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Intonation of Alternative Constructions in French: which cues allow distinguishing statements from questions?*

Intonation of alternative constructions in French

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Alternative questions in French are described as ending by a falling contour, while a rising contour occurs on the non-final conjuncts. This configuration is very similar to the one observed in statements with a disjunction. The similarity at the phonological level raises the following questions: Are intonational contours equally implemented at a phonetic level in questions and statements? If not, what are the acoustic cues that allow for distinguishing the two sentence types? The aim of this study is to show that the phonetic implementation of the intonation contours at the end of both sentence-medial and sentence-final conjuncts differ in alternative questions and statements with a disjunction in French. This finding may deepen our understanding on the relation between intonation and meaning.

Keywords: intonation, alternative constructions, intonational meaning, suprasegmental cues

1. Introduction

In many languages, interrogative sentences can be interpreted either as an alternative question (1a and 2a) or as a yes-no polar question with a disjunction (1b and 2b). In (1a), the set of statements that count as possible answers is {I want coffee, I want tea}, whereas

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b. Jean-Marie veut aller à Dublin ou à Madrid ?
 H* (H/0*) LH*H- !H*0/L%

The fact that declarative sentences are used for both questioning (see (3b)) and asserting (see (3a)) in French makes the ambiguity even more acute, as no grammatical element differentiates the two speech acts. The current study sets out to determine differences in the phonetic implementation of rising and falling contours between French alternative questions and statements with a disjunction (see, among others, Rossi *et al.* 1981). In particular, it investigates which acoustic cues could allow for distinguishing alternative questions from statements with a disjunction. Answers to these questions may be of interest to deepen our understanding on the relation between intonation and meaning in French, and more precisely, on the encoding of ‘interrogativity’. As both utterances have different meanings (i.e. (3b) as a question, and (3a) as a statement) despite the absence of morpho-lexical and phonological cues marking the distinction, we expect the difference to be encoded at the phonetic level with some prosodic feature indicating ‘interrogativity’ or ‘questioning’ in (3b).

This paper is organized as follows. In section 2, previous studies on the prosody of constructions with a disjunction are presented, which will explain which cues often play a role in the disambiguation of such utterances. Sections 3 and 4 present the methodology and the results of a pilot production study, respectively. Section 5 discusses the outcomes of the experiment in light of previous studies on this topic. Conclusions and perspectives are outlined in section 6.

2. Previous studies on the prosody of alternative constructions

As mentioned earlier (cf. Introduction), most of the work on alternative constructions has been carried out on Germanic languages (see, among others, Bartels 1999; Pruitt 2008; Pruitt and Roelofsen 2013; Michalsky 2014). Here we will focus on the prosodic properties that have been found to be crucial for disambiguating such structures.

Previous studies on English have mostly investigated the distinction between alternative questions and polar questions with a disjunction. Three prosodic features have been found to play a role in the encoding of such a distinction: phrasing, accentuation and the phonological form of the final contour (see, among others, Bartels 1999; Pruitt 2008 and Pruitt & Roelofsen 2013). In alternative questions, each conjunct is accented and usually phrased as a separate prosodic constituent. This realization reflects the fact that each conjunct is F-marked (+ focus) (see, among others, Han and Romero 2004; Truckenbrodt 2013).¹ The final conjunct is typically realized with a falling contour, which is said to indicate the exhaustive mention of the set of alternatives (see Bartels 1999; Biezma and Rawlins 2015).² The canonical prosody associated with an alternative question is thus of the form given in (4), a rising contour at the end of each non-final conjunct, and a fall at the end of the sentence.

¹ According to Han and Romero (2004) and Truckendrodt (2013), each conjunct may be considered to be an independent clause, with elliptical materials in the second conjunct, as shown below:

Do you want COFFEE or ~~do you want~~ TEA ? (AltQ)

² According to Bartels (1999), the closure of the alternative set is expressed by a falling contour, which is considered as a marker of “assertiveness”.

- (4) *Do you want coffee or tea ?*
 (H*/L* H-) (H* L- L%)

On the other hand, the prosody associated with polar questions with a disjunction differs in two ways: non-final conjuncts may be accented but they are not phrased separately, and the final conjunct is realized with a rising contour (Bartels 1999).

Among the three disambiguating prosodic properties (i.e. phrasing, accentuation and the sentence-final form of the tonal movement), the final fall has been said to be the most crucial cue for interpreting the utterance as an alternative question, as shown in a comprehension study (Pruitt and Roelofsen 2013).

More relevant to our study is the work by Michalsky (2014) on statements (5a) and alternative questions (5b) in German. The author analyses how the pitch accent H*L and the phonological rises L*HH% and L*H0% – which occur at the end of non-final prosodic phrases in both statements and alternative questions – are phonetically implemented. As for the nuclear rising contours (H*H% or H*0%), results show larger f0 excursions and peaks in questions than in statements.

- (5) a. Will Mone nachher zu Suse gehen)_{IP}, (kann sie nicht bei Narne
 H*L L*H H%|0% bleiben.)_{IP}
 If Mone wants to go to Suse later, she cannot stay with Narne.
- b. Will Mone nachher zu Suse gehen)_{IP}, (oder bei Narne bleiben?)_{IP}
 H*L L*H H%|0%
 Does Mone want to go to Suse later, or stay with Narne?

As for the prenuclear rises at the pitch accent (H*L), the author did not find any difference in the way they are implemented. He thus explained that the phonetic differences mostly

concern the nuclear contours as well as pitch scaling differences between the prenuclear rise and the nuclear rise.

As for French, the prosody associated with constructions with a disjunction (alternative questions, polar questions with a disjunction and statements with a disjunction) has received little attention. Concerning the distinction between alternative questions and statements with a disjunction, Di Cristo (2016) argues that the contour on the final conjunct represents the main cue to distinguish both sentence types. According to the author, a clear fall is realized in statements with a disjunction, and a plateau in alternative questions.³ Note, however, that the validity of the results may be questioned as the author does not seem to make a clear distinction between alternative questions and polar questions with a disjunction. Concerning the rising contours occurring at the end of the non-final conjuncts, they are described as being phonetically similar (see Rossi *et al.* 1981 and Di Cristo 2016, among others), even if they are called differently, i.e. *continuation* rise in statements with a disjunction, and *interrogative* rise in the case of alternative questions.⁴

³ According to Di Cristo: '(...)The difference between the final tone realized as a plateau and the fall assumes a distinctive function, which the intonational grammar of French must account for. This proposal seems all the more interesting to validate that in English, the second term of the alternative question has a fall and thus differs from the realization of the French plateau.' [English translation from Di Cristo 2016: 313].

⁴ Following Rossi *et al.* (1981), Di Cristo (2016: 316) uses a different terminology to refer to these rises because of their function in the language (continuation rise and interrogative rise). He believes, however, that they are similar at the phonetic level: '*Le patron intonatif du premier terme est identique dans les deux versions [statement & question]. Or, il s'agit potentiellement d'un Patron Continuatif, dans l'assertion et d'un Patron de Question, dans l'interrogation. Ce constat d'identité confirme donc le fait énoncé précédemment qu'il n'y a pas de différence notable entre le Patron Continuatif (...) et celui de la Question Totale. La distinction entre les deux types d'alternatives paraît donc dépendre de la configuration prosodique du second terme.*' [The intonational pattern associated with the first term (conjunct) is identical in both versions [statement & question]. But it is potentially a continuation rise in the assertion and a "question rise" in the interrogation. The fact that they are identical thus confirms what was said previously, i.e. that there is no noticeable difference between a continuation (...) and a question rising contour. The distinction between the two types of construction with a disjunction seems to depend on the prosodic configuration associated with the second term.].

Since the differences mentioned do not rely on well-described production studies, we decided to set up such an experiment aimed at testing these observations more systematically through an acoustic analysis of the prosodic cues realized on the final and non-final conjuncts. Our aim is to test whether, besides the final contour, French speakers signal the distinction between (alternative) question and statement (with a disjunction) prosodically *before* the end of the sentence. Hence, we focus (i.) on the way rises at the end of non-final conjuncts were implemented (in a similar fashion to what was done for German by Michalsky 2014); and also (ii.) on the way the matrix verbs before the conjuncts were realized, previous studies having shown that prenuclear accents are realized differently in questions and assertions (see, among others, Petrone and Niebuhr 2014).

3. The study

The production study was set up to examine the phonological and phonetic realization of sentence (minimal) pairs consisting of constructions with a disjunction (i.e. alternative questions compared to statements with a disjunction).

3.1 Materials and participants

A set of 10 minimal pairs was constructed (10 sentences x 2 modalities = 20 experimental sentences). Each sentence contained three conjuncts varying from two to four syllables, which are complements of the verb and located at the end of the sentence. To make the

reading more natural, the sentences were embedded in short paragraphs (question as in (6a) vs. statement (6b)).

(6) a. *J'ai entendu dire que tes voisins iront faire un voyage en Amérique latin.*

Tu en as parlé avec eux ? Ils iront au Guatemala, en Colombie ou en Argentine ?

They go-FUT-3rd-plur to Guatemala, to Colombia or to Argentina

'I heard that your neighbours will take a trip to Latin America. Did you talk about it with them? Will they go to Guatemala, to Colombia or to Argentina?'

b. *L'année prochaine, mes voisins veulent faire un grand voyage en Amérique du sud. Ils iront au Guatemala, en Colombie ou en Argentine.*

They go-FUT-3rd-plur to Guatemala, to Colombia or to Argentina

'Next year, my neighbours want to take a big trip to South America. They will go to Guatemala, to Colombia or to Argentina.'

The 20 experimental sentences were interspersed with 56 fillers sentences (represented by left-dislocated object NP, etc.) and presented in a pseudo-randomized order. The complete list of sentences was read by four French native monolingual speakers (2 males, 2 females, age average = 33; SD=14.3), who were unaware of the purpose of the study. Participants were instructed to read each sentence at a normal speed and only once. In case of hesitations, they were asked to read the sentence again at the end of the session.

Each participant was recorded (44.1 Hz, 16 Bit) individually in a sound proof room at ENSSAT Lannion.

3.2 *Method*

The recorded experimental sentences (10 sentences x 2 sentence conditions x 4 speakers = 80 experimental sentences) were orthographically transcribed and automatically segmented into phones, syllables, and orthographic words by means of the script EASYALIGN (Goldman 2011) as implemented in the PRAAT software (Boersma 2001, and Boersma and Weenink 2017). All alignments were manually inspected for errors, and corrected. In addition, sentences were segmented into prosodic phrases according to their morpho-syntactic structure (i.e. lexical words were parsed with grammatical words on their non-recursive side) as shown in (7). This procedure was done in order to avoid making predictions on boundary strength prior to the phonetic analysis of the data.

(7) (Il veut aller) (à Madrid) (à Amsterdam) (ou à Berlin)

On the basis of previous studies on French prosody (see, among others, Rossi *et al.* 1981; Delais-Roussarie *et al.* 2015; Di Cristo 2016), the phonological form of the tonal contours was described using a ToBI-like notation system. For the phonetic analysis of the intonational patterns, the following parameters were acoustically measured: a) the pitch range of the tonal movements at the end of each non-final conjunct and at the end of the sen-

tence (i.e. based on the semitone difference between the f0 minimum and the f0 maximum, cf. boxes in Figure 1 below); b) the slope of the tonal movements (calculated as semitones/seconds); and c) pitch scaling differences (in semitones) between the peaks of the rising contours realized at the end of the non-final conjuncts (e.g. the peak realized on *Madrid* compared to the peak realized on *Amsterdam*). As for phrasing, two cues were taken into account: final lengthening and pausing (see, Delattre 1966 and Michelas and D’Imperio 2010, among others). As for final lengthening, the duration of the last syllable of each non-final conjunct (e.g. syllable [dʁid] in *Madrid* and syllable [dam] in *Amsterdam*) was calculated and compared with respect to the total duration of the word. As for pausing, the presence or absence of silent pauses at the end of each non-final conjunct was encoded. These prosodic cues were compared across both sentence types (i.e. questions vs. statements).

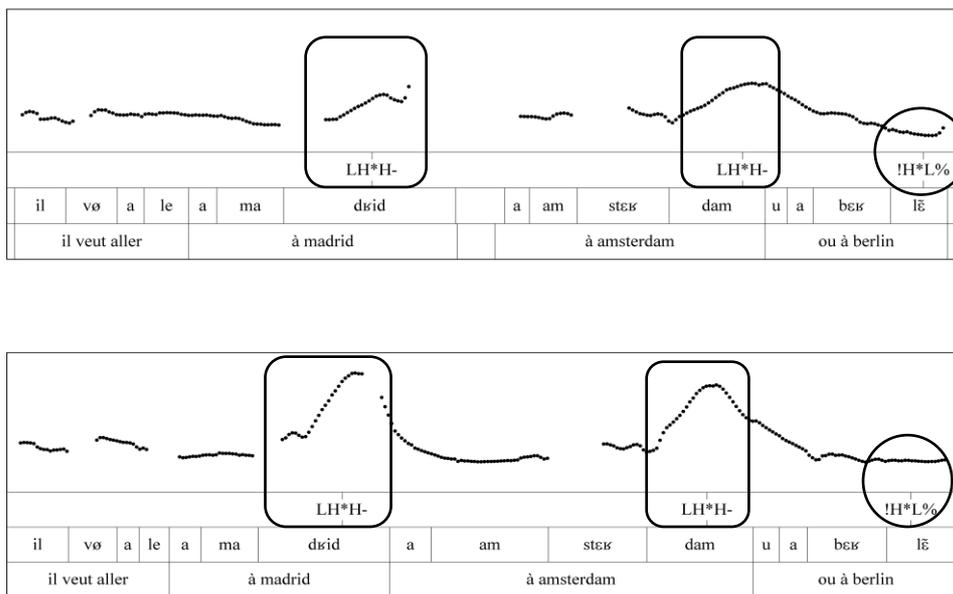


Figure 1. Example of segmentation (phrases, accented syllables), tonal contour and phrasing annotation (in ToBI) of the non-final and final conjuncts in statements with a disjunction (top panel)

and alternative questions (bottom panel). The rising tonal movements taken into account are in boxes, and the falling ones in circles.

4. Results

4.1 Utterance-final contour

4.1.1 Phonological analysis

Table 1 shows the distribution (absolute and relative numbers) of the tonal contours (falling !H*L% vs. plateau followed by a slight rise !H*0%) realized on the last syllable of the final conjunct (e.g. [lẽ] from Berlin in Figure 1 above) across sentence type.

Table 1. Counts (in %) of the tonal contours realized on the final conjunct of alternative questions vs. statements with disjunction. Absolute values are reported in brackets. (Number of occurrences for each type of sentence = 40). “Questions” stands for alternative questions and “Statements” stands for statements with a disjunction.

	Questions	Statements
!H* L %	55% (22)	100% (40)
!H* 0%	45% (18)	0

The phonological analysis of the final conjunct differs across sentence types: A chi-square test showed that this difference is significant ($\chi^2(1)=21.7, p < .0001$). As expected, in statements with a disjunction the final conjunct always hosts a falling contour (i.e. !H*L%). In alternative questions, the final conjunct is either realized with a fall (i.e. !H*L%),

like in statements, or with a plateau ending with a slight rise (i.e. !H* 0%). The falling movement is only slightly more frequent than the plateau.

4.1.2 Phonetic analysis of the falling contour

The phonetic implementation of the falling contour (!H* L%; 22 occurrences in questions vs. 40 occurrences in statements) was compared across sentence types. As shown in Figure 2, the f0 excursion of the falling movement is larger in statements with a disjunction (3.8 st averaged across the four speakers) than in alternative questions (1.5 st on average), with a difference of 2.3 semitones ($t=-7.45$, $df=61$, $p<.0001$).

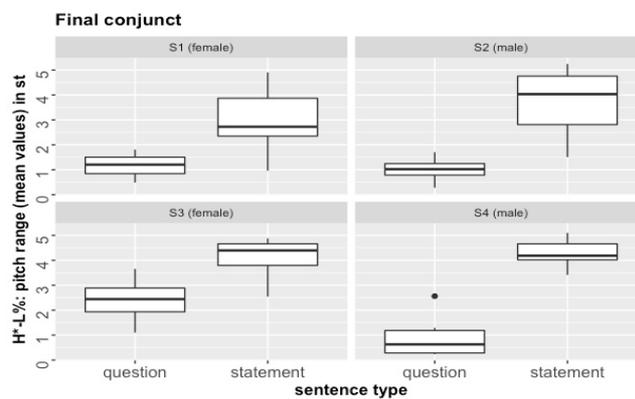


Figure 2. Pitch range (in semitones, y-axis) of the falling contour (i.e. H*L%) in alternative questions vs. statements with disjunction, (x-axis), split by speaker (S1, S2, S3, S4).

Further, the slope of the fall is much steeper in statements (22.1 st/sec) than in questions (7.9 st/sec; $t=-5.77$, $df=61$, $p<.0001$), as illustrated in Figure 3.

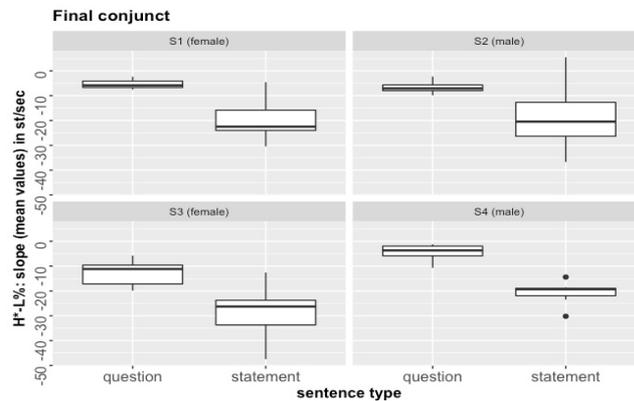


Figure 3. Slope (in semitones/seconds, y-axis) of the falling contour (i.e. H* L%) in alternative questions vs. statements with disjunction (x-axis), split by speaker (S1, S2, S3, S4).

4.1.3 Interim discussion

According to Di Cristo (2016), the tonal movement occurring at the end of an alternative question differs from the one occurring at the end of a statement with a disjunction. Our results confirmed this observation. The results show that the final contour consists of a fall or a plateau (i.e. !H* L% and !H* 0%, respectively) in alternative questions, whereas it is always a fall (!H* L%) in statements with a disjunction. Interestingly, the fall is differently implemented in alternative questions and statements with a disjunction: they have a larger f0 excursion and a steeper slope in statements than in questions. These phonetic differences are realized by all the four speakers.

4.2 Non utterance-final prosodic events

4.2.1 Intonational contours at the end of the non-final conjuncts

The non-final conjuncts were always realized with a rising contour of the form (L+)H* H- associated with the last stressed syllable (e.g. [la] in *au Guatemala* and [bi]

in *en Colombie*, see (6) above). The pitch range (see Figure 4) and the slope of these rises (Figure 5), however, differed across sentence type.

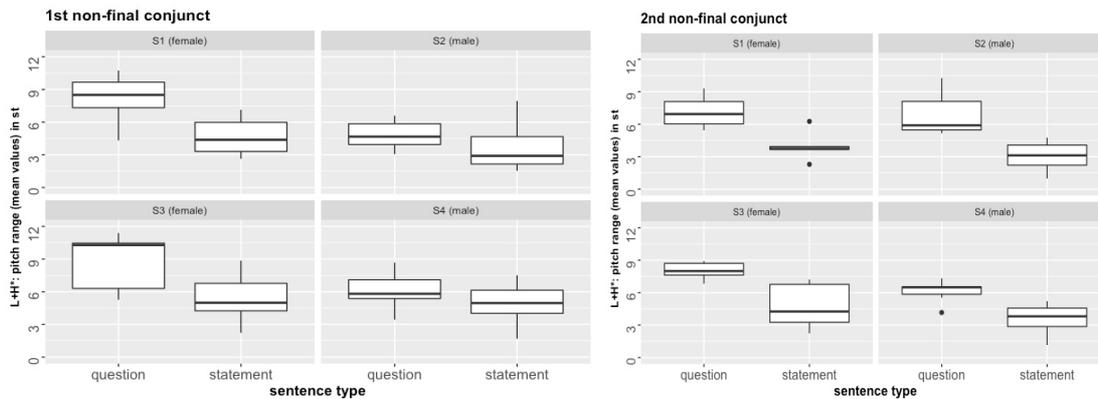


Figure 4. Pitch range (in semitones, y-axis) of the rise on the first non-final conjunct (left panel) and on the second non-final conjunct (right panel) in alternative questions vs. statements with disjunction (x-axis), split by speaker (S1, S2, S3, S4).

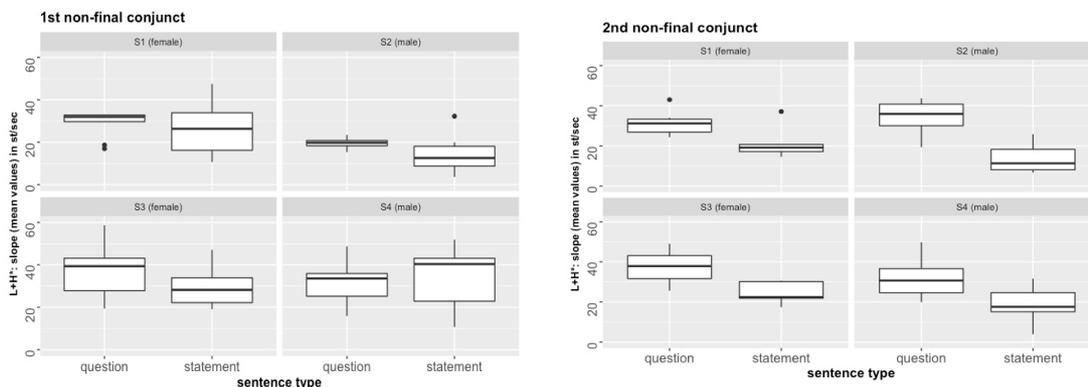


Figure 5. Slope (in semitones/seconds, y-axis) of the rise on the first non-final conjunct (left panel) and on the second non-final conjunct (right panel) in alternative questions vs. statements with disjunction (x-axis), split by speaker (S1, S2, S3, S4).

Figure 4 shows that the pitch range of the rises is broader in alternative questions than in statements with a disjunction (see Table 2 for mean values averaged across the four speakers; 1st conjunct: $t=4.19$, $df=79$, $p<.0001$; 2nd conjunct: $t=8.84$, $df=79$, $p<.0001$). Moreover, slopes of the rises are steeper in alternative questions than in statements with

a disjunction. Differences in steepness of the slope are significant for the second non-final conjunct only (see Table 3 for mean values averaged over the four speakers; 1st conjunct: $p = .3$; 2nd conjunct: $t = 6.74$, $df = 79$, $p < .0001$).

Table 2. Average pitch range (in semitones) of the rising contour realized on the first non-final conjunct and on the second non-final conjunct in alternative questions vs. statements with disjunction.

	Questions	Statements
1 st conjunct	7 st	4.7 st
2 nd conjunct	7.1 st	3.8 st

Table 3. Average slope of the rise (in semitones/seconds) of the rising contour realized on the first non-final conjunct and on the second non-final conjunct in alternative questions vs. statements with disjunction.

	Questions	Statements
1 st conjunct	29.5 st/sec	26.5 st/sec
2 nd conjunct	33.7 st/sec	19.6 st/sec

Next, pitch scaling differences were calculated as the semitone difference between the peak of the rise (i.e. (L+)H*) on the second non-final constituent minus the peak of the rise on the first non-final constituent (see Figure 6).

When the peak of the second non-final conjunct was higher than that of the first non-final conjunct, it was coded as an upstepped high pitch accent (^H*), and as a downstepped accent (!H*) when it was lower. Scaling differences of less than half of a semitone were assigned to a further tonal category (i.e. H*; see Table 4). Results show that there are

more downstepped accents in statements than in questions. By contrast, upstepped accents are comparatively more frequent in questions than in statements ($\chi^2(2)= 8.87, p < .05$)⁵.

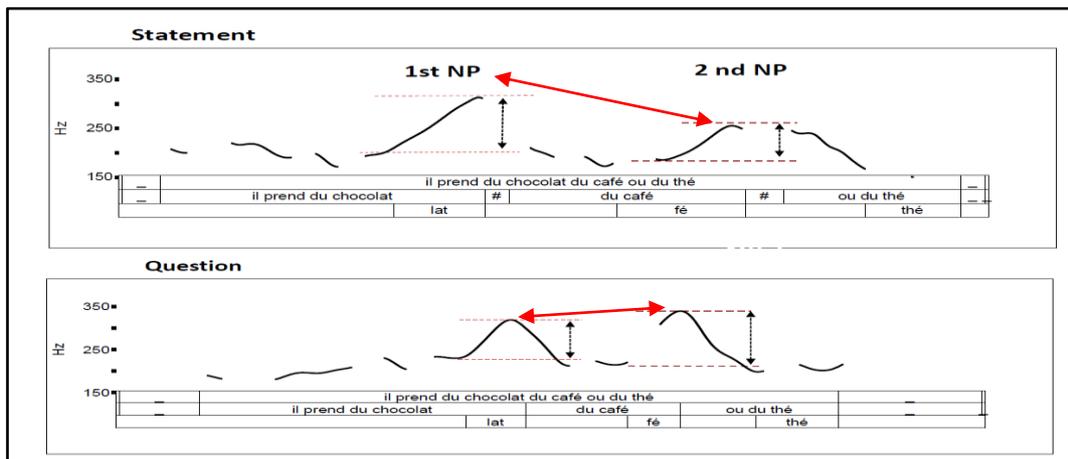


Figure 6. Illustration of the pitch scaling difference between the peak of the second non-final conjunct and the peak of the first non-final conjunct (as indicated by the red arrow) in statements with a disjunction (top panel) and alternative questions (bottom panel).

Table 4. Counts (in %) of upstepped pitch accents ($\wedge H^*$), downstepped pitch accents ($!H^*$) and unmodified pitch accents (H^*) of the second non-final conjunct in alternative questions vs. statements with disjunction. The three categories are based on the scaling difference (calculated in semitone) between the peak of the rise of the second non-final conjunct and the one of the first one. Absolute values are reported in parentheses. (Number of occurrences for each type of sentence = 40).

	Questions	Statements
$!H^*$	32.5% (13)	67.5% (27)
$\wedge H^*$	47.5% (19)	20% (8)
H^*	20% (8)	12.5% (5)

⁵ Scaling differences were realized by 3 speakers out of four (S3 appeared to use this strategy less).

4.2.2 Phrasing: final lengthening and pausing

As mentioned in section 3.2, final lengthening and pausing were taken as cues for phrasing and compared across sentence types. Regarding final lengthening, no difference was observed between questions and statements, neither for the first non-final conjunct (question: 41.7% vs. statement: 45.4%, $p = .2$) nor for the second non-final conjunct (question: 41.8% vs. statement: 43.4%, $p = .4$).

As for pausing, results on the distribution of silent pauses are presented in Table 5.

Table 5. Counts (in %) of the pauses realized at the end of the first and the second non-final conjunct of (alternative) questions vs. statements (with a disjunction). Absolute values are reported in parentheses. (Number of occurrences for each type of sentence = 40).

	First non-final conjunct		Second non-final conjunct	
	Questions	Statements	Questions	Statements
Pauses	45% (18)	57.5% (23)	12.5% (5)	37.5% (15) ⁶

Table 5 shows that at the end of the second non-final conjunct a pause is realized more often in statements with a disjunction than in alternative questions ($\chi^2(1) = 6.72$, $p < .01$) whereas, for the first non-final conjunct, there appears to be no differences across sentence types ($p < .2$).

4.2.3 Prosodic analysis of the matrix verb

⁶ Pausing at the end of the second non-final conjunct was observed more often in the productions by S1 and S3.

Previous studies on various languages have shown that the disambiguation of questions vs. assertions can occur (earlier) at the level of the prenuclear region of the sentence (see, among others, Van Heuven and Haan 2002; Vion and Colas 2006; Petrone and D'Imperio 2011; Petrone and Niebuhr 2014). To check for similar anticipatory effects in our data, we analysed the speech rate and the intonational contours associated with the matrix verb of the tested sentences (e.g. *Ils ironent*, cf. example (6)).

The speech rate analysis shows a rate increase in questions compared to statements (in approximately 75% of the cases for the male speaker, and 60% for the female speakers) when taking into account both the prenuclear domain (i.e. the matrix verb in our data) and the whole sentence (i.e. faster in alternative questions than in statements with disjunction).

The rate analysis is supported by the tonal analysis: the matrix verb is more often deaccented in alternative questions than in statement with disjunction (deaccentuation occurred in 69% of the cases for questions vs. 6% of the cases for statements, $\chi^2(1)= 23.8$, $p < .0001$). In the remaining cases, a falling tonal movement is associated with the matrix verb in alternative questions (H*L: 31%), whereas it is a falling or rising movement in statements with disjunction (H*L: 62%, LH*: 32%)⁷. The pitch excursion of the falling movements across sentence types (i.e. H* L: 31% in questions with 62% in statements) shows a difference of about one semitone on average (1.4 st in questions vs. 2.1 st in

⁷ Further research is necessary on this issue in particular with stimuli where the prenuclear domain also contains a subject NP. The realizations observed could sometimes be due to the occurrence of an initial accent on the matrix verb.

statements, $p = .2$).⁸ A follow-up experiment based on a visual-world paradigm is in preparation to determine to what extent these differences across modalities, when realized earlier in the sentence, assist French listeners in their on-line interpretation.

4.2.4 Interim discussion

Our preliminary results suggest a difference in the implementation of the non-final rising movements between alternative questions and statements with a disjunction. First, non-final rises are acoustically more prominent in questions than in statements, as shown by their wider range and steeper slope. Moreover, statements are characterized by a sequence of downstepped contours: the overall pitch shifts downwards reaching the bottom of the speaker's range at the end of the sentence, whereas in questions the peak of the rise on the second non-final contour is upstepped with respect to the first one. Second, silent pauses are more frequent in statements with a disjunction than in alternative questions. Finally, it appears that speech rate is faster for questions than for statements: this difference occurs already at the level of the prenuclear region (here, the matrix verb). Future studies will validate these preliminary findings on a larger data set and with more speakers. In particular, future studies should test more precisely how much earlier (and how systematically) these differences are encoded by French speakers. As it stands, our analysis shows several acoustic differences realized before the end of the sentence that may

⁸ The current analysis remains however very preliminary since the matrix verb was not always controlled in terms of number of syllables across sentence pairs. In addition, it would be of interest to also analyze the pitch movement associated with nominal subjects.

disambiguate the two sentence types. This finding is not in line with Di Cristo's (2016) observations (see section 2.2).

5. Discussion and phonological analysis

The phonetic differences observed at the level of the non-final conjuncts can be accounted for in light of two hypotheses: (i) the distinct ways of realizing the rising movements at the end of the non-final conjuncts may reflect a difference in phrasing between both sentence types ("The phrasing hypothesis" described in section 5.1), and (ii) the different realizations of the rises may derive from a different tonal pattern, in particular because of the meaning associated with the rising contours in questions. Indeed, it also indicates 'interrogativity' ("The tonal hypothesis", section 5.2).

5.1. *The phrasing hypothesis*

The higher and steeper rises at the end of the non-final conjuncts in questions could be analyzed as reflecting a difference in boundary strength, an Intonational Phrase boundary (IP) being realized after each conjunct in questions, and an intermediate or phonological phrase boundary (PhP) in statements, as shown in (8).

- (8) a. Statement: [(ils iron^t) (au Guatemala)_{PhP} (en Colombie)_{PhP}
(ou en Argentine)_{PhP}]_{IP}

scores obtained (on a 10-point scale) do not show clear differences across sentence type.⁹ By using the equivalences between ANALOR scores and boundary levels proposed by Delais-Roussarie and Feldhausen (2014), an IP boundary would be expected in all sentences. Main differences between questions and statements are observed in the way boundaries are implemented: duration and pause are crucial in statements, whereas melodic movement and pitch register are important in questions. The phrasing obtained probably result from the fact that the various conjuncts are treated as F-marked (+ focus) by all speakers in both sentence type, and phrasing reflects focus in French (see, among others, Fery 2001).

The second argument comes from the analysis of similar sentences with full clausal conjuncts (alternative questions and statements with a disjunction). If the presence of an IP boundary after each conjunct in questions derives from the syntactic analysis in (9) and is in conformity with the syntax-phonology mapping constraints formulated within *Match Theory* (Selkirk 2011), an IP boundary is expected at the right edge of each conjunct in questions and statements when conjuncts correspond to CPs (clauses) as in (10).

(10) [Il va accueillir Nicolas]_{IP/CP} [ou il va aller en vacances chez Julien]_{IP/CP}

⁹ On the 10-point scale (10 being the highest boundary strength), the difference in prominence strength is restricted to 0.3 point across sentence type: 7.6 in questions against 7.3 in statements for the first conjunct, and 6.1 in questions against 6.4 in statements for the second conjunct.

However, preliminary analyses of an additional data set (recorded by two speakers and composed of sentences comparable to (10) with questions or statements), showed differences in the realization of the pitch movement across sentence type. Indeed, the rises occurring at the end of the non-final conjunct in alternative questions were higher and steeper than the rises at the end of the non-final conjunct in statements (see Figure 7 and 8). Moreover, these rises are often comparable to the ones observed at the end of declarative questions as (11).

(11) Pierre va accueillir Nicolas ?

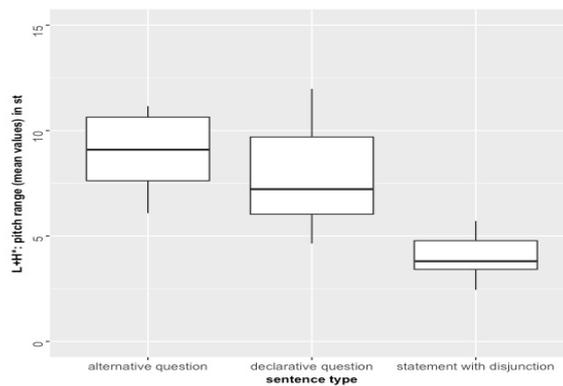


Figure 7. Pitch range (in semitones, y-axis) of the rise realized on the non-final conjunct (a clause) in statements (with a disjunction) and in (alternative) questions in comparison to the pitch range of the rise occurring at the end of declarative questions (x-axis).

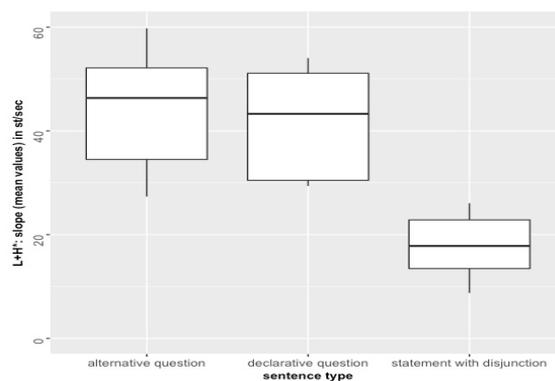


Figure 8. Slope (in semitones/seconds, y-axis) of the rise realized on the non-final conjunct (a clause) in statements (with a disjunction) and in (alternative) questions in comparison to the slope of the rise occurring at the end of declarative questions (x-axis).

The differences between statements with a disjunction and alternative questions in the realization of the rising contours on the non-final conjunct (a clause) clearly show that an analysis in terms of phrasing is not satisfactory. According to ANALOR, boundary strength is identical in both sentence types. Note, however, that boundaries are implemented differently: they are realized with larger pitch movements in questions, and with lengthening and pauses in statements.

5.2 *The tonal hypothesis*

Since the higher rising movements observed at the end of the various conjuncts in alternative questions cannot be considered as resulting from a difference in phrasing and boundary strength, an analysis in terms of tonal differences was investigated. Previous work on intonation and information structure in French showed that a contour, whose form was said to be determined by the illocutionary force associated with the utterance (a rise in questions and a fall in assertions), is realized at the right edge of any F-marked (Focus) constituent (see, among others, Martin 1975a, 1975b, Di Cristo and Jankowski 1999, Beyssade *et al.* 2004). Figure 9 below represents the rising pitch contour realized at the right edge of the clefted-PP *en Colombie* ('in Colombia') in a cleft sentence interpreted as a question, and in which *en Colombie* represents what is really questioned.

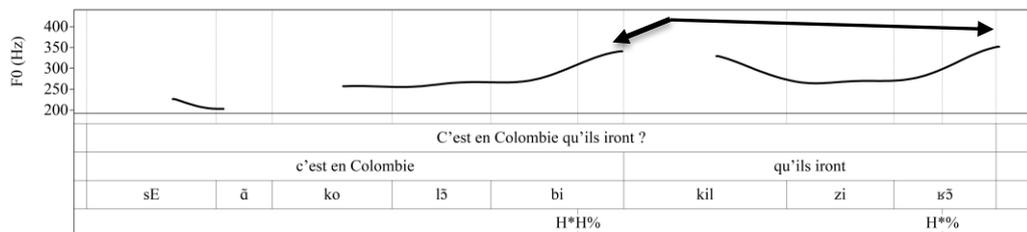


Figure 9. Pitch track associated with the cleft-sentence *C'est en Colombie qu'ils iront* interpreted as a question, with narrow focus on the clefted-PP *en Colombie*. The rising tonal event indicated by the black arrow is realized on the last syllable of the F-marked element, i.e. *Colombie*, and reproduced (“copied”) at the end of the utterance.

The tonal movements observed at the end of each non-final conjunct in alternative questions seem to be comparable to the rising contour realized at the right edge of the clefted-PP in the cleft sentence interpreted as a question (Figure 9). Indeed, as conjuncts are all F-marked (+ focus), and sentences interpreted as a question in alternative questions, such a contour is expected. Because of the sentence modality and the F-marking of the conjuncts, the last syllable of each non-final conjunct is associated with a rising contour which indicates both F-marking and questionhood. The difference observed in the way the rising contours are realized in alternative questions and statements with a disjunction would result from a sort of tonal crowding in alternative questions: the last syllable of each non-final conjunct is associated with (i) a continuation rise indicating the edge of a prosodic phrase (H*H% or H*H-), which also occurs in statements, and (ii) a rising tonal element noted H_Q that indicates ‘interrogativity’ and is associated with the right edge of the focal domain (see Beyssade *et al.* 2004), as shown in Figure 10. Such a phonological

analysis differs from previous studies that mostly encode rises in questions and statements alike (H*H%), and consider the difference to be phonetic in nature (see, for instance, Valtersson and Torreira 2015)

Statement with a disjunction														
								H* H%			H*H%			!H* L%
		(*)						*			*			*
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
il	zi	ɛ̃	o	gwa	te	ma	la	ã	ko	lõ	bi	u	ã	naɛ
														ɜ̃
														tin
Alternative question														
								H* H% H _Q			H*H% H _Q			!H* 0%
								/			/			
		(*)						*			*			*
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
il	zi	ɛ̃	o	gwa	te	ma	la	ã	ko	lõ	bi	u	ã	naɛ
														ɜ̃
														tin

Figure 10. Representation of the tonal patterns associated with the sentence *Ils iront au Guatemala, en Colombie ou en Argentine* interpreted as a statement (with a disjunction, top panel) and as an (alternative) question (bottom panel).

To sum up, we assume that a tonal event indicating ‘interrogativity’ is realized at the end of the non-final conjunct(s) in alternative questions, in addition to the minor or major continuation rise (H*H- and H*H-H%). Such analysis is, to a certain extent, similar to what is argued for by Michalsky (2014), but applies at the phonological level.

According to previous studies (Martin 1975a, 1975b, Di Cristo and Jankowski 1999, Beyssade *et al.* 2004), a falling tonal element should also be realized at the right edge of each conjunct in statements with a disjunction since the sentence is a statement and the conjuncts are F-marked, but this is not what we observed. Further research is thus currently carried out in order to explain such a discrepancy in F-marking in French.¹⁰

¹⁰ As suggested by C. Beyssade (p. c.), the tonal element H_Q indicating ‘sentence modality’ (and, more precisely, commitment to the proposition uttered; see Beyssade and Marandin 2007) may be optional in a declarative sentence interpreted as a statement or an interrogative sentence interpreted as a question,

6. Conclusion and outlook

In the current study, the acoustic properties of phonologically ambiguous (string identical) sentences – statements with a disjunction and alternative questions – were investigated by means of a production study carried out with four French monolingual speakers. Relevant findings concerning the final and non-final conjuncts suggest that, despite the phonological similarity, the phonetic implementation of the tonal contours (i.e. rising (L)H*H- contours on the non-final conjuncts and a falling !H* L% contour on the final conjunct) differs across the two sentence types. First, when the final conjunct is realized with a fall (H* L%: 100% of the cases in statements vs. 55% of the cases in questions), the tonal movement has a larger f₀ excursion and a steeper slope in statements than in questions (which we propose to be henceforth referred to as “fall-to-low” in statements, and as “fall-to-mid” in alternative questions). Second, similar acoustic differences affecting f₀ excursion and scaling are realized even earlier in the sentence (in the opposite direction). The rising contours on the non-final conjuncts (i.e. (L)H*) in questions are characterized by larger pitch excursions and steeper slopes than in statements, their peaks are upstepped from the first to the second non-final conjunct (whereas they are downstepped in statements).

Two analyses have been provided in order to account for the different ways of phonetically implementing the non-final rising movements. Firstly, an analysis in terms of phrasing in which higher and steeper rises would reflect a stronger prosodic boundary has been

whereas it is compulsory as soon as a mismatch exists between the syntactic type and the speech act intended by the speaker. Further research on this issue is currently being carried out.

investigated. It has been shown, however, that two facts go against such an analysis: (i) boundary strength assigned semi-automatically with ANALOR are similar in both sentence types, despite the difference in the realization of the rising movement, and (ii) a similar phonetic difference is also observed when the conjuncts correspond to clauses in alternative questions and statements. As a consequence, an alternative analysis was proposed: the differences in the realization of the tonal rises at the end of non-final conjuncts are considered (i) as resulting from the F-marked status of the conjuncts, and (ii) as indicating questionhood. In French, a tonal element, whose form is determined by illocutionary force, is usually associated with the last syllable of the focus constituent (see, among others, Beyssade *et al.* 2004). In the case of alternative questions, this tonal element, a H tone, is associated with the last syllable of each non-final conjunct, in addition to a continuation rise. The presence of this element would thus enhance the realization of the rising movement. This analysis, which needs to be validated with a larger dataset, is, to a certain extent, similar to what has been argued for by Michalsky (2014) for German. Moreover, comprehension experiments will be set up in order to evaluate the relevance of the tonal and acoustic cues found here, be they realized within the prenuclear domain, at the edge of the non-final conjuncts or sentence-finally. In particular, it will investigate which of these cues assist French listeners in the online interpretation of alternative questions, polar questions and statements with a disjunction.

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