

Evidence for a constraint-based account of French phrasing and accentuation in different speaking styles

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ABSTRACT

A number of interacting factors determine which syllables are accented in an utterance, such as word grouping, grammatical category, and speaking style. Two questions are addressed in this paper: (1) how does speaking style affect phrasing and accentuation in French, and (2) can the account proposed in Post [15], which uses partial ranking to model prosodic variation, adequately describe these data? Recordings of two Map Tasks were analysed auditorily and acoustically, and compared with earlier findings for read speech. The results support the account, showing that speakers produced slightly fewer phrases, and considerably fewer accents. The findings not only allow us to evaluate the explanatory power of partial ranking, but also have implications for a phonological account of French intonation. If clear predictions can be made about the locations of pitch movements in the utterance, the number of intonation contours that can be realised is restricted.

1. INTRODUCTION

Post [15] proposes a constraint-based account of the complex interaction between phrasing and accentuation in French, in which a number of universal well-formedness constraints are ranked relative to each other in the grammar (e.g. NoClash: two immediately adjacent accented syllables are prohibited, and RightmostPWd: Prosodic Words must have final accents). The surface form that best satisfies the higher-ranked constraints is the one that is selected [17]. For instance, the constraint hierarchy would select *de Jolis AIRS* ‘pretty tunes’ rather than *de joLIS AIRS* with a clash.

The hierarchy proposed in Post [15] describes a ‘default’ situation, that is, the patterns of phrasing and accentuation that are most frequent in careful speech which is produced at a normal rate (e.g. [7, 18]). However, alternative realisations have also been observed. In [14], for instance, potential clash items such as *de jolies airs* were sometimes realised with only one accent (*de jolies AIRS*), instead of the ‘default’ two (*de Jolis AIRS*). Variation in the realisation of accents and phrases depends on a number of factors such as speaking rate and style, but little is known about this kind of variation in French (but see e.g. [4, 5, 9, 10]).

Post [15] proposes to account for prosodic variation by means of partial ranking, which allows small subsets of constraints to be unranked relative to each other, while they are still crucially ranked relative to the other constraints [1]. The unranked constraints are the ones which regulate, for instance, the widening of a domain of application of a post-lexical process at a higher speaking rate. For example, instead of aligning with an X’ projection, a Phonological Phrase could align with an X’ projection (giving [*un verger vert*]PP instead of [*un verger*]PP [*vert*]PP ‘a green orchard’). A postlexical process that has the phonological phrase as its domain of application, such as Clash Resolution [14], will now apply within this enlarged domain (giving [*un VERger VERT*]PP instead of [*un verGER*]PP [*VERT*]PP, where the two accents are separated by a PP boundary). This can be captured by reranking two constraints that are immediately adjacent in the constraint hierarchy.

The model has the advantage that it gives a unified account of the data, making clear predictions about the forms that surface in ‘default’ cases and in cases of prosodic variation, while it still excludes ungrammatical forms (see [15] for a detailed description of the account).

The aim of this paper is to establish (1) how prosodic phrasing and accentuation vary as a function of speaking style in French, and (2) whether the account of prosodic variation proposed in Post [15] is indeed adequate to describe the variation we observe.

2. METHODS

Recordings of two Map Tasks [3] were analysed auditorily and acoustically, and compared with earlier findings for read speech [14].

2.1. Materials

The Map Tasks were specifically developed to test the interaction between phrasing and accentuation in (semi-) spontaneous speech in French. More specifically, a number of landmarks were included which allowed a comparison with the patterns that have been observed in careful, usually read speech. These ‘default’ patterns can be summarised as follows:

- (1) The ‘default’ accentual patterns
 - (a) All Phonological Phrases (PP) are obligatorily marked by a final pitch accent ([*des verGERS*]PP)
 - (b) PPs align with X’ heads ([*des vergers*]PP, N&V),

except for

- heads followed by a monosyllabic direct complement (align with X' [des vergers verts]PP, [14, 15])
 - prenominal adjectives (align with noun instead [de jolis airs]PP [11, 12, 18])
- (c) PPs have additional accents
- on the final syllable of each Prosodic Word ([de peTITS enFANTS]PP 'small children'), unless this creates a clash ([de Jolis AIRS]PP)
 - Prosodic Words with more than 2 syllables are also accented on the first syllable (la NEcessiTE)

The starting point of the account is that the Phonological Phrase (PP) is the domain of pitch accent distribution in French, regardless of factors such as speaking rate or style. That is, the pitch accent at the right edge of the PP is obligatory and other pitch accents are optional. Since Phonological Phrases are derived from the syntactic constituent structure by means of an algorithm [11, 12], the claim that every PP must end in an accent can be verified (see [14] for a discussion).

Post [14] tested the application of Clash Resolution in domains that formed a Small PP (derived from an X' head) as in (2), or two Small PPs which together can form a Maximal PPs (derived from an X'' head) as in (3) (cf. [12, 13]). The formation of MPPs is optional (depending on, for instance, rate of speech), and therefore, Clash Resolution does not have to apply in these contexts.

(2) X': [de Jolis AIRS]SPP

(3) X'': [de VERgers VERTS]MPP

or

X' & X': [de verGERS]SPP [VERTS]SPP

Since acoustic measurements confirmed the auditory judgements of phrase formation (i.e. which SPPs had been grouped into an MPP) and accentuation as in (2) and (3), we can conclude that Clash Resolution is a good indicator of phonological phrasing. In order to verify whether the algorithm for phrase formation holds for spontaneous speech, and whether PPs indeed have an obligatory final accent, a number of items with these structures were included in the Map Tasks.

These items were complemented with landmarks that did not have a clash context (as in (1c) above), so that the variation in accentual patterns as a function of speaking style could be examined. Similarly, landmarks with longer X'' projections were included, because the formation of MPPs appears to be sensitive to the number of syllables in the second SPP (not on whether it is branching, as [11] proposes [14, 15]), and it appears to vary with speaking rate and style. Variants of the 'default' patterns that we expected to observed are:

(4) Variation on the 'default' patterns

- (a) PPs only align with X' heads, never with X'' [des vergers]PP [verts]PP (e.g. [14])
- (b) PPs also form when the complement contains more than 1 syllable ([la station balnéaire]PP 'the seaside

resort') (e.g. [14])

- (c) a 'hammock' pattern: additional accents are realised on the first syllable of the first Prosodic Word in the PP, rather than on word-final syllables ([de PEtits enFANTS]PP (e.g. [7])
- (d) all non-final accents are omitted ([de petits enFANTS]PP) (e.g. [14])

2.2. Subjects and procedure

Two native speakers in their early twenties, both from Paris, took turns as Instruction Giver and Instruction Follower, so that a reasonably large speech sample could be obtained for each subject. The recordings were made on DAT-tape in a sound-treated studio, and digitised at 16KHz.

2.3. Auditory and acoustic analysis

136 speech samples with structures that were appropriate to test the patterns described in (1) and (4) were selected, including structures other than realisations of the landmarks. They were divided into different groups, depending on their morpho-syntactic structure (potential MPP or SPP), and the number of Prosodic Words and syllables (testing the realisation of additional initial or final accents and Clash Resolution). Then, the items were analysed auditorily to establish the location of accents and phrase boundaries. Judgements such as these were shown to be highly reliable in [14].

The data were analysed acoustically by means of the PRAAT signal processing package [2] to obtain independent evidence to support the judgements. The measurements were taken in a wide-band spectrogram in three vowels, as exemplified in (5): (V1) the first vowel of the first Prosodic Word in the PP, (V2) the final vowel of the prefinal Prosodic Word in the PP, and (V3) the final vowel of the PP. The second formant was used to identify the start and end points of the vowels.

(5) (a) [la station balnéaire]PP
V1 V2 V3

[la station]PP [balnéaire]PP
V1 V2 V3

(b) [un petit peu tortueux]PP 'a little bit winding'
V1 V2 V3

[un petit peu]PP [tortueux]PP
V1 V2 V3

Duration measurements were taken to verify whether pre-final lengthening supports the judgements of PP boundaries. Fundamental frequency measurements were taken to verify whether the auditory judgements of the accentual patterns were reflected in the pitch trace. Since non-final accents are generally assumed to be characterised by a high accent in French (H*; e.g. [7, 8, 15, 16]), fundamental frequency should normally be higher for accented than for unaccented syllables (exceptions in which V1 and V2 were located on a falling slope from a preceding higher accent were excluded).

71 of the 136 speech samples could not be analysed acoustically, because the PP-final accent was low instead of high (before an utterance boundary), or because one of

the vowels could not be measured. In *un petit peu*, for instance, the schwa of *pe* was often omitted altogether when it was not accented.

3. RESULTS

3.1. The algorithm for PP formation and PP final accents

The auditory judgements showed that of the 51 speech samples that contained an X' projection, the Phonological Phrase aligned with X'' in 15 cases (forming 15 MPPs), and with both X' categories in 36 cases (resulting in 62 SPPs). In the remaining 85 samples that contained only one X' category word, the SPP aligned with X', as expected. Except for one realisation of *les torrents*, where the initial and final syllables sounded equally prominent, all PPs had a final accent.

A comparison of the durations measured for the 90 PP-final vowels and the 119 non-final vowels of all PPs in the sample supported the judgements of phrasing (means: 90ms vs. 163ms.; $T(120.44)=-10.05$, $p<0.001$). However, there are several confounding factors that might bias the result in the direction of our hypotheses. Different vowels have intrinsically different durations, and if 'short' vowels happen to predominate in the non-final group, this would bias the results. However, we did not find any evidence to support this. More importantly, all final vowels were judged to be accented (except one), but only 42 of the 119 non-final vowels that were measured were accented, confounding the lengthening effect of an accent with that of a PP boundary. Therefore, all non-accented vowels were excluded in a second analysis. The difference in duration between non-final and final vowels was still highly significant (102ms. vs. 171ms. $T(119.3)=-7.81$, $p<0.001$).

As a second check on the judgements of PP boundaries, the application of Clash Resolution (CR) was investigated, which had proven to be a good indicator for phonological phrasing in a previous study [14]. 62 of the 136 speech samples contained a CR context, where two word-final accents are immediately adjacent within the PP unless the first accent is moved or omitted. 50 of those were of the *de jolis airs* type, which had only one X' head that can align with an SPP. As predicted, CR always applied in these cases. The remaining 12 cases, of the *des vergers verts* type, could form two SPPs or one MPP. Only in the latter case, CR would apply; in the former, two PP final accents would be required. With one possible exception, this was indeed what was found.

The fundamental frequency measurements confirmed that CR had indeed applied in within all PPs with the relevant context (mean for V1 228Hz. and for V2 218Hz.; paired samples $T(21)=3.19$, $p<0.001$). Unfortunately, there were not enough potential MPPs with a clash context in which f_0 measurements could be taken to make a meaningful statistical comparison between cases in which CR had applied and those in which it had not (4 and 5 cases, respectively).

3.2. Variation in Phonological Phrase formation

The aim of the second part of the analysis was to establish whether speaking style has an effect on phonological phrasing. As mentioned, 51 speech samples contained two X' projections which could optionally form an MPP. In 41 of those the complement was plurisyllabic (*la station balnéaire*), and in 10 it was monosyllabic (*le verger vert*). Monosyllabic complements phrased with the preceding material more often than plurisyllabic ones (50% versus 25% of cases). Whether the complement was branching (contained more than one word) or not did not have an effect (25% and 23% formed MPPs, respectively).

These findings are quite similar to those reported for read speech in [14, 15]. Here, 37% of plurisyllabic and 48% of monosyllabic complements grouped with the preceding material.

3.3. Variation in accentuation

The final set of analyses investigated the realisation of accentual patterns in the Map Task data. 100 PPs were selected which contained enough material to accommodate two accents without necessarily creating a clash, as specified in (6).

(6) Structure of the samples testing accentual variation

- (a) two plurisyllabic Prosodic Words (e.g. [*la station balnéaire*]PP)
- (b) a plurisyllabic word followed by a monosyllabic word (e.g. [*le verger vert*]PP)
- (c) more than two words (e.g. [*le deuxième petit pin*]PP 'the second small tree')
- (d) one word with more than 2 syllables (e.g. [*le tonnelier*]PP 'the cooper')

The 'default' pattern for the structures in (6a) and (6c) is a sequence of word-final accents, while in (6b) and (6d), an initial accent would be realised on the first word in (6c) or on the only word in (6d) (as specified in (1c) above). Accentual patterns such as these have been observed to vary in two ways. Either, the PP is marked by an initial and a final accent only ('hammock' [7]), or all non-final accents are omitted (e.g. [14]). The results are shown in Figure 1.

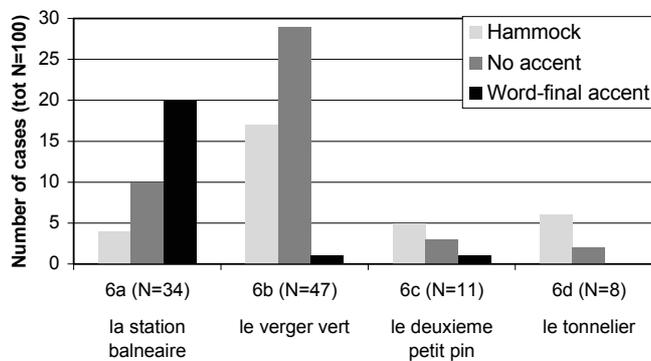


Figure 1: Non-final accents observed in 4 types of structures in the Map Task data

Although 32 of 100 cases showed a 'hammock', only 9 of those occurred in contexts (6a) and (6c), which means that

in the vast majority of cases, hammers occur in a context in which there is only one position available for the second accent in the phrase. When there is a choice, this accent tends to occur in word-final position (21 of the 45 cases in (6a) and (6c), and 22 cases in all).

The alternative is not to produce any non-final accents at all (44 cases in all). This is the preferred option in clash contexts like (6b) (29 cases of a total of 47 CR cases). For comparison, the non-final accent was omitted in only 14% of CR cases in the read speech data of [14]. Even in structures where there is more material (6a and 6c), the omission of the non-final accents is quite popular (13 of 45 cases).

4. CONCLUSION

The aims of this study were to investigate (1) how speaking style affects prosodic phrasing and accentuation in French, and (2) whether the constraint-based account of prosodic variation proposed in Post [15] is indeed adequate to describe this variation.

The results show that all Phonological Phrases are marked by a final pitch accent, regardless of speaking style, and that PPs either align with X' or X" projections. This finding confirms the starting points of Post [15]. The results also show that speakers produced slightly fewer phonological phrases than were observed for comparable data in read speech, and they produced considerably fewer accents in non-final position in the PP, where they are optional.

These findings can easily be accommodated in the model of Post [15]. Partial ranking has the advantage that prosodic variation that arises within the language system of one speaker is accounted for by essentially the same, minimally modified, grammar. However, it is not clear what mechanism should trigger a reranking of constraints. Although differences in the number of occurrences of a particular prosodic pattern were found in the speaking styles investigated here, all patterns were realised in both styles; a change in speaking style in itself does not seem to concur with a reranking of a particular pair of constraints.

Clearly, further studies are required with more speakers and a wider variety of structures, in which different prosodic domains and factors other than speaking style are also taken into consideration (cf. [9, 10]).

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