



## The prosody of rhetorical and information-seeking questions in Estonian: preliminary results

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### Abstract

This study provides one of the first systematic comparisons of the prosody of different speech acts in Estonian, investigating characteristics of rhetorical questions (RQs) as compared to information-seeking questions (ISQs). Phonological features such as the type and distribution of pitch accents and boundary tones, and phonetic features such as utterance duration, pitch range and mean pitch were analysed on the basis of materials from six speakers. The data consisted of identical RQs and ISQs in the form of an equal number of polar questions and wh-questions.

The analysis revealed several differences between the two speech acts. Although both were produced mainly with an H\*L pitch accent the distribution of accents varied depending on the type. RQs had on average a larger number of prenuclear pitch accents, whereas ISQs were significantly more often produced with a high boundary tone (H%) than RQs. The two speech acts were also distinguished by phonetic characteristics in that RQs had a longer duration, narrower pitch range and lower mean pitch than ISQs. In comparison with Germanic languages, Estonian seems to rely more on phonetic features and less on phonological properties when differentiating RQs from ISQs.

**Index Terms:** rhetorical questions, information-seeking questions, intonation, speech act, question type, Estonian

### 1. Introduction

The paper presents the results of a pilot study that aimed to identify the prosody of rhetorical questions (RQs) in Estonian and determine the features distinguishing them from information-seeking questions (ISQs). For the sake of cross-linguistic comparability, the study adapted the methodology of a series of earlier studies on the prosody of RQs in three Germanic languages: German, English, and Icelandic ([1]–[4]). Since Estonian intonation differs in several respects from that of Germanic languages, this study adds to the discussion on the prosodic typology of speech acts more generally.

The above-cited studies show that while there are differences between the examined languages they all distinguish between RQs and ISQs with clear phonological and phonetic means. The distinctive phonological features include types of boundary tones, edge tones (combinations of phrase accents and boundary tones), and nuclear and prenuclear pitch accents, as well as the distribution and alignment of pitch accents.

A common phonetic feature that differentiates RQs from ISQs is duration; RQs are shown to have a longer duration in e.g. German [1]. Phonetic features also have a disambiguating

function when phonological differences are absent, suggesting a direct correlation between the phonetic realisation and speech acts [1]. Additionally, RQs can be marked with a different voice quality, e.g. breathy voice quality appeared more often in RQs than in ISQs in both German and English [1], [3].

Estonian intonational phonology (described by [5]) differs in several respects from that of Germanic languages. In particular, Estonian possesses a relatively small inventory of pitch accent types. Phrase accents are not used, and the by-default low-ending boundaries are left unmarked (0%) in contrast with high boundary tones that are marked as H%. The use of H%, more common in spontaneous speech, is not obligatorily associated with any particular speech act or function, except possibly in listing to signal continuation [6].

The two main (nuclear) accent types in Estonian are H\*L and HL\*, and as H\*L is the default pitch accent, a series of these accents constitutes the default intonation contour. HL\*, on the other hand, can be considered to be marked in that it is associated with assertive force and utterance finality [7]; it never appears in questions [8]. Therefore, Estonian data is of interest with respect to a broader theoretical question as to whether RQs constitute assertions or not. If HL\* accents are found to occur in RQs it will be a strong indication that RQs have an assertive component.

Earlier research on the prosody of Estonian questions is sparse, but the consensus is that questions are on the whole not signalled by any specific intonation patterns [9]. Nevertheless some prosodic marking is used. In addition to the absence of the HL\* pitch accent, both polar and wh-questions are distinguished from statements by the tendency to end with an upstepped nuclear H\*L accent [5]. This is in accordance with the findings that declarative questions are distinguished from formally identical statements by a higher and later peak of the nuclear accent [10], and by shallower declination [5], [11]. As in many other languages, questions in Estonian have been found to be distinguished by an overall higher pitch [10]. Questions may also end with a rise.

Syntactically, Estonian polar questions are standardly formed by means of an initial unaccented interrogative particle (*kas*). Wh-questions are formed by fronting of the interrogative phrase, which usually receives a pre-nuclear accent. The present study examines the prosody of both question types occurring as RQs and ISQs.

On the basis of previous findings on the prosody of RQs in Germanic languages [1], [3], [4] and on Estonian intonation [5], [6], [8], [10] we hypothesise that RQs and ISQs in Estonian are distinguished by the following features: (1) distribution of pitch accents, (2) utterance duration, (3) mean F0, and (4) pitch range. RQs are expected to have a longer

duration, as has been found for Germanic languages, but a lower pitch level and, consequently, a narrower pitch range as has been found for Estonian statements as opposed to questions. RQs are expected to have more prenuclear accents and/or an earlier nuclear accent placement, similar to RQs in Germanic languages. Boundary tone type is hypothesised not to play a role in distinguishing between RQs and ISQs, as it has not been found to signal a particular speech act in Estonian. As for pitch accent type, which was found to be an important distinctive factor in Germanic languages, we hypothesise that RQs, like ISQs, will not display the HL\* accent signalling assertive force, given that in Germanic languages RQs were found to differ both from questions and from assertions.

## 2. Method

For the materials a subset of test items used in [1], [3], [4] was translated into Estonian and adapted with some modifications. The materials consist of 12 polar questions (e.g. *Kas keegi sööb sellerit?* ‘Does anyone eat celery?’) and 12 wh-questions (*Kes sööb sellerit?* ‘Who eats celery?’) with three sentence constituents: subject, verb and object. Two different context descriptions were constructed for each polar and wh-question, one eliciting an information-seeking question reading, and the other rhetorical question reading. This resulted in a total of 24 RQs and 24 ISQs (for a full description of the design see e.g. [1], [3]).

The recordings were made in the sound-detected booth at the phonetics lab of the University of Tartu using a Praat Demo script. The materials were recorded by 6 young female speakers (mean age 22.8, sd 2.3). The subjects were all speakers of Standard Estonian and unaware of the goal of the experiment. The test items were divided into two lists, each containing 12 RQs and 12 ISQs comprising of 6 pairs of polar questions and 6 pairs of wh-questions, as well as 24 fillers. Each list was presented in random order to 3 speakers. The test was self-paced with an option to re-record the latest item, and started with a short practice session including three trial situations. In total 144 test items were recorded. Two utterances had to be excluded from the final analysis due to mispronunciations.

The test utterances were automatically segmented, using the forced aligner of the Tallinn University of Technology [12], and manually corrected in Praat [13]. The utterances were annotated for pitch accents and boundary tones, using the Estonian tonal inventory in [5].

The following acoustic data was extracted using a Praat script: (i) utterance duration; (ii) the duration of the subject, which constituted an identical portion in all the wh-questions and polar questions respectively (in polar questions, the duration of the interrogative particle was also included in the duration of the subject); (iii) mean F0 of the utterance; and (iv) pitch range of the whole utterance. The results were tested using linear mixed models (lme4 [14] in R [15]) with question type as the fixed factor (levels: ISQ vs. RQ) and random intercepts for speaker and test token.

## 3. Results

Section 3.1 presents the results for the distribution of pitch accents and boundary tones, and section 3.2 for duration and pitch.

### 3.1. Pitch accents and boundary tones

The distribution of pitch accents and boundary tones by constituent type and speech act is presented in Figure 1. It can clearly be seen that the subject was nearly always accented. There was no significant difference between ISQs and RQs; the subject received an H\*L accent in 96% vs. 97% of the cases respectively. There were also no differences between the question types. In wh-questions, the subject position is occupied by the interrogative word *kes* ‘who’, and in polar questions by *keegi* ‘anyone’ preceded by the interrogative particle *kas*. The particle *kas* never received an accent and was normally heavily reduced.

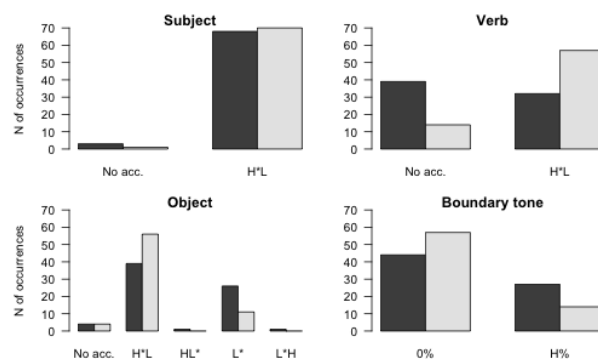


Figure 1: Distribution of pitch accents and boundary tones by constituent type and speech act: ISQ (dark grey) and RQ (light grey).

The verb was more often accented in RQs than in ISQs (79% vs. 45%) and the difference is significant ( $\chi^2(df = 1) = 16.3, p < 0.001$ ). There was no difference between the question types within ISQs and only a slight difference within RQs where the verb received an accent slightly more often in wh-questions than in polar questions (86% vs. 72%). This difference is most probably due to an emphasis on the word *keegi* (‘anyone’) in polar questions which caused the deaccentuation of the following verb.

There was no significant difference between RQs and ISQs with respect to object receiving an accent. The object was accented in 93% of RQs and 94% of ISQs. As can be seen in the lower left panel of Figure 1, there was slightly more intonational variation in ISQs: HL\* and L\*H occurred once each in ISQs but never in RQs. The low accent (L\*) occurred more frequently on the object of ISQs (37% vs. 15%), while the default accent H\*L was more common on the object of RQs (78% vs. 55%). There were no significant differences between polar and wh-questions.

As to boundary tones, there was a significant difference between the two speech acts. High boundary tones occurred significantly more often in ISQs than in RQs (38% vs. 19%;  $\chi^2(df = 1) = 5.2, p < 0.05$ ). There was also a difference in question types: rhetorical polar questions exhibited more high boundaries than wh-questions (25% vs. 14%), whereas within ISQs, H% occurred slightly more frequently in wh-questions than in polar questions (42% vs. 34%).

All in all, there were significantly more pitch accents in RQs than in ISQs ( $\chi^2(df = 1) = 17.78, p < 0.001$ ): 73% of RQs included three pitch accents as opposed to 37% of ISQs.

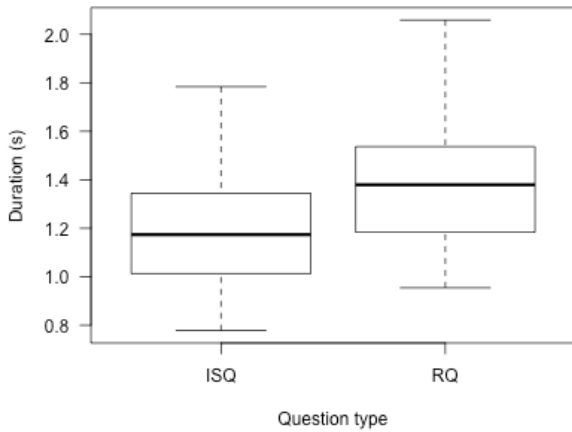


Figure 2: Duration of ISQs and RQs.

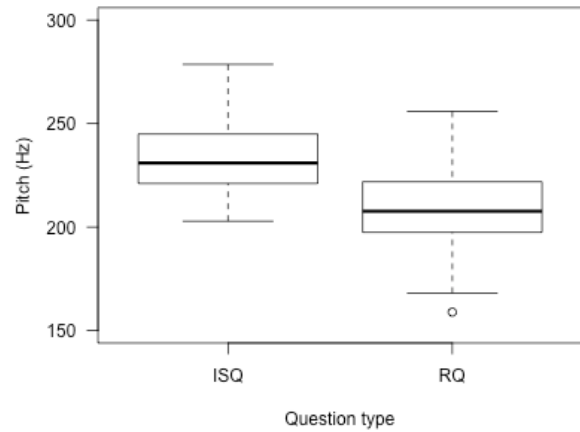


Figure 4: Mean F0 of ISQs and RQs.

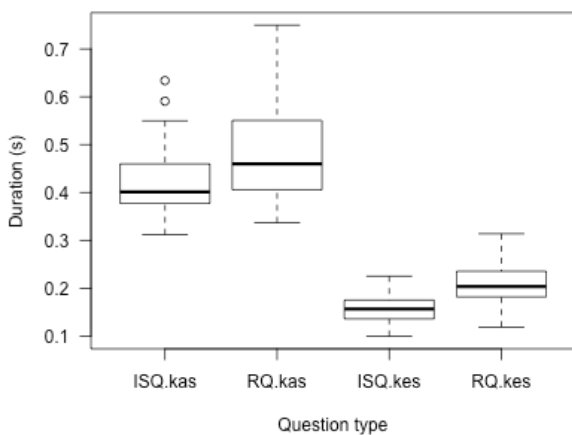


Figure 3: Duration of the subject in ISQs and RQs by question type (*kas* = polar question, *kes* = wh-question).

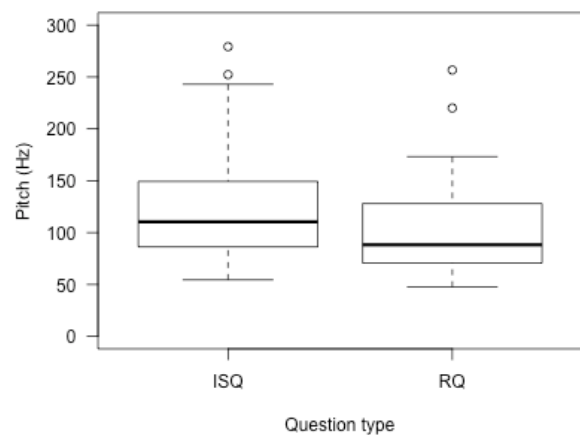


Figure 5: F0 range of ISQs and RQs.

### 3.2. Duration and pitch

Figure 2 compares the duration of ISQs and RQs. RQs were on average approximately 200 ms longer than ISQs, which is a significant difference ( $F(1, 125.06) = 44.05, p < 0.001$ ).

Figure 3 shows the duration of the subject in RQs and ISQs separately for the two question types. In both polar (*kas*) and wh-questions (*kes*), the subject was significantly longer in RQs than in ISQs. The duration of the subject in polar questions was always longer than in wh-questions because of more material in the subject position (*kas keegi* (interrogative particle *kas* + ‘anyone’) vs. *kes* (‘who’) respectively).

Figure 4 represents the mean F0 of the utterance in the two speech act types. There is a significant difference between RQs and ISQs ( $F(1, 125.11) = 138.34, p < 0.001$ ), the F0 in RQs being on average 26 Hz lower.

Figure 5 represents the F0 range in the two speech act types. The F0 range of RQs is approximately 24 Hz narrower than that of ISQs, which is a significant difference ( $F(1, 136) = 19.45, p < 0.001$ ).

## 4. Discussion

The study addressed the prosody of rhetorical questions as compared to information-seeking questions in Estonian. As predicted, the main phonological difference between RQs and ISQs was the distribution of pitch accents. RQs had more pre-nuclear accents than ISQs, which was due to the verb being accented significantly more often in RQs than in ISQs. There was no difference in the accentuation patterns of subjects and objects. This is unlike what was found for some previously studied languages: e.g. in English rhetorical polar questions, the object was significantly more often deaccented than in information-seeking polar questions, in which case it was the subject that received the nuclear accent [3]. This pattern, which indicates an information-structural difference between ISQs and RQs, was not found in Estonian.

While there was a significant difference between the speech acts in the proportion of high boundary tones (38% in ISQs vs. 19% in RQs), the use of H% was to some extent speaker specific: three speakers almost never used it, one speaker (who was the only one who reported to have lived abroad for over a year) used it equally in RQs and ISQs, and two speakers used it more in ISQs. Clearly more speakers are needed in order to establish whether a more frequent use of H% would distinguish ISQs from RQs. Additionally, some of the ISQs that were produced with an H% seemed to represent

a different speech act. Indeed, certain context descriptions that were used in the design of the experiment can be considered to elicit a polite offer rather than a request for information. For example, in a situation where a host asks the guests whether they eat a particular type of food that s/he has cooked, a question like ‘Who eats celery?’ could be interpreted as an invitation to have some celery rather than a request for more general information. This suggests that for the purposes of future studies the design of the experiment will have to be checked for possible confounding factors.

The type of nuclear and pre-nuclear pitch accents played no distinctive role. In particular, neither RQs nor ISQs were produced with the HL\* nuclear accent (with one exception, which appeared in an ISQ), which has previously been found to be restricted to statements and utterance-final intonation phrases, usually constituting about 50% of the nuclear accents found in these contexts. This result implies that RQs do not constitute statements, as also suggested by the finding that in Germanic languages RQs differ both from questions and statements [2].

However, there remains the possibility that the phonetic realisation of the nuclear accent is different in RQs and ISQs, as found for some of the studied Germanic languages [3]. In particular the nuclear accent can be expected to have a smaller pitch movement and an earlier peak in RQs. This is something that needs to be addressed in further research.

While RQs and ISQs had few phonological differences, they were clearly differentiated by all the examined phonetic features. As hypothesised, RQs were characterised by a longer duration, lower mean pitch, and narrower pitch range. Another aspect that could be studied in the future is the F0 declination, which has previously been found to distinguish questions from statements in Estonian [5], [11].

A feature that was not included in the present study but that has also been shown to phonetically characterise RQs is voice quality; e.g. in German, RQs were often realised with breathy voice quality [1]. Some broad observations on the basis of this data suggest that voice quality may play a role even in Estonian as the speakers seemed to make more use of different voice qualities (breathy and creaky) as well smile and/or laughter when producing RQs.

## 5. Conclusions

The aim of the study was a preliminary identification of prosodic differences between Estonian rhetorical and information-seeking polar and wh-questions in order to compare them to those found for German, English and Icelandic in [1]–[4].

The results revealed that the main phonological difference between ISQs and RQs was a denser distribution of prenuclear pitch accents in RQs, which was also found in Germanic languages. However, unlike in Germanic languages, other phonological features did not play a significant role: pitch accent type and the placement of nuclear pitch accents made no difference, and while H% was significantly more frequent in ISQs its use was speaker-specific and possibly partly due to confounding factors in the design of the experiment.

Phonetically, RQs were characterised by greater duration, smaller pitch range and lower mean pitch. This is in accordance with previous findings which have shown that Estonian distinguishes between speech acts (specifically, questions and statements) phonetically, rather than

phonologically. Languages may therefore fall into different types depending on whether they predominantly use phonological means (like Germanic languages) or phonetic means (like Estonian) to signal different speech acts.

Any follow-up studies based on larger sets of data should, therefore, pay attention to even more different phonetic aspects including the realisation of pitch accents (e.g. peak placement in the nuclear accent), declination as well as voice quality.

## 6. Acknowledgements

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