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Characterizing oratory speech through both prosody and syntax

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Characterizing oratory speech through both prosody and syntax

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Abstract. The role of prosody and syntax in identifying basic discourse units is a recurring issue in the studies of spoken language. In this paper, we focus on the terminal units of both syntactic and prosodic structures, studying respectively illocutionary units and intonative periods. This study focuses on their interactions and more specifically on both the synchronization and the relative number of their boundaries. Based on the analysis of a large spoken French corpus, we identify different types of such synchronizations (total, partial or absent) and relative proportions. We interpret these results from a functional point of view as an interaction between intonosyntax and the genre of discourse. Evidence strongly suggests a much more complex interaction between syntax and prosody than expected under intuitive assumptions. Hence, we believe that the features we propose may be interesting for the study of spoken discourse.

Prosody, Syntax, Illocutionary unit, Intonative period, Sub-genres, Oratory

1 Introduction

Discourse or textual genre has been widely studied in rhetoric and literature. Many studies in «traditional» linguistics highlighted the fact that given situations and social contexts correspond to specific modes of production, which are associated to specific formal markers of the discourse genre at all levels, e.g. semantic, syntactic or phonological. In this context, the objectives of textual typology are threefold. First it aims at describing the diversity of discourses, e.g. literary, legal, political, religious, etc. Second, it aims at understanding their articulation into genres [1] and third at estimating their formal markers, in particular the co-occurrences of specific cues that can be considered as being typical of a genre. While it is common to consider it for written language, some recent studies extended the concept of discourse genre to the oral domain, in particular at the interface of written and speech production [2,3]. An important challenge in this context is to provide a typology of genres that is robust and general at the same time.

Although theoretical studies concerning the genres of discourse have already made a long way, it remains very difficult to go further conventional generic types,

e.g. private, professional or public speech, and subdivisions, e.g. face to face or phone conversations, public debates, radio and TV broadcasts, spontaneous vs. planned speech, etc. [3]. In phonetics, the question of phonostyles modeling and recognition [4,5,6,7] is challenging for automatic speech processing. In particular, some kinds of public discourse, such as political, religious, journalistic and sport, are considered as cultural stereotypes and are related to specific expressive strategies that act as markers of a given phonostyle [8]. Identifying them is conceptually similar to discriminating between public or private discourses and is hence related to the identification of some generic types of discourse.

In any case, the proper identification of discourse units within the discourse flow is essential for understanding and modeling how interpretation occurs, where and when inferences are made, and how each component of discourse is related to the others in a (more or less) coherent way. Scholars have recently focused on defining «basic discourse units» [9], whether they be based on prosody and/or on syntax [10]. Once those units have been properly defined on theoretical grounds and annotated on a large corpus, it is an interesting challenge to assess whether they can be used to identify discourse genre as expected. Whereas most studies focus on only syntactic or prosodic [6,7] units to this purpose, very few authors addressed the use of both kinds of units to identify genre.

In this study, we build on the pioneering work of DEGAND and SIMON [9] on the matter of genre characterization through a joint intonosyntactical study. Our main contributions in this respect is first the use of recently proposed units, both prosodic with intonative *periods* (IP, [11]) and syntactic with *illocutionary units* (IU, [12]). Second, we make use of a large corpus of French spontaneous speech, for which both periods and IU have been annotated. Third, we show that the simple ratio between the number of periods over the number of IUs is indeed characteristic of some generic genres. Thanks to the fact that the considered corpus is large, these findings can be assessed on a statistical basis.

The respective role of prosody and syntax in identifying basic discourse units is a recurring issue in the work on spoken language. This study is meant to be a continuation of studies of the GARS [13] and previous works made in the frame of the tree-bank Rhapsodie. This corpus of spoken French samples different discursive genres and is annotated both in syntax and prosody to model intonosyntactic interface. We address this issue by focusing on the interface between macrosyntax and prosody. To this purpose, we propose a structured representation architecture based around these two levels, annotated separately one from the other. The first one, macrosyntax, is based on distributional constraints and syntactic tests to identify the units that compose it, regardless of prosodic information, the second one, prosody, is based on only acoustic and perceptual criteria¹. This strictly modular approach does not prejudge the reality of cognitive process. On the contrary, it avoids circularity to better answer the question of interactivity of the two components in a situation of verbal interaction.

In this paper, we will focus only on the terminal units of syntactic and prosodic representations manipulated in tree-bank Rhapsodie, respectively il-

¹ For a similar methodology see previous work of Degand and Simon (2009)[9]

locutionary unit (IU) and the intonative period (IP) as they have been defined by Lacheret et al. in [14,15]. We propose a study of their interactions in the corpus and more specifically the coincidence of their borders. We call «synchronized borders» borders that are both border IP and IU. The borders are *out of sync* when prosodic and syntactic boundaries instants do not coincide, i.e. when the boundaries of IP are not borders IU and vice versa. It is important to note that nothing prevents an IP whose border is aligned with an IU to contain several IU and vice versa (see Figure 1). Finally, each IP and IU can be fully synchronized when their right and left borders are synchronized or partially when it is only the right or left borders, which are synchronized. Our goal is first to report statistically different types of synchronization (partial vs total). Then, we propose to adopt a functional point of view and show that it is possible to exhibit in our corpus a correlation between the synchronization and number of intonosyntactic units and the type of discourse.

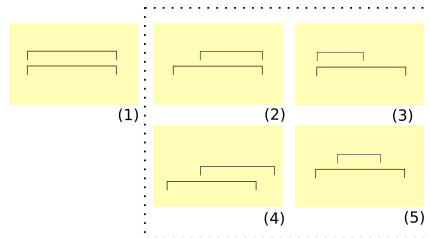


Fig. 1. Synchronization boundaries. (1) borders completely synchronized (the two units are aligned), (2) right partial synchronization, (3) left partial synchronization, (4) overlapping synchronization, (5) inclusive de-synchronization. Knowing that (4) and (5) are possibly combined with (2) and (3).

This paper is structured as follows. In section 2, we first present the syntactic and prosodic units we considered for our study. Since they have been proposed only recently within the RHAPSODIE consortium, we briefly review related research. In section 3, we provide the modus operandi through which this corpus was analyzed for our purpose. In section 3.2, we provide several quantitative results as well as a brief discussion as to how prosody and syntax may be used jointly to predict discourse genre. Finally, we conclude in section 4.

2 The Rhapsodie corpus, prosodic and syntactic annotation

The RHAPSODIE project [16] provides a reference transcription system, based on a syntactic and prosodic annotation, for the segmentation of French speech

into prosodic units of different levels. The RHAPSODIE corpus is a tree-bank of spoken French composed of 32.000 words and 64 speakers. Its purpose is the study of the interface between prosody, syntax and discourse².

2.1 Corpus design

The tree-bank Rhapsodie was created with the primary objective to propose and test — on a wide coverage of different constructions — new methods of annotation and analysis to model the syntax-prosody interface in spoken French. It consists of samples collect from existing datasets, including the corpus presented in [17,18,19,20,21], and samples recorded for the project, with a wide typological coverage (see table 1).

structure	monologue (M), dialogue (D)
social situation	private (0,1), professional (2)
planning	spontaneous, semi-spontaneous, planned
interactivity	interactive, semi-interactive, non-interactive
sub-genres	argumentative, descriptive, procedural, oratory

Table 1. Situational variables in Rhapsodie: 57 samples, 52 men, 35 women, duration = 3 h 18, 34 361 words. Where: monologues are coded M, dialogues D, private speech (0 or 1), public speaking (2). Thus, the D2006 sample is a public dialogue, '006' indicates the order number.

2.2 Prosody

Prosodic annotation For prosody, Rhapsodie annotators are built on the theoretical hypothesis formulated by the Dutch-IPO school [22] stating that, out of the total information characterizing the acoustic domain, only some perceptual cues selected by the listener are relevant for linguistic communication [8,23]. On this basis, only three perceptual phenomena characterizing real productions were annotated: prominences [24,25], pauses and disfluencies [26]. Starting from this annotation, a prosodic structure was automatically generated, organized around rhythmical and melodic components. In practice, the prosodic structure, generated on the basis of prominences, disfluencies and periods labeling, is built on the hypothesis that the distribution of prominences and their degree, disfluencies and pauses define different types of prosodic cohesion. We identify three major levels of prosodic cohesion inside the period, represented as a hierarchical constituent tree, from bottom-up: metrical foot, rhythmic group and intonation package.

As a very noticeable feature of this annotation procedure, it should be highlighted that those numerous primitives of prosodic structure were identified and

² The corpus samples can be downloaded on : www.projet-rhapsodie.fr/

annotated independently from any reference to syntax or pragmatics, and it is expected that they are sufficiently detailed to permit complex prosodic analysis of linguistic units.

The case of periods In the Rhapsodie corpus, the intonation period [11] is the highest intonation macro-unit of the prosodic hierarchy. The periods are calculated semi-automatically using the software Analor [27]. In practice, segmentation of a corpus into periods occurs if and only if the following four conditions are: occurrence of a pause of at least 300 ms; detection of an F_0 pitch movement reaching a certain amplitude, defined as the difference in height between the last F_0 extremum and the mean F_0 over the entire portion of the signal preceding the pause; detection of a «jump», defined as the difference in height between the last F_0 extremum preceding the pause and the first F_0 value following the pause and then absence of in the immediate vicinity of the pause.

It should be noted that the decision to recognize a periodic break is based on a principle of compensation thresholds³. In other words, detection is not dependent on the exact values of the parameters, but on their respective activation thresholds and associated weight: When a parameter is very slightly below the selected threshold, a boundary period is detected if other parameters have values above the threshold.

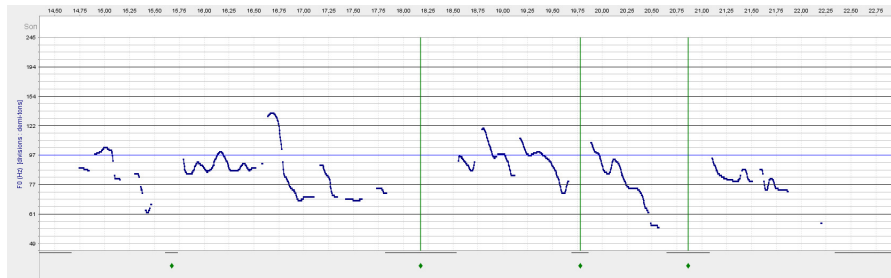


Fig. 2. Segmentation in periods by a vertical bar (3 bars give 4 periods): «*I think of the many victims of the storm [PERIOD] and their whole family [PERIOD] bereaved [PERIOD] we share the grief [PERIOD]*» [Rhap-M2004, Corpus Rhapsodie].

It must be emphasized that the decision to recognize a periodic break does not depend on the exact values of the thresholds but on their size. In other words, when one parameter is very slightly over the chosen threshold, segmentation can occur only if the other parameters have values distinctly above the threshold.

³ As reflected in the ToBI system, each element of the acoustic space such as silences or jump can actually have different meanings. For this reason a threshold system is considered.

2.3 Syntax

Syntactic annotation Combining the syntactic model proposed by the AIX SCHOOL [28] and the pragmatic model developed within the LABLITA experience [29], two levels of syntactic cohesion have been annotated within Rhapsodie. On the one hand, micro-syntax describes the kind of syntactic relations which are usually encoded through dependency trees or phrase structure trees. On the other hand, macro-syntax can be regarded as an intermediate level between syntax and discourse and describes the whole set of relations holding between all the sequences that make up one and only one illocutionary act.

The annotation of macro-syntax essential accounts for the para-tactic phenomena, which are typical of spoken French discourse. Just like prosody was not annotated using syntactic cues, macro-syntax was annotated in RHAPSODIE without considering any prosodic information. Therefore, macro-syntactic units were not annotated as proposed by BERRENDONNER [30], nor following the FLORENCE school that defines them based on prosody considerations.

On the contrary, building on CRESTI's proposition [29], maximal units of macro-syntax were chosen so as to coincide with the maximal extension of an illocutionary act. However, departing from CRESTI, the maximal extension of an illocutionary act was not defined as a set of prosodic units, but rather as a set of governed units that build up to form one illocutionary act. The maximal extension of an illocutionary act was called *Illocutionary Unit* (IU).

The case of illocutionary units The notion of illocutionary unit plays a central role in the macro-syntactic annotation. Each transcript is segmented into units, each one of them performing an illocutionary act (hence the name *illocutionary unit*), whose right boundary is denoted by //. Each IU necessarily contains a *kernel*, called Rectional Unit (RU), which carries the illocutionary force. Apart from this RU, it can be composed of several other units like introducers or illocutionary associated units. Formally, a IU is thus characterized by a unique RU, which is built around a head, independent from any parent. Some further elements may then depend on this head and the corresponding rections are characterized by imposed constraints in terms of parts of speech, morphological markers and restructuring alternatives (switching with a pronoun, deletion, passivation, cleavage, etc.).

In other words, segmentation of the discourse into IU is similar to a segmentation into sentences. Several examples of IU are :

- (1) ils avaient l'impression que 7a allait casser la machine //
they felt that it would break the machine // [D0005, PFC] [17]
- (2) en fait < euh j'ai choisi italien en deuxi8me choix //
in fact <uh I chose Italian as a second choice// [M1001, ESLO] [31]

Even if the annotation to be found in the Rhapsodie corpus contains all the macro-syntactic structure corresponding to all UR along with their associated illocutionary components, we focus here on the mere segmentation of discourse into IU. Hence, we refer the interested reader to more detailed presentations of the macro-syntactic ideas underlying the RHAPSODIE annotation [32,12].

3 Methodology and statistical analysis

Given both periods and IUs, we aim at studying whether they are informative with respect to discourse genre. To this purpose and for each one of the 57 samples of the corpus, we automatically extracted the total number of IU and IP as well as their temporal positions [33,34]. In this study, two main joint features are considered. First, we study the synchronization of IU and periods in section 3.2. Then, we study their frequency within discourse in section Relative frequency of IUs and periods.

3.1 Relative frequency of IUs and periods

IUs and periods are not synchronized evenly among all excerpts of the corpus. On the contrary, their *relative frequency* actually looks like a good indicator of the discourse genre:

$$\text{Ratio (sample)} = \log \left(\frac{\text{number of IP}}{\text{number of IU}} \right). \quad (1)$$

To show this, all excerpts of the corpus were labeled as to belonging to one of the 4 sub-genres considered : oratory, procedural, descriptive and argumentative.

The studied corpus includes all 3457 IU and 2904 IP. Computing the relative frequency (1) of IP and IU over all samples of the corpus, we note that one detached group of samples emerges, exhibiting more IP than IU and matching oratorical genre. To statistically verify this observation, we divided the samples according to the metadata corpus into four genres: oratory, procedural, argumentative, descriptive and we study whether the ratio (1) is a discriminant feature for identifying some of the groups. To this purpose, and since data cannot be considered as normal (discarding an ANOVA test), we applied a non-parametric KRUSKAL-WALLIS test, whose result are displayed on Figure 3. On this figure, we can clearly see that the null-hypothesis stating that the distributions of the ratio are the same in all groups can be safely rejected ($p = 5 \cdot 10^{-4}$). We can hence conclude that at least one of those distributions is significantly different from the others. The oratory sub-genre clearly emerges as characterized by a high number of periods per IU, highlighting the oratory propensity to be a scansion speech.

Another fact the can be noticed on Figure 3 is that, apart from oratory speech and some descriptive speech, most of the Rhapsodie corpus exhibits less IP than IU. Considering that the converse seems characteristic of oratory speech, which is a typical example of planned discourse, this result is expected, since the intent in creating the Rhapsodie corpus in the first place was to build a corpus of French spontaneous speech.

3.2 Synchronization of IUs and periods

The second step of this study is to assess whether synchronization may also be a discriminant feature for characterizing some discourse genres, as was the

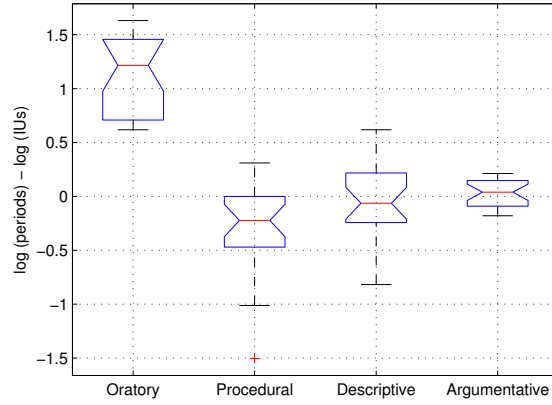


Fig. 3. Kruskal-Wallis test on sub-genre groups

relative frequency of IP and IU. For each of the 57 samples of the corpus, we automatically extracted [33] straight boundaries of IU and IP as well as their temporal positions in different configurations. Synchronization and desynchronization counts as well as percentages are given in Table 2.

borders relationship entre UI et PI	count	%
IU right border synchronized	1740	50,33
IP right border synchronized	1740	59,91
IU right border desynchronized	1717	49,67
IP right border desynchronized	1164	40,08

Table 2. Count of borders relationship between IP and IU

If periods or IU are to be synchronized with each other, their right boundaries ought to coincide. In order to study the temporal synchronization of IU and periods, we display a scatter-plot of the proportion of periods matching IU versus the proportion of IU matching periods, among the samples. Results are displayed in Figure 4.

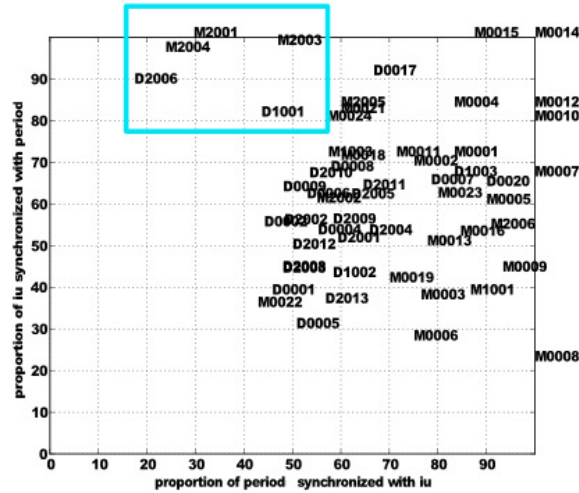


Fig. 4. Synchronization of IUs and periods for each corpus samples

On this figure, we can see that samples belonging to the *oratory* sub-genre group (blue frame) differ from others. Indeed, they exhibit a high synchronization between IUs and periods (more than 80%). On the contrary, periods of oratory speech rarely match a IU (20 to 50%), indicating that they often occur *within* an IU. As an example, a transcript of one of those samples of oratory speech is given in example (3) below. It is an excerpt of a speech given by former French president F. MITTERAND, exhibiting much more periods than IUs. This unbalance was found in the corpus to be typical of both political and religious speech.

Other features of speech could actually be noticed from Figure 4. Among them, it is noticeable that some samples located at the upper-right of the scatter-plot happen to have IU that are greatly synchronized with periods. Listening to these samples, it is noticeable that the corresponding speakers are obviously making an effort to have a *canonical* speech, i.e. a speech for which prosody does match syntax. Still, lacking objective metadata to assess this, we cannot proceed yet on statistical grounds on this point.

- (3) lorsque vous semblez mettre en doute [IP] notre amour des libert9s [IP] c'est un outrage [IP] que nous n'acceptons pas [IU-PI] nous sommes les h9ritiers de la tradition qui a instaur9 dans ce pays [IP] la d9mocratie politique et sociale [IU-PI] toujours [IP] toujours [IP] contre les droites coalis9es [IP] nos combats pour la conqudu droit [IP] jalonnent l'histoire des deux derniers si8cles [IU-PI] c'est 0 ceux de votre tradition [IP] que nous avons arrach9 le suffrage universel [IP] la libert9 d'association [IP] que nous avons arrach9 la libert9 d'association [IP] que nous avons arrach9 [IP] la libert9 de la presse [IP] le droit de gr8ve [IP] le droit 0 l'instruction [IU-PI]

When you seem to doubt [IP] our love of freedom [IP] this is an outrage [IP] which we do not accept [IU-PI] we are the heirs of a tradition established in this country [IP] the political and social democracy [IU-PI] Always [IP] Always [IP] Straight against the Right Wing coalition [IP] Our fights for the conquest of our rights [IP] marked the history of the last two centuries [IU-PI] It is against those of your tradition [IP] that we fought for universal suffrage [IP] freedom of association [IP] that we ripped the freedom of association [IP] that we ripped the freedom of the press [IP] the right to strike [IP] the right to education [IU-PI]
[Rhap-D2006, Broadcast corpus]

- (4) *alors en partant de la place Paul Vallier pour aller 0 la place Notre-Dame [IU-IP] alors j'emprunte la rue de Strasbourg [IU-IP] je passe par la place Vaucanson [IU-IP] je prends direction Maison du tourisme [IU-IP] euh 0 la Maison du tourisme je contourne enfin je prends la rue de la R9publique en remontant la rue de la R9publique [IU-IP] je tombe sur la place Saint-e-Claire on va dire 10 o9 il y a la halle [IU-IP] [Rhap-M0014, Corpus AVANZI[18]]*
then starting from the place Paul Vallier to go to the place Notre Dame [IU-IP] then I take the rue de Strasbourg [IU-IP] I pass by the place Vaucanson [IU-IP] I take the direction Maison du tourisme [IU-IP] uh at la Maison du tourisme I bypasses I finally take the rue de la R9publique up the street of the Republic [IU-IP] I arrive on the place St. Claire instead they will say where is the hall [IU-IP]
[Rhap-M0014, Corpus Avanzi [18]]

4 Conclusion

In this paper, we have studied whether prosody and syntax could be jointly used so as to characterize sub-genres of discourse such oratory speech. To this purpose, we have briefly reviewed how the discourse can be split into Illocutionary Units from a syntactic perspective and into periods from a prosodic perspective and that these annotation processes are independent from one another. Using a large corpus of French spontaneous speech, RHAPSODIE, for which both periods and IU are annotated, we demonstrated that for a given sample, a much larger number of periods than of IU is characteristic of oratory speech. Furthermore, the synchronization of those prosodic and syntactic meta-units seems to be related to *canonical* speech, i.e. one for which syntax and prosody do coincide. An interesting perspective could be to apply this framework to other languages. We indeed hypothesize that the relative frequency of periods over IU is a distinguishing criterion to classify and characterize the types of discourse. The difference between the observed frequency of use and intuitive expected frequency is illustrated by a massive production of periods compared to the number of IU (3180 IU for 5587 IP over the corpus). If this observation needs to be strengthened through further study, e.g. including descriptors of increased depth, it is of importance to several domains of studies on oral genres, whether they be text typology or *phonostylistic*.

In this study, we showed that the interface between prosody, syntax and semantics provides intonosyntactical features that appear in the message as stable markers of how discourse relations (contrast, concession, development summary, etc.) are woven into the text.

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