The complex relationship between the tunes and pragmatics of Greek wh-questions

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1. Introduction

The relationship between intonation and meaning has always been of interest but it has always been a contentious one as well (see Westera, Goodhue & Gussenhoven 2020, for a review). Intonation meaning has been examined both from the perspective of syntax, semantics, and pragmatics, and the perspective of phonetics and phonology. Approaches in the former mould often assume that tunes are related to specific communicative functions, such as indicating information structure distinctions (e.g., Steedman, 2000; Krifka, 2008; Büring, 2009). Phonetic and phonological approaches, on the other hand, vary considerably in their attention to intonation meaning. Some models, such as the IPO model ('t Hart et al., 1990) are not concerned with meaning, others concentrate on specific meaning aspects, such as focus (e.g., Xu, 2006, and subsequent publications), while a third set do consider meaning but adopt very different perspectives. For instance, treatises of intonation within the British School adopted an informal approach to meaning that often encompassed *attitude* (e.g., O'Connor & Arnold, 1973) or paralinguistic elements (e.g., Crystal,1969); see Nolan (2022) for a review. A key element of the British School is that most approaches assume that meaning largely derives from the tune's *nucleus*, which is treated as a configuration described using terms such as fall, rise, rise-fall etc.

A more fruitful approach is taken by researchers working within the autosegmental-metrical framework of intonational phonology (henceforth AM; Pierrehumbert, 1980; Ladd, 2008). In AM, tunes are composed of a string of low (L) and H (high) autosegments. AM distinguishes tones based on their association with structural positions in the metrical structure. By and large, tones that associate with metrical heads are known as pitch accents and indicated by a star; e.g., H*. Tones that associate with phrasal boundaries are collectively known as edge tones, and fall into two categories, phrase accents (e.g., L-), which associate with intermediate phrase boundaries, and boundary tones (e.g., H%), which associate with intonation phrase boundaries (for a detailed overview, see Arvaniti, 2022). Thus, what is described as a fall in the British School is treated as the composite of three distinct elements in AM, a H* pitch accent, a L- phrase accent, and a L% boundary tone.

The decomposition of configurations such as "fall" into distinct tonal components is also reflected in the treatment of meaning within AM. Using the inventory of pitch accents and edge tones posited by Pierrehumbert (1980) for American English, Pierrehumbert & Hirschberg (1990) developed a formal approach to intonation meaning which rests on the idea that intonational meaning is compositional. Tunes consist of discrete elements, each of which contributes independently to the overall meaning of the tune, which is then interpreted in context and in combination with syntax and lexical choices. Recent work provides evidence for the soundness of this approach and also confirms that the interpretation of intonation meaning is probabilistic (Calhoun, 2010; Im, Cole & Baumann, 2018; Kurumada & Roettger, 2022).

Approaching intonation meaning in this manner has two consequences. First, the elements of a tune are not only phonological elements but also morphemes, i.e. elements in which form and meaning are combined. Second, since tunes are interpreted in context, it follows that terms such as *question intonation* or *focus intonation* are useful shorthands but should not be interpreted to mean that all questions or focused elements are produced with one tune that is used only for that purpose (on this point, see also Cangemi & Grice, 2016). Note also that the differences between an informal system that relies on configurations vs. a formal system that assumes meaning is compositional, have repercussions for explanatory adequacy: for instance, while both the British School and AM acknowledge that the relationship between tune and meaning is not straightforward, for the former, recognition is necessitated by the empirical observation that a given tune can be interpreted in a variety of ways, while for the latter, the relationship follows naturally from the framework itself.

In the present work, we adopt a compositional approach to intonation meaning, akin to that of Pierrehumbert & Hirschberg (1990), to study the meaning of the tunes used with wh-questions in Greek in tandem with their phonetics and phonology. We further situate our work within an interactionist approach to communication, which does not focus exclusively on the speaker's intended meaning, but treats meaning as being co-constructed by speaker and addressee (cf. Gunlogson, 2003; Elder, 2019; Elder & Beaver, 2022).

Our research is couched in AM terms and builds on our earlier work on the intonation of Greek wh-questions (Gryllia et al., 2018; Gryllia et al., 2019; Baltazani et al., 2020). Our earlier conclusions were based on laboratory speech (Baltazani et al., 2020; Gryllia et al., 2018) and perception experiments that tapped into the meaning of two main tunes, L*+H L-H% and L+H* L-L%, presented in more detail in section 3, (Baltazani et al., 2020; Gryllia et al., 2019). For the present paper, we relied on a corpus of wh-questions produced by native Greek speakers in unscripted speech. Our purpose was threefold: first, to illustrate the range of possible tunes wh-questions can be produced with in Greek; second, to discuss the pragmatic import of the tunes and provide a compositional

analysis of them; third, to present an inventory of possible uses of wh-questions in Greek, following the classification of Eckardt (this volume).

In brief, we show that wh-questions in Greek can be produced with a variety of tunes each of which is used both for different types of wh-questions but also employed for other communicative purposes; e.g., the default tune for wh-questions is also used for negative statements containing the negative operator [ðen] "not" (Baltazani, 2006). Therefore, each tune's meaning depends on and is augmented by lexical choices, context, and the interlocutors' knowledge of the situation. In turn, such knowledge or lack thereof can lead to different types of interactions (cf. Elder, 2019). In short, we show that different types of wh-questions are not necessarily distinguished by means of intonation. Further, our pragmatic analysis of the tunes indicates that not all components of an intonational system are used to encode a specific function such as information structure (Pierrehumbert & Hirschberg, 1990), theme/rheme distinctions (Steedman, 2014), or epistemic stance (Bartels, 1997; Prieto & Borràs-Comes, 2018); rather, all of the above may be *partially* encoded using intonation. Finally, the investigation of our corpus testifies to the need to examine spontaneous speech elicited in different communicative situations, as these encourage the effortless use of specific discourse devices that cannot be as effectively elicited in the laboratory. It follows that firm conclusions cannot be drawn either by relying on laboratory speech alone or by considering data elicited by means of only one task, however natural it may be.

In the remainder of the paper, we present our corpus (section 2), and the main tunes used with wh-questions in Greek together with their pragmatic interpretation (section 3), based largely on Baltazani et al. (2020). We then present the pragmatic uses of each main tune as attested in our corpus (section 4). Section 5 presents some additional variation with respect to types of wh-questions. Section 6 briefly discusses the findings and concludes.

2. The corpus

The data on which the present analysis draws on come from two sources, (a) unscripted speech elicited for a phonetic study of intonation using three tasks, and (b) unscripted (i.e. not read from a teleprompter) speech from audio recordings of radio, television and online shows.

Dataset (a) was elicited from 36 speakers of Greek (19 Female, 17 Male; mean age = 23.7 y.o.; SD = 3.2), all functional monolinguals (with the exception of one Greek-Albanian bilingual speaker). The speakers were recorded either in quiet locations during COVID (N = 8; 4F; mean age = 24.1 y.o.; SD = 1.7) or in the studio of the Department of Musicology at the University of Athens (N = 28; 15F; mean age = 23.5 y.o.; SD = 3.6). Both groups took part in a number of tasks involving scripted and unscripted speech. The corpus used for the present study included wh-questions from

three unscripted tasks. In the first, the speakers took part in two rounds of Map Task (Anderson et al., 1984; Anderson et al., 1991), using different maps in each round and switching roles as instructor in one round and follower in the other. In addition, the speakers, in pairs, discussed a set of unusual objects (such as an egg separator resembling a spider) and their possible uses (cf. Edlund et al., 2010). They saw the objects on video (COVID group) or inspected them in person. Finally, the participants played a game of "Who Am I", using either a phone app (COVID group) or the board game *Μάντεψε τι + ποιος* "Guess what & who".

Dataset (b) consisted of audio recordings of cooking shows by three Greek celebrity chefs, Akis Petredzikis (Petredzikis, 2023, 2024), Argiro Barbarigou (Barbarigou, 2021), and Vefa Alexiadou (Alexiadou, 2024), and four episodes of Ellinofreneia (Ellinofreneia Official, 2024a, b, c, d, e), a radio show satirizing Greek politics. The cooking shows were selected because we expected the chefs to use pedagogical questions. This was particularly true of Akis Petredzikis who interacts frequently with his film crew. We selected Ellinofreneia (a blend of *Hellas* and *schizophrenia*) because it is a political broadcast that takes a critical and often ironic stance not only towards Greek politicians but also towards its own audience who call in at specific segments of the programme and engage in dialogue with the presenters. Thus we expected to find rhetorical and ironic questions in this show. In total, the corpus consisted of approximately 500 wh-questions.

In order to analyze the corpus, we listened to the audio files, identified wh-questions and categorized them according to function and tune. With respect to function, we separated canonical from non-canonical questions and for the latter, we followed the classification of Eckardt (this volume). With respect to the tune, we focused on two main elements: the type of accent on the wh-word (which is typically fronted and focused), and the type of boundary tone on the question's right edge. Each author classified the questions in a subset of the corpus, but final categorization depended on discussion of these classifications and consensus among the authors. The audio files used for the examples and figures in the paper can be found at: https://osf.io/qvw2g/.

3. Main tunes and pragmatic analysis

3.1 Main tunes

Wh-questions in Greek are typically produced with a fronted wh-word that carries the nuclear pitch accent of the question (for in-situ questions see 5.1.2). In our corpus, most of the questions with wh-word fronting were produced with one of four melodies that in AM terms differ with respect to two elements, the pitch accent on the wh-word and the edge tones at the end of the question.

The pitch accent on the wh-word is either a L*+H or a L+H* (Arvaniti & Baltazani, 2005; Arvaniti & Ladd, 2009; Gryllia et al., 2018; Baltazani et al., 2020). Phonetically, in canonical conditions, L*+H shows a rise from a low F0 point as well as peak delay, which can be quite substantial, especially among younger speakers (Gryllia et al., 2018). L+H* shows a shallow rise, and an accentual peak aligned with the stressed vowel of the wh-word or soon thereafter (Gryllia et al. 1018; Baltazani et al., 2020). See Figures 1 and 3 for examples of the two accent types.

The rise of both L*+H and L+H* can be substantially curtailed under extreme tonal crowding. Such tonal crowding applies frequently to wh-questions, since most wh-words in Greek start with a stressed syllable with a voiceless onset; e.g., [ti] "what", [pu] "where", [pos] "how", [pços] "who". The presence of a curtailed rise is supported by the pitch contours of questions with wh-words that have non-initial stress, such as [ʝaˈti] "why", and questions in which the wh-word is preceded by a preposition, such as [me ˈti] "with what". Because of the potentially missing rise, in the present analysis we used early vs. late peak alignment as our primary criterion for distinguishing between L+H* and L*+H respectively.

The accentual peak of both L*+H and L+H* is followed by a fall, which is steeper after L+H* (Gryllia et al., in prep.). F0 reaches the bottom of the speaker's range and remains low until either the end of the utterance or the last stressed vowel in the question, at which point F0 starts rising (Arvaniti & Ladd, 2009; Gryllia et al., 2018; Baltazani et al., 2020). Following Baltazani et al. (2020), we analyze the fall that persists to the end of the question as a sequence of L-L% edge tones, and the low F0 stretch that is followed by a rise as L-H%.[1] These descriptions apply to longer questions. In very short questions, such as those involving just a monosyllabic wh-word, there is significant undershoot: the rise to the accentual peak is minimal and may even be elided, while the low F0 stretch due to the L- phrase accent is realized as a dip instead (Arvaniti & Ladd, 2009).

The above representations of the nuclear pitch accent and following edge tones give rise to four potential combinations: L*+H L-H%, L*+H L-L%, L+H* L-L%, and L+H* L-H%. In section 3.2 we discuss the pragmatics of these tunes.

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[1] We note that in other work, such as Arvaniti & Baltazani (2005) and Arvaniti & Ladd (2009), the rising boundary tone is represented as !H% where the downstep symbol ! indicates the H tone's relatively low scaling. Current evidence suggests, however, that the scaling of this boundary tone can vary substantially but without any clear relation to meaning that would lead to a systematic distinction between !H% and H%. For instance, the findings of Gryllia et al. (2018) suggest that the difference is paralinguistic and related to politeness. Our current corpus supports the conclusion that H% scaling differences are paralinguistic. Thus, for reasons of parsimony, here we use H%.

3.2. Tune pragmatics

The four frequent tunes mentioned above, viz. L*+H L-H%, L+H* L-L%, L+H* L-H%, and L*+H L-L%, are each used for a variety of purposes. Thus, we cannot assume that each tune is associated with a specific communicative function, and it is not even possible to assume a distinction between tunes for canonical questions, on the one hand, and tunes for non-canonical questions on the other. How can we then provide a unified account that can help us predict the tune to be used in a given situation? We contend that our existing analysis in Baltazani et al. (2020) presented in more detail here provides an explanatorily adequate answer.

In Baltazani et al. (2020) we proposed that the suitability of each tune in different contexts depends on the combination of the pitch accent and the edge tones. The two can work synergistically or antagonistically. The default tune for canonical questions, which is L*+H L-H%, illustrates this point: L*+H, the pitch accent typically used in Greek to accent words in prenuclear position, serves to simply highlight the wh-word without biasing the question. It further ensures that the tune is well-formed, i.e., has an accent (cf. Calhoun, 2010a, 2010b, on metrically motivated accents in English; see Pierrehumbert & Beckman, 1988, on the role of metrical heads in tune well-formedness). The H% boundary tone opens the question to the addressee, indicating that an answer is expected. Together, the L*+H pitch accent and H% boundary tone indicate that the answer is to be chosen from an open set of possible answers and that the speaker assumes the answer is potentially known to the addressee. Thus, this tune is suitable for canonical questions, i.e. those that express genuine requests for information from the addressee. We will henceforth call these *information-seeking questions*.

In a similar vein, the accent and boundary tone contribute to the interpretation of L+H* L-L%. The L+H* accent is used in Greek to mark narrow focus (Arvaniti & Baltazani, 2005) and updates the information in the common ground. In wh-questions, its use indicates that the update in the answer is to be chosen from a closed set of potential answers (Rooth, 1992). Assuming that the L% boundary tone indicates that no answer is expected in wh-questions, just as it does in statements, the combination of the L+H* pitch accent with the L% boundary tone generates certain implicatures: either there is no good answer to the question (the set of potential answers is null), or no answer is needed on the part of the addressee as the answer is known to all and the speaker simply seeks the addressee's commitment with respect to the underlying proposition

(Biezma & Rawlins, 2016; Bartels, 1997).[2] The former interpretation makes the tune suitable for biased questions, while the latter makes it suitable for rhetorical questions in the sense of Caponigro & Sprouse (2007) who argue that rhetorical questions are precisely those to which the answer is already known. However, as we discuss in more detail in section 4.2.1, this tune can be used for canonical questions as well.

In the other two tunes, L+H* L-H% and L*+H L-L%, the pitch accent and edge tones operate antagonistically. The L+H* with L-H% edge tones indicates that an answer is expected from the addressee. Further, the use of L+H* indicates that the answer is to be chosen from a closed set of possible answers which are potentially known to the speaker, since she has already determined the set is small or null, and presumed to be known or easily inferable by the addressee. This can lead to a biased question with either positive or negative bias depending on the situation. Take, for instance, a question such as [ˈti θa ˈfame ˈsimera] "what will we eat today?" best translated in English as *guess what's for dinner?* where *guess* is conveyed by the tune. If uttered with L+H* L-H% by a parent to a child, the small set of options is likely to be interpreted as the set of dishes the child particularly likes. However, the same question uttered by an antagonistic sibling could lead the same child to interpret the closed set of alternatives as one that includes the dishes they particularly dislike.

The last possible permutation of accent and edge tones results in the L*+H L-L% tune. According to the analysis we have laid out, this tune would be interpreted as follows: the answer is chosen from an open set, because of the L*+H accent, but the L% indicates that no answer is required. Thus, this tune may be suitable for formulaic questions such as [ˈpços ˈkseri] "who knows?" or [ˈpu aˈkustice] "who has heard of such a thing?": the speaker indicates that they believe there to be a set of potential answers, but they are simultaneously declaring they are not interested in an answer. We have observed questions with this tune in our corpus and discuss them in sections 4.4. and 5.1.1, but they were too rare to allow us to analyze them with any certainty. Their rarity is likely due to the very specific meaning that the tune conveys.

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[2] This interpretation of the L% boundary tone is potentially contradicted by the polar question tune used in Greek, which is L* (L)H- L% (Baltazani & Jun, 1999; Grice et al., 2000; Arvaniti & Baltazani, 2005; Arvaniti et al., 2006). Polar questions do of course invite an answer, despite ending in L%. How can we reconcile our assumption that L% in wh-questions and statements indicates that no answer is expected with the fact that Greek polar questions end in L%? A plausible explanation is that the difference in meaning is related to the phrase accent: in wh-questions and statements, the L% boundary tone is preceded by a L- phrase accent, while in polar questions it is preceded by a H-, resulting in a final rise-fall. It is possible that the phrase accent contributes an independent component of meaning (cf. Pierrehumbert & Hirschberg, 1990; Bartels, 1997) or that it forms a meaningful unit with the boundary tone (cf. Portes & Beyssade, 2015). An investigation and assessment of these alternatives is beyond the scope of this paper.

4. Main tunes and their typical functions

In this section, we take a closer look at the four main tunes discussed in section 3 and examine their possible uses.

4.1 L*+H L-H%

4.1.1 Information-seeking questions with L*+H L-H%

Arvaniti & Ladd (2009) and Baltazani et al. (2020) consider the L*+H L-H% tune the default for information-seeking wh-questions in Greek. As mentioned in section 3.1, these questions start with the wh-word which carries the prosodic focus and is accented with a L*+H accent (Baltazani, 2002, 2003; Arvaniti & Baltazani, 2005; Arvaniti & Ladd, 2009; Grice, Ladd, & Arvaniti, 2000).

According to Arvaniti & Baltazani (2005), on the other hand, Greek uses L-L% edge tones as default for wh-questions, while L-H% (L-!H% in their notation) is used for "involved" questions. Baltazani et al. (2020), who investigated the differences between the L-H% and L-L% ending tunes in wh-questions, partially confirmed the contention of Arvaniti & Baltazani (2005) regarding tune interpretation: the L-H% ending tune is more "involved", in that participants rated wh-questions with this tune more polite than those with the L-L% ending tune. In terms of frequency, the L-H% tune appears to be more frequent and used by default when no instructions are given (Arvaniti & Ladd, 2009). Our present corpus confirms that the L*+H* L-H% tune is the default for information-seeking questions. The tune is illustrated in Figure 1 which comes from a Map Task, with the follower asking the instructor what they can see at a specific location on their map.
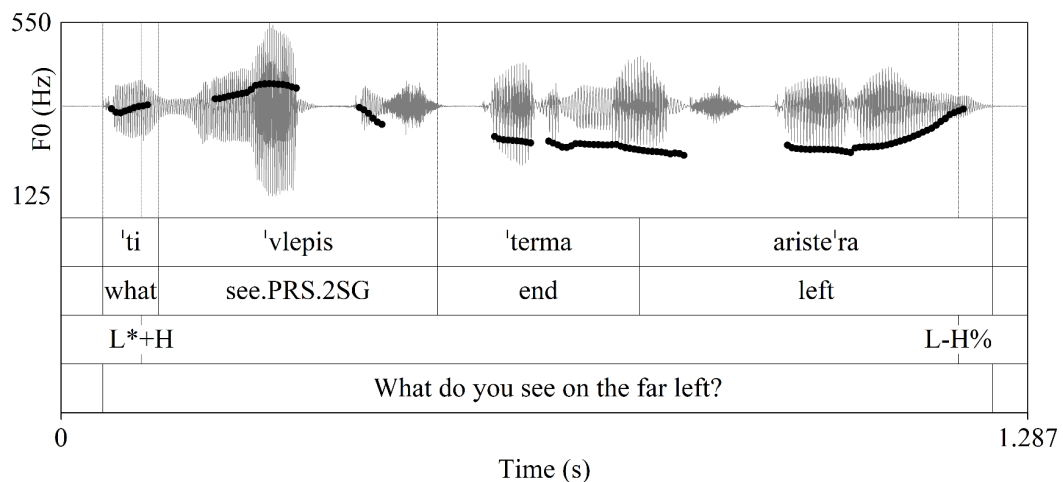

Figure 1. An information-seeking question with the L*+H L-H% tune; from a Map Task.

The realization of the L*+H L-H% tune may be changing among younger speakers, who show a tendency to use a very slight rise accompanied by an audibly elongated final vowel. The latter feature could be a reinterpretation of the vowel lengthening, originally needed for the pitch rise, as the primary cue (Gryllia et al., 2018). This variant is illustrated in Figure 2, which shows a final rise of only 10 Hz but also an unstressed final vowel, the [i] of [ˈvlepis] "see", that is 94 ms long. In Greek, this duration is highly unusual for an unstressed [i] followed by /s/ in utterance final position (Arvaniti, 2007).
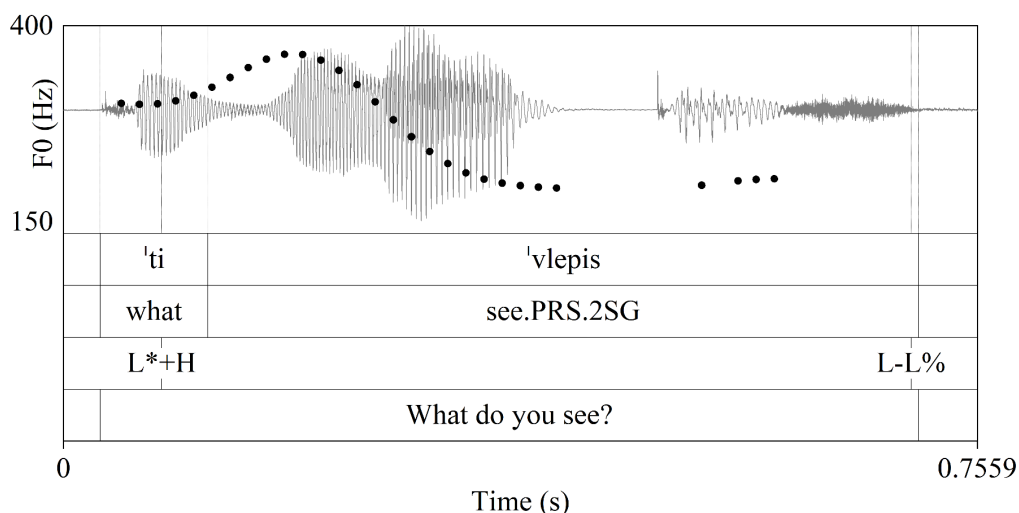

Figure 2: An information-seeking question with a L*+H L-H% tune showing minimal final rise and an elongated final vowel; from a Map Task.

4.2 L+H* L-L%

4.2.1 Information-seeking questions with L+H* L-L%

Baltazani et al. (2020) have shown that the L+H* L-L% tune is used for multiple purposes when produced with wh-questions, including information-seeking questions. How frequently L+H* L-L% is used with information-seeking questions is still a matter of debate: Arvaniti & Baltazani (2005) consider it the default tune for wh-questions, while Arvaniti & Ladd (2009) say it was extremely rare in their wh-question dataset. In our current corpus, collected in 2022 from speakers in their early 20s, this usage was quite frequent. In any case, the use of L+H* L-L% for information-seeking questions indicates that the tune on its own is not always sufficient in changing the interpretation of an utterance: since wh-questions are overtly marked, the possibility of using different tunes with the same neutral intent is to be expected. Such a neutral use can be illustrated with an example: a typical question one hears upon entering a taxi in Athens is [ˈpu ˈpate] "where are you going?". This question addressed by a taxi driver to a client is most likely

to be produced with the L+H* L-L% tune and does not generate bias; in this context, it is a straightforward information-seeking question.

The follower question from (1), shown in bold and illustrated in Figure 3, showcases the use of the L+H* L-L% tune for unbiased information-seeking questions. In this dialogue, the two participants realize that there is a discrepancy in their maps: the instructor's map includes an anemone, while the follower's does not. Once the issue is resolved, the follower asks a clarification question using the L+H* L-L% tune; her utterance is treated as a straightforward information-seeking question with the instructor providing the requested information.

(1)

| Follower	[ðen ˈexo aneˈmoɲi] "I don't have an anemone."
Instructor	[aˈfto to… luˈluði] "That…flower."
Follower	[ðen ˈexo ˈcapça aneˈmoɲi ‖ aˈla | e | eˈci pu ˈeçis ta leˈmoɲa (pause) ˈine sta aristeˈra] "I don't have an anemone. But, er, the spot where you have the lemons […] is it on the left?"
Instructor	**[ˈti ‖ ˈti enoˈis]** L+H* L-L% L+H* L-L% What what mean.PRS.2SG "What? What do you mean?"
Follower	[ˈeçis tin iˈkona me ta leˈmoɲa (pause) broˈsta su ‖ sto aristeˈro su ˈçeri ˈine i aneˈmoɲi] "You have the image of the lemons […] in front of you. Is the anemone on your left hand?"
Instructor	[ne] "Yes."
Follower	[oˈrea ‖ **c ap tin aneˈmoɲi | aˈpo pu ˈprepi na peˈraso**] "Great. And after the anemone, where should I go?"
Instructor	[θa peˈrasis aˈnamesa ap tin aneˈmoɲi ce ta ˈorima leˈmoɲa] "You will pass between the anemone and the ripe lemons."
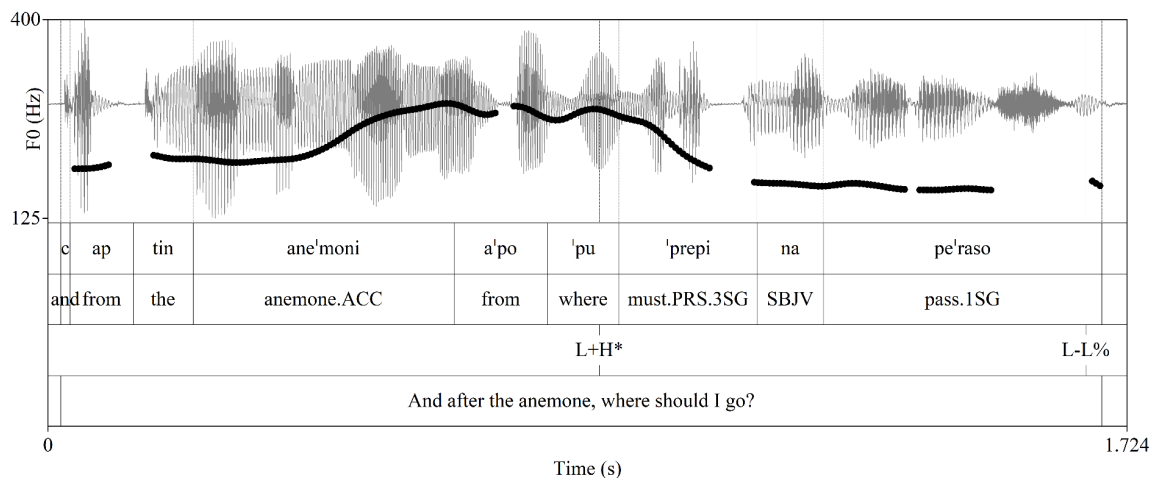
Figure 3. An information-seeking question with the L+H* L-L% tune; see (1) for the full dialogue excerpt; from a Map Task.

4.2.2 Biased questions with L+H* L-L%

As discussed in section 3.2, the L+H* L-L% tune lends itself to the encoding of biased questions. These can usually invite answers of the opposite polarity; informally, a positive polarity biased question usually implies a negative answer. For example, one can say to their partner [ˈpote maˈɟirepses teleˈftea foˈra] "When did you last cook?" using this tune to imply that the partner hasn't cooked for a long time. In a way, such biased questions of positive polarity can function as indirectly stating something negative, including criticism. In such uses, the addressee has two options: they can treat the utterance as a canonical information-seeking question and respond by providing information (e.g., the partner may reply *I cooked soup last Monday*), or they may address only the negative implicatures generated by the tune (e.g., *You're right, I don't cook often enough*), or they may do both (cf. Baltazani et al., 2020).

The interpretation of the tune and response choice depend at least in part on previous knowledge or general world knowledge. Consequently, whether the question is treated as neutral or generates implicatures depends on the circumstances. Revisiting the taxi example given in 4.2.1, the same question, [ˈpu ˈpate] "where are you going?", uttered with the same tune, L+H* L-L%, can be a biased question: if there is a demonstration in the city center and the taxi driver harbors reservations about driving there, they may ask the client where they are going before they allow them to get in the taxi. The implicature of the taxi driver's question is *if I don't like your destination I won't give you a ride*. If the client also knows a demonstration is taking place, they will easily compute this implicature. If they do not, their lack of knowledge may hinder their ability to discern the implicit bias in the taxi driver's question; in other words, the implicature is cancellable.

Needless to say, world knowledge can also lead addressees to different implicatures instead of the one intended by the speaker (see Baltazani et al., 2020, for a discussion).

Examples of biased questions from our corpus include the instructor question in (1), and the follower questions in (2) and (3), the second of which is illustrated in Figure 4. As already mentioned, in (1), the instructor and follower in a Map Task session needed to resolve the difficulty posed by a difference in their maps; when the follower tries to state the problem and asks a polar question, the instructor responds with two questions of his own, "What? What do you mean?", both with the L+H* L-L% tune. The follower recognizes the negative implicature generated by the questions and responds not by providing information but by asking a clarification question instead. Similarly, in the Map Task session in (2), the follower acknowledges the instruction, then refers to a previous instruction and finishes her turn asking a wh-question. By using the L+H* L-L% tune, she implicates that she cannot go the way the instructor tells her to. As in (1), her instructor recognizes the negative implicature and responds by asking a clarification question rather than providing information on the direction the follower is to take.

(2)

| Instructor	[sto iˈɣro liˈvaði pas pros to ˈplai ɟa na peˈrasis aˈnamesa sto iˈɣro liˈvaði ce to ɟelaˈðari] "At the wetlands you go to the side so as to pass in between the wetlands and the cattle egret."
Follower	[ne ‖ ce meˈta mu ˈipes na ˈpao pros ta ˈkato] "Yes. And then you told me to go downwards." **[ˈpu na ˈpao pros ta ˈkato]** L+H* L-L% where SBJV go.PRS.1SG towards the down "Downwards in what direction?"
Instructor	[to ɟelaˈðari ðen ton ˈeçis aˈpenadi ap to iˈɣro liˈvaði] 'Don't you have the cattle egret across from the wetlands?'
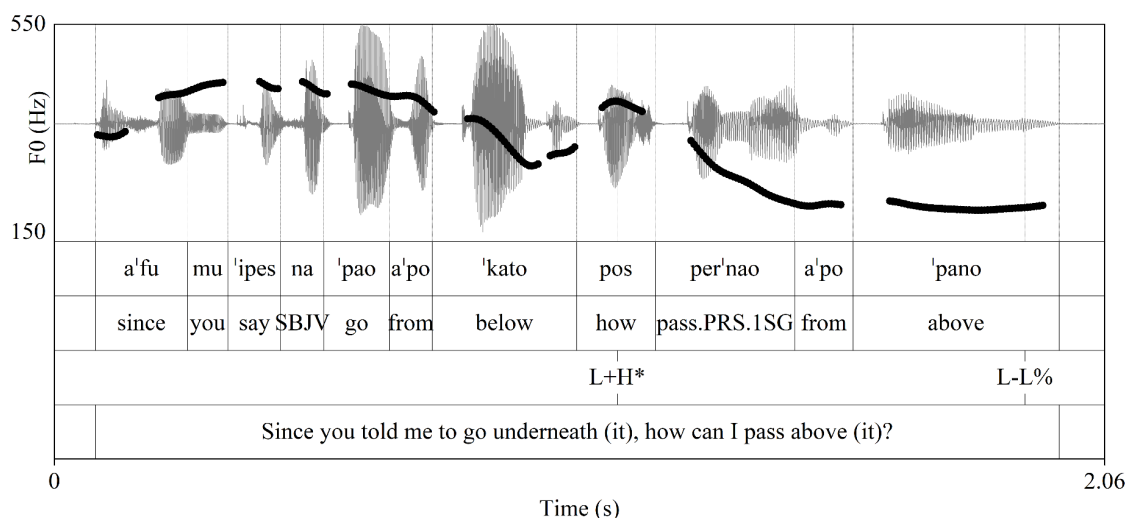
Figure 4. A biased question with the L+H* L-L% tune; see (3) for the full dialogue excerpt; from a Map Task.

Finally, in (3), also an excerpt from a Map Task, the speaker is implying that she cannot go the way the instructor tells her to. Here, the negative bias is overtly presented and is clearly intended as a challenge to the instructor, since the speaker herself mitigates the force of her utterance by hesitating and laughing. The instructor, in turn, responds by acknowledging that their earlier instructions were wrong, rather than by providing new information. See also Figure 4.

(3)

Instructor	[perˈnas ˈpano ap to iˈɣro liˈvaði] "You go above the wetlands…"
Follower	[aˈfu mu ˈipes] [na ˈpao aˈpo ˈkato ‖ˈ**pos perˈnao aˈpo ˈpano**] L+H* L-L% (interrupts) "since you told me to go underneath (it), **how can I pass above (it)?** (laughter)"
Instructor	[ˈzvisto ǀ ˈzvisto] "Rub it off, rub it off."

4.2.3. Rhetorical questions with L+H* L-L%

As noted in 3.2, the L+H* L-L% tune is also used for rhetorical questions. Rhetorical questions do not require an answer and can function as assertions (Hill & Miyagawa, 2024) because their answer is considered obvious to all interlocutors (Rohde, 2006;

Caponigro & Sprouse, 2007; Biezma & Rawlins, 2017; Ferin, this volume). Such a definition acknowledges uses where the answer suggested by the rhetorical question is a non-empty set. An example of such a rhetorical question is given in (4). It comes from Ellinofreneia (Ellinofreneia, 2024b) and the topic is weight gain during the Christmas holidays; after one of the presenters suggests it is time to go on a diet, his interlocutor replies "who starts a diet on a Thursday?". The wh-question is clearly meant as a rhetorical question to which an answer is not expected, as it is a recurring joke that diets start on a Monday.

(4) [ˈpemti | ˈðieta || ˈpços   ksekiˈnai]
                                   L+H*   L-L%
     Thursday.ACC diet.ACC   who.NOM start.PRS.3SG
     "Who starts a diet on a Thursday?"

Another example of a rhetorical question is shown in Figure 5. In this extract from Ellinofreneia the topic is the "email-gate" scandal in which a former Greek MEP candidate illegally obtained voters' contact information and sent them unsolicited emails to advertise her candidacy. One of the presenters suggests to a caller who received one of these emails to sue the MEP candidate to make some money (Ellinofreneia, 2024d). The caller considers this and is egged on by the presenter who asks, "what do you have to lose?" to which the caller replies with an idiomatic expression roughly translated as "indeed, you're right" (cf. Caponigro & Sprouse, 2007, on possible responses to rhetorical questions).
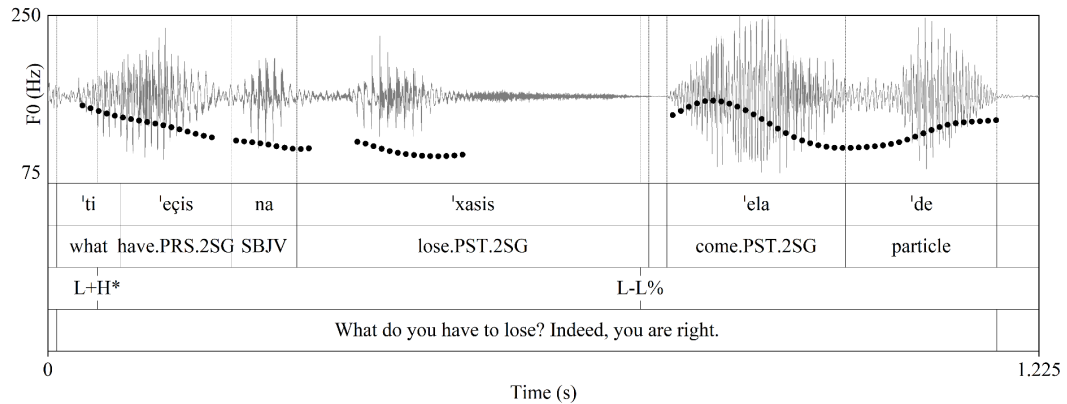

Figure 5. A rhetorical question with the L+H* L-L% tune, followed by a confirmatory response by the addressee (not annotated); from Ellinofreneia (2024d).

4.3 L+H* L-H%

As noted in 3.2, the L+H* L-H% tune is largely used for pedagogical and theme-setting questions (see also Baltazani et al., 2020 on this point). In some contexts, such questions can be biased, though the bias is only clear if the addressee can make a reasonable guess of the speaker's intentions. This was illustrated with the [ˈti θa ˈfame ˈsimera] "what are we having for dinner?" example discussed in section 3.2.

In our corpus, we did not find theme-setting questions, though as native speakers we believe these to be possible in Greek and produced with the L+H* L-H% tune. For example, the presenter of a cooking or a craft show can start with a question such as as [ˈti θa ˈftçaksume simera | ˈfiles ce ˈfili] "what will we make today, friends?".

The L+H* L-H% tune was used extensively in our corpus with pedagogical questions. These were very frequent in the cooking shows, where the presenter addressed either someone among the crew or the audience directly. This use is a rhetorical device (anthypophora) which seems to be quite frequent in Greek: wh- as well as polar questions are used as a way to draw attention or steer the discussion in a direction the speaker wishes to follow. An answer is required, even if it is, in some uses, given by the speaker themselves. Further, the set of appropriate answers is closed and known to the speaker.

From a prosodic perspective, most of the pedagogical questions are characterized by a pitch span upward expansion for the H%. This is often so extensive that the H% boundary tone is scaled noticeably higher than the H tone of the L+H* accent, a relationship between the two tones that is the reverse of what is typical with the L*+H L-H% tune. It is unclear at this point whether this constitutes a meaningful difference between types of H% boundary tones, though the most likely interpretation is that the pitch span expansion is paralinguistic; i.e. it is there to draw attention, a function in line with the speaking style of the type of discourse where most of these questions appear.

The pedagogical use of the L+H* L-H% is illustrated in Figure 6. In this example, chef Petredzikis is explaining the process of making rice and wishes to draw attention to the fact that minimum heat is required as soon as boiling starts. In order to explain this step, he turns the information into a question that he addresses to his cameraman: "As soon as I see the first bubble, what do I do, Dionissi?". Petredzikis then immediately continues with *I turn it down to the minimum*. Similarly, in (5), chef Vefa Alexiadou is demonstrating how to make fish cakes, and after asking "What will I add now?" she proceeds to answer her own question with *I have breadcrumbs here, my friends*.

(5) [ˈ**ti**   **θa** ˈ**valo**   ˈ**tora**]   [psoˈmaci ˈexo eˈðo triˈmeno ˈfiles ce ˈfili]
　　 L+H*   L-H%
　　 what FUT add.PRS.1SG now]
　 "What will I add now? I have breadcrumbs here, my friends".

me	to	pu	ˈðo	ti	ˈproti	burbuˈliθra	ˈti	ˈkano	ðjoˈnisi	
as	it	that	see.1SG	the	first	bubble.ACC	what	do.1SG	Dionissi	

L+H* L-H%

As soon as I see the first bubble, what do I do, Dionissi?

0   2.283
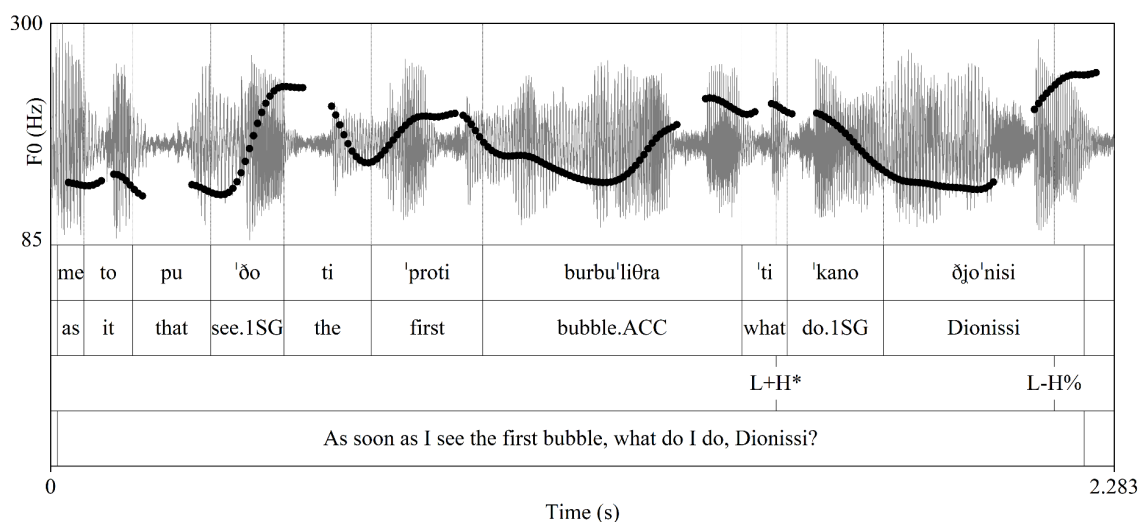
Time (s)

Figure 6. A pedagogical question with the L+H* L-H% tune; from Petredzikis (2024).

As mentioned, such pedagogical questions can be answered either by the speaker, as in the above examples, or by the addressee. In our corpus we find both options. For instance, in Petredzikis' show, the chef mostly answers his own questions, but on occasion, the cameraman offers an answer that is accepted as correct and sometimes augmented with additional information provided by the chef. In an exchange from the same episode as Figure 6, Petredzikis gives instructions for vegan chicken nuggets by saying: [ˈbenune sto ˈfurno | ce ˈposi ˈora xriˈazode ˈfile ðjoˈnisi] "they go into the oven, and how long do they need, Dionisis my friend?" The cameraman responds with the cooking time (10-12 minutes) which then Petredzikis repeats: *ten to twelve minutes, ok?* (Petredzikis, 2024).

Though pedagogical questions are particularly frequent in the cooking shows, they are not absent from other types of discourse we considered and were also typically answered by the speaker themselves. This is illustrated in Figure 7 with a question from Ellinofreneia (2024c).The speaker, a caller in the Ellinofreneia "people's time" segment, is talking about the inability of Greeks to pay their bills by asking: "why is a person in debt?" and continues with the answer: *because they have been devastated by taxation*.
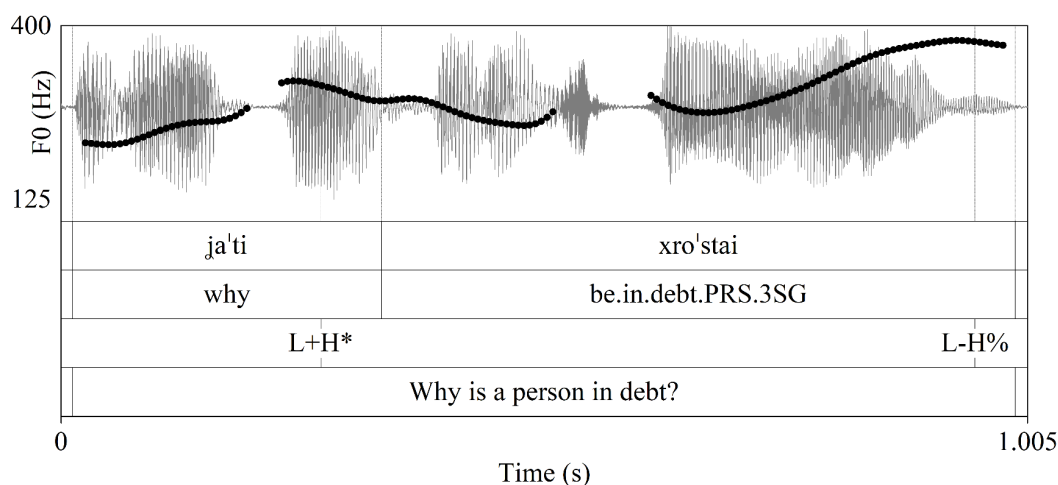
Figure 7. A pedagogical question with the L+H* L-H% tune; from Ellinofreneia (2024c).

4.4. L*+H L-L%

In our corpus, L*+H L-L% was used with rhetorical and conjectural questions. Although a complete analysis of the subtle pragmatic interpretation of the L*+H L-L% tune is not offered here, it's important to recognize a recurring theme in these questions: the speaker's indication of disinterest in receiving an answer. This is illustrated in Figure 8 which shows a rhetorical question by an Ellinofreneia presenter asking "why shouldn't New Democracy [Greece's ruling party] be re-elected?". The answer to a rhetorical question that includes negation is positive; in this instance, then, the answer is *there is no reason why New Democracy shouldn't be re-elected*. In this context, the rhetorical question is used ironically to imply that there are many reasons why New Democracy should not be re-elected. The presenter has playfully chosen to use this tune because it implies that he does not really want an answer and thus that his intended message is in fact the opposite of what the words in his question are saying. Understanding the irony requires real world knowledge, in this case, knowledge of the presenter's anti-New Democracy stance. A conjectural question with this tune is shown in Figure 9, and discussed in section 5.1.1. Finally, because of the lack of interest in a response, this tune may be appropriate for formulaic questions, such as [ˈpços ˈkseri] "who knows?", [ce ˈti na ˈkano eˈɣo ˈtora] "and what should I do now?" meaning *how is that my concern?* or [ˈti ˈpai na ˈpi] "so what?".
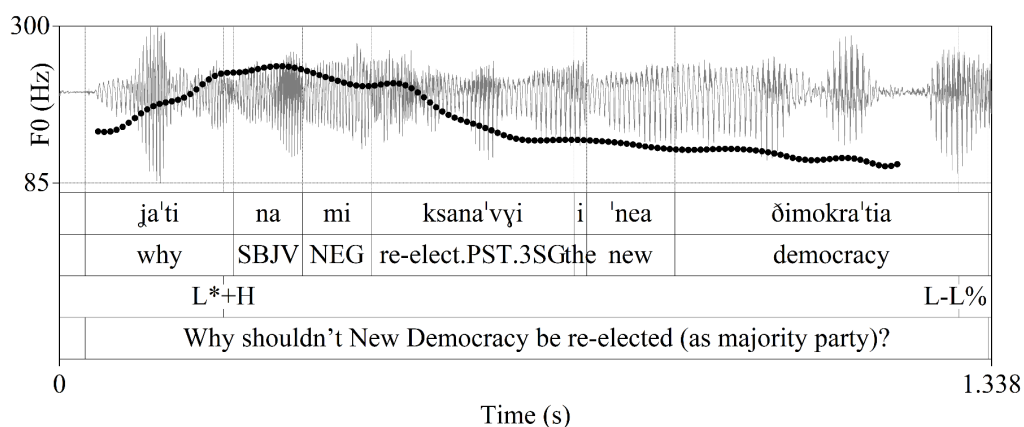
Figure 8. A rhetorical question with the L*+H L-L% tune; from Ellinofreneia (2024a).

5. Additional types of non-canonical questions

5.1 Additional types of non-canonical questions with typical tunes

5.1.1 Conjectural questions

Conjectural questions – sometimes called 'engaging' or 'inclusively self-addressed' questions (Farkas, 2020) – express the speaker's curiosity or speculation about a certain issue, rather than directly requesting an answer from the listener (Eckardt & Beltrama, 2019). An example is given in Figure 9, in which two speakers discuss the possible use of an unusual object and wonder what it might be. In this context, it is mutually assumed that the answer will be reached after a series of collaborative moves involving both participants in the conversation. Conjectural questions can have any of the main tunes, L*+H L-H%, L+H* L-L%, L+H* L-H%, L*+H L-L%. This is largely illustrated in Figures 9 and 10, in which the two conjectural questions are produced with L*+H L-H% and L*+H L-L% respectively, while the tune in (6) is L+H* L-L%.

Conjectural questions are often combined with particles of epistemic modality and other discourse markers and intensifiers that may indicate more uncertainty on the part of the speaker (Eckardt & Beltrama, 2019). The use of such markers distinguishes information-seeking from conjectural questions. This is illustrated in (6): (a) is an information-seeking question; its form makes it unsuitable for use as a conjectural question; (b)-(d), on the other hand, express increasingly more uncertainty forming a continuum. In (b) the subjunctive marker [na] is used, while (c) has also the modal [boˈri]
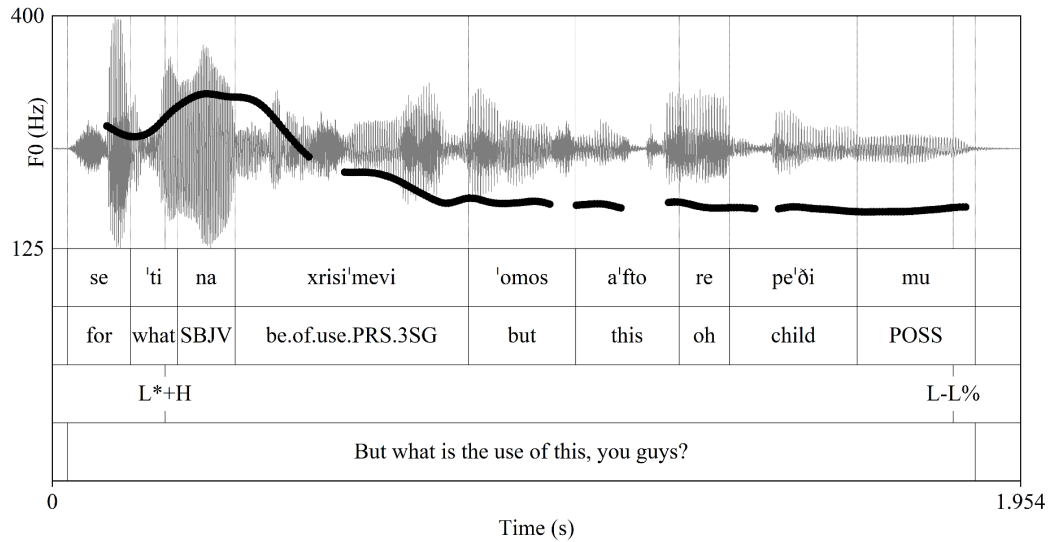
"might" and (d) – from a dialogue on the function of unusual objects – expresses even more uncertainty by the addition of the particle [ˈaraɟe] "I wonder". Figure 10 shows a compilation of discourse markers for a conjectural question during an unusual objects discussion.

(6) (a) [ˈpu xrisiˈmevi]   "What purpose does it serve?"
    (b) [ˈpu na xrisiˈmevi]   "What purpose may it serve?"
    (c) [ˈpu boˈri na xrisiˈmevi]   "What purpose might it serve?"
    (d) **[ˈpu   boˈri   na   xrisiˈmevi   ˈaraɟe]**
        L+H*   L-L%
        where may.PRS.3SG SBJV be.of.use.PRS.3SG particle
    "What purpose might it serve, I wonder?"

Figure 9. A conjectural question from an objects dialogue, with the L*H L-H% tune.

se	ˈti	na	xrisiˈmevi	ˈomos	aˈfto	re	peˈði	mu
for	what	SBJV	be.of.use.PRS.3SG	but	this	oh	child	POSS

L*+H   L-L%

But what is the use of this, you guys?

0   1.954

Time (s)

Figure 10. A conjectural question from an objects dialogue, with the L*H L-L% tune.

5.1.2 Wh-questions in-situ

Greek is a typical wh-movement language, like English. Thus, the wh-in-situ option is restricted. According to Tsimpli (1998), wh-in-situ questions are associated with an echo interpretation (on echo questions, see section 5.2.1). However, in our corpus we found wh-in-situ questions with other functions as well (see Sinopoulou, 2009; Vlachos, 2012; Roussou et al., 2014, for similar observations). Consequently, their tunes vary too.

An example of an information-seeking wh-in-situ question using the wh-word [pçaˈnu] "whose" is given in (7). The example comes from a Map Task; the speaker asks the addressee to provide information about the left side of a landmark so that she can continue navigating. In this instance, the tune is L+H* L-L%.

(7) [apo   tin   aristeˈri meˈr̩ja   pçaˈnu]
                                           L+H* L-L%
    from the.ACC left.ACC side.ACC who.GEN
    'On the left side of what?'

The same tune, L+H* L-L%, is used in Figure 11. In this instance, the presenters of Ellinofreneia discuss an excerpt from a parliamentary session in which a conservative MP accused a communist party MP of unseemly behavior (Ellinofreneia, 2024b). The presenter asks, "[unseemly] in relation to what?" implying that the behavior of MPs in the Greek parliament is generally unseemly. Thus, this is a rhetorical question and has the L+H* L-L% tune frequently employed for this function.
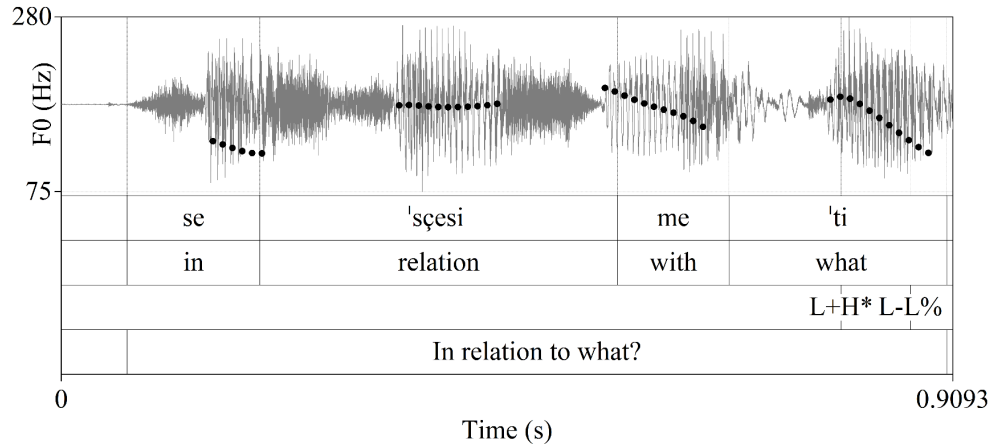
Figure 11: Wh-in-situ question with the L+H* L-L% tune; from Ellinofreneia (2024b).

In Figure 12, on the other hand, chef Petredzikis uses a wh-in-situ-question for pedagogical purposes: he is demonstrating a poke bowl recipe and near the end of the show, he says [to ˈmono pu mas ˈlipi ɟa na ˈine olokliroˈmeno to ˈpoke ˈboul mas ˈine | ti] "The only thing missing to finish our poke bowl is what?" with the wh-word [ti] "what" in-situ. Note that this utterance is divided into two intonational phrases (IPs): a long IP preceding the wh-word, with the wh-word itself forming its own IP. The first IP is (largely) the topic of the question and ends low; the wh-word carries the whole wh-question tune, which in this case is L+H* L-H%, as is typical of pedagogical questions.
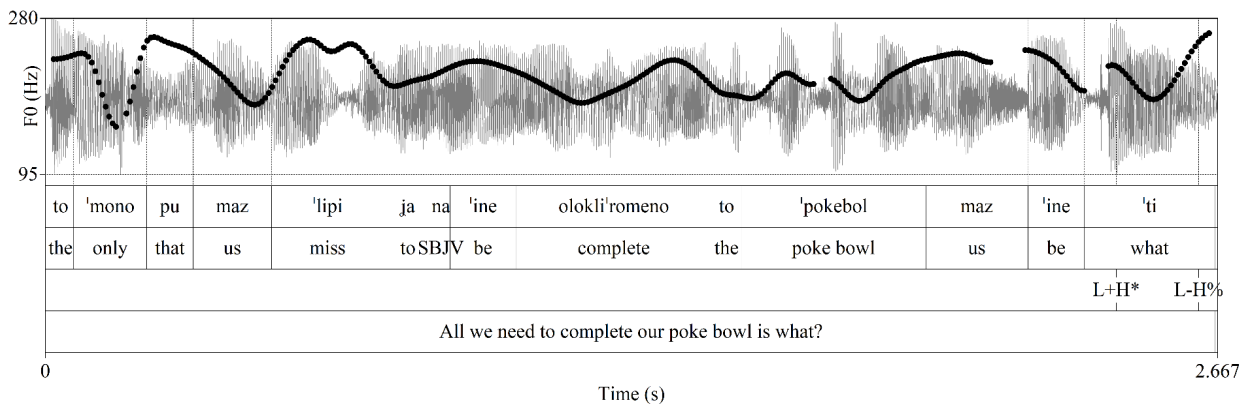

Figure 12. A pedagogical wh-in-situ question with the L+H* L-H% tune; from Petredzikis (2024).

In short, wh-in-situ questions serve several purposes in Greek; they are not always interpreted as echo-questions. Thus, the tune of a given wh-in-situ question is selected based on the function the question serves, showcasing once more the many-to-many relation between tunes and pragmatics, even with a syntactically marked construction.

Prosodically, what they all have in common is that the wh-word forms its own phrase and carries the entire tune associated with the question.

5.1.3 Ironic questions

In our corpus, wh-questions are frequently used for irony, particularly in Ellinofreneia. Most of the ironic questions in our corpus are used to express the opposite of what the tune would normally implicate (e.g., Kapogianni, 2021), whether this means that the question is prima facie interpreted as information-seeking, biased, or conjectural. Consequently, ironic questions can be uttered with any of the main tunes, depending on how irony is expressed.This is illustrated in Figures 8, 13, 14, and 15.

The question in Figure 8 is a rhetorical question with the L*+H L-L% tune used for ironic purposes (see section 4.4 for a discussion). Like the question in Figure 8, that in Figure 13 (Ellinofreneia, 2024c) is a classic example of an ironic utterance that expresses the opposite of the intended meaning. In this instance, a caller in Ellinofreneia starts talking about *Papadopoulos*. There is no doubt for the presenters and the audience that the caller (a supporter of the ultra-right) is referring to the leader of the Greek military junta of 1967-1974, because a recurrent argument of the ultra-right is that Papadopoulos' brutal regime created, counterfactually, a peaceful and safe environment. The presenter interrupts the caller with a question, "which Papadopoulos?", with the typical information-seeking tune, L*+H L-H%. By using this tune the presenter feigns ignorance of which person the caller is referring to. Indirectly, this move – asking for information – allows the presenter to cancel the claimed connection between the dictator Papadopoulos and peace and safety and thus forces an implicit acknowledgement of who *Papadopoulos* really was, a dictator. This example nicely demonstrates that the information-seeking tune can also convey irony, given an appropriate context.

In Figure 14, the question has the L+H* L-L% tune. One of the Ellinofreneia presenters asks "what do we need elections for?" (Ellinofreneia, 2024c). The tune is used to bias listeners towards the negative interpretation that elections are not necessary, and this is exploited for ironic purposes, effectively to argue for the opposite: elections are necessary because the ruling party must go. In order to understand the irony, the hearer needs to know both the political situation in Greece – namely that the ruling party has a very poor record in all aspects of government yet it keeps winning elections – and the stance of the Ellinofreneia presenters who are not fans of the government. Thus, the question is both biased (there is no reason to hold elections because New Democracy will win anyway) and ironic.

Finally, in Figure 15, the tune is L+H* L-H%. The topic is, once more, the uselessness of elections (Ellinofreneia, 2024b). Here the tune typical of conjectural questions is employed, though there is no forthcoming answer. The presenter uses this tune ironically once more, to imply the opposite of what his utterance ostensibly expresses: though he

speculates that voters need not engage in the election as it is futile (*why bother?*), as in example 14, the audience can grasp the underlying message that elections are indeed essential.
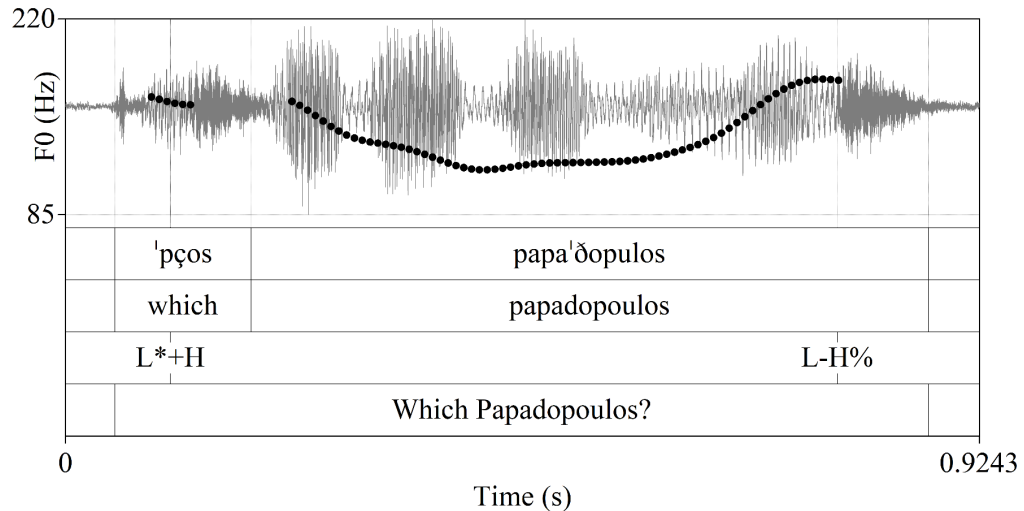

Figure 13. A question with the L*+H L-H% tune, typical for information-seeking questions, used ironically; from (Ellinofreneia, 2024c)
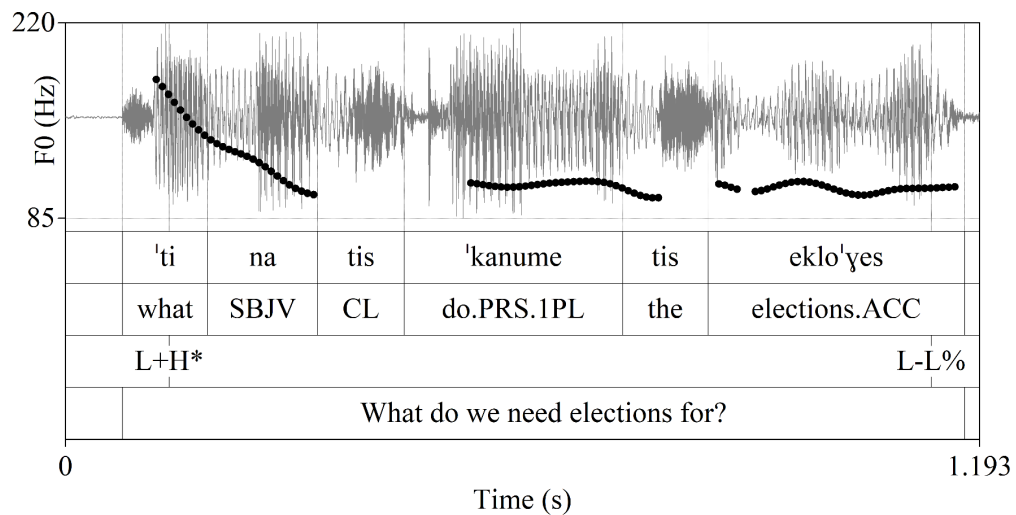

Figure 14. A question with the L+H* L-L% tune, leading to a biased question with an ironic interpretation; from (Ellinofreneia, 2024c)
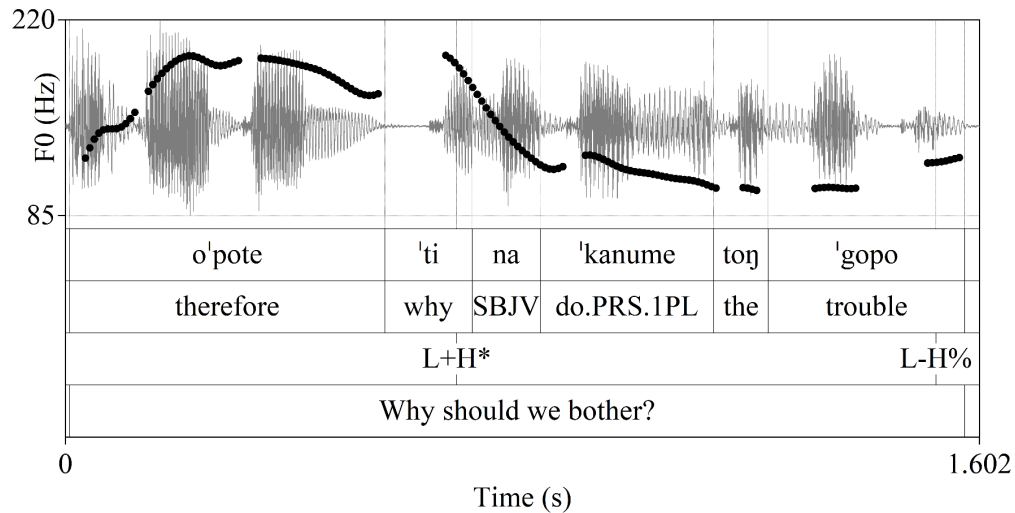
Figure 15. A question with the L+H* L-HL% tune, leading to a biased question with an ironic interpretation; from (Ellinofreneia, 2024c)

5.2 Non-canonical questions with distinct tunes

So far we have examined typical wh-question tunes with canonical or non-canonical interpretation. Here we broaden the discussion to include echo-questions (section 5.2.1), and (ii) information seeking wh-questions combining the morphosyntactic structure of a wh-question with the tune of a polar question (section 5.2.2).

5.2.1 Echo questions

The syntax and pragmatics of echo questions in Greek have attracted relatively little attention (but see, Tsimpli 1998; Sinopoulou, 2009; Vlachos 2010, 2012; Roussou, Vlachos & Papazachariou, 2014); their intonational analysis is even less well documented (Roussou et al., 2014). These studies have established that in echo-questions, the wh-word can remain in situ or move to the beginning of the sentence. Roussou et al. (2014) experimentally show that the echo question tune in both in- and ex-situ wh-questions is L* L-H%. Our corpus supports this intonational analysis, though we should note that we have not found any in-situ echo questions in our corpus. We further note that the same tune is used for echo questions that also encode surprise; in such cases, we see both an upward register shift of the overall tune to the middle of the speaker's range and a span expansion of the H% boundary tone.

Figure 16 shows an example of an echo question from the Map Task corpus. In this example, the follower acknowledges that the instruction given to them in an earlier turn of the instructor's is about a landmark consisting of nine items, but does not remember the type of items; the question asks about item type: *nine what?*.
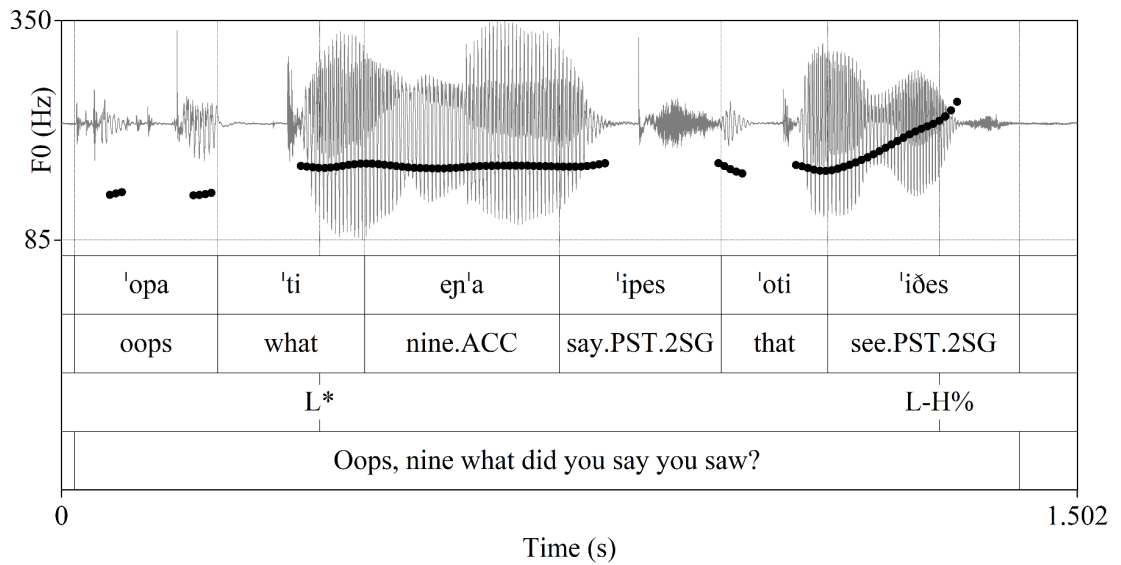
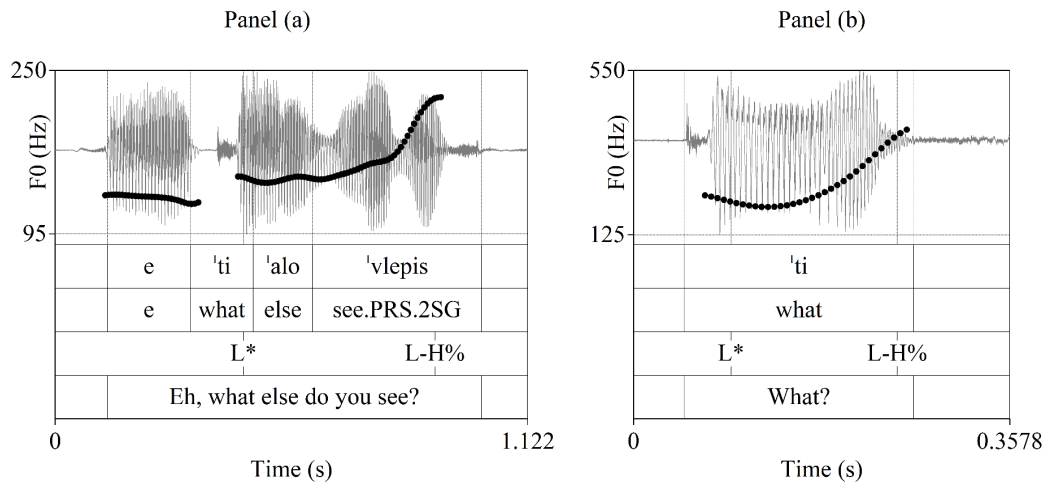**Figure 16.** An echo question with L* L- H% tune; from a Map Task.

Figure 17: Two echo questions with L* L-H% tune from a Map Task (panel a), and a discussion of unusual objects (panel b).

Finally, Figure 17 shows two more examples of echo questions. In Figure 17a, the use of [e] as a filled pause, shows that the tune is low relative to the speaker's range, thus supporting the analysis of it as L* L-H%. In panel (b), the question is uttered by a study participant to indicate that he had not heard an instruction of the experimenter's. As is clear from this example, the tune in this short question is realized as a quick dip and rise, rather than a low F0 stretch, as the entire tune must all be carried by one vowel [i], which is elongated for the purpose.

How can our compositional approach accommodate the tune of echo questions? So far we have implicitly assumed that the information-structural meaning of the accents we have discussed, L*+H and L+H*, is calculated as part of the utterance rheme, that is, it is intended to update the common ground (as are H* and H*+L found in declarative statements). Following Steedman (2014), we argue that the L*+H and L+H* accents are interpreted as a successful update, whereas the L* accent in echo questions expresses *unsuccessful* update. In other words, L* in echo questions signifies the failure to hear or understand the message of the interlocutor (see also Bartels, 1999, for an alternative explanation of L* as lack of commitment).[3]

5.2.2 Questions with wh-question morphology and polar question tune

An unusual pattern we observed in our corpus consists in questions that have wh-question morphology but are produced with the characteristic tune of Greek polar questions (e.g., Baltazani & Jun, 1999; Arvaniti et al., 2006). Figure 18 illustrates this: chef Akis Petredzikis is demonstrating what he describes as an "easy panettone" recipe; panettone is difficult to make, so after stating that the recipe he will show is easy, Petredzikis asks "how did Akis manage to do this?" and gives an answer himself: *I'll show you in what follows*. Note that although this has the flavor of a pedagogical question, like those we discussed in 4.3, it is produced with the tune of a polar question, despite the fact that morphosyntactically it is a wh-question. In essence, the speaker here is producing an embedded wh-question under an implicit yes-no question such as *Do you want to know…?*. This explains the polar question tune, the fact that the speaker talks about himself in the third person in the question, and the answer he gives. This type of question is an additional device used in Greek to steer the discussion and introduce a topic.

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[3] According to GRToBI (Arvaniti & Baltazani, 2005), L* accents appear in two additional contexts: they are the nuclear accent in polar questions, and are also used in continuation rises. Our interpretation of the role of L* in echo wh-questions can account for the use of L* in polar questions too. A number of proposals assume that when responding to a polar question, an interlocutor accepts or rejects the content of the proposition expressed by the question (Gunlogson, 2003; Roelofsen & van Gool, 2010; Farkas & Bruce, 2010; Biezma & Rawlins, 2012); consequently responses to polar questions engage with this content proposition implying there is no need to revise the common ground between interlocutors. Thus, a L* accent is a suitable prosodic marker to indicate a polar question in Greek. Regarding continuation rises, on the other hand, the GRToBI account may need revising: in our corpus we found that continuation rises can have low or rising F0 and it is not clear that the latter is due to L* undershoot under conditions of tonal crowding. Additionally, as native speakers, we cannot detect a clear difference in meaning between the two variants of continuation rise tunes. Further discussion of continuation rises is beyond the scope of this paper.

Figure 18. A wh-question produced with the polar question tune; from Petredzikis (2023).

Similarly, chef Argiro Barbarigou is giving instructions on how to grind crackers to make a base for cheesecake (Barbarigou, 2021). She warns the audience that the crackers must be turned into really fine crumbs. Then she continues by asking an in-situ question shown in (8) with polar question intonation meaning *(Do you want to know) why this is?*. She then adds, *I'll give you the answer at the end*.

(8) [c   aˈfto   ɟaˈti]
                          L* H-L%
     and this.ACC   why
"Do you want to know why this is?"

6. Discussion and Conclusion

In this paper we discussed a number of different tunes used in Greek with wh-questions, and offered both a prosodic and a pragmatic analysis for these tunes. By examining a corpus of spontaneous uses of wh-questions in different communicative situations, we have shown that wh-questions are used for various purposes, all of which are in line with Eckardt's categorisation (Eckardt, this volume).

With the exception of echo-questions, which have a distinct tune, most of the wh-questions in our corpus were produced with one of four tunes, L*+H L-H%, L+H* L-L%, L+H* L-H%, and L*+H L-L%. Consequently, each one of these tunes serves various pragmatic purposes, some unrelated to questions. For instance, L*+H L-H%, which according to Arvaniti & Ladd (2009) and Baltazani et al. (2020) is the default

wh-question tune, is also used with certain negative statements (Baltazani 2002, 2006); e.g., [ˈðen ˈexo leˈfta] "I don't have money" (Ellinofreneia, 2024d). It can also be observed in the confirmatory response to the rhetorical wh-question illustrated in Figure 5. Similarly, L+H* L-L% is also used for declarative statements with contrastive or corrective focus, found frequently in Map Tasks as in the following examples: [ˈpano apo to aɣriˈoʝiðo] "ABOVE the wild goat" or [eˈɣo ˈvlepo ˈena gremiˈzmeno neˈromilo] "I see a RUINED watermill [not an abandoned watermill]" (see Arvaniti & Baltazani, 2005, and Arvaniti, Katsika, Hu, in press, for data and discussion). In short, there is no one-to-one correspondence between tune and meaning–the mapping is many-to-many.

In addition to the prosodic analysis of the tunes, we provided a pragmatic analysis grounded in compositional approaches to intonation meaning. This analysis is based primarily on Pierrehumbert & Hirschberg (1990), with additional insights adopted from Steedman (2014). The main conclusion is that a compositional approach is better suited to account for the various uses of the tunes than a configurational approach. This is based on the recognition that the meaning of individual tune elements must be sufficiently abstract to be interpretable when a tune is used with different lexical choices and in different contexts. The role of the context cannot be overstated, as it can generate different implicatures for interlocutors. Similarly, our analysis demonstrates that various types of questions can function as ironic devices, yet the interpretation of such questions as ironic hinges on world knowledge shared by speaker and addressee; tune selection is critical but not sufficient.

The above should not be taken to mean that an analysis of intonational meaning can allow us to neatly separate the functions of wh-questions. Indeed our corpus confirms that many questions serve several functions at once. The use of rhetorical questions as an ironic device is a case in point. In contrast, the examples in section 4.2.2 indicate something we had already hinted at in Baltazani et al. (2020), namely that biased questions need not be interpreted as questions, in that the addressee is at liberty to address only the bias (the negative implicatures) without providing new information. As the above indicates, the function of the question is not always unique and unambiguous. On many occasions, interpretations required listening to the extended context in which our examples were used and discussion among us to best determine the function of a particular question in a given context. This should not be seen as a weakness of the compositional approach or a denigration of the role of intonation; rather, it reflects the nature of the communication process which is probabilistic and open to misinterpretation (Elder, 2019). It further reinforces the view that examining the pragmatics of intonation out of context is unlikely to lead to breakthroughs. Approaches closer to that advocated by interactional pragmatics (e.g., Ariel, 2016; Elder, 2019; Elder & Beaver, 2022) are more likely to lead to insights.

This investigation underscores the need to use spontaneous data that come from different sources and serve different communicative functions. In a laboratory environment, speakers may consistently opt for a default tune, simply because the

traditional tasks, such as reading sentences aloud, lack communicative intent. This tendency may be especially notable with less frequently used tunes, which are hard to elicit in the laboratory (Arvaniti, 2016); it may also be related to a specific speaker's ability to imagine the right context and use it to select an appropriate tune. This limitation of lab speech was particularly notable with respect to the L*+H L-L% tune. In Baltazani et al. (2020), we speculated about its meaning but did not have concrete examples of its use. The spontaneous speech examined here provided instances of L*+H L-L% and allowed us to better understand the functions of this tune.

Moreover, our analysis demonstrates that the limitations associated with laboratory speech cannot be solved by eliciting data through some frequently used unscripted task: our data revealed variations in the usage of wh-questions depending on the task at hand. For example, in our Map Task corpus, participants predominantly asked information-seeking questions, but also resorted to biased and echo questions, when the differences between instructor and follower maps led to misunderstandings. Rhetorical questions, on the other hand, were rare in the Map Task but frequent in the political satire of Ellinofreneia. Similarly, conjectural questions were frequent in the object dialogues and the "Who am I" game, because in both tasks, speakers wondered about how to convey or interpret information. Pedagogical questions, on the other hand, were frequent in the cooking shows. The importance of analyzing spontaneous and unscripted speech from varied communicative situations is underscored by the discovery of instances of L*+H L-L%, which we had not been able to elicit in laboratory settings and would have been difficult to find if we had restricted our corpus to one task.

Our description of tunes and their functions and pragmatics does not cover all our observations regarding wh-questions in our corpus. First, although our analysis focused on F0, as some of our discussion indicates, the tunes were realized using additional phonetic detail, such as changes in pitch scaling, segmental duration (see also Ferin, this volume on syllable duration in Italian questions), and on occasion speaking rate (see also Seeliger, this volume, on speech rate in Swedish); for instance, impressionistically, many pedagogical questions showed a fast speaking rate at the beginning coupled with the already mentioned expansion of pitch span for the final H% boundary tone. There are many potential sources for such variability; e.g., politeness may lead to slower speaking rate and higher scaling of the H%; surprise may raise either the register of an echo question or the span of the H% boundary tone, or both. It is also possible that some of the observed differences, such as the exceptionally high scaling of H% and accelerated speaking rate with some types of pedagogical questions could be part and parcel of the realization of that specific tune in specific contexts. Such changes seem to be largely stylistic – rather than related to linguistic structure – but may constitute redundant features that help listeners interpret the tune and thus the pragmatic intent of the question (cf. Braun et al., 2019; see also Arvaniti et al., in press, and references therein). Thus, a systematic overview of such features should more regularly accompany the description of tunes and should shed light on their function.

Another feature that deserves a more systematic analysis is the role of discourse particles which are often used with wh-questions (see also Seeliger, this volume, and references therein on question particles in Swedish, as well as Ferin, this volume, on question particles in Italian). Their role has not been investigated in great detail but we know they are frequently used particularly with conjectural questions, as discussed in 5.1.1.

We also did not address standardized questions which raise the possibility of intonation idioms, in the sense of Wells (2006), and Calhoun & Schweitzer (2012), i.e. expressions often produced with a specific tune. In Greek this may apply to several wh-questions such as the following: [ˈpos su ˈfenete] "how do you like it?"; [ˈpços ton/tin ˈkseri] "who knows what s/he is up to?"; [ˈçerete | ˈti ˈkanete] "hello, how are you doing?"; [ˈti na su ˈpo ˈtora] "what should I say to you now?" meaning *I am speechless*; [ˈti ˈala] "any other news?"; [ˈpos tolˈmas] "how dare you?"; [(eˈsi) ˈti ˈzori traˈvas] "why does it bother you?"; [ˈpu aˈkustice] "who heard of such a thing?". We have argued in section 4.4 that such questions may be preferentially uttered with the L*+H L-L% but this requires empirical confirmation.

Finally, two more topics remain unaddressed. The first relates to wh-exclamatives, which are sometimes considered a type of wh-question (see Zanuttini & Portner, 2003, and Repp, 2020, and references therein). The second has to do with the location of focus. In line with previous research, we assumed that the focus in Greek wh-questions is on the wh-word. However, our data indicate that there are exceptions. Specifically, in questions where the wh-word is part of a questioning phrase (e.g. *with which fork do I eat this?*) the focus can shift from the wh-word to another element in this phrase. In addition, we found instances of second occurrence focus and of focus shifting altogether from the wh-word to some other element in the question, such as the following verb (Alexopoulou & Baltazani 2012). For instance, in a Map Task dialogue, a speaker asks their interlocutor about a landmark and when he keeps offering the landmark's name, she asks, [ˈpos ˈmɲazi] "what does it LOOK LIKE?" to indicate that she wants a description, not the name of the landmark. Though this instance is straightforward, the pragmatic import of such focus changes is not always clear and has barely been discussed in the literature on Greek wh-questions (but see Alexopoulou & Baltazani, 2012). We leave these topics for future work.

In conclusion, we have provided a brief description of the prosody and uses of wh-questions in Greek, based on a large and varied corpus of unscripted speech. Our data indicate that wh-questions are produced with a variety of tunes, which are not used exclusively with wh-questions, and that wh-questions serve a variety of pragmatic purposes. Our findings advocate for a nuanced compositional approach to intonation meaning based on a variety of spontaneous data, if we wish to make progress with our understanding of both intonation structure and intonation meaning.

Acknowledgments

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