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Discourse Particles In French: Prosodic Parameters Extraction and Analysis

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Abstract. Detecting the correct syntactic function of a word is of great importance for language and speech processing. The semantic load of a word is different whether its function is a discourse particle or a preposition. Words having the function of a discourse particle (DP) are very frequent in spontaneous speech and their discursive function is often expressed only by prosodic means. Our study analyses some prosodic correlates of two French words (*quoi*, *voilà*), used as discourse particles or pronoun (*quoi*) or preposition (*voilà*). Our goal is to determine to what extent intrinsic and contextual prosodic properties characterize DP and non-DP functions. Prosodic parameters are analyzed with respect to the DP or non-DP function for these words extracted from large speech corpora. A preliminary test concerning the automatic detection of the word function is also carried out using prosodic parameters only, leading to an encouraging result of 70% correct identification.

Keywords: part-of-speech tagging, prosody, discourse particles, discourse structure, automatic prosodic annotation

1 Introduction

The correct category definition of homographic lexical units often determine their phonetic forms, stressed syllable or prosodic characteristics. But a word can also have different pragmatic properties which can impact the word semantic load. A word with low semantic content is often considered as a disturbance of the speech fluency and can then disappear in automatic processing (content retrieval, automatic translation ...). Therefore it becomes important to detect the syntactic and pragmatic properties of the words and, for a correct detection of these properties, the lexical context is sometimes not enough, prosodic information is also needed. The aim of this study is to investigate how the pragmatic properties of words can trigger different prosodic parameters. This study is part of a larger

project on discourse particles (DP) in French [2]. It aims to correlate DP’s prosodic properties with their syntactical, semantic and pragmatic properties. In this paper, we focus here on the prosodic analysis of two words, *quoi* (*what*) and *voilà* (*here is, that’s it, there*), frequently used as DP in formal and casual speech, and we mainly examine the relevance of some prosodic features in distinguishing between DP and non-DP use of these words.

Studies generally address DP through semantic and pragmatic descriptions, from synchronic or diachronic points of view (see [30, 24, 6, 13, 22, 5]). Syntactic analysis is less frequent (see [10, 29, 17]), while prosodic considerations remain peripheral or too general (see [31, 11, 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, tone, slope . . .) on the other hand. If such a correlation is confirmed, this could lead to an interesting tool for distinguishing different uses of the studied items (e.g. *quoi* as a pronoun or as a DP, and its different values as DP: closing, rhematic marker, reformulation, etc.).

2 Discourse Particles

DP convey information about utterance interpretation, epistemic state and affective mood of the speaker or the management of interaction [13]. DP do not form parts of speech like verbs or adjectives (contra Paillard [25]), but a ‘functional category’ [24, 15] whose lexical members, in addition to being DP, have more traditional grammatical uses, like coordinating conjunctions, adverbs, verbs, pronouns, interjections, adjectives. We focus here on major grammatical and discursive uses of *quoi* (pronoun vs. DP) and *voilà* (preposition, introducer [18] vs. DP) in French. We do not propose for the moment a more fine-grained sub-categorization.

2.1 Main features

DP frequently exhibit phonetic attrition. They have prosodic autonomy and can be singled out by a pause or a specific prosodic pattern (see [20, 21, 14, 1]). In French, they tend to be mono- or bisyllabic, but some of them are also ‘complex’, i.e., combinations like *’bon ben quoi voilà hein’*, *’mais enfin’* or *’écoutez donc’*. DP are neither argument nor circumstantial adjuncts. They are optional and their position in the utterance is neither fixed nor totally free (see [9, 27, 16, 13, 24]). 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 ‘pragmaticalization’ process whereby their initial meaning has given way to some pragmatic or ‘procedural’ values [28] (for DP main feature descriptions, see also [6, 13, 14, 12, 2])

2.2 Illustration: *quoi* and *voilà*

The words *quoi* and *voilà* have been chosen because they are very frequent in present-day French. They belong to different parts of speech, they occur in several positions and they play a role in discourse information structuring. Major DP values of *quoi* are closing, leftward focus marking (1), (re)phrasing signaling with a specificity to refer to the previous context (it has scope over the material to its left) (See [8, 12, 22, 23]). 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 on the discourse type (monologue vs. dialogue) [6, 7].

- (1) c'est un outil de travail mais c'est de l'abstrait quoi c'est c'est
 it's a working tool but it's abstract PARTICLE, it's it's
 c'est pas du concret quoi
 it's not concrete PARTICLE
 'It's a working tool, but an abstract one PARTICLE, it's it's it's not
 concrete PARTICLE'
 [22, p. 6]
- (2) c'est bon allez: ↓↓ on va mouiller ↓ voilà: vous remuez
 it's OK go, we are gonna get wet PARTICLE: you stir
 'It's OK, we will get wet, that's it: move'
 [6, p. 366]

3 Methodology and corpus

The study of the prosodic parameters of our DP words is corpus-based. The major part of our data processing is done automatically. An effort was made to build an automatic extraction and annotation procedure that will further allow enrichment of our DP database in a consistent way. However, manual intervention is still needed to distinguish between DP or non-DP uses. We kept only occurrences for which at least two expert annotators agreed.

3.1 Corpus constitution and extraction

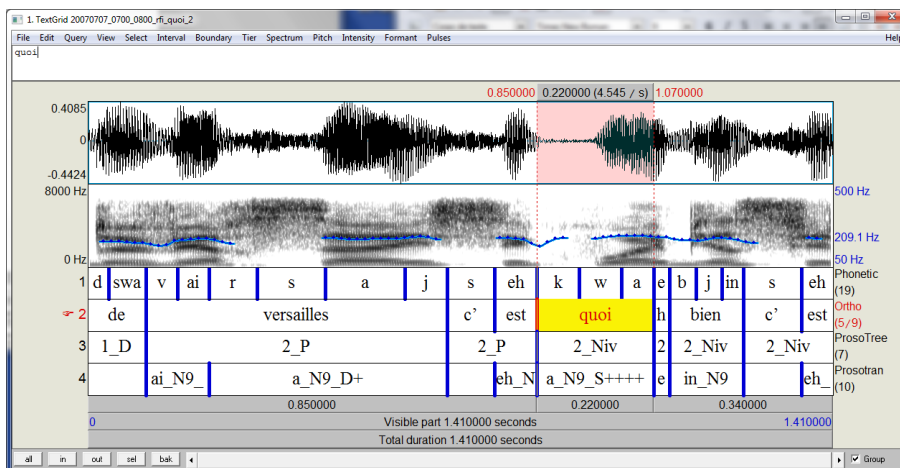
All occurrences of *voilà* and *quoi* are extracted from the ESTER corpus (French broadcast news collected from various radio channels, about 200 hours of speech) and from the ETAPE corpus (debates collected from various French radio and TV channels, about 30 hours of recordings). Their compositions slightly differ: ETAPE contains more spontaneous speech whereas ESTER is mainly constituted of broadcast news and includes relatively few interviews. An advantage in using such corpora is the rather good quality of the speech signal, which leads to a reliable acoustic analysis. Table 1 indicates the distribution of DP vs. non-DP uses of the two words, after manual annotation. As illustrated in Table 1, there is quite a difference between the DP uses of the two words studied here, in fact the DP use of *voilà* is almost twice as high as the DP use of *quoi*.

Table 1. Distribution of DP and non-DP uses (and number of occurrences) for the words *voilà* and *quoi* in ESTER and ETAPE corpora

	Number of occurrences	DP	Non-DP
quoi	1002	381 ⇨ 39 %	621 ⇨ 61 %
voilà	1407	971 ⇨ 69 %	436 ⇨ 31 %

3.2 Speech data pre-processing

ESTER and ETAPE contain manual transcriptions and information of different types (speakers, turn-takings, dysfluencies, noise, etc.). All the speech data processing is done automatically. First, grapheme-to-phoneme translation is carried out and the sound segmentation is achieved, using forced alignment (achieved with Sphinx tools). Subsequently, Prosotran annotator [3] is used, which, for each vowel, indicates the degree of its duration lengthening (compared to a mean vowel duration calculated on at least 5 adjacent syllables); its F0 slope, compared to the glissando threshold; its pitch level, quantized on a ten level scale calculated on the whole speaker data. Further prosodic information is provided by the detection of prosodic groups. Segmentation of the speech stream into prosodic groups is yielded by the ProsoTree software [4], which locates intonation group boundaries using information based on F0 slope values, pitch level and vowel duration (Figure 1).

**Fig. 1.** Result of prosodic processing of speech data using Prosotran and ProsoTree software

4 Analysis of results

As mentioned before, we investigate here whether intrinsic and contextual prosodic properties are reliable cues to characterize DP and non-DP uses of *voilà* and *quoi*, either separately or jointly. In this section, we analyze and discuss for the studied words the role of pauses preceding or following them, their pitch level in isolation and in relation to their immediate preceding and following contexts, their vowel duration, whose lengthening may indicate a stressed position and their position in the intonation group.

4.1 Pauses

Information about pauses are collected automatically. The occurrences of pause contexts are presented in Table 2. Some pauses whose durations have not been measured (they occur before the first or after the last word of the speech segment) do not appear in Table 2.

Several differences in pause occurrences are noteworthy:

- **Non-DP uses:** *quoi* occurs predominantly without a pause; if *voilà* occurs with a pause, the pause is predominantly before, with a big proportion of long pauses (> 250 ms).
- **DP and non-DP uses:** when *quoi* occurs with a pause, this pause comes pre-dominantly after, with a large proportion of long pauses (> 250 ms) for DP uses.

These pause occurrences correspond to syntactical and information structures of the non-DP and DP uses: non-DP *quoi* is often an argument of a verb, DP *quoi* is more often conclusive. Non-DP *voilà* begins an utterance and, as an introducer or a preposition, introduces the following discourse segment, which is syntactically dependent on it.

4.2 Position in the intonation group

The position of *quoi* and *voilà* in the intonation groups (IG) is analysed according to the intonation groups automatically detected using the Prosotree software. Results about their location in the intonation group are displayed in Figure 2.

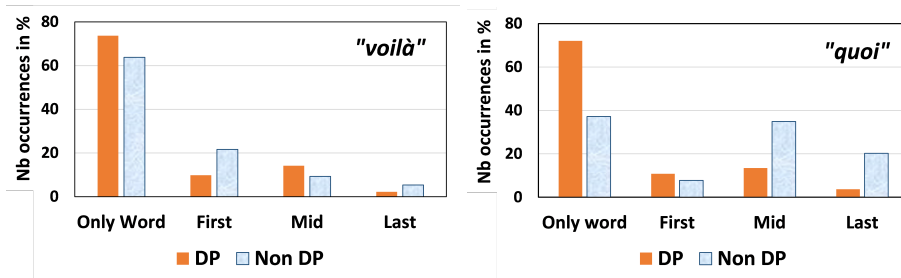


Fig. 2. Position of *voilà* and *quoi* in the intonation groups

Table 2. Number of pauses before and after *quoi* and *voilà*: number of occurrences (in parentheses) and percentage per category. (short ≤ 100 ms; mid ≤ 250 ms; long ≥ 250 ms).

		Pauses						No pause
		Before			After			
		short	mid	long	short	mid	long	
<i>quoi</i>	DP (399)	1.2% (5)	5.0% (20)	0.2% (1)	5.7% (23)	14% (55)	40.0% (160)	34.0% (135)
	Non-DP (630)	0.7% (3)	4.0% (25)	3.0% (19)	5.0% (32)	8.6% (54)	12.0% (78)	66.5% (419)
<i>voilà</i>	DP: (1019)	0.4% (4)	11.2% (114)	20.2% (206)	10.0% (103)	11.6% (118)	23.0% (232)	23.7% (242)
	Non-DP (416)	0.5% (2)	7.2% (30)	35.6% (148)	3.3% (14)	4.1% (17)	4.3% (18)	45.0% (187)

According to our results, *quoi* and *voilà* more frequently occur as single words in their corresponding intonation group, but relevant distinctions can be made when they are integrated into a larger IG.

DP *quoi* occurs predominantly as a single word. Its prosodic detachment is coherent with its syntactical and semantical relative autonomy. Non-DP *quoi* occurs as a single word, but in equal proportion in middle position in IG. The intermediate position seems to be an indicator of its syntactic and semantic integration.

DP *voilà* occurs predominantly as a single word too, for the same reason as DP *quoi*. Non-DP *voilà*, in contrast to non-DP *quoi*, occurs preferentially at the beginning and not in an intermediate position. This corroborates its ‘opening-introducing’ function.

4.3 Pitch level and F0 slope

Pitch level values of the syllable nuclei are yielded by the Prosotran software, quantized on a ten degree scale. In order to compare pitch levels for *voilà* and *quoi* in our data, only measurements on the last syllable (last nuclei) are used.

As illustrated in Figure 3, DP *quoi* is uttered very often at low pitch levels and very seldom at high pitch levels. It confirms its major conclusive function. On the other hand, *voilà* is often uttered at high pitch level.

4.4 F0 slopes linking with left and right contexts

The prosodic articulation between *voilà* and *quoi* and their neighbour words is measured by F0 slope values. The slope between *voilà* or *quoi* and its left

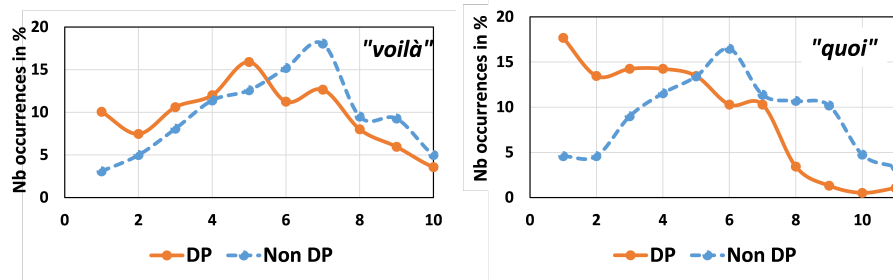


Fig. 3. Frequency of occurrences with respect to pitch level values (measured on the last syllable nuclei)

context corresponds to the ΔF_0 between the first (or unique) syllable of *quoi* or *voilà* and the last syllable of the previous word (a negative slope means that the *quoi* or *voilà* target syllable has a lower F_0 value than the last syllable of the previous word). The slope with respect to the right context is obtained as the ΔF_0 between the first syllable of the next word and the last or only syllable of *voilà* and *quoi* (a negative slope means that the *quoi* or *voilà* target syllable has a higher F_0 value than the first syllable of the next word).

For *quoi* as DP (see Figure 4), the F_0 slope has often a falling pattern in relation to its left context. The DP is generally added at the end of a sentence as a kind of ‘pronounced comma’ and its F_0 level is most of the time low or very low.

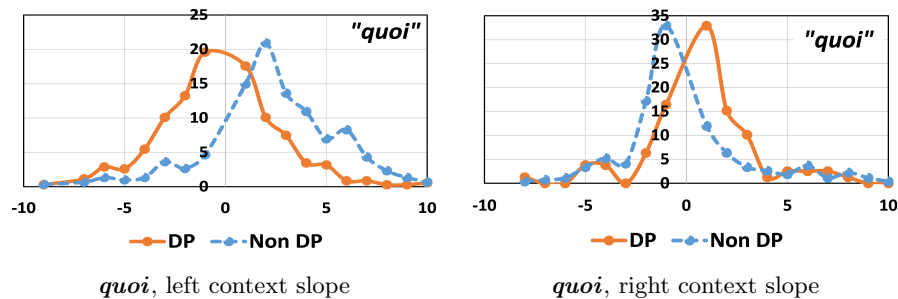


Fig. 4. Frequency of occurrences with respect to the ΔF_0 value for *quoi*

With respect to the F_0 slopes, the DP *voilà* has a similar behaviour as the DP *quoi*, since it is often used as a conclusive particle. However, its F_0 pattern is different from the particle *quoi*. In fact, (see Figure 5), this particle can be uttered with a conclusive (falling) but also with a continuative (rising) F_0 pattern. This observation is corroborated also by its pitch level characteristics (see Figure 3).

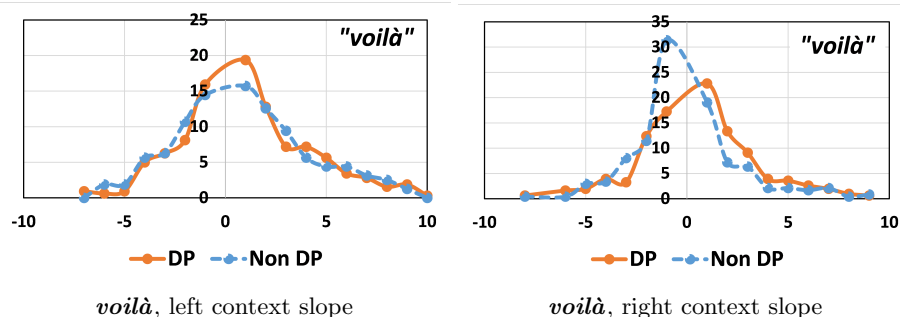


Fig. 5. Frequency of occurrences with respect to the $\Delta F0$ value for *voilà*

4.5 Vowel duration

Prosotran provides information about vowel duration, which includes three symbolic annotation degrees of vowel lengthening: very strong, strong and mild lengthening (see respectively D+++, D++ and D+ in Table 3 and Figure 6). This annotation is used for comparing duration lengthening of the last (or unique) vowels of the words. As vowel duration lengthening is a strong parameter cue for stressed syllable in French, it seems worthwhile to analyse how vowel duration lengthening contributes to the prosodic characteristics of the DP. Table 3 and Figure 6 show the number of occurrences and the percentage of lengthened vowels for both words, in their DP and non-DP uses.

Table 3. *quoi* and *voilà* last syllable duration, percentage of occurrences according to vowel lengthening, and number of occurrences in parentheses

		no lengthening detected D	Degree of lengthening of word last syllable		
			D+	D++	D+++
<i>quoi</i>	DP	80.0 % (305)	9.7 % (37)	6.0 % (23)	4.2 % (16)
	Non-DP	81.3 % (505)	9.7 % (60)	3.4 % (21)	5.6 % (35)
<i>voilà</i>	DP	65.0 % (632)	15.0 % (146)	9.9 % (96)	10.0 % (97)
	Non-DP	85.5 % (373)	8.9 % (39)	2.7 % (12)	2.7 % (12)

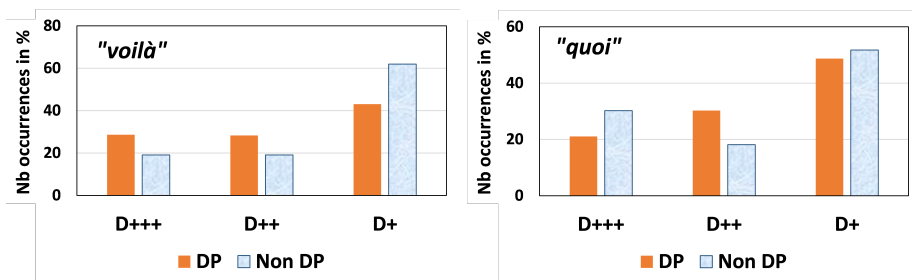


Fig. 6. *quoi* and *voilà*, last syllable vowel lengthening (percentage of the lengthened vowels)

Statistics in Table 3 show that for each sub-category, the target vowel is predominantly non-lengthened. However, if we analyse only the cases with lengthening (see Figure 6), we can observe that:

- The lengthening for *voilà* is more important when used as a DP than in a non-DP function;
- With respect to the strongest lengthening (D+++), *quoi* and *voilà* do not behave in the same way: DP *voilà* is more often markedly lengthened than non-DP *voilà*, contrary to DP *quoi*, which is less often markedly lengthened than non-DP *quoi*.

4.6 Automatic DP identification

An automatic identification of the DP function for the two words under study was carried out. The identification procedure relies only on the prosodic parameters described and analysed in the previous paragraphs.

We used the j48 decision tree [26] in the Weka toolkit [19]. 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% is kept for evaluating the classifier (identification of the DP function).

The results obtained by the classifier (see Table 4) are very encouraging. In fact, in more than 70% of the cases, 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 . . .) is introduced into the decision procedure.

Table 4. DP automatic identification scores in percentage

	Correct identification	Precision	Recall	F-Measure
<i>quoi</i>	71 %	71 %	71 %	71 %
<i>voilà</i>	73 %	73 %	73 %	73 %

5 Conclusion

Our study aims to identify pertinent prosodic parameters associated to two French words (*quoi* and *voilà*) when used as a discourse particle (DP function) or not (i.e., pronoun, preposition, ...).

The identification of the DP function of the words is very important for the automatic processing of speech data. For example, the translation of such words will be different whether they have a DP function or a non-DP function. It can be sometimes hard to retrieve the DP function from the written form only and other complementary information is also needed to identify correctly these discourse functions. It is found in this study, that the DP function can be successfully identified using prosodic parameters. In fact, our preliminary automatic identification of the DP functions of the studied words yielded very encouraging results: more than 70% of the word functions are correctly identified.

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