
____a) very well
____b) well
____c) not very well

____d) I cannot speak English at all.

Check the option that applies to you or provide the answer to the following questions

14- Do you have a friend that is a native speaker of English?

____ yes
____no

If "yes",
How often do you speak to your friend?
____a) everyday
____b) sometimes
____d) never

15- Do you speak English among your friends at the "Colegio"?

____yes
____no

If "yes",
how often?
____a) everyday
____b) sometimes
____d) never

16- Do you like to listen to music in English?
____yes
____no

If "yes",
how often?
____a) everyday
____b) sometimes
____d) never
17- Do you watch television in English?
____ yes
____ no
If "yes",
how often?
____ a) everyday
____ b) sometimes
____ c) never

18- Do you chat on Microsoft Messenger?

____yes

____no

If "yes",

what is your language of choice?_____

Appendix C: Spanish Word List

Spanish Word List

1- ba

2- cava

3- ga

4- ka

5- pata

6- taza

7- bata

8- da

9- gasa

10- pa

11- ta

12- capa

13- data

14- papa

15- gata

Appendix D: English Word List

English Word List

1- ba

2- cot

3- ga

4- pa

5- ta

6- baps

7- da

8- got

9- past

10- tads

11- bop

12- dot

13- ka

14- pot

15- top

Appendix E: Recording the Word Lists using PRAAT

1) In order to record a sound using PRAAT select **New** on the task bar and select *record mono sound* from the **New** menu in the PRAAT objects window. Then, a *sound recorder* window will appear on the computer screen.
2) In order to record the sound file, use the **Record** and **Stop** buttons on the *sound recorder* window to separately record the sound as a sound file and to stop the recording before moving on to another sound.
3) In order to check the recording of the sound file, use the **Play** button to listen to the recording to make sure that it has been recorded. Then assign the sound file a name in the space provided on the bottom of the *sound recorded* window.
4) In order to save the sound file, click on the **Save To List** button on the *sound recorder* window. By clicking onto the Save to List button, you will transfer the sound file to the PRAAT objects objects window. Repeat this process for each sound file you wish to save.
5) In order to save the sound files, select the sound file you wish to save from the PRAAT objects object window, click on write from the task bar, click on *Write to WAV file* from the write menu, assign a destination in your hard drive, and then save it into a file.

Appendix F: How to Measure VOT Using PRAAT

1) In order to measure VOT using PRAAT, you will need to input the data into the software in order to get visual maps or spectro-temporal representation of the data.
2) In order to input the data, you have to access an already existent file, which was a file previously recorded in PRAAT or any sound file (wav file) stored in a memory storage device (internal or external memory storage device).
3) In order to access a file, select **Read** on the task bar and then select the file you wish to work on. By selecting the file, PRAAT will automatically place the file on the *PRAAT Objects Window*.
4) In order to see the wave form of the file, go to the *PRAAT Object* window and select the file you want to work on. Then, click on the **Edit** button on the right side of the PRAAT objects window in order to see the wave form of the recording. A *Sound Editor* window will appear on the computer screen under the name of the file.
5) In order to see the spectrogram, the *Sound Editor* will provide you with a spectrogram or a grayish image in the bottom of this window. In cases where the spectrogram do not appear in the sound editor, zoom in the screen by either pressing the **ctrl** and **i** keys simultaneously or by selecting **View** and **Zoom In** on the task bar.
6) In order to be ready to measure VOT, you will need to adjust the spectrogram settings for a wide-band spectrogram settings 0-3000hz and 0.005 seconds. Select

0-3000hz on the space provided for *view range* and 0.005seconds on the space provided for *window length* and finally click **ok**.

7) In order to begin measuring VOT make sure that the spectrograms are showing the formants of the vowel, or bundles of energy that works as filters for glottal pulsing or voicing. The formants will be represented by red dots and lines along the greyest part (vowel) of the spectrogram. In cases where you do not see the formants on the spectrograms, go to **Formant** on the task bar and select *View Formants* and then *First Formant.* This option will give you the number where the first formant is shown. Once you have the number, close the *First Formants* dialog box.

8) In order to measure VOT, highlight on the spectrogram the area from where the burst is to the position on the first formant's number that is shown on the left axle of the display of the spectrogram. Then, zoom in the spectrogram by either pressing the **ctrl** and **i** keys simultaneously or by selecting **View** and **Zoom In** on the task bar until you can see a reading of milliseconds (e.g. .062343) above the spectrogram display and below the task bar. Once I had the number, I rounded it to its nearest thousand. Round the numbers to the nearest thousand and keep record of the numbers as milliseconds (62msec).

Appendix G:
Spanish Identification Answer Sheet

Prueba de Identificación
Lista de palabras en español.

I- Escriba una "x" al lado de la consonante que contenga la primera sílaba de la palabra que escuche en la grabación.

E.j. Grabación: *bola bola bola* On the sheet: p____ b__x__

1- p___ b___

2- k___ g___

3- k___ g___

4- k___ g___

5- p___ b___

6- t___ d___

7- p___ b___

8- t___ d___

9- k___ g___

10- p___ b___

11- t___ d___

12- k___ g___

13- t___ d___

14- p___ b___

15- k___ g___

Appendix H:
English Identification Answer Sheet

Identification Test
English Word List

I- Write an "x" next to the consonant contained in the first syllable of the word you hear on the tape.

E.g. Recording: *pat pat pat* On the sheet: p__x__ b____

1- p___ b___

2- k___ g___

3- k___ g___

4- p___ b___

5- t___ d___

6- p___ b___

7- t___ d___

8- k___ g___

9- p___ b___

10- t___ d___

11- p___ b___

12- t___ d___

13- k___ g___

14- p___ b___

15- t___ d___

Appendix I1: Identification by Advanced participants (A1 and A2) of voiceless stops in Spanish from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Item	Total c/i
Advanced English		pa	papa	pata	ta	taza	ka	capa	cava	
	Pre-Basic									
A1		c	c	c	c	c	c	c	c	8/0
A2		c	c	c	c	c	c	c	c	8/0
	Basic									
A1		c	c	c	c	c	c	c	c	8/0
A2		c	c	c	c	c	c	c	c	8/0
	Intermediate									
A1		c	c	c	c	c	c	c	c	8/0
A2		c	c	c	c	c	c	c	c	8/0
	Advanced									
A1		c	c	c	c	c	c	c	c	8/0
A2		c	c	c	c	c	c	c	c	8/0
	NS Spanish									
A1		c	c	c	c	c	c	c	c	8/0
A2		c	c	c	c	c	c	c	c	8/0
Total c/i		10/0	10/0	10/0	10/0	10/0	10/0	10/0	10/0	80/0

Appendix I2: Identification by Advanced participants (A1 and A2) of voiceless stops in English from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Item	Total c/i
Advanced English		pa	past	pot	ta	tads	top	ka	cot	
	Pre-Basic									
A1		c	c	c	c	c	c	c	c	8/0
A2		c	c	c	c	c	c	c	c	8/0
	Basic									
A1		c	c	c	c	c	c	c	c	8/0
A2		c	c	c	c	c	c	c	c	8/0
	Intermediate									
A1		c	c	c	c	c	c	c	c	8/0
A2		c	c	c	c	c	c	c	c	8/0
	Advanced									
A1		c	c	c	c	c	c	c	c	8/0
A2		c	c	c	c	c	c	c	c	8/0
	NS English									
A1		c	c	c	c	c	c	c	c	8/0
A2		c	c	c	c	c	c	c	c	8/0
Total c/i		10/0	10/0	10/0	10/0	10/0	10/0	10/0	10/0	80/0

Appendix I3: Identification by Advanced participants (A1 and A2) of voiced stops in Spanish from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Total c/i
Advanced English		ba	bata	da	data	ga	gasa	gata	
	Pre-Basic								
A1		c	c	c	c	c	c	c	7/0
A2		c	c	c	c	c	c	c	7/0
	Basic								
A1		c	c	c	c	c	c	c	7/0
A2		c	c	c	c	c	c	c	7/0
	Intermediate								
A1		c	c	c	c	c	c	c	7/0
A2		c	c	c	c	c	c	c	7/0
	Advanced								
A1		c	c	c	c	c	c	c	7/0
A2		c	c	c	c	c	c	c	7/0
	NS Spanish								
A1		c	c	c	c	c	c	c	7/0
A2		c	c	c	c	c	c	c	7/0
Total c/i		10/0	10/0	10/0	10/0	10/0	10/0	10/0	70/0

Appendix I4: Identification by Advanced participants (A1 and A2) of voiced stops in English from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Total c/i
Advanced English		ba	baps	bop	da	Dot	ga	got	
	Pre-Basic								
A1		c	c	c	c	c	c	c	7/0
A2		c	c	c	c	c	c	c	7/0
	Basic								
A1		c	c	c	c	c	c	c	7/0
A2		c	c	c	c	c	c	c	7/0
	Intermediate								
A1		c	c	c	c	c	c	c	7/0
A2		c	c	c	c	c	c	c	7/0
	Advanced								
A1		c	c	c	c	c	c	c	7/0
A2		c	c	c	c	c	c	c	7/0
	NS English								
A1		c	c	c	c	c	c	c	7/0
A2		c	c	c	c	c	c	c	7/0
Total c/i		10/0	10/0	10/0	10/0	10/0	10/0	10/0	70/0

Appendix I5: Identification by Intermediate participants (I1 and I2) of voiceless stops in Spanish from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Item	Total c/i
Intermediate English		pa	papa	pata	ta	taza	ka	capa	cava	
	Pre-Basic									
I1		c	c	c	c	c	c	c	c	8/0
I2		i	i	c	i	c	c	c	c	5/3
	Basic									
I1		c	c	c	c	c	c	c	c	8/0
I2		i	i	c	i	c	c	c	c	5/3
	Intermediate									
I1		c	c	c	c	c	c	c	c	8/0
I2		i	i	c	i	c	c	c	c	5/3
	Advanced									
I1		c	c	c	c	c	c	c	c	8/0
I2		i	i	c	i	c	c	c	c	5/3
	NS Spanish									
I1		c	c	c	c	c	c	c	c	8/0
I2		i	i	c	i	c	c	c	c	5/3
Total c/i		5/5	5/5	10/0	5/5	10/0	10/0	10/0	10/0	65/15

Appendix I6: Identification by Intermediate participants (I1 and I2) of voiceless stops in English from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Item	Total c/i
Intermediate English		pa	past	pot	ta	tads	Top	ka	cot	
	Pre-Basic									
I1		c	c	c	c	c	c	c	c	8/0
I2		c	c	c	i	c	c	i	i	5/3
	Basic									
I1		c	c	c	c	c	c	c	c	8/0
I2		c	c	c	i	c	c	i	i	5/3
	Intermediate									
I1		c	c	c	c	c	c	c	c	8/0
I2		c	c	c	i	c	c	i	i	5/3
	Advanced									
I1		c	c	c	c	c	c	c	c	8/0
I2		c	c	c	i	c	c	i	i	5/3
	NS English									
I1		c	c	c	c	c	c	c	c	8/0
I2		c	c	c	i	c	c	i	i	5/3
Total c/i		10/0	10/0	10/0	5/5	10/0	10/0	5/5	5/5	65/15

Appendix I7: Identification by Intermediate participants (I1 and I2) of voiced stops in Spanish from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Total c/i
Intermediate English		ba	bata	da	data	ga	gasa	gata	
	Pre-Basic								
I1		c	c	c	c	c	c	c	7/0
I2		i	c	i	i	c	c	c	4/3
	Basic								
I1		c	c	c	c	c	c	c	7/0
I2		i	c	i	i	c	c	c	4/3
	Intermediate								
I1		c	c	c	c	c	c	c	7/0
I2		i	c	i	i	c	c	c	4/3
	Advanced								
I1		c	c	c	c	c	c	c	7/0
I2		i	c	i	i	c	c	c	4/3
	NS Spanish								
I1		c	c	c	c	c	c	c	7/0
I2		i	c	i	i	c	c	c	4/3
Total c/i		5/5	10/0	5/5	5/5	10/0	10/0	10/0	55/15

Appendix I8: Identification by Intermediate participants (I1 and I2) of voiced stops in English from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Total c/i
Intermediate English		ba	baps	bop	da	dot	ga	got	
	Pre-Basic								
I1		c	c	c	c	c	c	c	7/0
I2		c	c	c	i	c	i	i	4/3
	Basic								
I1		c	c	c	c	c	c	c	7/0
I2		c	c	c	i	c	i	i	4/3
	Intermediate								
I1		c	c	c	c	c	c	c	7/0
I2		c	c	c	i	c	i	i	4/3
	Advanced								
I1		c	c	c	c	c	c	c	7/0
I2		c	c	c	i	c	i	i	4/3
	NS English								
I1		c	c	c	c	c	c	c	7/0
I2		c	c	c	i	c	i	i	4/3
Total c/i		10/0	10/0	10/0	5/5	10/0	5/5	5/5	55/15

Appendix I9: Identification by Basic participants (B1 and B2) of voiceless stops in Spanish from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Item	Total c/i
Basic level		pa	papa	pata	ta	taza	ka	capa	cava	
	Pre-Basic									
B1		i	i	c	i	c	c	c	c	5/3
B2		i	i	c	i	c	c	c	c	5/3
	Basic									
B1		c	i	c	i	c	c	c	c	6/2
B2		c	i	c	i	c	c	c	c	6/2
	Intermediate									
B1		c	i	c	i	c	c	c	c	6/2
B2		c	i	c	i	c	c	c	c	6/2
	Advanced									
B1		c	i	c	i	c	c	c	c	6/2
B2		c	i	c	i	c	c	c	c	6/2
	NS Spanish									
B1		c	i	c	i	c	c	c	c	6/2
B2		c	i	c	i	c	c	c	c	6/2
Total c/i		8/2	0/10	10/0	0/10	10/0	10/0	10/0	10/0	58/22

Appendix I10: Identification by Basic participants (B1 and B2) of voiceless stops in English from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Item	Total c/i
Basic level		pa	papa	pata	ta	taza	ka	capa	cava	
	Pre-Basic									
B1		i	i	c	i	c	c	c	c	5/3
B2		i	i	c	i	c	c	c	c	5/3
	Basic									
B1		c	i	c	i	c	c	c	c	6/2
B2		c	i	c	i	c	c	c	c	6/2
	Intermediate									
B1		c	i	c	i	c	c	c	c	6/2
B2		c	i	c	i	c	c	c	c	6/2
	Advanced									
B1		c	i	c	i	c	c	c	c	6/2
B2		c	i	c	i	c	c	c	c	6/2
	NS Spanish									
B1		c	i	c	i	c	c	c	c	6/2
B2		c	i	c	i	c	c	c	c	6/2
Total c/i		8/2	0/10	10/0	0/10	10/0	10/0	10/0	10/0	58/22

Appendix I11: Identification by Basic participants (B1 and B2) of voiced stops in Spanish from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Total c/i
Basic level		ba	bata	da	data	ga	gasa	gata	
	Pre-Basic								
B1		i	c	i	i	c	c	c	4/3
B2		i	c	i	i	c	c	c	4/3
	Basic								
B1		i	c	i	i	c	c	c	4/3
B2		i	c	i	i	c	c	c	4/3
	Intermediate								
B1		i	c	i	i	c	c	c	4/3
B2		i	c	i	i	c	c	c	4/3
	Advanced								
B1		i	c	i	i	c	c	c	4/3
B2		i	c	i	i	c	c	c	4/3
	NS Spanish								
B1		i	c	i	i	c	c	c	4/3
B2		i	c	i	i	c	c	c	4/3
Total c/i		0/10	10/0	0/10	0/10	10/0	10/0	10/0	40/30

Appendix I12: Identification by Basic participants (B1 and B2) of voiced stops in English from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Total c/i
Basic level		ba	baps	bop	da	dot	ga	got	
	Pre-Basic								
B1		c	c	c	i	i	i	i	3/4
B2		c	c	c	c	i	i	i	4/3
	Basic								
B1		c	c	c	i	i	i	i	3/4
B2		c	c	c	c	i	i	i	4/3
	Intermediate								
B1		c	c	c	i	i	i	i	¾
B2		c	c	c	c	i	i	i	4/3
	Advanced								
B1		c	c	c	i	i	i	i	¾
B2		c	c	c	c	i	i	i	4/3
	NS English								
B1		c	c	c	i	i	i	i	¾
B2		c	c	c	c	i	i	i	4/3
Total c/i		10/0	10/0	10/0	5/5	0/10	0/10	0/10	35/35

Appendix I13: Identification by Pre-Basic participants (PB1 and PB2) of voiceless stops in Spanish from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Item	Total c/i
Pre-Basic level		pa	papa	pata	ta	taza	ka	capa	cava	
	Pre-Basic									
PB1		c	c	c	c	c	c	c	c	8/0
PB2		i	i	c	i	c	c	c	c	5/3
	Basic									
PB1		c	c	c	c	c	c	c	c	8/0
PB2		i	i	c	i	c	c	c	c	5/3
	Intermediate									
PB1		c	c	c	c	c	c	c	c	8/0
PB2		i	i	c	i	c	c	c	c	5/3
	Advanced									
PB1		c	c	c	c	c	c	c	c	8/0
PB2		i	i	c	i	c	c	c	c	5/3
	NS Spanish									
PB1		c	c	c	c	c	c	c	c	8/0
PB2		i	i	c	i	c	c	c	c	5/3
Total c/i		5/5	5/5	10/0	5/5	10/0	10/0	10/0	10/0	65/15

Appendix I14: Identification by Pre-Basic participants (PB1 and PB2) of voiceless stops in English from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Item	Total c/i
Pre-Basic level		pa	past	pot	ta	tads	top	ka	cot	
	Pre-Basic									
PB1		c	c	c	c	c	c	c	c	8/0
PB2		c	c	c	i	c	i	c	i	5/3
	Basic									
PB1		c	c	c	c	c	c	c	c	8/0
PB2		c	c	c	i	c	i	c	i	5/3
	Intermediate									
PB1		c	c	c	c	c	c	c	c	8/0
PB2		c	c	c	i	c	i	c	i	5/3
	Advanced									
PB1		c	c	c	c	c	c	c	c	8/0
PB2		c	c	c	i	c	i	c	i	5/3
	NS English									
PB1		c	c	c	c	c	c	c	c	8/0
PB2		c	c	c	i	c	i	c	i	5/3
Total c/i		10/0	10/0	10/0	5/5	10/0	5/5	10/0	5/5	65/15

Appendix I15: Identification by Pre-Basic participants (PB1 and PB2) of voiced stops in Spanish from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	Item	Item	Item	Item	Item	Item	Item
		ba	bata	da	data	ga	gasa	gata	Total c/i
	Pre-Basic								
PB1		c	c	c	c	c	c	c	7/0
PB2		i	i	c	i	c	c	c	4/3
	Basic								
PB1		c	c	c	c	c	c	c	7/0
PB2		i	i	c	i	c	c	c	4/3
	Intermediate								
PB1		c	c	c	c	c	c	c	7/0
PB2		i	i	c	i	c	c	c	4/3
	Advanced								
PB1		c	c	c	c	c	c	c	7/0
PB2		c	i	c	i	c	c	c	5/2
	NS Spanish								
PB1		c	c	c	c	c	c	c	7/0
PB2		i	i	c	i	c	c	c	4/3
Total c/i		6/4	5/5	10/0	5/5	10/0	10/0	10/0	56/14

Appendix I16: Identification by Pre-Basic participants (PB1 and PB2) of voiceless stops in English from the digital folders of four proficiency levels from the Production Task. (c= correct; i= incorrect identification)

Participants	Digital proficiency folders	Item	item	Item	Item	Item	Item	Item	Total c/i
Pre-Basic level		ba	baps	bop	da	dot	ga	got	
	Pre-Basic								
PB1		c	c	c	c	c	c	c	7/0
PB2		c	c	c	i	i	c	i	4/3
	Basic								
PB1		c	c	c	c	c	c	c	7/0
PB2		i	c	c	i	i	c	i	¾
	Intermediate								
PB1		c	c	c	c	c	c	c	7/0
PB2		c	c	c	i	i	c	i	4/3
	Advanced								
PB1		c	c	c	c	c	c	c	7/0
PB2		i	c	c	i	i	c	i	¾
	NS English								
PB1		c	c	c	c	c	c	c	7/0
PB2		c	c	c	i	c	c	i	5/2
Total c/i		8/2	10/0	10/0	5/5	6/4	10/0	5/5	48/16

Appendix J: Socio-demographic and English use profile of the two participants who performed the Identification Task from each of the four proficiency levels: the Pre-Basic level (PBP1 & PBP2), Basic level (BP1 & BP2), Intermediate level (IP1 & IP2) and Advanced level (AP1 & AP2)

Student Participant	PBP1	PBP2	BP1	BP2	IP1	IP2	AP1	AP2
Place of Birth	PR	PR	PR	PR	PR	PR	US	US
Native language	Spanish	Spanish	Spanish	Spanish	Spanish	Spanish	English	Spanish
Father's place of Birth and native language	PR, Spanish	PR, Spanish	PR, Spanish	PR, Spanish	US, English	PR, Spanish	US, English	PR, Spanish
Mother's place of Birth and native language	US, Spanish	PR, Spanish	PR, Spanish	PR, Spanish	PR, Spanish	PR, Spanish	PR, Spanish	PR, Spanish
Speaks English at home	no	No	yes	no	yes	no	yes	yes
Has a native speaker of English with whom he speaks often	no	no	yes	no	yes	no	yes	yes
Speaks and understands English	not very well	not very well	not very well	not very well	very well	very well	very well	very well
Language of choice for media (Music, TV, and Internet chat services such as MSN	Spanish	Spanish	Spanish	Spanish	English/ Spanish	English/ Spanish	English	English