

Productions of "continuation contours" by French speakers in L1 (French) and L2 (English)

Katarina Bartkova¹, Anne Bonneau², Vincent Colotte² & Mathilde Dargnat¹

¹Nancy University, ATILF, France ²Nancy University, LORIA-CNRS

{katarina.bartkova, mathilde.dargnat}@atilf.fr

{anne.bonneau, Vincent.colotte}@loria.fr

Abstract

The goal of the present paper is to study interference between French and English prosody. In order to study the influence of the prosody on the second language pronunciation, F0 slopes and vowel durations of the last syllables of prosodic groups were measured and analyzed in the pronunciation of French native speakers speaking French and English, and of English native speakers speaking English. Significant differences appear in our data between the use of F0 slopes by French speakers speaking English and the use of F0 slopes by English native speakers: most of the time, non-native English production of F0 slopes is closer to French prosody than to English native prosody. For non-native (French speakers) vowel duration values are generally different from vowel durations in French data. However, they are somehow closer to values produced by English native speakers.

Index Terms: prosodic interference of L1 and L2, continuation F0 slopes, vowel duration.

1. Introduction

Many studies focus on the issue of interference of languages in second language learning especially at the segmental level. However, transfer from the L1 language is an important factor also at the intonation level.

According to [9], a prosodic transfer can take the form of both phonological and phonetic interference. Phonological influence results from differences in the inventory of phonological tones, their form, and the meaning assigned to them. Phonetic influence, in contrast, stems from a difference in the phonetic realization of an identical phonological tone. Furthermore, there is also evidence for a bi-directional interference between languages: not only does L1 influence L2, but L2 also has an effect on L1.

Contrastive research on prosody indicates that there are sharp differences between languages as far as their patterns of accentuation at the utterance level are concerned. This is especially true for Germanic (e.g. Dutch, English, German) and Romance languages (e.g. French, Italian, Spanish) [8].

French uses a combination of segmental and tonal cues to signal prosodic phrases, and differs in this respect from a language like English, which relies almost exclusively on tonal boundaries [7]. In French, lexical stress is mostly quantitative [4] and the final syllable is the one which undergoes a potential lengthening. However, lengthening of the last syllable of the word corresponds also in French to final (pre-boundary) lengthening, which concerns rhythm, and is not an accentual lengthening as in English [1].

French is generally considered as a language with mostly 'rising' F0 patterns accompanied by a lengthening of final syllables. According to [11], the French ear is trained to perceive rising *continuation* F0 patterns at the end of prosodic phrases: each prosodic phrase inside a sentence tends to end

with a high rise (Delattre's *continuation majeure*), or a smaller rise (Delattre's *continuation mineure*). The French prosodic phrasing was described through a functionalist approach by Delattre [2]. Though complemented by more recent studies [5,6], Delattre's works still remains a reference for studies on French prosody.

2. Goal of the study

The aim of this study is to investigate to what extent the prosody used by French speakers when speaking English is influenced by French prosody.

The prosodic interference between L1 (French) and L2 (English) languages is studied here using some recurrent prosodic patterns in non-conclusive clause positions. In French spontaneous speech data, a melodic rise is generally produced at the end of A in juxtaposed declarative clauses (i.e. AB, where A and B are clauses linked by a unmarked discourse relation). It indicates that A is an unfinished constituent at the discourse level, and that it can be associated with the term of "**grouping**" or "**major continuation contour**", according to Delattre's approach. In Delattre's theory of French intonation, a categorical difference in intonation patterns is expected between minor and major continuation patterns, which are syntax-dependent. Furthermore, according to Delattre, major continuation patterns are only rising, whereas minor continuations can show rising or falling patterns.

The goal of our study is threefold: first, we investigate whether contrasts between major and minor continuation patterns are gradient or categorical, that is, whether the differences between these patterns are significant; secondly, we examine to what extent the use of 'raising' F0 patterns in L1 influences the pronunciation of French speakers when speaking English. In fact, a transfer between French and English prosody can be expected, as continuation F0 slopes are essentially rising in French while they are predominantly falling in English (American English, [3], British English, [8]). Finally, we examine whether there are significant differences in the use of vowel durations on prosodic boundaries in the pronunciation of native speakers (French and English) speaking L1 and French speakers speaking English (L2).

3. Methodology

In order to study continuation F0 patterns under controlled conditions (minor and major continuation patterns depending on the syntactic structures of the sentences), a laboratory corpus was preferred to a corpus of spontaneous speech. Thus, it allows one to gather all the syntactic structures of interest in a small number of sentences and to control at the same time the length and the phonetic content of the target words used to measure the required prosodic parameters (F0 slopes and vowel lengths). The syntactic structures of the French and

English sentences are identical. Therefore similarities in the use of F0 patterns can be expected between French and English sentence sets.

3.1. Corpus

The corpus used in this study contains 40 short sentences belonging to the following 8 syntactic categories. The target words of the study, on which the prosodic patterns are calculated, correspond to the words underlined and in bold. Some examples are:

- (CAP). Continuative configuration at the end of the first clause in a two clause sentence, without any coordinating conjunction: "Il dort chez **Maria**, il va finir tard. / He'll sleep at **Maria's**, he'll finish late."
- (CAO). Continuative configuration at the end of the first clause in a two clause sentence, with a coordinating conjunction: "Il dort chez **Maria** car il finit tard. / He'll sleep at **Maria's** because it's too late."
- (CIS). Continuative configuration on a subject NP: "Les **agneaux** ont vu leur mère. / **The lambs** have seen their mother."
- (CIA). Continuative configuration on a NP subject in the first clause of a two clause sentence: "**Nos amis** aiment Nancy parce que c'est joli. / **Our friends** really like Nancy because it's pretty."
- (QAS). Question configuration at the end of a clause: "Il dort chez **Maria**? / Will he sleep at **Maria's**?"
- (QIS). Interrogative configuration on a simple subject NP: "Qui a appelé? **Nos amis**? / Who has phoned? **Our friends**?"
- (DIS). Short declarative sentence "**Nos amis**. / **Our friends**".
- (DAS). Longer declarative sentence: "Il dort chez **Maria**. / He'll sleep at **Maria's**".

Two kinds of non-conclusive F0 slope configurations are studied here on two levels. First, on the syntactic level: the slope of the final segment of a subject NP in a declarative sentence, followed (CIA) or not (CIS) by another sentence. Second, on the discourse level: the slope of the final segment of A in a two clause utterance AB, where A and B are declarative clauses connected by a discourse relation, marked (CAO) or not (CAP) by a conjunction.

The sentences used should allow one to investigate:

- Whether final F0 slopes measured on sentences where we expect a minor continuation (CIA-CIS) are different from those measured on juxtaposed sentences (CAP) and sentences with a coordinative conjunction (CAO) (a major continuation is expected in both, as claimed by Delattre);

- Whether slopes measured on paratactic sentences (CAP) are different from slopes measured on sentences with coordinative conjunction (CAO) and whether slopes measured on one-clause sentences (CIS) are different from slopes measured on two-clause sentences (CIA);

- Whether continuative slopes of rising CIA-CIS are different from interrogative slopes measured on a simple subject NP (QIS) and whether continuative slopes of rising CAO-CAP are different from interrogative slopes measured at the end of a clause (QAS);

- Whether continuative slopes of falling CIA-CIS are different from declarative slopes measured on short declarative sentences (DIS) and whether continuative slopes of falling CAO-CAP are different from slopes measured on longer declarative sentences (DAS).

3.2. Recording protocol

The same 32 French native speakers recorded the French and the English non-native corpora. Around 40 recorded occurrences are obtained for each sentence type with 5 different sentences per type (see above). During the recording sessions, sentences were presented with a small description explaining a context in which the sentence could be uttered. The context and the sentences are displayed by the recording software used. While recording the corpus, speakers were able to listen to their recordings and record a sentence again when they found their pronunciation unnatural. A set of sentences is recorded by each speaker: every sentence is recorded by the same number of speakers and every speaker utters a sentence only once.

The English sentences uttered by French speakers are compared to the sentences uttered by a native English control group of 20 speakers. The control group recorded the sentences under the same circumstances as the French group. However, every English speaker uttered every sentence of the corpus, which increased the total number of recorded sentences of the English database.

3.3. Segmentation and annotation of the speech signal

Each speech signal was automatically pre-segmented and then manually checked by an expert phonetician using a signal editor software. Intonation slopes are computed as regression slopes (RslopeST) using F0 values in semitones estimated every 10 ms. Slopes are calculated on the last two syllables of the target segments (in underlined bold characters in paragraph 3.1) of every sentence. Durations of the last vowels are calculated for each target word and are normalized by the mean value of the vowel duration obtained for every sentence.

3.4. Statistical analysis

F0 slope data are analyzed by fitting mixed linear regression models (R package *lme4*). Using this approach, one can contrast the different configuration types and show the differences that are significant and those that are not (function *glht*, package *multcomp*). Vowel durations are analyzed using ANOVA ?.

4. Results analysis

4.1. F0 slopes

The statistical analysis shows that in French, sentences where we expect minor F0 pattern, continuation patterns (CIA-CIS sentence types) have mostly rising F0 patterns (95%). The major continuation sentence types (CAP-CAO) have also rising F0 slopes (59 %); but there is a significant difference between sentences with coordinating conjunctions (CAO), containing 73% of rising F0 slopes, and paratactic (CAP) sentences containing only 46% of rising F0 slopes.

In English data produced by French speakers, minor continuation sentence types (CIA-CIS) have mainly rising F0 patterns (69%) but also more falling patterns (31%) than in the French corpus. F0 slopes on major continuation (CAP-CAO) sentence types are rising for 41 %, but, unlike in French, there is no marked difference between F0 slopes in juxtaposed sentences (CAO, 42% rising slopes) and F0 slopes in

sentences containing coordinating conjunctions (CAP, 37 % rising slopes).

In English data produced by English speakers, the F0 slopes measured in minor continuation (CIA-CIS) sentence types can rise (53%) and fall (47%) equally. In major continuation (CAP-CAO) sentence types, F0 slopes are seldom rising (21%) and there is no marked difference between F0 slopes in sentences with coordinating conjunctions (CAO, 18% of rising patterns) and F0 slopes in paratactic sentences (CAP, 24 % of rising patterns).

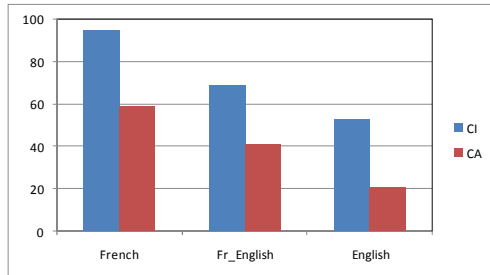


Figure 1: % of raising F0 patterns for the 3 speaker groups in major (CA) and minor (CI) continuation structures.

Our observations confirm that French speakers use more “rising” F0 patterns (especially in CI sentences where minor continuations are expected), than English speakers, who use more “falling” F0 patterns especially in CA (major continuation) structures.

The prosody of French speakers speaking English is influenced by the French prosody: F0 slope values are situated between the French and English native pronunciations (see Figure 1): there are more rising (CI-CA) F0 patterns than in our native English data but less than in French data.

However, our results do not confirm Delattre’s claim that F0 patterns are exclusively rising on major continuation prosodic boundaries. In fact F0 patterns in CA type sentences (where major continuation F0 patterns are expected) are more often falling than F0 patterns in CI type sentences (where minor continuation F0 patterns are expected).

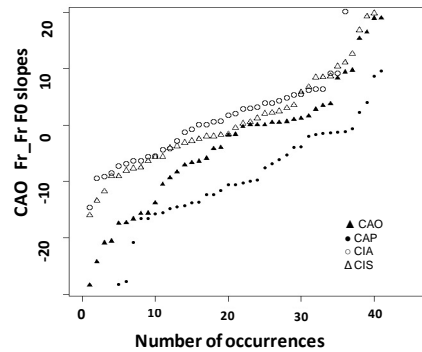
4.1.1. F0 slope contrasts

A more detailed analysis is obtained by studying F0 slope contrasts.

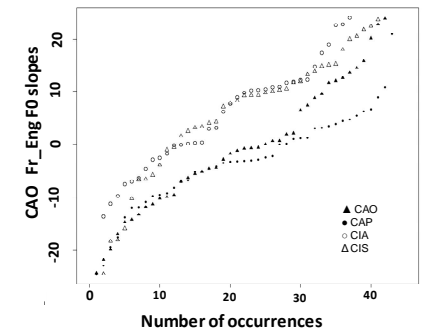
In the French corpus, slopes measured on minor continuation (CIS-CIA) sentence types are not significantly different from juxtaposed sentence types where major continuation slopes (CAO) are expected, although they are significantly different from slopes measured on sentences with coordinating conjunctions (CAP) (see Figure 2 (a)). Neither is there a significant difference between slopes measured on these two sentence types (CIA-CIS) (where minor continuation slopes are expected). However, the slopes of the latter are significantly higher than the slopes measured on short declarative sentences (DIS) and significantly lower than the slopes measured on simple subject NP questions (QIS). On the other hand, slopes measured on juxtaposed sentences (CAP) are significantly lower than those measured on sentences with coordinating conjunction (CAO).

Figure 2 compares F0 slope values for the 3 corpora in 4 sentence types. *Y axis* corresponds to $R_{slopeST}$ value ($R_{slopeST}$ = slope of the regression line of the pitch data points in semitones) and *X axis* to increasing ordering of observations (each point is an observation).

(a)



b)



(c)

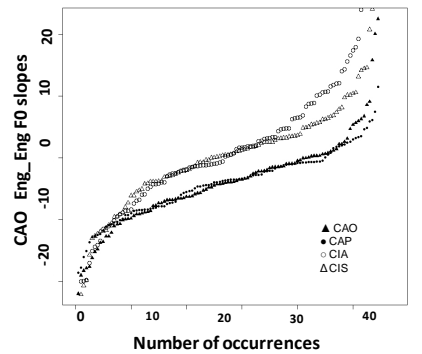


Figure 2: F0 slope values for the 1st test group for the 3 corpora (a) native French speakers, (b) French speakers speaking English, (c) native English speakers

In the pronunciation of the English corpus by French speakers, F0 slopes measured on minor continuation sentence types (CIS-CIA) are not significantly different from sentence types where major continuation slopes are expected (CAO-CAP). Unlike in the French corpus, slopes measured on paratactic sentence types (CAP) and sentence types with a coordinative conjunction (CAO) are not significantly different, which means that speakers are less influenced by the presence of the coordinative conjunction (see Figure 2 (b)).

In the control group (English speakers), slopes of minor continuation sentence types (CIA-CIS) are significantly higher than slopes measured on major continuation sentence types (CAO-CAP) and are also significantly higher than slopes measured on short declarative sentences (DIS). However, no significant difference is found here between minor continuation slopes (CI) and slopes measured on short

questions (QIS). English speakers (like French speakers speaking English) do not utter juxtaposed sentences (CAP) differently from sentences containing coordinating conjunctions (CAO) (see Figure 2 (c)). Furthermore, major continuation slopes (CAP-CAO) are not significantly different from slopes measured on longer declarative sentences (DAS) and interrogative (QAS) sentences. Table I gives a more synthetic view of the analysis.

Table I. Contrast tests: Comparison of F0, ++ marks significant differences

Test I: CAO-CAP-CIS-CIA

	Fr_Fr	Fr_Eng	Eng_Eng
CAP-CAO	++		
CIA-CAO			++
CIS-CAO			++
CIA-CAP	++	++	++
CIS-CAP	++		++
CIS-CIA			

Test II: CAO-CAP-DAS-QAS

	Fr_Fr	Fr_Eng	Eng_Eng
DAS-CAO	++		
DAS-CAP			
QAS-CAO		++	
QAS-CAP	++	++	

Test III: CIS-CIA-DIS-QIS

	Fr_Fr	Fr_Eng	Eng_Eng
DIS-CIA	++	++	++
DIS-CIS	++		++
QIS-CIA	++	++	
QIS-CIS	++	++	

Finally, it is worth mentioning that in French corpus there are more significant contrasts than in English corpus uttered by French and English speakers (9 vs. 6 out of 14).

4.2. Vowel duration analysis

The other major parameter of the continuation demarcation in French is the duration of the last (stressed) syllable, especially of its nucleus. Therefore, in addition to F0 slopes, vowel durations of the last vowels in the target words are also shortly analyzed. Vowel durations measured in the 8 sentence types are compared for the three groups of speakers by means of an ANOVA, in order to test whether the duration differences are significant or not. It turns out that vowel durations in the pronunciation of French speakers speaking English are significantly longer than vowels on prosodic boundaries measured in French, except vowels in short questions (QIS) and declarative final sentences (DIS). Although French speakers use vowel durations in English differently from English native speakers, their use of vowel durations in English is even more different from their use of vowel durations in French (significant differences in 5 sentence types, indicated by ellipses in Figure 3).

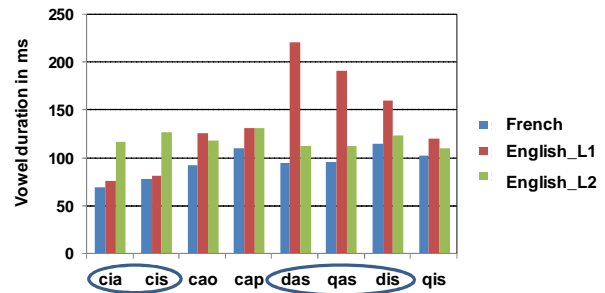


Figure 3: Mean duration values on last syllables of target words – significant differences between English L1 & L2 are indicated by ellipses.

5. Conclusions

In the present study, we examined whether continuation F0 slopes and vowel durations are produced in a similar way in French and English by native (French & English) speakers and by non-native speakers (French uttering English sentences). The data show that prosodic similarities remain between L1 and L2, especially in the use of continuative F0 slopes. As for vowel duration, the English vowel lengths for French speakers speaking English are more different from the French vowel lengths in our French corpus (distinctive differences found for 8 sentence categories) than from the English vowel lengths (distinctive differences found for 5 sentence categories only).

Since the analysis carried out in this study is essentially statistical, it would be useful to supplement it by a more qualitative study.

6. References

- [1] Campbell, W.N. (1992). Syllable-based segmental duration. In *Talking machines: theories, models and design*, Bailly & Benoît (eds). Amsterdam: Elsevier, 211-224.
- [2] Delattre, P. (1966). Les dix intonations de base du français, *The French Review*, 40/1, 1-14.
- [3] Delattre, P. (1938). A comparative study of declarative intonation in American English and Spanish, *Hispania* XLV/2, 233-241.
- [4] Delattre P. (1938), L'accent final en français: accent d'intensité, accent de hauteur, accent de durée, *The French Review*. XII/2, 141-145.
- [5] Di Cristo, A. (2010). A propos des intonations de base du français. Ms.
- [6] Fónagy, I. (1980). L'accent français, accent probabilitaire: dynamique d'un changement prosodique. In *L'accent en français contemporain*, Fónagy & Léon (eds), *Studia Phonetica* 15, 123-233.
- [7] Gussenhoven, C. (1984). *On the grammar and semantics of sentence accents*. Dordrecht: Foris.
- [8] Hirst, D. (1998). Intonation of British English. In *Intonation Systems: A Survey of twenty languages*, Hirst & Di Cristo (eds), Cambridge: Cambridge UP, 56-77.
- [9] Mennen, I. (2004). Bi-directional interference in the intonation of Dutch speakers of Greek, *Journal of phonetics*, 32, 543-563.
- [10] Rasier, L. & Hiligsmann, Ph. (2007). Prosodic transfer from L1 to L2 Theoretical and methodological issues, *Nouveaux cahiers de Linguistique française*, 28: 41-66.
- [11] Vaissière, J. (2002). Cross-linguistic prosodic transcription: French vs. English. In *Problems and methods of experimental phonetics. In honour of the 70th anniversary of Pr. L.V. Bondarko*, Volskaya, Svetozarova & Skrelin (eds).147-164.