Acoustic Correlates of French Accentuation in Advanced Spanish Learners of French

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Abstract

The aim of this research is to examine whether Spanish speakers transfer some accentual properties from Spanish to French L2. Native Spanish learners of French and native speakers of French were instructed to read French sentences containing a trisyllabic target pseudoword. In some sentences, the pseudoword was in a stressed position, while in others it was in an unstressed position. Acoustic analysis (duration, F0, expressed in z-score values) were performed on the three vowels of the pseudoword. Results showed that Spanish speakers have acquired the knowledge that, contrary to Spanish, stress is fixed in French (on the last syllable), but not that stress is realized at the accentual phrase level rather than at the word level as in Spanish.

Keywords: French accentuation, acoustic correlates, French L2, Spanish L1

Acoustic Correlates of French Accentuation in Advanced Spanish Learners of French

It is well documented that French and Spanish do not share the same accentual properties. While French is a fixed-stress language with stress on the final

syllable of the accentual phrase, Spanish is a free-stress language with stress realized at the word level (among others, Jun & Fougeron, 2002; Lacheret-Beaugendre, 1999; Quilis, 1993). In Spanish, when there is no written accent, the structure of the final syllable of the word determines the position of stress: Spanish stress falls on the last syllable of the word if the syllable is closed, and it falls on the penultimate syllable if the syllable is open (or ending with –n or –s).

With regard to the acoustic correlates involved in the realization of stress (duration, fundamental frequency (F0) and amplitude), it has been shown that duration plays the most determinant role in French accentuation (stressed syllables are twice as long as unstressed syllables; Delattre, 1938; Léon, 2007), while amplitude is not an important parameter (at least for non-emphatic stress; Delattre, 1966). Moreover, French stressed syllables are also often superimposed with F0 rise or F0 peak, which, however, can also be related to prosodic boundaries (on account of the syncretism between accentuation and intonation; Rossi, 1979; Vaissière, 1991). In Spanish, stress is mainly produced by a combination of duration and F0 (Quilis, 1981). Along the same lines, recent research (Llisterri, Machuca, Ríos & Schwab, in press) has confirmed the major contribution of duration and F0 and the minor role of amplitude in the distinction between Spanish stressed and unstressed syllables.

In view of these differences, one might expect Spanish learners of French to transfer some accentual properties from Spanish L1 to French L2. The aim of the present research is to confirm Schwab (2012)'s findings by using a similar methodology with a larger sample of participants. As in Schwab (2012), two variables are taken into account: 1) the syllabic structure of the word (ending with a CV or CVC syllable), as it is important for the position of Spanish stress; 2) the word's position within the accentual phrase (stressed/unstressed), given that stress is realized at the word level in Spanish and at the accentual phrase level in French.

METHOD

Participants

Sixteen participants took part in this experiment: 8 native speakers (4 males and 4 females) of French from Geneva (hereafter "French"); and eight native Spanish advanced learners of French (B2-C1) (3 males and 5 females), living in Geneva (hereafter "Spanish"), with at least two years spent in a French speaking country. Spanish speakers were from the Iberian Peninsula (Aragon, La Rioja, Galicia, La Rioja, Extremadura and Andalusia) and French was their second foreign language after English.

Material

We used in the present experiment 18 trisyllabic French CV.CV.CV pseudowords with the following characteristics: they all began with one of the voiceless plosives /p/, /t/, /k/ (to facilitate the extraction of the pseudowords, if they were used, in the future as stimuli for perception experiments). The three vowels within the pseudoword were /i/, /a/ and /u/, with each vowel appearing the same number of times in each position. We excluded the other French vowels to avoid non-transparent spellings (e.g. nasal vowels, [y]), the open-closed vowel distinction (e.g. [ɔ]-[o]) and the possible influence of a written accent (e.g. -é-, -è-). The consonants in the medial and final syllable were /p/, /t/, /k/, /m/, /n/, /l/ and appeared once in each position. We did not consider voiced stop consonants, given that they might be pronounced in French L2 as approximants (as they would in Spanish L1; Quilis, 1993), which would have made the measurements on the surrounding vowels difficult. What is more, each CV.CV.CV pseudoword (e.g. poutila) had a CV.CV.CVC counterpart (e.g. poutilar), ending with /R/ or /l/. Each of the two final consonants appeared the same number of times across t6he pseudowords. In total, 36 pseudowords were used in this experiment, 18 CV.CV.CV (CV condition) and 18 CV.CV.CVC (CVC condition).

Then, each CV.CV.CV pseudoword (and its CV.CV.CVC counterpart) was introduced in two different carrier sentences, in which its position within the accentual phrase varied. In one carrier sentence, the pseudoword was in a stressed position: it played the role of a noun in the subject nominal phrase and was at the right edge of the accentual phrase (*Noun* context; e.g. un certain poutila || piquait tous les touristes; *some poutila bit all the tourists*). In the other carrier sentence, the pseudoword was in an unstressed position: it played the role of a prenominal adjective in the subject nominal phrase and was not at the right edge of the accentual phrase (*Adjective* context; e.g. un poutila pic || était très utile, *a poutila pick was very useful*). In total, 72 sentences were used in the experiment.

Procedure

Speakers were recorded individually in a sound-treated booth. The experiment was divided into two parts: participants produced the sentences with the pseudoword in the stressed position (*Noun* context) and the sentences with the pseudoword in the unstressed position (*Adjective* context). Half the participants began with the *Noun* context condition and half with the *Adjective* context. Each pseudoword was presented first in isolation and then in the carrier sentence, in order to facilitate its production in continuous speech. Isolated pseudowords and sentences were presented on a computer screen. Participants were instructed to read them at a natural rate. If they hesitated, participants were asked to repeat the pseudoword or the whole sentence.

Data Analysis

All productions were automatically segmented in phones (EasyAlign under Praat; Boersma & Weenink, 2011; Goldman, 2011) and manually corrected. We excluded from the analyses those productions that presented a pause after the pseudoword (6% of the data), because of the particular status of prepausal syllables. For each vowel of each sentence, we extracted the duration (in ms), the mean value of F0 (in Hz). Note that F0 values were obtained using the Hirst algorithm (Hirst, 2011) in order to avoid some Praat F0 detection errors.

Contrary to Schwab (2012), we normalized the data with z-score values, which allowed us to take into account the variability, especially important in L2 speech. For this, we computed (for duration and F0) the mean value and standard deviation across all the vowels of the sentence. Then, we calculated the difference between the value of each vowel and the mean value, and divided this difference by the standard deviation. This normalization led each parameter to be expressed in standard deviations. We also calculated the articulation rate in syll/sec for each sentence.

We analyzed the data by means of mixed-effects regression models (Baayen, Davidson & Bates, 2008; Bates & Sarkar, 2007) in which participants and pseudowords were entered as random terms. Analyses were performed separately for each parameter (duration and F0). For each of them, the predictors were the group (French/Spanish), the syllabic structure (CV/CVC) and the pseudoword's vowel (V1, V2, V3). Given that the *Noun* and *Adjective* pseudowords' syllables were not in a same position in the sentence, the data in the *Noun* and *Adjective* contexts were hardly directly comparable[1]. Therefore, separate analyses were run for pseudowords in the stressed position (*Noun* context) and in the unstressed position (*Adjective* context).

Predictions

We expect Spanish speakers to transfer some accentual properties from Spanish to French. As mentioned in the Introduction, the syllabic structure might determine, in some cases, the position of stress in Spanish (i.e. stress on the penultimate syllable in a word ending with a CV syllable and stress on the last syllable in a word ending with a CVC syllable), whereas it has no influence on the position of stress in French (i.e. stress on the last syllable). Therefore, we predict the pseudoword's syllabic structure to have a different effect in French and Spanish speakers. In CVC pseudowords, we expect the last syllable to be stressed in French as well as in Spanish speakers. However, we predict French

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[1] In the stressed position (*Noun* context), the pseudoword's syllables were in positions 4, 5 and 6 (i.e. in a sentence like *Un certain poutila piquait tous les touristes*), while they were in positions 2, 3 and 4 in the unstressed position (*Adjective* context) (i.e. in a sentence like *Un poutila pic était très utile*).

and Spanish speakers to behave in a different way in CV pseudowords: contrary to French speakers, Spanish speakers might stress the penultimate syllable as they would do in Spanish. In other words, we expect, in statistical terms, a three-way interaction between Syllabic structure, Vowel and Group.

As mentioned in the Introduction, Spanish stress is realized at the lexical level, while French stress is realized at the accentual phrase level. In other words, all content words (i.e. nouns, adjectives, etc.) present a stressed syllable in Spanish, whereas only the last syllable of an accentual phrase is stressed in French. Therefore, we expect French and Spanish speakers to behave in a similar way in the stressed context, i.e. they will stress the pseudoword in the stressed *Noun* context. However, we expect them to behave in a different way in the unstressed position (*Adjective* context). Contrary to French speakers, Spanish speakers might stress the adjective, as they would do in Spanish, and thus show a similar pattern in the stressed and unstressed pseudowords.[2]

RESULTS AND DISCUSSION

Duration

Stressed Position (Noun Context). Analyses showed a main effect of vowel ($F(2, 1569) = 809.22$, $p < .001$), an interaction Vowel x Group ($F(2, 1569) = 7.48$, $p < .001$), an interaction Syllabic structure x Group ($F(1, 1569) = 13.03$, $p < .001$), and a three-way interaction Syllabic structure x Vowel x Group ($F(2, 1569) = 6.14$, $p < .01$)[3].

The three-way interaction indicates that the differences we observe between French and Spanish speakers are not similar in CV and CVC pseudowords. For this reason, we present the results for CV and CVC pseudowords in two different figures. Results for CV pseudowords are shown in Figure 1 which present the duration (in z-score values) as a function of Group and Vowel. A value of 0 means that the duration of the vowel is equal to the average duration across all the vowels of the sentence. A negative value indicates that the vowel is shorter than the average duration, and a positive value that it is longer.

As can be seen in Figure 1, Spanish speakers, contrary to our predictions, do no stress the second vowel (V2), as they would do in their mother tongue. Instead, Spanish speakers, like French speaker, present a statistically significant

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[2] These predictions are based on the conclusions of a study that was conducted in Spanish with the same methodology. In this study, Spanish speakers had to produce trisyllabic pseudowords in sentences like "Alguna *putila* cruzaba la calle" (*Noun* context) and "La *putila* cruz aparecerá" (*Adjective* context). Results showed that both nouns and adjectives present a stressed syllable expressed by a longer duration and a higher F0.

[3] We will not discuss here the main effects and the interactions that do not involve Group and Vowel, because they are not relevant for the purpose of this contribution. In case of the absence of the three-way interaction Syllabic Structure x Group x Vowel, we discuss the interaction Group x Vowel, if present.

progressive lengthening from the pseudoword's first (V1) to the last syllable (V3) (p < .001)[4]. In other words, both groups progressively lengthen the vowels towards the end of the accentual phrase (which has already been reported in French speakers; for example, in Léon, 2007).
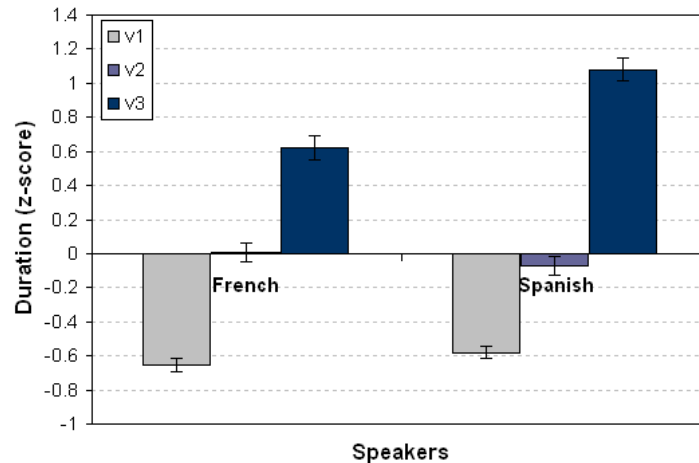

Figure 1. Duration (in z-score values) as a function of Group and Vowel for CV pseudowords in a stressed position (*Noun* context). Error bars are standard error of the mean.

More interestingly, although Spanish speakers globally behave like French speakers, they present a larger duration increase from the pseudoword's second vowel (V2) to the last vowel (V3) (p < .001). This comes from the longer last vowel (V3) in Spanish than in French speakers (p < .001).

Results for CVC are presented in Figure 2. Contrary to what we have observed in CV pseudowords, Spanish speakers present, in the three vowels, the same duration as French speakers (p > .05)[5]. Moreover, both groups show a statistically significant progressive lengthening from V1 to V3 (p < .001).

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[4] For the sake of simplicity, we will only present the significant post-hoc results with the p-value instead of detailing all the post-hoc analyses.

[5] In order to understand the differences between CV and CVC pseudowords, we examined whether the two consonants /R/ and /l/ had a different impact on the vowel lengthening (V3) in French and Spanish speakers. French speakers present longer vowels in front of /R/ than in front of /l/, while Spanish speakers present similar durations in front of both consonants (interaction Group x Consonant F(1, 268) = 6.61, p < .05). Nevertheless, although interesting, these findings do no explain why Spanish speakers present a longer V3 than French speakers in CV, but not in CVC pseudowords.
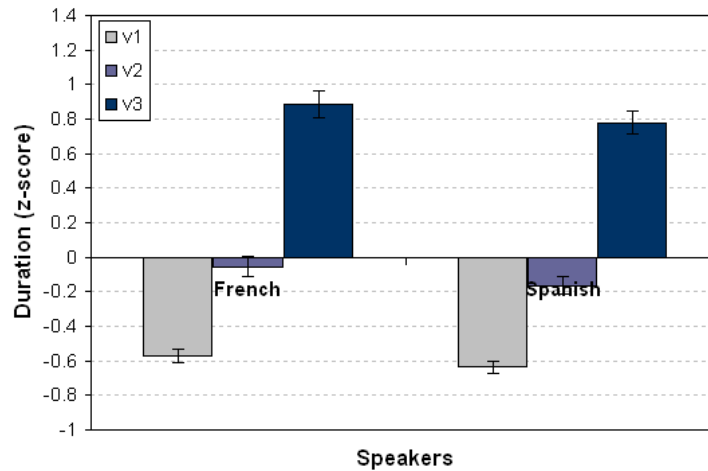
Figure 2. Duration (in z-score values) as a function of Group and Vowel for CVC pseudowords in a stressed position (*Noun* context). Error bars are standard error of the mean.

Unstressed Position (Adjective context). Analyses showed a main effect of syllabic structure ($F(1, 1592) = 5.78$, $p < .05$), a main effect of vowel ($F(2, 1592) = 244.48$, $p < .001$), an interaction Syllabic structure x Vowel ($F(2, 1592) = 3.32$, $p < .05$) and an interaction Vowel x Group ($F(2, 1592) = 14.15$, $p < .001$). Contrary to what we have observed in the stressed position, the absence of a three-way interaction indicates here that the differences between French and Spanish speakers are similar in CV and CVC pseudowords. Results for CV and CVC pseudowords are thus grouped together and presented in Figure 3.
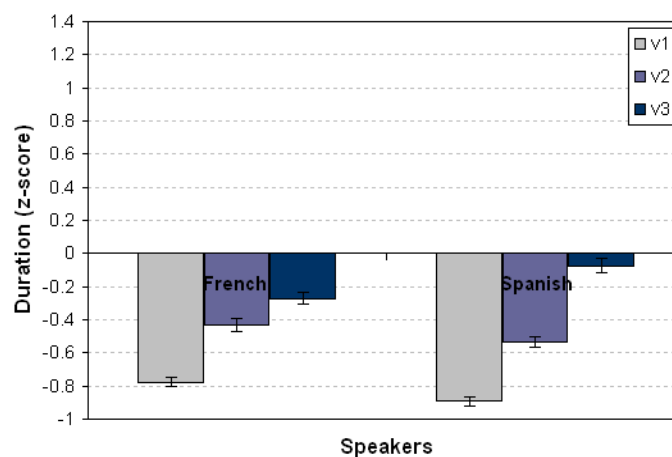

Figure 3. Duration (in z-score values) as a function of Group and Vowel for pseudowords in an unstressed position (*Adjective* context) (CV and CVC grouped together). Error bars are standard error of the mean.

Although French and Spanish speakers present a progressive lengthening from the first to the last pseudoword's vowel ($p < .001$) (i.e. towards the end of

the accentual phrase), Spanish speakers present, in comparison with French speakers, a larger duration increase from the second (V2) to the last vowel (V3) (p < .001) . This comes from the marginally longer V3 in Spanish speakers than in French speakers (p = .054).

Summary. The pseudoword's syllabic structure (CV/CVC), although involved in the three-way interaction, does not have the expected different effect in French and Spanish speakers. In fact, Spanish speakers do not stress the second vowel in CV pseudoword, as we predicted in case of an accentual transfer. Moreover, the pseudoword's position (stressed/unstressed) does not play either the expected different role in French and Spanish speakers. Remember that we expected, in case of a transfer from their mother tongue, Spanish speakers to produce unstressed adjectives as stressed nouns. However, Spanish speakers, like French speakers, were able to differentiate unstressed adjectives from stressed nouns in French. Nevertheless, we could observe that, in comparison with French speakers, Spanish speakers lengthened in a larger extent the pseudoword's last vowel, whether being in a stressed position (in CV pseudowords) or in an unstressed position (in CV and CVC pseudowords).

F0

Stressed Position (Noun Context). Analyses showed a main effect of syllabic structure (F(1, 1581) = 5.91, p < .05), a main effect of vowel F(2, 1581) = 865.66, p < .001), an interaction Syllabic structure x Vowel (F(2, 1581) = 20.10, p < .001), an interaction Syllabic structure x Group ((F(1, 1581) = 10.49, p < .01), and an interaction Vowel x Group (F(2, 1581) = 218.81, p < .001). Again, the absence of a three-way interaction indicates that the differences between French and Spanish speakers are similar in CV and CVC pseudowords.

As can be seen in Figure 4 (CV and CVC grouped together), French and Spanish speakers present a similar global F0 pattern, namely a decrease from the first (V1) to the second vowel (V2) and an increase from the second (V2) to the last vowel (V3) (p < .001). Nevertheless, we observe that Spanish speakers present, in comparison with French speakers, a larger F0 increase from the second (V2) to the last vowel (V3) (p < .001), due to the fact that they produce V3 with a higher F0 than French speakers (p < .001).
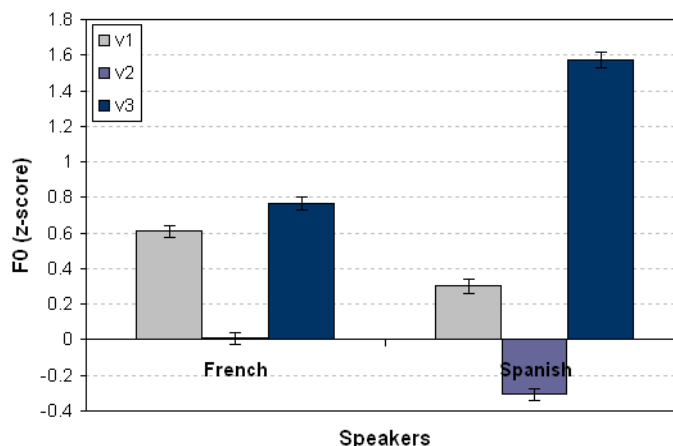
Figure 4. F0 (in z-score values) as a function of Group and Vowel for pseudowords in a stressed position (*Noun* context) (CV and CVC grouped together). Error bars are standard error of the mean.

Unstressed Position (Adjective Context). Analyses showed a main effect of syllabic structure (F(1, 1595) = 19.13, p < .001), a main effect of vowel (F(2, 1595) = 361.22, p < .001) and an interaction Vowel x Group (F(2, 1595) = 44.97, p < .001). As for the stressed position, the absence of a three-way interaction indicates that the differences between French and Spanish speakers are similar in CV and CVC pseudowords. Figure 5 present thus the results for CV and CVC pseudowords grouped together.
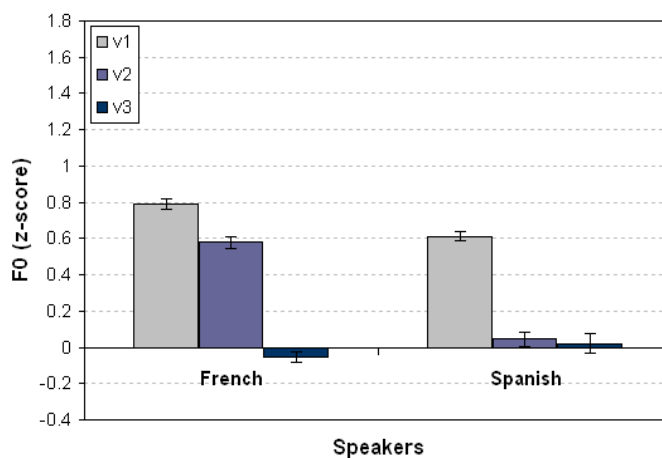

Figure 5. F0 (in z-score values) as a function of Group and Vowel for pseudowords in an unstressed position (*Adjective* context) (CV and CVC grouped together). Error bars are standard error of the mean.

French and Spanish speakers present a similar global F0 pattern, namely a F0 decrease from the first vowel (V1) to the last vowel (V3) (p < .05). However, it is important to note that, although French and Spanish speakers present a similar F0 on the last vowel (V3) (p > .05), Spanish speakers present, in comparison with

French speakers, a much smaller F0 decrease from the second (V2) to the last vowel (V3) (p < .001), because they produce V2 with a unexplainable lower F0 than French speakers (p < .001).

Summary. As for duration, the pseudoword's syllabic structure (CV/CVC) and the pseudoword's position (stressed/unstressed) do not have the expected different impact in French and Spanish speakers. Nevertheless, we could note that, in comparison with French speakers, Spanish speakers present a higher F0 on the pseudoword's last vowel in the stressed position, but not in the unstressed position.

CONCLUSION

This research aimed at examining whether Spanish speakers transfer some accentual properties from Spanish to French L2. Given that the word final syllable determines (in absence of a written accent) the position of stress in Spanish, we expected Spanish speakers to produce CV and CVC pseudowords in a different way (i.e. with stress on the penultimate syllable in CV and on the last syllable in CVC pseudowords). However, Spanish speakers produced in a similar way the CV and CVC pseudowords, like French speakers. These findings suggest that Spanish speakers have not transferred their knowledge about stress position from Spanish to French L2.

Moreover, given that Spanish stress is lexical, we predicted Spanish speakers to produce a stressed syllable in the stressed (*Noun* context) as well as in the unstressed pseudowords (*Adjective* context), as they would do in Spanish (see the conclusions of the study we conducted in Spanish; cf. note 2). However, our results showed that, contrary to our predictions, Spanish speakers were able to differentiate unstressed adjectives from stressed nouns in French.

Taken together, these results show that advanced Spanish learners of French have not simply transferred the properties of stress from their mother tongue to French L2. However, our results revealed that Spanish speakers, in comparison with French speakers, tended to mark (i.e. to stress) in a larger extent the pseudoword's last vowel. Indeed, Spanish speakers produced it in the stressed position (*Noun* context) with a longer duration (at least in CV pseudowords) and a higher F0, which suggests that Spanish speakers have over-stressed the last syllable of the pseudoword. Nevertheless, given the fact that the position of stress in French coincides with a prosodic boundary, we have no way to determine whether the realization of the stressed syllable is conditioned by the position of stress and/or by the prosodic boundary. In the unstressed position (*Adjective* context), Spanish speakers produced, in comparison with French speakers, the pseudoword's last vowel with a longer duration, but not with a higher F0, (which might be explained by the fact that the pseudoword was not at a prosodic boundary). This seems to indicate that Spanish speakers stressed the

last vowel in a stronger way than French speakers, which might a cue of a lexical accentuation on the last vowel of a content word. Thus, we can conclude that the advanced Spanish learners of French have acquired the knowledge that the position of the stressed syllable is fixed in French (i.e. on the last syllable), but they have not totally acquired the knowledge that the stress domain in French is the accentual phrase, and not the word as in Spanish.

ACKNOWLEDGEMENTS

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