

Do native Spanish speakers transfer accentual acoustic properties from Spanish to French L2?

Sandra Schwab

University of Geneva
Sandra.Schwab@unige.ch

Abstract

The aim of this research is to examine whether Spanish speakers transfer some accentual acoustic 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 and amplitude) were performed on the three vowels of the pseudoword, as well as on the first vowel following 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.

Index terms: accentual transfer, Spanish L1, French L2, acoustic parameters, syllabic structure.

1. Introduction

French is considered a fixed-stress language, in contrast to free-stress languages such as Spanish or English. Given that French (primary) stress has a fixed position on the final syllable of the accentual phrase, it can not play a distinctive role at the lexical level but rather a demarcative role at the utterance level [1]. Thus, the notion of accentual phrase (also called "groupe de sens" or rhythmic group [2, 3]) makes more sense in French than the notion of word stress. Due to the phrase-final location of primary stress, accentuation and intonation are both anchored on the final syllable of an accentual phrase in French, which leads to a "fusion" between accentual and intonational structures in French [3]. This is the so-called "syncretism" between accentuation and intonation [4].

As for Spanish, a free-stress language, lexical (primary) stress is realized at the word level. As it can appear on one of the last three syllables of the word (e.g. número, ['numero], *number*; numero, [nu'mero], *I number*; numeró, [nume'ro], *he/she numbered*), Spanish stress plays a distinctive role [5]. Stressed syllables can be identified by the presence of a written accent (e.g. número, ['numero]) or by the syllabic structure of the word. 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 on the penultimate syllable if it is open (or ending with -n or -s).

With regard to the acoustic correlates of stress (duration, fundamental frequency (F0) and amplitude), research on French stress has shown that amplitude is not an important parameter, at least for non-emphatic stress [6]. At the same time, duration plays the most determinant role in French accentuation: stressed syllables are twice as long as

unstressed syllables [7, 8]. Moreover, as stated by [9], French stressed syllables are also often superimposed with F0 rise or F0 peak. Nevertheless, [9] highlights that F0 are directly related to prosodic boundaries and not to stressed syllables (on account of the aforementioned syncretism between accentuation and intonation). In Spanish, stress is mainly produced by a combination of duration and F0 [10]. Recent research [11] 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 the accentual differences between French and Spanish, the aim of this research is to examine whether native Spanish speakers transfer some accentual acoustic properties from Spanish to French L2 (i.e. French as a Foreign Language). Two variables have been taken into account in this study: the syllabic structure of the word, because of its importance in the position of Spanish stress; and the word's location within the accentual phrase, as stress is realized at the word level in Spanish and at the accentual phrase level in French.

2. Method

2.1. Participants

Six participants took part in this experiment: 3 native speakers (2 males and one female) of French from Geneva (hereafter "French"); and three native Spanish advanced learners of French (B2-C1) (2 males and one female), living in Geneva (hereafter "Spanish"), with at least two years spent in a French speaking country. Spanish speakers were from the Iberian Peninsula (Castilla, Extremadura and Galicia) and French was their second foreign language after English.

2.2. Material

Following the conclusions and perspectives of [12] in a preliminary study on the production of French stress by Spanish speakers, we used in the present experiment 18 trisyllabic French CV.CV.CV pseudowords. They present the following characteristics: they all begin 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 are /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 are /p/, /t/, /k/, /m/, /n/, /l/ and appear 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

[9]), which would have made the measurements on the surrounding vowels difficult. What is more, each CV.CV.CV pseudoword (e.g. *poutila*) has a CV.CV.CVC counterpart (e.g. *poutilar*), ending with /R/ or /l/. Each of the two final consonants appears the same number of times across the pseudowords. In total, 36 pseudowords were used in this experiment, 18 CV.CV.CV (CV condition) and 18 CV.CV.CVC (CVC condition).

As mentioned by [4, 13] among others, the accentual phrase in French is built, at the linguistic level, on syntactic, semantic and metrical information. Thus, 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 varies. In one carrier sentence, the pseudoword plays the role of a noun in the subject nominal phrase: it is thus at the right edge of the accentual phrase (i.e. subject 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 plays the role of a prenominal adjective in the subject nominal phrase: thus, it is 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 other words, in terms of the phrase-final location of stress, each pseudoword is in a stressed position in the Noun context, while it is in an unstressed position in the Adjective context. In total, 72 sentences were used in the experiment.

2.3. 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 Noun context and the sentences with the pseudoword in the 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.

2.4. Data analysis

All productions were automatically segmented in phones (EasyAlign under Praat, [14, 15]) 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. Instead of considering the whole sentence, we only performed measurements on 4 vowels: the 3 vowels of the pseudoword (V1, V2, V3; e.g. *un poutila pic*) and the vowel following the pseudoword (Vp1; e.g. *un poutila pic*). For each of these four vowels, we extracted the following parameter values: duration (in ms), mean value of F0 (in Hz) and maximum value of amplitude (in dB). Note that F0 values were obtained using the Hirst algorithm [16] in order to avoid some Praat F0 detection errors.

For duration, F0 and amplitude, we computed for each production the mean value across the four vowels and calculated for each vowel the ratio between its value and the mean value of the four vowels. We analyzed the data by means of mixed-effects regression models [17, 18], in which participants and pseudowords were entered as random terms.

Analyses were performed separately for each parameter (duration, F0 and amplitude). For each of them, the predictors were: Group (French/Spanish), Syllabic structure (CV/CVC), Context (Noun/Adjective) and Vowel (V1, V2, V3, Vp1).

3. Results and discussion

3.1. Duration

As results showed an interaction involving Group and Syllabic structure, we ran separate analyses for CV and CVC data.

3.1.1. CV

Figures 1 and 2 present duration values (in ratio) in CV pseudowords as a function of Group and Vowel in the Noun and Adjective contexts respectively. Independently of the group, we observe an interaction between Context and Vowel ($F(3, 808) = 81.00, p < .001$): vowels follow different duration patterns in sentences with the pseudoword as a noun (see Figure 1) and as an adjective (see Figure 2).

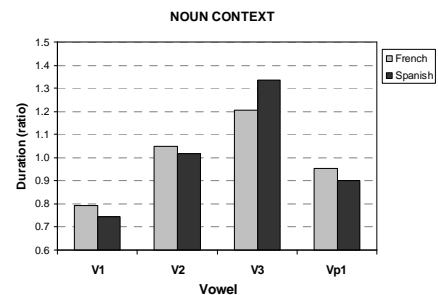


Figure 1: Duration values (in ratio) as a function of Group and Vowel in the CV Noun context (e.g. *un certain poutila piquait tous les touristes*).

In the Noun context, duration gradually increases from V1 to V3 and decreases from V3 to Vp1, whereas it gradually increases from V1 to Vp1 in the Adjective context. It is important to note that Spanish speakers and French speakers significantly lengthen the intended stressed in both the Noun (i.e. V3) as well as the Adjective (i.e. Vp1) context.

Moreover, an interaction between Group and Vowel is present, whatever the context may be ($F(3, 808) = 5.64, p < .001$). While duration in V1 and V2 is statistically similar in both groups, we observe a longer duration in V3 for Spanish speakers than for French speakers ($\beta = 0.14, p < .001$), as well as a shorter duration in Vp1 ($\beta = -0.08, p < .05$), whether the pseudoword is a noun or an adjective.

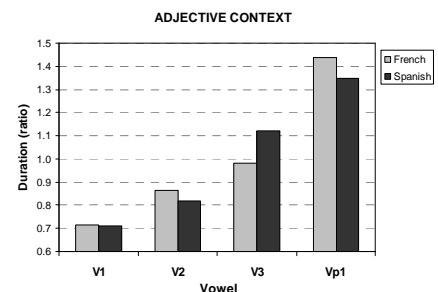


Figure 2: Duration values (in ratio) as a function of Group and Vowel in the CV Adjective context (e.g. *un poutila pic était très utile*).

3.1.2. CVC

Figures 3 and 4 present duration values (in ratio) in CVC pseudowords as a function of Group and Vowel in the Noun and Adjective contexts respectively. Whatever the group, we note, as for CV pseudowords, an interaction between Context and Vowel ($F(3, 804) = 116.23, p < .001$): a gradual durational increase from V1 to V3 followed by a decrease in Vp1 can be seen in Figure 3 for the Noun context, whereas a gradual increase from V1 to Vp1 is observed in Figure 4 for the Adjective context. Again, Spanish speakers and French speakers significantly lengthen the intended stressed vowel in both contexts.

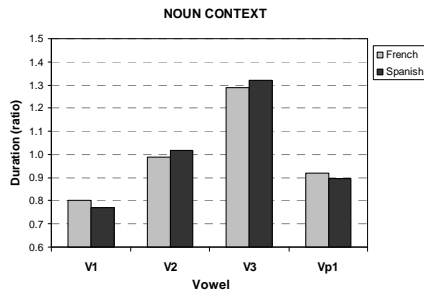


Figure 3: Duration values (in ratio) as a function of Group and Vowel in the CVC Noun context (e.g. *un certain pouñila piquait tous les touristes*).

Furthermore, no interaction between Group and Vowel is observed in any of the contexts ($F(3, 804) = 0.43, n.s.$). As can be seen in Figures 3 and 4, Spanish speakers, in comparison with French speakers, do not lengthen V3 in CVC pseudowords, contrary to what occurs in CV pseudowords.

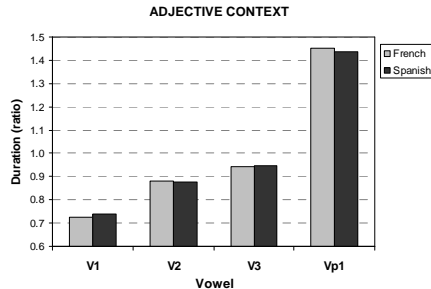


Figure 4: Duration values (in ratio) as a function of Group and Vowel in the CVC Adjective context (e.g. *un pouñilar pic était très utile*).

3.2. F0

As results showed no interaction involving Group and Syllabic structure, we grouped CV and CVC data. Figures 5 and 6 present F0 values (in ratio) as a function of Group and Vowel for the Noun and Adjective contexts respectively. Irrespective of the group, we note, as for duration, an interaction between Context and Vowel: F0 is not distributed in a similar way across the four vowels in sentences in which the pseudoword is a noun and in sentences in which it is an adjective ($F(3, 1601) = 280.83, p < .001$). On average, in the Noun context, F0 decreases from V1 to V2, increases from V2 to V3 and decreases from V3 to Vp1, while it decreases from V1 to V3 and increases from V3 to Vp1 in the Adjective context.

Moreover, we observe that, like French speakers, Spanish speakers present a significantly higher F0 on the intended stressed vowel (relatively to the previous vowel) in both contexts.

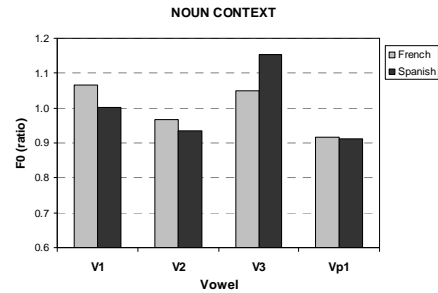


Figure 5: F0 values (in ratio) as a function of Group and Vowel in the Noun context (e.g. *un certain pouñila piquait tous les touristes*).

More interestingly, an interaction between Group and Vowel is observed in both contexts ($F(3, 1601) = 89.41, p < .001$). While F0 in V1 and V2 is lower for Spanish speakers than for French speakers in both the Noun context (V1: $\beta = -0.06, p < .001$; V2: $\beta = -0.03, p < .001$) and the Adjective context (V1: $\beta = -0.05, p < .001$; V2: $\beta = -0.04, p < .001$), we observe a higher F0 in V3 for Spanish speakers than for French speakers in both contexts (Noun: $\beta = 0.10, p < .001$; Adjective: $\beta = 0.06, p < .001$). Note that Vp1 F0 is statistically similar for both groups in the Noun context, but is higher for Spanish speakers in the Adjective context ($\beta = 0.05, p < .001$).

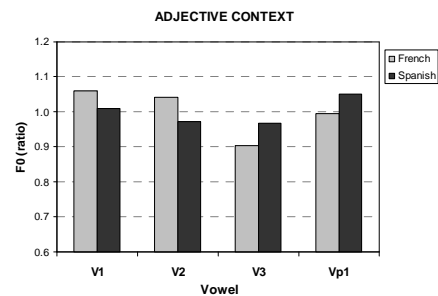


Figure 6: F0 values (in ratio) as a function of Group and Vowel in the Adjective context (e.g. *un pouñilar pic était très utile*).

3.3. Amplitude

As results showed no interaction involving Group and Syllabic structure, we grouped CV and CVC data. Whatever the group, we note, as for duration and F0, an interaction between Context and Vowel ($F(3, 1620) = 9.01, p < .001$). In the Noun context, amplitude is similar in V1, V2 and V3 and decreases on Vp1; in the Adjective context, it increases from V1 to V2 and is similar from V2 to Vp1. Therefore, contrary to duration and F0, amplitude is not significantly higher on the intended stressed syllable, whatever the group and the context may be. Moreover, no interaction between Group and Vowel is observed in any of the contexts ($F(3, 1620) = 0.67, n.s.$). Contrary to what happens for duration and F0, Spanish speakers do not present higher amplitude values in V3 than French speakers, regardless of the context.

4. General discussion

This research aimed at examining whether Spanish speakers transfer some accentual acoustic properties from Spanish to French L2. Results showed first that Spanish speakers are able to produce the intended stressed syllable at the right edge of the accentual phrase (i.e. subject phrase). They stress the final syllable of the pseudoword (V3) in the Noun context (e.g. un certain poutila || piquait tous les touristes), whereas they stress the final monosyllabic word (Vp1) in the Adjective context (e.g. un poutila pic || était très utile). Moreover, Spanish speakers, in the same way as French speakers, mark the stressed syllable by means of variations in duration and F0, but not with changes in amplitude. Altogether, these findings indicate that advanced Spanish learners of French are capable to realize a phrase-final stress in French. Nevertheless, it might also be that Spanish speakers have reproduced the prosodic pattern found in this kind of sentence in their mother tongue (the so-called (S)(VO) pattern; [19]) and have placed a sentence-internal boundary (after the subject phrase) in French, as they would have done in Spanish. A similar study (with the same pseudowords) is currently being run in Spanish L1, in order to examine the acoustic implications of such sentence-internal boundaries in Spanish.

However, our results also revealed that, whatever the pseudoword context may be (stressed/unstressed), Spanish speakers, in comparison with French speakers, tend to produce the final syllable of the pseudoword with a longer duration (at least in CV pseudowords) and with a higher F0. In the Noun context (i.e. with the pseudoword at the right edge of the accentual phrase), these cues might reflect 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 in the Noun context is conditioned by the position of stress and/or by the prosodic boundary. In the Adjective context (i.e. with the pseudoword not at the right edge of the accentual phrase), the presence of such cues (longer duration and higher F0) seems to suggest that Spanish speakers do stress the last syllable of the pseudoword. Therefore, it appears that Spanish speakers 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 acquired the knowledge that the stress domain in French is the accentual phrase, and not the word as in Spanish.

Conclusions about syllabic structure (CV/CVC) support this hypothesis. If Spanish speakers had transferred, from Spanish to French L2, the knowledge about the role of the syllabic structure in the position of stress, we would have found different results for CV and CVC pseudowords, or some cues of stress on the second syllable in CV pseudowords (i.e. the stressed position in a Spanish CV word). However, we observed no interaction between group and syllabic structure (for F0 and amplitude), which indicates that syllabic structure does not have a different effect in Spanish and French speakers. In the same way, we did not note a longer duration on the second syllable in CV pseudowords. Thus, Spanish speakers have not transferred their knowledge about stress position from Spanish to French L2.

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. In fact, they

have acquired the knowledge that, contrary to Spanish, stress is fixed in French, but they have not acquired the knowledge that stress is not realized at the word level, as in Spanish, but at the accentual phrase level. These findings still need to be confirmed with a larger sample of participants on the one hand and a similar study in Spanish L1 on the other, in order to determine the influence of prosodic boundary and syllabic structure on native Spanish accentuation.

5. Acknowledgements

We would like to thank M. Avanzi, L. Baqué, M-A. Barquero, I. Racine and F. Zay for their help in designing this study. This research project is funded by the Swiss National Science Foundation (100012_132144/1; dir: I. Racine).

6. References

- [1] Jun, S. A. and Fougeron, C., "Realizations of accentual phrase in French intonation", *Probus*, 14: 147-172, 2002.
- [2] Vaissière, J., "Cross-linguistic prosodic transcription: French vs. English", in N.B. Volskaya, N.D. Svetozarova and P.A. Skrelin [Eds], *Problems and methods of experimental phonetics*. In honour of the 70th anniversary of Pr. L.V. Bondarko, 147-164, St Petersburg: St Petersburg State University Press., 2002.
- [3] Lacheret-Dujour, A. and Beaugendre F., "La prosodie du français", Paris: CNRS éditions, 1999.
- [4] Rossi, M., "Le français, langue sans accent", *Studia Phonetica*, 15: 13-52, 1979.
- [5] Quilis, A., "Tratado de fonología y fonética españolas", Madrid: Gredos, 1993.
- [6] Delattre, P., "Studies in French and comparative phonetics", The Hague: Mouton, 1966.
- [7] Delattre, P., "L'accent Final en Français: Accent D'intensité, Accent de Hauteur, Accent de Durée", *The French Review*, 12, 141-145, 1938.
- [8] Léon, P., "Phonétisme et prononciations du français", Paris: Armand Colin, 2007.
- [9] Vaissière, J., "Rhythm, accentuation and final lengthening", in J. Sundberg, L. Nord, R. Carlson [Eds], *French in Music, Language, Speech and Brain*, 108-120 Wenner-Gren International Symposium Series Macmillan Press, Vol. 59, 1991.
- [10] Quilis, A., "Fonética acústica de la lengua española", Madrid: Gredos, 1981.
- [11] Llisterri, J., Machuca, M., Ríos, A. and Schwab, S., "El acento léxico en contexto: datos acústicos" *Proc. V Congreso de Fonética Experimental*, October 2011, submitted.
- [12] Schwab, S., "L'accentuation en français L2 chez les apprenants hispanophones: une étude acoustique", *Working Papers in Corpus-based Linguistics and Language Education*, 9, in press.
- [13] Delais-Roussarie, E. and Post, B., "Unités prosodiques et grammaire de l'intonation : vers une nouvelle approche". *Actes des XXVIIème Journées d'Études sur la Parole (JEPTALN 2008)*, Avignon, Juin 2008, 2008.
- [14] Goldman, J.-P., "EasyAlign: an automatic phonetic alignment tool under Praat", *Proc. 12th Interspeech*: 3233-3236, 2011.
- [15] Boersma, P. and Weenink, D., "Praat: doing phonetics by computer (Version 5.2)". www.praat.org, 2011.
- [16] Hirst, D., "The analysis by synthesis of speech melody: From data to models". *Journal of Speech Sciences*, 1(1): 55-83, 2011.
- [17] Baayen, R. H., Davidson, D. J., and Bates, D. M., "Mixed effects modeling with crossed random effects for subjects and items", *Journal of Memory and Language*, 59: 390-412, 2008.
- [18] Bates, D. M. and Sarkar, D., "lme4: Linear mixed-effects models using Eigen and R syntax", R package version 2.6., 2007.
- [19] D'Imperio, M., Elordieta, G., Frota, S., Prieto, P. And Vigarío, M., "Intonational phrasing in Romance: The role of syntactic and prosodic structure", in S. Frota, M. Vigarío and M.J. Freitas [Eds], *Prosodies: With Special Reference to Iberian Languages*, 59-97. Berlin: Walter de Gruyter, 2005.