

French Tonal Structures

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Abstract

Despite the rather large body of literature on French intonation, there is no agreement about the number of contrastive contours in the system. Since the descriptions use different methodologies and theoretical frameworks, their relative merit cannot be evaluated straightforwardly.

This paper introduces a tonal analysis of French intonation that is based on empirical evidence. The stressed syllables and boundaries in the utterances determine at which locations melodic changes can occur, and the tonal structure specifies how the melody can be varied at those points. Thus, the analysis states unambiguously which variations in pitch function contrastively, and its claims can be experimentally verified.

1. Introduction

Controversies persist about the contrastive intonation contours of French in the literature [1, 2, 3, 4, 5, 6, 7, 8, 9].¹ Although there is a general consensus about the contrast between falling, rising and rising-falling contours at the end of the utterance [1, 4, 7, 10], there is little agreement about the contrasts that arise from variation within these contours, and about their phonological representation.

This paper aims to show that these controversies can be resolved when the French system of intonational contrasts is accounted for in an Autosegmental-Metrical framework [11]. In the analysis presented here, an inventory of two pitch accents² and five boundary specifications restricts the number of contrastive intonation contours that can be generated. At the phonetic level, the tones are implemented as targets, which are connected through phonetic transitions to form the surface melodic contour. It will be argued that the description is more parsimonious and transparent than previous accounts. Also, since phonological tones are distinguished from their phonetic implementation, one intonational category can have a range of realisations, and crucially, the description makes clear predictions about discreteness in variations in pitch, which can be experimentally verified.

The aims of the study reported in this paper were therefore (1) to collect empirical evidence for the system of intonational contrasts in French, and (2) to develop a tonal analysis which accounts for all of these contrasts, but excludes any contrasts that cannot be attested.

2. Previous descriptions of French intonation

Traditionally, French intonation has been analysed in terms of global contours [e.g. 1, 2, 3, 5]. Delattre, for instance, identifies ten different intonation contours, whose variations in pitch are defined at four different pitch levels. Three of these contours are exemplified in Figure 1. The function of the *continuation majeure* is to indicate that two ‘sense groups’

(here *La petite Laure* and *l’aurait su*) are grouped together into a larger unit of meaning. The ‘implication contour’ on *intelligente* in the figure implies that the listener did or should have known that Laure is intelligent.

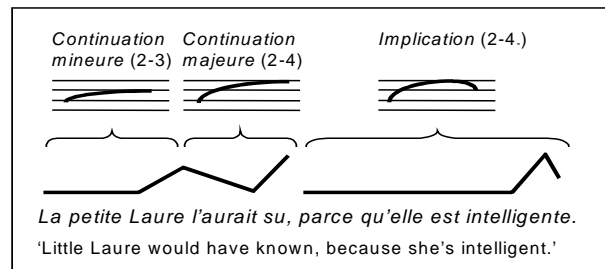


Figure 1: Three of Delattre's intonation contours with stylised representations of possible realisations of the contours.

Although Delattre's inventory reflects the phonetic forms that can be observed in French quite closely, a number of intonation contours cannot be analysed, such as pitch movements that occur at the beginning of a word, because the contours are essentially holistic units which are not formally related to specific points in the temporal domain. Also, some apparent similarities between the contours are not captured in a parsimonious way, such as the similarity between the *continuation mineure* and the *continuation majeure*. Although the difference in pitch height is very likely to be systematic in the phonetics, it does not need to be included in the inventory of phonological forms, because it can be described on the basis of the prosodic structure of the utterance (i.e. unlike the *continuation mineure*, the *continuation majeure* in Figure 1 precedes an Intonation Phrase boundary; they are analysed as H*H% and H* in the analysis presented here). Finally, the assumption of four distinct pitch levels as primitives in the description predicts a number of configurations that do not exist (cf. [12]). There is no principled reason why configurations like '1-3', '4-1', and '1-4-' exist, while '3-1', and '4-3' and '1-2-' do not.

In a more recent treatment, Mertens [4] proposes to analyse French intonation in terms of a sequence of tones (High and Low, defined at four different pitch levels) that are each linked to a syllable. He distinguishes tones on accented and unaccented syllables, and word-initial and word-final accents (the latter have two tones, marking the difference in duration). Mertens' description is observationally adequate, in that it gives a detailed account of the phonetic realisation of the intonation contours, but this degree of phonetic detail is unlikely to reflect the system of phonological contrasts. For instance, like Delattre's account, it fails to capture the similarity between the movements on *Laure* and *su* in Figure 1, which are given very different tonal specifications.

French intonation can be accounted for more straightforwardly by assuming a phonology of intonation that is separate from the phonetics [11]. In accordance with other autosegmental analyses of French [6, 7, 9], at the underlying level, French tunes are assumed to consist of sequences of Low and High tones here, which associate with the boundaries of Intonation Phrases (or Intonation Units; T%), and with accented positions in the utterance (T*). In principle, all combinations of the tones of the inventory are allowed, but their position relative to each other in the Intonation Phrase restricts the number of contours that can be generated. Thus, the analysis can make reference to the location of the turning points in the contours, while capturing the fact that only some configurations of tones are contrastive.

3. Methods

The realisation of French intonation contours was investigated auditorily and acoustically in a corpus of read and spontaneous speech (an edited version of the fairy tale *Cendrillon* and a Map Task; total duration 60 mins.). Four speakers of Standard French with comparable backgrounds took part in each set of recordings. The data were analysed auditorily and acoustically, resulting in (a) an overview of the similarities and differences in the observed pitch movements in the corpus, and (b) a transcription of the pitch movements produced in the read speech data.

The auditory impression of the fundamental frequency traces was summarised as a global pitch movement associated with an accented syllable. A first grouping was made on the basis of the direction of pitch around the accented syllable (falling, rising, rising-falling, falling-rising, and level pitch), and within each group, the movements were further subdivided according to (1) the pitch level attained (e.g. mid or low in the speaking range), (2) their location in the utterance (utterance-final, Intonation Phrase final, or within the IP) and (3) the number of preceding pitch accents.

Most of the data in the read speech corpus were also transcribed prosodically by means of a transcription system derived from IViE, a labelling tool developed for the transcription of intonational variation in British English [15]. IViE is different from other transcription systems in that it distinguishes between a rhythmic, a phonetic and a phonological level of transcription, a feature which was crucial to the analysis, because at this stage, it was obviously not clear what the appropriate phonological analysis of the intonation contours was. Transcribing the data in this way also had the advantage that the intonation contours in the corpus could be directly compared across speakers and contexts.

The analysis was primarily based on the read speech corpus, supplemented by data from the spontaneous corpus whenever necessary. The findings were then compared with those of previous studies, and hypotheses about the phonological distinctions between the pitch movements were drawn up, and accounted for in a tonal analysis. Finally, some of the predictions of the analysis were tested in two perception experiments (not discussed here; see [13, 14]).

4. Findings: Contrasting contours

Figure 2 shows the traditional distinctions between IP-final contours in the literature, which were reflected in our data. The final rising contour on *Marianne est venue* ‘Marianne has come’ in (a) in Figure 2 can signal a question, for instance, or

the speaker can use it to indicate that he has not finished speaking (‘continuation’). The falling contour in (b) is often used in neutral statements. In the example in (c), the rising-falling contour is most likely to signal an indignant exclamation. The contour in (d) is similar to that in (c), but here, the peak is located on the penultimate (unaccented) syllable. It is mostly used in statements, and in this example, it could be interpreted to signal that the speaker thinks it must be evident to the listener that Marianne came.

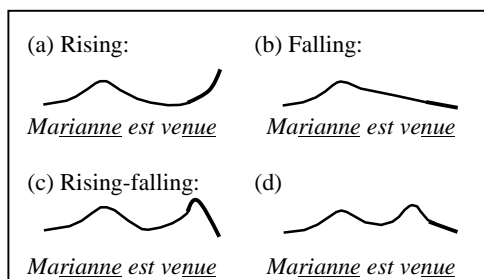


Figure 2: Representations of the uncontroversial contrasts in IP-final position. The bold line represents the portion of the pitch movement in the accented syllable.

Three further contrasts were identified in IP-final position, where variation in the pitch level at the end of the contour was phonologically distinct (Figure 3). Two levels can be distinguished for the height of the peak in final rises (mid/high), and for the depth of the fall in final falls and in movements with a penultimate peak (mid/low). For instance, speakers can produce a fall to the middle of the speaking range instead of a fall to low when they want to sound less definite, or more compassionate.

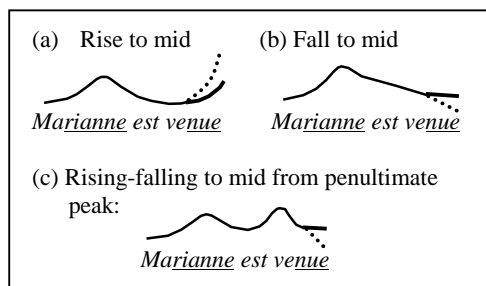


Figure 3: Representations of IP-final contrasts depending on differences in pitch level (high vs. mid and mid vs. low).

The investigation of IP-internal pitch movements in the speech corpus revealed a three-way distinction between overall rising, rising-falling and falling movements around the accented syllable, shown in Figure 4. A rising movement towards a peak in the accented syllable could be followed by level or rising pitch (a) or by falling pitch until the following accented syllable (b). These movements are assumed to contrast with movements in which the accented syllable is located on an overall falling slope (c; pitch can be level or falling on the unaccented stretches). Although some findings suggest that IP-internal falling movements may not be accent-lending [16, 17], it is assumed here that French has a contour similar to English, German and Dutch, in which IP-internal pitch accents are systematically lowered [6, 7].

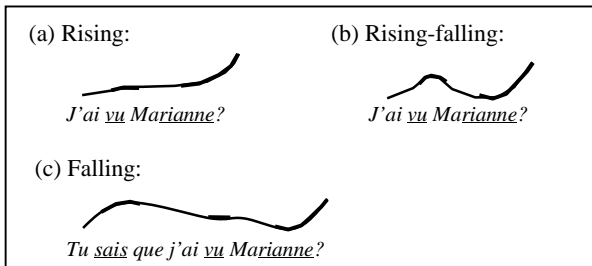


Figure 4: Representations of IP-internal rising, rising-falling and falling contours.

5. An Autosegmental-Metrical account

5.1. Outline of the system

In the present proposal, French intonation is analysed by means of the following tonal primitives: (1) the pitch accents H^* and $H+H^*$, (2) the boundary specifications $L\%$, $H\%$ and 0% (i.e. unspecified for tone [18]), and (3) an L -tone, which is optionally inserted between two high starred tones.

The tonal specifications can be combined within the Intonation Phrase according to the grammar given in (1) (curly brackets contain the set of tones available in the given position, parentheses indicate optional elements, and $H^*(L)$ can be repeated on any non-final stressed syllable).

- (1) The Intonation Phrase:
- $$\left\{ \begin{array}{l} \%L \\ \%H \end{array} \right\} (H^*(L))_0 \left\{ \begin{array}{l} H^* \\ H+H^* \end{array} \right\} \left\{ \begin{array}{l} L\% \\ H\% \\ 0\% \end{array} \right\}$$

The tonal string is interpreted in terms of fundamental frequency and time alignment of the phonetic targets. The targets of H^* tones that immediately follow a high tone (including $H+$) are automatically lowered, unless they are followed by a high boundary tone.

5.2. Analysis of the contrasting contours

The grammar in (1) attributes the difference between IP-final rising and rising-falling movements to the boundary tone, as is shown in Figure 5. The contours are structurally similar in that they consist of the same pitch accent H^* , but they differ because of the following boundary tone: $H\%$ in the rising, and $L\%$ in the rising-falling contour.

The figure also shows how L -insertion accounts for the contrast between these contours and the falling contour. The presence of the low tone is morphologically determined. That is, the speaker chooses to realise a low tone, and thereby modifies the interpretation of the pitch accent, leading to a more explicit separation of the items marked by the starred tone. The low tone is usually aligned just before the accented syllable, which results in a contour that is very similar to the one described by Gussenhoven [19] for Dutch and British English as 'partial linking'.

The crucial point about the low tone is that, when it is absent, the second high tone is automatically lowered. This means that a sequence of two H^* tones surfaces as a fall, as can be seen in Figure 5. Note, though, that automatic lowering is blocked by a high boundary tone (as in the rising contour in the figure).

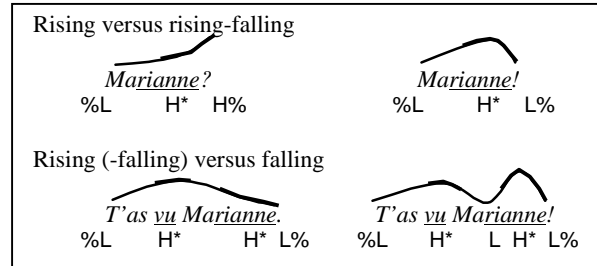


Figure 5: The contrast between IP-final rising, rising-falling and falling movements: $H\%$ vs. $L\%$ and L -insertion.

The third type of contrast to be captured is the difference between falls to mid ($H^*H^*0\%$) and falls to low ($H^*H^*L\%$). In both cases, H^* immediately follows a high tone and is therefore automatically lowered, but in the fall to low, the lowered H^* tone is followed by $L\%$, and implemented at the bottom of the speaking range. When the boundary is left unspecified for tone (0%), it is realised at a higher level. The same applies to the $H+H^*$ pitch accent which transcribes falling movements from a penultimate unaccented peak. In $H+H^*$, the leading tone associates with the penultimate syllable, and H^* with the final accented syllable of the Intonation Phrase. Since H^* is immediately preceded by H , it is lowered. The contour ends at the bottom of the speaking range when the boundary is low, and it ends in the middle of the speaking range when it is not specified for tone.

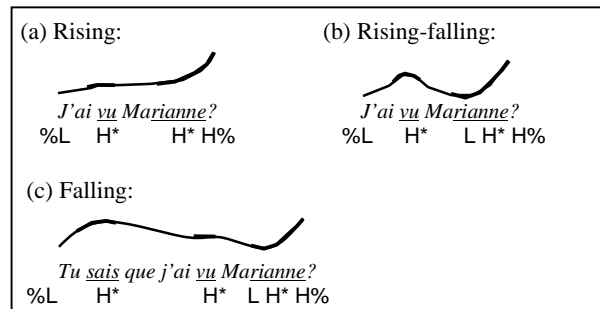


Figure 6: The contrast between IP-internal rising, rising-falling and falling contours: L -insertion.

The latter situation is similar to that of falling pitch accents in non-final position, where there is no immediately following boundary tone which could lower it further, as shown in Figure 6.

Thus, the tonal analysis covers all of the contours identified in the speech corpus. However, does it also correctly predict which phonological contrasts do not occur?

5.3. Clear predictions

Given the grammar in (1) above, the present proposal makes strong predictions about the intonational contrasts that can be generated in French. That is, a sequence of, for instance, $HL\%$ is excluded, because unstarred H -tones only exist as the leading tone in the $H+H^*$ pitch accent in the system. As a consequence, unstarred H can never directly precede an IP-boundary specification. The fact that the account makes such strong predictions makes it testable.

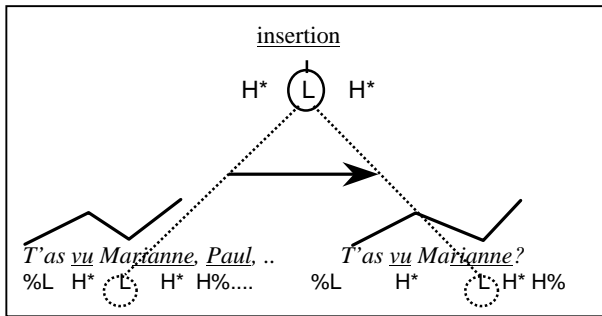


Figure 7: A prediction of the tonal analysis: The timing of the inserted low tone is gradient.

Another prediction is that the timing of the inserted low tone cannot function contrastively, as is illustrated in the tonal transcription in the examples in Figure 7. This is one of the predictions that was tested experimentally, and the findings indicated that the timing of the dip is indeed gradient [13, 14].

6. Discussion and conclusion

The study reported in this paper aimed to resolve the disagreement in the literature about the number of contrasting contours in French by (1) formulating clear hypotheses about intonational contrasts on the basis of empirical data, and (2) providing a testable analysis of the contours which accounts for all contrasts, without generating unattested ones.

As in competing Autosegmental-Metrical accounts of French [6, 9], all surface melodic contours are derived from the same set of underlying tones in the analysis proposed here. There is no difference between the tonal primitives at the level of the tonal inventory, and intonational contrasts only arise when the tones of the inventory are associated with the segmental structure. The incorporation of tonal specifications for accented syllables and boundaries as separate elements in the inventory naturally accounts for the fact that a greater number of intonational contrasts occurs in IP-final position than elsewhere.

However, the strict division of labour between the phonetic and phonological levels of representation in the present proposal gives it a number of advantages over previous accounts. Only tones that have phonetic targets are represented in the phonology, which minimises redundancy in the analysis. All contrasting contours can be accounted for by means of a small set of tonal primitives, and the number of surface forms that can be generated is constrained in a transparent way. Moreover, it forces the investigator to make clear decisions about the grammatical status of an intonational phenomenon; since observed variation has to be described as either a difference in the tonal structure, or as a difference in phonetic realisation, the choice needs to be motivated, and the description is verifiable. Finally, clear hypotheses can be formulated about the contribution of variations in pitch to the interpretation of intonation contours.

7. Notes

¹ The work reported in this paper was carried out at the University of Nijmegen. I am very grateful to Carlos Gussenhoven for our discussions of the analysis proposed here.

² The coincidence of stressed syllables and word-group boundaries has led some authors to deny the existence of word stress in French (e.g. [1]; see [21] for a discussion). Nevertheless, metrical

prominence appears to be relevant to the assignment of pitch movements, as is argued by, for instance, Dell [22] on the basis of the different alignment of intonation contours with utterances that end in a final full syllable and those in which the final syllable was a schwa.

8. References

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