English Speakers Learning Spanish: Perception Issues Regarding Vowels and Stress

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Abstract—**The present pilot study examines both the perception of Spanish vowels /a, e, o/ in word – final position and the perception of final and penultimate stress of words ending in those vowels by beginner American English learners of Spanish. Seventeen English speakers and seven native Spanish speakers participated in this study. The English speakers were exposed to 90 hours of Spanish lessons during a three–week course in Mar del Plata, Argentina, a Spanish speaking country. Participants' perception was assessed by pretest and posttest, which consisted of identification tasks with nonce words. The study yielded these results: (a) native English-speaking participants perceived Spanish vowels like native Spanish-speaking participants after a three-week language course; (b) Initially, English speakers received lower scores in the perception of stress than did Spanish speakers who served as a comparison (control) group; c) Three weeks after exposure to the language, the English speaking students performed like Spanish speakers in the perception of penultimate stress but not in the perception of final stress. The article concludes that vowel perception is not a problem for English speakers learning Spanish while the perception of stress contrasts is a difficult challenge. More emphasis should be given to stress perception in Spanish programs for English speakers, as stress contrasts, together with vowels, are key to interpreting the meaning of a verb in the Spanish verbal morphology system.**

Index Terms— **perception, vowels, stress, Spanish**

I. INTRODUCTION

A. Why Vowel Endings and Stress Matter When Teaching Spanish

Vowel sounds in Spanish are crucial for the distinction of person- number and tense in verb endings. The linguistic competence in Spanish that teachers aim to develop in students crucially implies appropriate management of person-number and tense features, which are carried out mainly by stressed or unstressed vowels in the last two syllables of each verb.

Spanish vowels /a, e, o/ have a communicative load that is essential for identifying tense and mood in 1st and 3rd person singular verb endings: *toma* (3rd sg. present indicative), *tome* (1st and 3rd sg present subjunctive), *tomo* (1st sg. present indicative), *tomara* (1st and 3rd person imperfect subjunctive), *tomaré* (1st future indicative).

Besides, stress also operates functionally on /a-e-o/ to differentiate person, tense and mood features in otherwise identical verb forms: *toma* (3rd sg. present) vs. *tomá* (2nd sg. imperative), *tomara* (1st and 3rd sg. imperfect subjunctive) vs. *tomará* (3rd sg. future indicative), *tome* (1st and 3rd sg present subjuntive) vs. *tomé* (1st sg preterite indicative), *tomare* (1st and 3rd sg future subjuntive) vs. *tomaré* (1st sg. future indicative), *tomo* (1st sg. present indicative) vs. *tomó* (3rd sg preterite).

Spanish being a pro-drop language (Zagona, 1988), i.e. a language that preserves the optionality of subject pronouns (Green, 1990, p. 245), the foreign student should learn to rely on verb endings and not on pronouns to identify the subject. Vowel endings and stress matter when teaching Spanish because every 1st and 3rd person singular verb form in Spanish but *es* ends in a vowel, independently of tense or mood. Vowel endings have different meanings whether stressed or unstressed.

B. Vowels in Spanish and English

The vowel systems of Spanish and English differ significantly. English has a relatively crowded vowel system in comparison to the Spanish vowel inventory: 11-12 nonrhotic vowels /iː, ɪ, eᴵ, ə, ɛ, æː, ɑː, ʌ, ɔː, oᵁ, ʊ, uː/ that vary in height (four levels) (Quilis & Fernández, 1982) and backness (front versus back), and two rhotic vowels /ɚ, ɝ/ and three true diphthongs /aɪ, ɔɪ, aʊ/ . In many dialects of American English, "the distinction between /ɑː, ɔː/ has been neutralized to a low, slightly rounded /ɒː/" (Nishi, Strange, Akahane-Yamada, Kubo & Trent-Brown, 2008, p. 577). Spanish, in contrast, has only 5 monopthongs /i, e, a, o, u/(Navarro Tomás, 1966; Quilis & Fernández, 1982; RAE, 2011; Schwegler, Kempff, & Ameal-Guerra, 2010) which vary in three levels of height (close/high, mid, open/low), and

fourteen diphthongs /ai, ei, oi, au, eu, ou, ja, je, jo, ju, wa, we, wi, wo/ (Alarcos Llorach, 1983; Quilis & Fernández, 1982).

The first part of English long vowels /eɪ/ and /oʊ/, is closer to the Spanish vowels /e/ and /o/ than any other monophthong from the English system, and may lead to interference or transfer (García de las Bayonas, 2004). Though there are some Spanish and English vowels in the same slots of Figure 1, it should not be assumed that they are the exact same sounds in both perception and production; Spanish and English vowels differ in their quality.

Figure 1. English and Spanish (Between Brackets) Vowels Classified in Terms of Openness and Backness (Adapted from ANAE, 2006, p. 13; García de las Bayonas, 2004, p. 11; IPA, 2005; Vergun, 2006, p. 24)

(F2)	Front	Central	Back
(F1) Close/High	i [i] ɪ		u [u] ʊ
Close/High-Mid	eᴵ [e]	ə	oᵁ [o]
Open/Low-Mid	ɛ æ	ɜ	ʌ ɔ
Open/Low		[a]	ɑ

C. Stress in Spanish and English

Both English and Spanish are frequently classified as free stress (unpredictable, lexically specified) languages (Altmann, 2006, Saalfeld, 2012) but in fact, they could be placed somewhere in between as having partially lexical and partially phonological stress (Kijak, 2009).

Altmann (2006) justifies the classification of English and Spanish within non-predictable stress languages by stating that the phonological shape of a word alone could not determine the position of stress within a word in any of the languages. In both English and Spanish, stress is contrastive (i.e. it is used to make lexical distinctions), and therefore, it is encoded in the phonological representation of each word.

In Spanish, vowels are given their full quality either when stressed or unstressed, contrary to English where the stressing of vowels in one syllable is systematically accompanied by vowel reduction in one or more surrounding syllables (Tyler & Cutler, 2009). These differences may have consequences in the way English speakers process stress in Spanish.

In terms of frequency of occurrence, stress in Spanish falls on the penultimate syllable of vowel-final words and on the final syllable of consonant-final words (Green, 1990; Navarro Tomás, 1957; RAE, 2012), but this rule applies only to nonverbs. Verb stress, however, is morphologically governed, i.e. predictable from the number/person features of the subject or from the tense/mood/aspect features of some verb form but not from its phonological properties. For example, penultimate stress is the norm for 1st and 3rd person singular present tense forms (*lloro* 'I cry'), and final stress is the norm for 1st and 3rd person singular of regular past tense forms (*lloró* 'I cried'), and strong irregular past tense forms have penultimate stress as the norm (*hice* 'I did').

Based on frequency facts, the most common stress pattern in English, just like in Spanish, is stress on the penultimate syllable (Clopper, 2002; Murphy & Kandil, 2004). The main difference between both languages regarding stress is that in English it is not used to signal contrasts within verb forms but to signal noun-verb and noun-adjective contrasts such as **im**port / im**port** and **con**tent / con**tent**.

D. Predicting Phonological Difficulties Regarding Vowel Endings

Theories of L2 speech learning like the Speech Learning Model (SLM, Flege 1988, 1995, 2003), and the Second Language Linguistic Perception Model (L2LP, Escudero, 2005) posit that at the initial state of L2 learning, L2 sounds are perceived through the L1 speech perception system which interferes with the development of L2 sound categories. Both models predict difficulty in both perception and production experienced by L2 adult learners depending on whether *new* or *similar* sounds are involved. However, the predictions that these models make for those learning scenarios are different.

SLM (Flege, 1995) hypothesizes that a *new* sound (very different from any L1 category) will not be perceptually assimilated to any L1 category and eventually an L2 category will be created. He posits that L2 learners will not face major difficulties when perceiving *new* L2 sounds. However, SLM claims that if there are insufficient perceived

differences between an L2 sound and the closest L1 sound (*similar* sounds), then the L2 sound will be treated as equivalent to the L1. The L1 and the L2 will be combined as a *diaphone*, a single category used for both sounds which has properties of the L1 and the L2. This learning scenario may lead to perception and production difficulties.

In contrast to SLM's predictions, L2LP hypothesizes that *new* sounds will be more difficult to perceive than *similar* sounds because of the number and nature of the learning tasks that learners have to perform. According to the L2LP (Escudero, 2005), in the *similar* L2 learning scenario, the learner equates two L2 phonemes with two L1 phonemes. However, if two L2 sounds are equated to one L1 sound, the learner faces a *new* learning scenario. Unlike the *new* scenario, L2 learners faced with a *subset* scenario use part of their existing L1 categories (i.e. a *subset* of the L1 vowels) in their L2. The *subset* scenario was addressed in Escudero & Boersma (2002) as *multiple category assimilation* (MCA) but in L2LP Escudero (2005) refers to it as the "*subset* L2 perception scenario" (p. 204).

According to both the SLM and the L2LP, Spanish and English /e/ and /o/ would be considered *similar* sounds. These sounds have been treated as similar sounds across languages in Bradlow's study (1995). Similarly, English speakers were reported to assimilate Spanish /e/ and /o/ to English /eɪ/ and /oʊ/ in Morrison's (2003) study though in a following study he considered Spanish /e/ to be a subset sound, assimilated to some instances of English /ɛ/ and some instances of English /ɪ/ (Morrison, 2006).

Models differ in relation to the low vowel. In terms of the SLM, Spanish low central /a/ would be a *new* sound for English speakers because they have a low front vowel /æ/ and a low back vowel /ɑ/ but no low central vowel, as described by Bradlow (1995). In contrast, L2LP would not consider Spanish /a/ a *new* sound for English speakers because this model assumes that in this scenario the speakers' L1 has fewer categories than the L2. The opposite to the *new* learning scenario is the *subset* scenario, which is true for English speakers as their L1 has more sounds than the target language. In this case, Spanish /a/ would be assimilated to two or more English sounds, /æ + ʌ + ɒ + ɛ/, through *multiple-category assimilation* (MCA, Escudero & Boersma, 2002), as shown in Morrison's study (2003).

Considering that both models make different predictions in relation to the target vowels, in this study we will attempt to test them. We hypothesize with SLM that *similar* vowels like Spanish /e/ and /o/ and English /eɪ/ and /oʊ/ would pose the most difficult challenge to English speakers while the *new* Spanish low central vowel /a/ would not be problematic for them. If so, English speakers learning Spanish will fail to hear crucial grammatical features: those related to the e/o difference in verb endings.

E. Predicting Phonological Difficulties Regarding Stress

It remains uncertain which stress properties of the native language actually affect L2 acquisition. Two theory-independent stress perception models have been proposed to predict learners' stress perception performance, based on their L1 stress systems. Both models were tested with learners with different L1s.

The Stress Deafness Model (SDF, Dupoux et al. 2001, Pepperkamp & Dupoux 2002) predicts that the rate of success in perceiving stress differences in a language decreases with increasing regularity (predictability) of stress assignment in the L1. The more regular the L1 stress system is, the more difficulties learners would have in perceiving stress contrasts in a language. Dupoux et al. (2001) found that native speakers of French, in contrast to those of Spanish, showed stress 'deafness', i.e. had difficulties in discriminating stress contrasts. In French, stress is non-contrastive (predictable). In Spanish, however, stress is used to make lexical contrasts (unpredictable). Pepperkamp & Dupoux (2002) examined three other languages with non-contrastive stress and different degrees of stress regularity, Finnish, Hungarian and Polish, and proposed a *stress deafness* hierarchy, classifying languages from Class I (major difficulties in distinguishing stress contrasts) to Class IV (almost no problems distinguishing stress contrasts).

It is worth noticing, however, that the Stress Deafness Model accounts only for learner's general perception ability, and thus, does not make specific predictions about L2 acquisition (Altmann, 2006). Moreover, it fails to consider (phonologically) unpredictable stress languages (i.e. English and Spanish) or non-stress languages (i.e. Chinese and Japanese).

The Stress Typology Model (STM, Vogel, 2000; Altmann & Vogel, 2002), expands on the SDM as it not only includes predictable stress languages, but also unpredictable stress languages and non-stress languages. The STM predicts different degrees of difficulty regarding the acquisition of primary word stress in a certain L2 by speakers of different L1s. This model classifies languages into two categories: stress languages and non-stress languages. Within these categories, stress languages are further divided into predictable and unpredictable categories, and non-stress languages are divided into pitch and non-pitch languages. Speakers of non-stress L1s (i.e. Chinese and Korean) are expected to best perceive L2 stress because there are no L1 stress setting parameters (stress properties) that could interfere with L2 acquisition (i.e. in STM's words, no-stress languages have negative (no) L1 stress setting parameters). Speakers of predictable stress languages (regular stress assignment) (i.e. Arabic and French) will have more problems perceiving the location of stress than unpredictable languages (i.e. Spanish and English) and non-stress languages.

So, assuming the STM's predictions for stress perception, no problem is predicted for English and Spanish. That is, English speakers should perform like Spanish native speakers because Spanish and English share the same stress parameters (properties) (Altmann, 2006, p. 39).

II. THE CURRENT STUDY

The present study investigates both the perception of Spanish vowels /a, e, o/ in word – final position and the perception of final and penultimate stress by beginner American English learners of Spanish, and explores whether beginner learners improve their perception accuracy of vowel and stress contrasts after 90 hours of a Spanish course in the Programa Mar del Plata, Argentina.

The Programa Mar del Plata (Cortés & Menegotto, 2000; Menegotto, 1999, 2005, 2007) is a three–week immersion Spanish language program addressed to young adult students who are supposed to fulfill in three weeks the requirements of two regular courses from an American university (Span 201 and 202) carried out at the Universidad Nacional de Mar del Plata (UNMdP). Students are exposed to 60 hours of in class Spanish language interactions among themselves and with the native teacher and 30 hours of 'real world' outside classroom natural interactions with native speakers [1].

The general research questions are:
1. Do English speakers succeed in perceiving Spanish vowels like native speakers?
2. Do English speakers succeed in perceiving Spanish stress like native speakers?
3. Are the 90 hours course load of exposure to Spanish enough to improve students' vowel and stress perception?

III. METHOD

Perceptual identification tests at the beginning and at the end of the Programa were carried out to answer these questions. A group of American students and a group of native Argentinian speakers participated in this study. Participants' perception was assessed by a test administered together with the placement tests on the first day of the Program (the pretest) and repeated with the final exams on the last one (the posttest). The test consisted of identification tasks with nonce words.

A. Participants

The participants were 17 American English speakers (4 male, 13 female) and seven Spanish speakers (2 male, 5 female) (Table 1). All English speakers were enrolled in the Programa Mar del Plata, Argentina, and were students of several colleges located in New York City. They had to fulfill the requirements of either SPAN 102, 201 or 202.

The test was administered to all students but learners who spoke a first language other than English were not included in the data analysis. The learners' average age was 22.6 years. They were all born in the United States; 13 were born in New York. They all began to learn Spanish either in high school or college. Seven learners had prior knowledge of a third language, mostly French, but also Italian, Portuguese and Polish. The control group was seven Argentinians who spoke River Plate Spanish as L1. They had an average age of 27.4 years at the time of testing, and were born in the city where this study was conducted. Neither of the speakers in this study reported any speech or hearing problem.

B. Pretest and Posttest

English and Spanish speakers performed the same test on day 1 (first day at the University, though not first day in Argentina), from now on pretest, and on day 21 (last day of the Program), after 90 hours and three week of project work and Spanish lessons, from now on posttest.

The test consisted of 42 three–alternative forced choice perceptual identification tasks. They were expected to select the trisyllabic nonce words they heard, naturally produced by a female Argentinian contrasting /a, e, o/ in stressed and unstressed word final position. Nonce or non-existent words were used in the perception task as done in several other perception studies (Altmann, 2006; Bullock & Lord, 2003; Dupoux et al., 2001; Kijak, 2009; Pepperkamp & Dupoux, 2002) to avoid a possible effect of familiarity with a real word, or of memorized information regarding the stress location in a lexical item. The test included 42 triplets that differed only in the final vowel and/or stress. Learners heard a target word and checked the answer on their working sheet, for example (1) SEMAPA – (2) SEMAPÁ – (3) SEMAPO.

The 42 non–existent test items did not violate phonotactic constraints of Spanish, and therefore, could be novel words in Spanish. Word–final stressed and unstressed /a, e, o/ appeared twice in each of the three possible triplet word positions in the task, first, second and third. Moreover, each of the three vowels appeared three times in combination with the other two unstressed and stressed vowels (a–o, a–ó, a–e, a–é; o–a, o–á, o–e, o–é; e–a, e–á, e–o, e–ó) after the

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[1] Mar del Plata is a main touristic spot in Argentina, well known because of the wonderful beaches crowded with young people and its amazing night life together with entertainment facilities for the whole family. So the Program was designed to both warrant the student's learning the language and their experiencing the life of the city. The syllabus is based on project work with TAs. TAs are students of Language Arts from Universidad Nacional de Mar del Plata, native speakers of Spanish, who work with the foreign students every afternoon to give them guidance and help in the process of achieving their projects. Foreign students are grouped in teams of 3 to 5 people and assigned a TA, who will help them to develop weekly projects. Project work is a language learning and cultural experience carried out partially outside the classroom which offers the learner an opportunity to take a certain responsibility for their own learning, settle their own objectives for the project and the end-product to be achieved. Project work is carried out during afternoons, while the 4 hour morning classes offer the communicative and grammatical content needed to carry out the project. (Menegotto, 1999; 2005, 2007, Cortés & Menegotto 2000).

following consonants /p, t, k, s, f, r/ (36 stimuli). Within the triplets six distractors were included ending in unstressed and stressed /ɪ, u/.

Soundfiles for the perception test were recorded with Audacity 1.2.6 and downsampled (22050HZ).

The test was carried out in the language lab of the Faculty of Humanities at UNMdP. After the perceptual test, a questionnaire was administered to the participants to collect basic sociolinguistic information. Participants were selected based on the information on the questionnaire.

In the current identification tasks, learners were forced to identify the target vowel against two other possibilities, a task that may be more challenging to the listener than the discrimination task adopted in previous L2 studies discussed earlier. Identification tasks are believed to be more effective in aiding learners to form L2 categories than the discrimination tasks (Jamieson & Morosan, 1886, 1989).

C. Data Analysis

To score the perception tasks, it was first determined if a participant responded correctly or incorrectly to each word, that is, whether (1) the target vowel was perceived; (2) stress was indicated on the syllable that was stressed at the stimuli.

The Statistical Package for the Social Sciences (SPSS Inc. version 20.0.0) was used to examine the data. Both descriptive and inferential statistics were used. Statistical procedures included (1) independent sample T tests to compare pre and post-test differences in mean percentage correct identification scores between English and Spanish groups, (2) paired T tests to assess improvement from pretest to posttest after three weeks of exposure to L2 Spanish. To investigate whether the listeners perceived vowels and stress differently, the English and Spanish groups' correct identification scores were broken down to three individual vowels (i.e. /a, e, o/) and to two individual stress patterns (i.e. final and penultimate stress). Then, the groups' identification scores on final and penultimate stress were subdivided into the three individual vowels. A significance level of 0.05 was used for all inferential statistics. Mean percentage correct identification scores were converted to arcsine values.

The Spanish native speakers completed the perception task once, so the same data were used to compare learners' pretest results and posttest results.
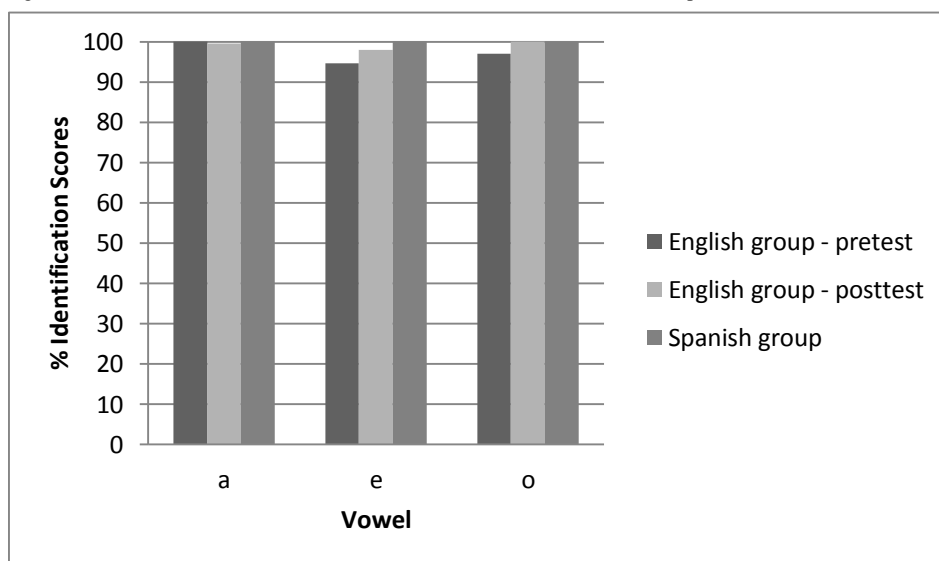
IV. RESULTS

A. Results on Vowel Perception

Pretest and Posttest

Overall results. The pretest mean percentage correct identification scores by each group were 97% for the English group and 100% for the Spanish group. The independent sample *t*-test performed to compare mean correct identification scores between the English and the Spanish groups yielded a significant difference between the groups $t(16.000)=$ 4.484, *p*= .000. These results indicate that, overall, the English group was less accurate than the Spanish group in the perceptual identification of Spanish vowels. In fact, even though there was a statistically significant difference between the groups, 76,5% of subjects identified Spanish vowels with a 97% or more accuracy, indicating that the English learners were actually highly accurate in the perception of vowels.

Posttest results showed no significant difference between the groups on the perception of vowels $t(16,000)=1.826$, *p*=.087. Overall, the mean percentage correct identification scores were 99% for the English group and 100% for the Spanish group. With some exposure to the L2, the English speakers could perform like the Spanish speakers in vowel perception.

Individual vowels. The pretest and posttest mean scores for each group on each vowel are presented in Figure 2. The groups differed in the perceptual identification of /e/ $t(16.000)=3.290$, *p*=.006, and /o/ $t(16.000)=2.530$, *p*=.022. However, the English and the Spanish speakers did not show differences in their performance on the perception of Spanish /a/ at the outset of the study. The fact that there is no significant difference in the perception of vowels in the posttest renders redundant the analysis of individual vowels.

Figure 2. Pretest and Posttest Mean Correct Identification Scores of the Three Spanish Vowels for Each Group


B. Results on Stress Perception

Pretest and Posttest

Overall results. The mean percentage correct identification scores of Spanish stress in the pretest and the posttest for the English and the Spanish groups are presented in Figure 3. The independent *t*-test performed to compare perceptual identification of stress between the English and the Spanish groups in the pretest revealed a significant difference between the groups $t(22)=8.315$, $p= .000$. This result indicates that at the outset of the experiment the English speakers displayed a poor performance in the perceptual identification of stress.

Overall, the identification scores were 86% for English speakers and 98% for Spanish speakers in the posttest. The results after three weeks of exposure to Spanish revealed a significant difference between the English group and the Spanish group $t(22)=2.587$, $p=.017$ in the perception of stress. Even after three weeks of exposure to the target language, the English speakers could not perceive stress contrasts in Spanish like native speakers.

Figure 3. Pretest and Posttest Mean Percentage Identification Scores of Spanish Stress for the English Group and the Spanish Group
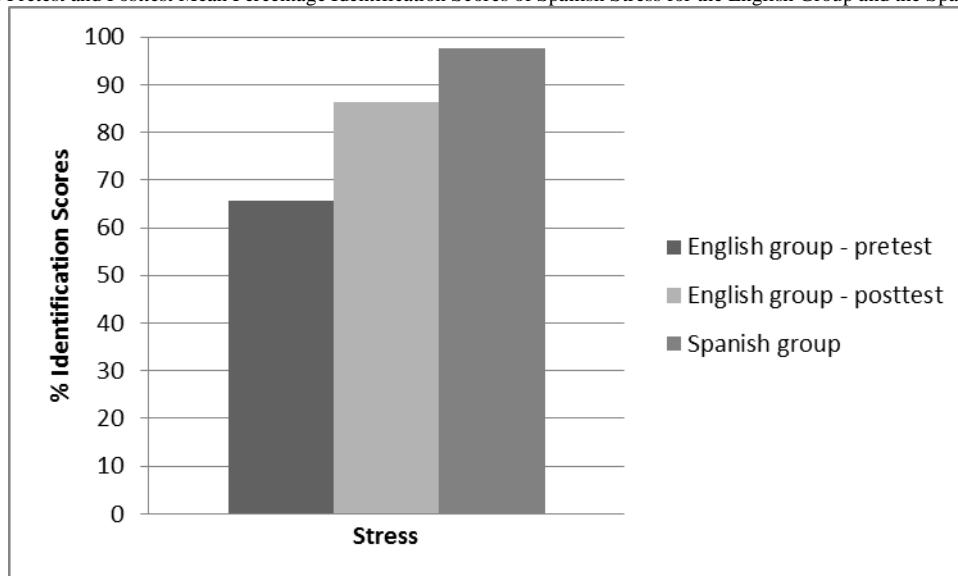

Individual stress patterns. The mean scores for each group on each stress pattern in the pretest and the posttest are presented in Figure 4. A significant difference between the English group and the Spanish group in the perceptual identification of both final stress $t(22)=8.763$, $p=.000$, and penultimate stress $t(22)=3.689$, $p=.001$, was found at the outset of the study.

However, the results after three weeks indicated a significant difference between the English and the Spanish groups in the identification of final stress $t(22)=3.172$, $p=.004$, but no significant difference in the identification of penultimate

stress $t(22)=1.555$, $p=.134$. Contrary to what happened with vowels, even after being immersed in the Spanish language for some weeks, English speakers did not identify final stress in a native-like manner. English speakers, however, reached native levels of accuracy in the perception of penultimate stress after exposure to the target language.

Figure 4. Pretest and Posttest Mean Percentage Identification Scores of Spanish Final and Penultimate Stress for the English Group and the Spanish Group
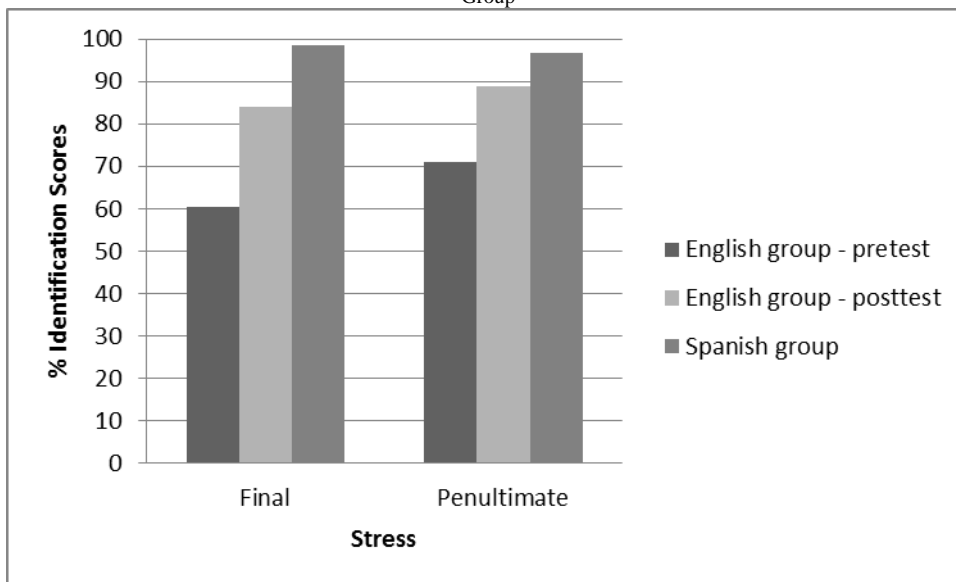

C. Results on Stress and Vowel Perception

  Pretest and Posttest
  Overall results. The tests performed on the perception of stress on each of the three word-final vowels in the pretest and the posttest (Figure 5) revealed a significant difference between the groups for each of the three word-final vowels at the outset of the experiment: /a/ $t(21.956)=5.948$, $p=.000$, /e/ $t(7.561)=8.705$, $p=.000$, and /o/ $t(22)=5.882$, $p=.000$. Similarly, the analysis yielded a significant difference between the groups in the perception of stress for each of the three vowels after three weeks of exposure to Spanish: /a/ $t(22)=2.681$, $p=.014$, /e/ $t(22)=2.101$, $p=.047$, and /o/ $t(22)=2.378$, $p=.026$. Overall, these results indicate that even after 90 hours of exposure to Spanish, the English speakers could not handle stress contrast on vowels /a, e, o/ like Spanish native speakers.

Figure 5. Pretest and Posttest Mean Correct Identification Scores of Spanish Stress on the Three Vowels for the English and the Spanish Groups
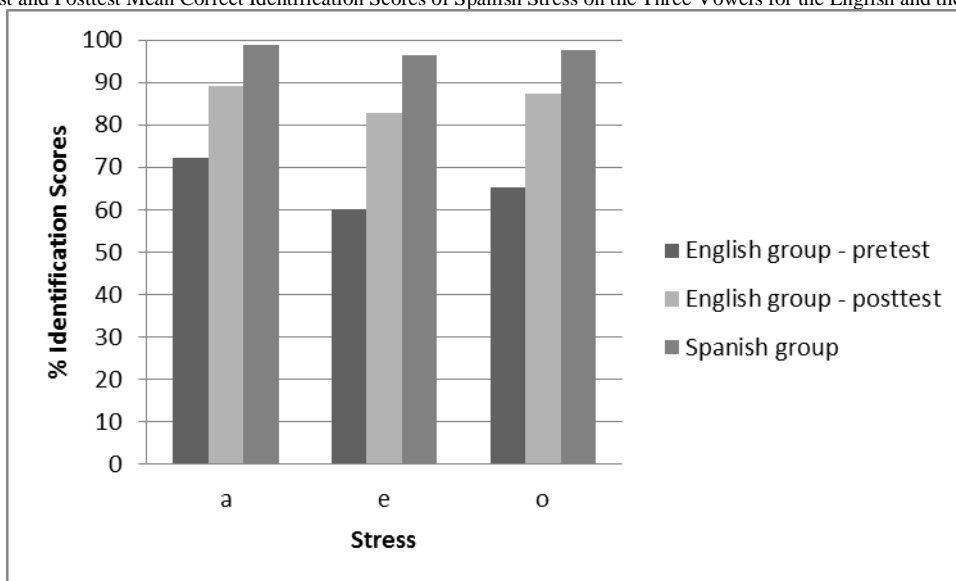
  Individual results. The test for final stress across vowels yielded a significant difference between the groups on the three vowels in the pretest: /a/ $t(16.000)=5.650$, $p=.000$, /e/ $t(22)=4.262$, $p=.000$, and /o/ $t(22)=4.976$, $p=.000$ (Figure 6). The same behavior was found for penultimate stress on the individual vowels: /a/ $t(21.275)=3.309$, $p=.003$, /e/

t(22)=3.281, *p*=.003, and /o/ *t*(22)=2.696, *p*=.013 (Figure 7). Results on both final and penultimate stress show that English speakers performed poorly across each of the three vowels in comparison to the Spanish speakers at the onset of the experiment.

Figure 6. Pretest and Posttest Mean Correct Identification Scores of Spanish Final Stress on Each Individual Vowel for the English and the Spanish Groups
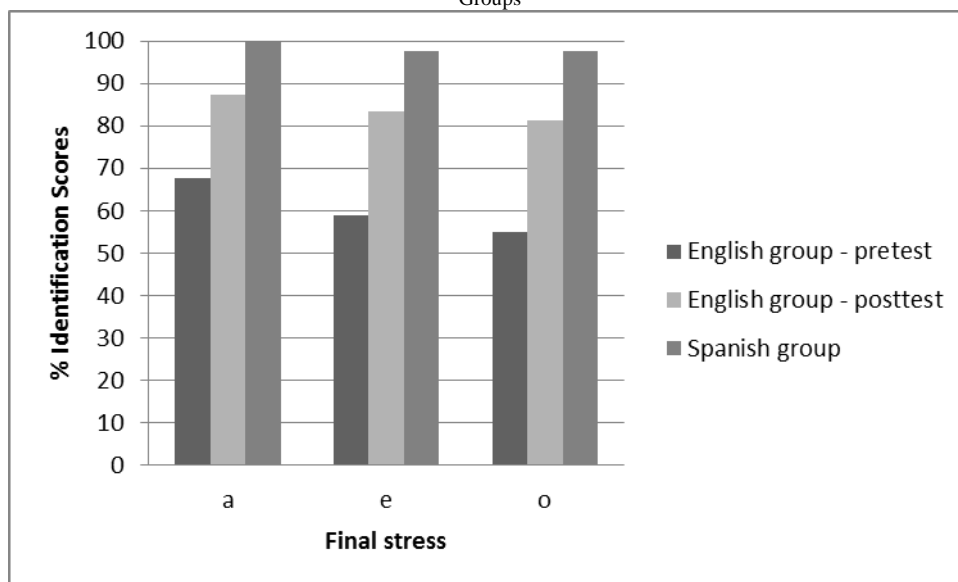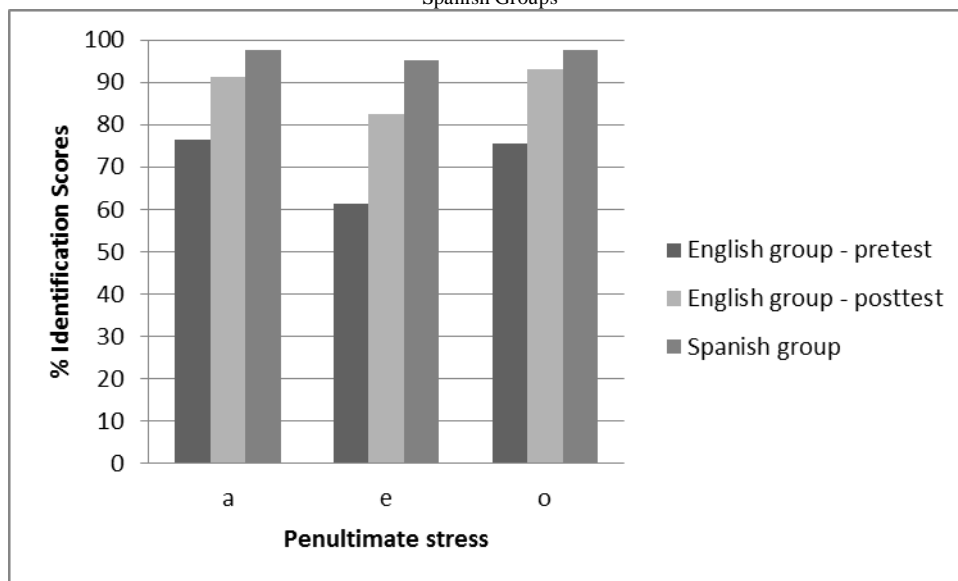

Figure 7. Pretest and Posttest Mean Correct Identification Scores of Spanish Penultimate Stress on Each Individual Vowel for the English and the Spanish Groups

The posttest analysis revealed different results for final and penultimate stress. The *t*-tests on final stress yielded a significant difference between the groups for each vowel: /a/ *t*(16.000)=4.515, *p*=.000, /e/ *t*(19.627)=2.803, *p*=.011, and /o/ *t*(21.189)=2.579, *p*=.017 (Figure 7). Unlike final stress, the results on penultimate stress showed no significant difference for any of the three vowels between the groups: /a/ *t*(18.188)=1.352, *p*=.193), /e/ *t*(17.347)=1.741, *p*=.099, and /o/ *t*(22)=.669, *p*=.511 (Figure 7). These results reveal that English listeners showed difficulties in the perceptual identification of final stress on the three Spanish vowels. Even after several weeks of exposure to the target language, the English listeners still perceived final stress in a non-native like manner. However, they did learn to perceive penultimate stress across vowels in word-final position like Spanish native speakers.

D. Effects of Exposure to L2 Spanish

Vowel Perception

The paired *t*-test performed for the English speaker group on vowel perception performance to assess improvement from pretest to posttest, yielded a significant difference between the pretest and the posttest, indicating a general improvement in vowel identification accuracy *t*(16)=2.583, *p*=.020.

The group's perceptual identification scores were broken down to three individual vowels. The t-tests carried out on each individual vowel showed significant improvement from pretest to posttest solely for vowel /o/ $t(16)=2.530$, $p=.022$. It is important to note that there was no improvement on vowel /a/ because the group's mean identification score was the same in both the pretest and the posttest; they displayed 100% accuracy.

Stress Perception

The t-test revealed that English speakers improved in the perception of stress over time $t(16)=6.672$, $p=.000$. Significant improvement was found in the identification of both final stress $t(16)=4.383$, $p=.000$, and penultimate stress $t(16)=2.618$, $p=.019$ from pretest to posttest (final: 60% vs. 84%, penultimate: 71% vs. 89%), indicating that exposure to the target language brought about improvement in stress perception.

Vowel and Stress Perception

English speakers improved in their perception of stress over time on each of the vowels: /a/ $t(16)=4.099$, $p=.001$, /e/ $t(16)=4.935$, $p=.000$, and /o/ $t(16)=5.664$, $p=.000$.

The analysis of both final and penultimate stress yielded a significant improvement from pretest to posttest in the perceptual identification of final stress on the three vowels: /a/ $t(16)=2.353$, $p=.032$, /e/ $t(16)=2.304$, $p=.035$, and /o/ $t(16)=3.250$, $p=.005$. Similarly, the t-tests revealed a significant improvement over time on the perception of penultimate stress on word-final vowels: /a/ $t(16)=2.637$, $p=.018$, /e/ $t(16)=3.293$, $p=.005$, and /o/ $t(16)=3.589$, $p=.002$. The results displayed indicated that three weeks living and studying in a Spanish speaking country brought about improvement in both stress patterns on each of the three vowels at the initial stage of learning.

V. DISCUSSION

Findings in the present study show that English learners perceived Spanish vowels and stress differently.

At the outset of the experiment, the English speakers showed difficulties in the perceptual identification of /e, o/. As predicted by the SLM, similar vowels like Spanish /e, o/ and English /eᶦ, oᵁ/ posed difficulties to the L2 learner; the similar but not identical L1 vowels seemed to interfere with the perceptual identification of L2 vowels. It is possible that the adult English speakers perceived Spanish vowels in terms of similar English vowels that are phonetically similar to Spanish ones, thus blocking the formation of accurate Spanish categories, as Morrison (2003)'s results suggest. However, an acoustic analysis would be needed to better assess our speculation on how English vowels are mapped onto Spanish vowels.

In relation to the perception of Spanish /a/ by English speakers, our results support SLM in contrast to the L2LP hypothesis: English speakers showed native levels of perceptual accuracy for Spanish /a/ both in the pretest and the posttest.

Even though the English native speakers in the present study showed some difficulties in the perceptual identification of Spanish /e, o/ at the beginning of the experiment, vowel perception was not proved to be a serious problem. The English speakers perceived all three vowels in a native-like fashion after 90 hours of exposure to the language.

While the ability to perceive L2 vowels might not have been a serious problem for English learners of Spanish in the current study, the perception of stress was a central issue. It was observed in the pretest that English speakers had difficulties in perceiving both final and penultimate stress. Our results did not support the predictions made by the Stress Typology Model: non-predictable stress languages like English and Spanish should have no difficulties in perceiving stress contrasts. Similarly, our findings did not confirm Altmann's (2006) in the reverse scenario i.e. English speakers perceiving Spanish stress contrasts. In her study, Spanish speakers did not have problems in perceiving stress contrasts in English, and in fact, they performed like English speakers. English speakers learning Spanish, however, did have problems identifying stress, proving that English speakers and Spanish speakers perceive stress contrasts differently, supporting the results found in Kijak's (2009) perception experiment. Experiments reported by Cutler & Pasveer (2006) testing the role of stress information in word- recognition by native speakers of English, German, Dutch and Spanish (Cooper, Cutler & Wales, 2002; Cutler & Van Donselaar, 2001; Cutler, Norris & Sebastián-Gallés, 2004; Soto-Faraco, Sebastián-Gallés & Cutler, 2001; Van Donselaar, Koster & Cutler, 2005) found significant differences in the way English speakers exploited stress information in word-recognition. English speakers differed from the speakers of the other three languages in that they made much less use of stress cues: in Dutch, German and Spanish stress information reduces considerably the number of candidate words activated in word recognition, while in English it does not. Lexical stress is more useful in spoken-word recognition in Spanish than in English, and consequently, English speakers pay less attention to stress in general which would explain their poor performance in comparison to Spanish speakers[2].

The transfer of an L1 stress pattern or the generalization of the rule of penultimate stress in Spanish could explain the difficulties that English speakers encountered in the perception of final stress. Either the L1 stress pattern interfered in the perception of L2 stress or English speakers generalized the rule of Spanish penultimate stress valid for most vowel ending words except verbs to all cases in which words ended in a vowel. So they may be treating stress as fixed

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[2] For further evidence on the use of lexical stress in word recognition read Cooper, Cutler & Wales, 2002; Cutler, Wales, Cooper & Janssen, 2007.

and not optional. They failed to notice that Spanish speakers do stress word-final syllables ending in a vowel to signal past tense or mood contrasts.

Another question to be answered is why English speakers in this experiment encountered difficulties in the perception of penultimate stress. Soto-Faraco, Sebastián-Gallés & Cutler (2001) addressed the role of suprasegmental and segmental information in the activation of spoken words and found that in Spanish, both are employed in exactly the same way in word activation. Similarly, Cutler (1986) analyzing cross-modal associate priming experiments with minimal stress pairs in English (*trusty- trustee*) argued that suprasegmental differences between minimal stress pairs were useless in constraining lexical activation. She found that suprasegmental information in English is redundant because differences in stress nearly always involve differences in vowel quality, and thus, listeners gain little from paying attention to suprasegmentals in word recognition.

Thus, in English, segmental information outweighs suprasegmental information in lexical activation and miss-stressing in English has no inhibitory effect unless it results in an alteration of vowel quality (Bond & Small, 1983; Cutler & Clifton, 1984; Slowiaczek, 1991; Small, Simon & Goldberg, 1988). English listeners' judgements of stress in English were reported to be mainly determined by vowel quality rather than by any suprasegmental cue (Fear, Cutler & Butterfield, 1995).

In Spanish, vowels are given their full quality either when stressed or unstressed, contrary to English where the stressing of vowels in one syllable is systematically accompanied by vowel reduction in one or more surrounding syllables (Tyler & Cutler, 2009). These differences may have consequences in the way English speakers process stress in Spanish. If they transfer this processing practice to Spanish, it would be useless because Spanish vowels do not suffer vowel quality changes neither in stressed nor in unstressed syllables.

Cutler (2009, p. 3522) distinguishes three syllable types in English: "stressed with a full vowel (common), unstressed with a reduced vowel (common) and unstressed but with a full vowel (rare)." This latter case would be of interest for the present study as English speakers had a hard time perceiving penultimate stress, i.e. they perceived Spanish word final unstressed syllables with full vowel as a word final stressed syllable with full vowel. Fear, Cutler & Butterfierld (1995) studied the production and perception of syllables in English, which varied in vowel quality (full, reduced) and stress, by native English speakers. The authors found that listeners made a distinction between stressed and reduced vowels, grouping unstressed unreduced vowels (i.e. full vowels in unstressed syllables) by preference with stressed vowels. This preference could be observed in the present study, as English learners treated word-final unstressed vowels (which are always full in Spanish) as stressed.

The results of the posttest showed that English speakers learned to perceive penultimate stress like Spanish native speakers while they continued identifying final stress inaccurately. Though learners' perceptual accuracy of both stress patterns improved significantly after 90 hours of exposure to Spanish, more hours of exposure might be necessary for final stress to be perceived in a native-like manner. English listeners in the present study showed a clear tendency to perceive final stress as penultimate stress in accordance with the stress assignment in their L1. Exposure to Spanish alone might not be enough to help the English speakers identify final stress accurately. Future studies need to assess whether targeted training on stress contrasts would bring about enough improvement on the perception of final stress so as to help English speakers perceive this stress pattern like Spanish native speakers.

VI. Conclusions

As every teacher hopes, learners improved in their perception from pretest to posttest. After 90 hours of exposure to Spanish over a three–week course, English speakers significantly improved in both vowel and stress perception. Exposure was more effective for vowel than for stress perception as English speakers could not perceive final stress in Spanish in a native–like manner.

As predicted by Flege´s SLM, vowel perception difficulties did not appear for /a/, which is a new sound for English speakers learning Spanish. Though scarce, perception difficulties appear when L1 and L2 vowels are similar, as is the case for English /eᴵ, oᵁ/ and Spanish /e, o/,.

However, stress seems to be a major problem for English speakers learning Spanish, in contrast to the predictions made by the STM (Vogel, 2000; Altmann & Vogel, 2002). The English speakers performed poorly in the perception of both final and penultimate stress across the three Spanish vowels when compared to the Spanish speakers. Though they significantly improved in both stress patterns after the three-week Program, English speakers did not reach a native like command of final stress. Stress on the final syllable of a word was the most difficult to identify, in accordance with their L1 stress assignment.

Though 90 hours and three weeks of exposure seem enough to achieve native like perception of vowels in word–final position, it seems that the English speakers might benefit from targeted training on stress contrasts to improve their stress perception.

There are some major limitations that need to be acknowledged and addressed regarding the present study. First, results need to be replicated with a larger number of learners and with different language levels, to check after how many hours of exposure to the language stress perception improvement reaches native like command, if ever. Second, future research needs also to examine whether strictly perceptual or morphologically redundant training has any effect

on stress perception: would training with nonce words have any effect on stress perception of real words or should training with verb contrasts facilitate stress perception?

The issue is by no means minor. In the Spanish verbal morphology system, vowel and stress are key to interpreting the meaning of a verb.

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