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4. Prosodic differences between yes/no questions and biclausal discourses

1. Introduction

In this section I will investigate the phonetic realization of *che fare* questions in Sienese. At first sight, c*he fare* questions look like biclausal discourses containing two questions. Indeed, it is possible to form minimal pairs of *che fare* question and the corresponding biclausal discourse, which contain the same lexical items. An example is given in (1).

1) a. Che fai dormi?
che do-PRES.2.Sg sleep-PRES.2.Sg
'Are you sleeping?'

[*che fare* question]

b. Che fai?
what do-PRES.2.Sg
'What are you doing?
Dormi?
sleep-PRES.2.Sg
Are you sleeping?'

[biclausal discourse]

However, I have shown that *che fare* questions are subject to some syntactic constraints which do not apply to biclausal discourses. These constraints are summarized in (2).

2) a. *Fare* and the lower verb must share phi-, tense, mood and aspect features.
b. Only a single negation is allowed.
c. The subject cannot occur between *fare* and the lower verb.

In addition, *fare* can combine with any verb in *che fare* questions, irrespective of its thematic structure. This is possible because *fare* behaves as a light verb that is devoid of its original lexical meaning. By contrast, biclausal discourses do not allow *fare* in the first question to co-occur with a verb that does not assign an agentive role to its subject in the second question. This follows from the fact that *fare* is always lexical in biclausal discourses.
On the basis of these syntactic arguments, I have concluded that *che fare* questions are distinct from biclausal discourses (see chapter 3).

1.1 The problem

Distinguishing a *che fare* question from the corresponding biclausal discourse containing two questions is relatively straightforward. When there are phi-, tense, mood or aspect feature mismatches, or two negations, or the subject occurs between *fare* and the lower verb, we know for sure that we are dealing with a biclausal discourse.
However, the reverse is not always true. In fact, the absence of one of these characteristics does not necessarily mean that we are dealing with a *che fare* question. Therefore, it is important to develop tests that can unambiguously establish the syntactic status of these constructions. More specifically, it is necessary to address the questions given in (3).

3) a. Do speakers use grammatical cues, other than morphosyntactic ones, to distinguish between *che fare* questions and biclausal discourses?

   b. How can the distinction between *che fare* questions and biclausal discourses be established when they form a minimal pair, such as (1.a-b)?

In order to answer these questions, it is necessary to look at the prosody of *che fare* questions and of the corresponding biclausal discourses. If they exhibit distinctive prosodic properties, then we have a further argument in favor of a sharp distinction between these constructions.

2. Production experiment

To tackle the questions in (3), a production experiment was designed and carried out. The aim of the experiment is to investigate whether speakers make a prosodic distinction between *che fare* questions and the corresponding biclausal discourses containing two questions.
If my hypothesis concerning the monoclausality of *che fare* questions is on the right track, I would expect the subjects to use different prosodic cues to distinguish the two constructions In contrast to this, the absence of any prosodic differences would show that they are in fact the same.

2.1 Methods

2.1.1 Stimuli

A PowerPoint presentation consisting of 35 slides was developed, containing 14 yes/no questions, 15 biclausal discourses containing two questions, and 6 control sentences.
The slides contained 5 minimal pairs of yes/no questions and biclausal discourses. The lexical items and the morphosyntactic information in the minimal pairs were identical, so as to allow for potential ambiguity. However, the presentation of the sentences did signal a difference between the structures by using a different punctuation. More precisely, the yes/no questions were written on a single line, followed by a single final question mark. The biclausal discourses were presented on two separate lines and were

each signaled by their own question mark. An example of the minimal pair stimuli that were included in the PowerPoint presentation is provided in (4) below. Figure 1 shows a sample of the slides that were used in the presentation.

4) a. Che fai vai al mare?
che do-PRES.2.Sg go-PRES.2.Sg. to-the sea
'Are you going to the sea?'
[yes/no question]

b. Che fai?
what do-PRES.2.Sg.
Vai al mare?
go.PRES.2.Sg. to-the sea
'What are you doing? Are you going to the sea?'
[biclausal discourse]

Figure 1.a: Sample of slides used in the PowerPoint presentation[1].

[1] One may argue that writing the biclausal discourses on two lines rather than on one line could in principle affect the way the speakers pronounced the sentences. However, I exclude that the speakers were encouraged to produce a larger pause by the disposition of the sentences in the screen. The two sentences clearly cohere textually, with the second question being a follow up on the first one. A new paragraph would have required a break in textual cohesion. For this reason, I strongly doubt that the speakers produced an end-of-a-discourse prosody rather than an end-of-a-sentence one.

Figure 1.b: Sample of slides used in the PowerPoint presentation

In addition, there were 3 quasi-minimal pairs of yes/no questions and biclausal discourses. The lexical items in the yes/no question and in the biclausal discourse were not exactly the same in these cases. *Fare* was replaced by a different verb in the first question of the biclausal discourse because of its incompatibility with the theta-role assigned to the subject by the verb in the second question. A sample is given in (5).

5) a. Che fa assomiglia al su babbo?
che do-PRES.3.Sg resemble-PRES.3.Sg to-the his/her father
'Does (s)he look like his/her father?'
[yes/no question]

b. Com' è?
how be-PRES.3.Sg.
Assomiglia al su babbo?
resemble-PRES.3.Sg. to-the his/her father
'How is (s)he? Does (s)he look like his/her father?'
[biclausal discourse]

c. # Che fa?
what do-PRES.3.Sg.
Assomiglia al su babbo?
resemble-PRES.3.Sg. to-the his/her father
'What does (s)he do? Does (s)he look like his/her father?'
[biclausal discourse]

A quasi-minimal pair is illustrated in (5.a-b). *Fare* 'do' was replaced with *essere* 'be' in the biclausal discourse in (5.b) because *fare* 'do' assigns an agentive theta-role to its subject,

while the verb *assomigliare* 'resemble' does not. The discourse in (5c) is infelicitous (as indicated by the # sign), because the question with fare concerns a request with respect to an agentive event, while the second question that specifies this first question refers to a state (*assomigliare* 'resemble'). The status of the sentences in (5.a) and (5.b) is unambiguous. On the one hand, the sentence in (5.a) could never be interpreted as a biclausal discourse, as shown by the ungrammaticality of (5.c). On the other hand, (5.b) is clearly not a monoclausal yes/no question because it lacks *fare*.
There were 6 yes/no question slides and 6 biclausal discourse slides that did not form minimal pairs. Out of these 6 biclausal discourse slides, 2 were potentially ambiguous and 4 were not. These 4 biclausal discourses were characterized by the following properties:

- phi-feature mismatch between *fare* and the lower verb;
- tense mismatch between *fare* and the lower verb;
- aspect mismatch between *fare* and the lower verb;
- the subject occurring after *fare* and before the lower verb.

A sample of unambiguous biclausal discourse is given in (6).

6) a. Che fate?
what do-PRES.2.Pl
S' esce o no?
we.Subj.CL go.out-PRES.1.Pl or not
'What are you doing? Are we going out or not?'
[phi-feature mismatch]

b. Che fece la tu mamma?
what do-PAST.3.Sg the your mother
La comprò la macchina?
it.Obj.CL buy-PAST.3.Sg the car
'What did your mother do? Did she buy the car?'
[subject position]

As for the 6 yes/no question slides, I used a wide variety of lexical items in order to make sure that prosodic patterns were not conditioned by the presence of specific lexical items. I also included stimuli of different lengths, again to make sure that the length of the stimuli was not affecting the results. A sample is given in (7).

7) Che fanno moiano se un gli
che do-PRES.3.Pl die-PRES.3.Pl if not to-them.CL
dai l' acqua tutti i giorni?
give- PRES.2.Sg the water every the days
'Do they die if they aren't watered every day?'

Finally, I included 7 control slides. Two of them contained two declaratives, two a single declarative and two a question/answer pair. A sample is given in (8).

8) a. Ieri si mangiò la panzanella.
yesterday we.Subj.CL eat-PAST.3.Pl the panzanella
'We ate panzanella yesterday.'
[single declarative]

b. Vai al mare? Noi sì.
go-PRES.2.Sg to-the sea we yes
'Are you going to the sea? We are.'
[question/answer pair]

This experiment was specifically designed for Sienese speakers. Therefore, its lexicon is often dialectal and refers to typical Sienese food and names. This choice was made to ensure that speakers would give judgments of the relevant dialect and not be influenced by their knowledge of Standard Italian. An example is provided in (8.a), where a typical Sienese/Tuscan dish is mentioned (*panzanella*). Another example is given in (9).

9) Che fai ti garba la figliola
che do-PRES.2.Sg to-you.CL please-PRES.3.Sg the daughter
del Brogi?
of Brogi
'Do you like Brogi's daughter?'

In the sentence in (9) the Standard Italian word *figlia* 'daughter' was replaced by the Sienese word *figliola* 'daughter' in order to make it more Sienese. In addition, a very typical Sienese surname (*Brogi*) was chosen.
Two different slide shows were created, with one the opposite of the other. Six speakers were shown the slides in one order and 5 speakers in the reverse order. This was done to make sure that possible order and learning effects would be balanced.
In addition, both slide shows were designed in such a way as to avoid two slides from a minimal pair occurring next to each other. This was done to make sure that the participants would not start comparing them and get a grasp of what was being tested.

2.1.2 Procedure

The experiment was conducted in a quiet room. Participants were recorded individually, using a head-mounted close-talking microphone (Audio Technica PRO8HE). They were seated at a table with a computer screen in front of them. The distance between the subjects' eyes and the screen was about 70 centimeters. The sentences were written in a large font (Minion 54), to make sure that they could be read easily by all subjects.
The participants were given specific instructions before the experiment started as to how they should read the sentences. More precisely, I told them that they should read them as if they were in a very informal situation, such as in the headquarters of their *contrada*[2]. I told them that I was interested in Sienese and encouraged them to

[2] Siena has seventeen districts, which are called *contrada* in the local dialect. They participate in a horse race called *Palio*, held twice each year on July 2nd and August 16th in the main square of the town. This ritual started in the Middle Ages and is now more alive than ever. *Contradas* compete

pronounce the sentences on the screen without repressing their Sienese accent. This was not always easy as people tended to feel that they were somehow under examination. As a result, some speakers were using a more standard pronunciation at the beginning of the recordings. When this happened, I would stop and convince them once again that I was interested in Sienese as they would speak it in their *contrada*, not in standard Italian.

Subjects were presented with a slide show. They had to press the space bar to start the show. This was done in order to respect each person's individual reaction time. An automatic slide show with a preset on-screen time might alter the results in this case, as the subjects might feel pressured to read the sentences faster than they would normally do.

The recordings were first saved as sound files on the flash disk memory of the recorder (Marantz PMD620). They were eventually transferred to computer disk and stored in a database.

2.1.3 Participants

Eleven Sienese speakers took part in the experiment. Among them were 7 women and 4 men, aged between 26 and 70 years. The participants were all Siena residents, who were born and raised in Siena. They were all linguistically naive and unaware of the specific purpose of my study. All they knew was that I was generally interested in Sienese as a dialectal variety. Their educational level was medium to medium-high. An overview is given in table 1 below:

Table 1. Overview of the participants.

Participant	Gender	Age	Educational level
CL	male	70	High school diploma
GG	female	26	MA degree
MB	female	26	MA degree
ES	female	26	MA degree
PM.	female	44	High school diploma
PT	male	53	High school diploma
FG	male	39	High school diploma
DL	male	37	High school diploma
CM	female	49	High school diploma
SN	female	53	BA degree
SL	female	26	MA degree

All speakers participated voluntarily and were not remunerated for their service.

against one another in the *Palio*. Rivalry and competition are an integral part not only of the months preceding the event, but of the whole year. This tradition is extremely important for the Sienese people and represents without any doubt the heart and soul of Siena. Therefore, I decided to emphasize the participants' personal commitment to their *contrada*.

2.2 Analysis

The recordings comprised eleven sound files (one for each speaker), the durations of which varied between 1.17 and 2.13 minutes. Each file contained 35 utterances.
Since I am interested in the contrast between minimal pairs of monoclausal yes/no questions and their corresponding biclausal discourses, only the members of such minimal pairs were digitally analyzed with the *Praat* speech processing software (Boersma & Weenink, 2005). The productions of all speakers were analyzed. They consisted of 110 utterances in total (5 minimal pairs × 11 speakers).
The sound files were first manually segmented and labeled. For each utterance, a *Praat* annotation file (called TextGrid) was set up which includes four annotation tiers.
The first annotation tier was labeled *clause*. It contains a point in time corresponding to the potential clause boundary, i.e. right after *fare*. The point was placed at the beginning of the pause in those utterances where a pause occurs between *fare* and the following word.
The second tier was labeled *word*, as it was dedicated to a segmentation of the utterance into words. This was done in order to be able to extract duration and intensity measurements for some of the words included in the utterances. As already anticipated, some utterances contain a prosodic break after *fare*. The prosodic break was labeled *P*, when present.
In the third tier, a portion of the utterance was segmented that was characterized by a pitch fall. Namely, the pitch fall occurring at the left of the potential clause boundary was segmented, corresponding to the word *fare*. This was done in order to be able to extract measurements relative to the size, duration and steepness of the fall. The relevant tier was labeled *F*.
The fourth tier was labeled *V*, and was dedicated to the labeling of the segment where pre-boundary vowel lengthening (henceforth PBL) could potentially take place. Since the aim of this study is to compare a monoclausal and a biclausal construction, it was hypothesized that one of the differences should lie in the presence of PBL (or the absence thereof). However, not only the vowel that could potentially lengthen was segmented and labeled. Rather, the inter-stress interval between *fare* and the following word (henceforth ISI) was identified as the portion of utterance where PBL could take place. This was done to check for potential spill-over effects of PBL outside the word boundaries of *fare*.
The second step in the acoustic analysis was extracting the sounds' pitch information. A *Praat* PitchTier file was created for each utterance, which represents a time-stamped pitch contour. It includes the time-frequency coordinates of selected pitch points, without voicing information. An example of TextGrid and PitchTier file is given in figure 2 below.

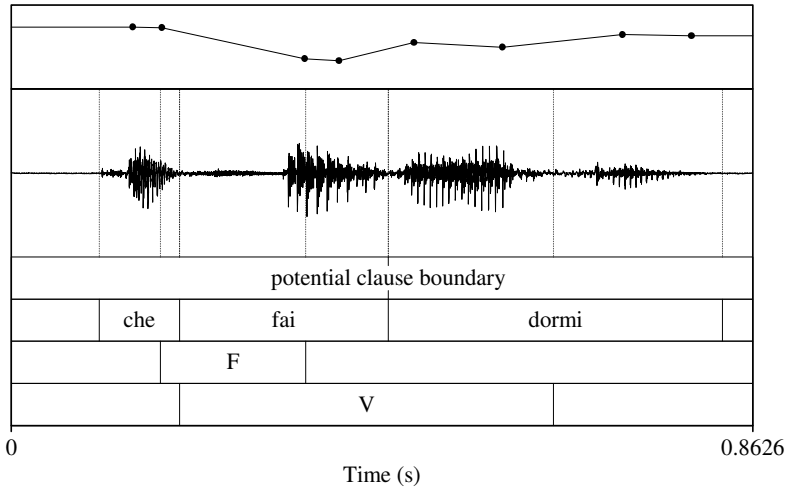

Figure 2: Example of a Praat TextGrid and PitchTier file. The top panel shows the PitchTier, the second panel contains the waveform. The four annotation tiers (bottom part of figure) are explained in the text.

A fourth step in the analysis was to obtain duration, intensity and pitch curve measurements. The duration and intensity of the first two segments was automatically extracted with the help of a *Praat* script.[3] The duration of the pause P, which can occur between *fare* and the following word, was also extracted, together with the duration of all segments occurring after the pause. This was done in order to be able to compute the total duration of the utterance with and without the pause. Measurements relative to the size, duration and steepness of the pitch fall were also extracted with the same script.
All these measurements were eventually stored in a database for off-line statistical processing with IBM SPSS Statistics 19.[4]

2.2.1 Variables considered

The experiment described in this chapter aims at comparing the phonetic realization of two groups of utterances that differ with respect to their underlying structure. One group includes biclausal discourses containing two questions (i.e. a *wh*-question and a yes/no question), while the other group includes the monoclausal interrogative constructions that were analyzed as *che fare* questions in chapter 1.
The *PowerPoint* presentation that was shown to the speakers contains a wide variety of stimuli, as discussed in section 2.1. However, I decided to concentrate on minimal pairs of biclausal discourses and *che fare* questions because I am interested in the phonetic realization of these constructions in the absence of any morphosyntactic cues.

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[3] I would like to acknowledge the help of Jos Pacilly, engineer of the LUCL Phonetics Laboratory.
[4] For ease of discussion, IBM SPSS Statistics 19 will be referred to as SPSS from now onwards.

A shown in chapter 1, *che fare* questions have a monoclausal structure and display a different syntactic behavior than their corresponding biclausal discourses (see ex. 2). The question now is whether different syntactic structures systematically correlate with different prosodic and phonetic properties. In order to address this question, a number of variables were taken into consideration, as discussed in section 2.3.

2.3 Results

For ease of discussion, I will first present all the variables that were taken into consideration in the analysis. Then, I will discuss the results of the statistical processing that was eventually performed with SPSS.

2.3.1 Variables included in the analysis

As described in the preceding sections, the experiment reported in the present chapter involved a comparison of two constructions characterized by a different syntactic structure. By hypothesis, I expected them to be marked by a variety of distinctive acoustic cues. Among these cues, I expected to find an increased segmental duration in biclausal discourses, as they by definition contain a boundary. In fact, PBL is one of the most widespread strategies to segment speech into linguistically meaningful units and mark the right edge of prosodic domains (cf. Hayes, 1997; Vaissière, 1983).
In particular, I expected the accented vowel of *fare* to lengthen, since *fare* is the word that occurs right before the boundary between the *wh*-question and the yes/no question. Conversely, I expected *che fare* questions to have a shorter duration. This follows from the assumption that there is no clause boundary between *fare* and the rest of the sentence, as *che fare* questions are strictly monoclausal constructions. Hence, no PBL should take place.
As anticipated in section 2.2, the ISI was labeled as the safest segment where PBL can potentially take place. This was done in order to check for potential spillover effects of PBL to the immediate environment of the vowel whose duration is supposed to increase.
Furthermore, I expected the biclausal constructions to be able to host a pause, as opposed to *che fare* questions. In fact, the presence of PBL and of a pause (or absence thereof) represent two sides of the same coin. Namely, both variables relate to the hypothesis that there is no boundary in *che fare* questions, as opposed to biclausal discourses containing two separate questions.
After a first informal inspection of a sample of TextGrid files, some recurrent properties of the two different interrogative constructions were observed. One of these properties is related to the duration and intensity of the first two words of every sentence, namely *che* and *fare*. Both *che* and *fare* showed a consistent tendency to have a higher intensity in biclausal discourses than in their monoclausal counterparts.
From a theoretical perspective, it seems reasonable to assume that functional material is marked as less prominent than lexical material by e.g. intensity (a.o. Van Bergem, 1993). This observation fits in with the pattern characterizing the sample taken into consideration. Indeed, *che* and *fare* have a lower intensity in monoclausal yes/no questions, where they do not convey any lexical meaning. In contrast to this, they are

characterized by a higher intensity when they retain their full lexical meaning, as in biclausal discourses. For this reason, I decided to check for the mean intensity and peak intensity of *che* and *fare*. Their duration was also controlled for, as consistent evidence emerged that *che* and *fare* have a longer duration in biclausal discourses than in their monoclausal counterparts.

Duration was measured in seconds, while intensity was measured in dB. An example of the intensity curve of a *che fare* question and its corresponding biclausal discourse is provided in figures 3 and 4 below. The intensity curves reported in figures 3 and 4 correspond to the sentences provided at the beginning of the chapter in examples (1.a) and (1.b), respectively, reported below as (10.a) and (10.b).

10) a. Che fai dormi?
che do-PRES.2.Sg sleep-PRES.2.Sg
'Are you sleeping?'

[*che fare* question]

b. Che fai?
what do-PRES.2.Sg
'What are you doing?
Dormi?
sleep-PRES.2.Sg
Are you sleeping?'

[biclausal discourse]

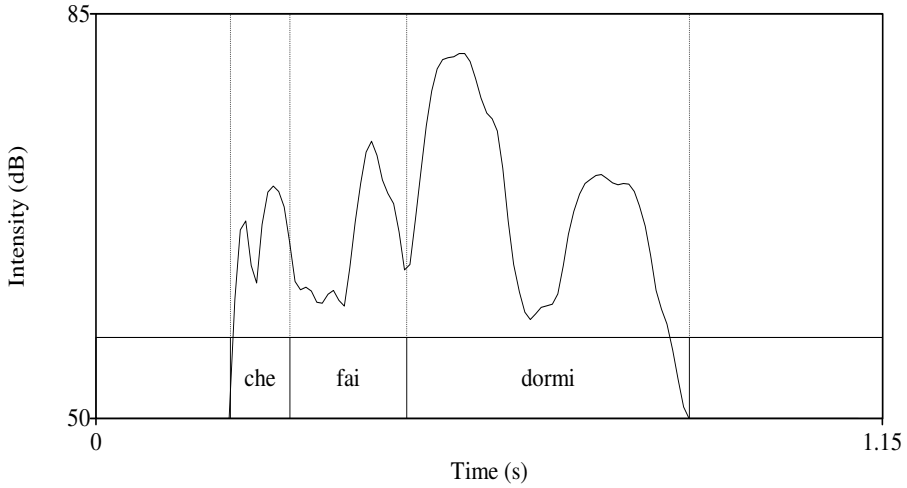

Figure 3: Intensity curve of the *che fare* question reported in (10.a).

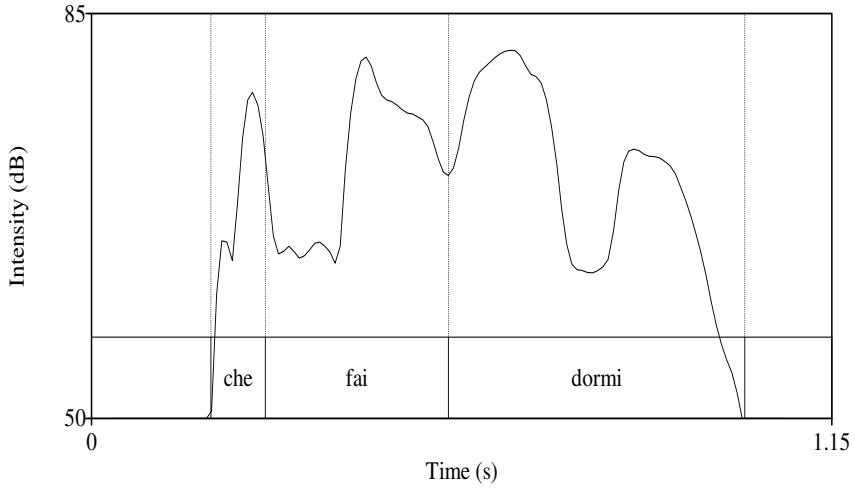

Figure 4: Intensity curve of the biclausal discourse reported in (10.b)

From a brief comparison between the intensity curves shown in figures 3 and 4, it is possible to observe that the intensity of *che* and *fare* is higher in the curve of the biclausal discourse. In addition, it can be noticed that the duration of the segment including *che* and *fare* is longer in the intensity curve of the biclausal discourse in figure 4.

Another recurrent property characterizing the sentences included in the sample concerns their pitch curve. Both sentence types are characterized by a pitch fall in on the word *fare*. However, the fall occurring in *che fare* questions appeared to be longer, larger, and less steep than the fall occurring in the corresponding biclausal discourse.

An example of the pitch curve of a *che fare* question and its corresponding biclausal discourse is provided in figures 5 and 6 below. The pitch curves reported in figures 5 and 6 correspond to the sentences provided in examples (11.a) and (11.b) below.

11) a. Che facesti andasti a casa?
che do-PAST.2.Sg go-PAST.2.Sg to home
'Did you go home?'

b. Che facesti? Andasti a casa?
what do-PAST.2.Sg go-PAST.2.Sg to home
'What did you do? Did you go home?'

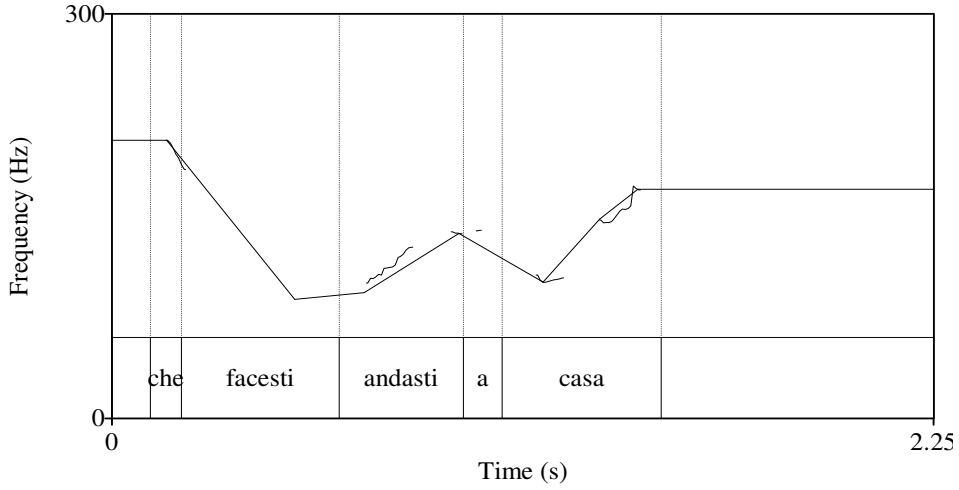

Figure 5: Pitch curve of the *che fare* question reported in (11.a).

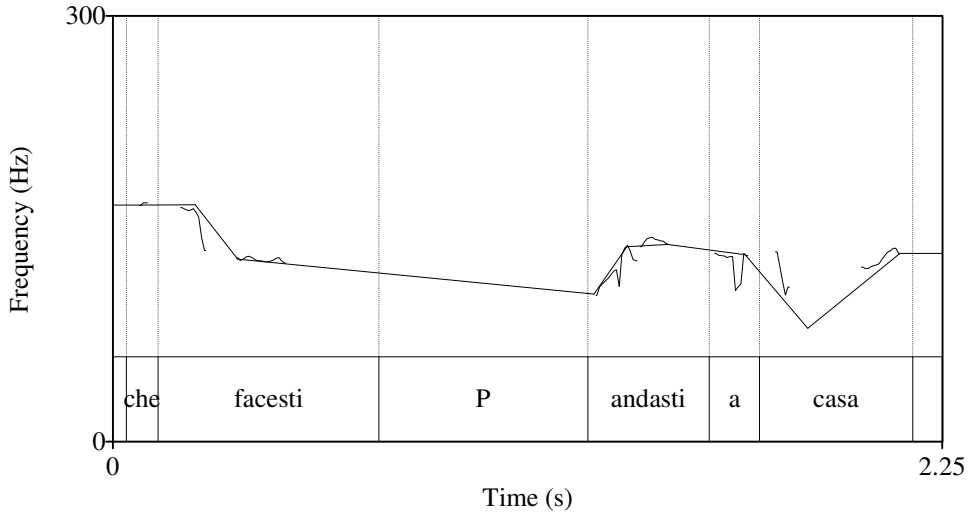

Figure 6: Pitch curve of the biclausal discourse reported in (11.b).

The pitch fall occurring on *facesti* in the *che fare* question in figure 5 is definitely longer and larger than its counterpart in the biclausal discourse in figure 6. This pattern recurred quite often in the data. Therefore, the values pertaining to the fall's duration (measured in seconds), excursion size (measured in semitones) and steepness (measured in semitones per second) were also extracted by the *Praat* script. They were eventually stored in a database for off-line statistical processing with SPSS.

The variables discussed so far in the present section are all dependent variables, such as duration and intensity of *che* and *fare*, duration of the ISI and duration, size and

steepness of the pitch fall realized on *fare*. Instead, sentence type (*che fare* questions vs. biclausal discourses) and the speakers' names are independent variables (or factors).
An overview of all the variables that were included in the analysis is provided in table 2 below.

Table 2: Overview of the variables included in the analysis.

Variables	Nature of the variables
Speakers	independent
Sentence type	independent
Presence of a pause	independent
Duration of the ISI	dependent
Duration of *che*	dependent
Mean intensity of *che*	dependent
Peak intensity of *che*	dependent
Duration of *fare*	dependent
Mean intensity of *fare*	dependent
Peak intensity of *fare*	dependent
Size of the fall on *fare*	dependent
Duration of the fall on *fare*	dependent
Steepness of the fall on *fare*	dependent

2.4 Statistical processing of the data

As mentioned in section 2.2, all measurements that were automatically extracted from the recordings with the help of a *Praat* script, were stored in a database. They were analyzed using descriptive statistics and paired-samples t-tests. For some variables, a Linear Discriminant Analysis was eventually performed. In the following section, some basic statistical concepts will be presented which are relevant for my analysis. Then, the results of the analyses performed with SPSS will be reported and discussed.

2.4.1 Some basic statistical concepts and methods

In this study, I decided to use paired-samples t-tests as the data included in the two groups could not be treated as completely independent. As already introduced, the eleven speakers who participated in the experiment produced a total of 110 sentences. While speakers are independent of each other, the utterances spoken by each individual are not. Running an independent t-test on all individual data points would have violated the condition that all data in the samples should be independent of each other.
The last step in the statistical analysis was applying Linear Discriminant Analysis (LDA) to the data. LDA is often used to determine which variables discriminate between two (or more) groups. The main purpose of LDA is to predict group membership based on a linear combination of variables. The procedure begins with a set of observations

where both group membership and the values of the variables are known. The end result of the procedure is a model that allows prediction of group membership when only the values of the variables are known. A second purpose of LDA is gaining a better understanding of the data set itself. In fact, a careful examination of the prediction model that results from the procedure can give a better insight into the relationship between group membership and the variables used to predict group membership.

LDA can be run either in a stepwise or in a non-stepwise fashion. In stepwise LDA, a model of discrimination is built step-by-step. Specifically, at each step all remaining variables are reviewed and evaluated to determine which one contributes most to the discrimination between the groups. That variable is then included in the model, and the process starts again but includes the next best predictor variable only if it independently makes a significant contribution. In non-stepwise discriminant function analysis, the program is forced to include one or more variables in the analysis. As a consequence, the independent contribution made by each single predictor in determining group membership is not taken into consideration. Instead all the predictors are all included whether or not they make a significant independent contribution – typically yielding an unrealistically good discrimination rate.

In my analysis, I used LDA in order to check which variables contribute most to distinguishing between the groups of monoclausal *che fare* questions and their corresponding biclausal discourses. Both stepwise and non-stepwise analyses were used. The results are discussed in section 2.5.

2.4.2 Presence of a pause

As mentioned in section 2.3.1, one of the variables included in the analysis is the presence of a pause between *fare* and the rest of the utterance, or the absence thereof.

By hypothesis, I expected *che fare* questions not to be able to host a pause[5] between *fare* and the following word, as opposed to biclausal discourses. If *che fare* questions are indeed monoclausal constructions, they should not allow the presence of any prosodic break within their clause boundaries. Conversely, their corresponding biclausal discourses contain two independent questions. Therefore, they should in principle be able to host a pause between the two questions. This follows from the fact that they are two different clauses, each with its own prosodic and syntactic boundaries.

My hypothesis concerning the role of a pause in determining the syntactic status of the utterances included in the data set was confirmed by the results of the statistical analysis. The speakers produced indeed 27 utterances containing a pause, out of a total of 110 utterances. Crucially, all utterances including a pause are biclausal discourses. This means that a pause occurs in 24.5% of the utterances, and 49% of the biclausal discourses. Still, it is interesting to notice that 100% of these prosodic breaks occur in biclausal discourses. This confirms the hypothesis that only biclausal discourses can

5 Only silent intervals longer than 200ms are labeled as pauses in the present work. Silent intervals shorter than 200 ms, such as those found before voiceless plosives, are therefore excluded.

host a pause. The presence of a pause therefore seems optional in biclausal discourses, but impossible in *che fare* questions.
An overview of the duration of the pause in the 27 biclausal discourses where it occurs is provided in figure 7 below. The vertical axis reports the number of cases in which a pause is found, while the horizontal axis reports its duration.

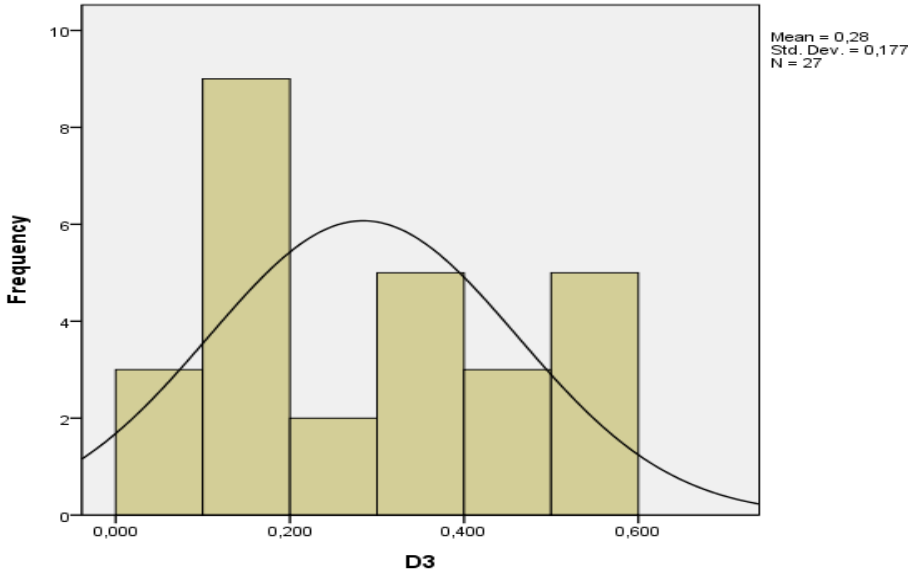

Figure 7: Overview of the duration of the 27 pauses realized in biclausal discourses.

From a quick observation of the overview reported in figure 7, it is possible to conclude that the duration of the pause occurring in the biclausal discourses does not have a normal distribution. This means that the data have more of a tendency to produce unusually extreme values. These results show that there is no overall pattern when it comes to the duration of the pause. Still, it is possible to conclude that in most utterances containing a pause, its duration is between 0.1 and 0.2 seconds.
Nevertheless, my investigation was not concerned with the duration of the pause *per se*. Rather, I wanted to check whether my initial hypothesis was on the right track in assuming that *che fare* questions should never be able to host a pause, as a consequence of their monoclausal status. The results reported in the present section confirm the hypothesis, as they show that only the *che fare* questions included in my data set contain a pause, as opposed to the biclausal discourses.
All in all, the data suggest that the presence of a pause is an infallible diagnostic criterion for the biclausal status of an utterance. Its absence, however, does not have any diagnostic value in this model. Hence, it is necessary to run some secondary measurements in order to establish the syntactic status of the utterances that do not contain a pause.

2.4.3 Duration of the ISI

Another variable was included in the statistical analysis prior to any (in)formal inspection of the data set. Namely, the duration of the inter-stress interval (ISI). The ISI corresponds to the segment comprised between the stressed syllable of *fare* and the stressed syllable of the following word. This means that the ISI also includes the pause, when present. This choice was made in order to check for potential spillover effects of PBL to the immediate environment of the vowel whose duration is supposed to increase as a consequence of PBL.

By hypothesis, the ISI was expected to have a shorter duration in *che fare* questions, as they do not contain a clause boundary. Conversely, biclausal discourses were expected to display a longer ISI, as a consequence of PBL and possibly of the presence of a pause.

All expectations were actually confirmed by the results of the statistical analysis, which establishes the duration of the ISI as a crucial parameter in determining the syntactic status of the utterances included in the data set.

The first step in the statistical analysis was to run descriptive statistics on the data set in order to obtain a simple summary, which includes the values of the means and of the standard deviation. I decided to opt for the mean values, rather than for the median or modal values, as they are the most commonly used method for describing central tendencies. The results are provided in table 3 below. Mean duration and its standard deviation are reported in milliseconds (ms).

Table 3: Mean duration (ms) of the inter-stress interval between *fare* and the following word.

Sentence	Mean	N	SD
che fare questions	511	55	117
biclausal discourses	773	55	259
Total	642	110	239

From a quick observation of the values reported in table 3, it is clear that the duration of the ISI is longer in biclausal discourses (773 ms) than in the *che fare* questions (511 ms). The difference (262 ms) is highly significant by a paired t-test on the mean durations per speaker ($p = .001$, one-tailed).

The presence or absence of a physical pause does not contribute substantially to the difference between the duration of the ISI in *che fare* questions and biclausal discourses. Even if the duration of the pause is excluded from the total duration of the ISI in biclausal discourses, the difference (190 ms) between the duration of the ISI in *che fare* questions and biclausal discourses is still highly significant by a paired t-test on the mean durations per speaker ($p = .002$, one-tailed). These results suggest a strong effect of preboundary vowel lengthening.

Table 4: Mean duration (ms) of the inter-stress interval between *fare* and the following word (excluding the duration of P).

Sentence Type	Mean	N
che fare questions	511	55
biclausal discourses	700	55
Total	605	110

The difference between the duration of *fare* in *che fare* questions and their corresponding biclausal discourses turned out to be statistically very significant (see section 2.4.4), too. This shows that a comparable result is obtained if the pause is subtracted from the ISI and that the difference in duration between the ISI in biclausal discourses and *che fare* questions cannot only be reduced to the presence or absence of a physical pause. Rather, it must also be attributed to some spillover effects of PBL in the immediate environment of the lengthened vowel. If this were not the case, the difference between the duration of *fare* in biclausal discourses and *che fare* questions would not be as significant as established by the results of t-tests.

A graphical representation of the duration of the ISI in the production of all speakers and broken by sentence type is shown in figure 8 below. For the biclausal discourses, the duration of the ISI is shown both including and excluding the pause. The three speakers (C.M., C.L. and G.G.) for whom only two bars are shown did not produce any pause.

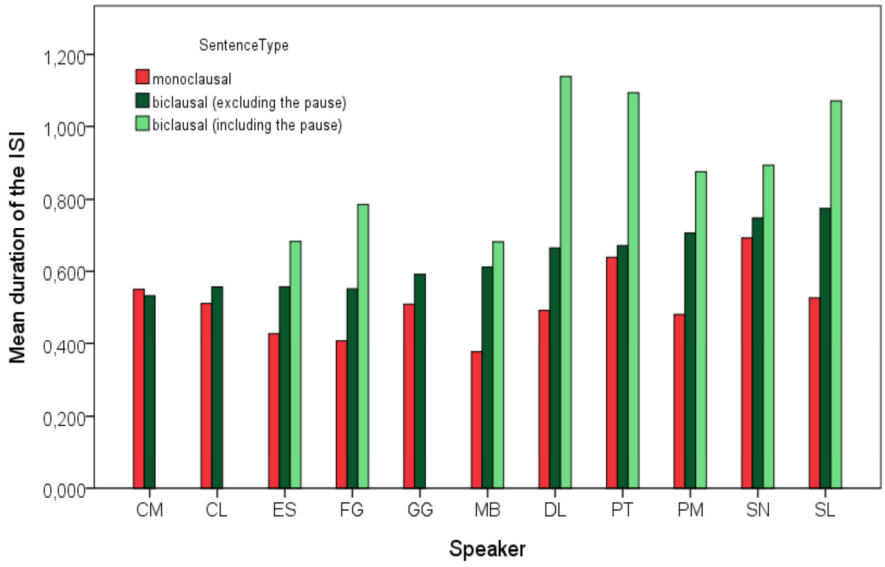

Figure 8: Duration of inter-stress interval between *fare* and the following word broken down by speaker and sentence type.

The overview provided in figure 8 shows that all speakers but one (CM) exploited PBL to distinguish *che fare* questions from their corresponding biclausal discourses. In fact, the duration of the ISI is slightly longer only in the *che fare* questions produced by CM.
As expected, the difference between the duration of the ISI in monoclausal and biclausal constructions is larger when the pause is included. Still, the duration of the ISI remains longer in biclausal constructions even if the pause is excluded.
It is possible to notice that for some speakers (D.L., P.T. and S.L.) the duration of the ISI is strongly affected by the presence of a pause, so the difference between *che fare* questions and biclausal discourses is not as spectacular anymore if the pause is excluded. In particular, P.T. produced a difference of more than 500 ms, which cuts down to about 40 ms if the pause is excluded. These data show that P.T. used pause insertion as a more prominent cue than PBL to mark biclausal discourses, as opposed to *che fare* questions.
This pattern contrasts with the production of M.B., where the difference between the duration of the ISI in biclausal discourses with and without the pause is less than 100 ms. As opposed to P.T., M.B. used PBL as a more prominent cue to distinguish *che fare* questions from their corresponding biclausal discourses.
The speakers with the largest difference between the duration of the ISI in *che fare* questions and biclausal discourses (excluding the pause) are M.B., P.M. and S.L. They produced a difference equal to or larger than 200 ms. In the production of the four remaining speakers (C.L., E.S., F.G and G.G.), this difference is comprised between 40 and 150 ms.
Despite the presence of between-speaker variation in the data, it is possible to conclude that the initial hypothesis concerning the duration of the ISI (and hence of the role of PBL) in discriminating between *che fare* questions and their corresponding biclausal discourses was confirmed. *Che fare* questions display less PBL than their corresponding biclausal discourses, both in the ISI and in *fare*.

2.4.4 Duration, mean intensity and peak intensity of *che* and *fare*

As discussed in section 2.3.1, the duration and intensity of the first two words seemed to make a consistent difference between *che fare* questions and their corresponding biclausal discourses. Therefore, I decided to include the duration, mean intensity and peak intensity of *che* and *fare* in the statistical analysis.
Again, the first step in the analysis was running descriptive statistics on the data in order to obtain a simple summary of the means and standard deviation. The results are provided in tables 5.a and 5.b below. Duration is reported in milliseconds (ms), while intensity is reported in decibels (dB).

Table 5.a: Means and standard deviations of duration (ms), mean intensity (dB) and peak intensity (dB) of *che*.

Sentence Type		che		
		Duration	Mean intensity	Peak intensity
Che fare questions	Mean	94	67.61	71.77
	SD	26	4.87	4.90
	N	55	55	55
Biclausal discourses	Mean	95	67.44	71.52
	SD	33	5.79	5.95
	N	55	55	55
Total	Mean	95	67.53	71.64
	SD	30	5.33	5.43
	N	110	110	110

Table 5.b: Means and standard deviations of duration (ms), mean intensity (dB) and peak intensity (dB) of *fare*.

Sentence Type		fare		
		Duration	Mean intensity	Peak intensity
Che fare questions	Mean	327	68.06	74.46
	SD	135	5.63	5.74
	N	55	55	55
Biclausal discourses	Mean	464	69.96	76.68
	SD	126	5.77	5.50
	N	55	55	55
Total	Mean	396	69.01	75.57
	SD	147	5.75	5.70
	N	110	110	110

From a quick observation of the data reported in table 5, it is possible to see that the means do not differ much in the monoclausal and biclausal cases. In addition, the high value of the standard deviation suggests that data points are spread out over a large range of values.

Table 6: Results of paired-samples t-tests on the duration, mean intensity and peak intensity of *che* and *fare*.

Variables	Paired Difference	t	df	Sig. (2-tailed)
Duration of che	9.44	-.291	9	.777
Mean intensity of che	1.78	.245	9	.812
Peak intensity of che	1.91	.326	9	.751
Duration of fare	−89.01	−6.429	9	.000
Mean intensity of fare	.46	−1.793	9	.103
Peak intensity of fare	13.74	−2.214	9	.051

As shown in table 6, only the duration of *fare* turned out to be statistically significant across the monoclausal and biclausal constructions included in the data set. It is the only variable whose *sig.* value is below the threshold chosen for statistical significance (i.e. <0.05). According to the results of the paired-samples t-tests, the duration of *fare* plays in fact a very significant role in distinguishing between *che fare* questions and biclausal discourses ($p < .001$).

As opposed to the duration of *fare*, the peak intensity of *fare* did not turn out to correlate with the syntactic status of the utterances in the data set. However, its significance is just slightly below the alpha level. Thus, it is possible to conclude that the peak intensity of *fare* is not the most relevant factor in distinguishing between *che fare* questions and their corresponding biclausal discourses. Still, its effect seems to be significantly different from chance, which might suggest that it makes a contribution to the interpretation of the utterances as monoclausal or biclausal, as opposed to the other variables.

In general, all variables related to *fare* score better in the t-tests than the variables related to *che*. While the *sig.* scores of the duration and intensity of *che* are all way above the alpha limit, the *sig.* scores relative to *fare*'s duration and intensity are either below or slightly above it.

In fact, the *sig.* score of the mean intensity of *fare* is less close to the alpha limit than the *sig.* scores of the duration and peak intensity of *fare*. Still, it is much closer to it than the *sig.* scores of any variables relative to *che*. This is certainly a strong indication that the phonetic realization of *fare* is more sensitive than *che* to the syntactic status of the utterance that contains it. Thus, it can be used as more reliable diagnostics than *che* in distinguishing between *che fare* questions and their corresponding biclausal discourses.

A graphical representation of the duration and peak intensity of *fare* in *che fare* questions and biclausal discourses is provided in figures 9 and 10 below.

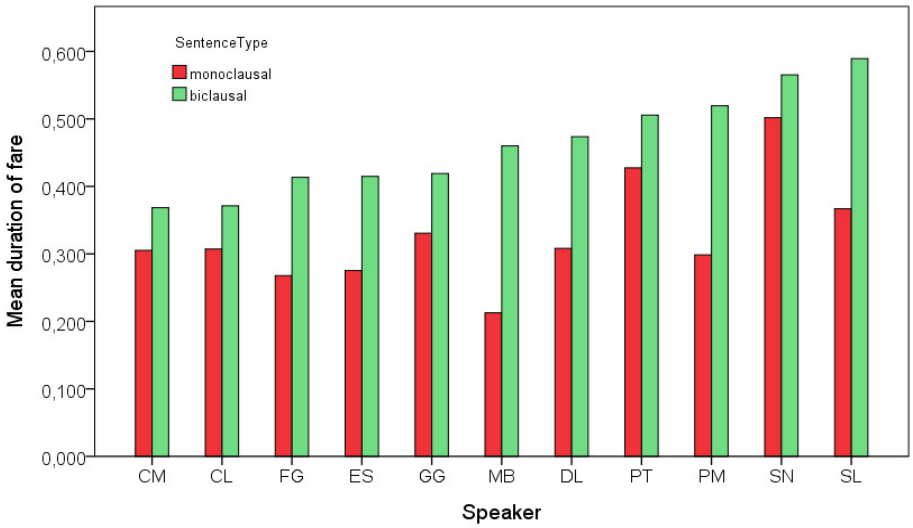

Figure 9: Duration of *fare* broken down by speaker and sentence type.

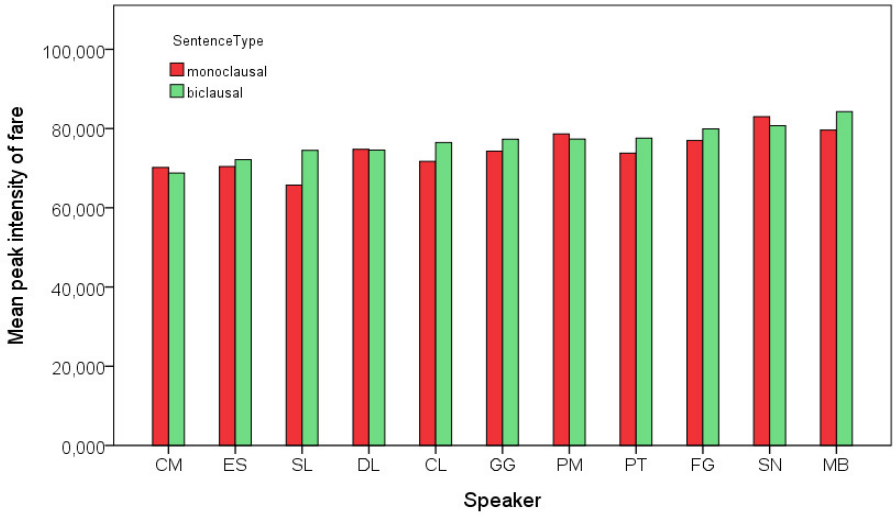

Figure 10: Peak intensity of *fare* broken down by speaker and sentence type.

The duration of *fare* turned out to be very significant, an expected result. It follows from PBL, which deeply affects the duration of *fare*. Still, this result is interesting because the target segment is different from the segment analyzed in section 2.4.3, which included the ISI. This was done in order to check for side effects of pre-boundary vowel lengthening in the first syllable of the word occurring after *fare*. When *fare* contained more than two syllables (ex.: fa-cé-sti), however, the first syllable was excluded from the ISI because it did not carry an accent.

As far as the peak intensity of *fare* is concerned, it seems reasonable to assume that *fare* is marked by intensity as more prominent when it has a lexical meaning. Conversely, it is uttered with a lower intensity when it serves as semantically depleted functional material, as in the case of *che fare* questions.
To sum up, only one of the variables discussed in the present section turned out to be extremely relevant in determining the syntactic status of the utterances included in the data set, more specifically, the duration of *fare*. The peak intensity of *fare* turned out to have some relevance as well, although its score on the t-test is slightly below the alpha level. The duration of *che*, the mean intensity of *che* and *fare,* and the peak intensity of *che* turned out not to have any diagnostic role in distinguishing *che fare* questions from their corresponding biclausal discourses.

2.4.5 Duration, size and steepness of the fall

The last group of variables that were included in the analysis relates to pitch movement. As introduced in section 2.3.1, the duration, size, and steepness of the fall occurring on *fare* were extracted and analyzed. According to the results of the paired-samples t-tests, none of these variables makes a significant contribution in distinguishing *che fare* questions and their corresponding biclausal discourses.
Before running a statistical analysis on the data, it was necessary to exclude three cases that displayed a pitch raise on *fare* rather than a fall. An example is provided below in figure 11.
The portion of pitch contour included between the two dotted lines is the segment where a fall was expected to occur. As shown in figure 11, it is characterized by a large pitch rise instead.

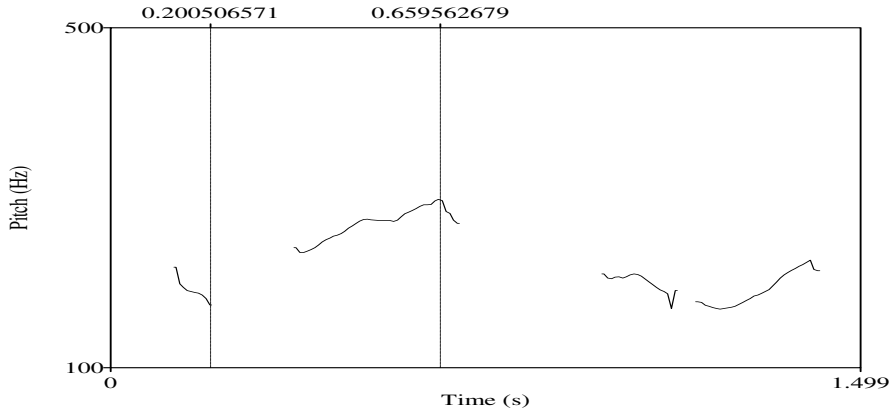

Figure 11: Pitch contour of biclausal discourse pronounced with surprise intonation.

The three excluded examples were all biclausal discourses, which displayed a prosodic break between the *wh*-question and the yes/no question. The *wh*-question was characterized by a final rise because the speakers pronounced it with surprise intonation. This pattern conforms to the general pattern of standard Italian. In standard Italian, *wh*-questions are usually characterized by a final fall (cf. Chapallaz, 1964). When

they display a falling-rising tune, they have been claimed to express doubt or surprise (cf. Lepschy & Lepschy, 1977).
However, this interpretation was not required, nor triggered in any way by the context. Thus, I decided to exclude the three cases with a pitch rise. The values relative to the means and standard deviation of the fall duration, size and steepness are reported in table 7 below.

Table 7: Means of the size (semitones), duration (ms) and steepness (semitones/second) of the pitch fall on *fare*.

Variables	Sentence Type	N	Mean	Std. Deviation	Std. Error Mean
Fall duration	*Che fare* questions	55	256	97.60	13.16
	Biclausal discourses	55	208	120.91	16.3
Fall size	*Che fare* questions	55	9.78	3.85	.51
	Biclausal discourses	52	8.69	3.94	.54
Fall steepness	*Che fare* questions	55	41.73	19.74	2.66
	Biclausal discourses	52	49.37	42.34	5.87

As shown in table 7, the mean value of the fall duration in *che fare* questions is higher than its counterpart in biclausal discourses. The mean value of the fall size shows a similar tendency, although the difference between its realization in *che fare* questions and biclausal discourses is not as large. Instead, the mean value of the fall steepness is higher in biclausal discourses than in *che fare* questions.
A paired-samples t-test was run on the effects in order to test their statistical significance. As anticipated, the results show that none of the variables relative to the fall plays a relevant role, as their effects turn out to be insignificant. The results of the paired-samples t-test run on the z-normalized values of the fall duration, size and steepness are reported in table 8 below.

Table 8: Results of paired-samples t-test on duration, size and steepness of the pitch fall on *fare*.

	Paired Differences	t	df	Sig. (2-tailed)
Z-normalized fall duration	1.0	1.45	9	.17
Z-normalized fall size	.87	1.6	9	.14
Z-normalized fall steepness	.52	−.11	9	.90

From a quick observation of the values reported in table 8, it emerges that the effects of duration and size of the fall are larger than that of steepness. Nevertheless, they are far from significant.

2.5 Discriminant Function Analysis

The last step in the statistical analysis was to create a model for predicting group membership, based on a linear combination of variables.
As mentioned in section 2.2, linear discriminant analysis (LDA) was used in order to obtain such model. Several LDAs were run, in order to find out which variables are the best predictors of group membership in my data.
First, the predictive power of all variables was tested, using both stepwise and non-stepwise methods. Then, a non-stepwise analysis was run on the two variables with statistical significance according to the results of the t-tests. These are the duration of the inter-stress interval between *fare* and the following word, and the duration of *fare*[6].
Finally, another non-stepwise discriminant function analysis was run which included fall size in addition to these variables. This was done to check the contribution of pitch movement to the interpretation of the utterances as monoclausal or biclausal.
All discriminant analyses described in this section resulted in functions that are significant and accurately classify at least 78% of the cases. This outcome shows that even if only a few variables turned out to be statistically significant, they still have a very strong predictive power. The results of the discriminant function analyses will be presented and discussed in the following four subsections.

2.5.1 Discriminant Function Analysis 1

As a first step, a non-stepwise discriminant function analysis was run which included all the variables described in the previous sections. This was done in order to check which level of accuracy could be reached in determining group membership if those variables that turned out not to be statistically significant were also included.
Since this analysis was conducted in a non-stepwise ('simultaneous entry') fashion, the program was forced to include all variables. Two filters were applied. Namely, the slope of the fall had to be positive, and the duration of the pause had to be equal to zero. The first filter was applied in order to exclude the three cases where a pitch rise is found on *fare* rather than a pitch fall. The second filter was applied in order to exclude the 27 biclausal discourses where a pause occurs between the *wh*-question and the yes/no question. This was done because the presence of a pause correctly classifies 100% of the utterances as biclausal discourses. Thus, it was decided to exclude those utterances, as it is not necessary to run secondary measurements in order to establish their nature. As discussed in section 2.3.2.3, the reverse is not true for the utterances without a pause. In fact, the absence of a pause does not automatically classify them as *che fare* questions.
In total, 82 utterances were included in the analysis as a result of the filters applied. The LDA returned one significant function, which accurately classified 89% of the cases. The results are shown in table 9 below.

[6] Of course, these two parameters are interrelated as (part of) the duration of *fare* is included in the ISI. Still, it is interesting to check their contribution to the prediction of group membership.

Table 9: Classification results of non-stepwise discriminant function analysis of all variables.

Original Sentence Type	Predicted		Total
	monoclausal	biclausal	
monoclausal	50 (90.9%)	5 (9.1%)	55 (100%)
biclausal	4 (14.8%)	23 (85.2%)	27 (100%)

The percentage of correctly classified cases reached with this analysis is very high, as shown in table 11. This percentage becomes even higher if the 27 cases are added which had already been correctly classified by the mere presence of a pause. By adding them to the number of correct decisions, and eventually dividing it by the total number of decisions made, this percentage increases up to 91.7%. This result is very positive, as it strongly suggests that the initial choice of the variables was in fact on the right track.

2.5.2 Discriminant Function Analysis 2

It is necessary to keep in mind that the LDA described in section 2.5.1 was conducted in a non-stepwise fashion. As already discussed, this means that SPSS was forced to include all variables in the analysis. Therefore, the result does not tell us anything about the contribution of the single variables in determining group membership.
In order to find out more about it, a similar LDA was run in a stepwise fashion. This means that SPSS had to review and evaluate all variables at each step to determine which one contributes most to the discrimination between groups. The same filters were applied, in order to exclude the utterances with a pause and those without a fall. Again, 82 utterances were included in the analysis.
The only variable selected by the LDA is the duration of the ISI. All other variables were excluded from the analysis, which only consisted of one single step. The discriminant analysis resulted in one function that was significant and correctly predicts group membership in 78% of cases. This percentage increases if those 27 cases are added whose biclausality is predicted by the presence of a pause. By adding them to the number of correct decisions, and eventually dividing the resulting number by the total number of decisions made, a percentage of 83.4% is reached. The classification results are provided in table 10 below.

Table 10: Classification results of stepwise discriminant function analysis of all variables.

Original Sentence Type	Predicted		Total
	monoclausal	biclausal	
monoclausal	44 (80%)	11 (20%)	55 (100%)
biclausal	7 (25.9%)	20 (74.1%)	27 (100%)

On the one hand, it is not surprising that the program picked up the ISI. According to the results of the paired-samples t-tests, this is indeed the variable that can best discriminate between the groups of *che* fare questions and their corresponding biclausal discourses.
On the other hand, it is quite impressive to find such a small difference between the results obtained including the ISI only, and those obtained including all variables in the analysis. From a comparison with the results of the discriminant analysis described in 2.5.1, it is possible to see that the contribution of all other variables together amounts to 8.3% only. Thus, their contribution appears to be minimal with respect to the contribution of the ISI, which alone amounts to 83.4%. These results strongly confirm PBL as the most significant phonetic cue for distinguishing minimal pairs of *che fare* questions from their corresponding biclausal discourses.

2.5.3 Discriminant Function Analysis 3

As discussed in section 2.4.4, the duration of *fare* establishes a statistically significant difference between *che fare* questions and their corresponding biclausal discourses. Nevertheless, it was not picked up by SPSS in the stepwise analysis described in the previous section. This seems to show that the correlation of *fare* and the ISI is so high that *fare* does not make an independent significant contribution anymore, once the ISI has been picked up by SPSS.
In fact, both the duration of *fare* and that of the ISI were initially selected as possible indicators of the presence or absence of PBL. However, only the duration of the ISI was picked up by SPSS in the stepwise analysis. Therefore, I found it necessary to further investigate the difference between the results yielded by the ISI and those yielded by the duration of *fare*. For this reason, a non-stepwise discriminant analysis was run which included both the duration of *fare* and of the ISI. Again, the same filters were applied in order to exclude the utterances with a pause and those without a fall. As a result, 82 utterances were included in the analysis.
The discriminant analysis resulted in one significant function, which correctly classified 79.3% of cases. This percentage increases up to 84.4% if the 27 utterances with a pause are taken into account. The classification results are provided in table 11 below.

Table 11: Classification results of discriminant function analysis of the duration of *fare* and of the inter-stress interval between *fare* and the following word.

Original Sentence Type	Predicted		Total
	monoclausal	biclausal	
monoclausal	45 (81.8%)	10 (18.2%)	55 (100%)
biclausal	7 (25.9%)	20 (74.1%)	27 (100%)

If these values are compared to the results yielded by the duration of ISI (see section 2.5.2), it emerges that the contribution of the duration of *fare* alone amounts to 1% only. This outcome suggests that the effects of (the absence of) pre-boundary vowel lengthening are more visible in the ISI than within the word boundaries of *fare*.
Indeed, the duration of *fare* turned out to be less relevant than the ISI according to the results of the t-tests. Still, it was designated as statistically significant by the results of the paired-samples t-tests. In order to illustrate the degree of correlation between the two variables, a scatter plot was created. This is reported in figure 12 below.

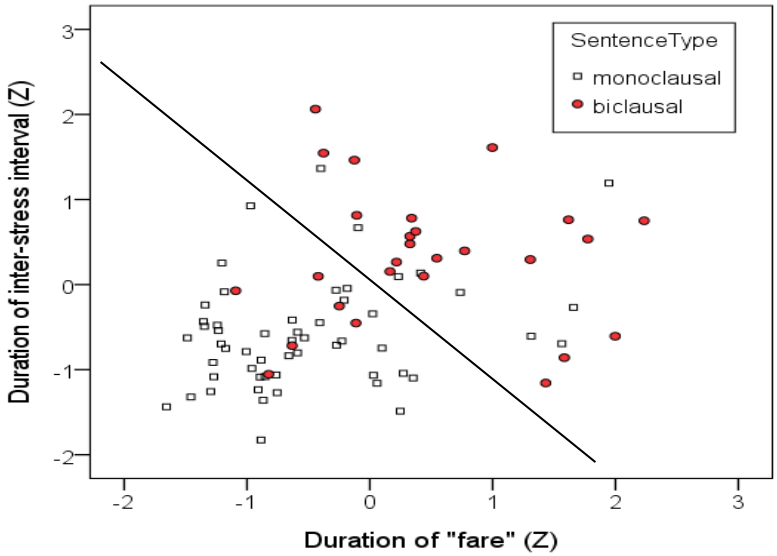

Figure 12: Scatter plot representing the correlation between the duration of *fare* and the duration of the inter-stress interval between *fare* and the following word.

As shown in figure 12, the scatter tends to concentrate in two separate clouds which can be divided by a category boundary. As reported in table 16, 7 biclausal discourses are wrongly predicted to be *che fare* questions when the grouping is conducted according to the duration of *fare* and of the ISI. Conversely, 10 *che fare* questions are wrongly predicted to be biclausal discourses. In fact, it is possible to obtain en even better

separation of the two clouds. This is shown in figure 12, where only 6 biclausal discourses are wrongly predicted to be *che fare* questions, and 9 *che fare* questions are wrongly predicted to be biclausal discourses.
All in all, this pattern appears to be very neat, as it yields a high percentage of correctly grouped cases. This confirms once again the statistical significance of these two variables in distinguishing between minimal pairs of *che fare* questions and their corresponding biclausal discourses.

2.5.4 Discriminant Function Analysis 4

The LDA described in the previous sections included the two variables that turned out to be statistically significant according to the results of the paired samples t-tests. As already pointed out, some variables yielded a significance that was just slightly above the threshold level. In order to find out what their actual contribution is to the interpretation of the utterances as monoclausal or biclausal, I decided to include them in an LDA.
The non-stepwise analysis described in the present section includes the values relative to the size of the fall realized on *fare*, in addition to the duration of *fare* and of the inter-stress interval between *fare* and the following word. The same filters were applied in order to exclude the utterances without a fall and those with a pause, which narrowed down the initial data set to 82 utterances.
This LDA yielded one significant function, which correctly classified 85.4% of cases. This percentage increases up to 88.9% if the 27 utterances with a pause are taken into account. The classification results are provided in table 12 below.

Table 12: Classification results of discriminant function analysis of the fall's size, the duration of *fare* and the duration of the inter-stress interval between *fare* and the following word.

Original Sentence Type	Predicted		Total
	monoclausal	biclausal	
monoclausal	48 (87.3%)	7 (12.7%)	55 (100%)
biclausal	5 (18.5%)	22 (81.5%)	27 (100%)

If the results obtained with this LDA are compared with those described in the previous section, it emerges that the contribution of the fall size amounts to 4.5 %.
From the LDA discussed in section 2.5.2, we know that the contribution of all variables but the duration of the inter-stress interval is equal to 8.3%. Thus, it possible to conclude that the contribution of the fall size in determining group membership is very high with respect to the other variables. This is especially interesting because the fall size did not pass the significance tests (see section 2.4.4).

3. Conclusions

The aim of this chapter was to provide experimental evidence for the claim that *che fare* questions are in fact monoclausal constructions. This was done by investigating whether Sienese speakers produce a difference between *che fare* questions and their corresponding biclausal discourses.

As discussed in chapter 3, there is consistent syntactic evidence to argue in favor of a monoclausal analysis of *che fare* questions. Namely, it was shown that *che fare* questions and their corresponding biclausal discourses are subject to a number of different syntactic constraints.

Nevertheless, it is not always possible to nail down the differences between these two constructions to the presence of certain morphosyntactic cues, or to the absence thereof. In order to unambiguously establish the syntactic status of Sienese *che fare* questions, it is necessary to address the questions in (3), and in particular, to establish whether Sienese speakers use any non-morphosyntactic cues to distinguish between *che fare* questions and biclausal discourses.

The results of the production experiment described in this chapter provide evidence in favor of a sharp distinction between *che fare* questions and their corresponding biclausal discourses even in the absence of any morphosyntactic cues. Specifically, it was shown that Sienese speakers produce a significant difference between minimal pairs of *che fare* questions and biclausal discourses when it comes to duration.

Biclausal discourses containing two questions are indeed subject to pre-boundary vowel lengthening, which affects the inter-stress interval between *fare* and the following word. As a result, the mean duration of this segment is significantly shorter in *che fare* questions than in their corresponding biclausal discourses. These results strongly suggest that *che fare* questions do not contain a clause boundary and hence that they are monoclausal constructions. Further evidence for the absence of a clause boundary in *che fare* questions is provided by the complete absence of prosodic breaks. No speaker inserted a pause that corresponded to the potential clause boundary in *che fare* questions. On the contrary, 49% of the biclausal discourses contain a pause between the *wh*-question and the yes/no question.

This outcome confirms the initial hypothesis that *che fare* questions should not allow the presence of any prosodic break within their clause boundaries if they are monoclausal constructions.

In addition to pre-boundary vowel lengthening and pausing, the duration and intensity of *che* and *fare* were analyzed in order to check whether they make a significant contribution in discriminating between *che fare* questions and their corresponding biclausal discourses. The intensity of *che* and *fare* turned out not to be statistically significant. However, their duration was highly statistically significant. This was an expected result, since it follows from the effects of pre-boundary vowel lengthening (or the absence thereof).

A study of pitch movement was also included in the analysis. In particular, the size, duration and steepness of the fall occurring on *fare* were taken into consideration as potential diagnostics of mono- or biclausality. However, the discriminating power of these parameters turns out to be statistically insignificant. In fact, the fall size is more significant than its duration and steepness, but it still did not pass the relevant statistical tests.

All in all, it is possible to conclude that timing is a more reliable cue than melody for distinguishing *che fare* questions from their corresponding biclausal discourses in Sienese. Pre-boundary vowel lengthening is indeed the most important phonetic cue differentiating between these two constructions.

By contrast, melody does not make a significant contribution to the interpretation of the utterances as monoclausal or biclausal. The results of the production experiment discussed in this chapter strongly suggest that timing rather than melody is often the overriding cue when it comes to clause boundaries in Sienese *che fare* questions. This is in line with other experimental findings that confirm the leading role of timing as the most salient phonetic cue (cf. Nooteboom, Brokx & De Rooij, 1978; Van Dommelen, 1980; Nooteboom & Doodeman, 1980; Elsendoorn, 1984a; Flege & Hillenbrand, 1986). It would be interesting to check whether similar results can be reached with a perception experiment.