NEW PERSPECTIVES ON THE PRONUNCIATION OF SECOND LANGUAGE SPANISH VOWELS: A CORPUS STUDY[i]

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Abstract:
This study focuses on the acquisition of the Spanish vowel system by English-speaking L2 learners. The vowel inventory of Spanish varies greatly from the English vowel system, yet the two are not normally differentiated in instructional strategies. We focus primarily on the mispronunciation of vowels, as they are critical to verb morphology in Spanish, as well as their mispronunciation can lead to confusion between minimal pairs in Spanish (e.g., reino 'kingdom' vs. reno 'reindeer'). Using the Corpus Oral de Español como Lengua Extranjera (ELE), we explored the most frequent types of mistakes produced by these learners in their pronunciation of Spanish vowels. Analysis showed that these mispronunciations included, but was not limited to, vowel reduction or vowel alternation. Moreover, the study concludes with an interpretation of plausible sources of this problem as well as discussing the role of vowel mispronunciations in L2 learner's intelligibility.

Keywords: corpus study; vowel inventory; pronunciation; vowel reduction; diphthongization; vowel alternation

Resumen:
Este estudio se centra en la adquisición del sistema vocálico español por parte de estudiantes de L2 de habla inglesa. El inventario de vocales del español varía mucho del sistema de vocales del inglés, sin embargo, estas diferencias no se incluyen normalmente en las estrategias de instrucción. Este estudio se enfoca principalmente en las pronunciaciones incorrectas de las vocales, ya que son fundamentales para la morfología verbal en español, ya que una pronunciación incorrecta puede generar confusión entre pares mínimos en español (por ejemplo, *reino* vs. *reno*). Utilizando el Corpus Oral de

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[i] NUEVAS PERSPECTIVAS SOBRE LA PRONUNCIACIÓN DE LAS VOCALES DEL ESPAÑOL EN UNA SEGUNDA LENGUA: UN ESTUDIO DE CORPUS

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Español como Lengua Extranjera (ELE), exploramos los tipos de errores más frecuentes que los aprendices ingleses producen en la pronunciación de las vocales del español. El análisis mostró que estas pronunciaciones incorrectas incluían, pero no se limitaban a, reducciones o alternancias vocálicas. Además, el estudio concluye con una interpretación de los orígenes plausibles de este problema, así como con la discusión del papel de las pronunciaciones incorrectas de las vocales en la inteligibilidad del alumno de L2.

Palabras clave: estudio de corpus; inventario de vocales; pronunciación; reducción de vocales; diptongización; alternancia de vocales

1. Introduction

The cross-linguistic study of vowels has received considerable attention in the literature (for a review, see Rosner and Pickering 1994), although not as much attention has been given to their acquisition of a second language (L2). Spanish and English are two examples of how languages differ widely in their vowel inventories. While Spanish contains five distinct vowels (Foster et al. 1999), the English system is more complicated, ranging from nine (Ladefoged 1975) to eleven (González Barrera 2010), or even fifteen (García Bayonas 2007) vowels. In a more recent study, Ladefoged and Disner (2012) identified the existence of fourteen or fifteen vowels in North American English, but up to twenty different vowels in British English. From the acquisition perspective, then, for a speaker of a language whose vowel system consists of more than nine vowels (like English), the challenge is to learn to use a system with only five sounds (such as Spanish), none of them a sound that exists in its pure form in the native system (García Bayonas 2007). While current pronunciation literature is focused on improving learners' intelligibility and comprehensibility as opposed to acquiring native-like speech (Derwing and Munro 2015), correctly acquiring the Spanish vowel system is more important than what it might seem.

As proposed by Elliott (1997), the acquisition of the vowel system in Spanish is important for two reasons. First, the Spanish verb system relies heavily on vowel accuracy. Incorrect vowel production can lead to miscommunication of the person, number, tense, aspect or mode of the intended utterance, a fault that can lead to miscommunication (e.g., *toma* ('drink' 3rd sg. present indicative), *tome* (1st and 3rd sg. present subjunctive), *tomo* (1st sg. present indicative)). Second, learners can be self-conscious, especially adult learners, about their pronunciation. While they may not be able to identify the problem, they know that something is not "right", that is, while they can identify that their pronunciation is not native-like, they cannot identify how this mispronunciation happened in the first place (e.g., Dlaska and Krekeler 2008). This self-awareness leads to reluctance to speak with native speakers, thus reducing their opportunities for natural, comprehensible input (Krashen 1988). We could interpret that, being able to pronounce the vowels accurately gives the learners more confidence, encouraging them to seek out native speakers with whom they can practice their Spanish.

This practice gives them more opportunities to listen to naturally spoken Spanish, helping them build stronger phonemic distinctions in their L2, and increasing confidence in their desire to acquire the language. Meanwhile, the affective filter is lowered, helping them to be even more confident in their attempts to speak the language, in line with Krashen (1988)'s Affective Filter hypothesis. Krashen's view predicts that a high level of anxiety, together with low motivation and reduced self-confidence, impedes language acquisition. Thus, in learning the vowel system from the initial stages of Spanish acquisition, learners improve their opportunities to interact with people who speak the language, increasing their motivation and reducing their anxiety levels.

Nevertheless, even though there is evidence indicating how learning accurate pronunciation from the initial stages of acquisition can be beneficial for learners (see Baker 2014), research that deals with the acquisition of the Spanish vowel system is scarce (see Cobb and Simonet 2010). The limited number of studies dealing with the production of Spanish L2 vowels has a direct impact on teaching resources and tools for teachers, which tend to be limited to correctly addressing learners' needs (Gil Fernández 2007, 2012). The aim of the current article is to provide the results of a descriptive corpus study, which describes the most frequent mispronunciations of Spanish L2 vowels as produced by English-speaking learners (without focusing on a given phonemic contrast). In the following sections, we provide a more detailed account of the difference between Spanish and English vowels and a description of previous findings on the production of L2 vowels.

2. Literature review

2.1 Spanish and English vowels

A cross-linguistic comparison between English and Spanish shows the challenges that English-speaking learners of Spanish face when learning the phonology of their L2. On the one hand, across dialects, Spanish only has five monophthongs /i, e, a, o, u/ (as shown in Figure 1, adapted using the data from Quilis and Esgueva 1983), which do not change between stressed and unstressed syllables. Spanish also has a number of diphthongs (combination of two adjacent vowel sounds within the same syllable) including /ai, ia, au, oi, ei, ie, eu, ue/. These are characterized by initial and final targets which approximate pairs of monophthongs, as well as a stable rate of transition between initial and final targets (Borzone de Manrique 1979, Hualde and Prieto 2002).

By comparison, the number of vowels in English varies from dialect to dialect but, on average, there are 12 or 13 vowels. General American English, for example, has eight (or nine, depending on the region) stressed vowels that are traditionally called monophthongs /i, ɪ, ɛ, æ, ɑ, ɔ, ʊ, u/, and two stressed vowels which are traditionally called phonetic diphthongs /e, o/ (notice that the latter two cases are often transcribed using digraphs such as [eɪ, oʊ]). Figure 1 represents this information (adapted using the data from Allen 1978). General American English also has three sounds that are traditionally called true diphthongs (/aɪ, ɔɪ, aʊ/) and several sequences of glides and vowels (e.g., /ju,

wi/). English is also known for undergoing vowel reduction, that is, vowels in unstressed position are produced as centralized vowels (schwa /ə/) or with certain other vowels described as being "reduced" and having lost some of their original properties (e.g., Stevens, 1959; Allen 1978; Assmann, Nearey, and Hogan, 1978).
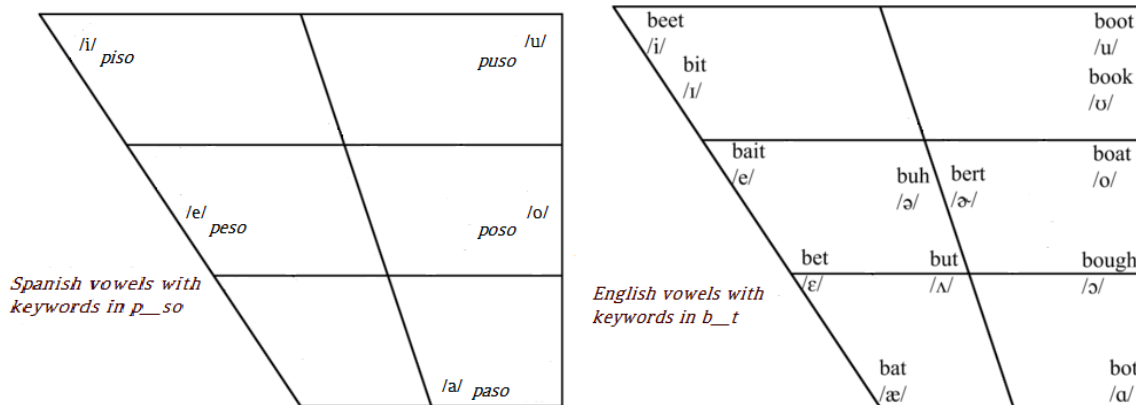
Figure 1: Spanish and English IPA vowel charts, including minimal pairs

English speakers learning Spanish are therefore faced with learning to adjust to a more limited vowel inventory. Even for those cases in which there seems to be a match between the two languages, research has found that the precise location of Spanish vowels in the acoustic space is different from that of English vowels (e.g., Bradlow 1995). Learning Spanish as an L2 can be, therefore, challenging for English speakers, and understanding the specific problems they face in their acquisition process will help us better prepare to help them in their learning process.

2.2 Production of (Spanish) L2 vowels and implications for language acquisition

The role of age of acquisition (AOA) in the production of L2 vowels has been examined by several studies, showing that the earlier the L2 is acquired, the more accurate the productions are (e.g., Jun and Cowie 1994; Munro, Flege, and MacKay 1996; Piske et al. 2002; Oh et al. 2011). A similar pattern has emerged among the studies exploring the role of length of residence (LOR), as the more experienced learners showed a more native-like production of the L2 vowels, as compared to inexperienced learners (e.g., Bohn and Flege 1992; Cho and Lee 2016). However, not all the studies agreed with this conclusion (e.g., Flege, Bohn, and Jang 1997; Flege and Liu 2001). These results illustrate the complexity of L2 speech production. Since factors such as LOR do not seem to be a uniform predictor of performance, other factors may need to be considered to explain the data. For example, Flege, Bohn, and Jang (1997) conducted a study in which they examined the production of L2 English vowels by different groups of experienced and inexperienced learners (L1 speakers of German, Spanish, Mandarin, and Korean). While part of their results supported the idea that LOR, or L2 experience, benefits the production of L2 vowels (the experienced German and Mandarin subjects showed more native-like productions), not all their data supported this claim, as experienced and inexperienced Korean and Spanish

subjects showed similar results. To explain their results, Flege et al. (1997) considered the vowel inventory of the different subject groups' L1 and their "perceived phonetic similarity" between the L1 and L2 vowels; that is, some of the groups that do not have the phonemic distinction included in the study (/i/ vs /ɪ/) did not show a native-like pattern, even among the experienced subjects (see Flege et al. for discussion regarding the interpretation of the Chinese results).

Thus, research on L2 speech production has emphasized how the nature of the L1 vowel inventory influences L2 production, even more than AOA or LOR in some cases (for a review, see Zampini 2008). This influence has been shown to be either facilitative (when the L1 and L2 sound systems are the same) or hindering, thus underlining the role of L1 transfer on the production of L2 vowels and focusing on the comparison of the acoustic characteristics (e.g., the average formant frequencies or duration of articulation) produced by learners to those of monolingual speakers (Hansen Edwards & Zampini 2008). However, these are not the only factors that may influence L2 production of vowels. Several recent studies have demonstrated that orthography may aid L2 phonological and lexical learning (e.g., Escudero, Hayes-Harb, and Mitterer 2008; Hayes-Harb, Nicol, and Barker 2010; Simon, Chambless, and Alves 2010; Escudero, Broersma, and Simon 2013; Showalter and Hayes-Harb 2013). This means that the availability of different orthographic representations can help learners create separate lexical representations, thus leading to more accurate perception and production of the contrasts and thus to further L2 development. However, this effect may be more limited than previously thought, as recent findings seem to indicate that orthography only helps with contrasts that are relatively easy to discriminate (Escudero 2015).

The role of AOA, LOR, and orthography has been studied in the production of L2 vowels in different L2-L1 combinations. However, the number of studies exploring the production of Spanish vowels by learners from different L1 backgrounds is considerably scarce. In a study exploring the acquisition of Spanish vowels by Quichua (Ecuadorian Quechua) speakers, Guion (2003) found that only early and simultaneous bilinguals can develop L2 categories that resemble those used by Spanish-speaking monolinguals (while late learners continue using Quichua vowel categories in their Spanish). Quichua-speaking learners of Spanish present an interesting scenario, because these learners need to acquire vowels that do not exist in their native language (Quichua only has 3 vowels). However, the opposite scenario (native speakers of languages which have more vowel categories than Spanish, such as English) has also been explored. In principle, this scenario could be considered to be less challenging, as the acquisition process would not involve having to create new phonemic categories. However, previous acoustic analyses on English-speaking L2 learners of Spanish production of L2 vowels show that proficiency tends to lead to more native-like production of stressed vowels (e.g., Cobb 2009; Cobb and Simonet 2010; Menke and Face 2010), while the results regarding the degree of non-native-like level of vowel reduction in unstressed syllables is inconclusive. Some studies have found a negative correlation between proficiency and degree of vowel reduction (e.g., Menke and Face 2010) and others a positive effect of proficiency (e.g.,

Cobb 2009) and even some mixed results depending on the vowels investigated (e.g., Cobb and Simonet 2010). Differences in the acoustic parameters calculated and compared have been proposed as the explanation for these discrepancies.

Not only the general acoustic realizations of Spanish vowels or the degree of vowel reduction in L2 Spanish have been examined. Spanish vowels have also been used as the mechanism to test theories of L2 speech learning such as the Speech Learning Model (SLM, Flege 1988, 1995, 2003), and the Second Language Linguistic Perception Model (L2LP, Escudero 2005; Leussen and Escudero 2015). Both models posit that the initial stages of L2 learning use the L1 speech perception system as a filter when perceiving L2 sounds, predicting difficulties in both perception and production depending on whether new or similar sounds are involved, but they differ in the predictions they make. SLM (Flege 1995) predicts that a new sound (different from any L1 category) will create a new L2 category, because it will not create major difficulties in perception. However, if the L2 sound has insufficient perceived difference from the closest L1 sound (they are similar), then a single category will be formed for both sounds, leading to perception and production difficulties. On the other hand, L2LP (Escudero 2005; Leussen and Escudero 2015) hypothesizes that new sounds will be harder to perceive and produce. When two L2 sounds are acoustically similar to a single L1 sound, learners must either create a new L2 category or split their existing single L1 category, which is a difficult scenario for L2 learners. In contrast, when the two L2 sounds are acoustically close to the typical productions of two separate L1 sounds, learners can replicate and then adjust the new L2 category boundaries. Thus, L2LP predicts that this shifting is less problematic than creating new categories.

These predictions have been tested in perception using the Spanish vowels. For example, Romanelli and Menegotto (2015) examined the identification of Spanish /a, e, o/ in word – final position by beginner American English learners of Spanish. These specific vowels were chosen because of their productivity in the final position (e.g., *toma* ('drink' 3rd sg. present indicative), *tome* (1st and 3rd sg. present subjunctive), *tomo* (1st sg. present indicative)). Moreover, Spanish and English /e/ and /o/ have been considered similar sounds (Bradlow 1995; Morrison 2003, 2006). Thus, according to the SLM model similar vowels like Spanish /e/ and /o/ and English /eɪ/ and /oʊ/ would be particularly challenging to English speakers while the new Spanish low central vowel /a/ would not be problematic for them. The results indicated that native English-speaking listeners can perceive all Spanish vowels in a native-like manner even in the early stages of acquisition. This set of results opens an interesting scenario, because they seem to suggest that Spanish vowels are not problematic (at least in perception) for English-speaking learners of the language. However, it is not clear at this point whether the same results would be replicated in production (with all vowels being produced with equal accuracy). In the current study, we provide one of the first corpus analyses on the oral production of Spanish as an L2, focusing specifically on the production of Spanish vowels by English-speaking L2 learners of Spanish. This is a unique study that provides a detailed account of the most common mistakes associated with vowels, without being limited to just a

specific contrast of sounds and taking advantage of the benefits of using a corpus (such as the continuous possibility to access the data, or the objectivity involved).

3. Corpus study

3.1 Data

For the corpus study, all instances of mispronunciations produced by native speakers of English from the Corpus Oral de Español como Lengua Extranjera (ELE) were retrieved. This corpus contains recordings of approximately 13 hours and 36 minutes (Campillos Llanos 2014) of spoken Spanish. The corpus contains data from 40 participants with a high-beginner, low-intermediate level of proficiency in Spanish, and study abroad students in Spain at the time in which the recordings were made. In total, the corpus includes 4 participants per language (each interview took about 15 minutes per participant), from a total of 9 different languages (Portuguese, Italian, French, English, Dutch, German, Polish, Chinese, and Japanese), as well as just one Korean, Finnish, Hungarian, and Turkish participant. No more information is given about the participants. Only the L1 English data was used in this study (which accounts for about 1 hour of recordings).

Each interview is a semi-spontaneous dialogue between the researcher and the learner, in which the learner was asked to (1) describe some cartoons, (2) describe two pictures related to food, and (3) comment on today's alimentation style, always following the structure used in the speaking portion of the DELE exams (Alzugaray, Barrios, and Hernández 2006).

This corpus was specifically selected, despite other existing corpus with more data (such as the C-Oral-Rom project (Cresti and Moneglia 2005) or the SPLLOC project (Mitchell et al. 2008)), because of all the information it provides. All the interviews in the corpus are manually transcribed, including speech phenomena (disfluencies, pauses, repetitions, etc.). The transcriptions in this corpus follow the CHAT transcript format (as used in the C-Oral-Rom project and the conventions used in the SPLLOC project). Importantly for the current research, transcriptions of the oral productions carefully annotate the mispronunciations present in the audios, following a typology based on previous studies for English (James 1998; Granger 2003: Nicholls 2003) and Spanish (Fernández 1997; Bustos Gisbert 1998; Vázquez 1999), including segmental and suprasegmental mispronunciations. Example 1 provides an example of how the mispronunciations were originally transcribed in the corpus.

(1)
… y … pues estudié en la escuela [əsˈkwe.lə] mm… pero la docencia [doˈsen.sjə] de los [ləs] idiomas [ɪˈdjo.məs] en la escuela…1

… and … I studied in the school mm… but the foreign language instruction in the school…

All the instances of mispronunciations produced by native speakers of English were extracted and the examples of transcriptions related to the pronunciation of vowels were then manually identified, yielding a sample of 196 instances of incorrectly produced vowels. All these instances were further coded as the type of mispronunciation they showed: vowel reduction (as in those cases in which learners produced a schwa instead of a full vowel in unstressed syllables), diphthongization (cases in which a single vowel in Spanish was pronounced as two vowels), vowel alternations (when a Spanish vowel was completely mispronounced, as in the vowel /e/ being pronounced as /i/), incorrect category (when a Spanish vowel was pronounced using a similar English vowel, but not being exactly the same as a native speaker would produce, as pronouncing the Spanish /i/ as /ɪ/), epenthetic vowels (the insertion of a vowel in a context in which there should not be a vowel), or missing vowels (the deletion of existing vowels in Spanish). Real examples of each category can be found in the Results Section. Some decisions had to be made when categorizing the mispronunciations found in the corpus:

- When a given word showed more than one instance of the same category (e.g., *Inglaterra* ("England") showing two instances of vowel reduction, as in the case of [ɪŋgləˈteɹə]), they were counted as one single mispronunciation.
- When one word showed two different errors, it was counted twice (once for each category), as in the case of *dibujo* ("drawing") pronounced as [deˈβuxə], which was categorized as an example of incorrect vowel and of vowel reduction.
- In ambiguous cases (for example, when it was not clear whether a given mistake was intended as a diphthong or as the wrong vowel), recordings were manually checked and compared to how other instances of that given sound were produced in other contexts.
- Each individual instance of the vowel [ɪ] was visually inspected and analyzed using PRAAT (Boersma and Weenink 2010) and the formant frequency (F1 and F2) values of this vowel were extracted and compared to those of [i] and [ə] produced by the same speakers (as in Flemming 2009). Whenever the value of the F1 and F2 values of [ɪ] fell within the range of [i], those instances were classified as examples of vowel alternations. On the other hand, whenever their values fell within the range of [ə], those instances were classified as examples of vowel reduction. In all cases, the F1 and F2 of [ɪ] were closer to those found for [i], and then they were classified as vowel alternations.
  The categories were created after exploring the results obtained in the corpus.

3.2 Results

Table 1 provides information regarding the distribution of the mispronunciations produced by native speakers of English in the different categories. As can be observed, the most frequent error was vowel reduction, followed by vowel alternations and using the incorrect category, and cases of diphthongization of single vowels in Spanish. Cases of vowel insertion (epenthesis) or vowel deletion only account for 3.06% of the mistakes found in the corpus, and they were only attested in the lower levels of proficiency (the

two participants were considered to be high beginners). No other effect of proficiency was observed in the data, as the distribution of the mispronunciation was the same among the high beginner and low intermediate learners.

Table 1: Distribution of the errors in the different categories included in the study

	Number of Instances of each Mispronunciation	Percentage of Occurrence of each Mispronunciation
Vowel Reduction	95	48.47%
Diphthongization	21	10.71%
Vowel Alternations	49	25.00%
Incorrect Category	25	12.76%
Epenthetic Vowel	1	0.51%
Missing Vowel	5	2.55%
Total	**196**	**100%**

Next, real examples extracted from the corpus are reported for all the types of mispronunciations, together with a more detailed description of each type of mistake transcribed.

3.2.1 Vowel reduction ([ə])

Vowel reduction is the phenomenon which describes the weakening of the unstressed vowels, changing their sound quality to become more centralized, also known as becoming a schwa or neutral vowel: [ə] (O'Grady, Dobrovolsky, and Aronoff 1997). This was the most frequent mispronunciation attested in the corpus analyzed, with a total of 48.47% of the cases. Examples (2) and (3) show two sentences produced by English-speaking learners with clear instances of vowel reduction:

(2)
… y … pues estudié en la escuela [əs.ˈkwe.lə] mm... pero la docencia [do.ˈsen.sjə] de los [ləs] idiomas [ɪ.ˈdjo.məs] en la escuela…1

 … and … I studied in the school mm… but the foreign language instruction in the school…

(3)
… en la otro [ˈo.tɹə] lado [ˈla.rə] de la calle [ˈka.jə]…
… in the ([sic] feminine article) other side of the street…

3.2.2 Diphthongization: /o/ → [oʊ] and /e/ → [eɪ]

Diphthongization or vowel breaking is a vowel shift in which a monophthong becomes a diphthong (Andersen 1972). This was the fourth most frequent type of mispronunciation attested in the corpus analyzed, with a total of 10.70% of the instances found being cases of diphthongization. Examples (4) and (5) show several instances produced by the learners:

(4)
¿qué tipo de vino [ˈbinoʊ]?
What type of wine?

(5)
… y también... es porque estudio economía [eikonoˈmia] ...
… and also… it is because I study Economics…

3.2.3 Vowel alternation

Occasionally, a vowel was pronounced slightly more closed, such that /e/ was pronounced like [ɪ] or even [i], which was the most common pattern of vowel alternation in the corpus (the most frequent alternation pattern). However, there are also instances in which /i/ is pronounced as [e] or /au/ as [ɔ], indicating that there may be an undetected influence on the vowels. This was the second most frequent mispronunciation attested in the corpus analyzed, with a total of 25% of the cases. Examples (6) and (7) show two sentences produced by the learners:

(6)
… y pues me gusta mucho primero porque no... no lo tenemos [tʰeˈnɪmos] en
 Inglaterra,…
… and I do like it, first because we don't… don't have it in England,…

(7)
… y… pero… no comprendo [kʰomˈpɹendo]… qué [ˈkʰɛ:] es [ˈɛ:s]… qué [ˈkʰe] pasó
[pʰaˈso]… en este… dibujo [deˈβuxə]…
… and… but… I don't understand… what is… what happened… in this… drawing…

3.2.4 Incorrect category

Although this category could be considered a subset of the vowel alternation category, we decided to categorize it differently. This category includes instances in which the Spanish vowel /i/ was pronounced as [ɪ] or /o/ as [ɔ]. These examples seem to indicate that the learners are aware of the perceptual properties of the vowels (they can distinguish between /e/ and /i/, for example), but they have not yet acquired those same properties in production. A total of 12.76% of the mispronunciations found in the corpus were cases of incorrect category, as shown in examples (8) and (9):

(8)
… la primera [pɹɪˈmeɹə]… ¿primera [pɹɪˈmeɹə]? está paella…
… and the first… first? is ([sic] estar instead of ser) paella…

(9)

… ah… ¡ah! ¿qué [ˈkʰe] hora [ˈɔːɹə] es? ¿qué [ˈkʰe] hora [ˈɔːə] es? Y…

… ah… ah! What time is it? What time is it? And…

3.2.5 Epenthetic and missing vowels

There was just one instance of an epenthetic vowel, shown in example (10). On the other hand, the examples of missing vowels, as shown in example (11), are cases in which a vowel that should normally be normally fully produced in Spanish is not present in the production of the learners, mostly occurring in unstressed positions. This category accounted for only about 3% of all the instances reported in the study:

(10)

… despúes ah… de la comida ah… ah… el señor [sɪˈɲoːɾə] le gus… le gusta su… comida [kʰɔˈmiðə]… y…

… after ah… lunch ah… ah… the mister li… likes his… food… and…

(11)

… y… y que [keɪ] la gente [ˈhente] aquí [əˈki]… son normalmente [ˌnɔːməˈmente] muy abierto… y muy… muy interesando… interesando [ɪntɹeˈsando]… cuando [ˈkʰʷwando] alguien está… extranjero [ekstɹanˈheɹo] o algo como así [əˈsi]…

… and… and that people here… are normally very open… and very… very interesting ([sic] invented word in Spanish) interesting ([sic] invented word in Spanish)… when someone is ([sic] estar instead of ser)… a foreigner or something like that…

4. Discussion

This research was originally proposed as an exploratory study of the most common mispronunciations produced by English-speaking L2 learners of Spanish in their production of Spanish vowels. While the perception and production of certain sound contrasts have been studied in detail in the literature (e.g., Zampini 1998; McAllister, Flege, and Piske 2002), this is one of the first studies to carefully explore the production of vowels, trying to pinpoint the types of errors produced and their possible origin.

Results indicated that the three most frequent mispronunciations were related to vowel reduction, followed by vowel alternations, and using the incorrect category, an effect that was consistent between the two groups (beginner and intermediate learners of Spanish). These results seem to be consistent with those reported in the previous acoustic analysis made of English-speaking L2 learners' productions of Spanish vowels. Previous studies on the production of L2 Spanish vowels by native speakers of English have found that this group of learners is able to produce stressed vowels in a native-like manner, but that their production of unstressed vowels does not always follow native-like standards (e.g., Cobb 2009; Cobb and Simonet 2010; Menke and Face 2010), with proficiency effects

being inconclusive at this point. This is consistent with the fact that, in our corpus study, cases of vowel reduction count for almost 50% of the mispronunciation instances reported. The fact that only vowels produced in unstressed position show apparent problems in their realization seem to indicate that there is some sort of relationship between the production of Spanish vowels and the placement of lexical stress within the word, as Menke and Face (2010) also proposed in their study. Thus, in principle, we could propose that L2 Spanish vowels in stressed position are "easy" for English-speaking learners to acquire. In fact, recent evidence shows that, in perception, a larger vowel inventory in the L1 seems to facilitate native-like L2 vowel perception skills, as compared with learners whose L1 has a smaller vowel inventory than their L2 (e.g., Iverson and Evans 2007, 2009), also in line with Garcia Bayonas (2004, cited in Menke and Face 2010) at ceiling accuracy scores in the identification of Spanish vowels. Thus, the same pattern seems to emerge for production in this corpus study.

What is not clear at this point, however, is the origin of these pronunciation issues. Let us discuss the example of diphthongization. There are different possibilities to explain this error. First, students may diphthongize words to keep word-boundary-related duration patterns in English; that is, they try to lengthen the final syllable of words in Spanish as they do in English (Turk and Sawusch 1997). However, even though this is a feasible possibility, it does not seem the most appropriate explanation for this phenomenon, as it does not explain all the data reported. If we observe Example 5, the diphthongization occurs in the first syllable of the word ([eikono'mia]). If the problem of diphthongization were related to their cue of word boundaries, this example would be parsed as the wrong Spanish word, in which "[ei]" would have been intended as the last syllable of the word estudio ('I study'), instead of the first syllable of the economía ('Economics'). However, this is not the pattern observed.

Another explanation is a misperception error, by means of which the Spanish vowels /e/ and /o/ are misperceived as the diphthongs [oʊ] and [eɪ]. This possibility taps into the idea that, in L2 phonological acquisition, misproduction reflects misperception. However, this is a question that remains unanswered in the literature. While there is general agreement that in L1 acquisition, accurate perception precedes accurate production (e.g., Smolensky 1996), the picture regarding L2 phonological acquisition is not so clear. While some researchers claim that many of the difficulties in L2 production stem from the inaccurate perception of L2 targets (e.g., Flege 1995), current research seems to provide conflicting evidence. For example, studies like the one by Hayes-Harb and Masuda (2008) show how perceptually, but not in production, English speakers learning Japanese can successfully discriminate singleton-geminate consonant contrasts. These findings, as well as some of those reported in other studies (e.g.,Weber and Cutler 2004; Cutler, Weber, and Otake 2006), seem to suggest a lack of direct relationship between misperceptions leading to mispronunciation. Apart from the fact that the literature seems to disprefer a hypothesis like the one proposed here, this possibility does not explain why some vowels undergo this diphthongization process in the data report

but not others. This explanation, again, does not seem to describe all the data found in this corpus.

Rather than a misparsing or a pure misperception phenomenon, this example seems to be a case of L1 transfer. In English, diphthongs can occur in both open (sue /suː/, bay /beɪ/) and closed (beam /biːm/, eight /eɪt/) syllables (Lass, 1984). However, open, stressed syllables tend to be longer and, given the intrinsic nature of diphthongs as a combination of two segments, diphthongs tend to appear in this position in English (Klatt, 1976). English learners seem to transfer this pattern to their L2 Spanish, by diphthongizing the Spanish /e/ and /o/ vowels appearing in open, stressed syllables. Although there seems to be a tendency towards these diphthongs appearing in word-final position, intrinsically the longest syllable in Spanish (Harris 1969), this pattern emerges in learners' productions also in word-initial position (e.g., [eikonoˈmia]). The appearance of diphthongs in different positions seems to agree with the L1 transfer hypothesis, as diphthongs in English are not limited to one position within the word. L1 transfer seems to be a plausible explanation, which accounts for all the data reported in this study, although more research is needed. Moreover, Spanish and English /e/ and /o/ have been considered similar sounds (Bradlow 1995; Morrison 2003, 2006) and, thus, English learners could be more likely to transfer their English knowledge into the production of these sounds.

Although other explanations could be proposed, L1 transfer could be one of the most likely scenarios to account for the patterns observed. The current study seems to be consistent with the claims that English speakers learning Spanish have no major problems in perceiving stressed vowels in Spanish (e.g., Morrison 2003; Romanelli and Menegotto 2015), as a misperception error cannot solely account for the pattern observed in the corpus data. Moreover, a purely misparsing hypothesis was ruled out, as it does not explain all the data reported in the corpus, as it happened with the hypothesis that learners were using this diphthongization to keep word-boundary-related duration patterns in English (lengthening the final syllable of words). Beyond being a plausible example of L1 transfer, this specific pronunciation problem provides an interesting scenario for future research to compare the predictions of L2 speech learning models such as SLM (Flege 1988, 1995, 2003), and the L2LP Model (Escudero 2005; Leussen & Escudero 2015) in production, and as a direct comparison to Romanelli and Menegotto (2015)'s study. According to SLM, Spanish /e/ and /o/ and English /eɪ/ and /oʊ/ are considered similar (Bradlow 1995; Morrison 2003, 2006) and particularly challenging for learners. While in perception Romanelli and Menegotto found not such an effect (all vowels were perceived equally accurately), the current corpus study seems to suggest that, at least in the early stages of acquisition, the SLM predictions may be accurate in production.

While attaining a native-like production of a L2 phonology may not be something plausible to achieve, we need to keep in mind the importance of working towards improving learners' intelligibility/comprehensibility (Derwing & Munro 2015). Considering that Spanish is a null-subject language (it allows for the explicit subject to be dropped wherever it is clear from the context), vowels in Spanish are important to

communicate verbal morphology, as incorrect vowel productions can lead to miscommunication of the person, number, tense, aspect or mode of the intended utterance (e.g., *toma* ('drink' 3rd sg. present indicative), *tome* (1st and 3rd sg. present subjunctive), *tomo* (1st sg. present indicative)). Not only for verbal morphology, as Spanish vowels do have several minimal pairs that could be confusable is not produced correctly (e.g., *reino* 'kingdom' vs. *reno* 'reindeer'). The current study indicates that, at least at the earlier stages of L2 vowel production, English-speaking learners do show problems in producing Spanish vowels (both in stressed and unstressed positions). While the limitations of the current study need to be kept in mind when interpreting these findings (small data sample, not a large range of proficiency tested, etc.), these results should be taken as evidence that the teaching of vowels must be a factor to consider within the established curricula.

5. Conclusion

The current study provided a short, exploratory overview of some of the major problems that English-speaking L2 learners of Spanish face when producing the Spanish vowels at a beginner-and-intermediate level of proficiency. We explored some of the main problems they face (vowel reduction, diphthongization, vowel alternations, incorrect category, epenthetic vowel, or missing vowels) by looking at real examples extracted for a corpus of spoken Spanish and by trying to understand the underlying problems leading to those mispronunciations.

While the main purpose was to explore what type of errors English-speaking learners make in the production of Spanish vowels, these findings also emphasized the importance of working towards achieving learners' intelligibility and, potentially, the need for the instruction of pronunciation in the foreign language classroom.

Ethical statement and competing interests (required)
The author(s) declare(s) no competing interests.

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