How to be a Discourse Particle?

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University of Lorraine and ATILF CNRS
{katarina.bartkova,mathilde.dargnat}@atilf.fr
alice.bastien2@etu.univ-lorraine.fr

Abstract

Our study analyses some prosodic correlates of nine French words or expressions: *alors, quoi, voilà, bon, ben, tu sais, vous savez, tu vois, vous voyez*. Besides their general grammatical categorization as adverb, pronoun, preposition, '*introducer*', adjective, adverb and sentence, these expressions are very frequently used as discourse particles (DP) in spontaneous speech. Our goal is to determine to what extent intrinsic and contextual prosodic properties are useful and sufficient to characterize their DP and non-DP functions. The expressions under study are extracted from large corpora, than a manual annotation is carried out to distinguish DP and non-DP functions and an automatic processing is applied for prosodic data extraction and labelling. This allows getting fine-grained and systematic prosodic information. Automatic classification tests of the DP functions based solely on prosodic parameters are carried out and lead to very encouraging results as correct identification ranges from 73% to more than 90%. Finally an automatic clustering procedure provides prosodically significant DP sub-classes for every studied expression.

Index Terms: discourse particles, prosodic parameters, automatic classification and clustering

1. Introduction

The meaning of certain expressions depends on their pragmatic discourse functions therefore the detection of these functions is crucial especially in automatic speech processing such as automatic translation or speech recognition. Pragmatic functions are often marked by strong prosodic cues which, in absence of other linguistic cues, are the only way of their identification.

We focus here on the prosodic analysis of nine French items, frequently used as discourse particles (hence DP) in spontaneous speech: *alors, quoi, voilà, bon, ben, tu sais, vous savez, tu vois, vous voyez* and we examine the relevance of some prosodic features in distinguishing DP and non-DP uses of these expressions. This study is part of a larger project on French discourse particles [24] conducted at Atilf research laboratory.

Studies generally address DP in terms of semantic and pragmatic descriptions, from synchronic or diachronic points of view (see [31],[5],[21],[4]). Syntactic analysis is less frequent (see [9],[29],[28]), while prosodic considerations remain peripheral or too general (see [32],[10],[1]). The goal of our study is to construct a fine-grained corpus-based prosodic analysis, in order to identify possible correlations with other linguistic properties of DP. The main question addressed here concerns the correlation between syntactic properties (mainly position in the utterance) and discourse values (information structure) on the one hand, and prosodic features (pause, position in prosodic group, syllabic duration) on the other hand. If such a correlation emerges, it can be a valuable diagnostic tool for distinguishing between different uses of the items under study, for example, is *quoi* used as a pronoun or as a DP, what is its value as DP (closing, rhematic marker, reformulation, etc.), is *bon* an adjective or a DP, what is its DP value (discourse break, aknowlegment, etc.), etc.

2. Discourse Particles

2.1. Particle interpretation and features

According to [12], DP convey information about utterance interpretation, epistemic state and affective mood of the speaker or the management of interaction. DP do not form a part of speech like verbs or adjectives (contra Paillard [23]), but a 'functional category' ([18],[14]) whose lexical members, in addition to being a DP, have more traditional grammatical uses, like coordinating conjunctions, adverbs, verbs, pronouns, interjections, adjectives.

DP have prosodic autonomy and can be singled out by a pause or a specific prosodic pattern (see [19],[20],[13]). They tend to be mono- or bisyllabic, but some of them are also 'complex' (combinations like '*bon ben quoi voilà hein*'). DP are neither complements nor usual circumstantial adjuncts. They are optional and their position in the utterance is neither fixed nor totally free (see [8],[26],[15]). DP do not contribute to the propositional content of the utterance. As a result, they do not affect its truth value. They have undergone a 'pragmaticalisation' process whereby their initial meaning has given way to some pragmatic or 'procedural' values ([27]). (For DP main feature descriptions see also [12],[11],[24]).

2.2. Illustrations

The items under study show different linguistic behaviours and belong to different grammatical categories. Generally deverbal DP and *quoi* cannot function alone, without any linguistic context, although *bon, ben* and *voilà* and under some circumstances *alors* can function alone. Moreover, DP differ with respect to their position in the host-utterance, some of them preferentially occupying an initial or final position.

Major DP values of *quoi* are closing, leftward focus marking (1), (re)phrasing signaling. Their specificity is to be 'retroactive' (they have scope over the material to their left) (see [7],[22]).

(1) *c'est un outil de travail mais c'est de l'abstrait* ***quoi*** *c'est c'est c'est pas du concret* ***quoi*** ([21], English : "it's a work tool but it's abstract though, it's it's not concrete though" [6]).

Major DP values of *voilà* are closing, sometimes with agreement expression about the previous discourse, and stage marking in an ongoing non-linguistic activity (2). Its position depends on its pragmatic values and the discourse type (monologue vs. dialogue) ([5],[6]).

(2) *c'est bon allez: ↓↓ on va mouiller ↓* ***voilà****: vous remuez:* ([5], 366) (English: "it's fine, let it be, we will get wet, there it is, move").

3. Methodology and corpus

Our study of the prosodic parameters of the nine DP expressions is corpus-based. The major part of our data processing is done automatically. An effort was made to exploit an automatic extraction and annotation procedure that will allow further enrichment of the DP database in a consistent way. However, manual intervention is still needed mainly to annotate the DP or non-DP word functions.

3.1. Corpus

All the expressions studied here are extracted from the ESTER corpus (French broadcast news collected from various radio channels, about 200 hours of speech), the ETAPE corpus (debates collected from various French radio and TV channels, about 30 hours of recordings) and the TCOF corpus (about 50 hours of spontaneous, mainly conversational speech [29]) which is used to complete the extraction of some underrepresented words and expressions in ESTER and ETAP corpora.

Table 1 contains the amount of extracted words and expressions from the three above corpora, and it indicates the distribution of DP vs. non-DP use for these eight items, after manual annotation.

All the expressions studied can be used as DP and non-DP except *ben* (well) which cannot occur as non-DP. According to the manual annotation, all of them but *quoi* and *vous voyez* are more frequently used as DP than as non-DP. The number of occurrences of deverbal particles (except *vous savez*) is very low even in our spontaneous (TCOF) corpus.

Table 1. *Distribution of DP and non-DP use (according to manual annotation) in ESTER, ETAPE and TCOF corpus*

	Extracted words	DP use	Non DP use
alors	582	77%	22%
ben	1299	100%	--
bon	2085	71%	28%
quoi	1002	39%	61%
voilà	1407	69%	31%
vous savez	410	60%	39%
tu sais/vois	104	68%	31%
vous voyez	150	26%	73%

3.2. Speech data pre-processing

The speech data processing is done automatically, and exploits the manual orthographic transcriptions and associated information (speakers, turn-takings, dysfluencies, noise, etc.) available for the ESTER, ETAPE and TCOF data. First, grapheme-to-phoneme translation is carried out and the sound segmentation is achieved, using forced alignment. Subsequently, an automatic prosodic annotator (Prosotran, [2]) is used, which, for each vowel, calculates the degree of its duration lengthening (if any); its F0 slope, compared to the glissando threshold; its pitch level, quantized on a ten level scale calculated from the speaker's pitch range (Figure 1, 3rd annotation tier). Further prosodic annotation is provided by the detection of prosodic groups (ProsoTree [3]), based on F0 slope values, pitch level and vowel duration (Figure 1, last annotation tier).

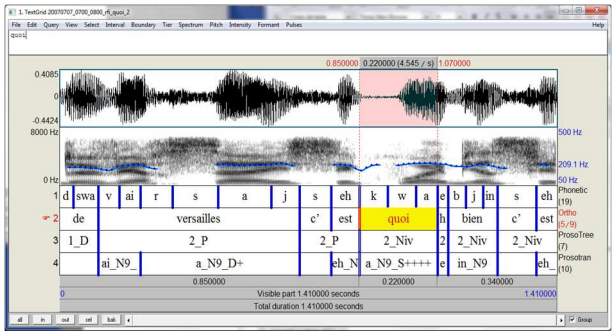

Figure 1. *Result of prosodic processing using prosodic annotator software (Prosotree – tier 3 & Prosotran – tier 4)*

4. Analysis of data

The goal of our study is to determine whether intrinsic and contextual prosodic properties are good clues to characterize DP and non-DP uses of the expressions under study, either separately or jointly. In this section, we analyze and discuss for them the role of some of the prosodic parameters extracted from the speech data.

Among the analyzed DP's prosodic parameters are pauses, their pitch level (measured on their vowels) , and the pitch level of their immediate preceding and following contexts, their last vowel duration lengthening and finally their position in the prosodic groups.

4.1. Pause occurrences

The occurrence of pauses before or/and after the discourse particles can participate to underline DP or non-DP function. For this reason it seems important to investigate whether their occurrences are different in DP and non-DP uses of the expressions of our data. The occurrences of pause contexts are presented in Table 2. For the words in DP functions there are higher occurrences of pauses in left and right contexts (before and after the word) than for non-DP functions (red column in Table 2). Moreover, non-DP functions have higher no pause contexts than DP functions (green column in Table 2). Non-DP use of *voilà* and *vous savez* has very low occurrences of pauses on right context (after the word).

Table 2. *Percentages of pause contexts for DP and non-DP word uses*

	Pause before after		Pause before		Pause after		No pause	
	no DP	DP	no DP	DP	no DP	DP	no DP	DP
alors	15	**22**	43	51	7	8	34	**19**
ben		**22**	--	36	--	10	--	**32**
bon	11	**35**	12	28	20	13	58	**24**
quoi	10	**36**	18	12	20	34	52	**17**
voilà	30	**46**	37	34	**5**	17	28	**2**
vous savez	6	**16**	37	31	**8**	20	48	**33**
vous voyez	2	**17**	26	17	16	11	56	**54**
tu sais tu vois	--	**5**	19	19	11	21	69	**54**

Pause occurrences detected in our data highlight syntactical and information structures of the non-DP and DP uses: for example non-DP *quoi* is often an argument of a verb and occurs

predominantly without a pause, while DP *quoi* is more often conclusive, followed in large proportion by long pauses. On the other hand, non-DP *voilà* as an '*introducer*' or a preposition, introduces the following discourse segment, which is syntactically dependent on it. Therefore if non-DP *voilà* occurs with a pause, the pause is predominantly before.

4.2. Pitch level and F0 slope

Pitch level values of the syllable nuclei of interest *(first syllable nucleus of the left and last syllable nucleus of the right context and syllable nuclei of the expressions under study in DP and non DP-functions)* are quantized on a ten degree scale using the speaker's pitch range (Prosotran software). Quantized pitch levels of the studied words are compared between DP and non-DP word functions on Figure 3.

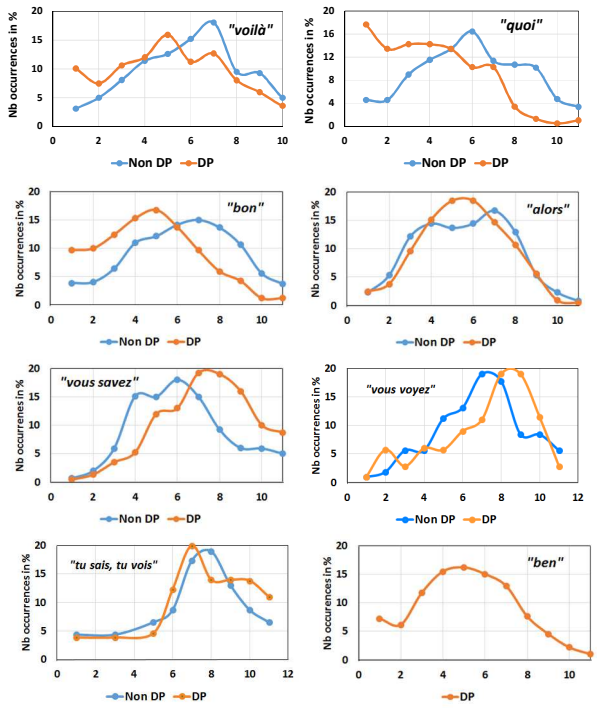

Figure 3. *Histograms of pitch level values (abscissa) calculated on the last syllables of words in DP and non DP functions*

DP *quoi* is uttered very often at low pitch levels and very seldom at high pitch levels which confirms its major conclusive function. On the other hand, DP *voilà* is more often uttered at high pitch level stressing its "challenging" ("defiant") F0 pattern. The sentence *vous savez* is often uttered with high pitch, displaying an "approval seeking" F0 pattern. The DP *bon* is uttered more frequently with lower F0 pattern than non-DP *bon*, underlining its conclusive character. As far as F0 level is concerned there is no major difference between DP and non-DP functions for *alors*. *Ben* is used exclusively at DP function and its F0 values are most frequently of mid-range, between level 4 and 7.

4.3. Vowel duration

Vowel duration lengthening is a strong parameter cue for stressed syllable in French, it seems therefore worthwhile to analyze how vowel duration lengthening contributes to the prosodic characteristics of the DP. The last vowel duration of the studied words is considered as lengthened when its duration exceeds the mean vowel duration and once or several times its standard deviation (calculated for every speaker, Prosotran). Three categories are used for duration quantization: 1st category (labelled **D+)** contains durations longer than mean vowel and once its standard deviation; 2nd category (labelled **D++)** contains durations longer than the mean duration plus two times its standard deviation and3rd category (labelled **D+++)** contains durations longer than the mean duration plus three times its standard deviation.

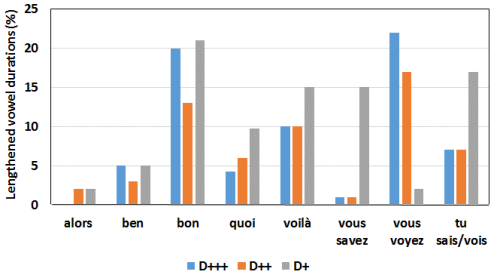

Figure 4. *Histograms of lengthened last vowel duration measured on DP words*

With respect to the strongest lengthening (D+++), *bon*, *voilà* and *vous voyez* are more often markedly lengthened than the other words and expressions in DP functions. The word *alors* is the one whose last vowel is very seldom lengthened and *vous savez* and *ben* have also only moderately lengthened vowel durations. This duration distribution confirms a conclusive function of *quoi* and *alors* or a strong syntactico-semantic links between the studied word and its right context.

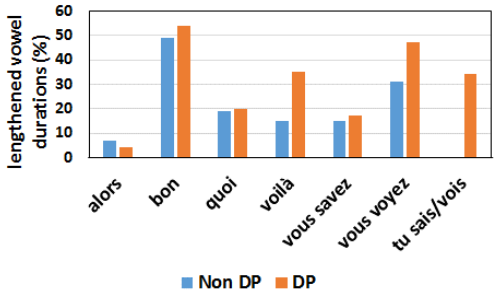

Figure 5. *Histograms of lengthened last vowel duration measured in DP and Non DP functions*

A comparison is carried out between DP and non-DP functions of words as to their vowel duration's lengthening. The words displaying significant differences between DP and non-DP function vowel durations are *voilà*, *vous voyez* and *tu sais/vois* (Figure 5). All the other words have very similar vowel durations for the two functions and therefore the vowel duration cannot be considered as a very reliable cue for DP function identification.

4.4. Position in the intonation group

The position of the words in the intonation groups (IG) are obtained after an automatic segmentation of the speech signal into IG. Results about their location and comparison between DP and non-DP functions are displayed in Figure 6.

According to our results, on average DP functions more frequently occur as single words and their prosodic detachment is coherent with their syntactical and semantical relative autonomy. But it appears from word by word analysis (data non present on Figure 6) that non-DP *quoi* and *bon* occur frequently in

middle position which seems to be an indicator of its syntactic and semantic integration. Non-DP *voilà*, in contrast to non-DP *quoi*, occurs preferentially at the beginning what corroborates it 'opening-introducing' function.

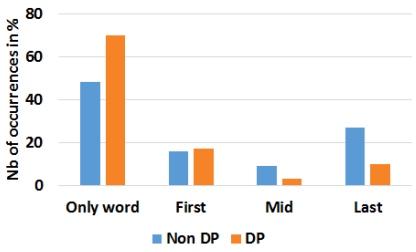

Figure 6: *Position in intonation group with respect to DP or non-DP function*

5. Automatic identification & clustering

Automatic identification and clustering procedures are carried out to identify DP and non-DP functions and to retrieve homogeneous prosodic and linguistic classes for DP function words of our data. For the classification and the clustering processing, software available in Weka toolkit [17] are used.

However, some verbal expressions (*vous voyez*, *tu sais/vois*) have too few occurrences for automatic classification investigation, therefore these low occurrence verbal structures are not further analyzed.

5.1. Automatic identification

The identification procedure relies on all the prosodic parameters described in Section 3.2. The identification is achieved through classification via the J48 decision tree ([25]). The use of a decision tree is motivated by the adequacy of this technique for data which contain numeric and symbolic values. The decision tree is trained on 60% of our data while the remaining 40% of the data is kept for evaluating the classifier (identification of the DP function).

Table 3. *DP automatic identification scores in percentage*

	precision	recall	F-measure	Correct identification
alors	0.77	0.78	0.78	**79%**
bon	0.75	0.76	0.75	**76%**
quoi	0.78	0.78	0.78	**78%**
voilà	0.92	0.96	0.94	**96%**
vous savez	0.72	0.73	0.72	**73%**

The results obtained by the classifier (see Table 3) are very encouraging. In fact, in more than 70% of the cases (from 73% to 96% depending on the words), the DP function is correctly identified using prosodic parameters only. Thus, one can reasonably expect a substantial improvement of these results when more linguistic information (part of speech, semantic and pragmatic features etc.) is introduced into the decision procedure.

5.2. Automatic clustering

As shown here, prosodic parameters vary for the different DP words implying that there should exist linguistically and pragmatically significant subclasses for every analyzed DP. In order to retrieve prosodically homogeneous classes a clustering of the DP words is carried out using the K-means approach (software available in Weka toolkit).

For this clustering procedure only DP's tonal and duration parameters are used: tone levels of the DP word, tone level of its left and right context (first syllable of the right and last syllable of the left contexts), last vowel duration of the DP and its F0 slope. A preliminary analysis of the classification results is given in Table 4, presenting the quantized F0 levels of DP's left and right contexts (if available) and the DP's F0 level (in red) for the most homogeneous clusters.

Table 4. *Most homogeneous cluster's quantized F0 levels (for the left context, DP's last syllable (red) and right context)*

	Clust 1	Clust 2	Clust 3	Clust 4	Clust 5
alors	1-**3**-2	7-**4**-2	5-**5**-6	5-**6**-8	7-**8**-8
ben	2-**2**-7	**3**-2	5-**4**-1	4-**6**-6	7-**6**-7
bon	2-**2**-4	3-**3**-3	4-**4**-5	6-**6**-5	*7-**7**-6*
quoi	2-**2**-3	4-**2**-4	4-**2**-8	5-**5**-4	6-**5**
voilà	3-**3**-4	3-**5**-4	4-**6**-4	6-**6**-5	7-**8**-5
vous savez	3-**4**-3	5-**5**-3	7-**7**-1	7-**7**-6	1-**8**-7

As it appears from Table 4, that tone levels of clusters *quoi* display mostly low F0 values and falling or flat slopes between its nucleus and left context, highlighting thus its conclusive character. Clusters of *vous savez* have predominantly higher tone values with mostly flat slopes conforming the "challenging" F0 pattern. Clusters of *ben* and of *bon* have preferentially lower tone values. Clusters obtained for *voilà* have falling slopes towards its right contexts while clusters of *alors* have falling slopes for low tone values and rising or flat slopes for high tone values. The linguistic reality of these automatically obtained clusters is to be confirmed by perceptual tests.

6. Conclusion

Our study aims to identify pertinent prosodic parameters associated to some French words when used as discourse particles. It is demonstrated here that words in DP functions contain characteristic prosodic parameters. The pertinence of these parameters is confirmed by their successful use in automatic identification procedure where a correct identification of the DP functions is obtained for more than 73% of the words.

According to our analysis, for each word or expression in DP function prosodic parameters vary substantially. It appears therefore that prosodically and linguistically relevant sub-classes can be obtained for every DP function. In this paper we have focused on the major grammatical and discursive uses of the items, we have not proposed a more fine-grained sub-categorisation. In fact for such a fine grained sub-categorisation the preliminary clustering procedure carried out in this study should be further investigated through listening tests, to confirm whether the automatically retrieved clusters are linguistically relevant or not.

7. Acknowledgements

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