

PRODUCTION OF VOWELS AND NUCLEAR ACCENTS BY CHILEAN LEARNERS OF ENGLISH AS A FOREIGN LANGUAGE

PRODUCCIÓN DE VOCALES Y ACENTOS NUCLEARES POR ESTUDIANTES CHILENOS DE INGLÉS COMO LENGUA EXTRANJERA

MARÍA DEL SAZ

Universidad de Santiago de Chile, Chile
maria.delsaz@usach.cl

XIMENA GRAU

Universidad de Santiago de Chile, Chile
ximena.grau@usach.cl

ABSTRACT

Previous studies show that L2 segments are easier to acquire than suprasegments. In an EFL context, the L1 influence seems to be minimized as learners gain L2 experience. Our study explores the effect of L1 transfer from Spanish and L2 experience in English on the production of vowels and nuclear accent, by comparing acoustically the productions of elementary and advanced learners of EFL in Chile. Results indicate improvement with higher L2 experience, although still far from native speakers. Concerning vowels, certain problems with tongue advancement and height persist at advanced levels, with overreliance on intensity to produce tense vowels. Regarding nuclear accents, correct nucleus placement improves with experience, and productions start to reflect the acoustic correlates of one English variety, still with a tendency to over rely on duration to mark the nucleus. Further research is warranted, such as on rhythm and fluency, to have a more holistic understanding of the effects of L1 transfer and L2 experience on L2 English.

Keywords: EFL, Chilean Spanish, L1 transfer, L2 experience, acoustic parameters.

RESUMEN

Estudios previos demuestran que los segmentos L2 son más fáciles de adquirir que los suprasegmentos. En un contexto EFL, la influencia de la L1 parece minimizarse a medida que los aprendices ganan dominio L2. Nuestro estudio explora el efecto de la transferencia del español como L1 y del dominio del inglés como L2 en la producción de vocales y

acento nuclear, por medio de la comparación acústica de las emisiones de aprendices de niveles elemental y avanzado de inglés en Chile. Los resultados indican mejoría a mayor dominio L2, aunque todavía lejos del nivel nativo. En cuanto a las vocales, persisten ciertos problemas con la posición de la lengua a pesar del dominio, con dependencia excesiva en la intensidad para producir vocales tensas. En cuanto al acento nuclear, la correcta ubicación del núcleo mejora a mayor dominio y las producciones empiezan a reflejar los correlatos acústicos de una variedad del inglés, aún con una dependencia excesiva en la duración para marcar el núcleo. Se requiere más investigación, como en ritmo y en fluidez, para tener una comprensión más holística de los efectos de la transferencia de L1 y el dominio de L2 en inglés L2.

Palabras clave: EFL, español chileno, transferencia L1, dominio L2, parámetros acústicos.

Recibido: 17/05/2021. *Aceptado:* 04/07/2022.

1. INTRODUCTION

In the process of second language acquisition (SLA), the interlanguage of non-native speakers is acoustically characterized, among other factors, by the presence of a foreign accent and some variations in the distinctive quality sound features of an L2 (Saito, 2011). The relationship between L1 dominance and L2 proficiency contributes to generate different patterns of variance that affect the perception and production of English (Shea, 2019), in which L2 proficiency is associated with better identification and production (Byers & Yavas, 2017); thus, L1 transfer seems to be minimized as L2 experience and proficiency are improved.

Research on ultimate attainment of the L2 phonetics and phonology in a SLA context suggests that L2 learners can achieve native-like proficiency provided some requirements are met. With a great amount of L2 input, high proficiency can be attained in terms of the acoustic and articulatory characteristics of L2 segments that are also present in the L1 but need some readjustment; in terms of pauses and reformulations, high proficiency can also be achieved in this case. Only if exposed to the L2 at an early age can high proficiency be achieved concerning the acoustic and articulatory characteristics of L2 segments that are not present in the L2, and concerning prosody (word stress, sentence accent, and intonation). Finally, fluency (articulation, speech rate) seems to be highly difficult regardless of age of L2 exposure (Saito, 2018).

In our study, we address both L1 transfer and L2 proficiency in the context of English as a foreign language (EFL) in Chile, where we examine the acoustic parameters of segments (minimal pairs of vowels) and suprasegments (sentence accent), and their relationship to the learners' first language and their proficiency in English.

2. LITERATURE REVIEW

2.1. L1 Transfer and L2 Experience

In general terms, language transfer refers to extrapolating patterns from one language into another. On the one hand, positive transfer takes place when what learners generalize from the L1 to the L2 coincides in terms of patterns, structures, and use in both languages. On the other hand, negative transfer is associated to those aspects of the native language which are used in the L2 incorrectly since they do not constitute homologous structures (Edwards & Zampini, 2008). In terms of phonology, L1 transfer is fundamental to understand the interlanguage stage of an individual, and it has been historically studied in several areas (Goldstein & Bunta, 2012; among others) by means of contrastive analysis.

Since the mid-50s, contrastive analysis has been conducted in all linguistics domains such as grammar and syntax, but particularly in the field of phonetics and phonology. It is in this area of language where L1 influence is clearly reflected in both perception and production of L2 sounds (Edwards & Zampini, 2008). In order to establish similarities and differences, Weinreich (1953) proposed an error taxonomy that included areas such as sound substitution, phonological processes, under/over differentiation, reinterpretation of distinctions, phonotactic and prosodic interference. Later, such taxonomy was simplified and applied to comparative studies into four main areas - phonemic errors, phonetic errors, allophonic errors and distributional errors (Major, 2008). All these superficial constructs, in terms of phonetics and phonology, are studied as segmental and suprasegmental features of the language performed by individuals. According to Major (2008), what contrastive analysis has not been able to explain are those errors not associated to L1 transfer that can be connected to universals, developmental factors, and other abstract principles that respond to cognitive and mental procedures in second language acquisition (SLA). Consequently, Error Analysis emerged as an alternative theory by the late sixties (Al-Khresheh, 2016).

Error Analysis attempts to explain L2 errors based on factors associated to second language acquisition, in addition to those explained by cross-linguistic interference. However, it has been criticized for two main reasons. First, the statistical character of the studies is considered inferentially too vague to create consistent generalization. Second, the limitations in explaining errors impede to account for all foreign language mistakes. Though, just like contrastive analysis, both methods are still used to generate insights in language acquisition and the influence of L1 transfer.

Even when the emphasis research has adopted recently implies comprehension and intelligibility as key elements of language acquisition, features related to sociolinguistic variation need to be considered to get a more holistic view of

the phenomenon. Recent models of SLA explain the importance of context and how sociobiological features affect language learning (Major, 2008). These analyses understand variation as a marker of social categories, since it constitutes a robust social semiotic system associated to different communities whose variation potentially expresses the full range of social concerns in such given community. Therefore, variation does not simply reflect, but also constructs social meaning and identity, being a force of social change (Eckert, 2012). All these meaningful features are reflected on an individual's L2 performance, especially regarding pronunciation, intonation, and word stress. The superficial aspects of non-native speakers' speech demonstrate what group or community they belong to, and their performance is susceptible to changes in the environment. Consequently, English as a second language (ESL) speakers present different parameters when developing tasks in an L2, in comparison to EFL speakers, whose superficial traits such as stress and intonation patterns will reflect a more distant understanding of the native phonetics and phonology due to their immersion in a monolingual context. Moreover, this condition is influenced by two broad variables: Language exposure and language use/experience. On the one hand, L2 exposure has to do with being surrounded by the target language which favors the individual to perform better, since there are more opportunities in the environment to witness how the L2 is used. On the other hand, L2 use allows learners to acquire more experience on how to communicate effectively in the target language, being a relevant factor when minimizing the influence that emerges from the L1.

Consequently, this piece of research fills a gap of knowledge in the context of EFL teaching, given that the findings encountered in studies of English as a second language cannot be generalized to the process of learning English as a foreign language. Therefore, better understanding of this phenomenon is expected to promote the development of adapted methodologies and strategies to guide this process and teach English accordingly.

2.2. English and Spanish Vowel Repertoires

English possesses twelve contrasting monophthongs while Spanish only five (Ladefoged & Johnson, 2010). Additionally, "Spanish speakers use only two dimensions, namely, high-low and front-back for distinguishing vowel contrasts. English speakers use three dimensions, the first of which includes durational information" (Escudero, 2000, p.11). Since the sound repertoire available in Spanish is considerably smaller than in English, Spanish learners have difficulty discriminating and producing contrastive English vowel sounds. It also affects the assimilation of new sounds of the target language that are not present in their mother tongue or that are similar to the ones existing in the L1. Table I illustrates that for every Spanish

vowel, the following English vowels can be associated, adapted from Swan and Smith (2001, p.91).

Table I. Spanish vowels and their counterparts in English (Swan & Smith, 2001).

Spanish Vowel	English Vowel
/a/	/ɑ/ / æ/ / ʌ/
/e/	/ɛ/
/i/	/i/ / ɪ/
/o/	/ɔ/
/u/	/u/ / ʊ/

Spanish L1 influence makes it difficult for late adult EFL learners to perceive and produce contrastive L2 vowel sounds, especially in words involving sounds which have one counterpart in Spanish. This issue has been studied through research (Bohn & Flege 1990; Bradlow, 1995; Fox, Flege & Munro, 1995; Escudero, 2000; Baigorri, Campanelli, & Levy, 2018; Cebrian, 2019) by means of a series of experiments that aimed to compare and contrast the quality of vowel sounds, in both languages, through the analysis of their corresponding formant frequencies for L2 production.

Regarding English and Spanish vowel inventories, several cross-language comparative studies have been conducted, claiming that perceptual vowel space of more proficient L2 speakers differs from those who are relatively non-proficient learners. Thus, L1 transfer is minimized as L2 experience and proficiency are improved. For example, Shea (2019) shows that the relationship between cross-linguistic constructs such as L1 dominance and L2 proficiency contribute to generate different patterns of variance that affects perception and production of English sounds. Similarly, Byers & Yavas (2017) study the influence of Spanish in the production of the English vowel schwa /ə/ in word final position, considering age and proficiency level as variables that trigger different results in the quality of acoustic production of this English vowel. In all cases mentioned, L2 proficiency is associated to better identification and production of English vowel sounds, whereas segmental characteristics in Spanish are more frequently transferred in those speakers who are less proficient in the target language.

Another work on vowel discrimination and production was carried out around the concept of similarity. Barrios, Jiang, & Idsardi, (2016) worked with the similarity universal in English and Spanish vowel systems. The researchers investigate the role of L1 phonological features of Spanish in the representation of English vowel contrast that are not present in the native language. The idea is to provide

insights on whether English learners reuse L1 phonological features to acquire non-native contrast in English. However, their findings suggest that even though availability of resources is important in the processes of L2 vowel perception and production, it is not sufficient to predict accurate learning outcomes, since L2 production is not completely constrained by the acoustic features available in the learner's mother tongue. Once again, exposure to appropriate input and L2 experience modify the influence of L1 transfer related to perception and production of vowel sounds.

From all previously exposed, an interesting point to highlight is what Fox et al. (1995) and Escudero (2000) have described as a contrast between English and Spanish vowel systems. In English, there are three main aspects to consider when discriminating vowels: Length, tongue advancement, and height, while in Spanish there are only two - tongue advancement and height. However, when Spanish speakers are asked to perceive and discriminate sounds, they tend to rely on length as a stronger indicator of vowel change rather than on the other parameters. Therefore, the present study attempts to obtain results in accordance with these ideas. The main difference, here, lies on the context where the study is conducted, being Chilean Spanish vowels /a/, /i/ and /u/ considered the main influence when discriminating American English vowel sounds /æ/, /ʌ/, /i/, /I/, /u/, /ʊ/, /ɑ/. Since every language possesses different sound repertoires, as well as different accents and dialects, comparing the vowel systems, and its corresponding formant frequencies, become crucial to establish the mechanisms and configuration learners use to understand and perceive speech contrasts, based on what individuals can produce and identify in their own language.

2.3. Prosody

Beyond the segmental level, inaccuracy in L2 English production can lead to intelligibility problems (Hahn, 2004). In fact, “segmental errors have a less detrimental effect on listeners' judgements of comprehensibility and accentedness of L2 speech than prosodic errors” (Rasier & Hiligsmann, 2007, p. 43). A stress-timed language like English presupposes a problem for speakers of syllable-timed languages like Spanish and mora-timed languages like Japanese. English rhythm implies that utterances are composed of a succession of strong and weak syllables. The vowels or diphthongs in strong syllables are realized in their full form, while the ones in weak syllables are reduced. This notion of strong/weak relates to one of the correlates of prominence, i.e., quality. The other three parameters that make a syllable prominent are pitch (sounds perceived as high or low), duration (sounds perceived as long or short), and loudness (sounds perceived as loud or soft). While they work in combination to make up prominence, the most important ones are

pitch and length (Roach, 2009). This study addresses quality in our first experiment and the other three correlates in our second experiment.

It was Halliday (1967) that introduced the concept of nuclear accent. In an utterance, the most important information falls on a certain word, whose stressed syllable receives the nuclear accent in the utterance. The nuclear accent is the pitch movement initiator, i.e., it determines the tone of the utterance (rising/falling). Any syllables highlighted prior to this accent are called prenuclear accents, and any syllables that do not conform to any of these accents are unaccented, making up the rhythm of English. Following this, Halliday defined the Last Lexical Item (LLI) rule, which states that unmarked utterances place their nucleus in the last lexical item (usually nouns, verbs, adjectives, and adverbs). Concerning the placement of the nucleus, Ladd (1979) proposed the concepts of broad and narrow focus. Broad focus means that the whole utterance implies that new information is presented, while narrow focus conveys the notion of both given and new information within the utterance. In this case, the nuclear accent can be on any word within the utterance, depending on the new information provided, the contrast intended, or the emphasis given; thus, the new information provided would contain the nucleus. The focus of information, as O'Brien & Gut (2010) put it, "refers to that part of a sentence which is prominent in terms of content, and which forms a contrast to the background information of the sentence" (p. 206). Nevertheless, not all information in focus receives the nuclear accent in English (Ortiz, 2000), and here is where the exceptions to the LLI rule come into play (Halliday, 1967; Ortiz, 2000; Wells, 2006). With certain structures, despite being broad focus utterances, the LLI rule does not follow, i.e., the last lexical item is not the one that contains the nucleus. For example, in event sentences (subject + intransitive verbs), the sentence accent falls on the subject, as in "The BUS is coming".

In Spanish, the LLI rule is also the unmarked (default) rule, especially given that syntactic movements such as right dislocation of the subject are possible – sometimes mandatory, as in the case of event sentences – in this language (Klassen, 2013; Ortiz, 1995, 2000; Véliz, 2001). In spite of this, "recent experimental work challenges this claim, showing that Focus commonly remains in situ" (Leal, Destruel, & Hoot, 2019, p. 449). In their work on focus placement by native speakers of Mexican Spanish and Chilean Spanish, as well as L1 American English learners of Spanish, they found that all groups realized focus subject in situ to a greater extent, rather than performing right dislocation, which contradicts the previous theoretical postulates of LLI for Spanish. Nevertheless, other works proved that L1 Spanish learners of L2 English seem to have problems with certain structures, especially in the cases in which "Spanish uses syntactic means to realize focus whereas English uses prosodic means" (Klassen, 2013, p. 76), given that the L2 learners tend to place the nucleus on the last content word of an utterance,

whether it implies new or given information (Ortiz, 1995; Ramírez Verdugo, 2002). Additionally, a further problem for L1 Spanish learners of L2 English is nuclear tone, whenever there are differences between both languages. Although “the intonation of most varieties of Spanish is somewhat similar to English in the contours associated with declaratives and absolute questions” (Trimbler, 2013, p. 80), *wh*-questions in English have a falling pitch movement by default, while they are realized with a rising pitch movement in Spanish (Valenzuela Farías, 2013).

All these factors can become obstacles for Spanish learners of English, especially at the beginning stages of learning (Derwin & Munro, 2008; Major, 2001), in which “they tend to over-accentuate, due to both a lack of fluency and ignorance of the accentual tendencies of connected speech in English” (Finch & Ortiz Lira, 1982, pp. 104). Furthermore, English word order is also posed as a problem, precisely because of the tendency in Spanish to accent the last lexical item. Finally, the exceptions to the LLI rule mentioned above imply an additional difficulty even for more advanced learners (pp. 104-105).

Concerning the exceptions to the LLI rule, a previous study by Ortiz (1995) reports nucleus placement by L1 Chilean Spanish speakers in L2 English sentences with these types of structures. There are two issues with this piece of research: a) the author reported that speakers were recorded after receiving a training course in the topic; nevertheless, their level of L2 English competence is not specified; b) no acoustic or statistical analyses were realized or at least reported in the study. Therefore, our study aims at filling this gap by a) taking into consideration two groups of L1 Chilean Spanish speakers: first-year students of an English Pedagogy university program (elementary) and students who finished this program (advanced); and b) carrying out acoustic and statistical analyses of their utterances in both L2 English and L1 Spanish.

2.4. Research question and objectives

According to what we stated earlier, we pose the following research question:

- Is it harder to learn segmental or suprasegmental features in L2 English?

Following this, our objectives are:

- To analyze the influence of L1 Chilean Spanish and competence in L2 English on the production of L2 English vowel sounds /æ/, /ʌ/, /i/, /ɪ/, /u/, /ʊ/, /ɑ/.
- To analyze the influence of L1 Chilean Spanish and competence in L2 English on the production of L2 English sentence accent in utterances with exceptions to the last lexical item rule.

Given that Spanish only has three monophthongs /i, a, u/ for seven vowels in American English /i, ɪ, æ, ɑ, ʌ, u, ʊ/ and presents different sentence accent patterns than English, we expect to find higher influence of the L1 on the production of L2 English at the beginning stages of learning (first-year university students), while more similar patterns to the target language at later stages of learning (students after graduation).

3. METHODS

3.1. Participants

For this study, we recorded 3 groups of participants: twenty L1 Chilean Spanish speakers (ages 18-20; 16 females and 4 males), first-year students in an English major from a state-funded university, with elementary level of English; twelve L1 Chilean Spanish speakers (ages 24-28; 8 females and 4 males) who graduated from the same program, with advanced level of English; and twelve L1 English speakers (ages 25-32; 8 females, 4 males; 7 American English, 5 British English), TEFL teachers in Chile. None of them reported speech or hearing disorders, and they all participated voluntarily in this study.

3.2. Materials

For the analysis of vowels, we worked with 6 words containing Spanish vowels /i/ (hito, *milestone*; pito, *whistle*), /a/ (ata, *helshe ties*; hada, *fairy*), /u/ (buda, *Buddha*; suda, *helshe sweats*) and 7 words for English vowels /æ/ (track), /ʌ/ (truck), /ɑ/ (aunt), /i/ (beat), /ɪ/ (bit), /u/ (pool), and /ʊ/ (pull). The words were embedded in carrier sentences such as “*Digo X de nuevo*” and “I say X again”, for Spanish and English respectively, (the Spanish speakers recorded both sets of sentences twice; American English speakers recorded the English sentences twice). Additionally, these items were selected for having similar vowel-consonant combinations and the presence of minimal pairs was favored, as they are not functionally equivalent and represent contrastive units in English. This was expected to be a difficult aspect to produce by Spanish speakers. The analyses are described in section 3.1. All instruments were validated by a group of experts.

To analyze nucleus placement, we employed 14 English sentences taken or adapted from Ortiz (2000), which comprise diverse exceptions to the LLI rule, divided into two main groups: focus on the last noun and focus on another lexical item prior to the last lexical item. The first group was comprised of nouns (accented) followed by an adjective, intransitive verb, or infinitive (unaccented). The

second group contained lexical items –not necessarily nouns– (accented) followed by adverbials or by objects of general reference (unaccented). Additionally, we also employed their 14 Spanish counterparts in the analysis. (likewise, the Spanish speakers recorded both sets of sentences twice; both groups of native speakers recorded the English sentences twice). They are described in detail in section 4.2. Sentences with final vocatives, softening phrases, and reporting clauses are said to present similar patterns in English and Spanish (Ortiz, 1995); thus, we did not consider these categories in this study (see Véliz, 2001, for further comments on these types of structures).

3.3. Procedure

Sentences in both experiments were extracted and tagged using Praat (Boersma & Weenink, 2001), and subsequently normalized. Peak amplitude was scaled to 5000Hz for males and 5500Hz for females. For the analysis of vowel sounds, we labeled target vowels using TextGrid and then ran a Praat script (Elvira-García, 2019) to obtain frequencies F0, F1, F2, F3, F4 (Hz), duration (ms), and intensity (dB). Similarly, to analyze nucleus placement, vowels were then labeled using TextGrid, and nuclear focus was marked (N). Nuclear accent in English sentences was confirmed by two experts and a native speaker of English; nucleus placement in Spanish was confirmed by two native speakers of Chilean Spanish and an expert. After normalizing all audio files, we ran a Praat script (Elvira-García, 2014) to obtain the following information: overall pitch range of each utterance (st) and pitch range from the nuclear accent to the last point in each utterance (st), as well as duration (ms) and intensity (dB) of each nuclear accent. We then analyzed all data statistically by means of generalized linear models (GLM). Our target was to compare the elementary and the advanced groups of learners in their productions of English vowels and English sentence focus placement with native speakers of English, and to compare the L2 English utterances with their productions in Spanish, to determine the influence of their L1 and their L2 proficiency level.

4. RESULTS

4.1. Production of minimal-pair vowels

Before presenting results for elementary and advanced learners, it is mandatory to present the characterization obtained from F1 and F2 for both Chilean Spanish and American English as L1 seen in Fig. 1 and 2 respectively.

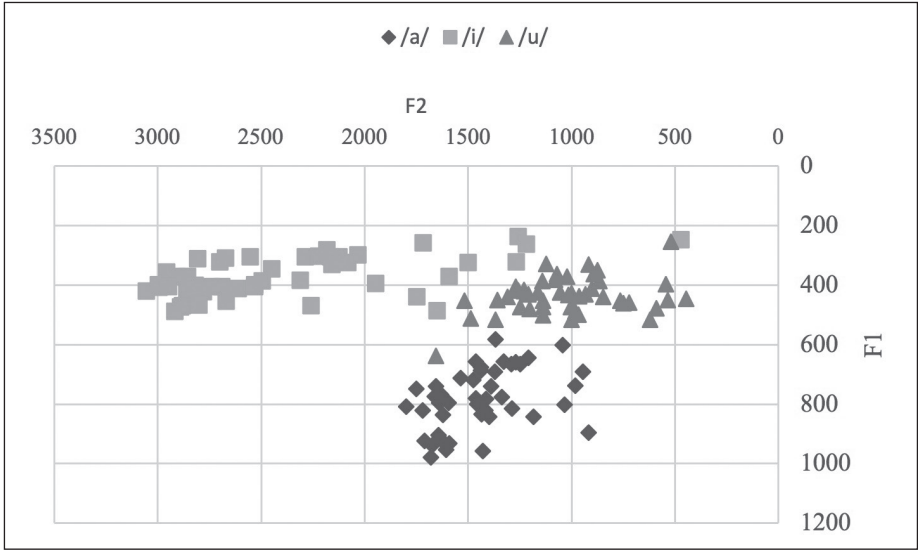


Figure 1. Cardinal Vowel Diagram for Chilean Spanish Vowels.

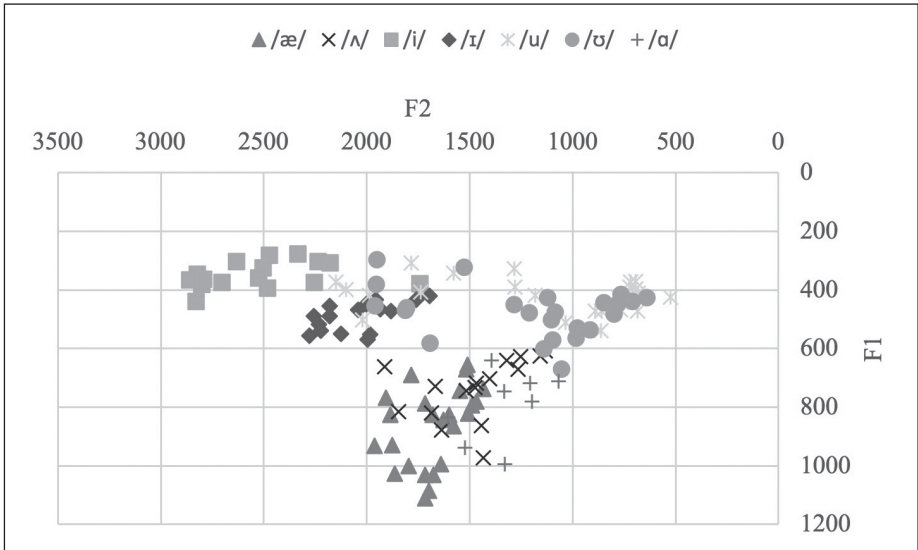


Figure 2. Cardinal Vowel Diagram for American English Vowels.

Upon looking at these figures, it can be established that the main difference in height is a shorter range for F1 in Spanish, while in terms of tongue advancement, F2 in Spanish is more ample than in English. These differences are also reflected in L2 English, especially in elementary level as seen below.

Table II. General variability measures for F1 and F2 in L1 and L2 English.

Vowel Sound	F1			F2			
	<i>M</i>	<i>SD</i>	<i>SE</i>	<i>M</i>	<i>SD</i>	<i>SE</i>	
AmE L1	/æ/	865.8	133.76	27.303	1674.3	153.06	31.242
	/ʌ/	738.6	105.21	26.303	1475.8	227.81	56.953
	/i/	347.3	44.23	11.06	2513.1	307.13	76.78
	/ɪ/	491.4	49.28	12.32	2045.5	176.58	44.14
	/u/	419.2	57.9	11.819	1155.6	537.25	109.665
	/ʊ/	474.2	84.87	17.325	1219.4	429.72	87.716
	/ɑ/	795.6	119.74	42.335	1333.1	176.05	62.244
AmE L2	/æ/	737	129.83	29.031	1589	219.14	49.002
Elementary	/ʌ/	735	131.49	30.993	1496.5	216.81	51.104
	/i/	401.2	60.27	13.15	2545.9	417.7	91.15
	/ɪ/	425.4	74.53	16.26	2399.3	478.66	104.45
	/u/	446.3	58.22	12.704	811.8	160.88	35.107
	/ʊ/	498	94.36	20.592	917.1	122.31	26.691
	/ɑ/	620.6	151.76	33.117	1281.7	345.74	75.446
AmE L2	/æ/	710.8	190.53	55.002	1592.5	285.7	82.474
Advanced	/ʌ/	759.4	137.86	61.65	1470.2	266.98	119.39
	/i/	392	76.24	31.12	2552	310.84	126.9
	/ɪ/	441.5	88.466	36.116	2202.3	240.219	98.069
	/u/	460.7	64.79	26.450	819.2	118.95	48.562
	/ʊ/	484	85.81	35.033	895.2	198.50	81.039
	/ɑ/	593.7	235.1	95.979	1230.5	214.12	87.413

Results in Table II indicate that elementary L2 English learners produce F1 and F2 values for /ʌ/ accurately due to the similar nature with Spa /a/. Nevertheless, L2 English /æ/ is produced incorrectly with not enough openness [diff. = -160.39; SE = 38; z = -4.221; p = <.001] and the tongue positioned back in the mouth [diff. = -145.5; SE = 59.8; z = -2.431; p = 0.045] similar to L1 Spanish /a/. The same situation occurs to vowel /ɑ/ which is a back vowel produced with the tongue in its right position, but not open enough [diff. = -1739; SE = 47.4; z = -3.647; p = <.001]. Interestingly, this sound is statistically different from Spanish F1 as well [diff. = -184; SE = 27.6; z = -6.68; p = <.001]. Therefore, it seems that what these learners use to distinguish the three English phonemes in production is the F2 (tongue advancement).

In the case of L2 English /i/ and /ɪ/, even when we find a clear influence of L1 Spa /i/, L2 English /i/ is articulated correctly in terms of tongue height (F1) and tongue advancement (F2), since the two phonemes are front close vowels in both languages. L2 English vowel /ɪ/ is produced significantly different from L1 English in terms of openness [diff. = -72.4; SE = 20.5; $z = -3.534$; $p = 0.001$] and tongue advancement [diff. = 329; SE = 108; $z = 3.04$; $p = 0.007$]. Therefore, the distinction between both phonemes is not successfully achieved and is clearly influenced by their L1.

In terms of L2 English /u/ and /ʊ/, both sounds present consistent problems in tongue advancement. Both vowels are produced further back in the vocal tract - /u/ [diff. = -363.5; SE = 89.1; $z = -4.077$; $p < .001$] and /ʊ/ ($F(1,27) = 10.869$, $p = 0.003$) – which is inaccurate for their L1 English counterparts, most likely influenced by L1 Spanish /u/. Additionally, L2 English /ʊ/ is produced accurately in terms of tongue height, but it fails to account for English F2 [diff. = -318.5; SE = 73.3; $z = -4.3437$; $p < .001$], which suggests that similarities with L1 Spanish /u/ interfere when articulating both L2 English vowels. Therefore, we see learners rely on tongue height (F1) but not on tongue advancement (F2) to maintain this distinction.

Results in Table 2 for advanced L2 English learners show that they can articulate /ʌ/ correctly for both tongue advancement and height. Similarly, sound /æ/ is produced correctly in terms of tongue advancement, though it is significantly different in height [diff. = 154.92; SE = 50.1; $z = 3.094$; $p = 0.006$], which is higher than L1 English and closer to L1 Spanish /a/. The same situation applies to L2 English /ɑ/, which is articulated significantly higher than L1 English [diff. = 188.7; SE = 59.3; $z = 3.185$; $p = 0.004$] and L1 Spanish /a/ [diff. = -200; SE = 44.9; $z = -4.6$; $p < .001$], but with the correct tongue advancement for L1 English.

For vowels /i/ and /ɪ/, the tendency shows correct pronunciation in all aspects. Sound /i/ is produced accurately in both F1 and F2, being one of the sounds most accurately produced by L2 learners due to its similarity to L1 Spanish /i/. The same occurs in sound /ɪ/ which is articulated with correct height and tongue advancement for L1 English. Vowel sound /ɪ/ exhibits great improvements from elementary level since it gradually transitioned into a new category.

Once again for L2 English /u/ and /ʊ/, the problematic features are associated to tongue advancement. Sound /u/ is characterized by appropriate height, but significant differences in tongue advancement [diff. = 336.5; SE = 118.2; $z = 2.846$; $p = 0.013$], which exhibits clear influences from L1 Spanish /u/ as a back vowel. Likewise, L1 English /ʊ/ is produced with the right height, but tongue advancement [diff. = 324.25; SE = 97.2; $z = 3.3345$; $p = 0.003$] is not consistent with L1 English /ʊ/. In this sense, higher levels of proficiency still present a high degree of L1 transfer.

Table III. General variability measures for duration and intensity in L1 and L2 English.

Vowel Sound	Duration			Intensity			
	<i>M</i>	<i>SD</i>	<i>SE</i>	<i>M</i>	<i>SD</i>	<i>SE</i>	
AmE L1	/æ/	116.9	33.46	6.831	81.7	2.9	0.591
	/ʌ/	102.1	38.45	9.612	81.9	3.3	0.826
	/i/	126.3	29.03	7.758	76.1	5.59	1.493
	/ɪ/	94.2	21.173	5.293	82.6	4.703	1.176
	/u/	111.3	33.30	6.796	81	4.6	0.938
	/ʊ/	101.3	29.76	6.074	82.4	4.64	0.948
	/ɑ/	88.5	34.71	8.677	82.3	3.26	0.814
AmE L2	/æ/	131.4	27.09	4.716	80.9	3.43	0.597
Elementary	/ʌ/	120.9	21.88	3.753	82.8	1.9	0.326
	/i/	115.2	28.21	4.839	81.1	4.81	0.825
	/ɪ/	122.8	30.170	5.174	82.5	4.794	0.822
	/u/	113.4	47.69	8.178	83.3	3.93	0.673
	/ʊ/	111.8	34.11	5.851	81.7	3.83	0.657
	/ɑ/	164.2	33.95	5.823	81.7	3.91	0.671
AmE L2	/æ/	108.9	20.10	5.802	82.1	2.35	0.679
Advanced	/ʌ/	83	18.36	5.805	79.6	2.88	0.909
	/i/	89.3	23.69	6.840	81.3	2.74	0.791
	/ɪ/	65.3	5.462	1.577	82.5	0.798	0.230
	/u/	78.8	21.44	6.189	85.5	1.88	0.544
	/ʊ/	83.7	21.63	6.245	83.3	4.58	1.322
	/ɑ/	100.8	14.9	4.302	82	1.60	0.461

If we now consider differences in duration and intensity, presented in Table III, we have additional details to provide to the characterization explained earlier. Vowels /æ/, /ʌ/ and /ʊ/ are produced with similar duration and intensity values than L1 English. This is true for both elementary and advanced learners. Vowel /ɑ/, however, tends to be longer in elementary level [diff. = 75.7; SE = 9.55; z = 7.92; p = <.001] but progresses to the right duration in more proficient levels. Other problems associated to duration occur with L2 English /ɪ/ which is longer at initial stages [diff. = 28.6; SE = 7.60; z = 3.76; p = <.001], due to L1 influence from Spanish /i/, and shorter in more advanced levels [diff. = 28.9; SE = 9.57;

$z = 3.02$; $p = 0.008$]. In the same line, advanced learners present problems with vowel /i/ whose L2 production is shorter than L1 English [diff. = 37; SE = 10.85; $z = 3.41$; $p = 0.002$]. Concerning differences in intensity, vowel /i/ exhibits an interesting behavior. Even when elementary learners produced vowel /i/ correctly in terms of duration, they exaggerate intensity [diff. = 5.004; SE = 1.49; $z = 3.362$; $p = 0.002$] and continue this trend in advanced levels [diff. = -5.19; SE = 1.84; $z = -2.814$; $p = 0.015$]. Finally, something similar happens for L2 English /u/, whose duration is similar to L1 English, but fails to account for the right intensity in more proficient levels [diff. = -4.50; SE = 1.39; $z = -3.24$; $p = 0.004$]. Apparently, L2 learners use intensity more than duration as a salience cue to identify and produce the contrast between English tense and lax vowels (long vs short).

4.2. Production of nuclear accent

The first group of exceptions to the last lexical item rule we analyzed is when the nucleus is followed by adverbials of time and place. In all English sentences considered here, the nuclear accent clearly falls on a lexical item before the adverbials. In their Spanish counterparts (1-3), it falls on the noun in the NP that forms the adverbial, i.e., the last lexical item. In sentence (4), half of the Chilean Spanish speakers accented *frío* (chilly), while the other half accented *acá* (here). Unlike the other three sentences, the adverbial in sentence (4) consists of an adverb instead of an NP, which may have prompted these results (also reported by Ortiz, 1995).

- | | |
|--------------------------------|--|
| (1) Are you FREE this evening? | ¿Estás libre esta TARde? |
| (2) Can you WAIT for a minute? | ¿Puedes esperar un mINUTO? |
| (3) There's a FLY in my soup. | <i>Hay una mosca en mi sOpa.</i> |
| (4) It's a bit CHILLY in here. | <i>Hace un poco de FRÍo acá.</i>
<i>Hace un poco de frío acá.</i> |

Concerning the sentences in which the nucleus is followed by an object of general reference, this object is unaccented in English. In Spanish, the tendency is again to accent the last lexical item; however, in sentence (7), 56.85% of the speakers placed the nuclear accent on *alguien* (anybody), while 43.15% placed it on *contaste* (tell).

- | | |
|-------------------------------|--|
| (5) It's NICE to help people. | <i>Está bien ayudar a la GENTE.</i> |
| (6) You're IMAGIning things. | <i>Son imaginaciones TUYas.</i> |
| (7) Did you TELL anybody? | ¿Se lo contaste a ALguien?
¿Se lo cONTaste a alguien? |
| (8) Did you GO anywhere? | ¿Fuiste a algún LADO? |

In the case of a noun followed by an intransitive verb in English, the nucleus was found to be clearly on the noun. In Chilean Spanish, the nucleus was also placed on the noun, although in this case this implies the syntactic movement of the subject after the verb and, thus, it conforms the last lexical item.

- (9) My BATTERY's going to die. *Se va a morir mi batería.*
 (10) I wonder how long the VIDEO lasts. *Me pregunto cuánto tarda el video.*

Nouns followed by a post-modifying infinitive in English received the nucleus of the utterance. In Spanish, a great majority of the speakers did not follow the last lexical item rule, i.e., they accented the noun instead of the verb, in disagreement with Ortiz (2000).

- (11) I've got a couple of BOOKS to read. *Tengo un par de libros que leer.*
 (12) I don't know which BUS to take. *No sé qué micro tomar.*

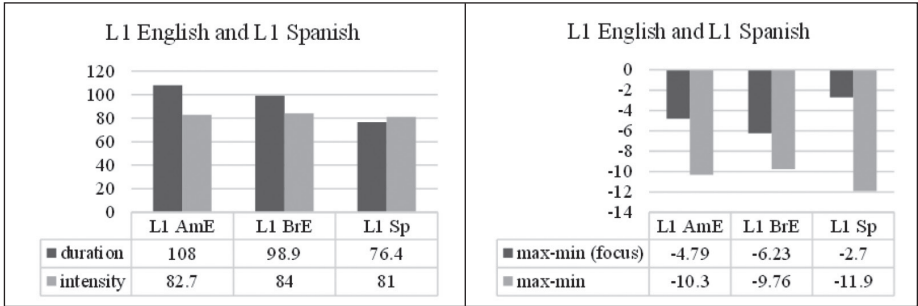
Finally, in the case of a noun followed by a post-modifying adjective in English, the nucleus also fell on the noun. In Spanish, the nuclear accent was placed on the post-modifying element instead.

- (13) There's a lot of MONEY involved. *Hay mucho dinero en juego.*
 (14) He left the DOOR open. *Se dejó la puerta abierta.*

In the analysis of nucleus placement, we considered 114 sentences recorded by the native speakers of English, 130 sentences by the advanced learners of English, 195 sentences by the elementary learners of English. Focus was placed correctly in 84.44%, 61.54%, and 10.77% of the cases, respectively. As we stated before, quality was addressed with vowels in the previous section, and we now provide acoustic and statistical analyses of four parameters concerning the nuclear accents in the English and Spanish sentences: duration (ms), intensity (dB), pitch range from the nucleus to the end of the utterance (st), and overall pitch range of the utterance (st). We report the values for the statements only, as absolute questions (yes/no questions) have proved to yield similar patterns between both languages (Trimbler, 2013).

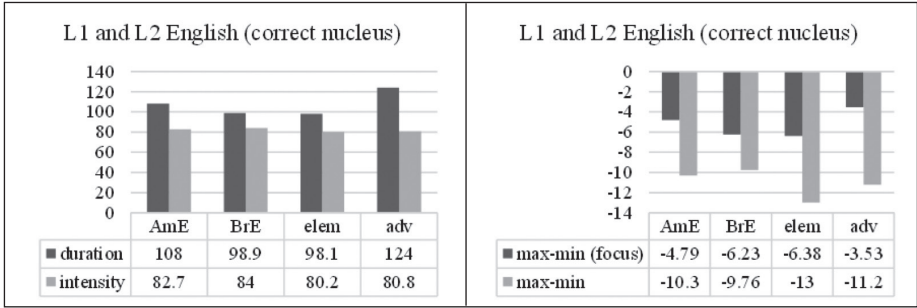
Concerning the acoustic characteristics of nuclear accents, we compared the four values mentioned above between L1 English sentences and their L1 Spanish counterparts that had correct focus placement and tone (falling pitch tone), by means of GLM (fixed factor: L1 variety; random factor: speaker). Given that the native speakers that recorded the sentences are speakers of two distinct Eng-

lish accents (American and British), we separated both groups to first determine what differences exist between them and, then, how they compare to Spanish parameters. As we can see in Graph 1, both English accents present similar values except for pitch range from the nucleus, which is in fact significantly wider in British English (BrE) than in American English (AmE) [diff. = -1.44; SE = 0.453; $z = 3.18$; $p = .004$]. Comparisons between L1 Spanish and each English variety revealed that Spanish present similar overall pitch range to both English accents, and similar intensity to AmE, but significantly lower than BrE [diff. = 2.57; SE = 0.660; $z = 3.89$; $p < .001$]. Duration of nuclear vowel and pitch range from focus in Spanish is significantly lower than in both English varieties. Sp-AmE: duration [diff. = 39.62; SE = 4.97; $z = 7.97$; $p < .001$], pitch range: [diff. = -2.36; SE = 0.365; $z = -6.45$; $p < .001$]; Sp-BrE: [diff. = 30.50; SE = 5.44; $z = 5.61$; $p < .001$], [diff. = -3.80; SE = 0.400; $z = -9.50$; $p < .001$].



Graph 1. L1 English and L1 Spanish acoustic parameters.

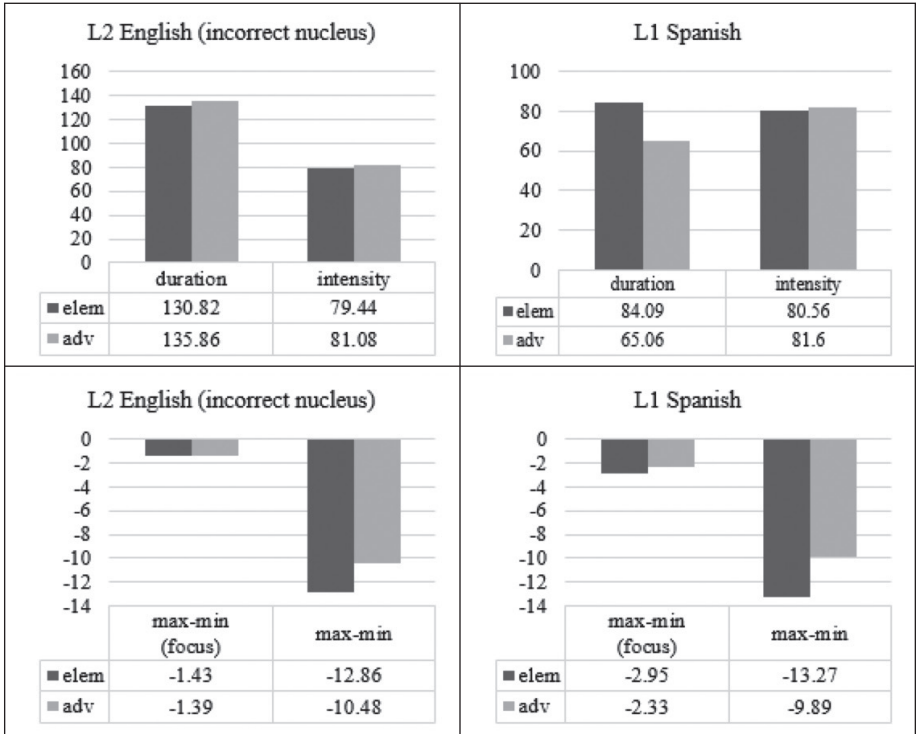
Upon comparing the L1 and L2 English utterances with correct focus placement and tone (fixed factor: speaker group; random factor: speaker), we see that both groups of L2 learners displayed similar overall pitch range to the native speakers (Graph 2), but lower intensity [elementary: diff. = -3.95; SE = 0.970; $z = -4.07$; $p < .001$; advanced: diff. = -2.63; SE = 0.578; $z = -4.55$; $p < .001$]. Interesting results were obtained concerning pitch range from nucleus and duration, key elements in marking the nuclear accent. Advanced learners' utterances displayed lower values for pitch range [diff. = -2.694; SE = 0.583; $z = -4.619$; $p < .001$] than BrE speakers and higher values for duration than BrE speakers [diff. = -25.32; SE = 9.49; $z = -2.666$; $p = 0.046$], but showed no differences with respect to AmE speakers. Nevertheless, elementary learners showed similar values to those in both groups of L1 English speakers.



Graph 2. Acoustic parameters for L1 and L2 English (correct nucleus).

We compared the values for nuclear accent and utterances in L1 Spanish with those in L2 English that presented incorrect nucleus placement (i.e., nuclear accent on the last content word), to understand the extent of L1 transfer other than the location of the nucleus (fixed factor: learner group; random factor: speaker). As shown in Graph 3, both groups of learners show similar overall pitch range and intensity in their English and L1 Spanish utterances. Nevertheless, pitch range from nucleus is significantly higher in their L1 Spanish than in their L2 English productions [elementary: $\text{diff.} = -1.5890$; $\text{SE} = 0.188$; $z = -8.432$; $p < .001$; advanced: $\text{diff.} = -1.0198$; $\text{SE} = 0.297$; $z = -3.431$; $p = 0.004$]. Likewise, duration is significantly longer in their L2 English utterances than in their L1 Spanish sentences [elementary: $\text{diff.} = -44.15$; $\text{SE} = 4.56$; $z = -9.69$; $p < .001$; advanced: $\text{diff.} = -71.70$; $\text{SE} = 7.19$; $z = -9.98$; $p < .001$].

It seems that in the production of L2 English sentences, L1 Spanish speakers transfer their L1 patterns into the L2 in terms of nucleus placement, at least in the initial stages of learning, when L1 influence is higher. However, despite incorrect placement, nuclear accents show higher duration than in their Spanish productions, although they fail to reach a higher pitch range from nucleus.



Graph 3. Acoustic parameters for L2 English (incorrect nucleus) and L1 Spanish.

5. DISCUSSION

Our findings show that the production of L2 English minimal pairs of vowels that have only one counterpart in L1 Chilean Spanish presents certain problems for L2 learners, some of which are solved with L2 proficiency. On the one hand, positive transfer is seen in L2 English vowels /i/ and /ʌ/, whose quality is similar to Spanish /i/ and /a/, respectively. Vowels /i/ and /ʌ/ are accurately produced by both elementary and advanced learners, as both English /i/ and Spanish /i/ are front high vowels, and both English /ʌ/ and Spanish /a/ are low central vowels. On the other hand, negative transfer hinders L2 production, and three main cases are distinguished. Vowel /ɪ/, which is a front mid-close vowel, is initially assimilated to Spanish /i/ (Flege & Bohn, 1989), but gradually transitions into the right parameters for English. At advanced levels, this sound does not present any problem in terms height or tongue advancement which is consistent with the results obtained by Smith, Johnson, and Hayes-Harb (2019).

Secondly, for English vowels /æ/ and /ɑ/, which are front open and back open vowels, respectively, appropriate height is not achieved despite L2 proficiency. Even when F2 becomes more accurate at higher levels of proficiency, F2 does not quite reach the quality of the English vowels. Thirdly, in the case of English /u/ and /ʊ/, which are back close and back mid-close respectively, L1 transfer seems to affect tongue advancement, although height is achieved. The initial stages show inconsistencies in terms of tongue advancement, generally further back than required for English (Smith et al., 2019). This tendency is also present at advanced levels; thus, L1 dominance over L2 patterns explains the lack of improvement regardless of L2 experience.

In terms of duration and intensity, the most remarkable findings suggest that both groups of learners underachieve duration. Interestingly, several studies indicate that L1 Spanish learners of L2 English resort to duration as a cue to perceptually distinguish vowels in the target language despite not being an acoustic cue in their native language (Jiang, 2018) and thus, not the result of L1 transfer but rather of psychoacoustic salience (Strange & Shafer, 2008). Unlike perception, production shows the opposite tendency: learners seem to use intensity instead of duration to mark tense vowels (long vowels).

Evidence gathered in this study shows that learning an L2 with a greater vowel repertoire than the L1 presents difficulties. Vowels in the L2 that are similar to L1 vowels can be easily assimilated (Best & Tyler, 2007) and produced, as is the case of /i/ and /ʌ/. Additionally, greater knowledge and use of the L2 may aid in the creation of new L2 phonetic categories (Iverson & Evans, 2009), which is what seems to happen with /ɪ/. The rest of the L2 vowels analyzed present little improvement with proficiency, although at least one of the parameters (either height or tongue advancement) is achieved, which indicates learners attempt to distinguish the L2 categories in production. It may be that learners have created a new phonetic category with a deviant (or poor) exemplar of the phoneme it represents. In any case, these results are conditioned to both the L1 variety of the learners (Chilean Spanish) and the L2 variety analyzed (American English). Studies show that both factors play a role in perception -and production (Escudero & Chládková, 2010; Escudero & Williams, 2012), i.e., results may vary with a different L1 or L2 variety.

Concerning our findings in terms of prosody, we have seen that L2 English sentences that present exceptions to the last lexical item rule initially pose a problem for L1 Spanish learners of English in terms of nucleus placement, as Spanish tends to place the focus of the utterance on the last lexical item and can also resort to syntactic movement to draw attention onto a lexical item. With more competence in the L2, their productions start to become more accurate, as shown by the advanced learners of English. Nevertheless, some constructions seem to be easier to acquire than others, as also reported by Ortiz (1995). In our study, nucleus followed by

objects of general reference yielded the highest scores for elementary learners, but the lowest scores for advanced learners. The latter reported the highest scores for nucleus followed by adverbials and by infinitive, in agreement with Ortiz.

In terms of the acoustic characteristics of nuclear accents, particularly duration and pitch range, L1 English nuclear accents are characterized by longer duration and wider pitch range from the nucleus than L1 Spanish. In cases where L2 English utterances are produced with correct nucleus placement, elementary learners' productions (10.77%) displayed similar parameters to both groups of native speakers. Advanced learners' utterances (61.54%), however, displayed a much longer duration of the nuclear accent and lower pitch range from nucleus than British native speakers (Ramírez Verdugo, 2002), but not American English. This may simply indicate that these learners achieved their proficiency by being exposed to the latter variety of English and quite successfully produced the parameters required to mark the nuclear accent in this variety. As explained before, the type of L2 variety exposed to influences the perception and production of the target language. However, if British English was the target or the variety exposed to, they clearly underachieved pitch range and over relied on duration. Additionally, although not measured, we could speculate that advanced learners' higher fluency in the L2—as attested by the experts and native speaker who assessed their productions—may cause a tradeoff with pitch range (narrower) and prompt them to resort to duration (longer) to signal nuclear accent. As derived from the comparisons of those L2 utterances that showed incorrect nucleus placement, i.e., on the last lexical item, with their L1 Spanish counterparts (nucleus also on the last lexical item), we saw that both display similar pitch range from nucleus and intensity, while overall pitch range was higher in Spanish, and duration was higher in English. Here is where we can see that L1 Spanish learners relied on duration, rather than pitch, as an essential correlate of prominence in English. In this study, the duration of the nuclear accent in L1 English proved to be significantly longer than its duration in L1 Spanish; thus, learners may perceive this correlate as a highly salient cue (Strange, Bohn, Trent, & Nishi, 2004), as opposed to other acoustic features.

Finally, these results should be taken with caution, given the uneven number of participants per group and the limited number of target words and sentences analyzed. Nevertheless, we hope our findings will encourage further research on L2 perception and production.

5.1. Pedagogical implications for EFL

Considering these findings, future research should consider how these results affect the perception by native speakers of English. According to Baitman and Véliz Campos (2012), while non-native speakers tend to judge L2 English pro-

ductions in terms of vocabulary and grammar, native speakers focus on fluency and pronunciation. Future research could aim at determining what parameters, or combination of parameters, affect to improve teaching techniques within a EFL context. Learners and teachers are faced with the caveat that “suprasegmental features such as intonation are of paramount importance for communication but especially hard to teach. In contrast, segments present no serious problem for teaching but do not weigh a great deal in discourse” (Benrabah, 1997, p. 162). In the case of vowels, studies suggest that training on perception will eventually lead to improvements in production, for both height and tongue advancement, which also reduces the influence of negative cross linguistic interference from the L1 (Barreiro, 2002; Strange & Shafer, 2008; Baigorri et al., 2018; Smith et al., 2019) This idea is summarized by Barreiro, who stated that “it is believed that a person cannot articulate sounds properly, unless he or she can listen to L2 sounds accurately” (2002).

In the case of prosody, it is said to be the first element acquired in our L1, while the hardest one to acquire or learn in our L2. Finch & Ortiz Lira (1982) recommend that students get a feel for rhythm from the very early stages of learning, as instruction focused on awareness seems to be crucial to achieve high proficiency (Luchini, 2017). As Erickson (2013) puts it, teachers need to help students “to be perceptually sensitive to prosodic (including rhythmic) characteristics of the target language, and then to practice this repeatedly” (p. 156). For this reason, Chela Flores (1997) suggests that the practice of pronunciation must go hand in hand with the grammar and vocabulary being learned at each stage of the course, with a focus on English rhythm (Sugiura & Hori, 2019). In line with this, recent research proves that training L2 English learners in rhythm with beat gestures is beneficial to improve detection of pitch accents in utterances, especially complex ones (Gluhareva & Prieto, 2017). Thus, the goal is to prioritize pitch over duration (Desaki, 2019).

6. CONCLUSIONS

We examined the influence of the L1 and proficiency in the L2 on the production of seven English vowels with only three counterparts in Spanish, and on nuclear accent in statements that contained exceptions to the last lexical item rule in English. These findings partially support the notion that higher proficiency in a foreign language yields patterns that are closer to the target language. In terms of vowels, advanced learners improved certain parameters that were problematic for elementary learners, but overall English /æ/ and /ɑ/, while uttered as open vowels, were not open enough, and /u/ and /ʊ/ were uttered further back than in English. The question remains whether they are distinct enough for intelligibility. In terms

of sentence accent, although advanced learners showed more accuracy in nucleus placement with respect to elementary learners, their achievement was still far from the native speakers'. However, their acoustic parameters differed only from British English, not American English, which reinforces the importance of differences in language varieties in perception and production, although both groups showed a tendency to over rely on duration. We encourage further research on other aspects such as rhythm and fluency to have a more holistic understanding of the factors that affect L2 production and to adapt language teaching strategies for improvement in an EFL context.

7. ACKNOWLEDGMENTS

This work is part of the research project DICYT 031851DCRMO, funded by the Universidad de Santiago de Chile. We would like to thank the anonymous reviewers for their comments on this article. Special thanks to Dr. Domingo Román, Rachel Laycook, and the volunteers that made it possible.

REFERENCES

- Al-Khresheh, M. H. (2016). A review study of error analysis theory. *International Journal of Humanities and Social Science Research*, 2, 49-59.
- Baigorri, M., Campanelli, L., & Levy, E. S. (2018). Perception of American–English Vowels by Early and Late Spanish–English Bilinguals. *Language and Speech*, 62(4), 681-700. <https://doi.org/10.1177/0023830918806933>
- Baitman, B. & Véliz Campos, M. (2012). A comparison of oral evaluation ratings by native English speaker teachers and nonnative English speaker teachers. *Lingüística y Literatura*, 27, 171-200. <http://dx.doi.org/10.4067/S0716-58112013000100010>.
- Barreiro, S. C. (2002). Speech perception in L2. *Odisea*, 2, 7-14. <http://dx.doi.org/10.25115/odisea.v0i2.10>.
- Barrios, S., Jiang, N., & Idsardi, W. J. (2016). Similarity in L2 Phonology: Evidence from L1 Spanish late-learners' perception and lexical representation of English vowel contrasts. *Second Language Research*, 32(3), 367-395. <https://doi.org/10.1177/0267658316630784>.
- Benrabah, M. (1997). Word stress – A source of unintelligibility in English. *International Review of Applied Linguistics*, 35(3), 157-165. <https://doi.org/10.1515/iral.1997.35.3.157>.
- Best, C. T. & Tyler, M. D. (2007). Nonnative and second-language speech perception. Commonalities and complementarities. In O-S. Bohn & M. J. Munro

- (Eds.), *Language Experience in Second Language Speech Learning: In Honor of James Emil Flege*, (pp. 31-52). Amsterdam, NLD: John Benjamins Publishing Company.
- Boersma, P. & Weenink, D. (2001). Praat, a system for doing phonetics by computer. *Glott International* 5(9/10), 341-345.
- Bohn, O.-S. & Flege, J. E. (1990) Interlingual identification and the role of foreign language experience in L2 vowel perception. *Applied Psycholinguistics*, 11, 303-328. <https://doi.org/10.1017/S0142716400008912>.
- Bradlow, A. R. (1995). A comparative acoustic study of English and Spanish vowels. *The Journal of the Acoustical Society of America*, 97(3), 1916-1924. <https://doi.org/10.1121/1.412064>.
- Byers, E. & Yavas, M. (2017). Vowel reduction in word-final position by early and late Spanish-English bilinguals. *PLoS One* 12(4): e0175226. <https://doi.org/10.1371/journal.pone.0175226>
- Cebrian, J. (2019). Perceptual assimilation of British English vowels to Spanish monophthongs and diphthongs. *The Journal of the Acoustical Society of America*, 145(1), EL52-EL58. <https://doi.org/10.1121/1.5087645>
- Chela Flores, B. (1997). Rhythmic patterns as basic units in pronunciation teaching. *Onomázein*, 2, 111, 134.
- Derwing, T.M., & Munro, M.J. (2008). Putting accent in its place: Rethinking obstacles to communication. *Language Teaching* 42, 476 - 490. DOI:10.1017/S026144480800551X
- Desaki, A. (2019). The use of pitch and duration on new and given information by native and non-native speakers of English and its pedagogical implications. In S. Calhoun, P. Escudero, M. Tabain, & P. Warren (eds.) *Proceedings of the 19th International Congress of Phonetic Sciences, Melbourne, Australia 2019* (pp. 3363-3367). Canberra, Australia: Australasian Speech Science and Technology Association Inc
- Eckert, P. (2012). Three waves of variation study: The emergence of meaning in the study of variation. *Annual Review of Anthropology*, 41, 87-100. <https://doi.org/10.1146/annurev-anthro-092611-145828>
- Edwards, J. G. H., & Zampini, M. L. (Eds.). (2008). *Phonology and second language acquisition* (Vol. 36). John Benjamins Publishing.
- Elvira-García, W. (2014). Prosodic-data-extraction v2.1. [Praat script] (Retrieved from <http://stel.uab.cat/labfon/en/praat-scripts>) Distributed under GNU General Public License.
- Elvira-García, W. (2019). vowelFormants v1.1. [Praat script] (Retrieved from <http://stel.uab.cat/labfon/en/praat-scripts>) Distributed under GNU General Public License.
- Erickson, D. (2013). *Speech rhythm in English and applications to second*

- language teaching. *Acoustical Science and Technology*, 34(3), 153-158. doi:10.1250/ast.34.153.
- Escudero, P. (2000). Developmental patterns in the adult L2 acquisition of new contrasts: the acoustic cue weighting in the perception of Scottish tense/lax vowels by Spanish speakers. Unpublished M. Sc. thesis, University of Edinburgh.
- Escudero, P., & Chládková, K. (2010). Spanish listeners' perception of American and Southern British English vowels. *The Journal of the Acoustical Society of America*, 128(5), EL254-EL260. <https://doi.org/10.1121/1.3488794>
- Escudero, P. & Williams, D. (2012). Native dialect influences second-language vowel perception: Peruvian versus Iberian Spanish learners of Dutch. *Journal of the Acoustical Society of America*, 131(5), EL406-EL412. <https://doi.org/10.1121/1.3701708>
- Finch, D. F. & Ortiz Lira, H. (1982). *A course in English phonetics for Spanish speakers*. London, UK: Heinemann Educational Books Ltd.
- Flege, J. E., & Bohn, O. S. (1989). The perception of English vowels by native speakers of Spanish. *The Journal of the Acoustical Society of America*, 85(S1), S85-S85. doi: 10.1121/1.2027177
- Fox, R. A., Flege, J. E., & Munro, M. J. (1995). The perception of English and Spanish vowels by native English and Spanish listeners: A multidimensional scaling analysis. *The Journal of the Acoustical Society of America*, 97(4), 2540-2551. <https://doi.org/10.1121/1.411974>.
- Gluhareva, D. & Prieto, P. (2017). Training with rhythmic beat gestures benefits L2 pronunciation in discourse-demanding situations. *Language Teaching Research*, 21(5), 609-631. <https://doi.org/10.1177/13621688166651463>.
- Goldstein, B. A. & Bunta, F. (2012). Positive and negative transfer in the phonological systems of bilingual speakers. *International Journal of Bilingualism*, 16(4), 388-401. <https://doi.org/10.1177/1367006911425817>
- Hahn, L. D. (2004). Primary stress and intelligibility: Research to motivate the teaching of suprasegmentals. *TESOL Quarterly*, 38(2), 201-223. DOI: 10.2307/3588378
- Halliday, M. A. K. (1967). *Intonation and Grammar in British English*. The Hague: Mouton.
- Incera, S., Shah, A. P., McLennan, C. T., & Wetzel, M. T. (2017). Sentence context influences the subjective perception of foreign accents. *Acta psychologica*, 172, 71-76. <https://doi.org/10.1016/j.actpsy.2016.11.011>
- Iverson, P. & Evans, B. G. (2009). Learning English vowels with different first-language vowel systems II: Auditory training for native Spanish and German speakers. *Journal of the Acoustic Society of America*, 126(2), 866-877. DOI: 10.1121/1.3148196

- Jiang, N. (2018). *Second language processing: An introduction*. New York & Abingdon: Routledge.
- Klassen, J. (2013). Second language acquisition of English focus prosody: Evidence from Spanish native speakers. In J. Cabrelli Amaro et al. (eds.), *Proceedings of the 12th Generative Approaches to Second Language Acquisition Conference* (pp. 76-84). Somerville, MA: Cascadilla Proceedings Project.
- Ladefoged, P. & Johnson, K. (2010). *A course in phonetics*. Wadsworth Publishing Company.
- Ladd, D.R. (1979). Light and Shadow: A study of the syntax and semantics of sentence in English. In L. R. Waugh & F. Van Coetsen (eds.), *Contributions to Grammatical studies-Semantics and Syntax*. Leiden: E. J. Brill.
- Leal, T., Destruel, E., & Hoot, B. (2019). The acquisition of focus in L2 Spanish. *Second Language Research*, 35(4), 449-477. <https://doi.org/10.1177/0267658318784343>.
- Luchini, P. L. (2017). Measurements for accentedness, pause and nuclear stress placement in the EFL context. *Ilha do Desterro*, 70(3), 185-200. <http://dx.doi.org/10.5007/2175-8026.2017v70n3p185>.
- Major, R. C. (2001). *Foreign accent: The ontogeny and phylogeny of second language phonology*. Mahwah, New Jersey: Lawrence Erlbaum Associates Publishers.
- Major, R. C. (2008). Transfer in second language phonology: A review. In J. G. Hansen Edwards & M. L. Zampini (eds.) *Phonology and Second Language Acquisition* (pp. 64-82). Amsterdam: John Benjamins Publishing Company. <https://doi.org/10.1075/sibil.36.05maj>
- O'Brien, M. & Gut, U. (2010). Phonological and phonetic realisation of different types of focus in L2 speech. In K. Dziubalska-Kolaczyk, M. Wrembel, and M. Kul (eds.), *Achievements and perspectives in the acquisition of second language speech: New Sounds* (pp. 205-215). Frankfurt: Peter Lang.
- Ortiz, H. (1995). Nucleus placement in English and Spanish: A pilot study of patterns of interference. In Lewis J. Windsor (ed.), *Studies in General and English Phonetics: Essays in Honor of Professor J. D. O'Connor* (pp. 255-265). London & New York: Routledge.
- Ortiz, H. (2000). Word stress and sentence accent. Santiago: UMCE Manuscript.
- Ramírez Verdugo, D. (2002). Non-native interlanguage intonation systems: a study based on a computerized corpus of Spanish learners of English. *ICAME Journal*, 26, 115-132.
- Rasier, L. & Hiligsmann, P. (2007). Prosodic transfer from L1 to L2. Theoretical and methodological issues. *Nouveaux cahiers de linguistique française*, 28, 41-66.
- Roach, P. (2009). *English phonetics and phonology: A practical course*. Cambridge: Cambridge University Press.

- Saito, K. (2011). Examining the role of explicit phonetic instruction in native-like and comprehensible pronunciation development: an instructed SLA approach to L2 phonology. *Language Awareness*, 20(1), 45-59. DOI: 10.1080/09658416.2010.540326
- Saito, K. (2018). Advanced Second Language Segmental and Suprasegmental Acquisition. In Paul A. Malovrh & Alessandro G. Benatti (eds.), *The Handbook of Advanced Proficiency in Second Language Acquisition* (pp. 282-303). Hoboken; NJ: John Wiley & Sons, Inc. <https://doi.org/10.1002/9781119261650.ch15>
- Shea, C. (2019). Dominance, Proficiency, and Spanish Heritage Speakers' production of English and Spanish Vowels. *Studies in Second Language Acquisition*, 41(1), 123-149. <https://doi.org/10.1017/S0272263117000328>
- Smith, B. L., Johnson, E., & Hayes-Harb, R. (2019). ESL learners' intra-speaker variability in producing American English tense and lax vowels. *Journal of Second Language Pronunciation*, 5(1), 139-164. <https://doi.org/10.1075/jslp.15050.smi>
- Strange, W. & Shafer, V. L. (2008). Speech perception in second language learners: The re-education of selective perception. *Phonology and second language acquisition*, 36, 153-192. <https://doi.org/10.1075/sibil.36.09str>
- Strange, W., Bohn, O. S., Trent, S. A., & Nishi, K. (2004). Acoustic and perceptual similarity of North German and American English vowels. *The Journal of the Acoustical Society of America*, 115(4), 1791-1807. <https://doi.org/10.1121/1.1687832>
- Sugiura, K. & Hori, T. (2019). Effect of repeating rhythmic beats on short sentences on L2 pronunciation of Japanese learners of English. In S. Calhoun, P. Escudero, M. Tabain, & P. Warren (eds.) *Proceedings of the 19th International Congress of Phonetic Sciences, Melbourne, Australia 2019* (pp. 1347-1351). Canberra, Australia: Australasian Speech Science and Technology Association Inc.
- Swan, M. & Smith, B. (2001). *Learner English: A teacher's guide to interference and other problems*. Cambridge: Cambridge University Press.
- Trimbler, J. C. (2013). Perceiving intonational cues in a foreign language: Perception of sentence type in two dialects of Spanish. In C. Howe et al. (eds.), *Selected proceedings of the 15th Hispanic Linguistics Symposium* (pp. 78-92). Somerville, MA: Cascadilla Proceedings Project.
- Valenzuela Farías, M. G. (2013). A comparative analysis of intonation between Spanish and English speakers in tag questions, wh-questions, inverted questions, and repetition questions. *Revista Brasileira de Linguística Aplicada*, 13(4), 1061-1083. <http://dx.doi.org/10.1590/S1984-63982013005000021>
- Véliz, M. (2001). A contrastive study of English and Spanish post-nuclear patterns. *Onomázein*, 6, 53-68.

Wells, J. C. (2006). *English intonation. An introduction*. Cambridge: Cambridge University Press.

Weinreich, U. (1953). *Languages in Contact*. The Hague: Mouton.