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Intonation of *Wh-questions* in Northern British English Spontaneous Speech

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ABSTRACT

In this paper, we report the analysis of the melodic behavior of *wh-questions* from the North of England. The corpus contains 107 utterances issued by 19 different native informants in real communicative situations, extracted from recordings of street interviews published on YouTube and carried out in the cities of York, Manchester, Sheffield and Liverpool. The analysis is conducted through the Melodic Analysis of Speech (MAS) method (Cantero, 2002) which allows us to quantify, standardize and compare melodic configurations. The results describe four different intonation patterns for this type of question. A rising final inflection pattern (E1: 27%); a falling final inflection pattern (E2: 58%); a circumflex rising-falling final inflection pattern (E3: 5%); and a high nucleus falling pattern (E4: 10%). After describing and quantifying each of these patterns, the results are discussed in relation to those melodic descriptions made by precedent authors in the existing literature.

KEYWORDS

Intonation; Melodic Patterns; Melodic Analysis of Speech (MAS); Spontaneous Speech; British English; Acoustic Phonetics; *Wh-questions*.

1. INTRODUCTION

In all verbal human exchanges, prelinguistic features perform a fundamental role. The meaning and illocutionary force of utterances can be determined and interpreted differently

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according to subtle variations in the contrast of relative frequencies in speech. Thus, the study of melodic production and reception and their possible pragmatic functions have attracted considerable attention in the fields of linguistics, applied linguistics and sociolinguistic research. In this sense, we could distinguish two main schools of analysis that have traditionally predominated the study of languages' melodic behavior.

The British tradition, which initiated with the works of Palmer (1922), Kingdon (1958) and Crystal (1969) further developed by Couper-Kuhlen (1986), Cruttenden (1997), Gimson (1980), O'Connor and Arnold (1973), Tench (1996), or Wells (2006); is characterized by using the *analysis of configurations*, where the pitch contour, i.e., each intonation phrase, is divided into a nuclear configuration and a prenuclear configuration. The nuclear configuration contains the only compulsory element of an intonation phrase, the nucleus, which consists of the last (or only) accented syllable of the profile. Any unaccented syllables after the nucleus make up the tail. The pre-nuclear configuration is optional and consists of a head and a pre-head. The head contains the syllables from the first accent up to the syllable before the nucleus. The pre-head includes the unaccented syllables before the first accent.

The American School (Ladd, 1996; Leben, 1976; Liberman, 1975; Pierrehumbert, 1980; Pierrehumbert & Hirschberg, 1990; Pike, 1945; Trager & Smith, 1957; Wells, 1945) represents intonation as a series of tone levels (or tonal targets), which in the latest theories, such as the *Autosegmental-Metrical* approach (Gussenhoven, 2004; Ladd, 1996; Pierrehumbert, 1980) or *ToBI* (Beckman & Hirshberg 1993; Beckman & Ayers-Elam 1997) are specified as H (high) or L (low). H and L tones can be associated to stressed syllables or to the edges of the intonation phrases. When the tones are associated with stressed syllables, they are marked with an asterisk. Thus, "H*" and "L*" mean that a high pitch and a low pitch occur within an accented syllable. The final movements of a pitch contour are described employing boundary tones which can be of two kinds depending on whether they signal the edge of a higher prosodic domain (the intonation phrase) or a lower prosodic domain (the intermediate phrase). The final tones of an intonation phrase or boundary tones are marked with "%" (i.e., L% and H%), whereas the tones at the end of an intermediate phrase are known as phrase accents and are indicated with the symbol "-" (i.e., L- and H-).

Both schools have undoubtedly contributed to the description of speech tunes of a great number of world languages. Nevertheless, these analysis methods consider the F0 as an absolute parameter and thus, do not facilitate a precise quantification of meaningful tonal movements, nor the comparison among micromelodic differences that characterize speakers of different frequential ranges. By employing the *Melodic Analysis of Speech* (see section 5) we aim at contributing to a detailed description of the relevant melodic features contained in each pattern by the standardization and reliable quantification of the data object of the study.

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On another note, most of the melodic descriptions available in linguistic literature have been performed upon laboratory speech analysis. The analysis of planned speech has drawbacks since it does not usually reflect the complex phenomena that generally occur in genuine oral speech and spontaneous oral interactions among speakers. For instance, omissions and assimilations of sounds, the emphasis and conveyance of authentic emotions, or the existence of traits typical of regional varieties, specific registers, etc. The description of laboratory speech depicts pronunciation models differing from reality, inevitably normative and often prescriptive, as the so-called *Received English*. By contrast, when describing spontaneous speech, the complexity of oral exchanges and emerging phenomena become apparent.

Therefore, the importance of carrying out descriptions that reflect the intonation variety that occurs among different geographical regions in spontaneous speech stems from the need to offer authentic, inclusive and dynamic pronunciation models, to both teachers and learners of second languages, in order to guide didactic actions for the acquisition of the phonic competence from a more complex communicative paradigm.

All this said, in subsequent epigraphs, we will state this paper's objective, review the previous literature on the *wh-questions* melody of the English language, we will detail our method of analysis and results, and discuss them to then conclude and propose further research on this matter.

2. OBJECTIVES

The main target of this research paper is to analyze, describe and quantify the melodic patterns of *wh-questions* of the Northern British variety extracted from a corpus of non-planned or spontaneous speech through the Melodic Analysis of Speech (MAS) method (Cantero, 2002). Preliminary melodic patterns will be established according to the characteristics observed in the tonal segments and their relationships along the phonic hierarchy (see section 5).

The melodic characteristics that inform these tonal profiles rely on the percentual tonal distances that take place along the following three components of the statements, which constitute their defining features: i) the final inflection developed from the nucleus of each emission, ii) the existence or lack of an anacrusis preceding the first stressed segment, and iii) on the tonal behavior of the body from the first peak of the sentence to the nucleus.

Through the observation of the distribution of the profiles extracted from our analysis and quantification of speakers' preferences when uttering these specific *wh-questions* in this corpus, we establish the potential differences that might occur among Northen varieties included in our sample.

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We will also explore the correspondence between the pattern and their pragmatical meaning (information questions, rhetorical questions, echo questions and requests) according to the responses obtained by the interlocutors in each given pair.

The results will be discussed by comparing them with existing melodic descriptions of *wh-questions* in those studies of the North American and British varieties of the English language. Based on these precepts, our objectives are:

I) To establish the preliminary melodic patterns of Northern English *wh-questions* in spontaneous speech and to describe their features.

II) To observe the preferences of speakers' pronunciation within this region's territories and to determine possible existing varietal distribution of these preliminary melodic patterns.

III) To associate the obtained melodic profiles with their corresponding pragmatic meaning through the correlation of the question pairs.

3. BACKGROUND

English pronominal questions also denominated *wh-questions* (Crystal, 1971; Crystal, 1980; Sadock & Zwicky, 1985; Quirk et al., 1985), or *information questions* (Sadock & Zwicky, 1985) are characterized by the inclusion of an interrogative word of the type "wh-" or "how" in the initial position of the statement. This lexical mark identifies them as interrogative and they are generally used to obtain specific information about a previously formulated part in the interrogative sentence (Crystal, 1985; Schachter, 1985). On the other hand, the syntactic and melodic structure of *wh-questions* is also associated with other types of statements, such as *echo questions* and *rhetorical questions*, depending on the response or the absence of it (in the case of rhetorical questions) expected from the interlocutor.

From an intonational point of view, it is widely accepted that this type of statement usually describes a melodic contour with a final descending (fall) inflection of the type H*LL% (Bartels, 1997; Bolinger, 1989; Cruttenden, 1997; Halliday, 1994; O'Connor & Arnold, 1973; Pierrehumbert & Hirschberg, 1990; Quirk et al., 1985; Ultan, 1978). Nevertheless, other types of melodic configuration have also been described for these questions, such as the rising H*HH% (Bartels, 1999; Bolinger, 1989; Cruttenden, 1997; Quirk et al., 1985; Sobin, 1978) or a descending-ascending circumflex or fall-rise H*LH% (Bartels, 1999).

There seems to be unanimity in affirming that echo questions tend to be performed exclusively with a rising final inflection (Bartels, 1999; Bolinger, 1989; Cruttenden, 1997; Quirk et al., 1985; Sobin, 1978;), although Dehé's and Braun's (2019) experimental analysis indicate a predominant realization of the descending pattern L+H*LL%. For its part, unlike

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other types of interrogative statements, the prosody of rhetorical questions does not seem to have been studied in detail (Dehé & Braun, 2019).

Apart from experimental analyses carried out with laboratory corpus or semi-spontaneous speech, few studies describe intonation, in general, and the melody of English *wh-questions* in particular, in spontaneous or unplanned samples of speech. Works carried out with a corpus of spontaneous speech in North American English varieties (Hedberg, Sosa, Görgülü, & Mameni, 2010) depict a richer melodic description (see Table 1). In the following table, the melodic configurations in both methodological fashions (analysis of configurations and ToBI) are reflected. This corpus consists of 200 *wh-questions* recorded from telephonic conversations between people who were acquainted with each other.

Table 1. Different melodic configurations of *wh-questions* as described by Hedberg, Sosa, Görgülü, and Mameni (2010: 2).

Nucleus	ToBI and Number (total=200)	
High Fall	H*LL% (64)	!H*LL% (34)
Rise Fall	L+H*LL% (42)	L+¡H*LL% (1)
	L+!H*LL% (6)	¡L+H*LL% (1)
Low Fall	L*LL% (14)	
Low Rise	L*HH% (25)	L*LH% (1)
	L*H¡H% (1)	

Nucleus	ToBI and Number (total=200)	
High Rise	H*HH% (3)	!H*HH% (1)
Fall Rise	H*LH% (2)	
Rise-Fall-Rise	L+H*LH% (2)	L+!H*LH% (1)
Level	H*HL% (1)	H*!HL% (1)

As can be observed in Table 1, by adding the falling contours, these authors find a total of 81% *wh-questions* whose typology is inserted in the request for information questions. The rising contours represent 18% of the total.

In the mentioned studies, the abstraction of the tonal inflections, indicating *fall*, *rise*, *low* or *high* to the descents and ascents, does not provide with means to quantify the extent to which a certain descent or ascent occurs. To dimension the abstraction of the patterns, the reference point could be considered the tonal range of the informant, but the tonal ranges can also be different not only between informants of the same genre, but even more distant if the tonal ranges of the different sexes and ages are considered. Therefore, it would not be possible to establish a tonal range as a frame of reference to establish comparative analyzes in an equitable way. To tackle this matter, in this contribution, the MAS method is applied, which allows, on the one hand, to quantify the degree of rises and falls along the acoustic signal and, on the other hand, to standardize the acoustic data by neutralizing the micromelodic variables of the individual emissions (see section 5).

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As well as the above discussed, it must be noted that most investigations on intonation have been performed upon laboratory speech, some of which were expressly created to carry out these analyses. In the following section, we will detail how the characteristics of our sample differ.

4. CORPUS

Our corpus consists of 107 utterances emitted by 19 native speakers: (5 females [26%] and 14 males [74%]) in authentic communicative situations. The recordings, made in the cities of Manchester, Liverpool, York and Sheffield, are obtained from the *YouTube* platform, and come from the *Easy English*, street interviews channel. The selected audiovisual data represents spontaneous speech sample obtained from genuine and unplanned interactions among native speakers of the analyzed language varieties. The audio files have been extracted from the video recordings of the program called Easy English, in which an interviewer addresses the public in the street of the mentioned cities to talk about issues related to the local culture. These videos have the explicit objective of helping the audience to learn the English language as it is actually spoken on the street.

Once the data is digitized, the transcription of the selected statements is made. This transcription is carried out, in the first place, by the interviewers themselves, native speakers of the language of the region described. The selection of statements under analysis is organized according to their order of appearance and classified according to the type of communicative function they perform, considering the response obtained by the interlocutor (questions that require information from the interlocutor, echo questions, or requests), or the absence of an answer, as in the case of rhetorical questions. In this sense, we have also considered and transcribed each one of the interlocutors' responses in each question-answer pair. Finally, the statements are conveniently labeled for subsequent analysis using *Praat* (Boersma & Weenink, D. 1992-2021) and the MAS method (Cantero, 2002) described in the following section.

5. METHOD

The MAS method, fixed in Cantero (2002), established as a protocol in Cantero and Font-Rotchés (2009), and updated in Cantero and Font-Rotchés (2020), permits a representation of the stylized melodic curve of the statements through the discrimination, standardization and correlation of the relevant phonic information contained in them. This method of analysis is based on the principle of phonic hierarchy, according to which speech sounds are not a mere linear succession of isolated utterances but are organized into phonic groups whose core is a vowel segment (Cantero, 2002: 147). In each phonic group, the melodic relevance of vowels is hierarchically superior to that of the other segments of the phonic group. The concept of

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phonic hierarchy (Cantero, 2002: 99-102) conceives the melodic configuration not as a linear succession of segments that register certain frequency values (F0), but as a systemic structure in which the different components maintain intrinsic relationships among themselves, and the value that they record would be the result of this interrelation. Abercrombie (1967: 107) and Crystal (1971) already pointed in this direction, indicating that a view of "absolute pitch defined solely in terms of frequency is both artificial and unhelpful, or to put it charitably, misconceived" (Crystal, 1971: 20). Following these precepts, to obtain the standardized and quantifiable melodic curve of an utterance, we proceed with the steps described below.

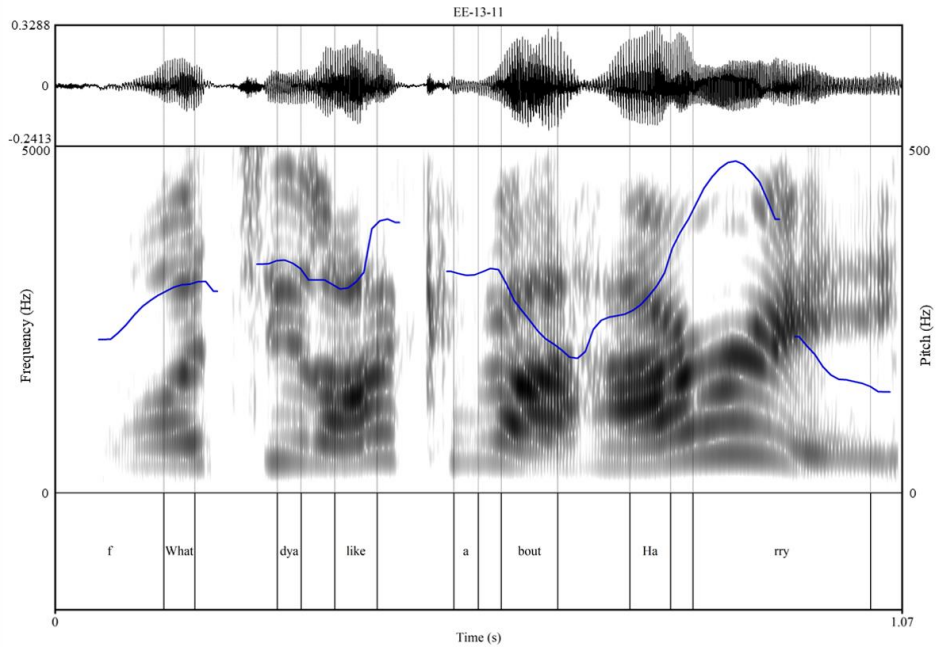

Figure 1. Extraction of the relevant absolute frequency values (Hz) in *Praat*.

In the first place, it is necessary to discriminate the absolute frequency values (Hz) of each one of the vocalic segments of the phonic group. Figure 1 shows an example of the extraction of the F0 from the statement EE-13-11: "What dya like about Harry?". The vowel segments of this utterance are boxed to indicate the extraction points of the relevant frequency values. As can be observed, the framed areas correspond to the superimposed vertical lines in the spectrogram, where each of the vowel segments that make up the utterance is located. The value of F0 in Hz is obtained from each of these segments. These values are transferred into an annotation table (see Table 2).

Table 2. Annotation table of the absolute F0 (Hz) values in the statement EE-13-11: "What dya like about Harry?"

EE-13-11	What	dya	like	a	bout	Ha	rry?	rry?*
Hz	324	353	334	343	279	308	473	275

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As mentioned above, in spontaneous speech it is frequent to observe elisions or assimilations of certain elements of the spoken chain. Such phenomena can be verified through the corresponding spectrographic analysis of the sample. We represent these phenomena in parentheses to indicate where the elisions or assimilations occur. However, the elided or assimilated element is included in the segmentation of the statement to facilitate its reading.

Generally, a single frequency value is obtained from each vowel segment. Sometimes, tonal inflections can affect the same segment (see Table 2). This phenomenon is annotated by adding one or two asterisks (*) indicating that, although it is the same tonal segment, two or more frequency values with significant tonal variations are produced within the same segment. These tonal variations can be rising, falling or circumflex. Since the different segments of the contour maintain a hierarchical relationship with each other, what is melodically relevant is not the absolute value (F0) registered by each segment of the contour, but rather the relative tonal distance between these values.

Thus, to obtain the relative tonal distance between segments, the annotated absolute values (F0) are processed using a relativization formula. The data is processed and normalized taking the number 100 as the initial reference value to which, the relative values obtained are applied. The relativization and standardization formulas of the frequency values can be consulted in Torregrosa-Azor and Font-Rotchés (2017). Mateo (2010) developed a script to be installed in *Praat* (Boersma & Weenink, 1992-2021, version 6.1.39) that allows semi-automatic processing of the acoustic data by applying the relativization and standardization formulas and generating the graphs from the previously labeled statements.

Table 3. Complete annotation table of the values contained in the statement EE-13-11: "What dya like about Harry?"

EE-13-11	What	dya	like	a	bout	Ha	rry?	rry?*
Hz	324	353	334	343	279	308	473	275
Perc	100%	9%	-5%	3%	-19%	10%	54%	-42%
SC	100	109	103	106	86	95	146	85

Table 3 shows the complete annotation table after the F0 values have been processed by applying the relativization (Perc) and standardization (SC) formulas. Once the data has been processed through the described procedure, the standard melodic curve is generated (see Figure 2). The resulting configuration does not correspond exactly to the melodic curve pronounced by the emitter and generated from the F0 data, but it is similar, since in this way the attention is focused on the strictly tonal aspects and the percentual variations that take place among them, facilitating the extraction and study of the common melodic features in each linguistic variety.

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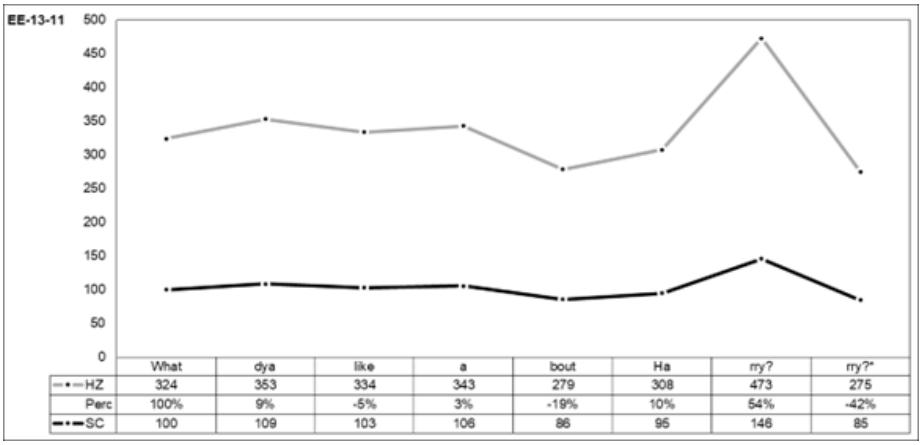
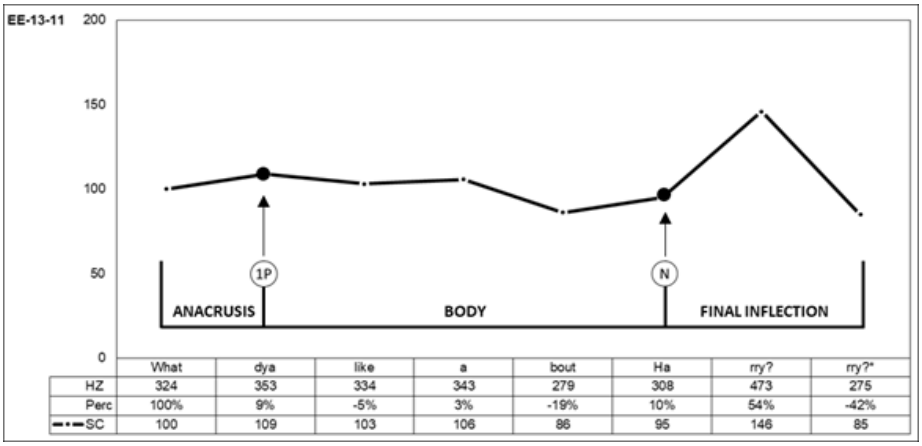


	What	dya	like	a	bout	Ha	rry?	rry?"
HZ	324	353	334	343	279	308	473	275
Perc	100%	9%	-5%	3%	-19%	10%	54%	-42%
SC	100	109	103	106	86	95	146	85

Figure 2. Melodic curves representation of absolute and standardized values in EE-13-11: "What dya like about Harry?"

Figure 2 shows: i) the graph generated from the absolute values obtained, represented with a gray line (Hz); and ii) the standardized data graph, represented with a black line (SC). This figure represents two similar configurations of the same statement. The configuration in gray color (Hz) preserves the micromelodic variables associated with the speakers' tonal range, which identify the individualized speech and does not allow its comparison with other configurations emitted by other speakers. On the other hand, the configuration in black color (SC) is generated from the tonal distances among segments (Perc) disregarding the micromelodic variables (see also Figure 3).



	What	dya	like	a	bout	Ha	rry?	rry?"
HZ	324	353	334	343	279	308	473	275
Perc	100%	9%	-5%	3%	-19%	10%	54%	-42%
SC	100	109	103	106	86	95	146	85

Figure 3. Characteristics of the functional elements in the contour.

In order to determine the number of configurations associated with each of the observed patterns and define their characteristics, the different melodic realizations that occur in each component of the contour (anacrusis, body and final inflection) of each of the utterances have been analyzed (see Figure 3).

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First, attention is focused on the different tonal movements that take place in the final inflection: rising, falling and circumflex inflections, noting the respective percentual values. Next, the melodic configurations in the body of the contour are analyzed. This phase allows us to establish a first classification considering jointly the melodic characteristics observed in the final inflection and the body of the contour. Finally, the percentual data observed in the anacrusis contour are noted and related to the data recorded in the final inflection and the body.

After applying the described procedure, the percentual values obtained in each of the constituents of the contour translate into the algorithmic expression of each statement's melody, defining with precision the relative tonal distances among its segments, independently of the individual micromelodic variations. Subsequently, from the algorithmic expression, we extract the standard melodic profile that enables its comparison with the set of standard profiles of the rest of the statements analyzed. The standardized configuration also provides the description and quantification of the melodic characteristics based on the functional elements of the contour, indicated in Figure 3.

In short, the main advantage provided by the MAS method over other intonation analysis methods is that it allows greater precision in determining the different melodic contours thanks to the standardizing protocol of the tonal values of vocal segments. Another noteworthy feature that differentiates this intonation analysis model from other methods is that it allows for accurate quantification of the degree of rise or fall of tonal inflections, thus, to make comparisons among melodic profiles of statements issued by informants with different frequency ranges, and to extract objective and generalizable melodic configurations. Parallelly, we can relate these standardized melodic patterns to the different semantic and pragmatic values associated with linguistic varieties.

6. RESULTS

In the following sections, we provide a detailed description of those melodic features that characterize the four patterns obtained after the application of the MAS method (described above) to the sample of *wh-questions* of our spontaneous speech corpus.

6.1. E1: Rising Final Inflection Melodic Pattern

From the melodic point of view, the contour represented in Figure 4 is characterized by a rising final inflection of no more than 50% from the emission of the nucleus of the statement (see Figures 4, 5 & 6).

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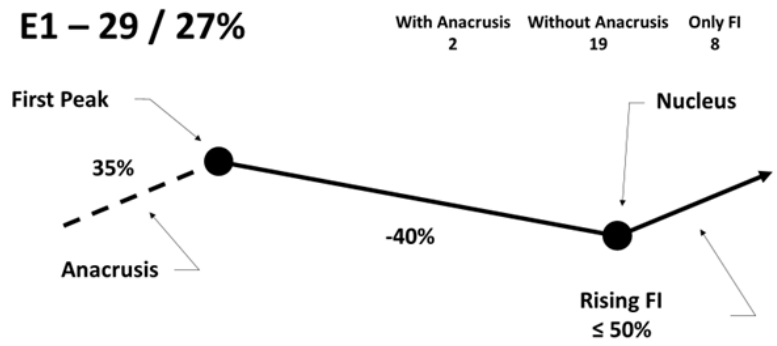
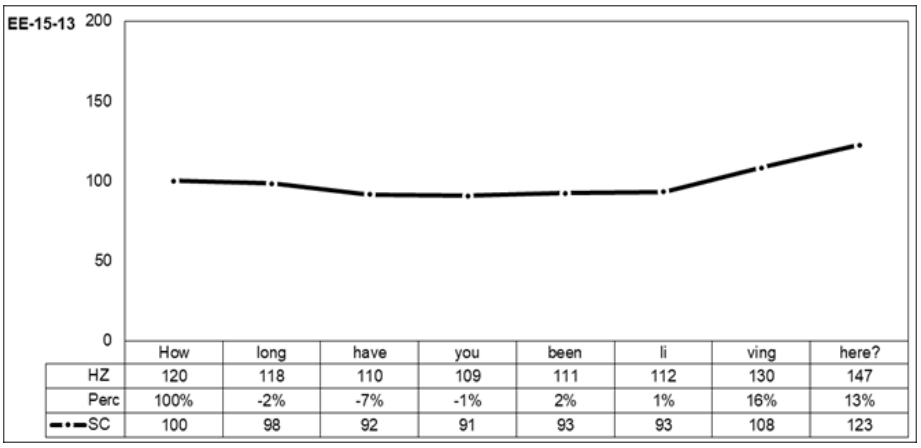


Figure 4. Melodic configuration of E1: rising final inflection pattern.

In addition to the rise observed in the final inflection (FI), these statements are characterized by two other melodic features observed in the first peak and the body of the contour. Concerning the first peak, the contours of this pattern present an optional anacrusis which, if it occurs, undergoes a slight tonal rise of up to 35% until the emission of the first peak. In general, the first peak coincides with the first tonic syllable of the contour; it is located at the top of a tonal rise and it is the tonal segment that registers the highest frequency value (Hz). However, on occasions, the tonal segment that registers a higher frequency value does not coincide with the first tonic segment of the contour and may fall on the anterior or posterior atonic segment, and rarely on the posterior tonic segment. This tonal displacement is usually associated with a feature of emphasis when, exceptionally, it does not follow the characteristics of the neutral melodic pattern. When this displacement occurs persistently, it can also correspond to a characteristic melodic feature of the linguistic variety analyzed and be distinctive in relation to other linguistic varieties. The body of the contour develops from the emission of the first pick. In E1 it is characterized by a decline of up to 40% tonal descent until the emission of the nucleus of the contour.



	How	long	have	you	been	li	ving	here?
HZ	120	118	110	109	111	112	130	147
Perc	100%	-2%	-7%	-1%	2%	1%	16%	13%
SC	100	98	92	91	93	93	108	123

Figure 5. Example configuration of the E1 rising FI pattern without anacrusis: EE-15-13 “How long have you been living here?”

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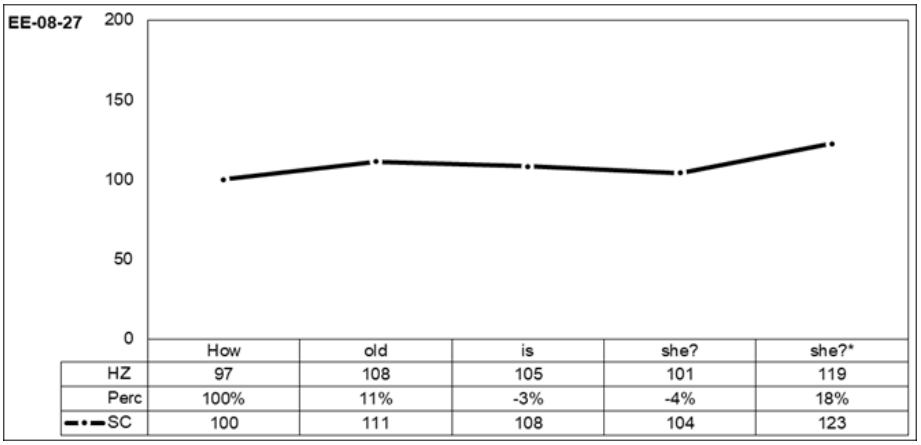
The statement depicted in Figure 5 does not present an anacrusis. A soft tonal decrease of -7% is produced from the emission of the first segment until the emission of the nucleus “li”, from which the final inflection develops, describing a tonal ascent of 31% culminating in the "here" segment. In the E1 pattern, this type of configuration without anacrusis is the most recurrent in our corpus. Of the 29 utterances that present a rising FI, 19 (66%) do not present an anacrusis.



	How	old	is	she?	she?*
HZ	97	108	105	101	119
Perc	100%	11%	-3%	-4%	18%
SC	100	111	108	104	123

Figure 6. Example configuration of the E1 rising FI pattern with anacrusis: EE-08-27 “How old is she?”

The utterance depicted in Figure 6 presents an anacrusis describing a tonal rise of 11% until the first peak. The body of the contour develops from the emission of the first peak. A -6% decline between the first peak and the nucleus is produced. The final inflection describes a rise of 18%. In our data, of the 29 statements that present a rising final inflection, only 2 (7%) show an anacrusis. On the other hand, we have observed 8 (28%) configurations composed only of the final ascending inflection within the total of the corpus data.

6.2. E2: Falling Final Inflection Melodic Pattern

The main characteristic of the pattern represented in Figure 7 is the falling final inflection (FI), which represents a tonal decrease of less than -50%. A number of 64 E2 statements are obtained, 60% of the total data analyzed. This intonation pattern presents an optional anacrusis which, if it occurs, describes a tonal rise of up to 25% until the emission of the first peak, from which a decline of less than -40% is developed in the body of the contour.

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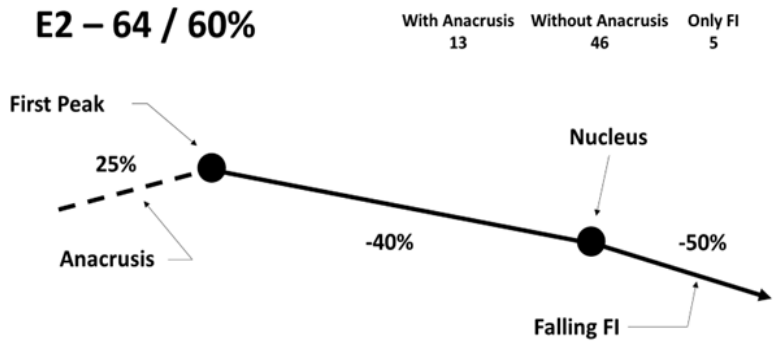

Figure 7. Melodic configuration of the E2: falling FI pattern.

Of the 64 (60% of the total data) utterances obtained that conform to the melodic characteristics of the E2 pattern, 13 (20%) utterances show anacrusis, and 46 (72%) utterances lack anacrusis, of which 5 (8%) are characterized by being constituted only by the final inflection.

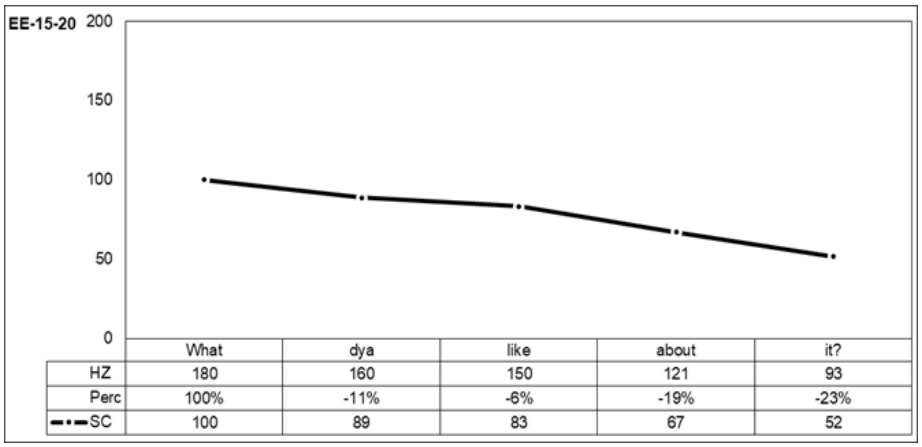

Figure 8. Example configuration of the E2 falling FI pattern without anacrusis: EE-15-20 "What dya like about it?"

Figure 8 represents a graphic example of a statement that fits the described melodic characteristics of the E2 pattern without anacrusis. This statement describes a downward decline of -33% until the emission of the "about" nucleus. The final inflection develops from the nucleus, showing a tonal decrease of -23% until the emission of the last tonal segment.

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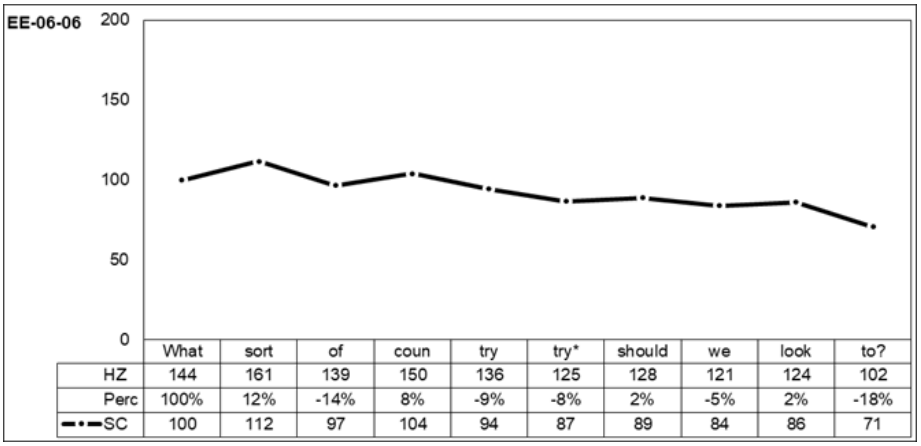

	What	sort	of	coun	try	try*	should	we	look	to?
HZ	144	161	139	150	136	125	128	121	124	102
Perc	100%	12%	-14%	8%	-9%	-8%	2%	-5%	2%	-18%
SC	100	112	97	104	94	87	89	84	86	71

Figure 9. Example configuration of E2 falling FI pattern with anacrusis: EE-06-06 "What sort of country should we look to?"

The statement in Figure 9 presents an anacrusis with a tonal rise of 12% until the emission of the first peak "sort". Next, the body of the contour describes a tonal decrease of -23% until the emission of the nucleus "look", from which the final inflection develops with a tonal decrease of -18%.

6.3. E3: Rising-falling Final Inflection Melodic Pattern

The melodic pattern described below (see Figure 10) presents three distinctive melodic features that differentiate it from the above described (E1 & E2). In the first place, one of its characteristic features specifically relies on the behavior of the final inflection, since it does not describe a simple tonal ascent (rise) or tonal descent (fall), it draws an ascending-descending (rising-falling) circumflex tonal movement from the emission from the nucleus. The trajectory generally describes a tonal rise of up to 30% and then a tonal fall of up to 40%.

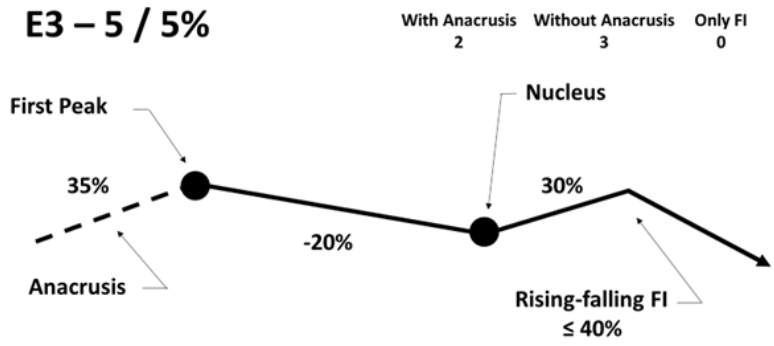

Figure 10. Melodic configuration of E3: rising-falling FI pattern.

Another melodic feature by which this melodic profile is characterized has to do with the tonal development of the body of the contour, which generally describes a smooth falling

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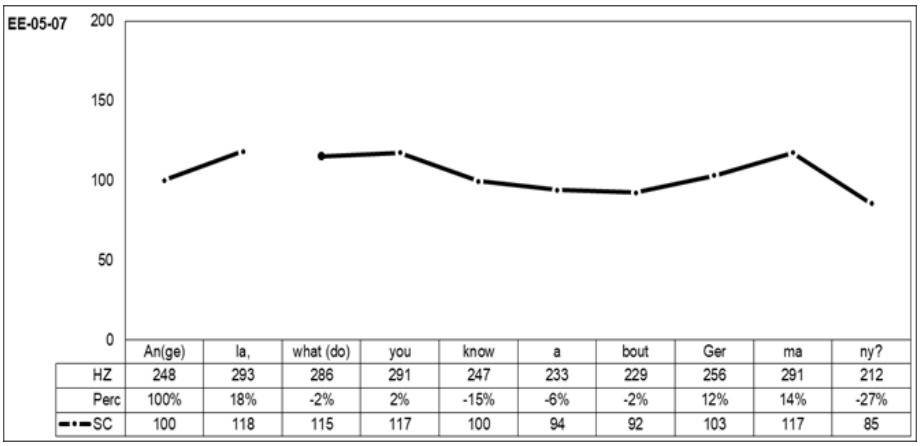
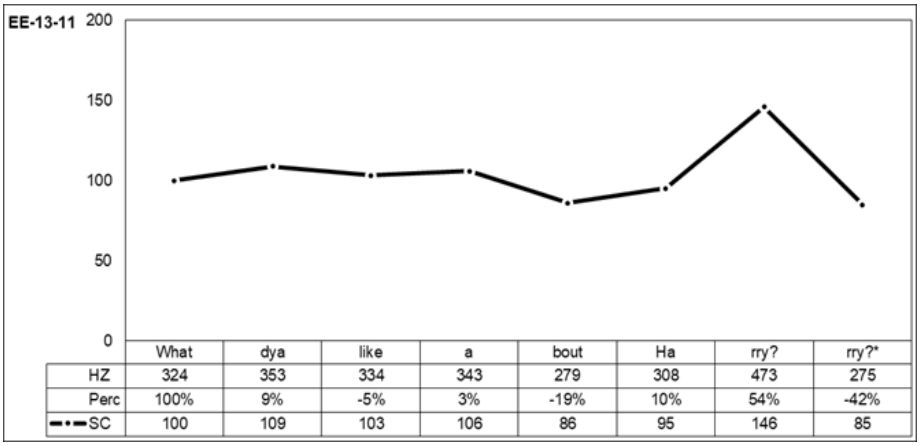
profile up to -20% until the emission of the contour nucleus. The total number of statements that fit into this type of pattern is 5, which corresponds to a 5% total occurrence of the statements analyzed. 3 statements (60%) out of 5 do not present an anacrusis (see Figure 11) and 2 (40%) present anacrusis (see Figure 12).



	An(ge)	la,	what (do)	you	know	a	bout	Ger	ma	ny?
HZ	248	293	286	291	247	233	229	256	291	212
Perc	100%	18%	-2%	2%	-15%	-6%	-2%	12%	14%	-27%
SC	100	118	115	117	100	94	92	103	117	85

Figure 11. Example configuration of E3 rising FI pattern without anacrusis: EE-05-07 "What do you know about Germany?"

As seen in Figure 11, this statement does not present anacrusis at the beginning of the contour. It describes a smooth decline from the emission of the first tonal segment, up to the segment with the lowest tonal value "bout" and a faint rise of 12% until the emission of the nucleus in "Ger". From the nucleus on, there is a rising tonal progression of 14% until the next segment and then a fall of -27%.



	What	dya	like	a	bout	Ha	rry?	rry?*
HZ	324	353	334	343	279	308	473	275
Perc	100%	9%	-5%	3%	-19%	10%	54%	-42%
SC	100	109	103	106	86	95	146	85

Figure 12. Example configuration of E3 rising FI pattern with anacrusis: EE-13-11 "What dya like about Harry?"

This contour is melodically characterized, firstly, by presenting anacrusis at the beginning of the statement. A very smooth tonal rise of 9% is described from the emission of

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the first tonal segment 'What' until the emission of the first peak of the contour 'dya'. After the emission of the first peak, the decline shows a smooth fall of -13% until the emission of the nucleus “Ha”, which is the last stressed syllable of the contour. Starting from the nucleus, a final rising-falling circumflex inflection is observed, registering a tonal rise of 54% in the first section, then a decrease of -42% in the final section. The rise observed in the first section of this statement could correlate with a melodic variant that presents the feature /+emphasis/ in the final inflection, since the contours characterized by the E3 pattern generally show a rise no higher than 30%.

6.4. E4: High Nucleus Final Inflection

The distinctive characteristic of the melodic E4 pattern described below (see Figure 13) relies on the tonal movement behavior of the final inflection, where the nucleus of the contour appears in a high frequency that contrasts with the decline observed in its body.

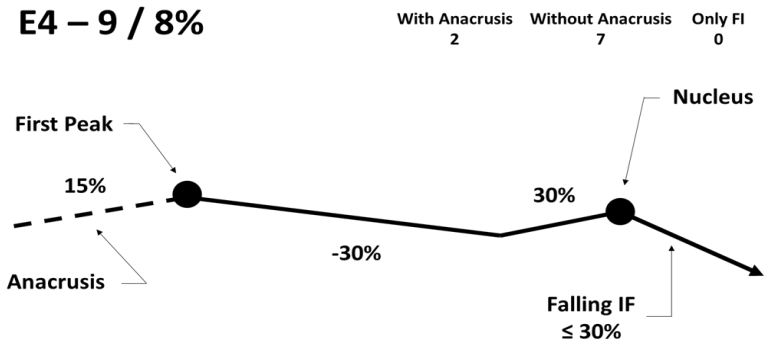

Figure 13. Melodic configuration of the E3: rising-falling FI pattern.

This contour presents an optional anacrusis which, if manifested, registers a tonal rise of 15% until the emission of the first peak. In the corpus analyzed, only 2 statements of this profile that present an anacrusis have been recorded (see Figure 15).

Between the first peak and the nucleus, this pattern usually describes a decline of approximately -30% until the emission of the segment that registers the lowest tonal value in the body, from which a tonal increase of about 30% occurs until the emission of the nucleus. The tonal fall that takes place from the nucleus represents no more than 30% in its final inflection.

9 statements have been obtained that would fit into the melodic characteristics described for this profile, representing a percentage of occurrence of 8% in the corpus used. Of the set of statements inserted in this pattern, 7 (78%) are produced without anacrusis and 2 (22%) statements do not present anacrusis.

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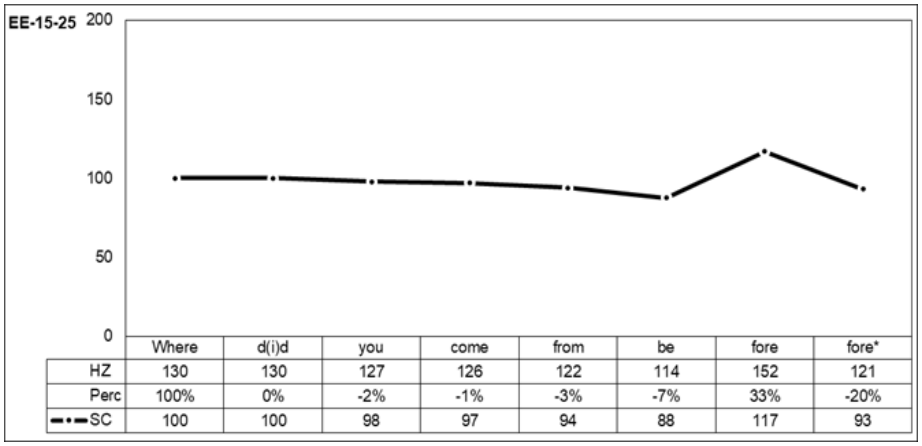
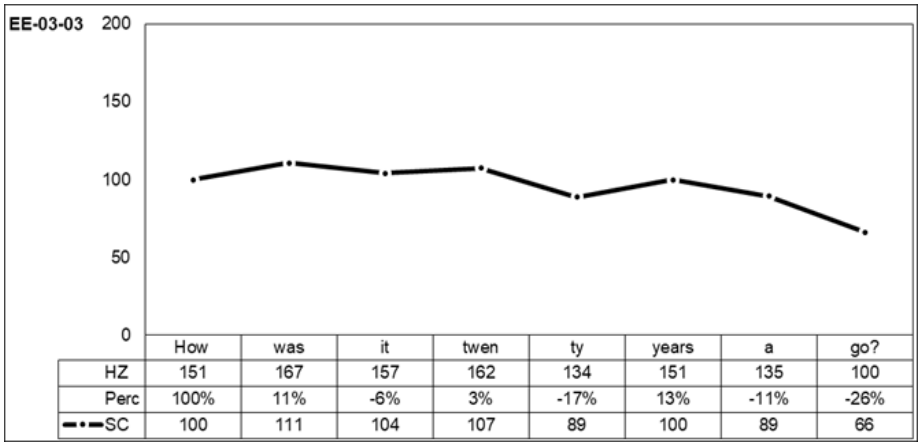


	Where	d(i)d	you	come	from	be	fore	fore*
HZ	130	130	127	126	122	114	152	121
Perc	100%	0%	-2%	-1%	-3%	-7%	33%	-20%
SC	100	100	98	97	94	88	117	93

Figure 14. Example configuration of E4 rising FI pattern without anacrusis: EE-15-25 "Where did you come from before?"

As can be observed in Figure 14, this E4 statement does not present anacrusis. The body of the contour develops from the first tonal segment "Where", describing a decline of -12% until the segment "be" that precedes the emission of the nucleus of the contour 'fore', where a repositioning with a significant tonal increase of 15% is observed. The final inflection describes a tonal decrease of -20%.



	How	was	it	twen	ty	years	a	go?
HZ	151	167	157	162	134	151	135	100
Perc	100%	11%	-6%	3%	-17%	13%	-11%	-26%
SC	100	111	104	107	89	100	89	66

Figure 15. Example configuration of the E4 rising FI pattern with anacrusis: EE-03-03 "How was it twenty years ago?"

The utterance shown in Figure 15 presents an anacrusis with a smooth rise of 11% until the emission of the first peak "was". Following the first peak, a decline with a fall of -20% develops in the body until the emission of the syllable which precedes the nucleus of the contour "ty", and then, a tonal rise of 10% occurs as the nucleus "years" is pronounced. The final inflection constitutes a fall of -32%.

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7. DISCUSSION

We have obtained four melodic patterns that are used to formulate *wh-questions* in spontaneous speech:

(i) E1: Rising final inflection.

(ii) E2: Falling final inflection.

(iii) E3: Rising-falling final inflection.

(iv) E4: High nucleus final inflection.

However, the performance of each described pattern is different. Figure 16 synthetically shows the percentage of occurrence of the four melodic patterns.

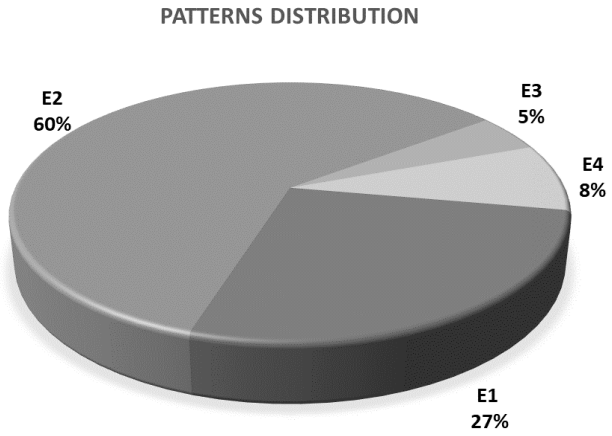

Figure 16. Percentual distribution of the four melodic patterns described.

As observed in Figure 16, the E2 (falling FI) pattern seems to stand out by predominance of use by speakers from the northern areas of England analyzed when using *wh-questions*, with a 60% occurrence within this corpus. Next, the E1 (rising FI) pattern represents the second most used pattern with a 27% occurrence. In contrast, the E3 (rising-falling, circumflex FI) pattern and the E4 (high nucleus FI) pattern seem to represent an occasional yield of 5% and 8% respectively.

On the other hand, in terms determined by the orientation of the final inflection described by these four melodic patterns, the predominancy of the falling patterns (E2 and E4) can be stated, with a percentage of occurrence of 68% of the total number of statements. The rising pattern (E1) represents a 27% occurrence and finally, the rising-falling (E3) pattern a 5%. Figure 17 graphically shows this distribution.

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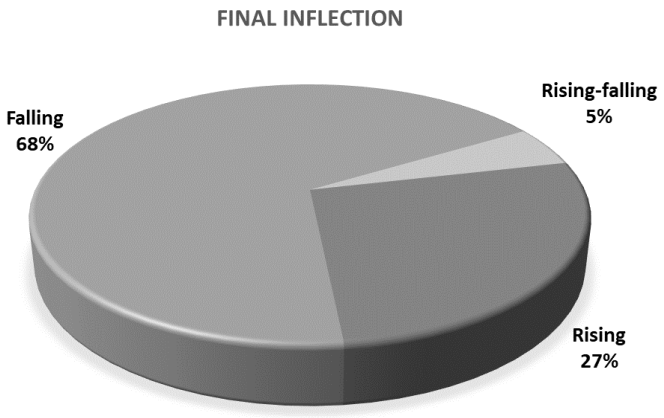

Figure 17. Percentual distribution of rising and falling FI.

These results are aligned with those described as fall, or of type H*LL% (Bartels, 1997; Bolinger, 1989; Cruttenden, 1997; Halliday, 1994; O'Connor & Arnold, 1973; Pierrehumbert & Hirschberg, 1990; Quirk et al., 1985; Ultan, 1978). Nevertheless, we have also found those types of melodic configurations such as the rising H*HH% (Bartels, 1999; Bolinger, 1989; Cruttenden, 1997; Quirk et al., 1985; Sobin, 1978).

In our analysis, there has not been observed the pattern described as descending-ascending circumflex or fall-rise H*LH% (Bartels, 1999). Instead, our corpus contains the expression of a rising-falling FI pattern that had not been described in the literature before, as far as we are concerned.

Remarkably, the percentage of occurrence of rising and falling utterances, adding up all four different melodic contours described (see Figure 17), can be found to coincide in a great measure with those found in non-controlled speech (phone conversations of North American variety) by Hedberg, Sosa, Görgülü, and Mameni (2010: 2). These authors found a total of 81% falling *wh-questions* whose typology is inserted in the request for information questions while the rising contours represent 18% of the total.

In relation to the geographic distribution, we observed widespread use of the E1 and E2 patterns in the four cities where the data was obtained. However, in our corpus, the E3 pattern seems to be located exclusively in the northeast, since 4 out of the 5 utterances corresponding to this pattern were issued in Sheffield and the remaining utterance in York. A similar result occurs with the E4 pattern, whose use also seems to be predominant in the northeast. Of the 9 statements analyzed, 5 were issued in York, 3 in Sheffield and 1 in Manchester. We cannot compare these findings with previous research, since we have not been able to consult specific studies that analyze the different linguistic variants of the North of England apart from the investigation carried out by Knowles (1973) with the linguistic variant spoken in Liverpool.

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Another relevant aspect to be mentioned refers to the initial part of the melodic contour. The results obtained indicate a general preference in the 4 melodic patterns described to formulate the *wh-questions* with little tonal contrast in the emission of the first tonal segments of the utterance until the emission of the first stressed syllable. 70% of the utterances analyzed do not present anacrusis, since the tonal contrast between the segments preceding the emission of the first tonic segment of the utterance is less than 10%. The preference in the formulation of *wh-question* presents a tendency equal to or greater than 60% in the 4 melodic patterns described. We are able to obtain these detailed data thanks to the MAS method, but comparisons with descriptions drawn by other schools of analysis don't generally offer a description of the configuration of the head for this kind of statement.

Regarding the relationships among *wh-questions*' melodic patterns and their pragmatic use, we have, as indicated above, considered the question-response pairs to determine each question statement's function. In this sense, our results show that the *echo questions* analyzed all correspond to E2 (falling FI); 30% of the *rhetorical questions* correspond to a rising pattern (E1) and the remaining 70% are falling (E2); we only encountered one request in the form of *wh-question* which was formulated through a high nucleus FI pattern (E4). All four melodic patterns were found in the *wh-questions* requesting information (see Table 4).

Table 4. Distribution of the obtained patterns according to their pragmatic value.

	QUESTION	RHETORICAL-Q	ECHO-Q	REQUEST	TOTAL
E1	**26** (24.3%)	**3** (2.8%)	**0** (0.0%)	**0** (0.0%)	**29** (27.1%)
E2	**51** (47.7%)	**7** (6.5%)	**6** (5.6%)	**0** (0.0%)	**64** (59.8%)
E3	**5** (4.7%)	**0** (0.0%)	**0** (0.0%)	**0** (0.0%)	**5** (4.7%)
E4	**8** (7.5%)	**0** (0.0%)	**0** (0.0%)	**1** (0.9%)	**9** (8.4%)
TOTAL	**90** (84.1%)	**10** (9.3%)	**6** (5.6%)	**1** (0.9%)	**107**

According to our results, we cannot agree on the general affirmation that *echo questions* tend to be performed exclusively with a rising final inflection (Bartels, 1999; Bolinger, 1989; Cruttenden, 1997; Quirk et al., 1985; Sobin, 1978). Our results coincide with those obtained by Dehé's and Braun's (2019) experimental analysis conducted on a corpus from different linguistic variants of Canada and North America. These authors describe a predominant realization of the descending pattern L+H*LL%. As mentioned in this work's background section, for its part, unlike other types of interrogative statements, the prosody of rhetorical questions does not seem to have been studied in detail (Dehé & Braun, 2019).

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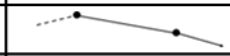
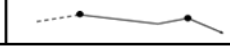
8. CONCLUSION

Our main objective in this research was set as: to analyze, describe and quantify the melodic patterns of the *wh-questions* of Northern British varieties in spontaneous speech.

The existing discrepancies observed, both in the types of configurations that are described in previous research, as well as in the prevalence of use of certain models of intonation, have been revealed in the theoretical framework and the discussion of the results. We believe that these discrepancies may be mainly due to the type of corpus analyzed. On the other hand, it is verified that the different methodologies generally used to analyze English intonation do not contemplate the possible incidence that micromelodic variations, which individualize the speech of each informant, could produce on the results.

After conducting the systematic intonational analysis of a spontaneous speech corpus consisting of a total of 107 *wh-questions* emitted by 19 native speakers in authentic communicative situations from the cities of Manchester, Liverpool, York and Sheffield, we have observed the performance of four different melodic patterns:

Table 5. Summary of the results.

Pattern		TOTAL and % upon 107	With Anacrusis and % out of pattern total	Without Anacrusis and % out of pattern total	Only FI and % out of pattern total
E1		29 (27%)	2 (7%)	19 (66%)	8 (28%)
E2		64 (60%)	13 (20%)	46 (72%)	5 (8%)
E3		5 (5%)	2 (40%)	3 (60%)	0
E4		9 (8%)	2 (22%)	7 (78%)	0

Our MAS method allows the completion of robust and detailed descriptions of each of the configurations, and elements of the melodic curve, through the identification, standardization and observation of the relevant hierarchal values that carry the meaningful information within the spoken prelinguistic segments. These descriptions of the melodic contours permit, likewise, comparisons among different frequential ranges of speakers, thanks to the neutralization of the micromelodic differences and the focus placed on the percentual variation among the relative tones.

Through this study, we quantified a percentage of 68% falling FI patterns, a total percentage of 27% rising FI pattern, and 5% of *wh-questions* that produce a circumflex rising-falling FI. The results seem to indicate a clear preference for the use of melodic configurations with final falling inflection in the formulation of *wh-questions* in Northern British English. On the other hand, the results also suggest the existence of 2 types of

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melodic configurations (E1 and E2), whose use seems to extend throughout the entire geographical area analyzed, whereas another 2 types of configurations (E3 and E4) seem to be performed almost exclusively in the northeastern area of the analyzed corpus.

As future investigations, we intend to obtain and analyze a greater number of emissions in order to verify, on the one hand, the existence of the stable differentiation observed in the use of melodic configurations (E3 and E4) and, on the other hand, to confirm the widespread use of the melodic configurations (E1 and E2) throughout the northern territory.

In this research, we have also set out to explore the correspondence between the melodic patterns obtained and their associated pragmatic meanings. The corpus of data analyzed in this work not only contains the formulation of the pronominal questions asked by the different informants, but also the answers associated with the question that each of the interlocutors provide. The answers are indicative, firstly, of the recognition by the interlocutor of the melodic and syntactic characteristics of the interrogative proposition and, secondly, of the recognition of the illocutionary value associated with the formulation of the question. This evidence allows us to classify the pragmatic meaning of each *wh-question* and to associate them to the different melodic configurations in which they are manifested. The resulting classification has finally been established into four different categories, which have previously been shown synthetically in Table 4.

These results suggest that the communicative use of *wh-questions* in spontaneous speech mainly focuses on obtaining specific information from the interlocutor. We obtained a number of 90 questions that request information (see Table 4, QUESTION column), out of a total of 107, which represents a percentage of occurrence of 84%. Regarding its distribution, in relation to the type of melodic configuration, the most widespread use is the type E2 pattern with a descending final inflection, which represents a 47.7% occurrence of the total; followed by the E1 pattern with ascending final inflection, with 24.3% occurrence. It is also observed that the illocutionary act of obtaining specific information could be associated with the other two melodic patterns described (E3 and E4), but its use is significantly less common and possibly also limited to the north-eastern zone. Of the 13 'QUESTION' type *wh-questions* pronounced using the E3 and E4 melodic patterns, 12 were registered in the York and Sheffield areas and only 1 of them in Manchester. These are provisional results that require further analysis of a greater volume of statements in order to confirm the described trend and to broaden the detailed differentiation of the E1 and E2 patterns' usage.

The rest of the types of questions (rhetorical, echo and requests) that have been considered represent a much lower value than those questions that request specific information. Together, they represent a percentage of occurrence of 15.9%. The analysis of a larger volume of data would be needed to determine if the distribution that we have obtained

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concerning the association between the type of questions and certain melodic patterns remains stable or if, on the contrary, they could be related to other types of melodic configurations.

On the other hand, even though we consider the results obtained as prospective, the melodic realization of the *echo questions* has drawn our attention, since previous investigations affirm that their melodic realization would be associated with rising final inflection melodic patterns. However, our results suggest that, in spontaneous speech, the melodic realization of *echo questions* would be associated with a falling final inflection.

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