

# Prosodic correlates of negative rhetorical questions in Lombard Italian

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## Abstract

Our goal was to investigate whether Lombard<sup>1</sup> Italian speakers reliably use prosodic features to distinguish canonical *wh*-questions (CQs) and non-canonical rhetorical *wh*-questions (RhQs). We hypothesized that such speakers could identify each question type by using prosody alone, and we designed both a perception and a production task to test this hypothesis. The former consisted of a forced-choice identification task with 32 target stimuli. To elicit the production data, participants performed a discourse completion task with the same number of stimuli as in the perception study. Utterances were intonationally labeled and acoustically analyzed for pitch change (prenuclear pitch accent and nuclear contour), initial and final pitch, and relative duration. Results revealed that participants were highly accurate at identifying RhQs but less so at identifying CQs. Results of successful productions showed that initial but also final cues were systematically used, with pitch level being lower in RhQs than in CQs, and final boundary tones reliably differentiating RhQs from CQs. Finally, RhQs were significantly longer than CQs. We conclude that speakers do rely on both intonation and duration cues to distinguish CQs from RhQs.

**Index Terms:** prosody, intonation, meaning, *wh*-questions, rhetorical questions.

## 1. Introduction

In Italian, a *wh*-question, as illustrated in (1), can receive a canonical (CQ) or a rhetorical (RhQ) interpretation.

- (1) *Cosa farai dopo la laurea?*  
What (you) will do after the\_F graduation  
'What will you do after your graduation?'

Although the rhetorical interpretation can be made explicit by inserting the adversative particle *ma* 'but' at the beginning of the utterance [40,41], we explore here the hypothesis that native speakers can disambiguate RhQs using prosody alone. Indeed, this is to be expected if there are systematic differences in production, either involving tonal variations (e.g., differences in initial pitch level or in the selection of nuclear pitch accents and boundary tones) and/or in the overall segmental duration.

To tackle this issue, we designed both a perception and a production experiment, which are presented in §2. Before describing our methods and results, we briefly review our assumptions about the semantics of rhetorical questions (section 1.1) and motivate our hypotheses based on previous

literature on the semantics of questions and the prosodic characteristics of both canonical and rhetorical questions in Italian and other languages (section 1.2)

### 1.1. The semantics of rhetorical questions

What conversational move can be made when we ask a question? A canonical question (CQ) comes with the assumptions that (i) the speaker is ignorant about the answer, (ii) the addressee is knowledgeable about it, and (iii) the addressee is disposed to share his/her knowledge with the speaker [1, 2, 3]. For example, in most situations an utterance of the interrogative *Who will stay for dinner?*, when asked as a standard question, is felicitous if the speaker does not know who will stay for dinner while the addressee does, and the addressee is also in a good position to share her knowledge. Non-canonical questions (NCQs) are either marked by a special prosody or by a special syntax (or both), signaling to the addressee that the question being asked is not standard, hence the normal assumptions which accompany a question are not made.

Rhetorical questions are an example of NCQ, in that they have been often analyzed as questions whose answer is already accepted by all discourse participants [9,10,11,12]. A rhetorical question seems to signal that all discourse participants (not just the speaker) are biased towards one (and the same) answer to the question. Here we focus on constituent questions, that is, sentences with an interrogative syntax and an interrogative pronoun (English *who*, *what*, *why*, etc.) in sentence-initial position. Examples in (2) and (3) illustrate two types of rhetorical questions: (2) is a rhetorical question with a negative answer; (3) is a rhetorical question with a positive answer.

- (2) Who would ever leave without an umbrella today?  
(Answer: nobody)
- (3) *Context: Ann is not surprised that Sam is the only one who was just asked to join the fencing national team.*  
After all, who practices 4 hours 7 days a week?  
(Answer: Sam)

Rhetorical questions are challenging because, even though they have an interrogative form, they seem to provide the same information as a parallel assertion [13]. [12] argue that rhetorical questions are questions that presuppose that the answer is already in the common ground of the participants' discourse, where the 'common ground' is the set of all beliefs publicly accepted by all discourse participants [14]. Along the same lines, [13] argue that rhetorical questions are interrogatives triggering the presupposition that the context

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<sup>1</sup> *Lombard Italian* is used here because the speakers we recruited came from Milan and neighboring towns.

entails the answer.” More recently, the idea that rhetorical questions require the speaker to believe the answer to the question has been challenged [16,17]. In fact, there are types of rhetorical questions where the answer is unknowable at the time of the conversation. The debate on the nature of rhetoric in questions is still open. In this study we focus on the negative rhetorical interpretation of Italian *wh*-questions without any syntactic, or lexical, marking of rhetoricity. Specifically, by analyzing the prosodic features of rhetorical questions in Lombard Italian, our goal is to investigate whether and how these questions are prosodically marked as being rhetorical and how reliable these prosodic cues are.

## 1.2. Wh-questions intonation

Most descriptions of the intonation phonology of NCQs are restricted to English, German and Icelandic [22,23,24]. Crucially, such research has shown that intonation is used to signal bias across sentence types ([25]; see [27, 28], for an overview), and that these differences are actively used by listeners to determine perceived beliefs [29]. The growing experimental literature that has explored the differences between CQs and a variety of biased questions (including declarative questions, in situ *wh*-questions and negative questions) has revealed phonological differences in the selection of pitch accents and boundary tones ([29, 30] for Spanish). We know, for example [24], that CQs and RhQs with a negative answer in English differ in the realization of pre-nuclear (preference for an L\*+H associated with the *wh*-word in RhQs) and nuclear (preference for bitonal accents in RhQs) accents. CQs and NCQs may show additional phonetic differences in the use of voice quality and/or pitch height at the beginning [22] or at the end of the phrase [22, 30, 31]. Phonetic differences in pitch range have been reported to be more important than phonological intonation differences in French [32].

Research on the realization of Italian CQs has concentrated on central and southern varieties, showing that the *wh*-word is consistently associated with a rising pitch accent [18,19, 20, 21] while the edge is characterized by different nuclear pitch accents and either a rising or falling boundary tone (e.g., [19]). [37] is the only available perception study focusing on the identification of polar and RhQ questions in Bari Italian.<sup>1</sup> This study shows that listeners are less accurate at identifying RhQs than CQs with unmanipulated stimuli, and that a manipulation of nuclear vowel duration (i.e., longer vowels) yields more RhQ responses.

## 2. Experiments

### 2.1. Experiment 1: Perception

The goal of the first experiment was to understand whether Lombard Italians can interpret a canonical and a (negative) rhetorical reading of a *wh*-question through intonation alone. Based on previous studies (e.g., [30]) showing that speakers of other Romance languages can use intonation to interpret speakers’ beliefs, we hypothesized that participants will be accurate at choosing the appropriate reading for each question type.

<sup>1</sup> The production of RhQs has only been studied for Bari Italian [39]. This study focuses on a range of RhQs with pragmatic functions that differ from those analyzed here.

### 2.1.1. Methods

Nine Italian speakers, born and raised in Lombardy, participated in this study. They ranged in age between 22 and 33, were all university educated and resided in the province of Milan. Stimuli consisted of 16 minimal pairs and 16 distractors for a total of 48 stimuli. Materials were recorded by a native speaker of Milan Italian in a quiet room. The two different readings were elicited by providing contexts that would yield either a canonical or a negative rhetorical question. Contexts were also provided to elicit distractors. Recordings were then checked by the authors to make sure that both questions were intonationally different. As shown in Figure 1, canonical and rhetorical questions differed both in nuclear accent type and in the final boundary tone, with CQs ending with a rising L\* H-H% nuclear contour while RhQs show a final falling H\* L-L% nuclear contour.

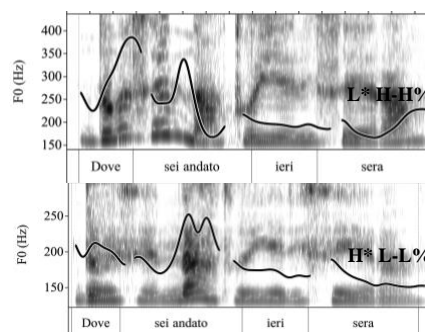


Figure 1: Example of stimuli used in Experiment 1: Dove sei andato ieri sera? ‘Where did you go last night’. Canonical (top) and rhetorical (bottom) question readings.

The forced-choice identification task was administered using the online software Gorilla (<http://www.gorilla.sc/>). Participants listened to stimuli, which were presented in different orders, and had to choose one interpretation out of three choices (i.e., RhQ, CQ or semantically unrelated interpretation). Confusion matrices were computed to understand the error patterns, and binomial mixed effects models were implemented in R [33] using the package lme4 [34] to determine whether there were differences in accuracy rate for CQs vs. RhQs responses.

### 2.1.2. Results

As shown in Figure 2, participants were highly accurate in the interpretation of RhQs, and less so in the interpretation of CQs and fillers. Results of a binomial mixed effects model with accuracy (treatment coded) as the dependent variable, question type as the independent variable and item and participant as random intercepts revealed that accuracy is significantly higher in RhQs than in CQs ( $\beta=2.97$ ;  $SE=0.84$ ;  $z=0.42$ ;  $p<.001$ ). Indeed, an analysis of error types, summarized in Table 1, shows that the two inaccurate responses obtained for RhQs were interpreted as ‘other’. Most CQs were also interpreted as such, although some of them were interpreted as RhQs.

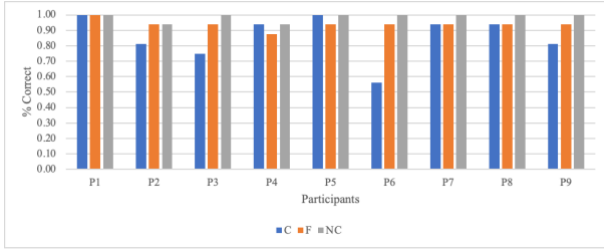


Figure 2: Accuracy by participant. C=CQs; NC=RhQs; F=fillers.

Table 1: Confusion matrix showing the distribution of accurate and inaccurate responses.

Stimulus/Response	CQ	RhQ	Other
CQ	124	9	11
RhQ	0	142	2

## 2.2. Experiment 2: Production

The goal of this experiment was to have a better understanding of some of the prosodic cues used in production to distinguish CQs from negative RhQs in Lombard Italian. Based on previous studies on Italian CQs, which analyzed different varieties relative to the one studied here [18, 19, 20, 21], we expect to find a variability in the realization of both the prenuclear and the nuclear contours. In fact, based on studies on rhetorical questions in Bari Italian [39], in other languages [24] and given our informal observations, differences between CQs and RhQs should be present both at the beginning and at the end of the utterance. Both the initial pitch level should be higher in CQs than RhQs and the wh-word should be accented in CQs but not in RhQs (see also [22]). As for the nuclear contour, it should be falling in RhQs while rising in CQs.

### 2.2.1. Methods

Nineteen participants took part in the production study, though we only focus on the production of the ten of them, since the remaining nine did not produce any difference between the two types of questions. Ten subjects (6 females, 4 males) were hence analyzed. They ranged in age between 21 and 35, lived in Milan and were born either in Milan or in neighboring cities (in Lombardy). All participants were university educated.

The contexts used for the production experiment were the same used to elicit the perception stimuli in Experiment 1, i.e., 32 target questions and 16 distractors. We used a Discourse Completion task [35] administered via a PowerPoint presentation, in which participants read a context silently and were instructed to read the question aloud, in a manner appropriate to each context, and trying to imagine that they were talking to a good friend. The task was recorded in a quiet room at the University Bicocca of Milan, using a unidirectional condenser lapel microphone and a Zoom H4N portable recorder. Recordings were labeled and acoustically analyzed in Praat [36]. For each target utterance, we labeled the intervals corresponding to the wh-word, the prenuclear pitch accent and the nuclear contour (i.e., nuclear pitch accent plus boundary tone), as in Figure 3. Pitch accents were labeled using a ToBI version inspired by versions for other Italian varieties [19].

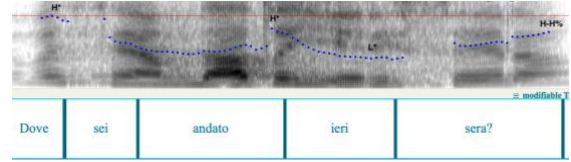


Figure 3: Illustration of labeling method.

The following acoustic parameters were extracted: initial F0 value, maximum and minimum F0 values for each of the labeled intervals, final F0 value (all in semitones), and duration of the whole utterance. We then calculated the F0 change associated with each labeled interval. Mosaic plots in R [33] were used to visualize the distribution of prenuclear pitch accents and boundary tones. Data were analyzed using Linear mixed effects regression (LMER) models implemented with the lme4 package [34]. Models had question type as the independent variable and participant and stimulus as random intercepts.

### 2.2.2. Results

The analysis of observed vs. expected prenuclear pitch accents by sentence type (Figure 4) reveals that CQs and RhQs have the same inventory of pitch accents but differ mainly in the proportion of L+H\*, which is higher in the latter type of question.

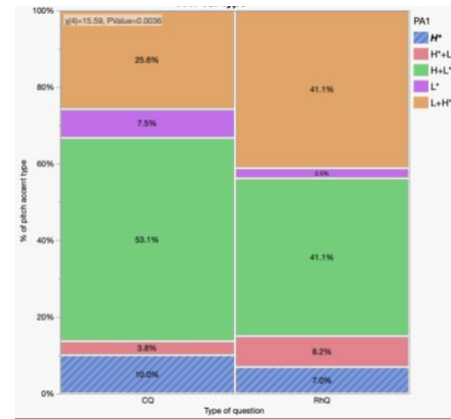


Figure 4: Mosaic plot showing the types and distribution of prenuclear pitch accents by question type.

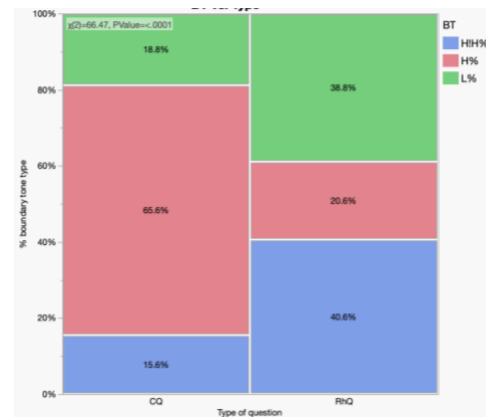


Figure 5: Mosaic plot showing the types and distribution of boundary tones by question type.

RhQs and CQs clearly differ in the types and frequency of boundary tones (Figure 5). CQs tend to finish with a rising boundary tone, whereas RhQs display similar proportions of L% and sustained pitch (H!H%).

Both types of questions differ significantly in the use of F0 in the prenuclear region (Figure 6). CQs have a significantly higher initial F0 ( $\beta=92.37$ ;  $SE=1.85$ ;  $t=49.87$ ;  $p<.001$ ), and a larger F0 change associated with both the wh-word ( $\beta=93.81$ ;  $SE=1.99$ ;  $t=47.06$ ;  $p<.001$ ) and with the prenuclear accent ( $\beta=6.14$ ;  $SE=0.55$ ;  $t=10.99$ ;  $p<.001$ ), relative to RhQs.

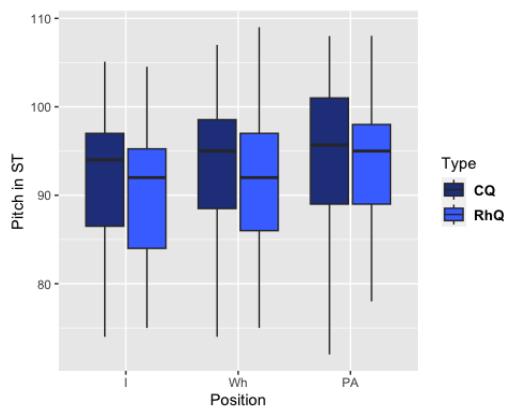


Figure 6: Differences in *initial F0*, *F0 max. associated with Wh-word*, and *F0 change over the first pitch accent (bottom)*.

Differences were also observed at the end of the utterance (Figure 7). Consistently with the analysis of boundary tones (Figure 5), CQs displayed a larger pitch change ( $\beta=6.71$ ;  $SE=0.53$ ;  $t=12.145$ ;  $p<.001$ ) and had a higher final f0 value than RhQs ( $\beta=90.27$ ;  $SE=2.03$ ;  $t=44.29$ ;  $p<.001$ ).

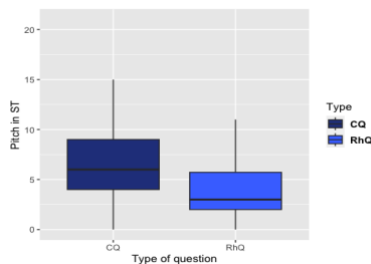


Figure 7: *Pitch change over the nuclear contour*.

Differences were also found in the relative overall utterance duration (Figure 8) with RhQs being significantly longer than CQs ( $\beta=162.32$ ;  $SE=15.15$ ;  $t=12.34$ ;  $p<.001$ ).

Although this was not the focus of our analysis, individual differences were also observed in the corpus. For instance, a female participant systematically used breathy voice in RhQs whereas a male participant lengthened the first content word in the same question type.

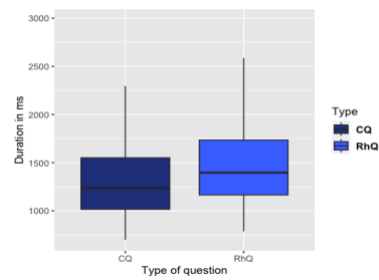


Figure 8: *Differences in duration between CQs and RhQs*.

### 3. Discussion

Results of the perception experiment (Experiment 1) support the hypothesis that speakers of Lombard Italian can interpret canonical and rhetorical versions of wh-questions using intonation alone, as opposed to what was found for Bari Italian [38]. As such, current findings, albeit based on a small sample size, are consistent with previous research [28] showing that speakers of other Romance languages can use intonation to infer speakers' beliefs in rhetorical vs standard question.

The production experiment (Experiment 2) first revealed that many participants are not able to naturally produce RhQ using a discourse completion task, since 9 out of 19 speakers did not produce any difference between CQs and RhQs. Participants who were able to perform the task, though, used a variety of cues to signal the contrast between CQs and RhQs. Consistent with previous studies, which focused on a variety of languages such as German, English and Icelandic, we not only found the hypothesized intonation differences at the beginning [22] but also at the end of the intonation phrase [22, 30, 31]. As reported for other varieties, we found that CQs are marked by an initial rising pitch accent associated with the wh-word [18, 19, 20, 21]. Moreover, CQs ended predominantly with a L\* nuclear pitch accent and a H-H% rising boundary tone. RhQs, instead, tended to begin and end with a lower F0 when compared to CQs, being intonationally closer to declarative utterances relative to CQs. This result was expected given that both RhQs and statements are non-information seeking speech acts. Further evidence for the common non-information-seeking nature of RhQs and declarative sentences comes from our finding that RhQs have longer duration than CQs. This finding is consistent with those reported for German [22] and English [24] as well as with studies that have argued that speech rate is a secondary cue for sentence type [37]. This initial approximation to the prosodic correlates of CQs and RhQs in Lombard Italian also revealed that there are other acoustic parameters which need to be considered, such as voice quality, which was reported as a correlate of rhetoricity in German and English [22, 24]. Since, in our sample, participants who changed their voice quality were female, it may be the case that the use of prosodic cues to signal a RhQ function deserve a future sociolinguistic analysis.

### 4. Acknowledgements

We want to thank Prof. Francesca Panzeri (U. Milano Bicocca) for providing us the space and facilitating participant recruitment, and Laura Escobar for her assistance analyzing the data.

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