ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

DOMINANT PANAMANIAN SPANISH DIALECTAL ALLOPHONE IN FREE VARIATION IN THE PRONUNCIATION OF THE ENGLISH VOICELESS POST-ALVEOLAR SOUNDS

DOMINIO DEL ALÓFONO DIALÉCTICO DEL ESPAÑOL PANAMEÑO EN VARIACIÓN LIBRE EN LA PRONUNCIACIÓN DE LOS SONIDOS POSTALVEOLARES SORDOS DEL INGLÉS

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Abstract

This research used the production of English voiceless post-alveolar sounds to measure the accuracy of the target sounds and to determine the dominant dialectal allophone voiceless post-alveolar sound in Panamanian Spanish through the frequency of usage in L2 pronunciation. Previous research has reported studies related to allophonic variations but in complementary distribution, which let this study offer a different analysis using Feature Geometry and Underspecification theory. Twenty-five Panamanian learners of English consented to a production task that comprised repeating twice a list of 58 words that had the target sounds in the study. Descriptive statistics and t-tests were performed after analyzing and coding the spectrograms of each utterance. The results showed a high percentage of usage of the Panamanian Spanish dialectal allophone [ʃ] in the pronunciation of /tʃ/ and /ʃ/ in English. The results implied that these Panamanian speakers learning English had not reached the phonemic split yet required for English. Another important conclusion based on Feature Geometry and Undespecification values suggested that in Panamanian Spanish the feature [-continuant] might be absent, which may also suggest a sound shift in the Spanish of Panamá.

Key word: Deaffrication, Feature Geometry, Underspecification Theory, markedness, phonological processes.

Resumen

Esta investigación utilizó la producción de sonidos post alveolares sordos del inglés para medir la correcta pronunciación de los sonidos del estudio y para determinar el sonido post alveolar sordo dialéctico dominante en el español panameño a través de la frecuencia de su uso en la pronunciación del inglés.

ISSN L 2953-2981

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Mayo – Octubre 2022

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

Investigaciones anteriores han reportado estudios relacionados con variaciones alofónicas, pero en distribución complementaria, lo que permite que este estudio ofrezca un análisis diferente utilizando la Geometría de Rasgos fonéticos y la teoría de la Sub-especificación. Veinticinco estudiantes panameños de inglés aceptaron participar en una tarea de producción que consistía en repetir dos veces una lista de 58 palabras que tenían los sonidos del estudio. Se hizo estadísticas descriptivas y *t-tests* después de analizar y codificar los espectrogramas de cada grabación. Los resultados mostraron un alto porcentaje de uso del alófono dialéctico del español panameño [ʃ] en la pronunciación de /tʃ/ y /ʃ/ en inglés. Esto demostró que estos participantes no habían alcanzado aún la distinción fonémica en inglés. Otra conclusión importante basada en los valores de Geometría de Rasgos fonéticos y características sub-especificadas es que se sugiere que en español panameño el rasgo [-continuante] podría estar ausente, lo que también podría sugerir un cambio de sonido en el español de Panamá.

Palabras claves: Deafricación, Geometría de los rasgos fonéticos, Teoría de la Sub-especificación, marcación, procesos fonológicos.

Introduction.

Instead of treating language as a general system (Czaykowska-Higgins and Dobrovolsky, 2010), it is recommended to view it in terms of dialects (regions), sociolects (social classes), genderlects (genders), or by idiolects (individuals) (Whitley, 2002) in order to contextualize a particular linguistic phenomenon.

For this study, we will consider L1 in terms of dialects and L2 as a general language. The L1 will be Panamanian Spanish, which, according to Alvarado de Ricord (1971), Hualde (2005), and Hualde, Olarrea, & Escobar (2001), exhibits some unique dialectal processes that are unpredictable due to the presence of allophones in free variation. Allophones —that is, sounds derived from a single phoneme— frequently surface in complementary distribution, where the environment is predictable and may alter the meaning of words; however, when allophones surface in free variation, their environments are unpredictable and may not alter the meaning of words (Nathan 2008).

In consequence, the sounds in study are English post-alveolar sounds that have counterparts in the Spanish of Panama with different phonological status, as shown in Table 1.

ISSN L 2953-2981

Revista Científica Especializada en Educación y Ambiente

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Mayo – Octubre 2022

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

Table 1

Phonological Status of the Target Sounds

Language	Phonemes and Allophones	
L2 (Target Language) = English	/tʃ/	/ʃ/
L1 (Native Language) = Spanish	[tʃ]	[ʃ]
	/tʃ/	

Note. Table elaborated by the authors based on the application of the literature.

According to Lado (1957), the most challenging scenario for a language learner to master while acquiring new sounds is splitting allophones of an L1 phoneme into two distinct L2 phonemes. Thus, [ʃ] and [tʃ] are allophones of the same phoneme /tʃ/ in Panamanian Spanish, and the two allophones are interchangeable or in free variation, being [ʃ] more commonly used (Alvarado de Ricord, 1982). Due to this distribution, it is projected that these speakers will struggle to acquire the distinction between English /ʃ/ and /tʃ/.

As a result, the basis of this inquiry stems from a worry that many second language pronunciation programs emphasize negative transfer from the first language's phonemic constraints (Whitley, 2002), rather than allophonic dialectal variances in L1. Thus, this study will examine whether native speakers of Panamanian Spanish who are learning English as a second language transfer their dialectal allophones to their second language pronunciation. As a consequence, this study may have pedagogical implications for pronunciation classes in Panama and the United States.

To gain a thorough understanding of the sounds under study, Feature Geometry and Underspecification Theory, as well as related research, will be used. Because this study will include not just the phoneme but also its behavior inside the syllable, the position of the segments is critical as well.

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

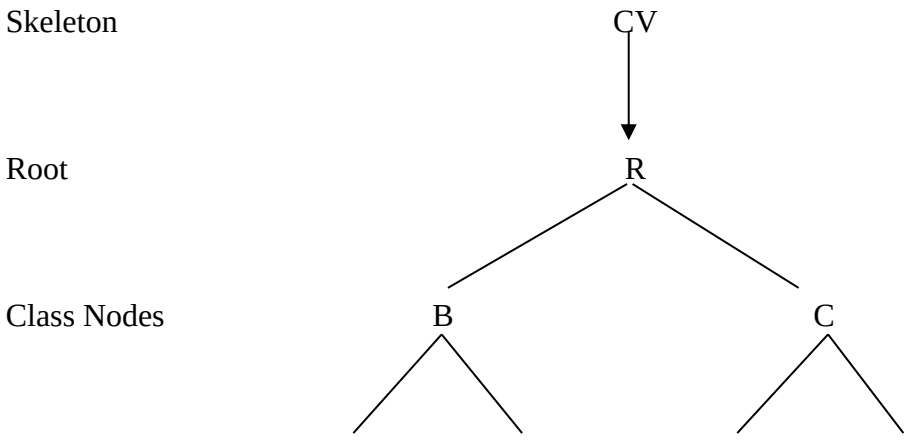
Table 2

Position of Segments in the Word

Language Phonemes	**Distribution of phonemes in words**		
L1= Spanish phonemes	**W-I**	W-M	**W-F**
/tʃ/	✓	✓	____
L2= English phonemes	**W-I**	W-M	**W-F**
/tʃ/	✓	✓	✓
/ʃ/	✓	✓	✓

Note. Table elaborated by the authors based on the application of the literature in this study.

Against the view that segments are a collection of unrelated features as presented in Chomsky and Halle's (1968) Sound Pattern of English (SPE) (as cited in Clements, 1985), Clements argued in his Feature Geometry Model that features obey a hierarchical organization in which some features can act independently or in groups to explain certain phonological processes, such as assimilation rules, which is the basis of his ideas. For explaining these processes, feature trees have been employed (see Figure 1), although many authors, such as Clements, Clements &Hume (1995), McCarthy (1988), Sagey (1986,1988 as cited in D'Introno, Del Teso & Weston, 1995) have differed from each other in the way they placed feature nodes.



ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
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Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

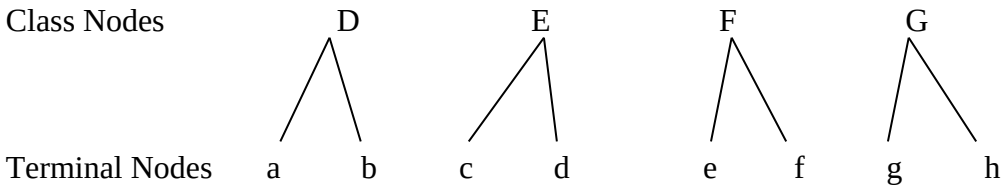

Figure 1 Feature Geometry Skeleton

Note. Based on Mateus and d'Andrade (2000, p.24).

Clements (1985), as well as Mateus and d'Andrade (2000), explained the feature tree skeleton as follows: *Terminal nodes* include more detailed phonetic information and are binary in nature, indicating that they obviously depend on a particular articulator. *Class nodes* are organized into several tiers that are dominated by a higher-level class node called the root node. These tiers can be used to create unary natural classes, such as the root tier, the laryngeal tier, the supralaryngeal tier, the place tier, and the manner tier. Finally, the *Root node* is linked directly to the syllable that Clements termed the CV tier, but Mateus and d'Andrade renamed it the X skeleton; it is here that the major class features are inserted. Underspecification Theory is concerned with the omission of redundant or noncontradictory information or features from representations that are based on them. Phonemes are the underlying sounds, whereas allophones, or derivative sounds of those phonemes, are the surface sounds (Nathan, 2008). Dresher and van der Hulst (1995) stated that by investigating phonological processes using Underspecification theory, we can more clearly determine the relationship between the target and what triggers it, or what intervenes between the trigger and the target.

According to Avery and Rice (1989), Paradis and Prunet (1990), and Archangeli (1988), D'Introno et al. (1995), Kaun (1993), Mateus and d'Andrade (2000), and Rice and Avery (1991; 1995), this study will use the Spanish language's phonemic inventory with the underspecification values shown in table 3 below.

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
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Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

Table 3 Spanish Underspecified Consonants

	p	b	t̪	d̪	k	g	f	(θ)	s	ɟ	x	tʃ	m	n	ɲ	(ʎ)	l	ɾ	r
[+cons]																			
[son]	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+
[cont]	-	-	-	-	-	-	+	+	+	+	+	±							
[lateral]																+	+	-	-
[nasal]													+	+	+				
LARYNGEAL	●	●	●	●	●	●				●									
[voice]	-	+	-	+	-	+				+									
LABIAL	●	●					●						●						
CORONAL			●	●								●							
[anterior]			+	+								-							
[distributed]			+	+								+							
DORSAL					●	●				●	●				●	●			
[back]					+	+				-	+				-	-			

Note. Phonemic inventory taken from Hualde et al. (2001, p.83) but symbols are updated to IPA.

The segments in parentheses are segments considered phonemes in a specific dialect area of the Spanish language. This table model was based on Mateus and d'Andrade (2000, p. 36).

It is very important to illustrate the phonetic status of the similar sound /tʃ/ between L1 (Panamanian Spanish) and L2 (English) to predict or anticipate the phonological processes that may occur. To do this, we used Feature Geometry and Underspecification Theory to display the phonetic condition of the phoneme /tʃ/.

Figure 2 compares the Spanish and English voiceless post-alveolar affricate. Because Spanish lacks the voiced counterpart /dʒ/, the value for [voice] is unnecessary. On the other hand, English does have a voiced equivalent /dʒ/, which is why the feature [-voice] is required, as it serves as a contrastive feature beneath this node. This conclusion adheres to the NAC's principles (Avery & Rice, 1989). The post-alveolar fricative /ʃ/ is not demonstrated since it is allophonic in Spanish and hence has a different status.

ISSN L 2953-2981

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https://revistas.up.ac.pa/index.php/rea

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Fecha de Aceptación 28/01/22

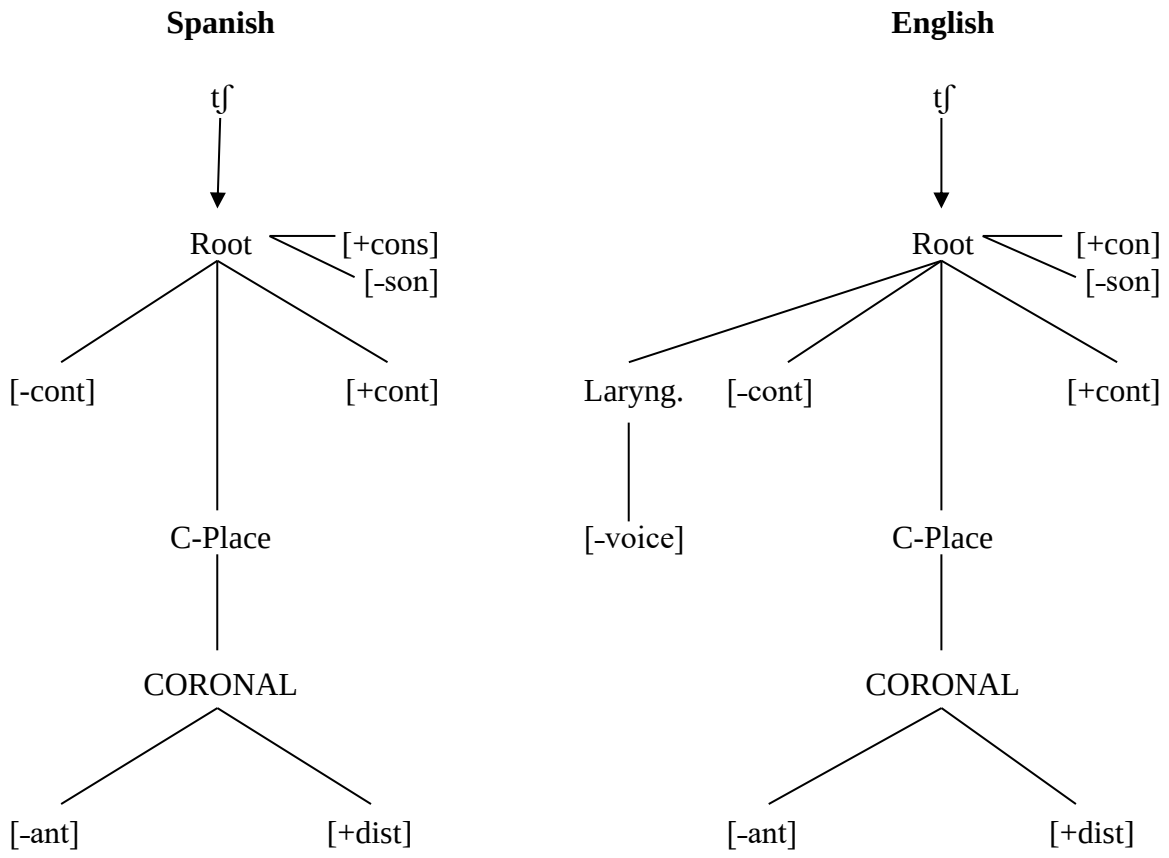

Figure 2 Underspecification of the Phone /tʃ/ using Feature Geometry

Note. Adapted from Lombardi (1990, pp. 375,376).

Now several studies will be reported to back up the analysis of the results. Brown (1998) conducted a study into the acquisition of non-native phonemes which contrasted in L2 (English) but not in L1 (Chinese and Japanese). Chinese and Japanese do not contrast the phonemes /l-r/, /b-v/, and /f-v/, instead having them as allophones. Chinese speakers almost accurately discriminated /l/ and /r/ in onset, coda, and clusters in the two perception tasks: an auditory discrimination task and a forced picture task. However, Japanese speakers exhibited low percentages of /l/ and /r/ perceptions in onset position and clusters, but higher percentages in coda position for both tasks. Brown concluded from these data that distribution within the word played a role in the acquisition of phonemic

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

contrasts. However, she maintained the position that syllable and segmental structure acquisition should be treated separately or independently.

Brown (1998) also observed that the age of exposure to English in a non-English-speaking country had no effect on the learning of a phonemic contrast because some Japanese speakers who started learning English at the age of ten could not perceive the phonemic contrasts /l/ and /r/ while most Chinese speakers who started learning English after the critical period could perceive /l/ and /r/. Brown asserted that, rather than age, the cause of the participant's inability to perceive the target sounds was the absence or presence of feature values that separated phonemic contrasts in the participant's native language's feature geometry.

Zampini (1997) conducted a study about the acquisition of Spanish voiced stops using native speakers of English as subjects. In Spanish, the stops become fricatives in certain environments (the spirantized Spanish allophones [β], [ð] and [ɣ] occur intervocalically), so Zampini hypothesized that the English-speaking learners of Spanish were going to be more accurate in formal speech (formal task: reading aloud) than in informal speech (informal task: answering questions). The results refuted the formal speech theory, since participants were less accurate with the target sounds. When the participants saw the graphemes 'b' 'd' or 'g', they tended to pronounce them as stops rather than fricative allophones; therefore, it is suggested that orthography had influenced the results.

Vokic (2010) concentrated on the usage of L1 allophones to achieve native-like pronunciation in L2. The study's target sounds were as follows: the voiced interdental fricative [ð] and the flap [ɾ]. In the instrument, the words were chosen to accord to the same environment in both languages, with equal number of overlapping (as in the Spanish word *de**d**o* [ˈde.ðo] that has the same environment to be pronounced as flap in English [ˈde.ɾo]) and nonoverlapping (as the Spanish word *cerdo* [ˈceɾ.ðo] that does not have the environment to be pronounced as flap) environments. By and large, the findings lacked statistical significance, implying that English learners of Spanish

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

lacked access to their allophones when speaking Spanish because they accessed more of their L1 phonemes instead of their allophones.

Eckman, Elreyes, and Iverson (2001; 2003) expanded their previous study on the learnability of target phonemic contrasts in second language pronunciation by examining three forms of substitution: allophonic split, deflected contrast, and hypercontrast. For the benefit of this investigation, the allophonic split will be used for analysis. They hypothesized that learning L2 contrastive phonemes that are allophones in a native language should take place first in tautomorphemic contexts (non-derived context words such as *"red"*) and second in heteromorphems (derived contexts such as "*redder")*. For Spanish, the voiced interdental fricative [ð] was chosen as the target sound that is an allophone of the phoneme /d/ and mostly occurs between vowels. For Korean, the voiceless post-alveolar fricative[ʃ] was chosen as the target sound that is an allophone of the phoneme /s/ and occurs in front of the high front vowel /i/. The findings indicated that if teachers could teach specific sounds' pronunciation in derived contexts, it should be easier for learners to recognize those same sounds in non-derived contexts; otherwise, learners would continue to make errors in both contexts.

It is difficult to ascertain whether a sound in the target language and the native language is similar or not. Indeed, none of the methodologies outlined above provides a perfect formula for determining this. Nonetheless, the references imply that a target sound that has a phoneme or allophone counterpart in L1 is considered a similar sound (Lado, 1957; Eckman, 1977; Flege, 1995; Major & Kim, 1996). Additionally, these similar sounds might differ in their distribution within words (Lado, 1957). Therefore, the sounds under investigation in this study are considered similar in English and Spanish.

Table 4 Markedness and Similarity/Dissimilarity Status

L2= English	L1= Spanish	Markedness Status	Similarity/Dissimilarity Status
/tʃ/ →	[tʃ]	More marked	
/ʃ/ →	[ʃ]	Less marked	Similar

Note. Table elaborated by the authors based on the application of the literature in this study.

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

Rice and Avery (1995) and Paradis and Prunet (1991) classified /tʃ/ and /ʃ/, which are CORONAL segments (Nathan, 2008), as not marked sounds, and the affricate is more marked than the fricative (Major & Kim, 1996). To gain a broader perspective on markedness, it is critical to consider features at the syllable level. For instance, Harris (1983) documented that the Spanish syllable structure, (C) (C) V(C) (C), possesses several properties of universal prosodic structure. Spanish maximally allows two segments at the onset, and mostly an obstruent plus liquid is permitted, in which Harris documented a universally unmarked cluster. This concludes that our sounds in study /tʃ/ and /ʃ/ only occur in one-segment onsets that is considered unmarked next to two-segment onsets.

On the other hand, rhymes are limited to three segments because they comprise the nucleus and the coda (Harris, 1983). Due to the absence of syllabic consonants in Spanish, the nucleus is thought to be less marked than in languages that do have a consonantal nucleus. The Spanish codas are restricted to glides or only to the CORONAL segments: /ɾ, l, n, d, s/. Because, as Yip (1991, p. 69) stated, "Codas may not have place features," Spanish codas are subject to numerous phonological processes such as assimilation, spreading, delinking, and deletion (Paradis & Prunet, 1991). In comparison to Spanish, the English syllable structure is considered more marked because it allows for more than three segments in onsets and codas and has syllabic consonants, Harris added.

Continuing this theme of similarity and markedness, it is critical to go thoroughly into phonological processes, such as lenition, where a sound becomes weaker (Kirchner, 2004). As a subcategory of lenition, Kirchner mentions *spirantization.* This is defined as the reduction from a stop or affricate sound to a fricative or an approximant sound. Thus, the alternation tʃ/→[ʃ] in Spanish is meant to be an example of *spirantization*, which Campbell (2004) also refers to as *fricativization,* and Campbell again specifies as *deaffrication* due to the fact that it restricts the process to affricates becoming fricatives. Figure 5 demonstrates the process of deaffrication in Spanish using feature geometry and underspecification values.

ISSN L 2953-2981

Revista Científica Especializada en Educación y Ambiente

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

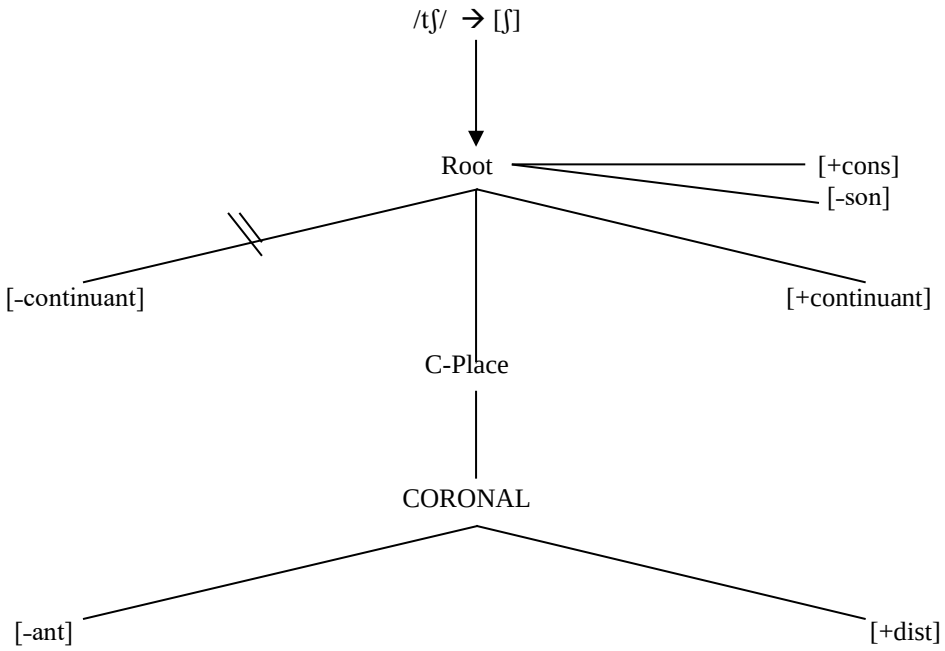

Figure 3 Deaffrication Phonological Process in Panamanian Spanish

Note. Figure elaborated by the authors based on the application of the literature in this study.

Most of the speakers of the Spanish language make their stops approximants or spirantized between vowels because this is a typical phonological process in Spanish (Alvarado de Ricord, 1971; D' Introno et al., 1995; Hualde, 2005; Hualde et al., 2001; Robe, 1960; Stockwell & Bowen, 1965; Whitley, 2002; Zampini, 1997), but the *deaffrication* process of /tʃ/ pronounced as [ʃ] is a dialectal variation (Alvarado de Ricord, 1971; Hualde, 2005; & Hualde et al., 2001) that only happens in a particular area that Lado (1957) also called the *accent*. This research is measuring the occurrence of this dialectal variation in Panamanian Spanish from the acquisition of a second phonological system: English, which has two distinctive phonemes as allophones in the Spanish of Panama. As a result, the question is whether Panamanian English learners transfer these sounds or have mastered them already.

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

Methodology.

This research has a non-experimental design with a quantitative approach. The type of study is exploratory and descriptive. To verify the dominant allophone of the post-alveolar affricate phoneme /tʃ/ in the Spanish of Panama, the following questions were targeted: What is the frequency of usage of the English target sounds /tʃ/ versus /ʃ/ word initially and word finally? Is there a significant difference in the accuracy of pronunciation of /tʃ/ and /ʃ/ word-initially and word-finally? What is the distribution of /tʃ/ and /ʃ/ in relation to their frequency of occurrence? What are the sound substitutions used by these participants?

The study population consisted of 90 students enrolled in a B.A. English program, with a sample size of *n*=25 students of the second year of the English career. For convenience, the statistical sample is non-probabilistic, as these sophomore participants have already accumulated a significant amount of input in L2. Twelve females and thirteen males were specifically sampled. The number of tokens per word position and sound was 350 (7 words x 2 repetitions x 25 participants), and the 25 participants generated a total of 1400 utterances. Specifically, there were 350 tokens for the /tʃ/ and 350 tokens for the /ʃ/ word-initially, and there were 350 tokens for the /tʃ/ and 350 tokens for the /ʃ/ word-finally.

The recordings took place in Santiago, Republic of Panama. Potential participants were briefed on the study's purpose and methods and asked to indicate their willingness to participate. After consenting to participate in the study and completing the consent form, participants were presented with demographic questionnaires to complete, and the recording phase began. The word list included 58 words, which participants were instructed to repeat twice as loudly as possible in front of the microphone. They were guided to pronounce ten consecutive words, pause to save them in a file, and then repeat the process until they reached the final word, 58. This step took an average of ten minutes per student.

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
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Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

Then, each utterance recorded was analyzed through spectrographic analysis software, primarily *Praat* and *Speech Analyzer*, as a backup. The purpose of spectrographic analysis was to determine the presence of the voiceless post-alveolar affricate, the voiceless post-alveolar fricative, or another sound. The researcher listened to, examined, coded, and transcribed all of the utterances. Consultation with a phonologist addressed transcriptional difficulties. The research questions were answered using descriptive statistics for each of the words in initial and final positions. The *PASW18.0* statistical software was used to examine the data. As such, dependent *t-tests* were used to determine whether there was a statistically significant difference in the accuracy of each sound in the two positions.

Results.

The purpose of the research questions was to find out the frequency of usage of the English voiceless post-alveolar sounds at the beginning and at end of words that the Spanish-speaking Panamanian participants employed when pronouncing English. The findings are provided by word positions.

As the descriptive statistics for the sound /ʃ/ in Table 5 demonstrate, word position exhibited varying degrees of correct usage. Although 1.14 % of tokens were produced with sounds other than /ʃ/ or /tʃ/, the majority of substitutes for word-initial position were /tʃ/. In final position, the mispronunciations were mostly the affricate /tʃ/ again. By and large, participants produced /ʃ/ more accurately in word-final position than in word-initial position. Additionally, more participants (18 subjects) obtained a perfect score on the production of word-final /ʃ/ than on word-initial /ʃ/ (6 subjects). All those six participants who obtained a perfect score on the initial /ʃ/ also obtained a perfect score on the final /ʃ/.

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

Table 5

Descriptive Statistics for the Voiceless Post-alveolar Fricative /ʃ/

Position	N	Mean	SD	Max.	Min.	% Correct Fricative	% Incorrect
Initial	25	10.56	3.78	14	0	75.4%	24.6%
Final	25	13.12	1.69	14	8	93.7%	6.3%

Note. Table elaborated by the authors based on the statistical results.

Dependent *t-tests* were used to determine whether the position of the sound has an effect on pronunciation accuracy. The analysis of the data revealed that the pronunciation of /ʃ/ word-initially was significantly different from word-finally as indicated by the statistics in Table 6.

Table 6 Word Initially vs. Word Finally of /ʃ/ Results

Position Phone	N	Mean	SD	Mean Difference	t(24)	Sig (two-tailed)	Cohen's Effect Size
/ʃ/ Initially	25	10.56	3.77				
/ʃ/ Finally	25	13.12	1.69	-2.56	-3.42	.002	0.68

Note. Table elaborated by the authors based on the statistical results.

The descriptive statistics for the sound /tʃ/ in Table 7 revealed that participants were less accurate for target /tʃ/ than for target /ʃ/. The mispronunciation of /tʃ/ in word initial position was /ʃ/ instead, as well as in final position, but 3% of tokens in final position were produced with sounds other than /tʃ/ or /ʃ/. By and large, participants more accurately produced /tʃ/ in word-final position than in word-initial position. Additionally, only two subjects obtained a perfect score in production of word-final /tʃ/, and only one subject obtained perfect score in word-initial /tʃ/. Those three participants produced fairly well-crafted utterances in both positions.

Table 7 Descriptive Statistics of the Voiceless Post-alveolar Affricate /tʃ/

Position	N	Mean	SD	Max.	Min.	% Correct Affricate	% Incorrect
Initial	25	6.4	4.97	14	0	45.7%	54.3%
Final	25	8.0	3.67	14	2	57.1%	42.8%

Note. Table elaborated by the authors based on the statistical results.

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

Dependent *t-tests* were used to determine whether the position of the sound has an effect on pronunciation accuracy. Even though word-finally was pronounced a little more accurately than /tʃ/ word-initially, the analysis of the data revealed that there was not a significant difference on the accuracy of pronunciation of /tʃ/ in the two positions, as shown in Table 8.

Table 8 Word Initially vs. Word Finally of /tʃ/ Results

Position Phone	N	Mean	SD	Mean Difference	t(24)	Sig (two-tailed)	Cohen's Effect Size
/tʃ/ Initially	25	6.4	4.97				
/tʃ/ Finally	25	8.0	3.67	-1.60	-1.67	.107	0.33

Note. Table elaborated by the authors based on the statistical results.

The next step in the investigation was to determine the correctness of pronunciation in the initial and final positions using two dependent *t-tests*. The results of the two sounds by positions are condensed in Tables 9 and 10 below.

Table 9 /ʃ/ vs. /tʃ/ Word Initially Results

Position Phone	N	Mean	SD	Mean Difference	t(24)	Sig (two-tailed)	Cohen's Effect Size
/ʃ/ Initially	25	10.56	3.77				
/tʃ/ Initially	25	6.40	4.97	4.16	2.87	.008	0.57

Note. Table elaborated by the authors based on the statistical results.

Both sounds in initial position exhibited a lower level of accuracy than word finally; however, /ʃ/ word initially was much more accurately pronounced than / tʃ/ word initially.

Table 10 /ʃ/ vs. /tʃ/ Word Finally Results

Position Phone	N	Mean	SD	Mean Difference	t(24)	Sig (two-tailed)	Cohen's Effect Size
/ʃ/ Finally	25	13.12	1.69				
/tʃ/ Finally	25	8.0	3.67	5.12	5.86	<.001	1.17

Note. Table elaborated by the authors based on the statistical results.

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

Again, there was a substantial difference in accuracy for final word position, as demonstrated by the statistics in Table 10, where the word final /ʃ/ was produced significantly more accurately than the word final /tʃ/.

In conclusion, the dependent *t-tests* by word position demonstrated that subjects had a significantly higher level of accuracy with the post-alveolar fricative /ʃ/ than with the post-alveolar affricate /tʃ/ in both word positions.

In other words, transfers occurred at a high rate. When the English words to pronounce contained the target affricate /tʃ/ phoneme, the majority of participants negatively transferred their Spanish dialectal allophone [ʃ]. This is highlighted further in Figures 4 and 5, which demonstrate the superiority of the voiceless post-alveolar fricative /ʃ/ over the voiceless post-alveolar affricate /tʃ/ in both positions and for both target sounds and overall usage percentages in the research.

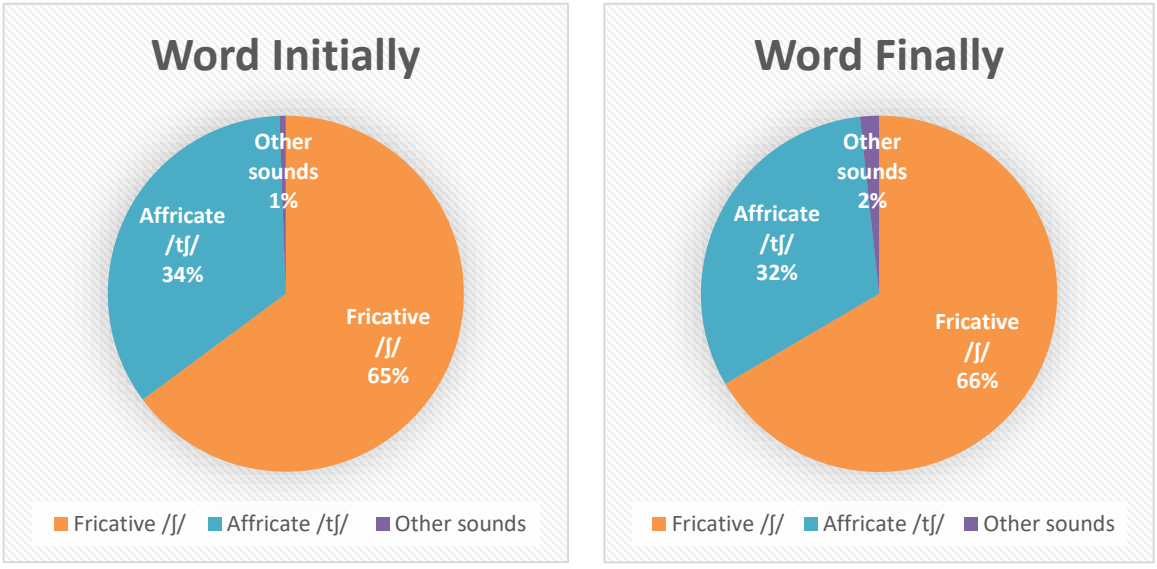


Figure 4 Overall Percentage of Usage by Word Position

Note. Figure elaborated by the authors based on the statistical results.

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

The percentage of preferred sound usage for the 1400 tokens produced by the 25 participants is visualized in Figure 5. The channel between the English phoneme /ʃ/ and the Spanish allophone [ʃ] appears to have had a high degree of freedom of access, but the channel between the English phoneme /tʃ/ and the Spanish allophone [tʃ] appears to have had some restraints. In other words, the widespread use of the voiceless post-alveolar fricative /ʃ/ for both English target sounds argues in favor of the transfer of the dialectal allophone [ʃ] from Panamanian Spanish.

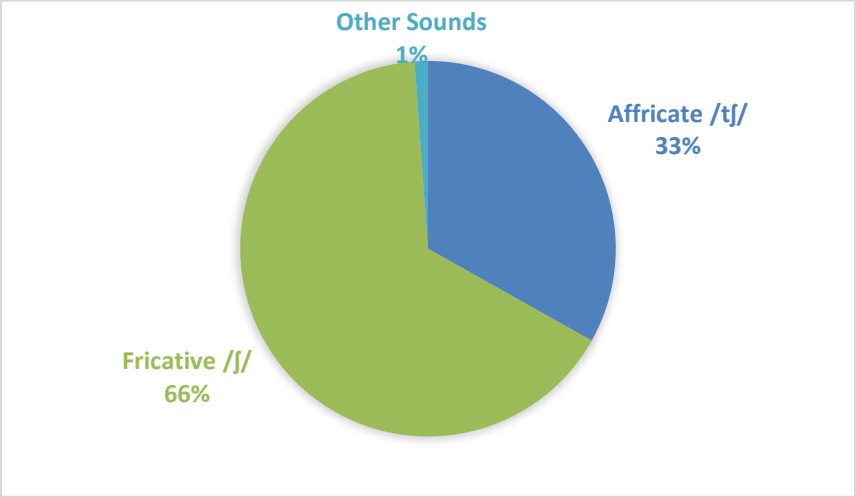


Figure 5 Total Percentage of Usage of the Studied Sounds

Note. Figure elaborated by the authors based on the statistical results.

Discussion.

The question to be answered based on the results is whether Panamanian English learners transfer these sounds or have mastered them already. At first glance, this study appears to contradict Vokic's (2010) study, which examined English learners' production of allophones in complimentary distribution between English and Spanish. Her findings indicated that her participants exhibited greater access to their L1 phonemic inventory than to their L1 allophonic inventory. Contrary to Vokic's study, the participants of this study accessed their allophonic

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

inventory instead of their phonemic inventory because they tended to replace the English phonemes with their L1 dialectal allophone [ʃ].

Zampini (1997) concluded in his study about the production of the spirantized Spanish consonants, [β], [ð] and [ɣ] by English speakers learning Spanish that in informal conversation, his participants produced the spirantized consonants because they did not see the graphemes, while in the formal task, these same participants did not produce the spirantized consonants because they saw the graphemes that stood for each sound. This current study is comparable in that all participants used graphemes as visual aids throughout the production task because they were required to read a list of words, but the graphemes — the graphemes 'ch' in the words that had /tʃ/and the grapheme 'sh' for the sound /ʃ/, which is not present in the Spanish language— should have indicated the correct phoneme for our participants.

The findings indicate that participants produced the Panamanian dialectal allophone [ʃ] the most frequently for both English phonemes, possibly because the graphemes 'ch' and 'sh' are closely intertwined with their L1 allophone. Nonetheless, more research into production without visual aids is required to support Zampini's observations and my hypothesis.

Eckman, Elreyes, and Iverson (2001; 2003) presented allophonic splits as one of the three different scenarios for the learnability of contrastive sounds in a second language. They stated that allophonic split is one of the most challenging scenarios that a student can encounter, and this statement concurs with numerous scholars such as Eckman (1977), Flege (1995), Lado (1957), Major (1987), and Major & Kim (1996). The following Table 11 summarizes the results of applying this theory to the sounds included in this investigation. In fact, the results of this study support that theory because the majority of the Panamanian Spanish learners of English could not split these two phonemes in English. The suggested reason by Vokic (2010) is that those allophones are stored in the participant's mind as one phonological unit. This could be a difficulty while learning a second language, since when a Spanish speaker learns English, he or she must make this distinction in order to avoid confusing the English listener (Lado, 1957). Nevertheless, these results may also

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

indicate progress in the distinction of the English phonemes due to the accurate pronunciation of the English phoneme /ʃ/.

Table 11 Application of the theory of the most difficult scenario to master contrastive sounds by L2 learners

L2= English	**L1= Spanish**
/tʃ/ and /ʃ/ contrast	[tʃ] and [ʃ] are allophones of the same phoneme /tʃ/

Note. Table elaborated by the authors based on the statistical results.

Additionally, Eckman et al. (2001; 2003) claimed that if contrastive sounds are learned or taught in non-derived contexts first (i.e., *ladder, red*), contrastive sounds will be difficult to learn in derived contexts (i.e., *redder, noisy*). The reversal of this process ensures the successful acquisition of the contrastive sounds. Given that the list of words employed in this study consisted entirely of free morphemes or non-derived words, it is reasonable to assume that they would continue to misbehave in derived contexts as well.

According to the statistics given in this study, the use of [tʃ] was rarely present and erroneously produced in both positions ($p=.107$), but the usage of [ʃ] was extremely common and accurately produced in both positions ($p=.002$). This suggests that the phone [ʃ] is the most frequently used in Spanish and may even be more frequently employed in informal and formal speech, as numerous linguists have reported (Alvarado de Ricord, 1971, 1982; Campbel, 2004; Hualde 2005, 2001; Whitley, 2002).

This could possibly be the start of a sound shift in which the original Spanish phoneme /tʃ/ is being replaced by the phoneme /ʃ/ in Panamanian Spanish. This would be a progressive shift, as there is still some use of /tʃ/ in target and non-target English environments, albeit at a very low rate in contrast to the use of /ʃ/ in target and non-target English environments (See Figures 4 & 5). To conclude, however, that the phoneme is becoming /ʃ/ in Panamanian Spanish, additional research should be undertaken to examine the history and linguistics of this sound.

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

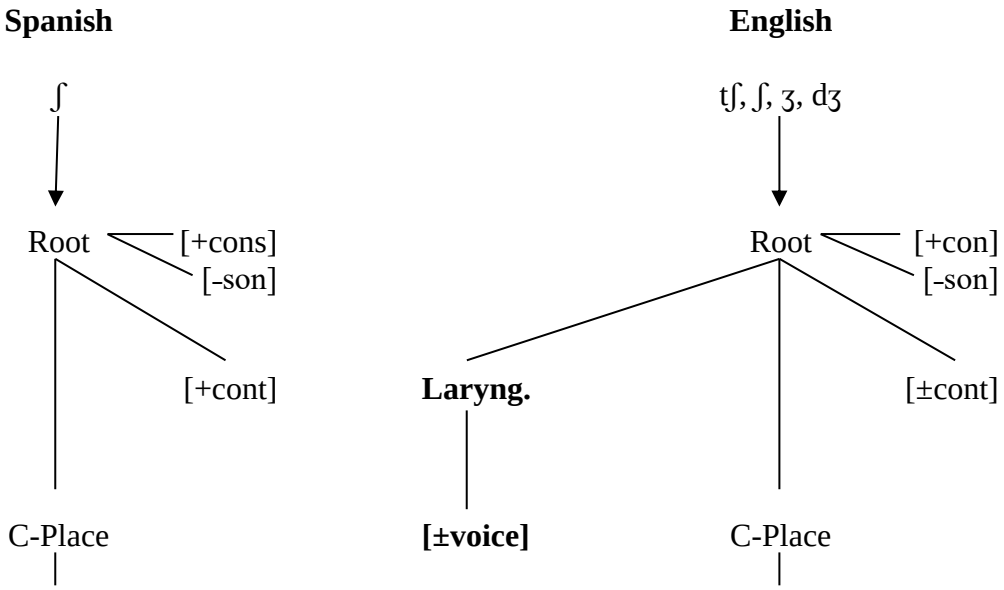
Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

If we accept the premise that the Spanish allophone [ʃ] is progressively trying to replace [tʃ] as the default production of /tʃ/, we have another perspective on how to understand the studies examined in this study. With this in mind, Figure 6 illustrates the features that Spanish and English's feature geometry have for their post-alveolar sounds.

As noticed below, the first main difference is in laryngeal node since English requires this feature to distinguish the voiced post-alveolar counterparts /ʒ/ and /dʒ/. Based on the results of this study that the post-alveolar fricative is the default sound, the [-continuant] feature lacks in the Panamanian Spanish in the underlying representations in the feature geometry because the Spanish of Panama does not need it. This may have had an effect on the production of the English voiceless post-alveolar affricate. More studies related to the production of the dialectal allophone [ʃ] should be carried out in Spanish in Panamá to decide the presence or absence of the feature [-continuant] in the feature geometry values. However, it is important to highlight that between [+continuant] and [-continuant], [-continuant] is more marked than the other (Nathan, 2008), and that could be a reason why it was difficult to pronounce (Eckman, 1977; Flege, 1995; Major & Kim, 1996).



ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

Figure 6 Panamanian Spanish and English Features for their Post-alveolar Sounds

Note. This figure of feature geometry with the underspecification values was elaborated by the authors based on the results of this study and the application of theories in the literature of Clements (1985), Lombardi (1990), Mateus and d'Andrade (2000), Hualde et al. (2001), Avery & Rice (1989), Paradis & Prunet (1990), Archangeli (1988), D'Introno et al. (1995), Kaun (1993), and Avery (1991; 1995).

Another point to make in this section of the discussion is that, according to Brown's (1998) study, an important aspect of a learner learning to contrast target sounds is that the feature geometry of L1 must contain the distinctive features of the target language's target sounds. In this case, the Spanish language in general has both [-continuant] and [+continuant] features to distinguish other stops and fricatives in its feature geometry. However, the Spanish of Panamá lacks this feature because it is a dialectal allophone mostly used by its speakers. Based on that, this result agrees with Brown's observations. These Panamanian Spanish speakers were able to produce the post-alveolar affricate but with inaccuracies or low percentages of usage in both word positions. The marked feature [-continuant] —used to discriminate stops and affricates— is suggested to be absent in the feature geometry of the Panamanian Spanish, which sets the degree of difficulty in the production and may be the acquisition of the English voiceless post-alveolar affricate /tʃ/.

These interpretations would suggest that, in the Spanish of Panamá, the underlying representation (UR) of the voiceless post-alveolar affricate is still /tʃ/ and its surface representation (SR) is the voiceless post-alveolar fricative [ʃ]. Due to the fact that this allophone is in free variation, the results of this study indicate a strong preference for [ʃ] over [tʃ]. However, it is still possible that the voiceless post-alveolar fricative [ʃ] becomes a phoneme in Panama or that it becomes de facto a typical dialectal feature of Panamanian Spanish as other phones, such as /θ/ in Spain and [ʒ] in Argentina (Hualde 2005).

ISSN L 2953-2981

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

Revista Científica Especializada en Educación y Ambiente

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

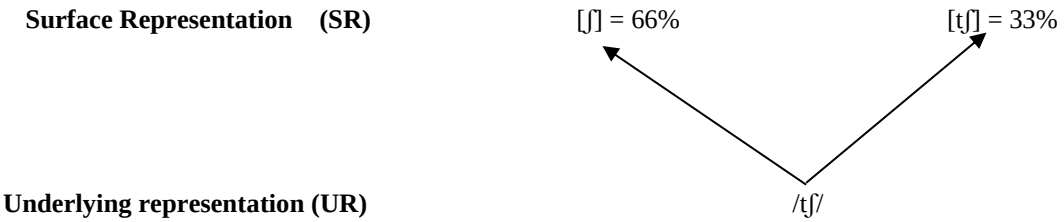


Figure 7 Phonological Status of the Panamanian Spanish Post-alveolar

Note. This figure of the underlying and surface representations was elaborated by the authors based on the results of this study and the application of feature geometry, underspecification theories, and markedness in the literature of Clements (1985), Lombardi (1990), Mateus and d'Andrade (2000), Hualde et al. (2001), Avery & Rice (1989), Paradis & Prunet (1990; 1991), Archangeli (1988), D'Introno et al. (1995), Kaun (1993), and Rice & Avery (1991; 1995). Eckman (1977), Major & Kim (1996), and Harris (1983).

As illustrated in Figure 7, it is expected that the fricative will account for more than 66 percent of usage in Panamanian Spanish. Although Panamanian Spanish speakers utilized more [ʃ] than [tʃ], both allophones exist in Panamanian Spanish. The prominent allophone in Panamanian Spanish, the voiceless post-alveolar fricative [ʃ], appears to have transferred to English.

Definitely, more studies should be carried out in L1 to find out the possible distribution of the Panamanian allophones using phonotactics and also follow-up studies in L2 to see the progress of the interlanguage with greater L2 input when learning a second language.

Conclusions.

Based on the results of the realization of the English phonemes /ʃ/ (66%) and /tʃ/ (33%) that have counterparts as allophones in the Spanish of Panama, it is concluded that the default sound of the Panamanian Spanish phoneme /tʃ/ is the allophone [ʃ] rather than the allophone [tʃ].

This matches with Alvarado de Ricord's (1982) investigations, in which the allophone [ʃ] was employed almost exclusively. Additionally, the majority of the studies discussed in this paper depict settings in which allophonic variations occur but in complimentary distribution (Lado (1957) and Zampini (1997)), in which sounds arise in predictable environments and may alter the meaning

ISSN L 2953-2981

Revista Científica Especializada en Educación y Ambiente

Vol.1,Nº1 pp. 60-84
Mayo – Octubre 2022

https://revistas.up.ac.pa/index.php/rea

Fecha de Recepción 29/11/21
Fecha de Aceptación 28/01/22

of words (Nathan, 2008; Czaykowska-Higgins & Dobrovolsky, 2010). However, this scenario for post-alveolar sounds in Panamanian Spanish is in free variation, which complicates matters because those allophones coexist in the same context without altering the meaning of words.

It has been suggested that there is a sound shift in progress in Panamanian Spanish where the voiceless post-alveolar fricative allophone [ʃ] is taking over the voiceless post-alveolar affricate allophone and phoneme /tʃ/. This conclusion is drawn as a result of the arguments presented by the theories of this study —the values of Feature Geometry, Underspecification Theories, studies related to those two approaches, and markedness— where illustrate the lack of the feature [-continuant] in Panamanian Spanish particularly but not in the Spanish language widely.

Without a doubt, the voiceless post-alveolar fricative sound [ʃ] was frequently produced in this study for both the English phonemes /ʃ/ and /tʃ/; therefore, this data confirms that Spanish-speaking Panamanian English learners have not yet achieved the phonemic split required for English /ʃ/ and /tʃ/.

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