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# CLASHES REVISITED IN THE LIGHT OF INTERPROSODY

Guri Bordal<sup>a,b</sup> & Anne Lacheret<sup>b</sup>

<sup>a</sup>University of Oslo, Norway; <sup>b</sup>MoDyCo, Université Paris Ouest Nanterre La Défense, France  
guri.bordal@ilos.uio.no; anne@lacheret.com

## ABSTRACT

The aim of this study is to examine some aspects of the prosodic system of Central African French, a variety of French spoken by L1 speaker of Sango, an African tone language. On the basis of a comparison of acoustic correlates of syllables involved in clashes in corpora of spontaneous Central African French and Standard French, we argue that the former has a hybrid prosodic system that contains traces of the tonal system of Sango, the speakers' L1.

**Keywords:** contrast Constraint, clashes, French Prosody, interprosody, language contact, tones

## 1. INTRODUCTION

According to several models of French prosody [6, 7, 11, 14, 20, 21] a highly ranked constraint in French prosodic grammar is the **Clash Resolution constraint**. In fact, one of the main characteristics of French prosody is that the domain of primary stress is a unit larger than the lexical word, here referred to as the **Accentual Phrase (AP)** [13]. The AP consists of one or more content words and the dependent function words [13] and the avoidance of clash, defined as the occurrence of word stress on adjacent syllables [15, 20], is said to be an important constraint in the formation of the AP [11, 20].

However, the succession of perceptually prominent syllables in clash contexts is frequently attested in spontaneous Standard French (SF). For instance, analyses of the *Rhapsodie corpus* of SF prosody show that in average one prosodic constituent out of three contains clashes [20]. This can in some cases be explained by production constraints, such as anticipation of the stress target [16]. Nonetheless, in most cases, prominent syllables follow each other in clash contexts if they have different functions, e.g. focal and contrastive (*ce champs-là*, 'this field'). More importantly, adjacent prominent syllables are always realized with different acoustic cues [22]; the first prominent syllable is typically realized with high pitch whereas the second is characterized by vowel

lengthening. Consequently, data from corpora of spontaneous speech indicate that the Clash Resolution constraint might be too general to characterize French prosodic grammar, and that there exists an even more fundamental cognitive constraint, which prohibits the production of successive strong syllables with identical pitch profiles. We will refer to this as the **Contrast Constraint**.

The study presented here shows that the Contrast Constraint is not respected in **Central African French (CAF)**, a variety of French spoken in the Central African Republic; clashes without pitch contrasts are in fact commonly attested in a corpus of spontaneous speech produced by 12 Central African speakers. We claim that this observation provides evidence that the prosodic system of CAF is fundamentally different from that of SF. Further, we argue that the differences between the prosodic systems of CAF and SF can be explained by language contact; according to what we refer to as the **Interprosody Hypothesis**, CAF has a hybrid prosodic system that contains traces of the tonal system of Sango, the speakers L1.

## 2. DATA

### 2.1. Corpus

Our data are collected within the framework of the Phonologie du Français Contemporain (PFC) project. All PFC investigations follow the same research protocol: twelve speakers are selected according to variables such as sex, age and education level and the recordings include both reading tasks and spontaneous speech [8].

The speakers of the PFC sub-corpus of CAF are multilingual; their first language (L1) is Sango, an African tone language (some of the speakers also speak other related tone languages). In their daily communication, they alternate essentially between Sango and French; Sango is used in informal settings whereas French is the language of work and other formal contexts.

For this study, we have examined 10 minutes of spontaneous speech for each speaker. The corpus is two hours long and contains 21470 syllables.

## 2.2. Prosodic annotation

The results we are presenting here are obtained inductively by a method that is inspired by the Rhapsodie project [1, 22].

An inductive method has been adopted for two reasons. First, we are generally convinced that corpus annotation should be as objective as possible and not guided by any particular model or theory [20]. Second, for this particular corpus, a general overview of the data was needed before we could propose precise hypotheses about the system; as far as we know, there are few studies of this kind and we therefore lack data on which we could base potential predictions.

The method we used consists of the following measures: In order to get a first overview of the data, we detected perceptually **prominent** syllables. Then we looked at the distribution and acoustic cues of syllabic prominences and finally we paid special attention to audible pitch variations that were automatically detected.

### 2.2.1. Software

The corpus is transcribed in Praat [3], segmented in words, syllables and phonemes and transcribed in SAMPA by the Praat script Easyalign [9]. Syllabic prominence is detected by the software Analor [2] and annotations of tones were automatically undertaken by Prosogram [17].

### 2.2.2. Detection of prominent syllables

In our approach, a prominent syllable is one that stands out from its environment by virtue of some combination of acoustic properties that makes it perceptually more salient than its neighbor syllables [24]. Thus, the function and acoustic correlates of prominences are not defined prior to the empirical investigation [1]. The annotation of prominences in our corpus is based both on automatic detection and perceptual judgments.

The automatic detection is undertaken by Analor, which has been developed with the aim of detecting acoustic variations that are audible to human listeners. The software determines the relative prominence of a syllable in relation to the acoustic profile of the three preceding and three following syllables on the basis of an algorithm that considers several parameters, such as length,

relative pitch, melodic variations on the syllable nucleus and pauses (see [2]).

As regards the perceptual judgments, we selected three naïve human annotators, who are not linguists, in order to eliminate any theoretical bias. The annotators were selected according to their knowledge of the system of CAF: a) one is a native speaker of Norwegian and does not speak French (no knowledge), b) one is a native speaker of a variety of French that is close to SF (partial knowledge), and c) one is a speaker of CAF and Sango (total knowledge). They were asked to listen to small parts of the recordings (not more than 6 seconds at once) and mark the syllables that they perceived as more salient than the other syllables.

Our hypothesis was that the annotations by Analor and by the different human annotators would complement each other. As for Analor, the acoustic parameters of detection are well defined; there are few coincidences in the results. However, the annotation of the software should be confirmed by human perception. Concerning the human annotators, they bring different perspectives to the annotation: We hypothesized that the first human annotator would base his annotation on purely acoustic criteria [18] and annotate the most acoustically salient syllables, the second would use his knowledge of Standard French prosody to detect major differences between his own system and CAF and the last annotator would contribute with knowledge of the systems of both CAF and Sango.

We assumed that the syllables that were perceived as prominent by at least two of these different annotators contain some cue that distinguished them from their environment and should therefore be further examined. Consequently, the syllables that are annotated as prominent in our reference corpus are those that were perceived prominent by at least Analor and a human annotator or at least two human annotators. All other syllables were considered as not prominent.

This method seemed solid, since clear patterns emerged both concerning the distribution and the acoustic correlates of syllabic prominences. 35,51% (7623/21470) of all of the syllables in the corpus are prominent. Some function words (19,70% (1501/7620)) and most content words (70,88% (5144/7257)) have a prominent syllable. In the case of polysyllabic content words, the prominent syllable was generally the last.

Analyses of the acoustic correlates of syllabic prominences were undertaken by Analor, which provides pluriparametric acoustic profiles (length, intensity, f0) of both prominent and non prominent syllables. These analyses revealed that high or rising pitch were the main reason why the prominent syllables stood out from their environment [4].

### 2.2.3. Detection of tones

Since high pitch turned out to be the main acoustic cue of prominences, we paid special attention to tonal patterns. The variations of F0 were analyzed automatically by Prosogram, which detects the “tone” of each syllable by comparing the value of F0 of its nucleus by its immediate left context (three syllables or maximum 450 milliseconds) [17].

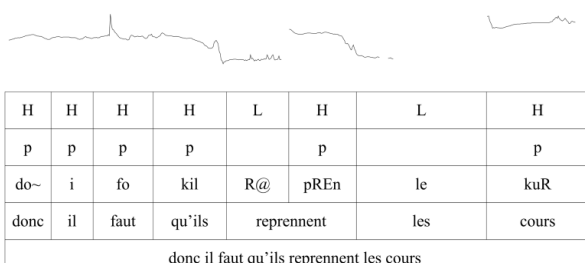
## 3. RESULTS

As in spontaneous SF, clashes occur frequently in the CAF. There is also an important tendency of “clashes” in contexts of clitics followed by monosyllabic content words (*il faut*, *it should*, *un mot* ‘a word’) (cf. figure 1).

As we have seen, according to the Contrast Constraint, Standard French prosody allows such clashes as long as the syllables involved are realized with contrasting pitch profiles. However, the automatic detection of tones [17] reveals that adjacent prominent syllables in CAF are systematically realized with identical static high tones (cf. figure 1).

Consequently, neither the Clash Resolution constraint nor the Contrast Constraint is respected in CAF.

**Figure 1:** Example of clashes from the CAF corpus. The first tier of annotation indicates tones and the second prominences.



## 4. THE INTERPROSODY HYPOTHESIS

We have seen that violations of Clash Resolution constraints are frequent in corpora of spontaneous

SF, but the violation of the Contrast Constraint in CAF constitutes a major difference from SF.

Other studies of prosodic outcome of language contact show that prosodic transfers are very common (perhaps more common than other types of transfers) (see for example [5, 12, 23]). We can therefore hypothesize that the prosodic system of CAF contains traces of the prosodic system of Sango, the speakers' L1, and that this is the main reason for the differences between CAF et SF.

The speakers' L1, Sango, is a lexical tone language with maximal tonal density; every syllable is associated with at least one tone and every tone is associated with one and only one syllable. Sango has few output constraints; the underlying tonal patterns are, with few exceptions, represented in the output. The succession of several identical tones within the same prosodic constituent is thus allowed by the grammar of Sango [4]; the Obligatory Contour Principle [10] that operates in many tone languages does not have any effect. A major difference between SF and Sango is that intonation in the former is post-lexical and depends on many factors, such as pragmatics, rhythmic constraints etc., whereas the sentence melody in the latter depends to a great extent on the lexical tones. If CAF shares properties with the prosodic system of Sango, this could be because it preserves traces of the latter's tone system.

A closer look at the CAF corpus strengthens this hypothesis. In fact, the words that are involved in the clashes are also realized with high tones in other occurrences in the corpus. For instance, the clitic “il” is annotated with a high tone in every occurrence in the corpus (365 sites) and monosyllabic content words, such as “faut” (52 sites), are almost systematically realized with high tones. These regularities indicate that words tend to be specified for tone in CAF, as they are in Sango. On the basis of these observations, we claim that the “clashes” that we attest in CAF are of a different nature than clashes in SF; they are better characterized as **tonal clashes**, which result from the adjacency of two or more high tone monosyllabic words.

## 5. CONCLUSION

In this article, we have argued that clashes in corpora of spoken Central African French and Standard French are fundamentally different and reflect different systems. The clashes in the latter

are functionally motivated and obey the Contrast Constraint. In the former, clashes originate from the tonal grammar. In fact, there is evidence that words in CAF tend to be specified for tone in the underlying representation. Tonal clashes, e.g. the succession of high tones, occur when monosyllabic words with high tone follow each other. Further, we argue that the prosodic idiosyncrasies of Central African French derive from language contact; in particular, constraints active in the speakers' L1, Sango, such as lexical specification of tone and fidelity to the underlying representation, are transferred to the Central African variety of French.

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