Functions of the French Initial Accent: a Preliminary Study

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Abstract

Previous studies have proposed that the French phonological system includes an Initial Accent on lexical words, which has rhythmic functions. Descriptions of English prosody propose that phonological phrases may have an early accent as a boundary marker. We report results from a preliminary production experiment, which tested the structural and rhythmic functions of the F0 of initial syllables. Our results showed that the F0 is used in French as a (left) phrase boundary marker, and that its value appeared to be correlated to prosodic constituent length.

1. Introduction

Traditional views on French prosodic phonology propose that French possesses only a phrase final accent, characterized by lengthening [6], [8], [10]. The location of this accent at prosodic boundaries has even led to the claim that French is a 'language without accent' [12], or a mere 'boundary language' [2], 16]. Recent studies of spontaneous speech in various speaking genres, however, have shown that French actually has a dual accentual system: the final accent seems to coexist with an initial accent, the latter contributing to accentual rhythmicity [1], [5], [7], [17].

Though often observed [7], this initial accent has been confused with the emphatic accent (or '*Accent d'insistance*'), and has only very recently been integrated into a model of French accentuation [4]. The model proposes that words are marked in the underlying phonological structure by initial and final accents, which are realized at a surface level according to grouping and rhythmic rules, as well as by pragmatic rules which assign nuclear and emphatic accents. The initial accent is described as having essentially a rhythmic function, i.e. it is introduced to avoid final accentuation clash or over-long series of unstressed syllables. This model has two major advantages: first, it fully integrates the initial accent in the phonological system of French; and second, it clearly poses a functional distinction between rhythmic and pragmatic initial accents. Along with [13], it proposes that the emphatic accent is a strong surface realization of the rhythmic initial accent. This functional distinction is reflected at a phonetic level: the initial accent is indeed said to be a true pitch accent with no lengthening correlate [13], whereas major lengthening is associated with emphatic accents.

The existence of the initial non-emphatic accent was supported by a study using three different speaking genres (Reading, Interview, Radio News Broadcast) [1]. Three experts were asked to indicate where they perceived initial accents and whether these were emphatic. The acoustic-phonetic correlates of these perceived accents were investigated in terms of duration and F0. Following [3], initial prominences were distinguished from final prominences by their lengthening patterns: initial prominences exhibit significantly longer Onset than Rimes, whereas the reverse is true for final prominences. More importantly, emphatic and non-emphatic initial accents could also be distinguished even if both had longer Onsets than Rimes: the Onset/Rime ratio is twice as large for emphatic than for non-emphatic initial accent. The two types of initial accent were also distinguishable via F0 dynamic parameters. Again rhythmic initial prominences have significantly shallower slopes and lower F0 peaks than do their emphatic counterparts.

Astésano's results [1] held for all three speech genres. Though non-emphatic initial accents were fairly common (of all accented syllables, 10.2% were non-emphatic initial accents for Reading and Interview, and 15% for News) and distinguishable, it is not yet clear what their function is. The literature on French accentuation describes a rhythmic function, a tendency to periodic accentuation. But beyond this well-known function, there is no systematic account in the literature as to where this initial accent occurs with regards to the syntactic structure, to the semantic and pragmatic context, all likely contributors of syllabic prominence.

The present investigation, part of a larger study of initial accents, tests the possibility that rhythmic and structural effects are both found. We ask, first, whether speakers use initial accents to mark prosodic phrase boundaries ('early accent') and with them syntactic boundaries, as proposed for English [14]. In this study, the authors found evidence that speakers placed pitch accents towards the beginning of words at the beginnings of intonational phrases, often to avoid stress clash. Our own study also asks whether speakers' tendencies to make such boundary indicators in French are affected by rhythmic factors such as the length of constituents. Thus, we predict that for any string of words with two possible syntactic structures, the one imposing a phrase boundary before a word will attract more initial accents to the word. We also predict that the structural attraction of these accents will be greater where the constituent is longer. Because [14] did not directly tackle the question of the constituent providing the domain of such rhythmic rules, we propose to test in the present study whether the occurrence of an 'early accent' in French is more dependent on the length of the Phonological Word or of the Phonological Phrase.

2. Material and Procedure

2.1. Material

2.1.1. Experimental conditions

To test the tendency of initial accent (hereafter, IA) to mark the onset of a prosodic phrase we constructed syntactically ambiguous NPs like (2), similar to the well-known examples like (1):

(1) Old men and women

(1a) ((Old men) (and (women)))
(1b) (Old ((men) (and (women))))
(2) Les gants et les bas lisses
'*the smooth gloves and stockings*'
(2a) ((Les gants) (et (les bas lisses)))
(2b) (((Les gants) (et (les bas))) lisses)

In (2) the adjective *lisses* might have narrow scope, applying only to the second NP (hereafter NP2), as shown in (2a). Or it might have broader scope, applying to the conjoined NP, that is, to both NP1 and NP2, as in (2b). As in English, speakers can encourage syntactic disambiguation by introducing a phonological phrase boundary before NP2 (as in (2a)), while using no phrase boundary between NP1 and NP2 when the adjective applies to the conjoined NP (NP1 and NP2) (as in 2b) [11]. Note that in (2b), a speaker can produce a phrase boundary between NP2 and the adjective.

The rhythmic function of IA was controlled by manipulating the length in syllables of the nouns and the adjective, including examples like (3) to contrast with (2).

(3) Les bonimenteurs et les baratineurs fabulateurs.

Example (3) contains both a longer noun N2 and a longer Adjective than example (2). This manipulation allows us to determine whether the tendency towards IA is controlled by the phrase length, composed of noun length + adjective length, or merely by the noun (N2) length itself. In the former case, we could be seeing the effect of the phonological phrase. In the latter case, we would be seeing the effect of the phonological word including lexical noun and its article.

The experiment used a factorial design, with 32 distinct conditions, all the possible combinations of

- Noun Length {1- 4 syllables}
- Adjective Length {1- 4 syllables}
- Syntactic Structure {broad v narrow scope of adjective}

2.1.2. Materials

The phonetic material was carefully controlled so as to avoid segmental variability and to limit contextual variation on the Target Word N2. Across the word-length variable, N2 words began wherever possible with the same first syllable and were followed by increasing numbers of syllables which were kept as similar on a segmental level as possible (*bas, balises, balivernes).* When this was not strictly possible, the segmental content was chosen to minimize any intrinsic duration variation. The same principle applied to the Adjectives *(louches, loufoques, louvoyantes*). Furthermore, the adjective's initial syllable at each N2 'word-length' was matched to the N2's *final* syllable at the next N2 'word-length' level (ex: *bas lisses, balises vertes, balivernes sottes* etc…) (see Table 1).

The target phrases were embedded in carrier sentences, controlled for number of syllables and syntactic construction. In each case, the adjective was followed immediately by *en fait*, 'in fact', which forces a prosodic boundary. Four different sets of sentences were constructed, each allowing all levels of N2 length, adjective length and syntactic structure. Each of the 384 sentences was read 3 times.

Table 1: Phonetic material: 2 sets of the 4 sets in total

Nouns (N2)	Adjectives
Bas	lisses/ licites/ licencieux/ libérateurs
Balises	vertes/ vermeilles/ verticales/ vertigineuses
Balivernes	sottes/ saumâtres/ saugrenues/ somnambuliques
Baratineurs	fades/ fameux/ fabuleux/ fabulateurs
Fours	mixtes/ miteux/ mitoyens/ mythologiques
Fourmis	louches/ loufoques/ louvoyantes/ luminescentes
Fourmilières	naines/ nacrées/ naturelles/ napolitaines
Filmographies	mièvres/ mielleuses/ militantes/ mirobolantes

2.1.3. Speakers and instructions

Two native French speakers, one male (Speaker M) and one female (Speaker F) comprised the pilot sample, which we report on here.

The sentences were presented on paper separated into 8 blocks, and the pseudo-randomized order of reading was different for each speaker and balanced over the 2 reading sessions. The same syntactic condition was not allowed to appear more than 3 times in a row, and no two repetitions of the same sentence were separated by less than 6 other sentences.

Subjects were instructed to read each sentence in a particular way by means of a disambiguating instruction which was not itself read aloud. For example (2), the full carrier sentence was (4), and the introductory sentence was either (4a) for restricting the scope of the adjective to NP2 or (4b) for applying it to the full conjoined NP:

(4) Les gants et les bas lisses, en fait, sont plutôt répandus.

(4a) Si les bas sont lisses, mais les gants ne le sont pas, vous dites:
'If the stockings are smooth, but the gloves are not, you say : …'

(4b) Si les gants et les bas sont lisses, vous dites… *:*
'If the gloves and the stockings are smooth, you say: …'

After (4a), we expect to elicit a phonological phrase boundary before NP2. If IA marks this boundary, N2 must carry the accent. After (4b), we expect no phrase boundary between the first and the second NPs, but possibly a boundary between NP2 and the adjective.

Informants were told that the recorded material was intended for a future perception experiment where other informants would have to determine the meaning of the sentence on the basis of their production.

Three pauses were introduced into each reading sessions. The experimenter would randomly interrupt the reader informant to ask a question about the meaning of the sentence he/she had just read, in order to avoid monotony and to force the informant to concentrate on the meaning of the sentences.

2.2. Hypotheses and predictions

Hypothesis 1: *IA is a phrase (left) boundary marker*. If the IA is a device to mark the prosodic phrase onsets, then we would expect to find an IA on the first syllable of N2 in the narrow scope readings 'Les gants et [les bas lisses]' and in 'les bonimenteurs et [les baratineurs fabulateurs]' following preliminary instructions like (4a) more often than in broad scope readings following instructions like (4b).

Hypothesis 2a: *IA is a rhythmic device based on the Phonological Word*: in this case, longer nouns would be more

likely to attract an IA regardless of the length of the adjective, and in both readings.

Hypothesis 2b: *IA is a rhythmic device based on the Phonological Phrase:* in this case, we would expect that an IA is more probable in '… et les balivernes saugrenues…' , in '… et les balises vertigineuses…', and in '… et les baratineurs fameux…' (all of which have a total of 6 syllables in their noun + adjective combinations, plus 2 weak syllables), than in any examples with shorter phonological phrases. This hypothesis predicts an interaction between phrase length and syntactic structure, i.e. an influence of phrase length in the narrow scope readings only.

2.3. Procedure

Because accents are notoriously difficult to objectively identify, this preliminary study examines the structural and rhythmical effects of the F0 value associated with the initial syllable of the Target Word N2.

2.3.1. Data analysis

To test whether a F0 peak was associated with the first syllable of N2, the onset and offset of the word N2 minus the last syllable was labeled by hand. We excluded the last syllable of N2 in the 'word' segmentation so as to avoid any major F0 movement usually found on the last syllable of a word/phrase in French. This way, the presence or absence of an F0 peak could only be interpreted as reflecting a pitch accent at the beginning of the target word.

The excerpts were digitized at 16 kHz and the fundamental frequency was modeled with a quadratic spline function using an automatic modeling algorithm [9] with manual corrections. The modeled F0 is represented by a sequence of Target Points <ms; Hz> corresponding to relevant F0 variations.

A script was used to detect the presence of a Target Point (TP) in N2 and to retrieve the F0 value associated with the highest TP in N2 when more than one TP was present.

3. Results

Acoustic analyses of peak F0 values on N2 were subjected to Analysis of Variance (ANOVA) with a separate by materials ANOVA for each of the two speakers. In each case, *Structure* (Narrow or Broad scope), *N2 length* (1 - 4 syllables), *Adjective length* (1 - 4 syllables) were repeated measures variables and *Materials Sets* (1-4) was a grouping variable.

Both speakers show the predicted effects of Structure (Speaker F: $F(1; 8) = 99.26$; $p < .0001$.; Speaker M: $F(1; 8) = 36.07$; $p < .0003$), with F0 peaks on N2 higher in the Narrow scope than in the Broad scope readings (see Figure 1).

In the search for rhythmic effects, we were interested in the effect of N2 length and of adjective length, particularly in the narrow readings, where N2 and adjective should belong to the same phonological phrase. We find some evidence of the effect of the length of N2, both as a main effect (Speaker F: $F(3; 24) = 68.65$; $p < .0001$; Speaker M: $F(3; 24) = 86.04$; $p < .0001$; see Figure 2), and for Speaker F in an interaction with Structure ($F(3; 24) = 39.94$; $p < .0001$; see Figure 3). Overall, the F0 peak on N2 increases as a function of the number of syllables in the noun, as we might predict from the rhythmic hypothesis. For Speaker F, one- and two-syllable nouns have significantly lower F0 peaks than three- and four-syllable nouns, while for Speaker M, one- and two-syllable nouns have lower F0 peaks than three- and four-syllable nouns, and three-syllable nouns have lower F0 peaks than four-syllable nouns. (all Scheffé tests at $p < .01$). An examination of Figure 3 (Speaker F), however, shows that the effect of Structure is largely felt on monosyllabic N2s, which have significantly higher F0s in the Narrow scope condition than in the Broad scope condition.

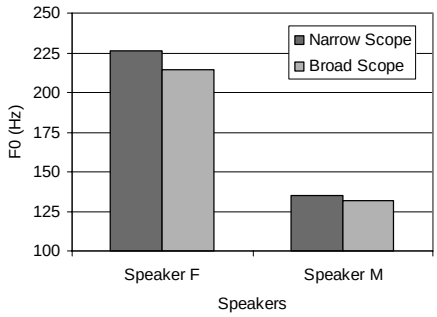

Figure 1: Effect of Structure on Peak F0 (Hz) in Syllable 1 of N2.

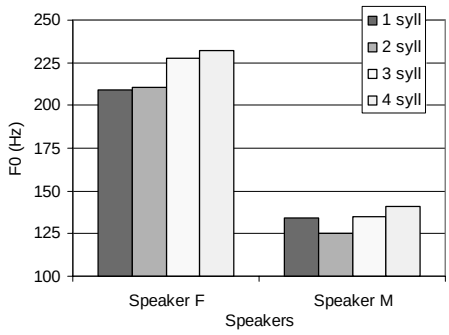

Figure 2: Effect of N2 Length on Peak F0 (Hz) for Syllable 1 of N2

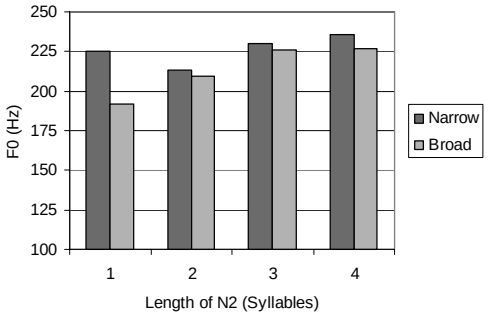

Figure 3: Speaker F: Effect of Structure and N2 Length on Peak F0 (Hz) for Syllable 1 of N2.

Hypotheses 2b depends on an additional influence of adjective length within Narrow scope readings where adjectives contribute to the length of the phonological phrase. We do not, however, find any evidence for an effect of the

length of the adjective either overall or in Narrow scope readings. The only significant effect involving adjective length is the three way interaction for Speaker F, shown in Figure 4 ($F(9; 72) = 2.03$; $p < .048$): in the Broad scope, where N2 and the following adjective do not belong to the same syntactic phrase, only noun length influences the height of the F0 peak on N2, the length of the adjective being influential for one-syllable nouns only. In the Narrow scope on the contrary, where N2 and the adjective belong to the same syntactic phrase, there is a much more confused pattern. If phrase length were the controlling factor in this interaction, then items with the same total number of syllables for N2 + Adjective should have similar F0s and should be fairly distinct from items with smaller or larger totals. The pattern seen in Figure 4 does not meet this prediction. For example, the 2 + 3-, 2 + 4- and 3 + 4-syllable combinations have lower F0 peaks than the 3 + 2-, 4 + 2- and 4 + 3-syllable combinations respectively. This pattern suggests that the result is based more on N2 length than on adjective length.

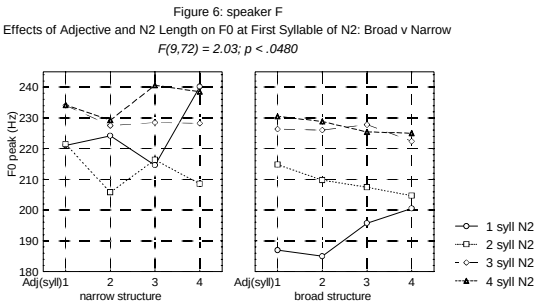

*Figure 4: Peak F0 values (Hertz) on N2 for Speaker F in the Structure * Noun length * Adjective length conditions.*

4. Discussion and conclusion

Our results confirmed the structural and rhythmic role of F0, insofar as it was used as a device to mark the beginning of a phrase: the F0 peak on N2 was significantly higher in the condition where the adjective applied to N2 alone, i.e. when the interpretation of the sentence called for the introduction of a phrase boundary between N1 and N2, compared to the condition where the adjective applied to both NP1 and NP2. Also, and in line with previous studies on French [1, 4], it appeared that the F0 peak on N2 increased with the number of syllables in N2.

At present, however, this conclusion needs to be tempered. Our data do not provide all the evidence needed to discover the unit to which the F0 rhythmic effect applies. The fact that the length of N2, but not the length of N2 + Adjective (Phrase), is correlated with the F0 value on the Target Word is consistent with the hypothesis that the Phonological Word is the relevant rhythmic domain. Confirmation of this suggestion awaits tabulation of phrase boundaries lying between N2 and the Adjective.

Admittedly, these are pilot results. Data from a further 6 speakers are under analysis. The present acoustic analysis will be supplemented with expert listeners' perceptual tests and with automatic detection of IA. With these, we hope not only to provide more satisfactory tests of our hypotheses, but also an account of how IA on N2 interacts with the occurrence of IA on the Adjective in Broad scope readings.

5. References

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