

Mapping focus to prosody in Italian: The case of wh-questions

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Abstract

Italian wh-questions with bare wh-elements are characterized by an exceptional prosodic pattern, whereby the *nuclear pitch accent* (NPA) is assigned neither to the wh-element nor to the default rightmost position, but it rather falls on the lexical verb, even though this is not semantically interpreted as a focus. Based on evidence from production, in previous work we argue that the NPA assignment is a reflex of the cyclic syntactic derivation, being sensitive to a syntactic [focus] feature borne by the wh-phrase. The striking dissociation between the NPA and focal interpretation that emerges from the production data raises the question of whether Italian hearers are sensitive to this marked prosodic pattern in understanding a question. To address this question, we carried out a comprehension experiment, where we manipulated the position of the NPA in biclausal wh-questions including two verbs: the verb of the matrix clause and the embedded verb. The results of this experiment confirm the psychological reality of our theoretical analysis, suggesting that hearers exploit prosodic cues to parse the sentence and to assign the correct interpretation to structures that only differ at the surface level with respect to the position of the NPA.

Keywords: focus, wh-questions, cyclic movement, Italian, prosody, main prominence, nuclear pitch accent, comprehension experiment

1. Introduction

In Italian, an exceptional prosodic pattern is observed in direct wh-questions with bare wh-elements: the *nuclear pitch accent* (NPA) fails to be assigned to the wh-element or to the default rightmost position. In these structures, the NPA is rather typically assigned to the lexical verb, as shown in (1) (cf. Calabrese 1982, Ladd 1996, Marotta 2001, Bocci, Bianchi & Cruschina 2021):

- (1) A chi hanno **chiesto** un aumento?
 to whom have.3PL asked a pay-rise
 ‘Who did they ask for a pay rise to?’

What is particularly surprising about this pattern is not that the NPA does not go on the wh-phrase, but rather that the verb is assigned the NPA, despite the fact that it is not interpreted as a narrow focus.

Drawing from previous work (Bocci, Bianchi & Cruschina 2021), our starting hypothesis is that in Italian direct wh-questions, the NPA placement is an effect of cyclic wh-movement and, in particular, it marks a lexical phase head whose edge hosts an intermediate link of the wh-chain, as required by the Phase Impenetrability Condition (Chomsky 2000, 2008). In particular, data from a production experiment reported in Bocci, Bianchi & Cruschina show that in biclausal questions with long distance wh-movement, the NPA can be assigned to the lexical verb either in the embedded or in the matrix clause; in contrast, in case of biclausal wh-questions with short distance wh-movement, the NPA is invariably assigned to the lexical verb in the matrix clause. Based on the evidence from long-distance wh-movement, NPA assignment cannot be reduced to a mere stress shift mechanism (see Marotta 2001) but must be analysed as a reflex of the cyclic syntactic derivation: specifically, it is sensitive to a syntactic [focus] feature borne by the wh-phrase (see also §4 below).

This proposal raises two issues. The first one is whether the two prosodic patterns observed in case of long-distance movement is a real case of optionality, rather than a by-product of an initial parsing with early resolution of the wh-dependency. The second issue is whether the patterns observed in production also affects the hearers’ comprehension of biclausal wh-questions, namely, whether the position of the NPA on the main or embedded verb has a disambiguating effect with respect to the distinction between long- and short-distance interpretation. To address these issues, we carried out an experiment on comprehension. The results of this experiment confirm the psychological reality of the theoretical analysis of NPA placement as a cyclicity effect.

The paper is organized as follows. In Section 2 we summarize the results of the production experiment discussed in Bocci, Bianchi & Cruschina (2021), as well as the theoretical analysis that was proposed there to account for the relevant findings. The comprehension experiment is presented in Section 3, while in Section 4 we discuss a revised version of the initial analysis in the light of the new data. Section 5 closes the paper with some final remarks.

Let us conclude this introductory section with a terminological clarification. The previous studies cited in this paper make reference to a notion of prosodic prominence defined at different levels: at the metrical level (i.e. main/sentential stress), at the intonational one (e.g. NPA), or at both levels (main prosodic prominence). For the sake of simplicity, here we only discuss the distribution of the NPA, that is, the rightmost and most prominent pitch accent within an intonational phrase constituent, which is not followed by other fully-fledged pitch accents (see Gili Fivela et al. 2015). However, we believe that the same considerations that we have been developing about the NPA can be applied to the metrical side too, that is, to the distribution of main/sentential stress, as experimentally shown in Bocci, Bianchi and Cruschina (2021).

2. The distribution of the NPA in Italian wh-questions: Bocci, Bianchi & Cruschina (2021)

The prosodic properties of wh-questions in Italian have received little attention in the literature. Calabrese (1982) and Ladd (1996) observed that in Italian main wh-questions, the NPA is not assigned to the wh-element, even though it should qualify as focus; the NPA is rather assigned to the lexical verb. This observation was later confirmed by Marotta in her experimental studies (Marotta 2001, 2002), where she reports that in spontaneous speech, as well as in laboratory speech, the NPA does not associate with bare wh-elements, but with the verb adjacent to the wh-element (2):^{1,2}

- (2) Marotta (2001: Fig. 5)
 Chi **canta** una canzone?
 who sings a song
 ‘Who is singing a song?’

This is an unexpected pattern in several respects. First of all, if we believe that in a wh-question it is the wh-item that counts as the focus of the sentence, we expect the NPA to associate with this element. This is however not the case, not only in Italian, but also in other languages (cf. Ladd 1996).³ Secondly, when the NPA falls on the lexical verb it is in a marked position, because in Italian the NPA is by default assigned to the rightmost element (cf. Nespor & Vogel 1986, Avesani 1990).

Empirical evidence about the distribution of the NPA in Italian wh-questions was limited to simple (i.e. monoclausal) direct wh-questions. To investigate the placement of the NPA in biclausal wh-questions involving more than one verbs, Bocci, Bianchi & Cruschina (2021) carried out a production experiment, which is described in the next section.

¹ The only exception to this generalization is the bare wh-element *perché* ‘why’, whose exceptional syntactic and prosodic properties have long been recognised in the literature. See Marotta (2001), Rizzi (2001), Bianchi, Bocci & Cruschina (2017), and Bocci, Cruschina & Rizzi (2021).

² This prosodic pattern is systematically observed even in child speech. See Del Puppo (2016).

³ The dissociation between wh-phrase and NPA suggests that wh-phrases are not inherently focal. See Bianchi, Bocci & Cruschina (2017) and Cruschina (2021) for discussion.

2.1. The production experiment

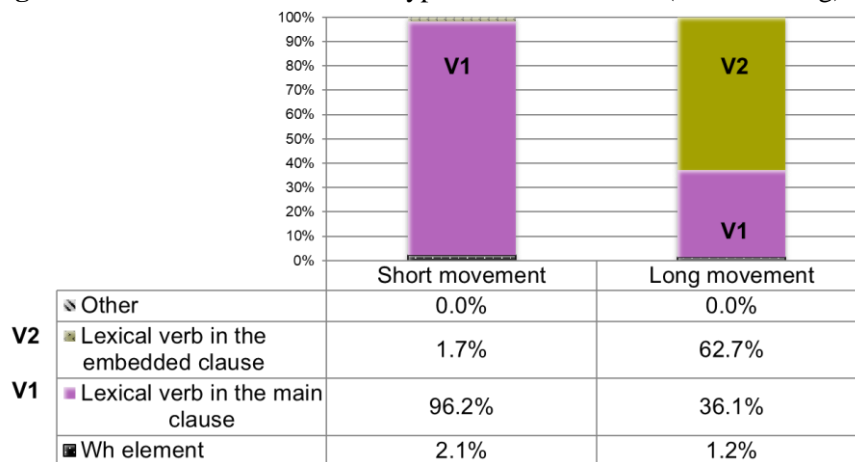
This production experiment tested the distribution of the NPA in biclausal wh-questions which include a matrix and an embedded clause, and therefore contain two verbs: V1 (the lexical verb of the matrix clause) and V2 (the verb of the embedded clause). The experiment involved a reading task. 12 items were tested under two conditions, for a total of 24 experimental stimuli. As we can see in (3), the stimuli in each pair differed with respect to the type of wh-movement involved: short-distance wh-movement (3a), where the wh-phrase corresponds to an argument of V1, and long-distance wh-movement (3b), where the wh-phrase is an argument of V2:

- (3) a. Chi __ pensa [che ti dovrei presentare al direttore]?
 who thinks that you.CL should.1SG introduce to-the director
 ‘Who thinks that I should introduce you to the director?’
 b. Chi pensi [che dovrei presentare __ al direttore]?
 who think.2SG that should.1SG introduce to-the director
 ‘Who do you think that I should introduce to the director?’

Crucially, the target questions in each pair were structurally unambiguous, as morphosyntactic cues allowed only for either a short or long-distance interpretation. To control for information structure effects, such as the givenness or newness of the arguments, the short and long-movement version of each pair were inserted in the same dialogue. A total of 478 target sentences, produced by 10 native speakers (Tuscan Italian) was collected and analyzed.⁴

The results of the experiment are shown in Figure 1:

Figure 1. NPA distribution across type of wh-movement (short vs. long).



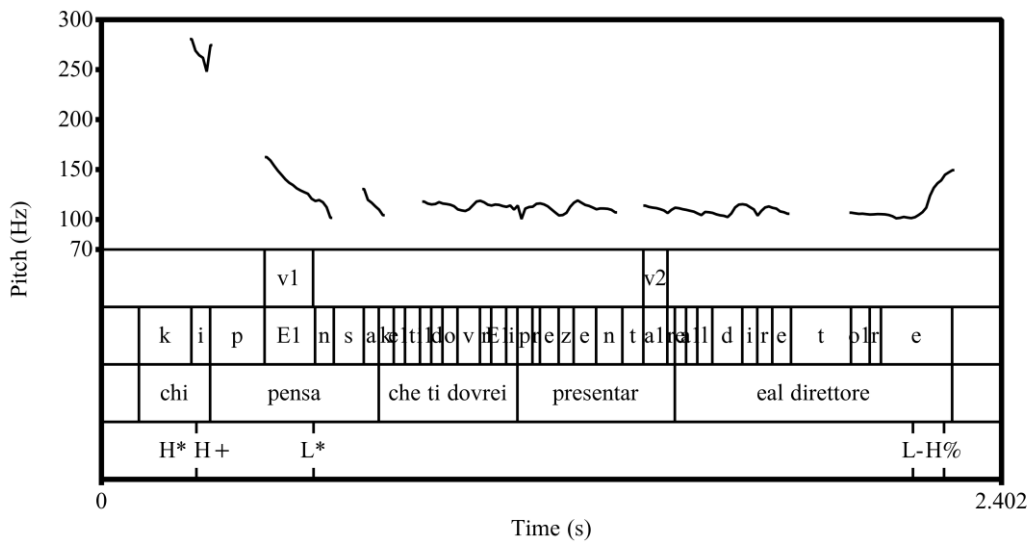
Source. Bocci Bianchi and Cruschina (2021)

⁴ The total number of sentences was the outcome of the following experimental design: 10 speakers * 12 items * 2 conditions (short/long movement) * 2 (disfluency-free) repetitions. The analysis was carried out by two transcribers, who identify the NPA as the rightmost fully fledged PA in the IntP (cf. Gili Fivela et al. 2015). As for the phonetic analyses, the following parameters were considered: the length of the stressed syllable/vowel in V1, in V2, and in the last constituent, and the F0 movement on V2 and the postfocal material. We refer to Bocci, Bianchi & Cruschina (2021) for further details.

In both conditions (short and long movement), the NPA is never (other = 0%) on the rightmost element (i.e. the default position for NPA in Italian), and it is virtually never assigned to the wh-element itself. These results about the short movement condition are consistent with those reported by Marotta (2001, 2002): under short movement, the NPA is virtually always on V1 (96.2%), the verb adjacent to the wh-phrase. However, under long movement we can observe two patterns: the NPA is predominantly (63%) assigned to V2, but in a smaller –but not marginal– percentage of cases the NPA is assigned to V1 (36.1%), which can be viewed as a secondary pattern. Figure 2 shows the pitch contour of a production after the sentence (3a), repeated here below for convenience.

- V1 V2
- (3) a. Chi **pensa** che ti dovrei presentare al direttore?
 who thinks that you.CL should.1SG introduce to-the director
 ‘Who thinks that I should introduce you to the director?’

Figure 2. A pitch contour produced after (3a) featuring short-distance wh-movement: NPA on V1.

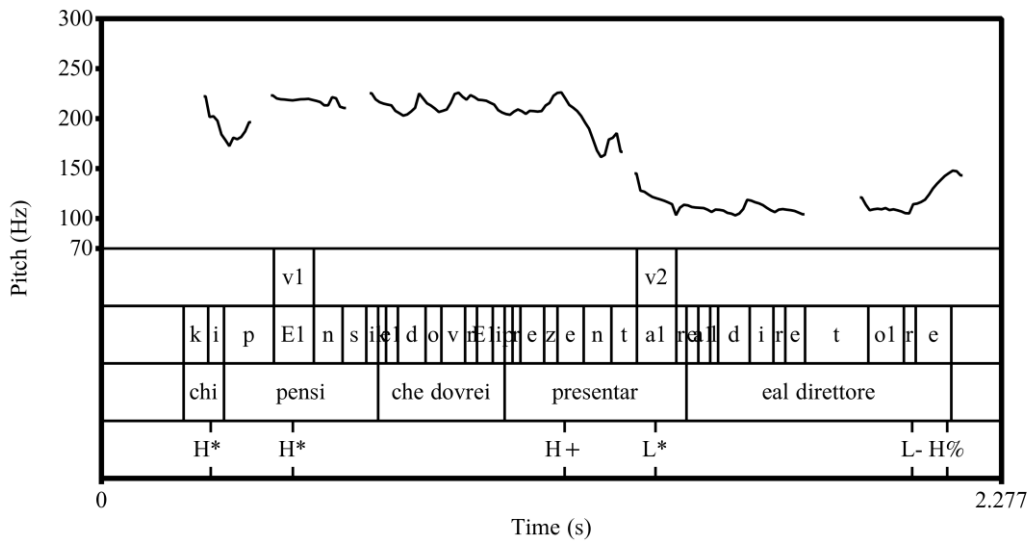


Source. Bocci, Bianchi and Cruschina (2021: Fig.2).

In Figure 3 we see an instance of production with long-distance movement, corresponding to the sentence in (3b). This example illustrates the predominant pattern by which the NPA is assigned to V2:

- V1 V2
- (3) b. Chi pensi che dovrei **presentare** al direttore?
 who think.2SG that should.1SG introduce to-the director
 ‘Who do you think that I should introduce to the director?’

Figure 3. A pitch contour produced after (3b) featuring long-distance wh-movement: NPA on V2.

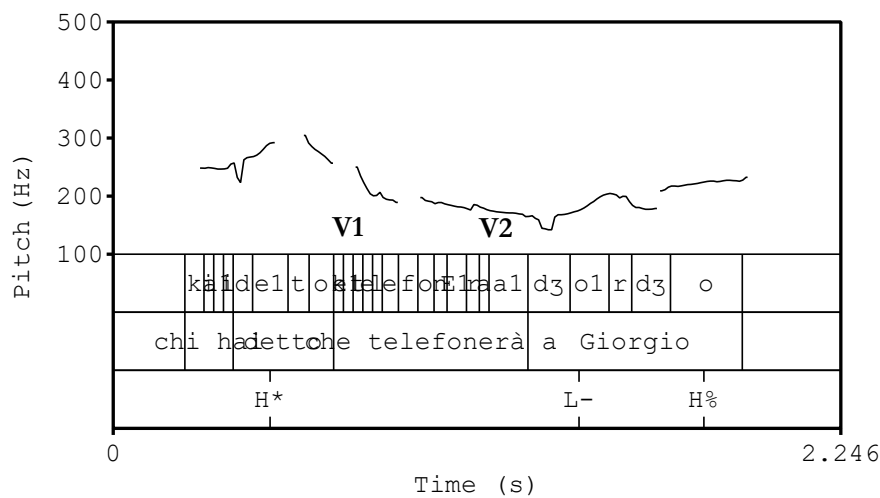


Source. Bocci, Bianchi and Cruschina (2021: Fig.3.1)

The secondary pattern observed under the long-distance movement condition is illustrated in Figure 4, which shows an example of the pitch contour produced in combination with the sentence in (4).

- (4) Chi hai ^{V1} **detto** ^{V2} che telefonerà a Giorgio?
 who AUX.2SG said that phone.FUT.3SG to Giorgio
 ‘Who did you say will call Giorgio?’

Figure 4. A pitch contour produced after (4) featuring long-distance wh-movement: NPA on V1



2.2. Open issues: optionality and comprehension

The results of the production experiment show that with short movement, the NPA is always assigned to V1. With long-distance movement, however, we have a prevailing pattern where the NPA falls on V2, but a secondary pattern with the NPA on V1 is also present to a non-marginal extent (cf. Fig. 1). The availability of these two patterns raises important questions:

- (i) Are we dealing with a case of partial optionality?
- (ii) What is the psychological reality of the analysis that links the syntactic derivation of the *wh*-element with the NPA assignment?
- (iii) Does the NPA distribution play a role in the comprehension of potentially ambiguous questions?

The optionality can be defined as partial because it is limited to long-distance movement. With short movement, the NPA is always assigned to V1 (cf. Fig. 1), so there is no optionality.

If the distribution of the prosodic prominence is part of the grammatical competence of native speakers, as a reflex of the derivational history of the *wh*-phrase and of its cyclic nature, we should expect the NPA distribution to play a role in comprehension, guiding the interpretation of superficially ambiguous utterances. To answer these questions, we carried out an experiment in comprehension, which is described in the next section.

3. The comprehension experiment

3.1. Materials and rationale

To assess the role of prominence distribution in comprehension, we carried out a web-based experiment in which we tested trials containing short dialogues. See the example in (5).

- (5) CONTEXT: A huge fight is about to explode in our condo.
- SPEAKER A:
- Ho detto all'amministratore che i Bianchi hanno mandato una diffida a Carla.
'I said to the building manager that the Bianchis sent a warning notice to Carla.'
- SPEAKER B:
- Scusa, non ho capito. A chi hai detto che hanno mandato una diffida?
'Sorry, I didn't understand. To whom did you say that they sent a warning notice?'

The dialogue ends with a *wh*-question, uttered by Speaker B and repeated in (6), which is compatible with both a long-movement and a short-movement construal, due to the optionality of the goal arguments in both the main and embedded predicate in (5B)/(6). As a result, the question (6) is superficially ambiguous between the structure in (7a) and in (7b).

- (6) A chi hai detto__ che hanno mandato__ una diffida?
to whom have.2SG said that have.3PL sent a warning notice
- (7) a. To whom did you say <to whom> that they sent a warning letter? [short]
b. To whom did you say that they sent a warning letter <to whom>? [long]

Notably, both the short and long construal of (6) are plausible within this exchange. Indeed, Speaker A could propose two distinct answers and both would count as congruent answers to (6): one involving the goal argument of the matrix predicate (e.g. *to the building manager*) and the other involving the goal of the embedded predicate in the embedded clause (e.g. *to Carla*). The first answer corresponds to a short-distance construal of the question (cf. 7a), while the second answer derives from a long-distance interpretation (cf. 7b).

In the light of the results obtained in the production experiment (cf. §2), we can make clear predictions concerning how these superficially ambiguous questions are interpreted in comprehension by the hearer. If the question in (6) is pronounced with the NPA on V2, the hearer (i.e. Speaker A) should assign a long-distance interpretation to the question, since, in production, NPA on V2 was only observed in cases of long-distance movement. Furthermore, we can explore whether the co-existence of two prosodic patterns under the long-distance condition in production represents a genuine case of partial optionality or whether the observed secondary pattern (NPA on V1) should be seen as a misinterpretation of long-distance questions in production, i.e. a systematic experimental error due to the higher structural complexity of long-distance questions.

If we face a case of partial optionality, both the short and the long interpretation should be possible in comprehension when the NPA is realized on V1. Conversely, if we observe in comprehension that the presence of NPA on V1 systematically leads to a short-distance interpretation of the question, we could reasonably conclude that the secondary pattern observed in production was the result of frequent misanalysis of the long-distance questions.

To test these predictions, we thus used prosody (i.e. the location of the NPA) as a predictor of the question interpretation assigned by the hearer. As shown in (8), we manipulated the NPA placement in the *wh*-questions, prerecording utterances in which the NPA is on V1 (8a) and others where the NPA falls on V2 (8b). The pitch contours of our prerecorded material are illustrated in Figures 5 and 6, for the utterances in (8a) and (8b), respectively:⁵

⁵ It is important to note that, even if the context may well support this type of interpretation, the questions in (8) are not echo-questions. First of all, echo-questions are generally uttered as simple questions on a single constituent (cf. i) and not as biclausal questions involving a verb a saying as in (8):

- (i) Gli hanno mandato cosa?
to-them have.3PL sent what
'They send them what?'

Moreover, in Italian, as well as in several other languages, the *wh*-phrase of echo-questions is typically realized post-verbally (cf. Badan & Crocco 2021). This is not the case of the questions in (8).

- (8) a. A chi hai **detto** che hanno mandato una diffida?
 b. A chi hai detto che hanno **mandato** una diffida?
 to whom have.2SG said that have.3PL sent a warning notice

Figure 5. Pitch contour produced after (8a) featuring the NPA in V1

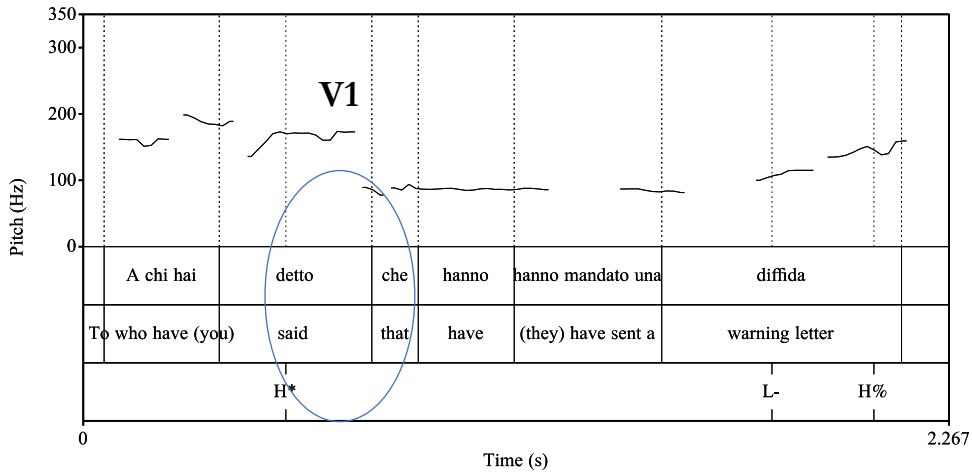
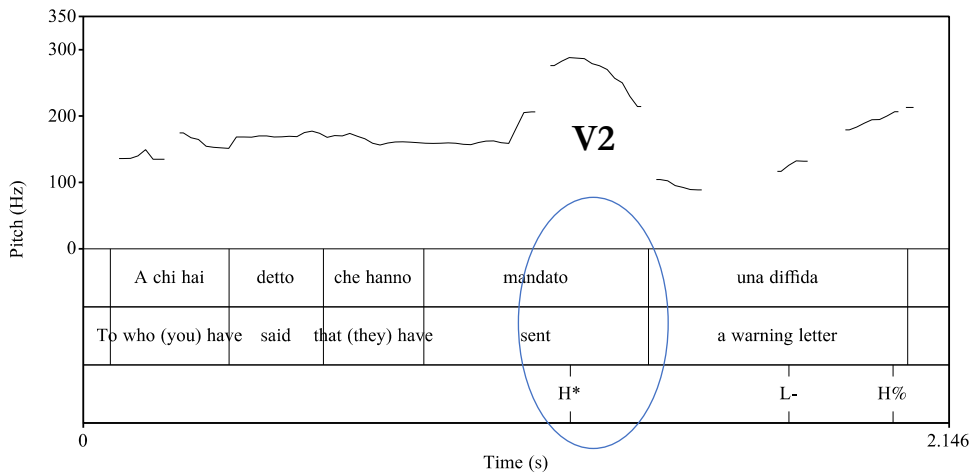


Figure 6. Pitch contour produced after (8b) featuring the NPA in V2



Our participants listened to prerecorded dialogues similar to that in (5). They were instructed to assume Speaker A's role and respond to Speaker B's question by typing their answers in a textbox field.

The collected answers were manually coded to correspond to either a short or long construal interpretation of the wh-question. The interpretation assigned by participants to the question can indeed be inferred from the way they answer the question, as illustrated in (9):

- (9) If a participant answers...
- (i) to the building manager → *short distance interpretation*
 - (ii) to Carla → *long distance interpretation*

If the answer is *to the building manager*, the question is assigned a short distance interpretation. If the answer is *to Carla* the question is interpreted as a long distance wh-question. Following this structure, we design 6 experimental items. In 3 items, the wh-phrase in the biclausal wh-questions was instantiated by an indirect argument (*a chi*, ‘to whom’). In the other 3 items, the wh-phrase corresponded to the adverbial element *quando* ‘when’. The experimental trials are listed in the Appendix.

To create the audio stimuli, we recorded a naïve male speaker (Florence, Tuscan variety of Italian) who read the entire dialogue. For the final audio files, we only used his production of the target wh-questions (Speaker B), while the parts corresponding to Speaker A were cut and replaced with the recordings of another speaker (the third author). When recording the naïve speaker, the dialogues to be read aloud (cf. 5) were presented with an additional turn produced by Speaker A, that is, the answer to the wh-questions that disambiguated the relevant interpretation of the question. For instance, (5) was presented with the answer (9i) and then again, the answer (9ii), corresponding to the long-distance and the short distance interpretation, respectively.

The naïve speaker read the entire dialogues, playing both roles (Speaker A and Speaker B), 8 times: 4 repetitions were produced under the short construal condition, and 4 repetitions under the long construal condition. The intended interpretation of the question was indicated by a side paraphrase and by the answer the question received. The naïve speaker played both roles since we wanted to be sure that his productions were not influenced by the interaction with another speaker. However, to simulate realistic exchanges, we had to create dialogues between two interlocutors. Therefore, the naïve speaker’s recordings were segmented using Praat (Boersma & Weenink 2024) to extract only the turns corresponding to Speaker B, which contained the biclausal wh-question. From these fragments, we selected a repetition with the intended prosodic pattern (NPA on V1 and NPA on V2). In more detail, we always started the selection from the second repetition. If the second repetition did not exhibit the relevant prosodic pattern or contained disfluencies, we proceeded to the subsequent repetitions (in the order of 2-3-4).

The researcher independently recorded Speaker A’s turn in isolation. Subsequently, the intensity (root-mean-square) of the selected fragments was normalized, and the dialogues were assembled to create the audio stimuli. Each audio file consisted of a short beep (0.2 s), followed by a brief pause (1 s), Speaker A’s turn, and, after another pause (1.5 s), Speaker B’s turn (e.g., either 9i or 9ii). These phonetic procedures were conducted with Praat. As a result, we obtained pairs of experimental stimuli that differed in the prosody of Speaker B’s wh-question but were identical with respect to Speaker A’s turn, as the same recording was used.

We followed an analogous procedure to create the audio stimuli used for filler and practice trials (see §3.2), but only 4 repetitions overall were collected as the filler and practice trials, not experimentally manipulated based on NPA-position or type of construal within-items.

3.2. Procedure

With this methodology, we tested 44 participants recruited via Prolific (www.prolific.com). The recruitment campaign on Prolific targeted individuals who are native speakers of Italian, born and currently residing in Italy, and who reported no literacy difficulties or language-related issues. They were paid 3GBP for their participation. The web-based experiment lasted on average 15 minutes and was

implemented on PCIBex (<https://farm.pcibex.net/>, Zehr & Schwarz 2022). The independent factor was the prosody of the wh-question (in Speaker B's turn): the NPA was assigned either to V1 or V2. We tested 6 experimental items under 2 conditions (NPA on V1 vs. NPA on V2) for a total of 12 experimental stimuli (see Appendix). The experimental trials were divided into 2 lists, following a Latin Square procedure. Within a single list, an item appeared only once, under a single condition. To each list, consisting of 6 experimental trials, we added 6 filler trials (identical across lists). The filler trials consisted of exchanges analogous to (5), but containing an *unambiguous* biclausal wh-question: 3 fillers with a short construal wh-question, and 3 fillers with a long construal wh-question.

The experiment started with a description of the task, followed by the presentation of the consent form.⁶ Subsequently, participants were presented with a short sociolinguistic questionnaire to gather information, including whether they were native speakers of Italian, their age, whether they were bilingual (and what languages they spoke), where they lived (country, region/city), upbringing location, and language-related issues. Detailed instructions were then provided, followed by a familiarization session comprising four practice trials. These trials resembled filler trials and featured unambiguous wh-questions (2 trials with short construal and 2 trials long construal). Following the familiarization session, the experimental session began. The presentation order of the trials was pseudo-randomized for each participant, with experimental and filler trials interspersed. Finally, participants were presented with a debriefing page explaining the aim of the experiment.

During the trials, in addition to auditory presentation of the entire exchange, Speaker A's turn was displayed on the screen as text. The audio playback began automatically after a 0.5-second delay from the start of the trial. Participants were given the option to replay the dialogues if desired (as a whole).

As described above, participants were instructed to listen to the dialogues and respond to the final question by assuming the role of Speaker A. Their task was to type the answer in a textbox field. Subsequently, the answers were manually categorized as congruent with either a short- or a long-distance interpretation of the wh-question.

3.3. Results

Out of the 44 participants, data from one participant were discarded due to reported language-related issues in the questionnaire. The remaining 43 participants met the recruitment criteria. We utilized the answers provided for the filler trials, which contained unambiguous wh-questions, as an attention check. The analysis of the fillers indicated that three participants provided more than two incongruent answers to unambiguous questions. Therefore, their answers were removed, resulting in a reduction of the number of observations to 40 participants.

To analyse the data, we constructed a linear mixed model with the package *lme4* (Bates et al. 2015) in *R* ('R: A Language and Environment for Statistical Computing' 2020), in which the probability of the short-distance interpretation was predicted by the binary factor *NPA-location* (NPA on V1 vs. NPA on V2). This factor was specified using a treatment coding, with NPA on V1 as the reference category.

⁶ The experimental protocol was approved by the Ethics Committee for Research in the Human and Social Sciences of the University of Siena (CAREUS) (act. no. 18/2021).

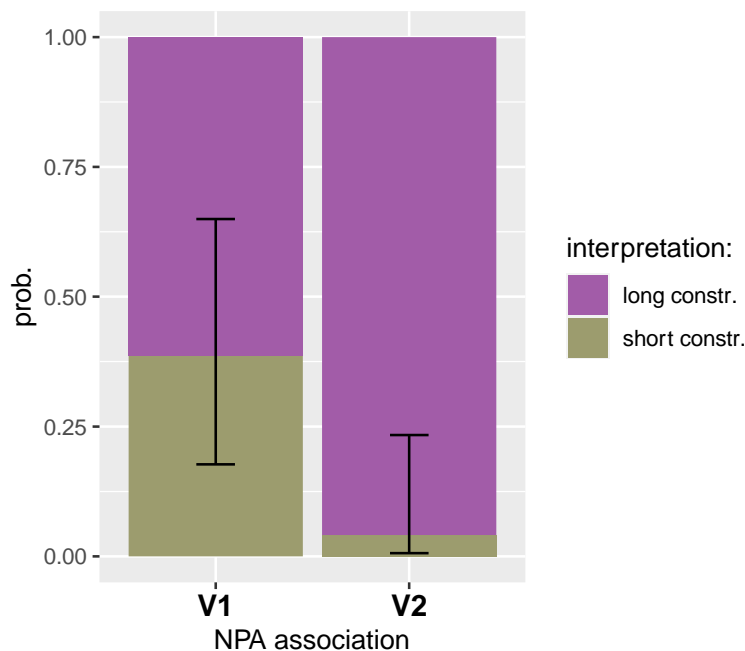
The most complex error structure justified by the data included by-items and by-participants intercepts. The details of the model are provided in Table 1.

Table 1. Details of the mixed linear model.

	Est.	S.E.	z val.	p value
Intercept (NPA on V1)	-0.449.	0.5242	-0.86624	0.386
NPA on V2	-2.8260	0.9097	-3.106	<.002

The values estimated by the model were extracted using the *effect* package (Fox & Weisberg 2019) and are represented in Figure 7, where the probability of the short interpretation (in green) over the long interpretation (in purple) is plotted as a function of the prosody of the questions: the NPA on V1 or V2.

Figure 7. Predicted probability of the association between NPA and long vs short interpretation.



The model revealed that when NPA is realized on V1, the probability of having a short interpretation over a long interpretation is not significantly different from chance ($p = 0.386$). By contrast, when NPA is assigned to V2, the probability of the short-distance interpretation is significantly lower ($p < 0.002$). See Table 1.

These findings from comprehension are fully consistent with the results from production (cf. §2, Fig. 1). First, they confirm our hypothesis that the association of the NPA with V2 forces the hearer to interpret the wh-question with a long-distance dependency. Second, they indicate that we are dealing with a case of partial optionality. In comprehension, the association of the NPA with V1 is compatible with both the short and long construal.

3.4. Empirical findings: A summary

Let us recap the empirical findings discussed so far. Italian *wh*-questions with a bare *wh*-element are characterized by a marked prosodic structure, in which the NPA is always assigned to a lexical verb. If the *wh*-extraction takes place from the matrix clause, by means of short-distance movement, the NPA is always realized on the lexical verb of the matrix clause (V1). On the other hand, if the *wh*-phrase is extracted from the embedded clause, via long-distance movement, the NPA can be assigned either to the verb in the matrix clause (V1) or to the verb in the embedded clause (V2). This yields a case of partial optionality in production, which is illustrated in (10):

- (10) a. with short distance movement → NPA on V1 (no optionality)
 b. with long distance movement → NPA on V1 or V2 (optionality)

This pattern is confirmed in comprehension (11). When the NPA is placed on V2 (11b), the hearer assigns a long-distance construal, while when NPA is assigned to V1 (11a), there is optionality of interpretation between the short- and long-distance construal:

- (11) a. NPA on V1 → either short or long distance (optionality)
 b. NPA on V2 → long distance (no optionality)

The empirical evidence from the comprehension experiment, therefore, proves the relevance of this phenomenon also at the psycholinguistic level: the NPA distribution is exploited in comprehension by the hearer as a clue to parse the syntactic structure.

4. The analysis

In this section, drawing from Bocci, Bianchi & Cruschina (2021), we present the syntactic analysis that we would like to propose to account for the empirical findings discussed in the previous sections. This analysis is based on a set of assumptions, both about the syntax of *wh*-questions (cf. §4.1) and about the syntax-prosody interface (cf. §4.2).

4.1. Syntactic assumptions

The evidence from comprehension confirms that the NPA placement is sensitive to the derivational history of the *wh*-phrase. We assume that the syntactic computation is subject to Phase Impenetrability Condition: In phase α with Head H, the domain of H is not accessible to operations outside α , only H and its edge are accessible to such operations. (Chomsky 2000:108). Furthermore, based on Bocci, Bianchi & Cruschina (2021), we adopt the following specific syntactic assumptions:

- (i) In Italian, *wh*-phrases are endowed with [wh] and [focus] features (cf. Rizzi 1997, Aboh 2004, a.o.).
 (ii) Under cyclic movement, *wh*-phrases *optionally* agree for [focus] with the phase heads (v° or C°) whose edge they move through; agreement is only mandatory

in the criterial position, that is, in the final landing site. This is illustrated in (13) for the English sentence in (12):⁷

(12) Who does Mary think John saw?

(13)

[_{CP} Who_{WH/F} C[°] [_{TP} Mary [_{VP} who_{WH/F} v[°] think [_{CP} who_{WH/F} C[°] [_{TP} John [_{VP} who_{WH/F} v[°] saw who_{WH/F}]]]]]]

4.2. Assumptions on the syntax–prosody interface

As for the syntax-prosody interface, we assume that:

- (iii) The NPA is assigned to the rightmost non-phonologically null element that is endowed with [focus]. If none bears [focus], the NPA is assigned by default to the rightmost non-null element.
- (iv) The prosodic structure is organized in accordance to the Strict Layer Hypothesis (cf. Selkirk 1984, 1996, Nespor & Vogel 1986, Truckenbrodt 1995, 1999, a.o.).
- (v) A phonological phrase boundary must be aligned with the right edge of the element which is assigned main prominence and the NPA (cf. Frascarelli 2000, Bocci 2013, a.o.).
- (vi) Prosodically-dependent elements cannot be wrapped into independent phonological phrases, unless they are the only pronounced elements within an intonational phrase.⁸

With respect to these assumptions, we adopt the morphophonological model proposed by Calabrese (2005, 2019). Put it in a nutshell, in this approach the grammar includes both *rules* (positive statements) and *filters* (negative statements). Filters check that a structure is well-formed, so the violation of a filter may lead the structure to crash.⁹ Following this model, it becomes clear that some of the specific assumptions (iii) and (v) are positive statements, while (vi) is a negative statement, i.e. a filter.

First of all, if the structure contains an occurrence of a focus feature [focus], the NPA must be assigned to a syntactic element that bears this feature. Since the structure may involve several instances of [focus], we need to assume (iii): the NPA must be assigned to the rightmost phonologically realized element that bears [focus]. Crucially, the phonological computation does not differentiate between the criterial instances of the focus feature in the final landing site of the wh-phrase and the formal

⁷ Even if we do not discuss it here, it must be clear that we assume that wh-phrases also agree with phase heads with respect to the [wh] feature. While agreement with the [focus] is optional, agreement with the [wh] feature always takes place. In fact, it is this feature that attracts the wh-phrase up to its final landing site. As discussed in Bocci, Bianchi & Cruschina (2021), it is possible to implement these agreement operations with the analysis proposed in Georgi (2017).

⁸ For the sake of simplicity, we are omitting consideration of the utterance phrase level.

⁹ Even if we adopt Calabrese's model, it must be pointed out that our proposal could be reformulated in other frameworks, such as in terms of Classical OT (cf. Prince & Smolensky 1993).

instances of the same feature in the intermediate steps (cf. Rizzi 1997 for this distinction).

The assumptions in (iv) and (v) are positive statements. The prosodic structure must adhere to the organization regulated by the principles and constraints of the Strict Layer Hypothesis, and the element that receives the NPA must be followed by a phonological phrase boundary.

Finally, (vi) states that prosodically dependent elements cannot form independent phonological phrases, unless they are the only pronounced elements within an intonational phrase. For the purposes of this paper, we assume that this prosodic class includes functional elements that cannot form independent phonological phrases, except when they turn out to be the only elements that are pronounced within an intonational phrase. More specifically, besides bare *wh*-phrases (with the relevant exception of *perché* ‘why’),¹⁰ this class includes elements like *hell*-expressions in aggressively non-D-linked *wh*-phrases,¹¹ complementizers, auxiliaries, conjunctions, and light prepositions. The assumption in (vi) is therefore a negative statement that acts as a PF-filter: when a prosodically dependent element is assigned main prominence and the NPA and it is phrased as an independent phonological phrase by virtue of (iv), the negative PF-filter in (vi) rules out the structure as ill-formed.

The observation that functional and lexical elements manifest distinct patterns regarding prosodic phrasing and prominence distribution holds consistent across various languages (see Elordieta 2008). Typically, functional elements, whether monosyllabic or polysyllabic, exhibit resistance towards being independently phrased into distinct phonological phrases and tend to be grouped along with an adjacent lexical element (typically to the following one, in Italian). Different models of the syntax-prosody interface have proposed different analyses to capture this distinction (see Elordieta 2008 for an overview). For instance, Selkirk (1984) proposes the *Principle of the Categorical Invisibility of Function Words* (but see also Selkirk 1996), whereas Truckenbrodt (1999) defines the *Lexical Category Condition*, according to which constraints relating syntactic and prosodic categories apply to lexical syntactic elements and their projections, but not to functional elements and their projections, or to empty syntactic elements and their projections. On different grounds, the distinction between functional and lexical elements is also central within the Relation-Based model developed by Nespor and Vogel (1986). In their proposal, the definition of the phonological phrase domain makes explicit reference to lexical elements.

By introducing the descriptive label of ‘prosodically dependent elements’, we aim to capture the commonly observed behaviour of functional elements at the syntax-prosody interface. This move deliberately sidesteps the exact phonological representation of these functional elements and abstracts from the specificity of different theoretical frameworks. What seems to be specific to Italian, as compared to English at least, is that focus does not easily induce a reorganization of the prosodic structure in which main prominence and the NPA are assigned to a functional element. This is why we have formulated (vi) as a filter.¹²

¹⁰ On the exceptional status of *perché* ‘why’, see footnote 1.

¹¹ On aggressively non-D-linked *wh*-phrases, see Bocci (2013) and Bocci, Cruschina & Rizzi (2021).

¹² A more comprehensive investigation of the prosodic behavior of functional elements in Italian potentially might prompt a redefinition of (vi), wherein the effect of the filter may

Before concluding the presentation of our assumptions, it is worth mentioning that by assuming (vi), our analysis of the peculiar pattern of wh-questions may, in future work, be integrated into a general account of the prosodic status of functional elements on phonological grounds. In this specific respect, the current approach contrasts with the analysis of wh-questions originally proposed by Marotta (2001), where the impossibility of associating NPA and main prominence to the bare wh-elements was connected to the morphosyntactic status of the latter. Under this view, wh-elements are analysed as morphosyntactically deficient and, more specifically, as weak elements in the sense of Cardinaletti and Starke (1999). As weak morphosyntactic elements, they are assumed to fail to bear prominence, which is then discharged on the adjacent material.

Although the original analysis formulated by Marotta cannot *per se* explain the patterns observed in long-distance wh-questions, Bocci, Bianchi, and Cruschina (2022) elaborated Marotta's insight of wh-phrases as weak elements to account for the behaviour of questions with long construal. While, on the one hand, this morphosyntactic approach is appealing since it traces back prosodic facts to specific morphosyntactic properties (and to the machinery of the syntactic computation), on the other, it requires one to postulate the existence of an almost complete double and homophonous series of wh-elements in Italian: a weak series and a strong series, with the latter being capable of bearing the NPA in fragment wh-questions (cf. footnote 13; see Bocci, Bianchi, and Cruschina 2022 for discussion).

4.3. Implementation and operational mechanisms

Having introduced the relevant assumptions in the previous section, let us explore how our analysis works. In a nutshell, the interaction of the rules (iii)–(v) and the filter in (vi) above penalizes in Italian those syntactic structures in which the only element endowed with [focus] is a purely functional bare wh-phrase. More specifically, (iii) excludes the default prominence-assignment in fully-fledged wh-questions, while the following assumptions, and in particular the filter in (vi), prevent NPA assignment to the wh-element. Therefore, a derivation in which the bare wh-element only agrees in its final landing will be always penalized over a derivation in which at least one lexical element obtains [focus] through optional agreement, since only in the last type of derivation can the filter in (vi) be satisfied, by assigning the NPA to another non-prosodically dependent element that shares the [focus] feature.

Under long-distance movement, the wh-phrase passes through the edge of the embedded vP and CP, then to the matrix vP, finally to the landing site in the matrix Spec/CP, as shown in (14):

$$(14) \quad [{}_{CP1} \text{ WhP}_F \text{ C}^0_{(F)} \dots [{}_{vP1} \langle \text{whP}_F \rangle \text{ v}^0_{(F)} \dots [{}_{CP2} \langle \text{whP}_F \rangle \text{ C}_{(F)} \dots [{}_{vP2} \langle \text{whP}_F \rangle \text{ v}^0_{(F)} [{}_{VP} \dots \langle \text{whP}_F \rangle]]]]]$$

If the wh-phrase agrees in the edge of vP2 by (ii), the embedded clause v⁰ head inherits [focus]. The head incorporates the lexical verb V2, and at the syntax-prosody interface, it qualifies as the rightmost [focus]-marked element and is assigned the NPA by (iii); both (v) and (vi) are satisfied. Alternatively, if the wh-phrase only agrees in

be restated as emerging through the interplay of violable constraints within the Optimality Theory (OT) framework (see Selkirk 1996, 2011, and Truckenbrodt 1995).

the edge of the matrix vP1, the matrix verb V1 qualifies for the NPA assignment. Thus, long-distance movement is compatible with both prosodic structures.

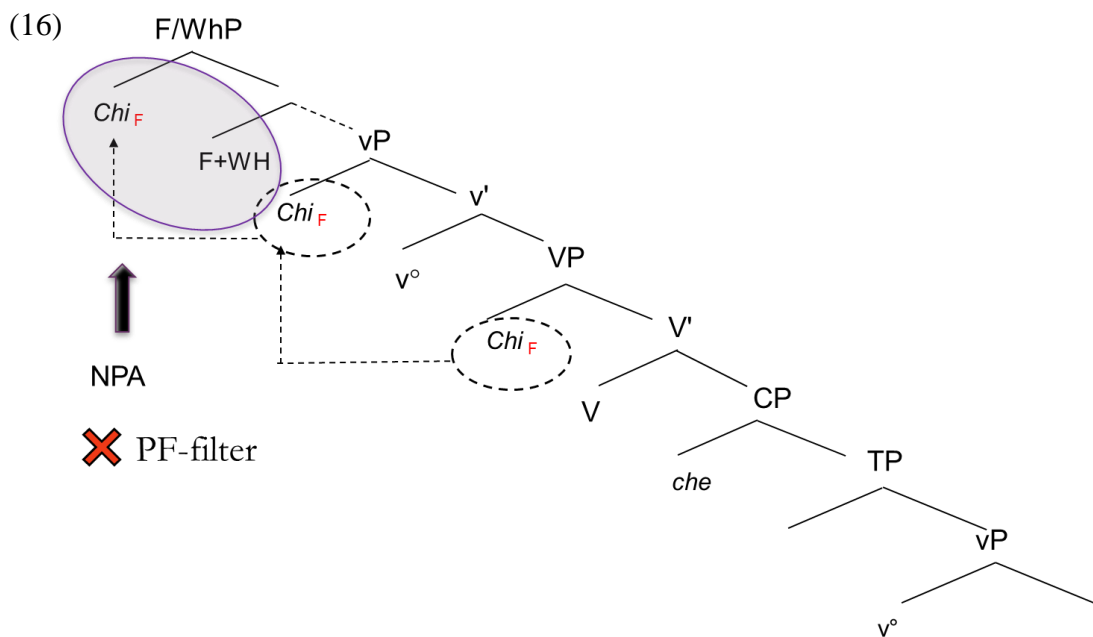
In contrast, when the wh-element undergoes short-distance movement, it only passes through the edge of the matrix clause vP1. The matrix v^0 receives the [focus] feature by Agree, and it is assigned the NPA: thus, the short-distance interpretation is only compatible with one prosodic structure.

Let us now examine in more detail, and with the help of examples, how our analysis is able to account for and to predict the possible and impossible prosodic patterns that we have discussed in the previous sections.

4.3.1. *NPA on a bare wh-element

Let us start with how the PF-filter allows us to rule out as an impossible prosodic pattern the assignment of the NPA to bare wh-elements. Bare wh-elements like that in (15), corresponding to example (3a) above, are never assigned the NPA, but for the sake of the argument, let us suppose a structure in which the initial wh-element is associated with the NPA – this is why we marked it in bold in (15).

- (15) ***Chi** pensa che ti dovrei presentare al direttore?
 who thinks that you.CL should.1SG introduce to-the director
 ‘Who thinks that I should introduce you to the director?’



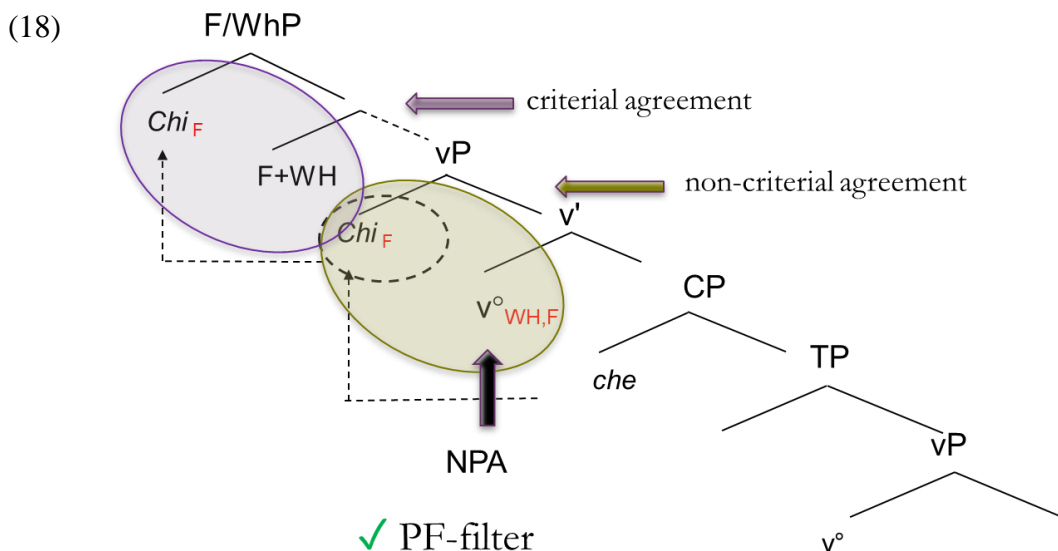
As we can see in (16), the wh-element is extracted from its first merge position and reaches its final landing site in the left periphery. Since [focus] sharing is optional in non-criterial positions (cf. (ii) above), the wh-phrase could reach the left periphery without sharing its focus feature with v^0 . In principle, at the syntax prosody interface, the mapping rule should thus assign the NPA to the wh-element itself since it is the only element endowed with the focus feature. However, *chi* is prosodically dependent:

the insertion of the phonological phrase boundary after the dependent wh-phrase *chi* gives rise to an ill-formed prosodic structure that the PF-filter rules out.¹³

4.3.2. NPA on V1 with short-distance movement

We now turn to how our analysis derives the different patterns that are actually possible, and we start with a wh-question with a bare wh-phrase featuring short-distance movement. In (17) we have the same example as in (15), but this time we analyse how the NPA is assigned to V1:

- (17) **V1** Chi **pensa** che ti **dovrei** **V2** presentare al direttore?
 who thinks that you.CL should.1SG introduce to-the director
 ‘Who thinks that I should introduce you to the director?’



With short-distance movement the NPA is always assigned to V1. As shown in (18), the wh-element is externally merged in the matrix clause, within the little v phase. Here an agreement relation can be established between the phase head and the wh-element. This non-criterial agreement is indicated with a green circle. The wh-

¹³ Note that the impossibility of the NPA assignment to bare wh-elements is specific to Italian. Jitcă et al. (2015) report that in Romanian bare wh-elements systematically associate with main prominence; beyond Romance, the same pattern is found in several other languages, including Greek, Hungarian and Russian (cf. Ladd 1996, Duryagin 2020). Notably, also in Italian the interaction among (iv)–(vi) does not prevent a bare wh-phrase from associating with the NPA: in wh-fragments like (i) below, the filter in (vi) does not apply since the wh-element is the only overt element in the intonational phrase:

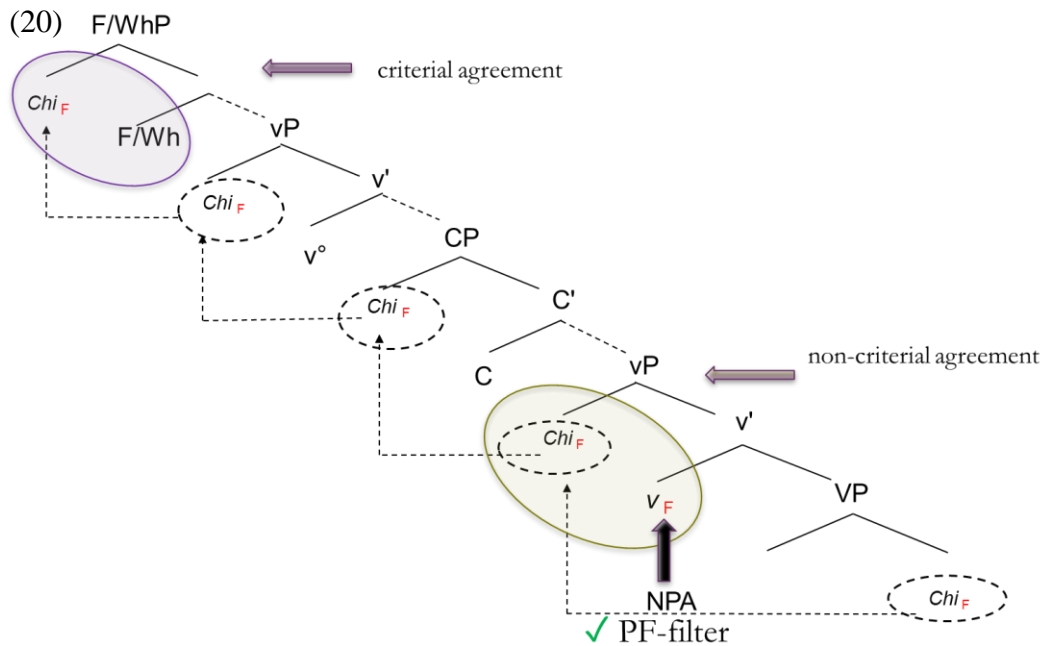
- (i) A: Hanno rotto qualcosa.
 have.3PL broken something
 ‘They broke something.’
 B: Che cosa?
 ‘What?’

element then moves up to the left periphery to meet the wh-criterion in its final landing site, indicated in purple. The embedded verb (V2) lacks both [wh] and [focus]. The rightmost phonologically realized element endowed with [focus] is then the lexical verb that incorporated in little *v* (V1), which is thus assigned the NPA. A phonological phrase boundary is inserted after the lexical verb: the resulting prosodic structure is well-formed, since the prosodically dependent wh-element is phrased together with the lexical verb.

4.3.3. Primary pattern with long-distance movement: NPA on V2

Let us now consider a case of a wh-question featuring long-distance movement like (19), which repeats (3b) above. In this structure, the NPA is assigned to V2, which is the prevailing pattern with long-distance movement:

- (19) V1 Chi pensi che dovrei V2 presentare al direttore?
 who think.2SG that should.1SG introduce to-the director
 ‘Who do you think that I should introduce to the director?’

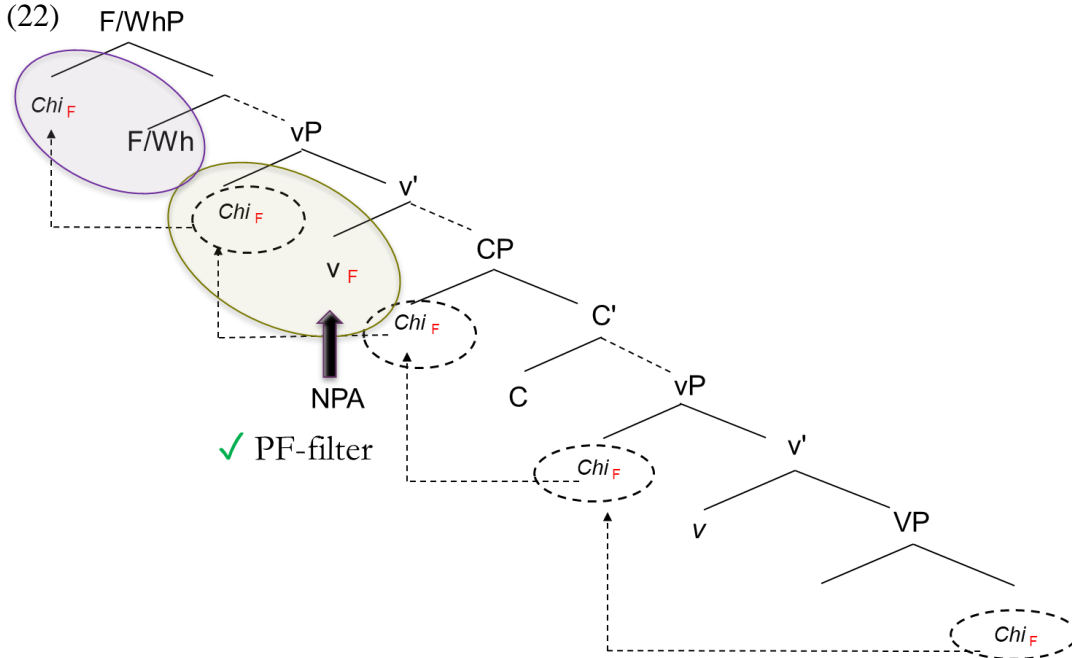


We assume that the wh-element, along its way to the matrix left periphery, shares [focus] with the little *v* phase in the embedded clause (cf. 20). The NPA is thus assigned to this position, where V2 is incorporated and counts as the rightmost phonologically realized element endowed with [focus]. This triggers the insertion of the phonological phrase boundary after the lexical verb: the resulting prosodic structure is well-formed and does not violate the PF-filter.

4.3.4. Secondary pattern with long-distance movement: NPA on V1

In Section 2.1, we showed that a secondary pattern is possible with long-distance movement, whereby the NPA is assigned to V1 (cf. 21):

- (21) **V1** Chi **pensi** che **dovrei** **V2** **presentare** al **direttore?**
 who think.2SG that should.1SG introduce to-the director
 ‘Who do you think that I should introduce to the director?’



We assume that in this case the wh-element does not establish agreement with the little *v* in the embedded clause (cf. 22). However, the wh-element does agree in the little *v* phase of the matrix clause. The matrix lexical verb (V1) is thus assigned the NPA, since it qualifies as the rightmost phonologically realized element endowed with [focus]. Once again, the phonological phrase boundary can be inserted after the lexical verb without offending the PF-filter.

5. Conclusions and further directions

Our empirical findings show that in Italian bare wh-questions, NPA distribution keeps track of the syntactic history of the wh-element. That phonology can mark the intermediate steps of the cyclic syntactic computation has already been described with respect to tonal languages (see Clements 1984 on Kikuyu, and Korsah & Murphy 2016 on Asante Twi/Akan). What these data show is that phonology can mark the intermediate steps also in an intonational language like Italian.

Furthermore, the findings in comprehension show that speakers exploit prosodic cues to parse the sentence, confirming the psychological reality of the linguistic analysis. Strikingly, this holds despite a clear dissociation between the phonological correlates of the focus feature and the position in which the focus feature is interpreted at the conceptual intentional interface, insofar as the verb is phonologically marked as focus, but it is not interpreted as such.

As consequence, these data show that focus cannot be directly encoded at PF: the interpretation of focus and its phonological correlates can be dissociated. In our

view, this provides a novel piece of empirical evidence to reject an interface approach to focus, in which focus is directly encoded at PF (cf. Reinhart 2006).

Several new questions emerge in light of the findings presented in this article, which identify possible extensions within this work and potential areas for future research. We list a few of the most prominent issues here. First of all, in our experiment, we only tested the position of the NPA, but it would be interesting to test the perceptual relevance of cues other than F0 play a role in the disambiguation of the sentences that allow for both interpretations (long and short distance) when the NPA falls on V1 (cf. Bocci, Bianchi & Cruschina 2021 for a phonetic analyses of F0 and of vowel duration in production). Along the same lines, it could be worth investigating whether the high plateau that stretches all the way from the left edge of the utterance to V2 (cf. Fig. 3 above) is a constant of the NPA-on-V2 pattern or is rather subject to inter-speaker variation.

Secondly, the analysis defended in this paper is not able to account for the prosody of sentences with focus fronting in Italian, in which the focus constituent appears in the left periphery of the clause and necessarily bears the NPA. In these structures, the NPA can never be assigned to the verb. Different assumptions are therefore needed about the agreement mechanism when the [focus] feature does not combine with the [wh] feature. A preliminary speculation in this direction could be that agreement for [focus] is parasitic on the one for [wh] (see footnote 7).

Finally, in this article we have only discussed bare wh-elements, but the prosodic pattern is different with wh-elements other than the bare ones. Bocci, Cruschina & Rizzi (2021), for example, discuss a distinct pattern with a specific type of partitive wh-phrase (cf. 23), where the NPA is significantly more likely to associate with the wh-element rather than with the verb:

- (23) Chi di **voi** ha lavato il divano?
 who of you have.3SG washed the couch
 ‘Who of you washed the couch?’

A similar pattern is also possible when the wh-phrase includes a lexical restriction, usually with a D-linked interpretation, as in (24):¹⁴

- (24) A quale ragazzo pensi che dobbiamo presentare il direttore?
 to which boy think.2SG that should.1PL present.INF the direct
 ‘To which boy do you think we should introduce the direct?’

We are currently working on wh-questions with these other types of wh-phrase and we hope to be able to report our results soon, in our future research.

¹⁴ The question of the NPA position in these types of wh-questions was raised by anonymous reviewer, who also observed that under the appropriate contextual conditions, wh-questions like (3a) above could be uttered with the NPA on the wh-element *chi* ‘who’. Indeed, the context that the reviewer specified fully supports a partitive interpretation of the wh-phrase, where *chi* has the meaning of ‘who of us’ or ‘who of them’.

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