Phonological and Phonetic Aspects of the L2 Acquisition of French and Spanish Stress

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1. Introduction

The acquisition of stress[1] in a second language (L2) is a core part of learners' overall prosodic organization of utterances. Most research to date, which has concentrated primarily on English as a target language, has shown that this involves both phonological and phonetic aspects, namely determining the location of prominence and the particular acoustic parameters used to realize it[2]. Determining the prosodic domain in which stress is assigned is necessary when acquiring the phonology of stress, as even typologically related languages such as French and Spanish may differ in this regard. Phonetically, learners must determine how prominence is conveyed, potentially using temporal versus spectral parameters or a combination of both in stressed and unstressed syllables. Specifically, learners have to determine several aspects of the target language. First, they need to establish whether the language they are acquiring has a fixed or variable[3] stress pattern. In the case of variable stress, learners need to determine which linguistic factors condition it. For example, in English and Spanish, as opposed to French, the position of stress is variable, but Spanish, as opposed to English, exploits stressed-based meaning differences more than English. Whereas most stress contrasts in English distinguish words that belong to different grammatical classes (nouns versus verbs or adjectives), in Spanish, stress productively distinguishes meanings within a class. To illustrate, consider the English noun and verb *produce*:

(1) *produce* (noun) ['pɹo.dus]

(2) *produce* (verb) [pɹə.'dus]

In Spanish, stress placement marks, among other things, the difference between the present subjunctive (3) and the preterit (4):

(3) *yo cante* 'that I sing' ['kan.te]

(4) *yo canté* 'I sang' [kan.'te]

Finally, learners need to acquire the specific acoustic cues (amplitude, duration, and/or pitch) that are used to signal prominence in the target language.

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[1] French stress may be more accurately described as phrasal prominence, since prominence in French is not usually analyzed at the word but rather at the level of the Accentual Phrase (Jun & Fougeron, 2002). While our analysis reflects this difference, we use the term *stress* for both languages. Phonological and phonetic characteristics of stress in English, French, and Spanish are discussed in §2.

[2] The phonology versus-phonetics dichotomy is not universally accepted. We distinguish between these two aspects given that, unlike previous research, we consider both accurate placement and acoustic realization.

[3] As one reviewer pointed out, it is alternatively possible to describe English and Spanish stress as lexical and French stress as non-lexical (see §2 for a more detailed description of prominence in the three languages involved in this study).

 Selected Proceedings of the 6th Conference on Laboratory Approaches to Romance Phonology, ed. Erik W. Willis et al., 129-144. Somerville, MA: Cascadilla Proceedings Project.

Most of the previous research in this area has focused on either the phonetic or the phonological aspect of the L2 acquisition of stress. The goal of the current production study is to investigate both aspects concurrently, focusing on two target languages (French and Spanish), which are frequently acquired in the North American context by native English speakers. The choice of languages is also motivated typologically. French differs from Spanish and English phonologically, having a different stress assignment domain (word level prominence in English and Spanish versus phrasal-level prominence in French). Spanish and French, though, are more similar phonetically in the acoustic parameters used to convey prominence: duration and pitch are the most important cues and stressed and unstressed vowels are similar in quality. In contrast to English, there is very little unstressed vowel reduction in these languages[4].

In the next section (§2), we will elaborate further on the differences between the languages being studied, briefly summarize the main findings of previous research on the L2 acquisition of stress, and present the hypotheses tested in the experimental study. Section §3 then discusses the method of our study, followed by the results (§4). The implications of our results for our understanding of the L2 acquisition of Romance languages will be addressed in (§5), followed by a brief conclusion in (§6).

2. The phonology and phonetics of stress: Cross-linguistic and language-specific aspects

2.1. Phonological and phonetic aspects of stress cross-linguistically

Before examining the particulars of the languages studied here, we first consider phonological and phonetic aspects of stress observed cross-linguistically. Using metrical theoretical terms (e.g., Selkirk, 1984; Halle & Vergnaud, 1987; Hayes, 1995), one can describe stress placement as involving the phonological construction of metrical feet. Foot shape varies cross-linguistically in terms of (i) size (bounded versus unbounded), (ii) headedness (iambic versus trochaic), and (iii) the role of rhyme shape in determining syllable weight and headedness (i.e., prominence)[5]. Phonetically, speakers must consider the realization of both stressed and unstressed syllables. The acoustic correlates of stress are multiple including duration, pitch, and intensity (e.g., Cruttenden, 1997; Rogers, 2000). Languages differ not only in the selection of cues but also in their relative importance. Vowel reduction, from both a temporal and spectral perspective, is one cue that may be used in unstressed syllables. Temporal vowel reduction involves the shortening of an unstressed vowel compared to its stressed counterpart. Spectral vowel reduction concerns the quality of the vowel, specifically the degree to which the vowel in question is more centralized with respect to its stressed counterpart (Ladefoged, 2001). Finally, given the potential durational differences between stressed and unstressed vowels, the stressed-to-unstressed duration ratio plays an important role, not only in the phonetic realization of stress itself, but also in the interaction between stress and rhythm.

2.2. The phonology and phonetics of stress in English, French and Spanish

Having looked at the phonology and phonetics of stress in the previous section, we now turn to the particulars of the three languages involved in the study – English, French and Spanish. Table 1 summarizes the metrical differences relevant to the present study. Foot formation in English, the learners' L1, differs significantly from French but less so from Spanish, the target languages investigated here. While English has a trochaic system and Spanish has a hybrid trochaic-iambic[6]

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[4] This is particularly true of controlled speech samples, as at least some degree of vowel reduction has been documented in a conversational French speech corpus (Meunier & Espesser, 2011). Vowel reduction in Spanish has also been observed in some Andean regions (see footnote 7) but not in the Colombian variety of Bogotá (Lipski, 1994) spoken by the native speaker controls in the present study (see §3).

[5] The list of metrical parameters discussed here is not exhaustive. We focus on those most important for the descriptive comparison of English, French, and Spanish.

[6] While a hybrid system is not possible within parametric metrical theory, our use of the term *hybrid* is for descriptive purposes. Indeed, formal analyses of Spanish stress (e.g., Roca 1988) distinguish the nominal from the verbal system. In the nominal system, the default rhythmic pattern is trochaic; words with ultimate and penultimate stress, albeit present, are extremely less frequent.

system, both of which involve bounded feet, French can be analyzed as having unbounded iambic feet. An English-speaking learner of Spanish does not need to relearn either of these phonological properties. In contrast, English speakers learning French must adjust both foot size and headedness. Additionally, learners of French must increase the size of the domain of stress assignment from the prosodic word to the accentual phrase.

	Parameters	
	Foot size: Bounded/Unbounded	*Headedness: Trochee/Iamb*
English	Bounded	Trochee
French	Unbounded	Iamb
Spanish	Bounded	Trochee/Iamb

Table 1. Foot size and headedness in English, French, and Spanish.

In stressed syllables, the phonetic correlates of stress also differ in these three languages as summarized in Table 2. In English, pitch and, to a lesser degree, duration, play the most important roles as cues to stress (e.g., Cruttenden, 1997; Sluijter, Van Heuven & Pacilly, 1997; Ladefoged, 2003). In French, duration would seem to be most important, followed by pitch and amplitude (e.g., Vaissière, 1991; Lacheret-Dujour & Beaugendre, 1999). In Spanish, duration, pitch, and amplitude are in a trading relationship with their relative importance depending on both sentence and vowel type. Duration, however, is almost always present as one of the cues (Ortega-Llebaria, 2006; Ortega-Llebaria & Prieto, 2011).

	Stressed Syllables		
	Duration	*Pitch*	*Amplitude*
English	Important	Most important	Of lesser importance
French	Most important	Important	Of lesser importance
Spanish	(Most) important	Important	Of lesser importance

Table 2. Relative importance of English, French, and Spanish stressed syllable acoustic parameters.

The phonetic realization of stress is also cued by the contrast between stressed and unstressed syllables. Table 3 highlights the phonetic parameters involved in the realization of unstressed syllables of the languages in this study. While unstressed vowels are centralized in English (e.g., Rogers 2000; Ladefoged, 2001; Braun, Lemhöfer & Cutler, 2008), this is not the case in French or Spanish[7] (Picard, 1987; Hualde, 2005). In terms of duration, stressed vowels can be up to twice as long as their unstressed counterparts in French (e.g., Pasdeloup, 1992; Léon, 2007). In English, stressed vowels are approximately 50% longer than their unstressed counterparts while in Spanish the difference has been reported to range from 10% (Delattre, 1966) to 20 or 30% (Quilis & Esgueva, 1983).

	Phonetic parameter	
	Vowel reduction	*Stressed-to-unstressed duration ratio*
English	Yes	1.5
French	No	2
Spanish	No	1.1-1.3

Table 3. Phonetic parameters of unstressed syllables in English, French, and Spanish.

To summarize, what must English-speaking learners of French and Spanish learn about their respective target language? The former must acquire a completely different phonological system in which the domain of stress assignment is larger and involves different foot size and headedness:

[7] Unstressed vowel reduction has been observed in some areas of Mexico and a few Andean regions (see Delforge, 2008 for the latter).

French has an iambic, unbounded foot isomorphic with a lexical phrase whereas English has a bounded, trochaic foot. Phonetically, these learners must also learn that duration is the most important stress correlate and that unstressed vowels do not undergo significant reduction in French as they do in their L1 English. L2 learners of Spanish are confronted with a rather similar stress system from a phonological point of view – in both English and Spanish, the trochaic pattern is the most frequent. Acoustically, the cues to stress in stressed syllables are also quite similar in English and Spanish but English speakers must learn, like their French-learning counterparts, that unstressed vowels do not undergo significant reduction in Spanish.

Having considered the phonological aspects as well as the phonetic realization of stress in English, French, and Spanish, we now turn to previous research that has investigated the L2 acquisition of these aspects.

2.3. L2 acquisition of stress

Some recurring themes that are relevant to the current study emerge in previous studies on the L2 acquisition of stress. The studies that we mention here all involve one of the three languages of the present study (English, French or Spanish). Overall, L2 learners, regardless the L1-target language pairing, experience some difficulty when acquiring stress. Our hypotheses for the present study all assume some degree of L1 (English) influence. A number of studies have looked at the effect of cross-linguistic influence on L2 stress acquisition. Altmann's (2002) work on perception is particularly relevant in this respect because her study considered L2 speakers of English with a variety of L1s (Arabic, Turkish, French, Chinese, Japanese, Korean, and Spanish). As she predicted, L1-based effects were observed. Specifically, learners with predictable L1 stress – the native speakers of Arabic, Turkish, and French – had problems perceiving the location of English stress whereas learners with unpredictable L1 stress (Spanish) showed almost perfect perception. Furthermore, those learners lacking word-level stress in their L1 – Chinese, Japanese, Korean – also demonstrated perfect perception. Ploquin's (2009) work also considers L2 speakers of English with different L1s, namely Chinese and French. This researcher found that her participants' English production differed from that of native speakers and from each others' in ways related to their respective L1s. Specifically, when realizing stress, the French speakers used pitch differently than English speakers, incorrectly transferring the accentual phrase rises from their L1 to English. The Chinese speakers, in contrast, used tones when producing English stress. More recently, Barquero Armesto (2012) and Schwab (2012) found that advanced L2 speakers may not master all aspects of the target language stress system. In both of these studies, the authors found that, whereas advanced L1 Spanish-L2 French speakers were able to master the phonological placement of stress at the right edge of the accentual phrase, they continued to realize stress inaccurately as a property of the word as opposed to the accentual phrase. L1 influence on L2 production occurs not only at the phonological but also phonetic level. For example, Menke and Face (2010) found that their L1 English-L2 Spanish speakers, while highly proficient in Spanish, still showed a tendency towards vowel centralization/reduction in unstressed positions. Kondo (2009) found a similar pattern in her L1 Japanese-L2 English study. While her Japanese-speaking participants were highly proficient in English, acoustic analysis revealed that they shortened unstressed syllables but did not centralize vowels in English, making use of the phonetic cue that was similar to their L1 (vowel shortening) but disregarding the cue that was different (vowel quality).

Based on the demonstrated L1-based influence on the L2 acquisition of stress at both the phonological and phonetic levels, we can make a series of hypotheses concerning stress placement and vowel quality and duration for English-speaking learners acquiring French or Spanish. In terms of stress placement, we predict that, given the greater phonological typological similarity of English and Spanish, a higher rate of accurate stress placement should be expected with learners of Spanish than those learning French (Hypothesis 1). In terms of vowel quantity, compared to native speakers, we expect learners of both French and Spanish to show a larger stressed-to-unstressed vowel duration ratio due to unstressed vowel reduction (Hypothesis 2). Finally, we expect learners of both French and Spanish to show greater centralization of vowels in unstressed syllables than native speakers (Hypothesis 3).

3. Methodology

The data for the 15 speakers examined here were taken from the *University of Toronto Romance Phonetics Database* (RPD; http://rpd.chass.utoronto.ca). Participants included L2 speakers of French or Spanish (5 of each) whose proficiency ranged from mid-intermediate to high-advanced (Table 4). These proficiency levels reflect self-reported ratings. The French native controls (n=2) were from Quebec; those for Spanish (n=3) were from Colombia[8].

	Language			
	French		Spanish	
	Learners	Native speakers	Learners	Native Speakers
N	5	2	5	3
Gender (M;F)	3;2	0;2	3;2	2;1
Mean age (range) at				
Onset of acquisition	7.6 (6-12)		17 (11-26)	
Testing	24 (19-40)	31	25 (18-29)	32
Immersion (months)	33[9] (0-150)	–	7 (1-15)	–

Table 4. Participant profiles.

All individuals were participants in the *University of Toronto Romance Language Survey* and had to perform four tasks: (i) carrier phrase reading; (ii) passage reading; (iii) narration of the *Little Red Riding Hood* story based on a set of pictures; and (iv) description of their favourite food/meal. The data analyzed here are taken from the first two tasks. A total of 108 stimuli for French and 139 for Spanish[10] were inserted in a carrier sentence (French: *Je dis* [stimulus][11] *encore une fois*; Spanish: *Digo* [stimulus] *otra vez* 'I say [stimulus] again') and read once by each participant. Stimuli were controlled for (i) length (1-4 syllables); (ii) stressed vowel quality; and, in Spanish, (iii) stress placement[12] (penultimate, ultimate). The passage read was the French or Spanish version of the *North Wind and the Sun* (see Appendix).

The data preparation began with the extraction of the target words or phrases from the carrier sentences and passage respectively. For the phonological analysis, stress placement was determined auditorily and coded with reference to the target. The authors listened to the word or phrase and, based on what was expected in the target language, coded what was heard as tonic, pre-tonic, ante-pretonic, post-tonic or post post-tonic[13]. Instances of secondary stress, restricted to French, were also noted. For the evaluation of the phonetic hypotheses (H2 and H3), the stressed as well as the preceding vowels occurring in the same word/phrase were segmented. The preceding vowel was measured in order to allow for direct comparison between the two target languages. Finally, using a PRAAT script (Kroos, Bundgaard-Nielsen, & Tyler; modified Antoniou, 2010), measurements of duration and formant frequency (F1 and F2) were taken.

[8] In the Canadian context, it seemed logical to use the dominant French variety. As for Spanish, students are less often exposed to Peninsular Spanish. Textbooks generally reflect Pan Latin American varieties. Our choice of Colombian Spanish was based on both frequency and practical purposes.

[9] The greater immersion experience of the French group is related to one of the five learners having resided in Montreal for over 12 years.

[10] See http://rpd.chass.utoronto.ca/docs/corpora_1.html for the complete lists.

[11] The fact that the target word stimuli in the carrier phrases contained prosodically prominent syllables was confirmed by the native speakers' productions: for all target words, there was final prominence and, variably, initial prominence (the French *accent rythmique*).

[12] Of the 108 Spanish words, only 3 contained 4 syllables. Of these three, only one had antepenultimate stress.

[13] There were two authors per language. In the few cases where there was doubt, the authors working on the particular language consulted each other until a consensus was reached.

4. Results and hypothesis evaluation

We now turn to the results and evaluation of the three hypotheses of this study. Given the small number of participants, only descriptive statistics are presented.

4.1. Hypothesis 1: Stress placement

The first hypothesis (H1) targeted stress placement: we predicted that, given the greater typological similarity of English and Spanish stress, a higher accuracy with stress placement was expected with learners of Spanish than those learning French. The percentage of correct stress placement was determined with respect to the canonical patterns expected in French (ultimate) and Spanish (penultimate or ultimate depending on the word).

The carrier phrase task performance of the L2 learners is presented in Figure 1. Ultimate two- and three-syllable contexts are reported for both French and Spanish while penultimate two- and three-syllable contexts are reported for Spanish only. While the L2 Spanish speakers performed at ceiling, making a very small percentage of errors (3%, 3 tokens) restricted to the two-syllable ultimate stress context, the L2 French learners were relatively less accurate, particularly in the three-syllable ultimate stress context (2-syllable: 7%, 28 tokens; 3-syllable: 20%, 16 tokens).

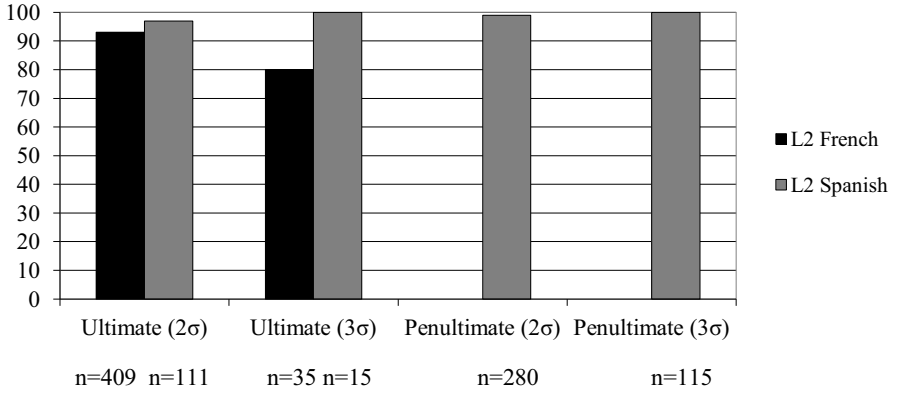

Figure 1. L2 French and L2 Spanish speakers' accurate stress placement (%) for the carrier phrase task by length (2 or 3 syllables) and target stress location (ultimate, penultimate).

Table 5 provides a break-down of the errors made in the carrier phrase task by type. In the two-syllable context, 2% (9 tokens) of the L2 French tokens were realized with multiple stresses, with both syllables being perceived as equally stressed. The majority of errors (5%, 18 tokens) involved pre-tonic stress. In the three-syllable context, where a higher error rate (20%) occurred, errors were almost evenly split between multiple stresses (11%, 4 tokens) and ante pre-tonic stress (9%, 3 tokens; e.g. target *grognement* 'grunt' [ɡʁɔɲəˈmɑ̃], learner form [ˈɡʁɔɲəmɑ̃]). The very few non target-like realizations produced by learners of Spanish were restricted to two-syllable targets (Ultimate 2%, Penultimate 1%).

Language	**Target**	**# syllables**	**Error type**			
			Multiple stresses	Ante pre-tonic	Pre-tonic	Post-tonic
French	Ultimate	2	2%		5%	
		3	11%	9%		
Spanish	Ultimate	2			1%	2%
		3				
	Penultimate	2				1%
		3				

Table 5. L2 French and L2 Spanish stress placement errors (%) by type: Carrier sentence task.

We now turn to stress placement in the reading passage task. These results mirror those reported above for carrier sentence reading. Ultimate two- and three-syllable contexts are reported for both French and Spanish while penultimate two- and three-syllable contexts are reported for Spanish alone. As shown in Figure 2, the L2 Spanish learners were highly accurate with both ultimate and penultimate forms with there being a single error in the ultimate three-syllable context. In contrast, the L2 French learners made a considerable number of errors with the error rate increasing in parallel to the number of syllables in the target form (2 syllables: 7%; 3 syllables: 28%; 4 syllables[14]: 43%).

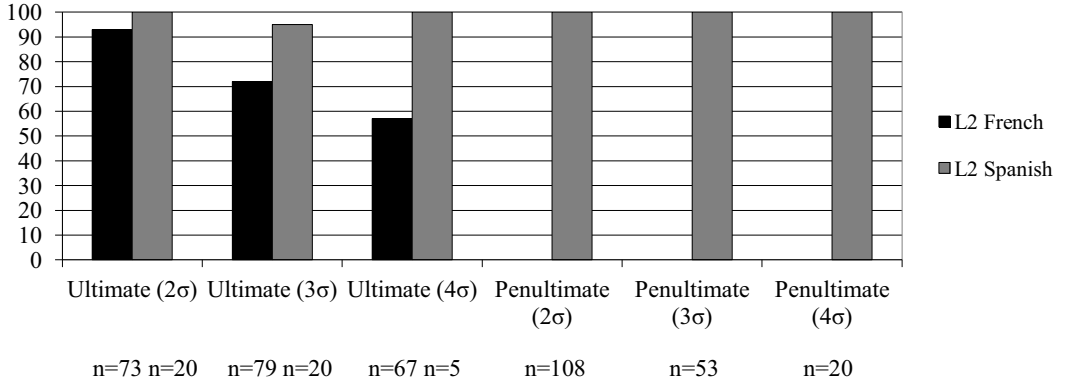

Figure 2. L2 French and L2 Spanish speakers' accurate stress placement (%) for the reading passage task by length (2, 3 or 4 syllables) and target stress location (ultimate, penultimate).

Table 6 summarizes the types of errors made by the L2 French speakers with the passage. The majority of errors in this task involved multiple stresses[15] (three-syllable: 10%; four-syllable: 30%).

# syllables	**Error type**		
	Multiple stresses	Ante pre-tonic	Pre-tonic
2			7%
3	10%	6%	12%
4	30%	9%	5%

Table 6. Percentage of incorrect L2 French stress placement for the reading passage task.

As shown in Figure 3, multiple stresses sometimes involved multiple accentual phrases separated by a pause. In this example, the intermediate L2 French learner in question realized the phrase *comme le plus fort* 'as the strongest' as two separate groups (*comme* + PAUSE + *le plus fort*) where native French speakers realized this phrase as a single stress group.

[14] The reading passage task is the only task where a comparable number of 4-syllable words occurred in both French and Spanish.

[15] One reviewer suggested that "multiple stresses" may be a consequence of fluency issues. An L2 learner could pause within a clause boundary creating two (or more) smaller intonational groupings. If each of these smaller intonational groupings receives final stress, the reviewer suggests that this may be considered target-like. We consider stresses in a smaller domain to be an incorrect stress placement, even if each grouping received final stress. The creation of smaller groupings is not target-like.

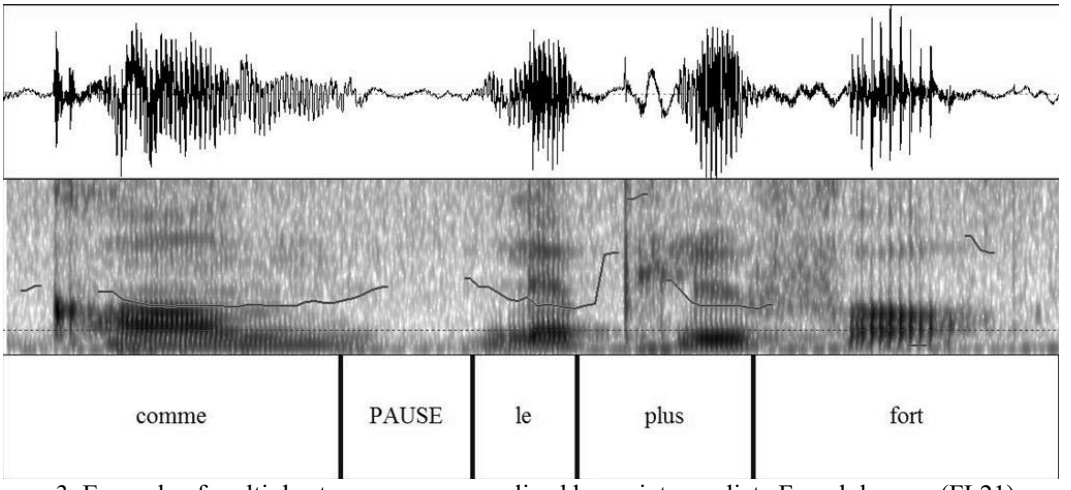

Figure 3. Example of multiple stress groups as realized by an intermediate French learner (FL21).

The next most common error involved pre-tonic stress-placement (two-syllable: 7%; three-syllable: 12%; four syllable: 5%). In French, this involved stress being realized on the penult. Finally, stress placement on the ante pre-tonic accounts for the smallest number of errors (three-syllable: 6%; four-syllable: 9%).

4.2. Hypothesis 2: Vowel quantity – Stressed-to-unstressed vowel ratio

As stated in the second hypothesis (H2), we expected unstressed vowels to be shorter than their stressed counterparts and, therefore, the learners' stressed-to-unstressed vowel duration ratios were expected to be higher than those of the native speakers. For the evaluation of this hypothesis, the tokens were restricted to those corresponding to the canonical stress patterns in French and Spanish (ultimate and penultimate respectively). Moreover, only tokens in which main stress placement was accurate were included, principally to facilitate comparison with the native speakers. Furthermore, the data here come only from the carrier sentence task because the passage did not include tokens with a sufficient variety of vowels in unstressed position. Finally, in order to facilitate between-language comparison, only /a,e,i,o,u/ were examined.

To calculate the stressed-to-unstressed duration ratio, for each occurrence of each vowel, the ratio of the duration of the stressed vowel to the preceding unstressed vowel was calculated[16]. The mean ratio was then calculated for each of the five vowels /a,e,i,o,u/ for each speaker. Figure 4 presents these values for French. For each vowel, the mean stressed-to-unstressed vowel ratio is presented first for the two native speaker controls combined, then for the L2 French learners as a group, and finally for each of the five learners. The L2 learner ratios exceeded that of the control group for /e/, and, more clearly, for /o/ and /u/, in support of Hypothesis 2. The opposite is true for the vowels /a/ and /i/, where the French control mean ratio was equal to or greater than the L2 learner values, refuting H2. Taken together, the findings offer partial support for this hypothesis.

[16] The following vowel was not considered, as it would not have allowed us to compare French with Spanish given that, in French, the stressed vowel is always phrase-final.

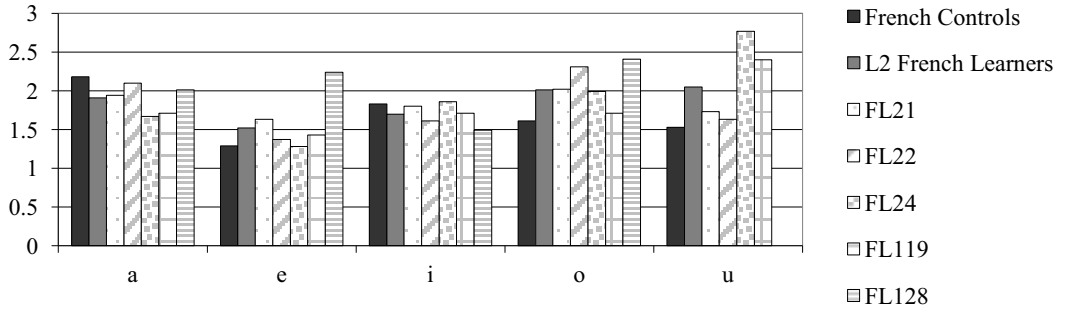

Figure 4. Stressed-to-unstressed vowel duration ratios for French /a,e,i,o,u/. Native speaker controls, L2 French learners as a group, and individual learners are shown.

In Spanish (Figure 5), sufficient data existed only for /a/, /e/, and /o/ given the low frequency of /i/ and /u/ in unstressed position in the stimuli, which is true of the language in general. The individual L2 Spanish learners' mean stressed-to-unstressed vowel duration ratios were greater than those of the Spanish controls for /o/ with one exception, providing support for Hypothesis 2. For /a/, only one learner ratio was clearly greater than the native speaker mean, while the results for /e/ show the mean control stressed-to-unstressed vowel ratio to be greater than that of all of the learners, refuting H2. Taken together, the findings provide mixed support for Hypothesis 2, as was the case for French.

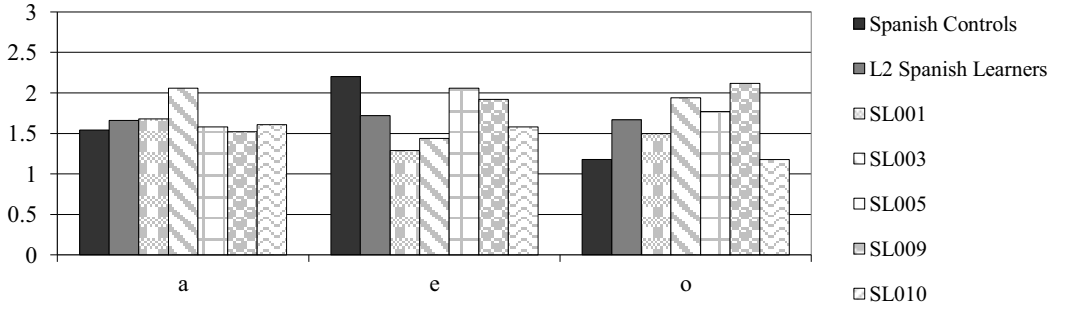

Figure 5. Stressed-to-unstressed vowel duration ratios for Spanish /a,e,o/. Native speaker controls, L2 Spanish learners as a group, and individual learners are shown

4.3. Hypothesis 3: Vowel quality in unstressed syllables

The third and final hypothesis (H3) focused on vowel quality. Specifically, we predicted centralization of unstressed vowels: both French and Spanish learners were expected to show a greater centralization of vowels in unstressed syllables compared to the native speakers. Formant values were extracted from the mid-point of both stressed and unstressed vowels for all speakers using a PRAAT script (Kroos, Bundgaard-Nielsen, & Tyler; modified Antoniou, 2010). The data here are the same used to test H2. For both learner groups, given that there was no normalization, speakers are separated by gender. Our intention was to compare these L2 speakers to their native speaker counterpart; Figures 6 through 12 allow for such comparisons.

In the stressed context, the female French L2 learners' production (Figure 6, square tokens) involved a relatively fronted vowel system compared to their native speaker counterparts (diamond tokens) with the exception of /a/.

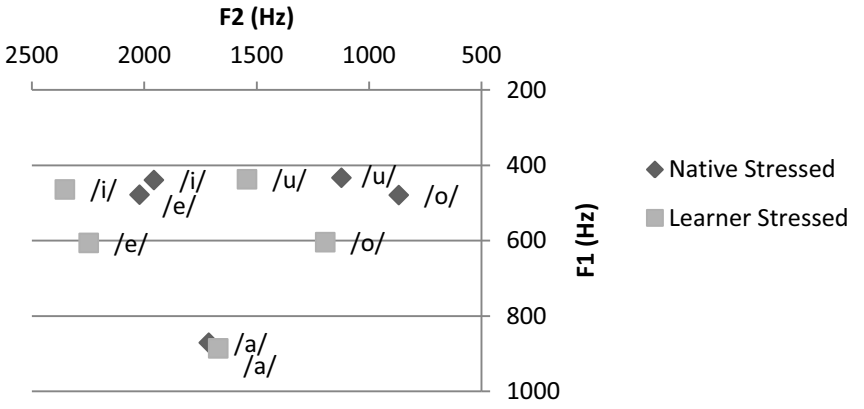

Figure 6. Female native speaker (diamond tokens) and L2 French learner (square tokens) mean formant (F1xF2) values for stressed /a,e,i,o,u/: Carrier sentence task.

In the unstressed context, the same French female learners showed a tendency to centralize vowels (square tokens) compared to their native French-speaking counterparts (diamond tokens) for all vowels except /a/ (Figure 7).

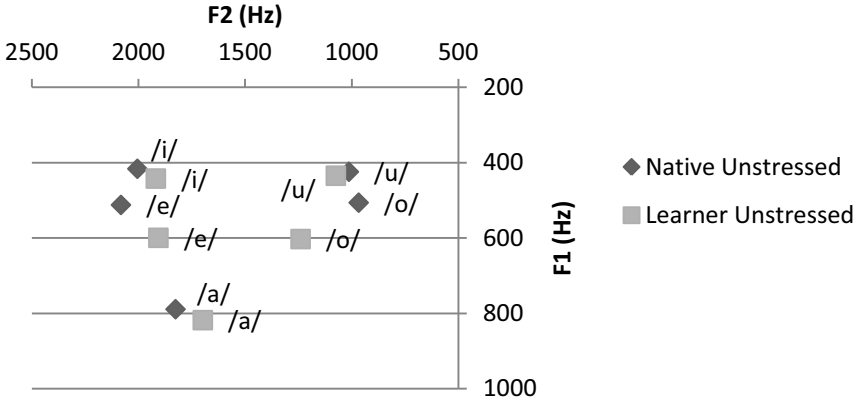

Figure 7. Female native speaker (diamond tokens) and L2 French learner (square tokens) mean formant (F1xF2) values for unstressed /a,e,i,o,u/: Carrier sentence task.

There were no male native French speakers available at the time of testing so we compare male L2 French production in stressed (diamond tokens) and unstressed (square tokens) contexts (Figure 8). These L2 French speakers showed a tendency towards vowel centralization in unstressed positions with respect to their own stressed vowel productions.

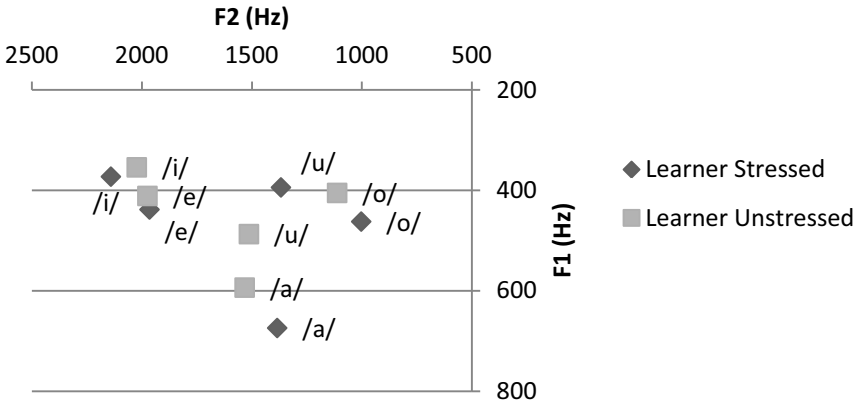

Figure 8. Male L2 French learners' stressed (diamond tokens) and unstressed (square tokens) mean vowel formant (F1xF2) values for /a,e,i,o,u/: Carrier sentence task.

Both female and male L2 Spanish speakers had a relatively fronted vowel system with respect to their native speaker counterparts (Figure 9 for female native and L2 Spanish speakers and Figure 10 for male native and L2 Spanish speakers) in the stressed syllable context. Although this tendency is more evident in male than in female speakers (the latter show noticeable fronting of /o/), the relative fronting of Spanish L2 learners is consistent with previous studies that have shown that the English vowel system is more fronted than that of Spanish (e.g., Bradlow, 1995).

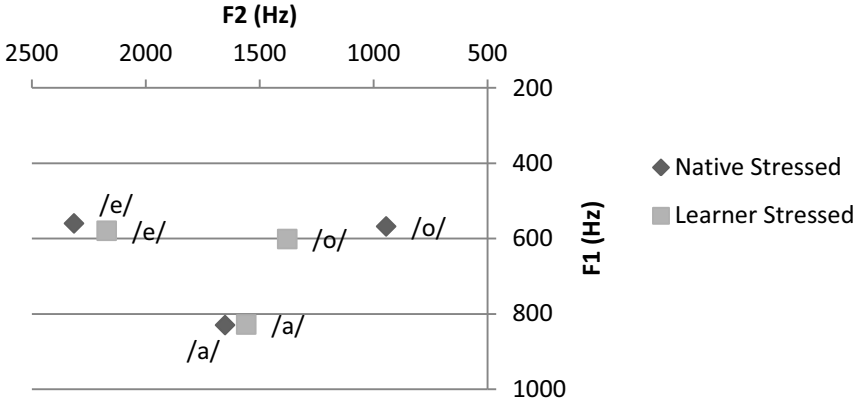

Figure 9. Female native speaker (diamond tokens) and L2 Spanish learners' (square tokens) mean formant (F1xF2) values for stressed /a,e,o/: Carrier sentence task.

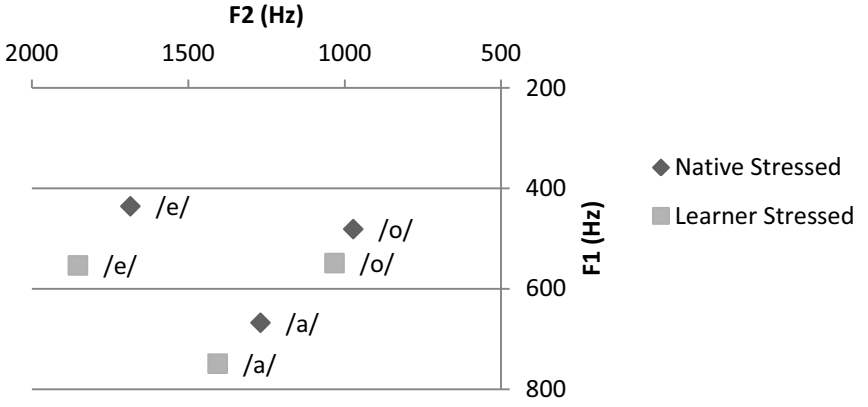

Figure 10. Male native speaker (diamond tokens) and L2 Spanish learners' (square tokens) mean formant (F1xF2) values for stressed /a,e,o/: Carrier sentence task.

In unstressed position, however, both female and male L2 Spanish speakers did not show any centralization (Figures 11 and 12 respectively). The most apparent difference between the learners and the native speakers is the relatively more open articulation of /o/ and, to a smaller extent, of /e/.

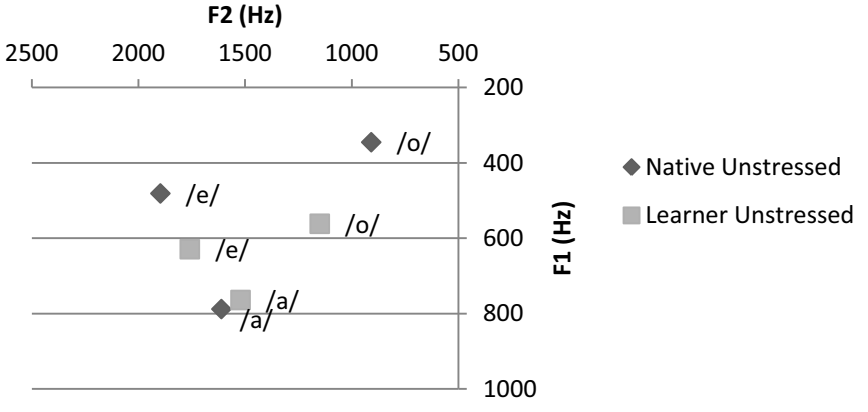

Figure 11. Native (diamond tokens) and L2 Spanish (square tokens) female speakers' mean formant (F1xF2) values for unstressed /a,e,o/: Carrier sentence task.

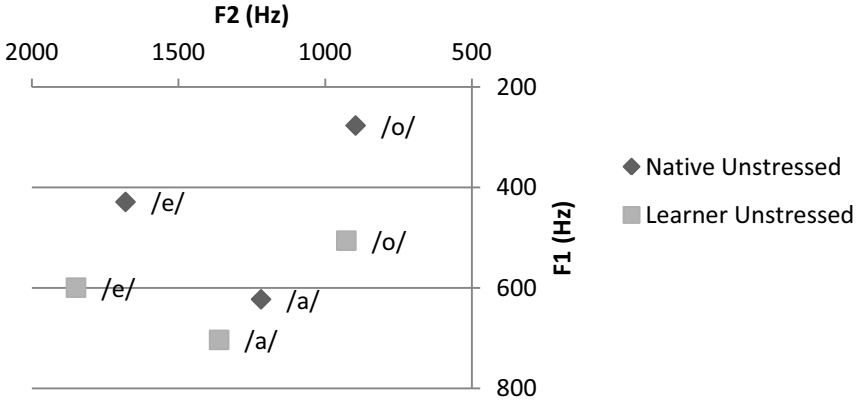

Figure 12. Male native speaker (diamond tokens) and L2 Spanish learners' (square tokens) mean formant (F1xF2) values for unstressed /a,e,o/: Carrier sentence task.

In summary, three hypotheses were evaluated. H1 focused on stress placement: a higher rate of accurate stress placement was expected with learners of Spanish than those learning French. This hypothesis was strongly confirmed. French L2 learners were less accurate than L2 Spanish counterparts with words/phrases of all lengths with no apparent task effect. This latter finding is not surprising given that both tasks involved reading. For the L2 French learners, accuracy correlated negatively with the number of syllables in the target: the greater the number of syllables, the lower the accuracy. Non-target-like production with this group included inaccurate stress placement, namely a tendency for stress to occur earlier in the phrase vis-à-vis the target, as well as multiple primary stresses and secondary stress. L2 Spanish speakers were very target-like. The errors in this group were restricted to the ultimate stress context, which is less frequent in their L1 (English).

As per H2, we expected both learners of French and Spanish to show a larger stressed-to-unstressed vowel duration ratio with respect to the native speaker counterparts because of unstressed vowel reduction. The French data provided mixed support for this hypothesis. For the vowels /a/ and /i/, the hypothesis was not supported: the French control mean stressed-to-unstressed ratio was greater or equal to that of the L2 learner group mean as well as those of each of the learners. In contrast, with /e/, /o/, and /u/, several of the L2 learner means exceeded that of the control group, supporting the hypothesis. This was most evident with the back vowels /o/ and /u/. Similarly, the Spanish data provided mixed support for Hypothesis 2. The L2 Spanish learners' stressed-to-unstressed vowel ratio was greater than that of the Spanish controls for /a/ (one L2 speaker) and /o/ but not for /e/.

Finally, following H3, we predicted learners of both French and Spanish to show a greater centralization of vowels in unstressed syllables. The French data alone supported this hypothesis. Indeed, the mean values for the L2 learners' unstressed vowels were centralized both in comparison to their own stressed vowels and to the unstressed vowels of the French controls. The Spanish data, in contrast, did not support the third and final hypothesis. In unstressed positions, there was no apparent centralization of vowels by L2 Spanish speakers

5. Discussion

What do these findings tell us about the L2 acquisition of the phonology and phonetics of stress, particularly in the cases of French and Spanish as target languages? Based on the results from the present sample, there is some support for the claim that the phonetics of stress may be acquired with greater difficulty than the phonology. In fact, while difficulty with stress placement was observed with French learners alone, difficulties with the phonetics of stress realization occurred with both groups of learners (French: quantity and quality; Spanish: quantity alone). It is true that stress placement errors were observed almost uniquely in L2 French but it is also true that English and Spanish are typologically similar. To some extent, one could claim that English-speaking learners get Spanish stress placement for "free" due to cross-linguistic influence. In terms of the phonetic realization of stress, the absence of vowel reduction in Spanish may be related to the proficiency of the learners. While our learners of Spanish began their acquisition later in life than those of French, overall their proficiency was higher. As L1-based influence diminishes with proficiency, the more target-like duration ratios of the Spanish-learning groups are not surprising.

As previously stated, all of the hypotheses assumed some degree of L1 English-based influence. Upon closer analysis of the errors made by the L2 French speakers, in the two-syllable context, the majority of errors (5%, 18 tokens) involved pre-tonic stress. Such errors are consistent with the predominant trochaic stress pattern in English. In the three-syllable context where a higher error rate (20%) occurred, errors were almost evenly split between multiple stresses (11%, 4 tokens) and ante pre-tonic stresses (9%, 3 tokens). These latter errors parallel the pre-tonic errors in the two-syllable context in that they are consistent with the English trochaic stress pattern. The existence of multiple stresses can also be attributed to the learners' L1, in which the lexical stress domain is smaller than that of French. Multiple stresses are the direct consequences of learners realizing single target French phrases as two or more smaller units. The passage reading errors for these speakers followed the same pattern. It was clear that, in many cases, the L2 French learners were realizing the target phrase as two or three separate phrases. These results could have been affected, in part, by the task itself. Both tasks were reading tasks. It may be the case that these speakers are implementing the French 'accent rythmique' (e.g., Astésano, 2001), an initial prominence common to formal registers including reading. Further experimental research is required to fully investigate this possibility.

The current findings parallel those reported in previous studies that have investigated the L2 acquisition of stress. Barquero Armesto (2012) and Schwab (2012) found that their L2 French speakers, whose L1 was Spanish, successfully mastered stress placement in the target language moving from trochees to iambs, but continued to have difficulty in increasing the size of the stress domain from lexical to accentual phrases. Phonetically, our findings are similar to Kondo (2009). In her study, highly proficient L1 Japanese-L2 English speakers were successful in implementing the correct target language duration parameter (vowel shortening in unstressed English syllables) but had greater difficulty with vowel quality (vowel centralization in unstressed English syllables).

Some caution is merited given the small sample size. While certain trends do emerge clearly, more data from a wider range of speakers will be necessary to confirm the patterns observed. A larger sample size would also allow a statistical analysis of the patterns observed. As highlighted, the two groups of L2 learners were not clearly comparable particularly in terms of proficiency but also with respect to their learning experience including their mean age at onset of acquisition and amount of immersion experience.

6. Conclusions

This study adds to the growing body of research on L2 prosody (e.g., Trofimovich & Baker, 2006; Trouvain & Gut, 2007; Nava & Zubizarreta, 2009). Our results speak to the importance of expanding our empirical coverage of language pairings, and of analyzing phonological and phonetic aspects of prosody. Along with increasing the sample size as discussed above, there are a number of other avenues of research that are possible. The first is to expand the number of phonological characteristics examined with respect to stress placement; one of these could be the role of syllable weight in primary stress assignment. Given the high rate of accuracy with learners of both languages, such an investigation would require examining learners of lower proficiency who have yet to master stress placement. Another possible extension would be to investigate the role of pitch, including the initial 'accent rythmique' in French, and final boundary tones in both native and learner realizations. As concerns the former, we hypothesized earlier that errors involving initial placement of stress in L2 French may not only be related to the learners' L1 stress system but also to the presence of these initial prominences in the target language, at least in more formal registers. Finally, individual variability, in both native and L2 speech, should receive more attention in future investigations.

Appendix: The North Wind and the Sun

French Version: La bise et le soleil se disputaient, chacun assurant qu'il était le plus fort. Quand ils ont vu un voyageur qui s'avançait, enveloppé dans son manteau, ils sont tombés d'accord que celui qui arriverait le premier à le lui faire ôter serait reconnu comme le plus fort. Alors, la bise s'est mise à souffler de toutes ses forces mais plus elle soufflait, plus le voyageur serrait son manteau autour de lui. Finalement, elle renonça à le lui faire ôter. Alors, le soleil commença à briller et au bout d'un moment le voyageur, réchauffé, ôta son manteau. Ainsi, la bise dut reconnaître que le soleil était le plus fort.

Spanish Version: El viento del norte y el sol discutían acerca de cuál de los dos sería el más fuerte, cuando, de repente, pasó un viajero envuelto en una amplia capa. Al verlo, convinieron en que el primero que consiguiera quitarle la capa sería el más fuerte. El viento del norte comenzó a soplar con mucha furia, pero, cuanto más soplaba, más se aferraba el viajante a su capa, hasta que el viento norte desistió. El sol brilló entonces con todo su esplendor, e inmediatamente, el viajante arrojó su capa. Así, el viento norte tuvo que reconocer la superioridad del sol.

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