Variation in Prosodic Boundary Strength: a study on dislocated XPs in French

Elisabeth Delais-Roussarie [1], *Ingo Feldhausen* [2]

[1] UMR 7110-Laboratoire de Linguistique Formelle, Université Paris-Diderot, France
[2] Goethe-Universität Frankfurt, Germany /UMR 7018-LPP, Université Paris 3, France

Elisabeth.roussarie@wanadoo.fr, ingo.feldhausen@gmx.de

Abstract

Three independently motivated types of information are usually assumed to influence prosodic boundary placement and to play a role in their relative strength: the morpho-syntactic structure, the information structure and the metrical complexity. The phonetic realization associated with the different boundary types (in particular IP and ip) is also assumed to vary.

Based on data of clitic left-dislocations in French, we argue here that differences in the relative strength of the prosodic boundary occurring at the end of the dislocated XP (i.e. an intermediate (ip) or an intonational phrase (IP) boundary) cannot be derived in a straightforward manner from these three types of information. In a production experiment, where the syntactic and information structure were controlled, while the metrical complexity was varied, the analysis of the data achieved with a semi-automatic tool, ANALOR, showed that the strength of the boundary occurring at the right edge of the dislocated object NP displayed a high degree of variability. In addition, the results indicate a lack of correlation between metrical complexity and boundary strength. The results lead us to argue that a sort of phonological neutralization occurs in certain textual contexts. This neutralization does not allow for distinguishing between intermediate and intonational phrase boundaries in all cases.

Index Terms: prosodic phrasing in French, boundary strength, phonetic realization, clitic left-dislocation (CLLD)

1.   Introduction

In most studies dedicated to prosodic phrasing and intonation, an utterance is considered to be segmented into hierarchically organized prosodic constituents (see, among others, [1], [2], [3], [4] und [5]). Three independently motivated types of information are usually assumed to influence prosodic boundary placement and to play a role in the evaluation of the relative strength of the boundary:

- The morpho-syntactic structure, as prosodic phrase boundaries align to designated edges of various syntactic phrases (right or left edge of heads of maximal projections, etc.). See [5], [6], [7] and [8], in which syntax-prosody mapping is expressed in terms of alignment constraints, as well as [3], [4] and [10] for different ways of describing prosody-syntax mapping.

- The information structure, as the topic or the informational focus of an utterance may call for the realization of specific prosodic boundary. See, for instance, the various constraints that account for the alignment of the prosodic phrases to the topic (as in [8],) or focus constituent (as in [11], [12], [13] and [14]).

- The metrical structure, since the size or the metrical structure of a syntactic unit, may influence prosodic phrase placement. In French, for instance, it has been shown that the size of the accentual phrase (or prosodic word) is usually limited to six or seven syllables (see, among others, [7], [15] and [16]). As for Spanish, Catalan and Portuguese, [17] showed that a constituent length of five syllables has an important effect on prosodic phrasing, in contrast to syntactic branchingness.

Even if these various types of information may influence boundary placement, we argue here that they cannot always account for the relative strength of the boundary. A sort of neutralization occurs in some contexts and prevents one from distinguishing between differences in boundary strength, in particular the difference between ip and IP boundaries (see [18] and [19] for a description of these two distinct prosodic constituents in French).

Our proposal is based on the investigation of the prosodic phrasing of clitic left-dislocations (CLLDs) in French, while using a semi-automatic procedure to assign boundary strength. CLLD is an optimal phenomenon for several reasons. First, in terms of syntactic structure, the canonical word order is changed according to the dislocation of a constituent. This yields a specific prosodic pattern, in which the right edge of the dislocated XP is aligned with a prosodic phrase boundary: many (prosodic and syntactic) studies claim that the CLLD constituent is typically demarcated by an IP boundary (e.g. [10], [20]), and some others show that the right edge of CLLDs coincide with either an IP boundary, or an ip boundary (see [8], [13], or [21]). Note however that some studies argued that CLLDs may be prosodically unmarked, or aligned with a lower level boundary such as prosodic word or accentual phrase (see [22] and [23]). Second, with respect to the information structural status, the CLLD constituent is usually considered to be a topic and to be given (in a general sense; see, among others, [23] for a discussion of the interpretative function of CLLD). Third, in the context of metrical structure, the branchingness or the size of the CLLD constituent can vary. We apply this option in the present study. [23] showed that the length of the dislocated XP may play a role in the strength of the prosodic boundary occurring at its right edge (IP, ip, or no real marking which leads to phrase the dislocated XP with the subsequent sentence material). Catalan CLLDs, in contrast, do not show any restructuring effects, according to [8].

Thus, by using CLLD structures, we control for the syntactic structure and the information packaging of the sentence (neither changes), while modifying the metrical structure (expressed in terms of branchingness or length). If a one-to-one correlation exists between the syntax of CLLD and its prosody, no variation in boundary strength (ip or IP) should occur. The same holds for the information status: since the interpretation of the CLLD constituent remains the same, the boundary strength should not differ. In addition, if metrical weight plays a role, boundary strength should be clearly correlated with the (non-) branchingness of the dislocation.

The results, however, show that there is great variation in both boundary strength and phonetic realization in each condition.

The paper is organized as follows. In section 2, the major theoretical issues concerning the representation of prosodic structure and the definition of prosodic phrases in French are given. Section 3 presents the methodology and the corpus used to carry out this research. In section 4, we give a description of the results obtained by analyzing prosodic phrasing in our data. Section 5 consists of a discussion of our findings and presents some perspectives for future research.

2. Background and problematic

In the last few decades, many theoretical studies in prosody have been dedicated to prosodic structure and its organization. Focus has been given to two different issues: the internal organization of the prosodic hierarchy and the criteria involved in the definition of the different prosodic units.

2.1 Prosodic hierarchy and levels of structuring

In most prosodic descriptions, an utterance is considered to be segmented into units that are hierarchically organized. The number of levels above the word level is usually assumed to be either two (e.g. the accentual phrase and the intonational phrase or the phonological/intermediate phrase and the intonational phrase as in [4] and [25]) or three (the accentual phrase, the intermediate phrase and the Intonational Phrase, see, [18] and [26] for French).

Even in studies that are not overtly based in the metrical-autosegmental framework, two or three distinct levels of phrasing above the word level are usually assumed for French (see, among others, [23] and [27]). It is worth mentioning that two authors working on French intonation argue for a different approach: Mertens proposes only a single unit called the *groupe intonatif* ([9], [10]), while Martin proposes that the number of levels of phrasing critically depends on the morpho-syntactic structure of the sentence, [16], [28], [29].

The proposal made here is done within the metrical-autosegmental framework (see [1] and [2]) and relies on the idea that three levels of phrasing are distinguished in French (e.g. the AP, the ip and the IP as in [18], and [26]). We will show, however, that the distinction between ip and IP phrases may be neutralized in some contexts.

2.2 Criteria for the definition of the prosodic constituents

Among the works focusing on the definition of different types of prosodic phrases, a distinction can be made between roughly two categories of work:

- In some works, realizational differences in the prosodic events occurring at phrase boundaries are crucial in distinguishing boundary strength (e.g. [18], [19]). In a certain sense, phonetic and phonological criteria are thus given priority compared to syntax-prosody mapping in the definition of the prosodic phrases.

- In others studies, the definition of prosodic phrases is considered to be constrained by the mapping between the morpho-syntactic, the informational and the metrical structure (see [4], [5], [6] and [8]).

As far as we are concerned, the difference between these two approaches should be limited to a unique perspective: one would hope that both approaches will lead to the same results.

In this work, we assume that differences in boundary strength (here: ip vs. IP) are associated with various prosodic realizations, but we also assume that some categorical differences exist between the different levels of phrasing which can be accounted for by the linguistic criteria explaining boundary placement. Our aim here is thus to determine which criteria come into play in the placement of the two prosodic phrase boundary. This will be done by calculating boundary strength through an automatic procedure in comparable structures.

3. Methodology

To carry out this research, data were gathered by means of a production test. The obtained utterances were then analyzed by using a semi-automatic procedure. The data collection protocol and the analysis procedure are explained in the next sub-sections.

3.1 Corpus and data collection protocol

The experiment was conducted in Paris (France). Ten native speakers of Standard French were recorded. For the present study, six speakers were analyzed, ranging in age from 22 to 29. All subjects were post-graduate students and remained naive as to the purpose of our investigation. The data were recorded as WAV files (16bits, 44.1 kHz) with the Roland UA-55 Quad Capture USB audio interface and the AKG C520 headworn condenser microphone. The speakers were asked to read sentences, for which a context was given.

The utterances to be produced were designed to contain clitic left-dislocations and consisted of simple assertions and questions as shown in (1). While the left-dislocated constituent in the assertions consisted of either one (1a) or two (or three) lexical words (1b), in the questions it consisted of only one lexical word (1c). In order to guarantee the givenness of the left-dislocated constituent (in bold in (1)) and the newness of the core clause, each utterance was preceded by a corresponding context, in which the dislocated element was mentioned, as exemplified in (2) for (1a,b) and in (3) for (1c); cf. the underlined element. The corresponding contexts allow for the classification of the left-dislocated elements as *active topics*, since the latter are active in the speaker's mind and are textually given, i.e. they have just been mentioned in the discourse.

(1a) **La bouteille** Jean-Marie l'a donnée au voisin.
'The bottle, Jean-Marie gave it to the neighbor.'

(1b) **La bouteille de Bordeaux** J.-M. l'a donnée au voisin.
'The bottle from Bordeaux, J.-M. gave it to the neighbor.'

(1c) **Et ce roman** tu l'as déjà lu ?
'And this novel, did you already read it?'

(2) Que s'est-il passé avec la bouteille de Bordeaux? Elle est où?
'What happened to the bottle from Bordeaux? Where is it?'

(3) Je t'ai apporté un roman policier. Je l'ai mis sur la table.
'I brought you a detective novel. I put it on the table.'

In our data, the left-dislocated element was always chosen as to fulfill the function of the object, there being an ongoing discussion of whether sentence-initial subjects in French are actually clear instances of left-dislocation (see [22], and [31]).

There were a total of 144 target sentences (four sentences of type (1a), five sentences of type (1b), three sentences of type (1c), multiplied by two repetitions and six speakers). Additional filler clauses were added.

The subjects were recorded in a quiet room at the Linguistics Department of the University of Paris 7. The stimuli were presented in a pseudo-randomized order on sheets of paper with roughly six target and filler sentences per page. The subjects were told to read the stimuli out loud at a normal rate of speech. Since no sentence-internal punctuation was used, the subjects were told to first read the sentences silently before uttering them aloud. Each recording started with a short practice session.

3.2 Prosodic analysis of the utterances

The data were analyzed in three steps. First, the data were transcribed by the two authors using *praat* [32]. Second, the utterances were automatically segmented into phones, syllables, and graphemic words by means of the speech processing script *EasyAlign* [33]. The obtained segmentations were controlled and corrected when necessary by the authors. Third, the strength of the prosodic breaks associated with the right edge of the dislocated elements was determined by means of the semi-automatic annotation software ANALOR (see [23], [34] and [35] for more details). The software automatically measures the four acoustic parameters (i) relative syllable duration, (ii) relative F0 average, (iii) slope contour amplitude, and (iv) presence of an adjacent silent pause, detects the prominent syllables, and assigns a degree of prominence to each syllable, be it prominent or not. The degree of prominence is calculated on the basis of the parameters that are considered as fundamental for marking prominence in French (see, among others, [23], [34] and [35]). ANALOR's calculations of the degree of prominence rely on two elementary principles, the *quantity principle* and the *compensation principle* (see [22]). The first states that the larger the number of acoustic parameters involved in the detection of a prominence, the stronger the prominence is perceived. The second balances the parameters with one another: if one parameter shows a high prominence score and the other a low one, they are perceived as presenting a medium score together. The results of the calculation are presented in grades ranging from 0 (no prominence) to 10 (high prominence). Since accentuation plays a crucial function in the demarcation of the prosodic units in French (see, among other,[9], [25], [26] and [36]) , we have inferred the boundary strength from the degree of prominence assigned to the last metrical syllable of each word: the higher the degree of prominence, the stronger the break.

Thanks to the software, the detection of the level of prominence for each syllable is robust and we could thus avoid the variation which typically occurs between experts in manual prosodic annotation (see, for instance, [1], p. 288ff). Since accentuation and phrasing are closely related in French (see [9], [23], [25] and [36] among others), we associate the degree of prominence with specific prosodic constituents:

- Level > 2 and < 3   = AP boundary
- Level 3 and 4   = ip boundary
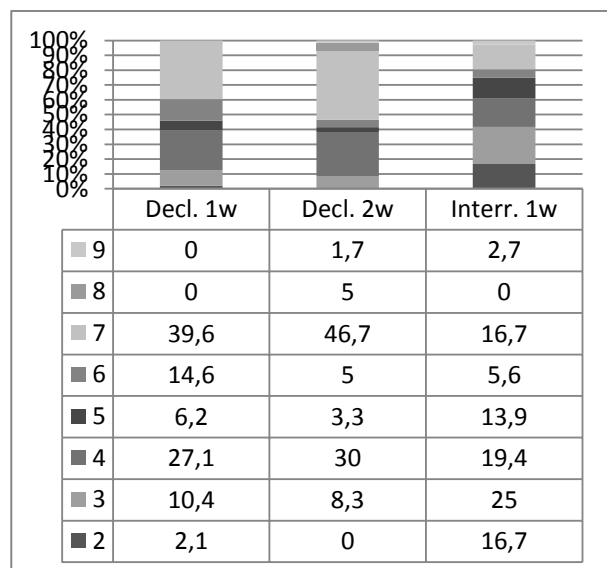- Level 5 and higher   = IP boundary

In describing the results in the next section, we rely mostly on the prominence levels. It is only in section 5 that the association between degree of prominence and prosodic constituents (or boundary strength) will be discussed in greater detail.

4.   Results

The results indicate that there is generally a prosodic boundary at the right edge of the left dislocated constituent, and its strength forms a gradient ranging from 2 (as > 2) to 9. In addition, this boundary corresponds to an ip or higher boundary in more than 97% of the cases in assertions. In questions, the prosodic boundary is weaker in more than 15% of the cases. In 16,7 % of the cases, it corresponds to an AP boundary.

Table 1 gives the scores of the boundaries at the right edge of the dislocated constituents as detected by ANALOR. Column 1 represents pattern (1a), column 2 (1b), and column 3 (1c). The bars at the top of the table illustrate the percentages given in the table for each score (from 2+ to 9; scores 1 and 10 are not attested in our data).

Table 1. *Prominence of final syllable in CLLD constituent (ANALOR degrees).*

	Decl. 1w	Decl. 2w	Interr. 1w
9	0	1,7	2,7
8	0	5	0
7	39,6	46,7	16,7
6	14,6	5	5,6
5	6,2	3,3	13,9
4	27,1	30	19,4
3	10,4	8,3	25
2	2,1	0	16,7

4.1 Dislocated constituent as a single word in assertions

The most prominent score in the assertive sentences with one lexical word (Decl. 1w) was 7 (39.6%; 19 out of 48 instances). The second highest score for this condition is 4, with 27.1% (13/48). In addition, scores 3, 5, and 6 were also attested more than one time (score 3: 10.4% = 5/48; score 5: 6.2% = 3/48; score 6: 14.6% = 7/48). Score between 2 and 3 is attested only once (2.1%). The percentages of scores ranging from 4 to 7 add up to 87.5% (42/48). Scores 8 and 9 are not attested.

According to these results, IP boundaries occur at the right edge of dislocated object NP in more than 60% of cases, while ip boundaries occur in only 37.5 %. The AP boundary is observed only in 2.1% of the cases.

4.2 Dislocated constituents with two words in assertive sentences

As for the condition with two lexical words (Decl. 2w), all scores between 3 and 9 were attested. Score 7 was by far the most prominent one with a percentage of 46.7 (28/60), followed by score 4 with 30% (18/60). All other scores fell below 10%. In condition 2w, the percentages of scores ranging from 4 to 7 add up to 85% (51/60). In contrast to condition 1w, condition 2w had instances of scores 8 and 9, but no instance of score inferior to 3. Together with the very high percentage for score 7, the data show that the prosodic boundaries in condition 2w are generally slightly stronger than in 1w.

Despite this picture, IP and ip boundaries occur similarly frequently in both conditions. Note that some speakers even realize a stronger boundary in 1w condition than in 2w condition.

4.3 Questions

Table 1 shows that score 3 was most prominent with 25% (9/36); followed by score 4 with 19.4% (7/36), and score between 2 and 3 with 16.7% (6 cases out of 36). These three scores add up to a total of 61.1% (22/36). This shows that the general degree of CLLD boundary strength is much lower in questions than in assertions - even though there were six instances of score 7 (16.7%) and 5 instances of score 5 (13.9%).

The interpretation of the results in terms of boundary level shows that an AP boundary occurs in 16.7 % of the cases, while an ip boundary occurs in 44.4 % and an IP in 38.9% of the cases. In comparison to assertive sentences, non-IP boundaries (i.e. AP or ip boundaries) are found to be more frequent in questions.

5.   Discussion

Up to now, the results were mostly presented by relying on the ANALOR scores of prominence. In this section, we would like to highlight the interpretation of these scores in terms of prosodic constituents and prosodic structure: accentual phrase (AP), intermediate phrase (ip), and Intonational Phrase (IP).

Before running the experiment, the authors agreed to assign all scores between 2 and 3 to the AP, the scores between 3 and 4 to the ip level, and the scores equal and higher than 5 to the IP level. [22] and [23] made slightly different choices in assigning scores between 2 to 3 (2<score<3) to the AP level, score 3 to the ip level, and everything equal and greater than 4 to the IP level. Despite the difference in the affiliation of score 4, this score always signals that a clitic-left dislocation in French is not obligatorily followed by an IP boundary, but rather can be realized on either the ip or the IP level. Similarly, the prominence of the ultimate syllable in the dislocated constituent is subject to strong variation.

According to the two classifications, our results show that it is only in questions that the CLLD constituent needs not to be prosodically separated from the following sentence by an ip or an IP boundary. In assertions, the CLLD constituent is almost always separated from the sentence by an ip or an IP boundary (just one case of an AP boundary was observed in all the data). The impossibility of having an AP is even clearer with branching CLLD constituents, as these never group with the subsequent material in our data. Interestingly, the

boundary at the right edge of the dislocation is the strongest boundary one can find sentence internally: (i) it is the strongest one within the dislocated XP (in case the XP consists of at least two distinct prosodic units, and (ii) it is also the strongest one with respect to the following sentence internal boundaries. This means, independently of the CLLD boundary being an ip or an IP boundary, it is always the strongest sentence-internal boundary. Only the sentence-final boundary might be stronger. The first point is not really surprising and confirmed what was said by [10], [15] and [16] among others. As for the second point, it shows that no restructuring with subsequent elements is possible in French, even when the boundary strength is not very important. To sum up, it is possible to say that a phrase boundary is always realized at the right edge of the CLLD in assertive sentences. The results show however that the mapping between syntax/information structure and prosody is not invariant with respect to the boundary strength, since it is either an ip or an IP boundary. In addition, the great variation in prominence and boundary strength in conditions 1w and 2w clearly indicates a lack of correlation between metrical complexity and phonetic realization of the boundary.

As for the behavior of CLLD in questions, we think that the sentence type may play a role: all questions were declarative questions, which end with a rising tonal contour. So, in order to distinguish this contour from the rising contour occurring after the CLLD, the speaker may realize a weaker sentence-internal rising contour, or even a falling one. These realizations confirm the proposal made in [16], [28] and [29]. They are also in accordance with more recent studies ([37], [38]) which show that global intonational patterns may be more important than the exact strength of a boundary as the "impact of prosodic boundaries depends on the other prosodic choices a speaker has made" ([38], p. 244). In the cases where a non-rising contour has been observed at the right edge of the dislocated XP, the assigned degree of prominence may result from the form of the contour. The calculation, as currently made has a tendency to underweight falling contours. Since such cases are not very frequent, they cannot invalidate the conclusions made here.

6.   Conclusion and Perspectives

The analysis of our data shows that the choice between the different boundary levels cannot be systematically explained on the basis of the three criteria usually claimed to account for prosodic phrasing, i.e. syntactic and information structure, and metrical complexity. There is great variation in the realization of boundary strength. To our mind, this could be attributed to a sort of neutralization: in some contexts, the distinction between ip and IP boundaries is not really relevant, since the sentence as a whole does not request to distinguish three levels of prosodic structuring. In order to be the strongest sentence-internal break, the prosodic break occurring at the end of the dislocated XP could be an ip or and IP boundary.

Further research is necessary to understand the exact motivation behind this neutralization. One could for instance take into account CLLDs in embedded clauses in order to address some of the issues. In addition, a more comprehensive study of the phrasing in questions has to be achieved in order to see what motivates the occurrence of AP boundary in this context: is it due to tonal and realizational constraints, or to the expression of some difference in speaker 's attitude.

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