Phonologies and Phonetics of French Prosody

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Abstract

Studies on French intonation are quite diversified, to the point where, looking at the descriptive results, one might wonder if all researchers did analyze the same language. Remarkable prosodic characteristics found in one study are not retrieved in another, and different theoretical approaches give very different insights on data, despite very similar experimental material.

In this paper we attempt to highlight some converging aspects of two types of intonation linguistic description on French, developed one in the Autosegmental-Metrical framework and the other with a phonosyntactic point of view. In particular, the contrast of melodic slope may be totally hidden with one approach, and appear as the main characteristic of French intonation with the other.

1. Introduction

We will attempt to highlight some converging aspects of two types of intonation linguistic description on French, developed one in the Autosegmental-Metrical framework (henceforth AM) and the other with a phonosyntactic point of view (from now on PY). Although the two approaches seem radically opposed at start, as the first follows a bottom up and the latter a top down process, both reduce the prosodic raw data essentially as movements in time of the fundamental frequency.

We will show how differences in theoretical assumptions will lead to apparently incompatible descriptions, based on various papers published by authors of both approaches, essentially [3], [8], [9] for AM, and essentially [2], [4], [5], [6], [7] for PY.

2. Autosegmental-Metrical and Phonosyntax

There is a general agreement to look on or around the accented (stressed) syllable for prosodic phenomena. Indeed, perceptually the stressed syllables are the most prominent, and a sentence reduced to only one word with only one syllable carries a stress (minimal condition).

2.1. Stress group and accentual phrase

Minimal units are also similar for both approaches. They contain one (lexical) stress and one optional initial stress (to correspond to the "arc accentuel" observed by [1]). They are called Accentual Phrases (AP) in the Autosegmental-Metrical (AM) framework and prosodic words PW (or stress groups) in the phonosyntax (PY) approach.

2.2. Content words and function words

In both theories, a minimum prosodic unit (AP or PW) contains one or more content word (open class word), and optional grammatical (closed class) words, but AM proceeds directly with this definition whereas in the case of PY it results from a 7 unstressed syllable rule [10].

AM: one or more content word and grammatical words, with one final stress and an optional secondary stress [3];

PY: one content word forms a group with grammatical words through dependency relations with one stressable last syllable. Depending on the speech rate, stressable syllables are effectively stressed (with a final – primary - stress). If two groups have few syllables (in the order of 2 or 3) they can form a larger group with its final syllable stressed. If the group has a large number of syllables (say > 7), it will receive a secondary stress [7].



Figure 1: Various configurations of stress groups with 2 to 8 syllables, showing the dependency relation (arrows and double arrows) between components, and the resulting stressed syllables(s), underlined in red.

2.3. Prosodic structure

Differences appear in AM and PY in the definition of the prosodic structure which organizes hierarchically the AP and PW. In AM, the structure has only 3 levels, and has the form {IP IP ... IP}, with IP = Intonation Phrase, with each IP formed with a sequence of Accentual Phrases AP: [AP AP ... AP], and each AP formed with prosodic words PW. This arrangement is govern by the Strict Layer Hypothesis where every AP is completely contained in an IP (as it is the case in a hierarchy...), and a single AP can constitute a complete IP (this is a reminiscence of a property of syntactic structures).

In PY, the prosodic structure is not level limited, and PW form larger prosodic units in a hierarchy that can also be represented by a tree. Here a Prosodic Word is simply part of a larger prosodic unit, except when the PS has only one PW.

2.4. Prosodic structure properties

Larger differences between AM and PY emerge essentially in the properties of the prosodic structure.

In AM AP are normally described in French by the sequence /LHiLH*/, the Hi part corresponding to the optional initial (secondary) accent, and the H* part to the (primary) final stress. The L and H symbols refer to the ToBI transcription of raw fundamental frequency acoustical data, and the standard pattern implies that all melodic contours are High, except the last one in a declarative sentence, which is Low (and transcribed L%) and H% in an interrogative sentence [3].

In PY, prosodic words have no pre-established standard pattern, as their melodic characteristics depend on the application of 2 rules [2]:

- a. IMS: Inversion of Melodic Slope rule
- b. AMV: Amplitude of Melodic Variation rule

The description of the final accent of a PW results from the application of these rules for a specific prosodic structure, and usually uses phonetic features such as Length (i.e. syllable duration), melodic Rise or Fall, Amplitude of melodic variation, etc. [6], [7]. Initial (secondary) accents do not play a role in the marking of the prosodic structure in PY, and are therefore always normally described with a melodic rise. Their role is only to ensure the presence of at least one stress in sequences of 7 consecutive syllables.

2.5. Prosodic and syntactic structures

The relation between the prosodic and syntactic structures is defined by alignment rules in AM, and by "sovereignty-association" in PY.

In AM, IP are basically aligned with major syntactic constituents and their hierarchy is predefined by the sequence $\{IP \ IP \dots IP\}$ with $IP = AP \ AP \dots AP$.



Figure 2: Association between syntactic (upper tree) and prosodic structures (squared tree)

The concept is very different in PY: in general more than one prosodic structure can be associated with a given syntactic structure, and every prosodic structure complies with the following constrains:

- a. Planarity
- b. Connexity
- c. Syntactic clash condition
- d. Eurhythmic restructuration
- e. Prosodic 7 syllables condition
- f. Prosodic word stress clash condition

2.6. Stress clash

Stress clash may occur when 2 consecutive syllables are stressed, but only in specific conditions when the units implied are dominated by the same node in the syntactic structure [7]. In this case, the first stressed syllable in clash moves to the left and becomes a secondary stress, located on the first or on the penultimate syllable (*hippopotame gris* vs. *hippopotame gris*).



Figure 3: An example of stress clash with no stress shift. The clashing units are not dominated by the same node in the syntactic structure. Case of an answer to a question such as "Comment Julien adore-t-il son café ?".



Figure 4: An example of stress clash with stress shift. The clashing units are dominated by the same node in the syntactic structure and the shifted accent becomes a secondary accent. Case of an answer to a question such as "Qu'est-ce que Julien adore?".

2.7. Rhythmic restructuration



Figure 5: An example of rhythmic restructuration. The prosodic structure groups [Julien adore] and [le café chaud] instead of [Julien] [[adore][le café chaud]] to achieve a more balanced number of syllables in the first level of the structure (eurhythmicity).

In PY, rhythmic restructuration can take place to ensure a more balanced number of syllables in the main (top) prosodic groups of the prosodic structure. If not, for instance to maintain congruence with the syntactic structure, a pause may be inserted by the speaker in an attempt to equilibrate syntactic groups duration.

2.8.Syntactic clash

Not all prosodic structures can be associated with a given syntactic structure if a syntactic clash condition prevails, when the prosodic structure assembles syntactic units dominated by distinct nodes as shown in Fig. 7. No syntactic clash condition occurs however if the prosodic structure separates units dominated by the same node in the syntactic structure.



Figure 6: The prosodic structure separates syntactic units dominated by the same node "adore" and "vraiment". There is no syntactic clash.



Figure 7: The prosodic structure assembles syntactic units dominated by the distinct nodes "Julien" and "adorent". There is a syntactic clash.

2.9. Rises and falls described by a unique H*



Figure 8: a (ToB1) High Fo level can correspond to a rise (left side) or to a fall (right side), depending if the alignment of the H^* target is done at the end or at the beginning of the stressed syllable.

3. Contrast of melodic slope

The most puzzling differences between the descriptions of AM and PY on French intonation pertain to the contrast of melodic slope, observed rarely in [3] or completely denied in [8]. Although one possible explanation is linked to the alignment of the H* tone with be beginning or the end of the stressed syllable (see 2.9), the key is to ensure that the observed contour located on a one syllable content word does correspond to a primary stress and not a secondary stress normally rising. An easy way to ensure this consists in applying the 7 syllable rules, so that enough number of syllables of the AP or PW guarantees the presence of a final stress and an appropriate observation of the melodic contour.

Fig. 8, 9 and 10 implement such an experiment: substituting *l'éléphanteau* to *le rat* makes the sequence *le rat* marron too large for one AP, witch is then divided in two PW. Indeed, Fig. 8 reveals a rising secondary stress on *rat*, whereas Fig. 9 shows a falling contour on *l'éléphanteau*, contrasting with the rising contour ending the larger prosodic group *l'éléphanteau marron*.



Figure 8: *le rat marron* forms one AP (PW), with a secondary stress on *rat* and a primary stress on *marron*. The is no contrast of slope, as the secondary stress is always rising.



Figure 9: *l'éléphanteau marron* has more than 7 syllables and therefore is divided in 2 prosodic words, ending both with a primary stress, the first one falling and contrasting with the final rising one.



Figure 10: In a longer sequence such as *Si le rat marron avait voulu manger le long mulot le marin roumain n'aurait pas voulu ranimer la jolie maman* the PW *Si le rat marron* ends with a falling contour contrasting with the rising contour on *mulot* (all these examples are adapted from sentences analyzed in [9]).

4. Examples revisited

Finally, we will examine some examples taken from [3]. In these illustrations, the top part reproduces the original published experimental data, and the bottom part of the figures gives the interpretation from a PY point of view, with the corresponding prosodic structure and the resulting melodic contours.





Figure 11: The last syllable on coléreux is high (H*) and falling afterwards (it may be not perceivable as a fall).

4.2. H* gives a rise, H* gives a rise



Figure 12: The first H* corresponds to a rise, explained by the prosodic structure associated with this example (which could be transcribed with punctuation marks as *Le garçon, remarquablement bon, ment à sa mère.*

4.3. Contrast of slope



Figure 13: A clear example of contrast of melodic slope on le *garçon* (falling) contrasting with *coléreux* (rising)

4.4. Rhythmic restructuration



Figure 14: This example illustrates a rhythmic restructuration to balance the number of syllable of *Marion mangera* (5) and *des bananes* (3), compared to the congruent to syntax *Marion* (2) *mangera des bananes* (6).

5. Conclusions

The examples shown in this paper illustrate how different theoretical assumptions can lead, from identical experimental data, to different interpretations which are poles apart. In particular, the contrast of melodic slope, characteristic of French intonation in PY view, may be totally hidden to comply with preconceived beliefs, although it can nevertheless be explained inside the AM framework by various processes such as a Low level insertion [8] or H* tonal alignment.

6. References

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