The complex prosody of complex wh questions

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Abstract

In this paper, we investigate the prosody of wh-questions with a complex wh-phrase, focusing on the role of the presence of a lexical restriction (e.g., *what book*) and of D(iscourse)-linking of the wh-phrase in the distribution of the main prosodic prominence (or nuclear pitch accent [NPA]). Through three read-aloud production studies, we show that the presence of a lexical restriction within the wh-phrase is a necessary condition for NPA assignment to the latter; that lexically restricted wh-

phrases allow for NPA assignment to both the verb and the wh-phrase; that the likelihood of NPA assignment to the wh-phrase is sensitive to the phonological heaviness of the wh-phrase, and that D-linking *per se* is neither a necessary nor a sufficient condition for such NPA assignment, such that there is no detectable correlation of NPA assignment with an interpretive effect. The distribution of NPA assignment in complex wh-questions is discussed in light of the analysis proposed by Bocci et al. (2021, 2024) for bare wh-questions.

Keywords: wh-questions, prosody, intonation, syntax, focus.

1. Introduction

In this paper, we investigate the realisation of the main prosodic prominence (or nuclear pitch accent, [NPA]) in Italian wh-questions with a complex wh-phrase. We focus on two dimensions: the presence of a lexical restriction (e.g., *which book, what book*) and D(iscourse)-linking of the wh-phrase. Previous work on wh-questions with a bare wh-phrase (*who, what, when*) has shown that Italian features a peculiar pattern in the assignment of main prosodic prominence, because the NPA is assigned neither to the sentence-final prosodic constituent, which constitutes the default position for Italian NPA (Gili Fivela et al. 2015), nor on the wh-phrase, which should qualify as the focal element in the utterance, but rather on the lexical verb (as in (1)); throughout the chapter, boldface in the examples will indicate the word carrying the NPA) (Calabrese 1982, Ladd 1996, Marotta 2001, 2002).

(1)   Che   cosa **legg-erai**   sull'aereo?
       what thing read-FUT.2SG   on_the_plane
       'What will you read on the plane?'

Bocci, Bianchi and Cruschina (2021, 2024) provided experimental evidence from production and comprehension that NPA assignment is sensitive to the derivational history of the wh-phrase. Specifically, under long-distance wh-movement from an embedded clause, as in (3), the NPA can fall either on the embedded clause verb or on the matrix verb. In contrast, under short distance movement as in (2), the NPA falls on the matrix verb only.

(2)   [CP   A   chi   hai   [vP   **detto** *t* [CP   che   ti=hanno   [vP   rubato
             to   who   have.2SG   said   that you.DAT=have.3PL   stolen
             la   macchina]]]]?
             the car
             'To whom did you say that your car was stolen?'
(3)   [CP   A   chi   ti=ha [vP   **detto** [CP   che   hanno   [vP   **rubato**   *t*
             to   who   you=has   said   that have.3PL   stolen
             la   macchina]]]]?
             the car
             'To whom did s/he tell you they stole the car?'

In a nutshell, the authors propose that the wh-phrase moves successive-cyclically through the edge of every vP and CP phase edge on its way from the external Merge (base) position to its final landing site and, in the intermediate chain links, it optionally transmits its [Focus] feature to the phase head under agreement. Thus, when the wh-phrase moves through the edge of a vP, the v° head can optionally receive [Focus]; since v° is incorporated to the lexical verb, the latter qualifies for NPA assignment. On the other hand, a PF filter prevents a bare wh-element from realising the NPA, since there is no (overt) lexical content, and purely functional elements are prosodically weak.

Notice that the hypothesized PF filter is expected not to apply to a wh-phrase that contains a lexical restriction. Then, the prediction is that, other things being equal (i.e. maintaining the assumption that all wh-phrases are [Focus]-marked and optionally share this feature with phase heads), lexically restricted wh-phrases should be able to bear the NPA. Bocci, Cruschina and Rizzi (2021) provide some preliminary evidence to this effect: in another production experiment, partitive wh-phrases like the one exemplified in (4) were assigned the NPA in the majority of cases.

(4)   [Chi di **voi**] ha lavato il divano?
       'Who of you washed the couch?'

Notice that this line of reasoning implies that the presence of a lexical restriction is a necessary condition for NPA assignment. The presence of a +NP feature in the wh-phrase has been hypothesized to be responsible for some syntactic effects found for so-called D-linked wh-phrases (see §2 below). On the other hand, the contrast between the bare wh-phrases in (2)-(3) and the partitive one in (4) could also be thought of as a difference in discourse properties, also associated with the notion of D-linking more properly: this opens the logical possibility that D-linking be a conditioning factor on NPA assignment.

Interestingly, Bocci, Cruschina and Rizzi (2021) found that in questions like (5), featuring the 'aggressively non-D-linked' wh-phrase *chi diavolo* 'who the hell' (lit. 'who devil'), the NPA was virtually never assigned to it. However, the wh-phrase also lacks a lexical restriction, because the noun diavolo 'devil' does not denote a restriction set, but it qualifies as a purely functional element.

(5)   [Chi diavolo] ha **lavato** il divano?
       'Who the hell washed the couch?'

Therefore, the factors underlying the assignment of NPA in complex wh-questions remain to be clarified. We developed a set of experiments to address this gap in the literature. After reviewing different notions of D-linking proposed in the literature (section 2), in section 3 we present two production experiments that tested the hypothesis that lexical restriction is necessary for the wh-phrase to bear the NPA, as well as the possible role of D-linking (conceived as a pragmatic feature, or as a presupposition imposed by the wh-determiner). The results suggest the further hypothesis that the prosodic weight of the wh-phrase may be a relevant factor; this factor was tested in a third production experiment reported in section 4. Finally, in section 5 we discuss our findings and then propose some concluding remarks in section 6.

2. Notions of D-linking

The syntactic literature, starting from Pesetsky (1987) and Cinque (1990), has invoked the notion of D(iscourse)-linking to characterize the difference between the interrogative phrases in (6) and (7):

(6)   *Che cosa* hai deciso di vendere?
       'What have you decided to sell?'
(7)   *Quale di questi mobili* hai deciso di vendere?
       'Which of these pieces of furniture have you decided to sell?'

In Pesetsky's original formulation, an interrogative phrase is D-linked when its descriptive term (the restriction) refers to a contextually familiar or salient set of entities; the prototypical case of D-linking is the partitive phrase in (4), where the definite description refers to a plural entity that provides the restriction set.

At least two phenomena have been claimed to be sensitive to D-linking. First, D-linked interrogative phrases can be extracted from weak islands more easily than non-D-linked ones (Cinque 1990; see Chesi, Bressan and Belletti 2023 for recent discussion). Taking for example extraction from an embedded question, consider the contrast in (8)-(9):[1]

(8)   * What do you wonder [who bought <what>]?
(9)   Chesi, Bressan and Belletti 2023: (2)
       ? Which book do you wonder [who bought <which book>]?

Second, in Italian bare interrogative phrases like *who* or *what* strictly require adjacency to the finite verb in main questions, whereas D-linked ones do not require adjacency and allow the subject, a topic or an adverb to appear between the wh-phrase and the verb (Rizzi 2006). Consider for instance the contrast between (10) and (11):

(10)   ?* Che   cosa *Gianni*   ha   consegnato a   Maria?
       What   thing Gianni   has   given   to   Maria
       'What did Gianni give to Maria?'
(11)   ? Quale   di   quei libri   *Gianni*   ha   consegnato a   Maria?
       Which   of   those books Gianni   has given   to Maria
       'Which of those books did Gianni give to Maria?'

The notion of D-linking, however, has been characterized in different ways in the literature. In the remainder of this section, we provide a brief overview of different proposals.

2.1 +Lexical restriction

One view of the contrast in island effects (10)-(11) reduces the difference to the presence vs. absence of a descriptive term *tout court*, independently of whether it

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[1]   While island effects are commonly considered to be syntactic in nature, an account has also been proposed in purely semantic terms (Szabolcsi & Zwart 1997).

denotes a set that is contextually salient or not: this is the view proposed by Friedman et al. (2009). From this perspective, the difference is stated in purely syntactic terms. The contrast in (10)-(11) is accounted for in terms of Featural Relativized Minimality (Rizzi 1990, 2001): the interrogative-phrase *which book* in (11), in contrast with *what* in (10), carries a +NP feature that makes it distinct from the intervening interrogative phrase *who*, hence the long-distance dependency is not subject to an intervention effect. The context of interpretation simply plays no role.

2.2 Familiarity of the descriptive term

The aforementioned view proposed by Pesetsky (1987) is characterized by Enç (1991) as (a type of) specificity: in her proposal, the descriptive term carries an index that can be anaphoric to a set discourse referent already introduced in the preceding discourse, or otherwise salient in the discourse context. This anaphoric dependency between the descriptive term and a set-type discourse referent is made explicit in partitive structures like (4), since the partitive phrase contains a definite description referring to a familiar discourse referent, which is a plural entity built out of a set (cf. Matthewson 2001). On the other hand, a "bare" interrogative phrase like *what,* lacking an explicit descriptive term, takes its value from a set of entities that is not contextually constrained. From this perspective, D-linking is conceived of as a purely pragmatic phenomenon, depending on a co-reference relation.[2]

There is evidence, however, that D-linked non-partitive DPs differ from overtly partitive DPs (see also Falco & Zamparelli 2024):

(12) Dayal & Schwarzschild (2010)Context: John returns from a shopping trip and says: "I bought a book to give to David on his birthday". Sue asks:
a. Which book did you buy?
b. #Which of the books did you buy?
c. #What did you buy?

The which-phrase in (12a) is felicitous even though there is no familiar set in the context, but the lexical restriction has been merely mentioned in the preceding discourse, i.e., it is discourse-given; on the contrary, the partitive structure in (13b) is deviant because it strictly requires familiarity of the descriptive term. Since both discourse-givenness and referent familiarity are potentially relevant, it will be necessary to separately test partitive and non-partitive which-phrases.

2.3 Topicality of the descriptive term

Another view, articulated in Rizzi (2001b, 2006), is that the descriptive terms of a D-linked interrogative phrase is "topic-like" in that it refers to contextually given information. According to Rizzi, the topic-like status prevents reconstruction of the descriptive term into the predicative nucleus of the sentence. The strongest version of this hypothesis is that the descriptive term qualifies as the sentence topic, namely the

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[2]   A compositional ingredient might be introduced via the assumption that bare interrogative phrases lack an index for the descriptive term altogether in the syntactic representation (and, *a fortiori*, they cannot enter in an anaphoric dependency).

entity (plurality)[3] that the question is about. Alternatively, it could be a Given topic in the terminology of Frascarelli & Hinterhölzl (2007).

Some support for topical status comes from the observation that in Italian partitive interrogative phrases can be connected to a clause-internal clitic pronoun (13b), exactly like clitic-left-dislocated topics; this possibility is instead precluded for bare interrogative phrases (13a).

(13) Rizzi 2006 (25)-(26):

a. * Che	cosa	lo/la		vorresti	regalare	a	Maria
what	thing	it.M.SG/it.F.SG		want.COND.2SG	give to	Mary	
b. ? Quale	di	questi	libri	lo	vorresti		regalare
which	of	these	books	it.M.SG	want.CND.2SG		give

a Maria?
to Mary?
'What / Which of these books would you like to give to Mary?'

A possible hypothesis is that, in virtue of their topic-like status, D-linked interrogative phrases occupy a position distinct from that of bare ones. In particular, Rizzi (2006) argues that bare interrogative phrases occupy a Focus position in the left periphery of the clause and the finite verb moves to the Focus head immediately adjacent to it; whence the impossibility for a subject to occupy an intermediate position between the interrogative phrase and the verb in (10) (see also Frascarelli 2000). On the other hand, the D-linked interrogative phrase moves to a Topic position above FocusP and does not trigger movement of the verb to the Topic head, whence the acceptability of (11).

2.4 Presuppositionality

Yet another characterization of D-linking may have recourse to the notion of presupposition. A determiner carries a presupposition whenever it places a restriction on the cardinality of the set that it can combine with; for instance, the determiner *both* must combine with a descriptive term denoting a set with exactly two (atomic) elements. Presuppositions are introduced by specific lexical elements or functional elements, known as presupposition triggers. From this perspective, we might assume that the interrogative element quale 'which' carries the cardinality presupposition that its descriptive term denotes a set with at least two members[4], and possibly more. If *which* is indeed a presupposition trigger, then D-linking *qua* presuppositionality would be lexically encoded, and this might also have reflexes at the syntactic level. From this perspective, even if the descriptive term is often anaphoric to a contextually salient

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[3]   A plurality is an entity defined as a sum of atomic individuals, in the so-called mereological approach introduced by Link (1983). The plurality can be automatically converted into a set of atomic elements.

[4]   The presupposition typically must be supported by information available to all the interlocutors (the so-called common ground: Stalnaker 1978, 2002); however, in contexts of belief report it can be satisfied in the reported belief state (Heim 1992). For instance, in a context in which I do not own any cars, I might felicitously utter (i):

(i)   Hannah wrongly believes that I own three cars, and she asked me which of the cars I like most.

set, discourse familiarity *per se* would be neither necessary nor sufficient for D-linking[5]. In addition, a clear contrast would be established between *quale libro* 'which book' and *che libro* 'what book', the latter lacking the presupposition trigger.

2.5 Individual variable

Yet another characterization, inspired by Heim (1987), makes reference to the semantic type of the variable bound by the interrogative phrase. In a nutshell, Heim proposed that in a question like (14a) the value to be supplied in the answer is not an entity but a number. This corresponds to the interpretation paraphrased in (14b):

(14)   a. How many books are there _ on the table?
        b. For which number n are there n-many books on the table?

On the other hand, a *which*-phrase as in (15) necessarily binds an individual variable varying over a set of entities; according to Heim, an individual variable is forbidden in the existential structure:

(15)   ?? Which book is there _ on the table?

The idea of an individual variable has been developed, in different ways, in Frampton (1991), Cresti (1995), and Szabolcsi & Zwart (1997) in their accounts of the interrogative island effect.

2.6 Taking stock

The different notions of D-linking are related to one another in terms of satisfaction conditions. The individual variable account (§2.5) simply places a constraint on the semantic type of the variable; the presuppositionality view (§2.4) requires that the variable ranges over a nonempty and non-singleton set of entities; familiarity (§2.2) requires the set to be familiar in the discourse context, whereas topicality (§2.3) requires that the set qualifies as the topic that the question is about.
On the other hand, the syntactic presence of a descriptive term in the interrogative phrase (§2.1) does not automatically entail any of these properties: a 'lexically restricted' interrogative phrase can bind a non-individual variable and lack a presupposed restriction set, as in (14), *a fortiori* failing to satisfy familiarity and topicality. Therefore, in our experimental investigation the presence of a lexical restriction within the wh-phrase was implemented as an independent factor separate from D-linking.
We tested *which*- and *what*-phrases, assuming that the latter too bind individual variables, since an entity-type referent constitutes a felicitous answer. On the other hand, we decided to set aside the topicality hypothesis, because the empirical evidence that has been brought to justify it, namely (11) vs. (10) and (13b) vs. (13a), involves marginally acceptable sentences that require a separate investigation. We therefore focussed on D-linking as a contextual factor (familiarity) vs. a presupposition triggered

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[5]   Note that this lexically encoded presupposition is distinct from the 'soft' existential presupposition (in the sense of Abusch 2010) that is associated to all wh-questions.

by the wh-determiner *quale* 'which'; the latter was tested both with a NP restriction and with a partitive phrase.

3. Experimental evidence: wh-questions with a complex wh-phrase

As discussed in §1, Italian main wh-questions with a bare wh-phrase[6] assign the main prosodic prominence (Nuclear Pitch Accent, NPA) to the lexical verb, although this has no special focal interpretation (Calabrese 1982, Ladd 1996, Marotta 2001, 2002, Bocci 2013). Analysing long extraction of bare wh-phrases, Bocci, Bianchi and Cruschina (2021, 2024) account for this phenomenon at the syntax-prosody interface: the [Focus] feature borne by the wh-phrase can optionally be transmitted via agreement to the head of the phases through which the wh-phrase moves; the prosodic component then assigns the NPA to the rightmost lexical element bearing [Focus] – in particular, a lexical verb incorporating a v° phase head. Crucially, Bocci, Bianchi and Cruschina (2024) assume a *filter* – in the sense of Calabrese (2005, 2019) – which bars prosodically dependent (functional) elements from bearing the main sentence prominence. See Bocci, Bianchi and Cruschina (2024: §4.2) for more details on the filter and on the syntax–prosody interface.

   The goal of this paper is to investigate what happens when the wh-phrase is *not* prosodically dependent. Bocci et al.'s analysis predicts that the PF filter should not apply to a wh-phrase that contains a lexical restriction. Thus, other things being equal (i.e. maintaining the assumption that all wh-phrases are [Focus]-marked and optionally share this feature with phase heads), lexically restricted wh-phrases should be able to bear the NPA. Along this line of reasoning, the relevant factor should be the presence of the lexical restriction and in particular of the + NP feature hypothesised in the Relativised Minimality account discussed in §2.1 above. This prediction appears to be confirmed by the results of the experiment conducted by Bocci, Cruschina and Rizzi (2021): partitive wh-phrases like the one exemplified in (4), repeated in (16), were assigned the NPA in the majority of cases.

(16)   Chi di **voi** ha lavato il divano?
       'Who of you washed the couch'

   However, the partitive wh-phrases tested differ from bare wh-phrases not only in the presence of a restriction, but also in that the restriction set is familiar. This leaves open the possibility that D-linking (here found in its strongest version) could in principle impact on NPA distribution.
   As discussed in §2, different notions of D-linking have been proposed in the literature. To operationalize their testing, we distinguished the following as experimental factors:
i)   the presence/absence of a lexical restriction;
ii)   the presence/absence of a D-linking context (introducing a familiar set referent);
iii)   the lexical encoding of presuppositionality (*quale N* 'which N' vs. *che N* 'what N');

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[6]   With the exception of *perché* 'why' (see Marotta 2001; cf. also Rizzi (2001a), Bianchi, Bocci and Cruschina (2017) and Bocci, Cruschina & Rizzi (2021).

iv)   the partitivity of the wh-phrase.
        These factors were tested in two production experiments that are reported in the next sections. We tested the following hypotheses:

H1) The presence of a restrictive term within the wh-phrase is either a necessary or a necessary and sufficient condition for it to be assigned the NPA.

H2) D-linking of the wh-phrase is either a necessary or a necessary and sufficient condition for it to be assigned the NPA. D-linking was tested as a contextually available set referent (§2.2), in terms of partitivity of the wh-phrase (§2.2), and in terms of lexical encoding of presuppositionality (§2.4: which vs what-phrases).

3.1 Experiment 1

In the first experiment, we addressed the role of the lexical restriction, of the type of determiner and of the presence/absence of a D-linking context. The experimental items were manipulated in four conditions, exemplified in (17). Conditions (17a-c) contain a lexically restricted wh-phrase, while (17d) contains a bare wh-phrase. (17a) and (17b) were presented in a D-linking context and differ minimally in the type of determiner, *quale* 'which' and *che* 'what' respectively. Conditions (17b) and (17c) are string-identical and differ only in the type of context.

(17) a. Quale   libro legg-erai   sull'aereo?   *Which N*; +D-linking context
          which   book read-FUT.2SG   on_the_plane
       b. Che   libro legg-erai   sull'aereo?   *What N*; +D-linking context
          what   book read-FUT.2SG   on_the_plane
       c. Che   libro legg-erai   sull'aereo?   *What N;* -D-linking context
          what   book read-FUT.2SG   on_the_plane
       d. Che   cosa legg-erai   sull'aereo?   *What*; -D-linking context
          what   thing read-FUT.2SG   on_the_plane
       'Which book/what book/what book/what will you read on the flight?'

        We make the following predictions[7]:

   (i)   if the presence of a restrictive term is a necessary condition, the NPA *can* fall on the wh-phrase in (17a-c), but not in (17d);
   (ii)   if the presence of a restrictive term is a necessary and sufficient condition, the NPA *must* fall on the wh-phrase in (17a-c), but not in (17d);
   (iii)   if the presence of a D-linking context is a necessary condition, the NPA *can* fall on the wh-phrase in (17a,b), but not in (17c,d);
   (iv)   if the presence of a D-linking context is a necessary and sufficient condition, the NPA *must* fall on the wh-phrase in (17a,b);
   (v)   if lexical encoding of presuppositionality is a necessary condition, the NPA *can* fall on the wh-phrase in (17a), but not in (17b-d);

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[7]   An anonymous reviewer suggested that in the presence of a restrictive term the participant may reconstruct a familiar interpretation independently of the context, driving NPA assignment to the wh-phrase. If this were the case, we would *a fortiori* expect a higher rate of NPA assignment to the wh-phrase in contexts that explicitly introduce a set referent. As shown in §3.1.4, this is not observed in our results.

(vi)   if lexical encoding of presuppositionality is a necessary and sufficient condition, the NPA *must* fall on the the wh-phrase in (17a), but not in (17b-d).

3.1.1 Design and materials

To test our hypotheses, we developed a production experiment whose design included one experimental factor, 'wh-type', with four levels, corresponding to the four conditions presented in (17) above. We designed 16 test items manipulated in the four conditions, which are exemplified in Table 1. Each trial consisted of a dialogue preceded by a paragraph describing a context. In the first two conditions, the context and/or the first two turns of the dialogue introduced a restricted and specific set of potential referents for the wh variable (discourse linking). In the non-D-linking conditions, there was no specific set available, either explicit or inferable from the context. Each dialogue was composed of four turns, alternating between the two characters introduced by the context; the target question was always the third turn.

Table 1. Example of experimental item manipulated in the four conditions of Experiment 1.

		Context	**Target question**	**Answer**
(17a) **+ D**		Pietro entra nell'ufficio di Donatella e vede uno scaffale pieno di libri. Sa che Donatella partirà per Lima il giorno dopo e quindi le chiede: P: Questi sono i libri che hai intenzione di leggere durante il viaggio? D: Sì, sono tanti, come puoi vedere.	**P: Quale libro leggerai sull'aereo?** *P: Which book will you read on the plane?*	D: Ma guarda, non ci ho ancora pensato.
(17b) **+ D**		*Pietro enters Donatella's office and sees a shelf full of books. He knows that Donatella will leave for Lima on the next day, so he asks:* *P: Are these the books that you mean to read on the trip?* *D: Yes, they're quite a lot, as you can see.*	**P: Che libro leggerai sull'aereo?** *P: What book will you read on the plane?*	*D: Oh, I haven't decided yet.*
(17c) **- D**		Pietro e Donatella sono al bar e parlano di viaggi di lavoro. Pietro chiede a Donatella: P: Ma quindi la settimana prossima vai a Tokyo per il convegno sull'intelligenza artificiale? D: Sì, sarà un viaggio lunghissimo.	**P: Che libro leggerai sull'aereo?** *P: What book will you read on the plane?*	D: Ma guarda, non ci ho ancora pensato.
(17d) **- D**		*Pietro and Donatella are at the cafè, talking about business trips. Pietro asks Donatella:* *P: So next week you're going to Tokyo for the conference on AI?* *D: Yes, it's going to be a very long trip.*	**P: Che cosa leggerai sull'aereo?** *P: What will you read on the plane?*	*D: Oh, I haven't decided yet.*

The structure of the target questions was always WHP – VERB – PP, with the wh-phrase always corresponding to the direct object of the verb. The verb was always inflected in the second person, such that the subject was always a null subject *pro* with second person features. The question always ended in a PP, which was either a prepositional argument of the verb or an adjunct.

The 16 test items were interspersed with 16 fillers. They had the same form as the target trials except for the target question, which was a polar question with one of two structures: SUBJECT DP – VERB – DP/PP (direct or indirect object or adjunct) or DISLOCATED OBJECT DP – VERB – PP (indirect object or adjunct).

The experimental items were manipulated across four conditions and distributed into four lists using a Latin square design. Each list contained each item in only one of the four conditions (4 items × 4 conditions = 16 experimental items). Participants were randomly assigned to one of the lists. For each participant, trial order was randomized both within and across blocks, with each block containing one item per condition. No two items from the same condition appeared consecutively. Filler trials, randomized independently, were systematically interspersed among the experimental trials, resulting in a total of 32 dialogues read per participant.

3.1.2 Procedure

21 participants (age 19-36, *M* = 25.0, *sd* = 4.8; 12 female, 9 male) were recruited through flyers and word of mouth at the University of Siena[8]. The sample was restricted to participants born and raised in the towns and provinces of Siena (*n* = 20) or Arezzo (*n* = 1). Information on participants' age, gender, origin and on their linguistic history was obtained through a questionnaire. Participants signed an informed consent and received a compensation of 12€. The entire session lasted about one hour and took place in a quiet room at the University of Siena.

Participants were recorded with a head-mounted microphone and a solid-state recorder (Zoom H-4) set at 48 kHz and 16 bits. The recordings were subsequently downsampled to 16 kHz. The dialogues were printed out and presented to the participants in two different sequences, corresponding to two different versions of the same list. Participants were instructed to silently read the context and then to read out loud the entire dialogue twice. After reading all dialogues in the first version of the list, they were instructed to repeat the same procedure on the second version (i.e., they read the same dialogues but in a different order). Thus, four repetitions of each dialogue were obtained for each participant.

3.1.3 Data treatment and analysis

For each item, two repetitions per participants were selected. By default, we selected the second repetition of each reading (i.e., the second and fourth); in case of reading mistakes, disfluencies, or problems in the audio track we kept the first repetition of the same reading or, as a last resort, the first repetition of the other reading. We thus obtained a final sample of 638 target questions (20 participants x 16 items x 2 repetitions; one item was discarded for one participant because of an incorrect word). Each file was automatically segmented at the phoneme and syllable level with the online software WebMAUS (Kiesler et al. 2017, Schiel 1999). Then, each file was annotated by auditory and visual inspection by the first author for 'position of the NPA'. We followed the definition proposed by Gili Fivela et al. (2015) for Italian, according to which the NPA is the 'rightmost fully-fledged pitch accent within an intermediate or intonational phrase'. This definition allows for the presence of reduced

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[8]   The majority of participants were students at the University of Siena. No one had knowledge of theoretical and experimental linguistics.

postnuclear pitch accents, which are possible in Italian and are realised with a very compressed pitch range (D'Imperio 2002; Grice et al. 2005).

3.1.4 Results
The results of the experiment are shown in Figure 1. For all conditions, in the majority of questions the NPA was assigned to the lexical verb. The second most frequent annotation of the NPA, also found in all conditions, was on the final constituent of the clause. Only in the *which N* condition did we find a modest number of instances of NPA on the wh-constituent (11%)[9]. Such productions were found in four out of 21 participants; two of them produced the pattern consistently in the *which N* condition and two of them occasionally. The results of this first experiment do not support hypotheses (ii, iv, vi): none of the investigated factors was a sufficient condition; otherwise, the NPA would have been assigned exclusively to the wh-phrase in some of the conditions: respectively to *which N, what N +D, what N -D* for the lexical restriction (ii), to *which N* and *what N +D* for a D-linking context (iv), or to *which N* for the lexical encoding of the presupposition (vi). In terms of necessary conditions, the finding that condition *which N* partially allows for NPA assignment to the wh-phrase is in principle compatible with hypotheses (i, iii, v), because the three factors (lexical restriction, D-linking context, lexical encoding) are combined in this condition: the necessary condition for NPA assignment may thus be any of the three, or a combination of two of the conditions, or of all three together.

Figure 1. *Results of experiment 1.*
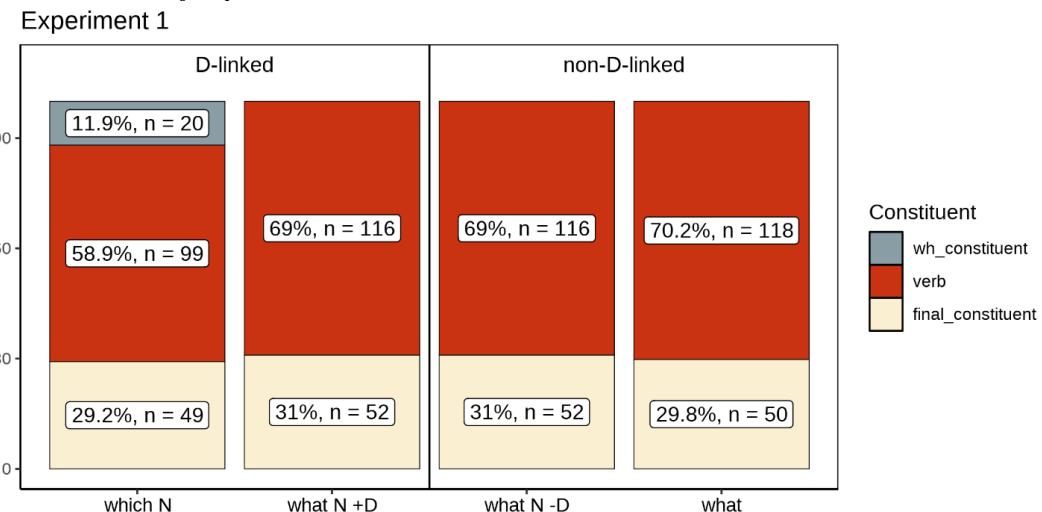
While a transcription of pitch accents and boundary tones was not performed systematically on the whole dataset, Figure 2 shows a representative example of the

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[9]   A statistical analysis was carried out on the probability of the NPA falling on the verb and the final constituent. Given the lack of datapoints in three out of four categories, it was not possible to fit a model on the probability of the NPA falling on the wh-phrase. The statistical analysis can be found in the supplementary material available at the OSF repository [osf.io/375vy]. The analysis confirmed that the probability of NPA on verb is significantly lower in the *which N* condition compared to the other three, while no difference was found for the NPA on the final constituent.

same type of contour, characterised by a H+L* fall on the nuclear syllable, which was either the stressed syllable of the wh-phrase (a) or of the verb (b). When the NPA fell on the verb or the wh-phrase, the boundary tone was either rising (e.g., L-H%, Figure 2b) or low (L-L%, Figure 2a). This optionality is typical of Italian wh-questions (Gili Fivela et al. 2015: 178-181). The pattern with the NPA on the final constituent, instead, exemplified in Figure 2(c), was not expected based on Bocci et al.'s (2021) analysis. The relatively high frequency of this contour was due in particular to the production of five participants, who used it exclusively or almost exclusively. A tentative transcription of the final portion of the tune could be L+H* H-H% (Figure 2c). A similar type of contour was found in other experimental studies on Italian wh-questions (see Bocci 2013: 65), where it is interpreted as a question tune associated with a formal register or a stereotypical reading strategy for wh-questions[10]. To provide independent evidence for this interpretation, we ran a perception task on a selection of productions of Experiments 1 and 2, in which participants were asked to rate the spontaneity of questions on a scale from 1 ('not spontaneous at all') to 7 ('completely spontaneous'). Questions with the NPA on the final constituent were judged significantly less spontaneous (M = 3.5, CI = [3.1-4.0]) than questions with the NPA on the verb (M = 5.0, CI = [4.5-5.4]). A full report of the perception experiment, including the design, materials and statistical analysis can be found in the OSF repository [osf.io/375vy].

[10]   Ferin, Sbranna & Albert (to appear) found that this type of contour was used with relative frequence by Central-Southern Italian speakers but not by Northern speakers.

Figure 2. *Examples of contours found in Experiment 1. (a,b)* Quale libro leggerai sull'aereo? *'Which book will you read on the plane?'; (c)* Che articolo metterai in prima pagina? *'Which article will you put on the first page?'.*

(a)
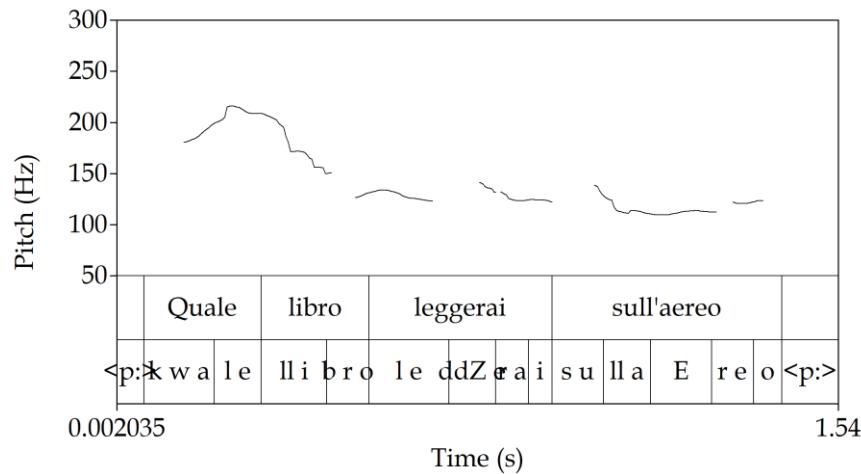
(b)
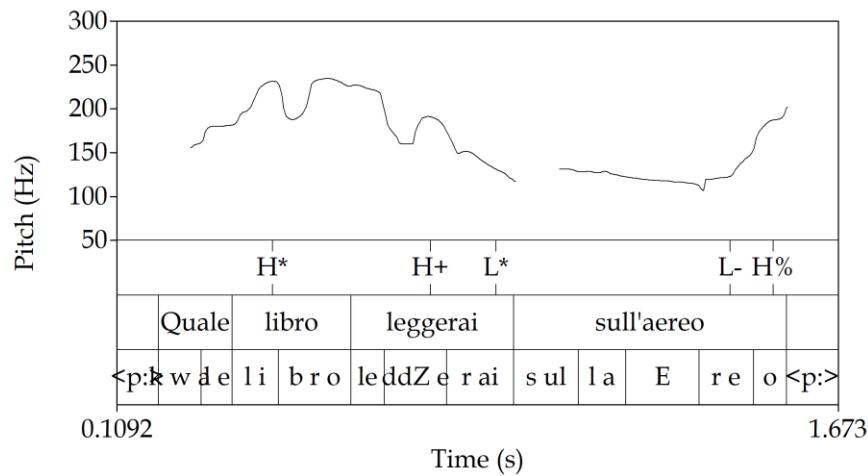
(c)
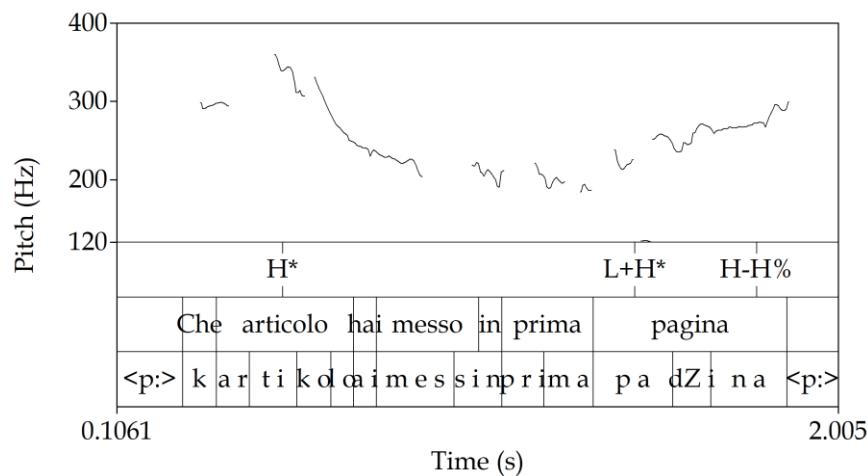
3.2 Experiment 2

In experiment 2, two new conditions were introduced (18a,b), with a double goal. First, we aimed at disentangling the role of the lexical restriction, of the type of determiner (with or without an encoding of presupposition) and of a D-linking context as necessary conditions for NPA assignment. Second, we explored the role of an overtly partitive wh-phrase (see §2.2). The experimental stimuli were manipulated in four conditions, exemplified in (18), two of which were repeated from experiment 1. Condition (18a) presents a *which*-phrase containing an overt partitive. The wh-phrase in (18b) is also partitive, but the partitive PP is left-dislocated. Both conditions are presented in a D-linking context. Crucially, (18b) is identical to (18a) in terms of type of determiner, *which*, in terms of contextual D-linking and in the property of partitivity. However, the wh-phrase itself does not syntactically contain the lexical restriction and is thus comparable to condition (18d), with bare *what*.

(18)   a. *Which of these N   +D*
           Quale   di   questi   libri   leggerai   sull'aereo?
           which   of   these   books   read-FUT.2SG   on_the_plane
        b. *Of these N, which   +D*
           Di   questi   libri,   quale   leggerai   sull'aereo?
           of   these   books,   which   read-FUT.2SG   on_the_plane?
        c. *What N -D*
           Che libro leggerai   sull'aereo?
           what book read-FUT.2SG   on_the_plane?
        d. *What   -D*
           Che cosa   leggerai   sull'aereo?
           what thing   read-FUT.2SG   on_the_plane
           'Which of these books/of these books, which/what book/what will you read on the flight?'

           We tested the following predictions:
   (i)   if partitivity of the wh-phrase is a sufficient condition, the NPA *must* fall on the wh in (18a) and (18b), but not in (18c) and (18d)[11]
   (ii)   if the presence of a lexical restriction is a necessary condition, independently from the type of determiner and context, the NPA *cannot* fall on the wh-phrase in (18b) and (18d).

3.2.1 Design and materials
We developed a production experiment with one experimental factor, 'wh-type', with four levels, corresponding to the conditions presented in (18) above. The experiment was constructed in the same way as Experiment 1, manipulating the same 16 test items, as exemplified in Table 3, for a total of 64 critical items. The construction of the items

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[11]   We did not test the prediction whether partitivity of the wh-phrase is a necessary condition because this is ruled out by the results of Experiment 1, in which NPA could be assigned to the wh-phrase also in the absence of an overt partitive.

and of the lists, as well as the randomization procedure and the filler items, were the same as for Experiment 1.

Table 2. Example of experimental item manipulated in the four conditions of Experiment 2.

		Context	Target question	Answer
(18a) +D		Pietro entra nell'ufficio di Donatella e vede uno scaffale pieno di libri. Sa che Donatella partirà per Lima il giorno dopo e quindi le chiede: P: Questi sono i libri che hai intenzione di leggere durante il viaggio? D: Sì, sono tanti, come puoi vedere.	**P: Quale di questi libri leggerai sull'aereo?** *P: Which of these books will you read on the plane?*	D: Ma guarda, non ci ho ancora pensato. *D: Oh, I haven't decided yet.*
(18b) +D		*Pietro enters Donatella's office and sees a shelf full of books. He knows that Donatella will leave for Lima on the next day, so he asks: P: Are these the books that you mean to read on the trip? D: Yes, they're quite a lot, as you can see.*	**P: Di questi libri quale leggerai sull'aereo?** *P: Of these books, which will you read on the plane?*	
(18c) -D		Pietro e Donatella sono al bar e parlano di viaggi di lavoro. Pietro chiede a Donatella: P: Ma quindi la settimana prossima vai a Tokyo per il convegno sull'intelligenza artificiale? D: Sì, sarà un viaggio lunghissimo.	**P: Che libro leggerai sull'aereo?** *P: What book will you read on the plane?*	D: Ma guarda, non ci ho ancora pensato. *D: Oh, I haven't decided yet.*
(18d) -D		*Pietro and Donatella are at the cafè, talking about business trips. Pietro asks Donatella: P: So next week you're going to Tokyo for the conference on AI? D: Yes, it's going to be a very long trip.*	**P: Che cosa leggerai sull'aereo?** *P: What will you read on the plane?*	

3.2.2 Procedure and analysis

20 participants (age 19-35, *M* = 23.6, *sd* = 3.3; 11 female, 9 male) were recruited through flyers and word of mouth at the University of Siena. The sample was restricted to participants born and raised in the towns and provinces of Siena (*n* = 16), Arezzo (*n* = 2), and Grosseto (*n* = 2); none had participated in experiment 1. The procedure, data treatment and analysis were identical to experiment 1. In particular, also in this experiment participants read each dialogue twice from one version of their assigned list, and then two more times from a different version (randomisation) of the same list. Two repetitions per participant were selected for the analysis, as described above.

3.2.3 Results

The results of experiment 2 are shown in Figure 3. The most frequent position for the NPA in conditions *of these N which*, *what N* and *what* is the lexical verb (in 86.7% 89.4% and 82.5% of cases respectively). Only in the condition *which of these N* do we find a certain number of productions with NPA on the wh-phrase (46.9%) (19a), but this pattern was not exclusive, as 24.4% of productions presented the NPA on the verb (19b). There were also two instances of NPA on the wh-word *quale* (19c). Thus, the

only condition with a D-linked interpretation *and* a restrictive term attracted the assignment of the NPA to the wh-constituent. However, a degree of optionality remains, suggesting that both factors are necessary, but neither is sufficient to determine the position of the NPA. Additionally, there were some instances of NPA assignment to the final constituent, as found in experiment 1. In experiment 2 they were not evenly distributed across condition, but they were more frequent in the condition *which of these N*[12].

(19) a. Quale di questi **libri** leggerai sull'aereo?
      b. Quale di questi libri **leggerai** sull'aereo?
      c. **Quale** di questi libri leggerai sull'aereo?
      'Which of these books will you read on the plane?'

These results support prediction (ii), because the NPA was never placed on the wh-phrase *quale* when the lexical restriction was left-dislocated. It thus appears that, indeed, the presence of a lexical restriction is a necessary condition for NPA assignment. Prediction (i) was not supported by the data, because the (overt) partitivity of the partitive PP was not a sufficient condition for NPA assignment. Figure 3 shows some examples of typical intonation patterns.

Figure 3. *Results of experiment 2.*
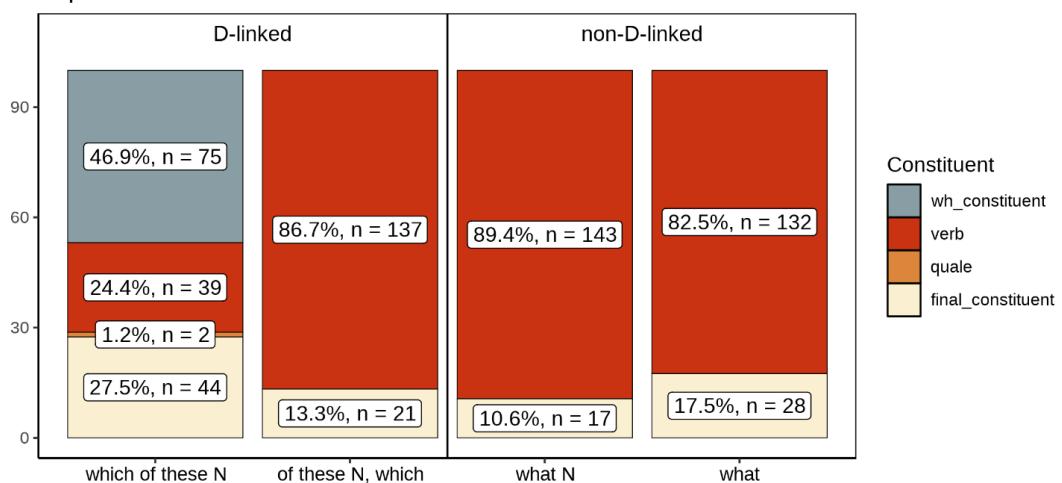
Figure 4. *Examples of contours found in Experiment 2. (a,b)* Quale di questi libri leggerai sull'aereo? *'Which of these books will you read on the flight?'; (c)* Di questi libri quale leggerai sull'aereo? *'Of these books, which will you read on the flight?'*

(a)
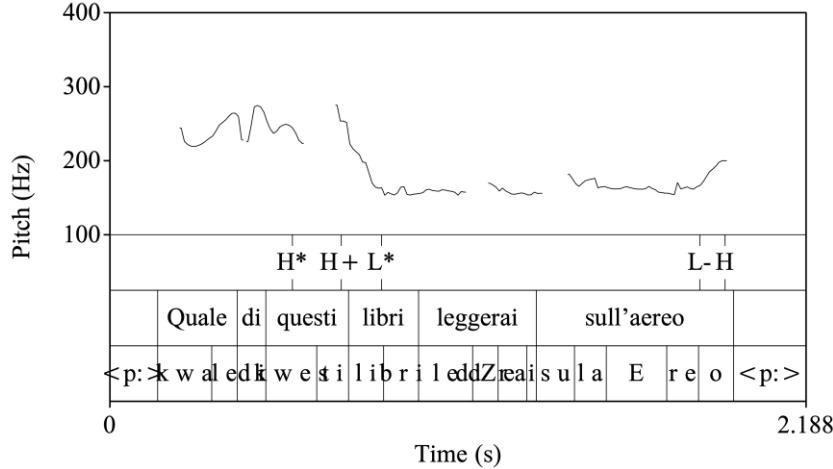
(b)
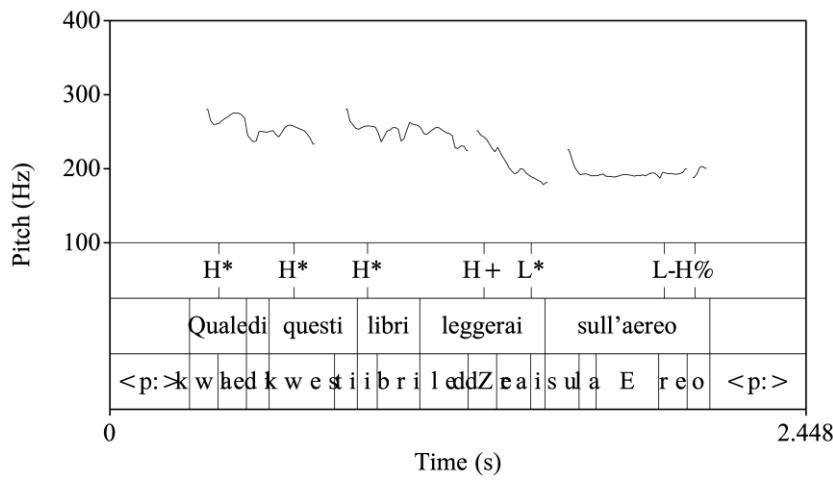
(c)
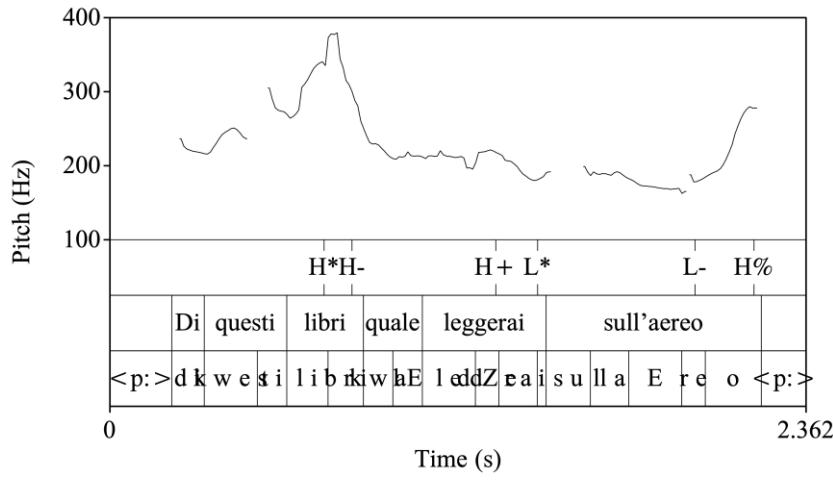
3.3 Interim discussion

The results of experiments 1 and 2, taken together, do not fully support our hypotheses H1 and H2. The syntactic presence of a restrictive term in the wh-phrase appears necessary if we compare conditions *which of these N* and *of these N, which*: both are strongly discourse-linked, due to the partitive phrase, and both share the same determiner, but if the partitive phrase is dislocated outside the wh-phrase, the latter fails to bear the NPA. On the other hand, the comparison between conditions *which N* and *what N* in experiment 2 shows that the restrictive term is not sufficient on its own: *what N* shares the exact same pattern as *what*.

        A comparison of the conditions with a restrictive term outlines a progression in the frequency of NPA assignment to the wh-phrase:

(20)   *which of these N > which N > what N*

We can envisage two alternative explanations. On the one hand, there might be an effect of lexically encoded D-linking: both the presence of a lexical restriction and the presuppositional wh-determiner are necessary conditions for NPA assignment; this however does not explain the stronger effect observed when the lexical restriction is a partitive phrase. On the other hand, the effect may not be determined by D-linking at all, but by the prosodic heaviness of the wh-constituent: *quale* 'which' is bisyllabic and carries lexical stress, while *che* is monosyllabic and monomoraic and may plausibly fail to project an independent prosodic word phrase (see Elordieta 2014); *quale di questi N* is even heavier from a syntactic and prosodic standpoint. Thus, it is possible that NPA assignment is not tied to its lexical, syntactic, or semantic characteristics, but to its prosodic weight. To test this hypothesis, we devised a third experiment, described in the next section.

4. Experiment 3

The goal of this third experiment was to verify the potential effect of the 'heaviness' of the interrogative phrase on the attraction of the NPA. Our predictions are the following:
   (i) If wh-heaviness has an effect on NPA assignment, we predict a gradual increase in the proportion of NPA assignment to the wh-phrase as its length increases;
   (ii) If presuppositionality of the wh-phrase is a necessary condition, the heaviness effect is found only with *which N*, while *what N* cannot be assigned NPA independently from its heaviness.

4.1 Operationalisation of heaviness

"Heaviness" is measured in various ways in the syntactic literature (e.g., on heavy NP shift): either as number of words or syllables, or as syntactic complexity, in number of syntactic nodes or of phrasal nodes (e.g., Francis 2010, Heidinger 2013, Krieger 2024). However, the three operationalisations were found to yield similar results for NP-shift phenomena (Wasow 1997). We choose to compare three levels of heaviness, which

differed at the same time for number of words, syllables and syntactic complexity, as shown in (21).

(21) a. Quale/Che   libro leggerai   sull'aereo?
      which/what   book read-FUT.2SG   on_the_plane
      'Which/What book will you read on the plane?'
      b. Quale/che   libro di   matematica   leggerai   sull'aereo?
      which/what   book of   maths   read-FUT.2SG   on_the_plane
      'Which/What maths book will you read on the plane?'
      c. Quale/che   libro di   matematica   avanzata   leggerai
      which/what   book of   maths   advanced   read-FUT.2SG
      sull'aereo?
      on_the_plane
      'Which/What book of advanced maths will you read on the plane?'

4.2 Design and materials

We constructed an experiment with a 2x3 design manipulating Wh-heaviness (short vs medium vs long) and Wh-type (*che* 'what' vs *quale* 'which'), as shown in (21) above. Each determiner was associated with the most natural context for its interpretation: which-stimuli were embedded in a D-linked context, what-stimuli in a non-D-linked context. 18 items were manipulated in all conditions and arranged in six lists with a Latin square design. Each participant was assigned to one list and saw each item only once, in one of the six conditions, for a total of three items per condition.

        Most of the stimuli were adapted from experiments 1 and 2. We added two additional items to reach a total of 18 items and we substituted two of the original contexts with new ones because the length manipulation produced questions that were deemed too unnatural. In this experiment, we only used 9 fillers, selected among those used in Experiments 1 and 2, with a ratio of 1 filler:2 test items to avoid an excessive length of the experiment. The items of each list were randomized with the following criteria: rigid alternation of filler – test – test; the items of the six conditions were distributed evenly throughout the list; the test items of each pair not separated by a filler were neither of the same length nor of the same Wh-type.

4.3 Procedure

18 participants (age 19-36, M = 22.6, sd = 3.1; 10 female, 8 male) took part in this third experiment, none of whom had participated in the previous experiments. The procedure was the same as Experiments 1 and 2, with two differences. Firstly, participants read each dialogue twice on one version of their assigned list, and then two more times on the same version (i.e., in the same order as before). Secondly, the dialogues were not read by the participants in their entirety, but in a dialogic form with the experimenter, who read the turns (second and fourth) associated with the second character in the dialogue. The goal was to attempt to minimize the stereotypical reading associated with the nuclear rise on the final constituent. Between each pair of contiguous test items, participants were asked to perform some simple arithmetic operations or to answer some general knowledge questions, which were formulated by

the experimenter as declaratives or polar questions (e.g., 'Four plus two plus two?' or 'Do you remember the capital of Japan?'), never as wh-questions.

4.4 Results

Results are shown in Figure 5. A gradual effect of length of the wh-phrase was found both within the *which* and within the *what* conditions. When the determiner was *which*, NPA placement on the wh-phrase increased from 0.9% with a short phrase, to 11.1% with a medium phrase, to a rate of 20.4% with a long phrase. With *che*, the NPA was never placed on a short wh-phrase (0%), very rarely on a medium phrase (2.8%) and in 10.2% of the cases on a long phrase[13]. Some examples for conditions medium and long are shown in Figure 6, with the NPA placed on the wh-phrase (Figure 6a,c) and on the verb (Figure 6b,d) Thus, prediction (i) was confirmed, since a gradual increase in NPA assignment to the wh was found based on its heaviness. Prediction (ii) was not confirmed, because the NPA could be assigned to medium and long *what N phrases* as well, proving that the type of wh determiner is, in fact, not a necessary condition for NPA assignment to the wh-phrase.

Figure 5. *Results of experiment 3.*
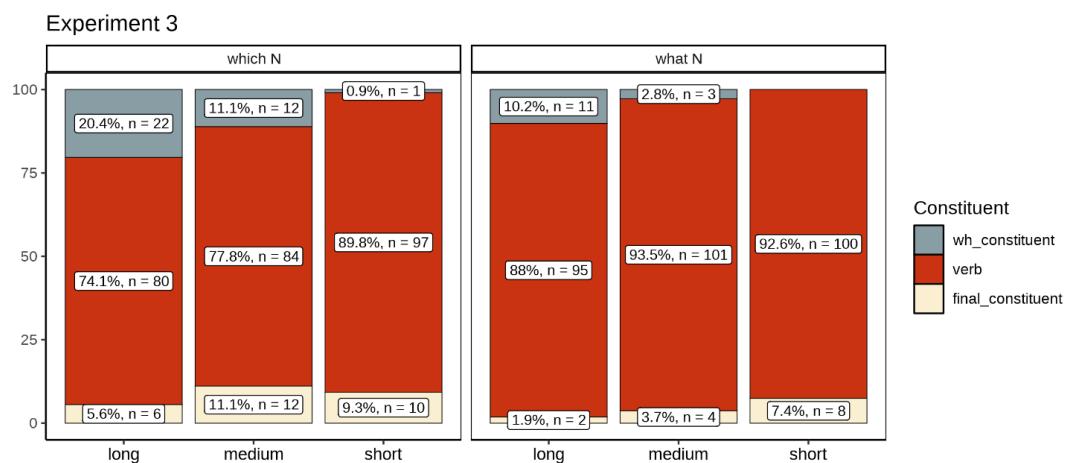

Figure 6. *Examples of contours found in Experiment 3 for condition* medium *(a,b) and* long *(c,d)*.

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[13]   As for Experiments 1 and 2, a statistical analysis on the probability of the NPA falling on the verb and on the wh-phrase can be found at [XXX].

(a)
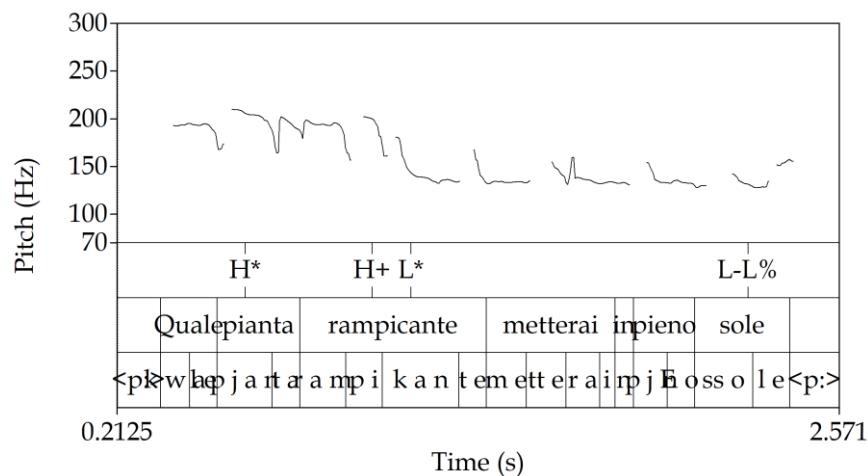
(b)
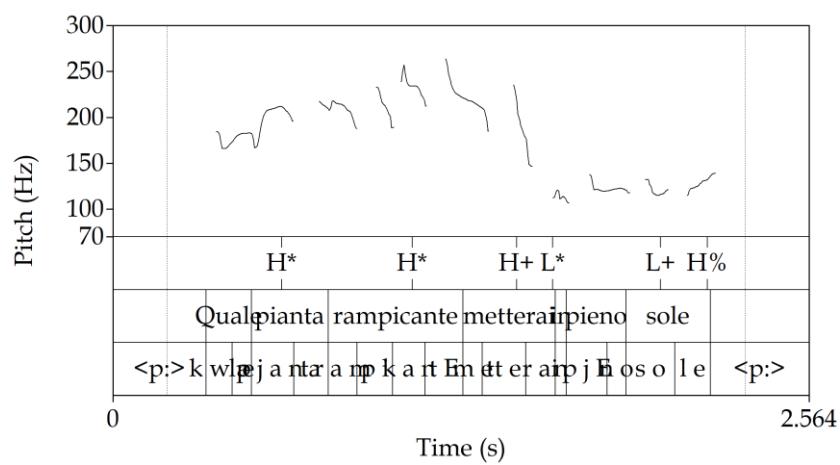
(c)
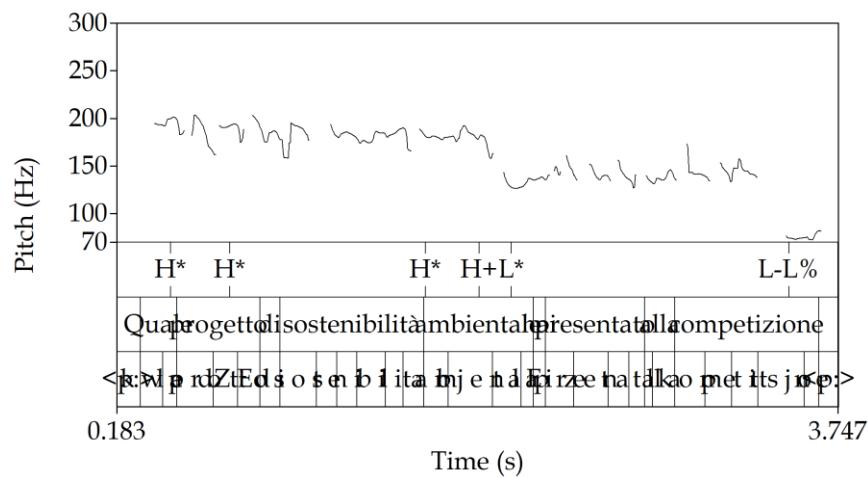
(d)
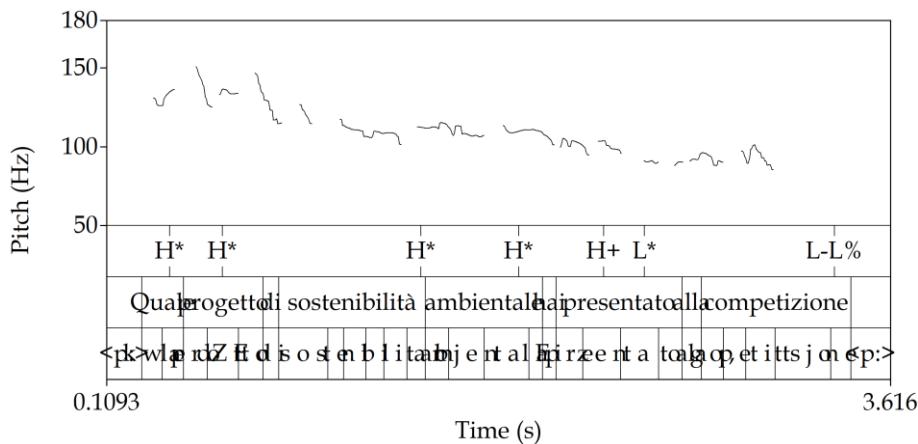
5. Discussion

We conducted three experiments to investigate the potential role of a lexical restriction and of D-linking in the assignment of the NPA to wh-phrase. Although D-linking can be conceptualised in various ways, as discussed in §2, in none of the conceptualizations we investigated (contextually available referent set; lexical encoding of presuppositionality; partitivity of the wh-phrase) was D-linking either a necessary or a sufficient factor for NPA assignment.

On the other hand, the presence of a lexical restriction turned out to be a necessary but not sufficient factor: only lexically restricted wh-phrases were optionally assigned NPA. Nevertheless, in the majority of cases the preference was still for NPA assignment to the verb, even when the wh-phrase was substantially heavy (*Which book of advanced mathematics will you read on the flight?*). This finding lends further support to the analysis proposed by Bocci, Bianchi and Cruschina (2021, 2024), which sees NPA assignment in wh-questions as the result of the interaction between the syntactic derivation of the wh-phrase and prosodic constraints. In particular, the findings of the three experiments prove that NPA assignment to the verb is not limited to cases when the wh-phrase is prosodically weak (pace Marotta 2001, 2002), but it is also the preferred position when the wh phrase is not weak and is, in principle, able to carry the NPA.

The optionality between NPA assignment to the wh-phrase and to the verb can readily be accounted for within BBC's framework. Assuming optional agreement for the {wh, focus} feature bundle at the phase edge of vP, there are two possible configurations: one in which the wh-phrase shares the F-feature through agreement with v° (22a), and one in which there is no agreement involving v°, but only criterial agreement at FocP. In the first case, the rightmost phonologically realized instantiation of [focus] is associated with the lexical verb incorporated in v°, and the NPA is assigned to it. In the second case, the only phonologically realized instance of the [focus] feature is on the wh-phrase and NPA is assigned to it. With a bare wh-phrase, this second option would be ruled out at PF by the prosodic requirements, to which we return below. When the wh-phrase contains a lexical restriction, however, the prosodic requirements are satisfied and this configuration is allowed.

(22) a. [CP [Quale libro]F   C°F [vP ~~quale libro~~F v°F   **leggerai**   sull'aereo]]?
             which book   read-2SG.FUT   on_the_plane

      b. [CP [**Quale libro**]F   C°F [vP   ~~quale libro~~F v°   leggerai   sull'aereo]]?
             which book   read-2SG.FUT   on_the_plane

The question naturally arises of how exactly to characterize the prosodic constraints that output the observed patterns. We outline here a possible account in terms of prosodic phrasing.

The difference between *che libro* (which was not assigned NPA) and *quale libro* (which was sometimes assigned NPA) may be cast in terms of a BinMin(φ,ω) constraint à la Selkirk (1996, 2011), which requires a prosodic phrase φ to be minimally binary, that is, consisting of at least two prosodic words (ω). The presence of NPA on an element forces the presence of a phonological phrase boundary to its right (Bocci, Bianchi & Cruschina 2024). The insertion of NPA, and the concomitant presence of a phonological phrase boundary at its right would lead to a violation of BinMin(φ,ω) if the resulting phonological phrase did not contain two prosodic words. Let us assume that *quale* qualifies as prosodic word, while the monosyllabic and monomoraic element *che* does not (cf. Elordieta 2014).[14] Consider first (22b): the Focus-bearing wh-phrase is assigned the NPA and followed by a prosodic boundary, resulting in an independent phonological phrase. Since *quale* and *libro* are two distinct prosodic words, the phrase is minimally binary, satisfying BinMin, as shown in (23a). Conversely, *che* in *che libro* does not project a prosodic word; if this wh-phrase did not undergo optional agreement and were assigned the NPA, the resulting phonological phrase would violate BinMin(φ,ω), penalizing (23b) relative to (23c). In this latter case, in fact, the NPA is assigned to the verb, outputting a phonological phrase that satisfies BinMin.

(23) a. [[Quale]$_\omega$ [**libro**]$_\omega$]$_\varphi$ leggerai sull'aereo?
      b. *[[Che **libro**]$_\omega$]$_\varphi$ leggerai sull'aereo?
      c. [[Che libro]$_\omega$ [**leggerai**]$_\omega$]$_\varphi$ sull'aereo?

When BinMin was satisfied, we further observed a graduality in the preference for NPA assignment based on the heaviness of the wh-phrase.

An analysis along these lines raises the issue whether a BinMin-type constraint is sufficient to account also for the lack of NPA assignment to *bare* wh-phrases, or whether a separate constraint is present that prevents functional elements from bearing main prominence. Bocci, Bianchi and Cruschina (2024) envision the prosodic requirement that bans bare wh-phrases from bearing NPA as a *filter* (or negative statement) in the sense of Calabrese (2005, 2019), which prevents prosodically weak elements from being assigned the NPA. The ban on *che cosa* 'what' would be explained through the activation of this filter. In light of our findings, we can give two possible interpretations. On the one hand, we may postulate that our results are due to a combined effect of BinMin (acting on *che libro* 'what book') and of a filter acting

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[14]   For a discussion of the distinctive syntactic behavior of *che* in comparison to other monomorphemic wh-elements, see Bocci, Bianchi & Bocci (2022).

on prosodically dependent elements (in our case, on *che cosa* 'what'). On the other hand, we may revise the previous analysis and unify the role of prosodic requirements: BinMin is in principle sufficient to rule out NPA assignment to *che libro* and *che cosa*, without further stipulations. Our data do not allow to conclusively choose between the two options[15].

5.1. A note on Calabrese (1983)

Our discussion above has relied on the assumption that there are two mutually exclusive patterns: when the wh-phrase is phrased independently, it is assigned NPA; when the NPA falls on the lexical verb, the wh-phrase and the verb are phrased together. However, this implicit assumption does not logically follow from our analysis: there is a third logical possibility, in which the wh-phrase is phrased independently, but the NPA is assigned to the lexical verb. This would follow from a configuration in which, at the syntactic level, the lexical verb incorporates to a v° carrying the [focus] feature, and is therefore assigned the NPA, while at the same time the wh-phrase is heavy enough to satisfy BinMin and be phrased independently (24).

(24) [Quale libro di matematica avanzata] [**leggerai**] sull'aereo?

Calabrese (1983) explicitly excluded this possibility and argued that the wh-phrase and the lexical verb carrying main prominence need to be phrased together under a single intonational phrase. In our production data, when the NPA is assigned to the lexical verb, we typically observe a high plateau that stretches from a high tonal target on the wh-element (interpreted as a prenuclear H*) up to the NPA on the verb, without prosodic boundaries in between. The same pattern was also found by Bocci, Bianchi and Cruschina (2021): even in case of long-distance extraction, as in (3) above, a plateau spans from the wh-phrase in the matrix clause to the embedded clause verb. This observation, although it does not constitute conclusive evidence, suggests that we should incorporate in our analysis an explicit hypothesis about prosodic phrasing and its interaction with NPA assignment. The relevance of prosodic phrasing seems corroborated by the gradient effect of phonological heaviness observed in (20) above and also in both conditions of Experiment 3. This remains as the next step for future investigation.

6. Conclusions

Our experimental study on NPA distribution in Italian *which-* and *what*-questions leads to the following conclusions:
i) the presence of a lexical restriction within the wh-phrase is a necessary condition for NPA assignment to the latter;

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[15]   Competing evidence speaks in favour of the two alternatives, which need to undergo further research. On the one hand, Bocci, Cruschina & Rizzi's results for *chi diavolo*, which was virtually never assigned the NPA, support the hypothesis of a filter on functional elements. On the other hand, the marginal possibility of NPA on *quale* when followed by a partitive PP (as we found in Experiment 1) would be more readily accommodated under the competing alternative.

ii) the likelihood of such an assignment seems to be sensitive to the phonological heaviness of the wh-phrase;

iii) D-linking *per se* is neither a necessary nor a sufficient condition for such NPA assignment; there is no detectable correlation of NPA assignment with an interpretive effect.

On the one hand, these results are compatible with the proposal that NPA assignment is driven by a Focus feature which can be *syntactically* transmitted from the wh-phrase to the phase head that gets incorporated in the lexical verb. On the other hand, assignment to the wh-phrase could be reduced to a prosodic well-formedness constraint (BinMin(ϕ, ω)), possibly in interaction with other prosodic phrasing principles that remain to be investigated.

However, there still are several aspects factors that this study did not cover. We have not considered *how-many*-phrases, which according to Heim (1987) bind a non-individual variable (cf. the discussion around (14) above); these too can occur without an overt restriction, with a NP restriction, or a partitive restriction. Moreover, the topic status of the restrictive term might have an impact: for the second author, a question like (13b), where the *which*-phrase is resumed by a clitic pronoun, is only acceptable with the NPA on the wh-phrase, not on the verb. A final avenue for future research concerns the investigation of how the NPA is assigned when modal verbs are present alongside the lexical verb (e.g., *Chi vorrebbe leggere questo libro?*)[16]. We are confident that these points can be investigated with the experimental methodology that we have adopted and refined in this study.

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