Baltic J. Modern Computing, Vol. 14 (2026), No. 32, 492-516
https://doi.org/10.22364/bjmc.2026.14.3.01

Some Acoustic Features of Lithuanian Questions

Asta KAZLAUSKIENĖ

Vilnius University, Universiteto str. 5, LT-01513 Vilnius, Lithuania

asta.kazlauskiene@vdu.lt

ORCID 0000-0002-6135-1635

Abstract. The aim of this study is to determine whether questions and their subtypes can be identified based on F0 and intensity parameters. The dataset consists of sentences specifically constructed for the experiment and read by four male speakers. The material includes direct, request-like, echo, alternative, and rhetorical questions, which may be classified as yes/no or wh-questions depending on their communicative function and the expected type of response. A statement was also recorded for comparison. In total, 320 phrases were analysed. The following acoustic parameters were examined: mean F0, F0 maximum and range, mean intensity, intensity maximum, intonation and intensity contours.

The results show that questions differ from the statement in several respects: (a) overall higher F0 values, (b) either a rising final intonation contour or a high F0 peak, whose rise begins on the stressed syllable of the narrowly focused word and reaches its maximum in the post-stressed syllable, and (c) higher phrase-initial intensity. The highest F0 parameters and higher mean intensity and intensity maximum are characteristic of questions without interrogative words.

Keywords: Lithuanian, question, fundamental frequency (F0), intonation contour, intensity.

1. Introduction

Questions are typically used to request information about a given topic. Based on communicative function and the structure of the expected response, questions are generally classified into yes/no and wh-questions. In yes/no questions, the speaker seeks confirmation of a proposition. In Lithuanian, such questions may occur without an interrogative word (e.g. *Perrašyti darbą?* 'Rewrite the paper?') or may include particles such as *ar, argi, negi, nejaugi, gal,* etc. (e.g. *Ar perrašyti darbą?* 'Should the paper be rewritten?'). Wh-questions request specific information (e.g. time, place, or agent) and are introduced by interrogative words such as *kas* 'who/what', *koks* 'what kind of', *kada* 'when', etc. (e.g. *Kada perrašyti darbą?* 'When should the paper be rewritten?'; *Kaip perrašyti darbą?* 'How should the paper be rewritten?'). A separate subcategory comprises rhetorical questions, which do not require an answer.

In textbooks and other teaching materials, a rising intonation contour is often treated as a primary marker of interrogativity. However, empirical research shows that yes/no questions exhibit considerable intonational variation. They may display rising contours (either throughout the phrase or in a fall–rise pattern), falling contours (throughout the phrase or in a rise–fall pattern), and more rarely level (plateau) contours. Such patterns

have been identified in American English (Pierrehumbert and Hirschberg, 1990; Hedberg and Sosa, 2002) and in Romance languages (Frota and Prieto, 2015).

Wh-questions most commonly exhibit a final fall in pitch, while the interrogative word itself typically shows a rising pitch movement. This pattern has been observed in a range of languages, including English (Hedberg and Sosa, 2002; Hedberg et al., 2010; 2017), Greek (Arvaniti et al., 2014; Baltazani et al., 2019), and Romance languages (Frota and Prieto, 2015).

The first experimental study of Lithuanian intonation, conducted by R. Ekblom (1925), reported falling intonation contours in both statements and questions.

Pukelis (1968; 1972) analysed subtypes of yes/no questions and their phonetic realisation, concluding that the fundamental frequency (F0) is the primary cue to interrogativity. Particularly, changes in F0 on the focal word and subsequent syllables are crucial. Depending on the position of the focal word, the final contour may be rising (if the focal word is final), rise–fall or fall–rise–fall (if the focal word occurs earlier in the question).

Alternative questions were examined by Talandienė (1968; 1970a; 1970b; 1972), who showed that intonation of this kind of question consists of two segments (e.g. *Meluoti ar prisipažinti?* 'Lie or confess?'). These questions may be realised by a range of contour combinations, including level, rising, or falling contours in each segment, as well as mixed configurations (e.g. level and rising, falling and rising, rising and falling).

Mikalauskaitė (1975, 83) found that questions without interrogative words typically exhibit a rising intonation contour. In yes/no questions with the particle *ar*, the rise occurs on the focal word rather than on the particle, followed by a fall and a subsequent rise. In wh-questions, the interrogative word shows a rise in F0, followed by a fall and a secondary rise on the final word, with an overall falling contour at the end of the question.

Vaitkevičiūtė (2001, 172–175) showed that in questions without interrogative words, the highest F0 occurs on the focal word, followed by a sharp fall. If the focal word is final, the question ends with a high F0.

Kundrotas (2018, 43–116) identifies seven intonation models in Lithuanian, most of which may be realised in questions. These include patterns characterized by (a) a gradual lowering of F0, (b) a higher initial F0 followed by a falling contour in the intonational centre (typical of questions with an interrogative word), and (c) rising or rise–fall contours in the intonational centre followed by a gradual decline. Further models involve a fall–rise contour in the intonational centre with a subsequent overall increase in F0, typically associated with continuation or formal speech, as well as configurations with two intonational centres (rising followed by falling), characteristic of rhetorical questions. Finally, a steadily rising contour in the intonational centre followed by an elevated overall F0 level is associated with questions expressing surprise or doubt.

More recent work by Kazlauskienė and colleagues (Kazlauskienė and Dereškevičiūtė, 2022a; Kazlauskienė et al., 2023, 102–112) shows that the final F0 of questions may be either low (when an interrogative word or narrow focus is present) or high (when neither is present). Yes/no questions in Lithuanian may exhibit rising, rise–fall, or falling intonation contours, with falling contours being the most frequent. Wh-questions also most commonly display falling contours. Perceptual data further indicate that a high final F0, the presence of an interrogative word, and narrow focus function as equally important cues to interrogativity.

2. Aim and Methodology

The aim of this study is to determine whether questions and their subtypes (yes/no and wh-questions; questions with and without an interrogative word; direct, alternative, and rhetorical questions, etc.) can be identified based on F0 and intensity parameters.

Although the intonation of Lithuanian questions has been previously studied, earlier research is either methodologically outdated or lacks sufficiently detailed acoustic data for practical application or reliable insights into its typological patterns. The present study, together with a previous analysis of directives (Kazlauskienė, 2026), forms part of a broader investigation into the acoustic properties of Lithuanian utterance types.

The following interrogative sentences were constructed for the experiment (in the present study, each analysed sentence corresponds to a single intonational phrase – IP):

IP1: *Perrašyti darbą*? 'Rewrite the paper?'
IP2: *Ar perrašyti darbą*? 'Should the paper be rewritten?'
IP3: *Gal perrašyti darbą*? 'Rewrite the paper?'
IP4: *Kada perrašyti darbą*? 'When should the paper be rewritten?'
IP5: *Kaip perrašyti darbą*? 'How should the paper be rewritten?'
IP6: *Siūlai perrašyti darbą*? 'Are you offering that the paper be rewritten?'
IP7: *Reikalauji perrašyti darbą*? 'Are you demanding that the paper be rewritten?'
IP8: *Ar galėčiau perrašyti darbą*? 'Could I rewrite the paper?'
IP9: *Kada galėčiau perrašyti darbą*? 'When will I be able to rewrite this paper?'
IP10: *Gal galėčiau perrašyti darbą*? 'Could I rewrite this paper?'
IP11: *Perrašyt darbą*?! 'Rewrite the paper?!'
IP12: [Liepė perrašyti darbą.] *Perrašyti darbą*? [They ordered me to rewrite the paper.] 'Rewrite the paper?'
IP13: *Perrašyti darbą ar ne*? 'Rewrite the paper or not?'
IP14: [Jis klausia:] „*Perrašyti darbą*?" [He asks:] 'Rewrite the paper?'
IP15: [Hmm.] *Perrašyti darbą ar neperrašyti*? [Hmm] 'To rewrite the paper or not to rewrite it?'

From a semantic-pragmatic perspective, IP3, IP8, IP9, and IP10 also function as requests; IP13 is an alternative question; IP12 is an echo question; IP14 is a direct quoted question; and IP15 is a rhetorical question. The remaining examples express direct questions. According to the expected response type, IP1–3, IP6–7, IP8, IP10, and IP11–13 are yes/no questions, while IP4–5 and IP9 are wh-questions.

For comparison, a declarative sentence (*Jonas perrašys darbą* 'Jonas will rewrite the paper', IP0) was also included. All sentences were read five times by four native Lithuanian male actors (aged 30–33; born in Kaunas, Šiauliai, Alytus, and Ignalina) in a professional recording studio under identical recording conditions. Male speakers were selected in order to minimise inter-speaker variability related to sex differences in voice characteristics and to allow a more controlled comparison of the acoustic properties of the analysed sentence types. The relatively small number of speakers likewise reflects the controlled experimental design, in which each speaker produced multiple repetitions of all sentence types under identical recording conditions.

Acoustic analysis was conducted using Praat (Boersma and Weenink, 2018). In addition, a perception experiment was carried out to investigate the cues underlying question identification.

The results are presented not in terms of absolute values of the acoustic parameters, but in terms of their relative ratios. An exception is made for intonation and intensity

contours, for which F0 was measured in semitones and intensity in decibels. Ratios for mean F0 and intensity were calculated as follows. First, the mean value of the given parameter was determined for each IP. Next, the median of the speaker-specific means across the entire dataset was calculated. Finally, the mean value for each IP was divided by this median. Maximum ratios were obtained by dividing the maximum value of each parameter by the median of the IP means. Intensity ratios were calculated using the formula $10^{(x-y)/10}$, where *x* represents the intensity of the measured unit and *y* the sample median. F0 range was calculated as the difference between maximum and minimum values (F0max − F0min). Range ratios were obtained by dividing the range value by the speaker-specific median range.

Statistical evaluation of the data was carried out using MANOVA (multivariate analysis of variance), followed by post hoc Bonferroni tests. Cluster analysis was performed using the Two-Step Cluster procedure implemented in IBM SPSS (IBM Corp. 2020).

3. Results and Discussion

3.1. Fundamental Frequency and Intonation Contour

As expected, all F0 parameters are highest in the expressively produced question (IP11) (see Table 1). High mean F0 is also characteristic of the rhetorical question (IP15), the alternative question (IP13), the direct quoted question (IP14), as well as question IP6 and IP1. All these also exhibit high F0 maximum. However, some of them (IP1, IP6, and IP13) do not show a wide F0 range, which indicates that F0 varies relatively little and is maintained at a high level throughout the IP.

Table 1. Ratios of F0 parameters[1]

IP	Mean	Maximum	Range	IP	Mean	Maximum	Range
IP11	1.14	1.61	1.2	**IP5**	1	1.55	1.24
IP15	1.14	1.52	1.17	**IP12**	0.98	1.43	0.98
IP13	1.12	1.49	1.07	**IP4**	0.98	1.38	0.94
IP14	1.1	1.62	1.22	**IP10**	0.96	1.4	0.97
IP6	1.08	1.48	1.05	**IP3**	0.96	1.33	0.9
IP1	1.07	1.46	1.01	**IP8**	0.96	1.36	0.95
IP7	1.03	1.70	1.37	**IP9**	0.96	1.34	0.91
IP2	1	1.43	1.01	**IP0**	0.87	1.06	0.56

No clear F0 patterns were identified that would allow yes/no questions to be distinguished from wh-questions. Some yes/no questions exhibit relatively high F0 values (e.g. IP1), while others show lower values (e.g. IP3 or IP8). However, another tendency emerges: differences between questions with and without interrogative words.

As shown in Table 1, higher F0 values are characteristic of questions without an interrogative word, except for the echo question (IP5), whose mean F0 is not particularly high, although its F0 maximum is among the highest. Thus, one of the defining features

[1] In this and in Table 2, the IPs are ordered according to the ratios of the means, from the largest to the smallest. The IPs are arranged in the same order in the box plots in Figures 1, 2, 10, and 11.

of questions without an interrogative word is a high mean F0, resulting either from a high F0 maximum (associated with the focal prominence) or from higher F0 across the entire IP. The wide dispersion of F0 values in these questions (see Figures 1 and 2) indicates deviations from a habitual pitch range, making it more difficult to maintain stable F0 even when repeating the same sentence.

The lowest F0 values are observed in the statement (IP0), whose intonation contour is likewise the lowest (see Figures 3–6). Most differences between the statement and the questions are statistically significant. Specifically, mean F0 differs significantly ($p \leq 0.029$), except in IP3–4 and IP8–10; F0 maximum differs significantly ($p \leq 0.014$), except in IP8; and F0 range differs significantly ($p \leq 0.02$), again except for IP8.

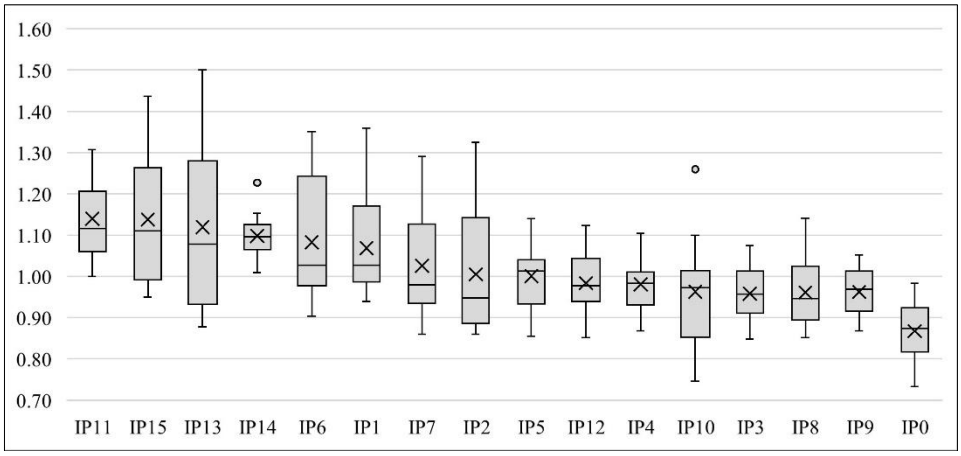

Figure 1. Ratios of mean F0

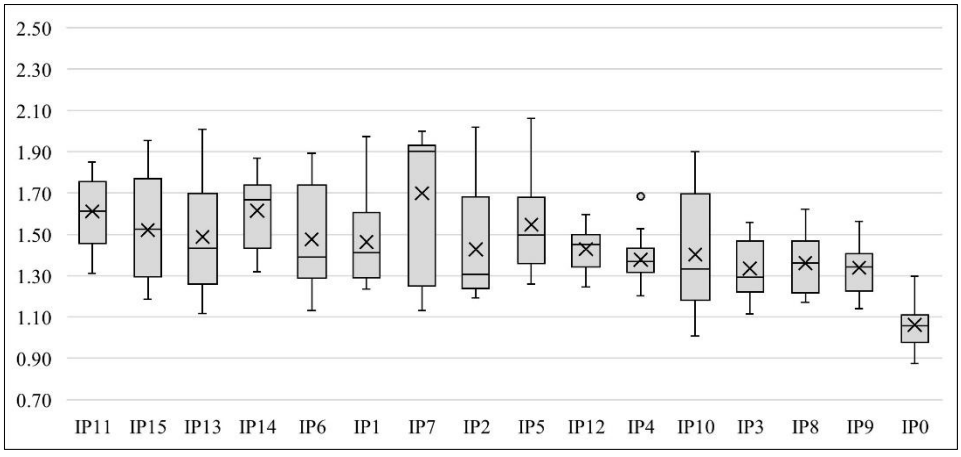

Figure 2. Ratios of F0 maximum

Based on F0 parameters, the analysed questions may be provisionally divided into three groups: questions with low F0 (IP0), medium F0 (IP2–5, IP7–10, IP12), and high F0 (IP11, IP13–15, IP6, IP1). Differences between questions within the same group are generally not statistically significant, although not all differences between groups reach statistical significance. For mean F0, statistically significant differences are observed between IP11 and IP2–IP5, IP10, and IP12 ($p \leq 0.027$), as well as between IP15 and IP2–IP5, IP10, and IP12 ($p \leq 0.032$). Additional significant differences are found between IP13 and IP3, IP4 ($p \leq 0.017$), and IP10 ($p \leq 0.024$), and between IP14 and IP3 ($p = 0.015$) and IP10 ($p \leq 0.024$).

For F0 maximum, statistically significant differences occur between IP7 and IP2–4, IP8, IP10, and IP12 ($p \leq 0.046$), and between IP3 and IP11 and IP14 ($p \leq 0.011$). Among the questions with particularly high F0 maximum is IP7, which contains the verb *reikalauji* 'you demand'. All speakers placed strong prosodic prominence on this verb, resulting in a large F0 range; accordingly, the difference between IP7 and IP1–4, IP8, IP10, and IP12 is statistically significant ($p \leq 0.013$). In addition, F0 range differs significantly between IP3 and IP5 ($p = 0.025$).

For the analysis of intonation contours, F0 (in semitones) was measured at four points: the first voiced sound of the question, the F0 peak, the last stressed syllable, and the final sound. To facilitate comparison, questions were grouped according to their structural and semantic-pragmatic properties, and their contours were compared with that of the statement (IP0). The contour of IP0 is rise–fall, with a peak in the post-stressed syllable *ra* of *perrašyti* 'rewrite'; in some tokens, the rise begins already in the stressed syllable *per*.

Speaker S4 produced unusually high IP-final F0 in IP3, IP9, and IP14. As this pattern was consistent across repetitions but not observed in the other speakers, these tokens were excluded from the general contour analysis in order to avoid distorting the overall patterns. However, S4's productions were retained where similar rising IP-final F0 was observed in the other speakers.

The intonation contours of questions without an interrogative word (IP1–3 and IP6–7) fall into three types (see Figure 3): (a) IP6 and IP7 (with *siūlai* 'you suggest' and *reikalauji* 'you demand') exhibit a rise–fall–rise contour; their contours almost coincide and differ only slightly in IP-final F0. The peak is on *perrašyti* 'rewrite', with the rise beginning at the stressed syllable *per* and reaching its maximum in the post-stressed syllable *ra*; (b) IP1 and IP2 show a rise–fall contour with an extended peak across the stressed syllables of both words, with the F0 rise beginning at *per*; (c) the contour of the question expressing doubt (IP3) is also rise–fall, but the peak is localised only on *perrašyti* 'rewrite', with the rise beginning at the stressed syllable *per* and reaching its maximum in the post-stressed syllable.

Within this group, IP-initial F0 ranges from 80 to 87 st, with a statistically significant difference between IP0 and IP6 ($p = 0.023$). At the peak, F0 ranges from 83 to 88 st, and the differences between IP0 and all questions are statistically significant ($p \leq 0.002$). IP-final F0 ranges from 77 to 86 st; statistically significant differences are observed between IP0 and IP1, IP3, and IP6; between IP3 and IP7; and between IP6 and IP7 (all $p < 0.001$), as well as between IP2 and IP6 ($p = 0.014$).

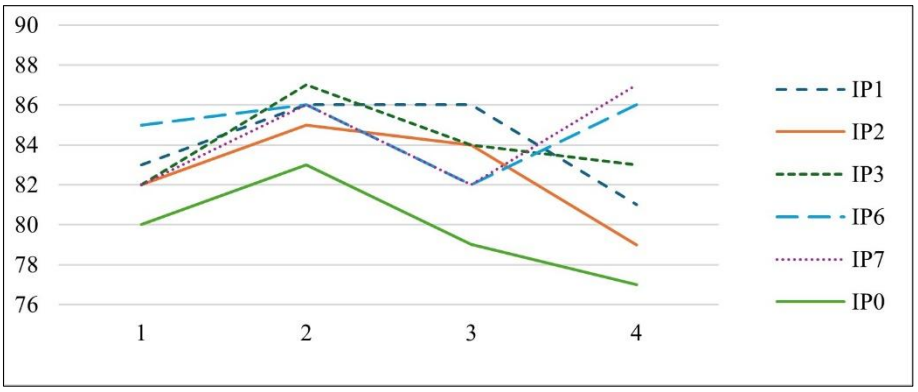

Figure 3. Intonation contour in IP1–IP3 and IP16[2]

The question with the interrogative word *kada* 'when' (IP4) exhibits a rise–fall contour that closely resembles that of the statement, but at a higher overall F0 level (see Figure 4). The contour peak is located on *perrašyti* 'rewrite', beginning at the stressed syllable *per* and reaching its maximum in the post-stressed syllable *ra*.

In IP5, narrow focus is placed on the interrogative word *kaip* 'how', resulting in increased prosodic prominence and a falling contour. IP-final F0 in this case is lower than in IP4 and approaches that of the statement (difference of 1 st). Thus, when the interrogative word carries focus, higher final F0 is no longer a reliable cue to interrogativity. Statistically significant differences in all positions are found between IP0 and IP4 ($p \leq 0.015$). The initial F0 of IP5 is statistically significantly higher than that of the other two IPs ($p < 0.001$).

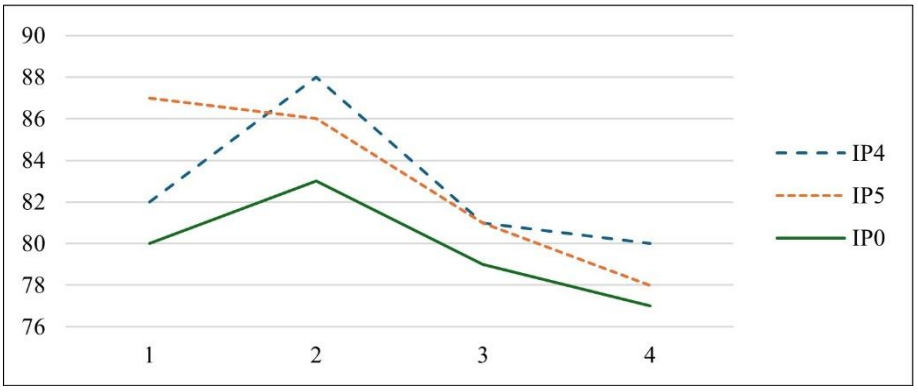

Figure 4. Intonation contour in IP0, IP4–5

[2] In this and in 4–6 figures, the digits on the *x*-axis indicate the segments in which the F0 was measured: 1 – the first voiced sound of the IP, 2 – the peak of F0, 3 – the last stressed sound, 4 – the final sound.

The questions containing the conditional verb *galėčiau* ‘I could’ (IP8–10), which convey a request-like meaning, display highly similar rise–fall contours (see Figure 5). The F0 peaks differ slightly across questions: in IP8 and IP9, the peak occurs on the stressed syllable *lė* of *galėčiau* ‘could’ or begins on the stressed syllable and reaches its maximum in the following post-stressed syllable, whereas in IP10 the peak is located on the stressed syllable of *perrašyti* (*per*) or *darbą* (*dar*). IP-initial (83 st) and IP-final (79 st) F0 are nearly identical across these questions, while peak values range from 86 to 87 st and the penultimate stressed syllable from 81 to 82 st. Although these contours are realised at a higher overall F0 level than the statement, the differences at the analysed positions are not statistically significant.

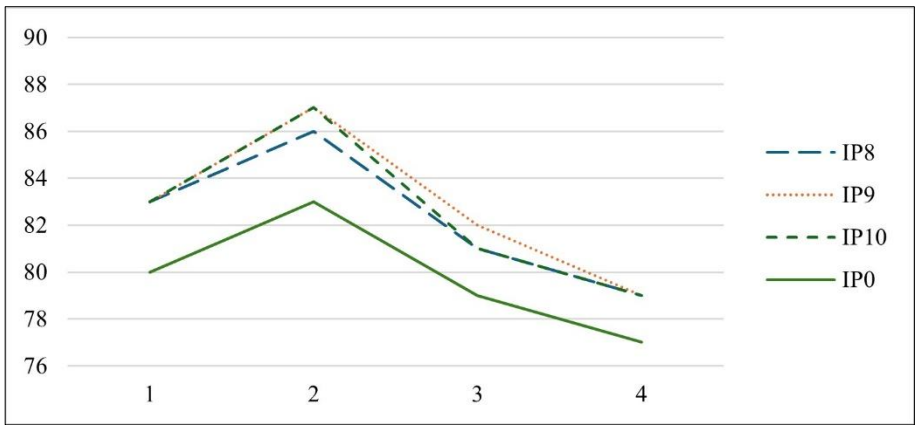

Figure 5. Intonation contour in IP0, IP8–10

A comparison of structurally identical questions (*Perrašyti darbą?* ‘Rewrite the paper?’, IP1, IP11, IP12, IP14) reveals two main tendencies (see Figure 6). First, the expressively produced question (IP11) and the echo question (IP12) exhibit rise–fall–rise contours, with the F0 peak beginning on the stressed syllable *per* of *perrašyti* ‘rewrite’ and reaching its maximum in the post-stressed syllable *ra*. Second, the direct quoted question (IP14) displays a rise–fall contour with an extended F0 peak that begins in the post-stressed syllable of the first word and reaches its maximum on the stressed syllable *dar* of the second word *darbą* ‘paper’. In this respect, its contour resembles that of IP1. Within this group, IP-initial F0 ranges from 81 to 86 st and IP-final F0 from 81 to 87 st. Statistically significant differences in IP-initial F0 are observed between IP11 and the remaining questions ($p < 0.001$).

The alternative question (IP13) follows the cross-linguistically widespread pattern in which a rising tone is associated with the first (or another non-final) option and a falling tone with the second (or the last) option (Huddleston, 2002, 869). The present study confirms this tendency, and, in contrast to the variation reported by Zapereckaitė-Talandienė (1968) and discussed in the introduction, no comparable diversity of contour realisations was observed in the analysed data.

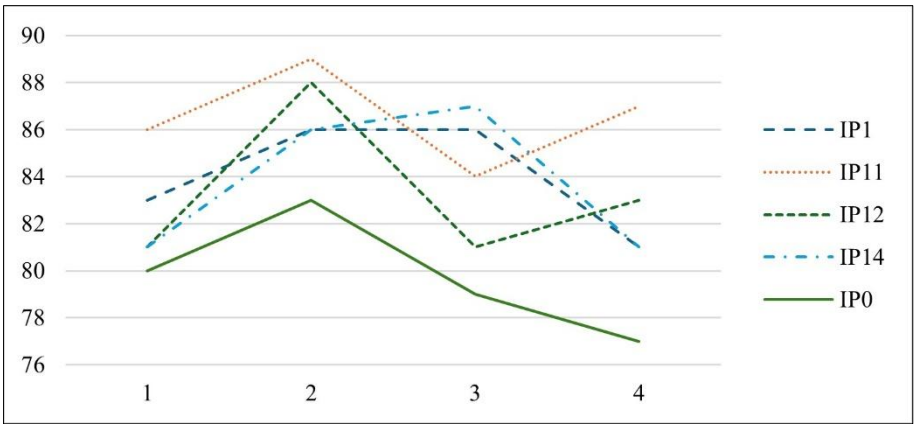

Figure 6. Intonation contour in IP0–1, IP11–12, IP14

The intonation contour of IP13 is relatively shallow rise–fall, with the peak located on the stressed syllable *dar* of the second word *darbą* ‘paper’ (see Figure 7). Although the contour itself is not sharp, the entire IP is realised at a considerably higher F0 level than the statement. Statistically significant differences between IP0 and IP13 are observed in both peak and IP-final F0 ($p < 0.001$).

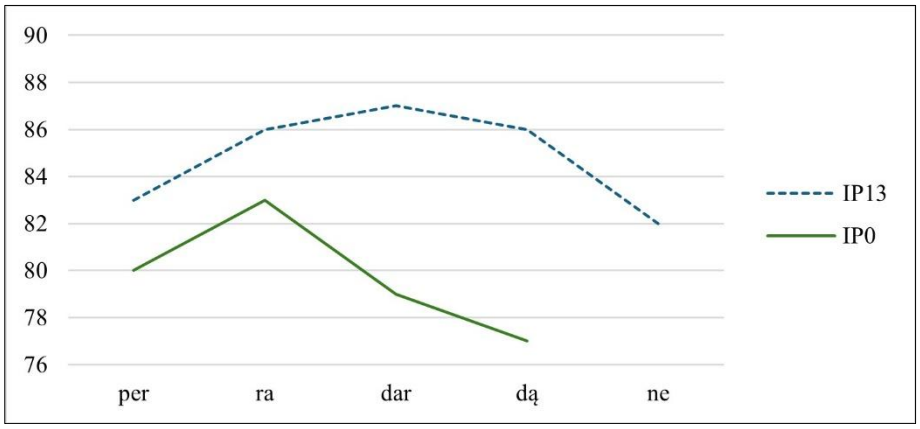

Figure 7. Intonation contour in IP13

The rhetorical question (IP15), which structurally resembles the alternative question, could be realised either as a single intermediate phrase or as two phrases. In 7 out of 20 recordings, speakers inserted a short pause before *ar ne* ‘or not’, but this did not alter the overall intonation contour, which consistently exhibited a sharp rise followed by a gradual fall (see Figure 8). The F0 peak occurs on the stressed syllable of either *perrašyti* ‘rewrite’ or *darbą* ‘paper’. IP-initial F0 in IP15 is slightly lower than in the statement, while IP-final F0 shows a small increase. Among the analysed positions, only the difference in peak F0 is statistically significant ($p < 0.001$).

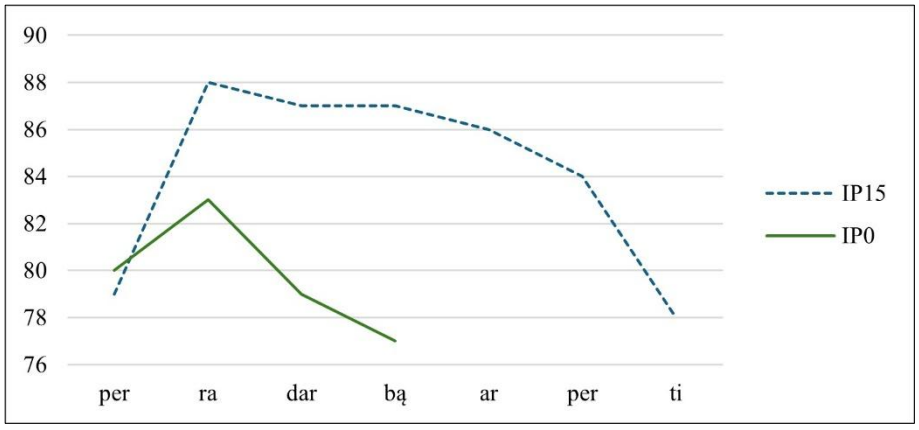

Figure 8. Intonation contour in IP15

Speaker S4 produced strongly rising IP-final F0 in IP3, IP9, and IP14 (see Figure 9). It is difficult to account for why these questions were produced with a markedly rising IP-final F0, as they are not related either structurally or in terms of their semantic-pragmatic function. IP3 and IP9 were realised with request-like prosody, whereas IP14 was produced in a somewhat more dramatic reading style. Overall, all three examples are perceptually identifiable as clearly read IPs, in contrast to the remaining questions, where a more spontaneous question-like intonation pattern was being imitated.

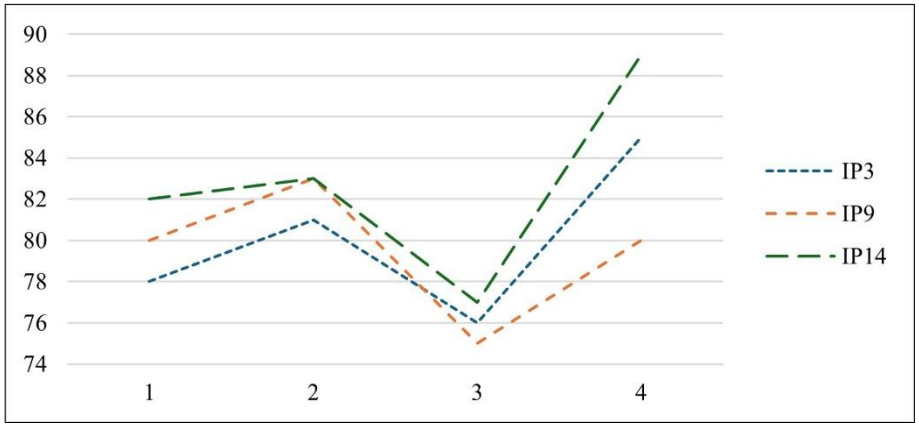

Figure 9. Intonation contour in IP3, IP9, and IP14 pronounced by speaker S4

To summarise the F0 analysis, questions containing interrogative words are generally produced with higher F0 than the statement, whereas questions without interrogative words exhibit the highest F0 values overall. In the analysed material (except for IP7), questions, particularly those without interrogative words, also show greater F0

maximum and wider F0 ranges than the statement. F0 may therefore be regarded as an important acoustic parameter contributing to the identification of interrogativity, especially in questions without an interrogative word.

IP-initial F0 is generally higher in questions than in the statement, except for IP15; in IP12 and IP14, IP-initial F0 differs only slightly from that of the statement (by approximately 1 st). IP-final F0 approaches that of the statement only in IP5 and IP15, whereas in the remaining questions it is higher.

In questions exhibiting rise–fall–rise contours (IP6–7, IP11–12), IP-final F0 is 1–5 st higher than IP-initial F0. By contrast, in questions with interrogative words (IP2, IP4–5, IP8–10), as well as in IP1, IP-final F0 tends to be 2–9 st lower than IP-initial F0, except in IP3, where IP-final F0 is 1 st higher. In this respect, these questions resemble the statement, whose IP-final F0 is 3 st lower than IP-initial F0. In the direct quoted question, IP-initial and IP-final F0 do not differ, while in the alternative and rhetorical question IP-final F0 is approximately 1 st lower than IP-initial F0.

Intonation contours of questions in the analysed material are rise–fall, rise–fall–rise, and, in only one question type, falling. Questions without interrogative words may be realised in two ways: (a) with a rise–fall–rise contour, characteristic of some yes/no questions, as well as the expressively produced question and the echo question (IP6, IP7, IP11, IP12; speaker S4 also realised IP14 in this way); (b) with a rise–fall contour, characterised by a high F0 throughout the IP (an extended peak) and a relatively low IP-final F0. In addition to the general yes/no question IP1, this contour characterises direct quoted, alternative, and rhetorical questions (IP13–15).

Questions containing interrogative words likewise exhibit two main patterns: (a) a rise–fall contour with elevated F0 throughout the IP and relatively low IP-final F0 (IP2 and IP3); (b) a rise–fall contour characterised by a high F0 peak and a low IP-final F0, as observed in wh-questions (IP4–5) and request-like questions (IP8–10). This contour is also found in the statement. Speaker S4 additionally realised IP3 and IP9 with rise–fall–rise contours.

Questions conveying request-like or doubtful meanings (IP3, IP8–10) exhibit lower F0 parameters than the other questions analysed, and their intonation contours are not particularly distinctive.

A falling intonation contour in questions is not uncommon cross-linguistically. Gordon (2016: 244–245), for example, reports that approximately two-thirds of the 100 languages surveyed exhibit rising final contour in yes/no questions, whereas rising final contour in wh-questions occurs in only about one-third of languages.

It has also been proposed (Hedberg et al., 2017: 43–44) that falling contour tends to occur when the speaker already knows the answer or does not expect a response. By contrast, questions that seek information are more likely to exhibit a slightly rising contour, while sharply rising contours tend to signal newly introduced information or narrow focus. In the present material, questions with falling IP-final F0 predominate, accounting for approximately two-thirds of all examples. Since the study examined read speech, the speakers produced questions without expecting a response. This likely explains the predominance of falling contours. It is therefore probable that somewhat different results would emerge in an analysis of spontaneous speech.

Previous studies have shown that wh-questions may exhibit rising tone to express politeness, as reported for Romance languages (Frota and Prieto, 2015), or when requesting initial information or initiating conversational repair, as in American English (Hedberg et al., 2010). However, the present read-speech data do not allow conclusions

to be drawn regarding the pragmatic function of rising contours in Lithuanian. This would require an analysis of spontaneous speech.

3.2. Intensity

When the ratios of mean intensity are calculated and the IPs ranked accordingly, it becomes evident that the lower-intensity group (the second half of Table 2, where mean intensity ratios are equal to or below 1) consists primarily of questions containing interrogative words. This group also includes the echo question (IP12) and the yes/no question without an interrogative word (IP1). In addition, the second part of the direct quoted question (IP14) displays similarly low mean intensity. All three of these questions share the same structure (*Perrašyti darbą?* 'Rewrite the paper?'). The only request-like question containing the particle *gal* 'perhaps/maybe' (IP10) shows higher mean intensity than the questions with interrogative words.

The highest mean intensity is observed in the expressively produced question (IP11). Relatively high intensity values are also characteristic of the question containing *reikalauji* 'you demand' (IP7), the alternative question (IP13), and the statement (IP0).

Although the differences in mean intensity ratios are substantial, ranging from 0.75 to 4.83 times, statistically significant differences are observed only between the expressively produced question (IP11) and all other questions ($p < 0.001$), and between the question containing *reikalauji* 'you demand' (IP7) and the lower-intensity questions IP2, IP3, and IP5 ($p \leq 0.048$).

Intensity maximums range from 3.88 to 23.14 times relative to the median of mean intensity values. Statistically significant differences are again observed between IP11 and all other IPs ($p < 0.001$), as well as between IP7 and IP1–IP3 and IP14 ($p \leq 0.047$).

Table 2. Ratios of intensity

IP	Mean	Maximum	IP	Mean	Maximum
IP11	4.83	23.14	**IP4**	1	5.86
IP7	2.06	9.03	**IP8**	0.99	5.5
IP13	1.54	6.12	**IP1**	0.98	3.88
IP0	1.27	6.31	**IP5**	0.98	6.57
IP10	1.14	6.01	**IP12**	0.97	4.97
IP15	1.13	5.56	**IP3**	0.86	5.03
IP6	1.11	5.2	**IP9**	0.86	4.83
IP14	1.1	4.14	**IP2**	0.75	3.99

Although mean intensity is strongly influenced by intensity maximum, this relationship is not absolute. For example, the question containing *kaip* 'how' (IP5) exhibits a high intensity maximum but relatively low mean intensity. This appears to result from the influence of IP-final intensity. Questions containing interrogative words tend to show reduced IP-final intensity, whereas increased intensity is concentrated at the beginning of the IP, particularly on the interrogative word.

The expressively produced question (IP11) and the question containing *reikalauji* 'you demand' (IP7) not only exhibit the highest intensity values but also the greatest

dispersion (see Figures 10 and 11). This variability is evident both across speakers and within repeated productions by the same speaker. As in the case of F0, this indicates non-uniform realisation and reflects speakers' attempts to depart from a habitual neutral reading style.

For the analysis of intensity contours, intensity was measured at three points: the nucleus of the first syllable, the intensity peak, and the nucleus of the final syllable. For comparative purposes, the questions were grouped in the same way as in the analysis of intonation contours.

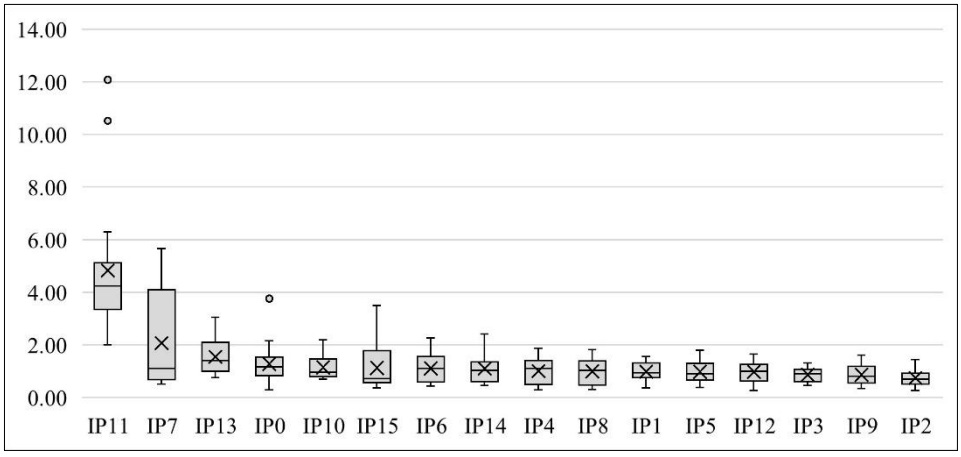

Figure 10. Ratios of mean intensity

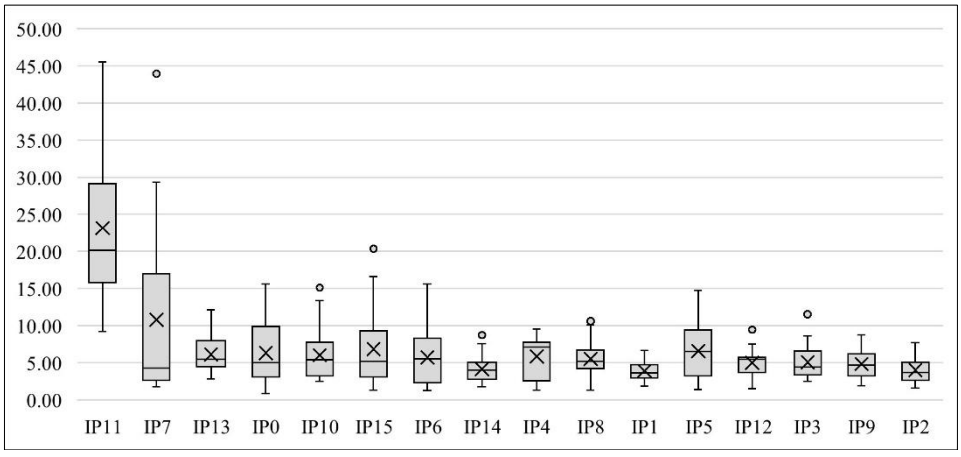

Figure 11. Ratios of intensity maximum

Although questions without interrogative words (IP1–3 and IP6–7) differ in intonation contour (rise-fall-rise, rise-fall), their intensity contours consistently display a rise–fall pattern (see Figure 12). IP-initial intensity ranges from 66.11 to 72.75 dB. Statistically significant differences are observed between the statement IP0 and IP1, IP3, and IP6 ($p \leq 0.003$), as well as between IP1 and IP2 ($p < 0.02$). Intensity peaks range from 74.96 to 77.31 dB, and these differences are not statistically significant. IP-final intensity ranges from 55.57 to 66.55 dB; statistically significant differences are observed between IP0 and IP7 ($p < 0.001$), and between IP2 and IP7 ($p = 0.001$). IP7 exhibits not only the highest IP-final intensity within this group but also a rising intonation contour. These two properties could be taken as indicators of interrogativity; however, a rising F0 contour is also present in IP6, where IP-final intensity does not differ from that of the other questions.

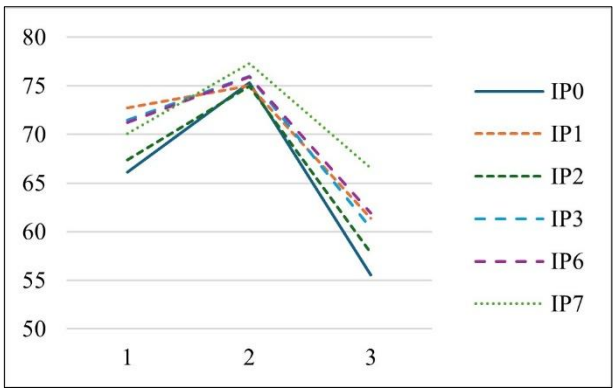

Figure 12. Intensity contour in IP0–IP3 and IP6–7[3]

In wh-questions (see Figure 13), IP-initial intensity ranges from 66.11 to 73.44 dB. Statistically significant differences are observed between the IP0 and IP5 ($p < 0.001$). In IP5, the interrogative word receives narrow focus, reflected in both increased F0 and higher initial intensity, both of which are characteristic acoustic correlates of narrow focus in Lithuanian (Kazlauskienė and Dereškevičiūtė, 2022b). Differences in peak and IP-final intensity are comparatively small (75.31–76.65 dB and 55.57–57.29 dB respectively) and are not statistically significant.

[3] In this and in 13–16 figures, the digits on the *x*-axis indicate the segments in which the intensity was measured: 1 – the nucleus of the first syllable, 2 – the intensity peak of F0, 3 – the nucleus of the final syllable.

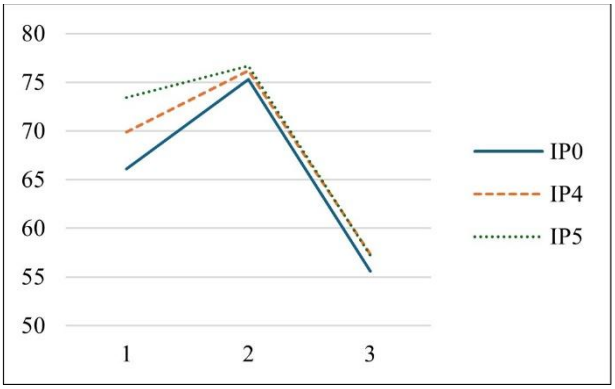

Figure 13. Intensity contour in IP0, IP4–5

Questions containing the conditional verb *galėčiau* 'I could' (IP8–10) display intensity contours that closely resemble that of the statement, differing primarily in IP-initial intensity (see Figure 14). IP-initial intensity ranges from 66.11 to 72.17 dB, and statistically significant differences are observed between IP0 and IP10 ($p < 0.001$). Differences in peak intensity and IP-final intensity are not statistically significant; the corresponding ranges are 75.31–76.49 dB and 55.57–56.27 dB respectively.

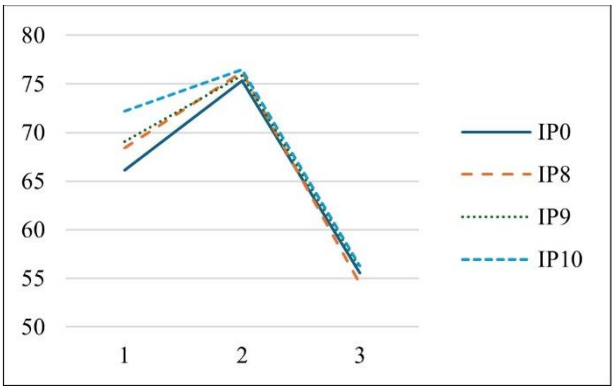

Figure 14. Intensity contour in IP0, IP8–10

Among structurally identical questions (*Perrašyti darbą?* 'Rewrite the paper'; see Figure 15), intensity varies most substantially at IP beginning and end. IP-initial intensity ranges from 66.11 to 79.64 dB, while IP-final intensity ranges from 55.57 to 73.85 dB. Statistically significant differences in IP-initial intensity are observed between IP11 and all remaining questions ($p < 0.02$). Similarly, statistically significant differences in peak intensity are found between IP11 and all other questions ($p < 0.001$).

IP-final intensity is higher in IP11 and IP12 than in the remaining IP, and both are additionally characterised by rising IP-final contours. Statistically significant differences

in IP-final intensity are observed between IP0 and IP12 ($p < 0.001$), IP1 and IP11 ($p < 0.001$), IP1 and IP12 ($p = 0.003$), and IP11 and IP14 ($p = 0.001$).

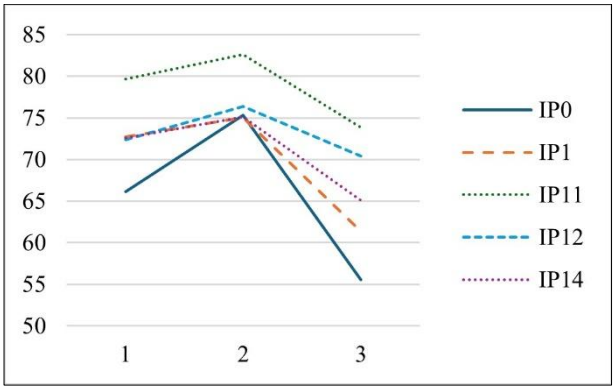

Figure 15. Intensity contour in IP0–1, IP11–12, IP14

Alternative and rhetorical questions display almost identical IP-initial intensity and intensity peaks but differ considerably in IP-final intensity (see Figure 16). In the rhetorical question (IP15), IP-final intensity is lower than in the statement, whereas in the alternative question (IP13) it is substantially higher. Statistically significant differences in IP-initial intensity are observed between the statement IP0 and IP13 and IP15 ($p < 0.001$). Differences in peak intensity are not statistically significant. IP-final intensity differs significantly between IP0 and IP11 and IP13 ($p < 0.001$), as well as between IP13 and IP15 ($p < 0.001$).

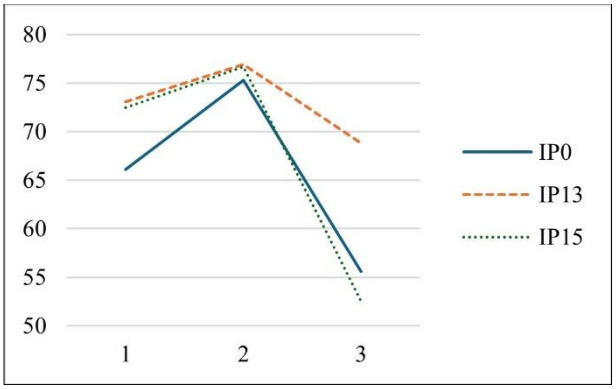

Figure 16. Intensity contour in IP0, IP13, and IP15

To summarise the analysis of intensity parameters, higher intensity values are generally characteristic of questions without interrogative words, and such questions also

tend to exhibit somewhat higher intensity maximum, although questions containing interrogative words may likewise display higher maximum. Higher mean intensity in questions without interrogative words results primarily from increased intensity at IP beginning and end, whereas intensity peaks themselves do not exhibit equally clear differences.

Nevertheless, high mean intensity and high intensity maximum are also observed in the statement. Intensity therefore cannot be regarded as a reliable independent indicator of interrogativity. This likely explains why intensity has received comparatively limited attention in earlier studies of question prosody.

One intensity-related feature that may contribute to the identification of questions is higher intensity at IP-initial and IP-final position. IP-initial intensity in all questions exceeds that of the statement by 1.35 to 5.41 times, and in IP11 by as much as 22.54 times. In many questions, IP-final intensity is likewise higher than in the statement (except in IP8 and IP15), ranging from 1.13 to 30.34 times above the statement value, and reaching 67.30 times in IP11. Intensity peaks, however, are not a reliable diagnostic feature, since the differences are relatively small (up to 1.58 times, or 5.35 times in IP11), and in some questions (IP1, IP2, and IP14) peak intensity is even lower than in the statement.

3.3. Cluster Analysis of F0 and Intensity

Using the Two-Step Cluster procedure in IBM SPSS, a cluster analysis was performed on all analysed IPs based on the relative values of the five acoustic parameters examined. The aim of the analysis was to determine whether the acoustic parameters of the analysed IPs naturally form clusters, whether these clusters correspond to the predefined question types, which acoustic features contribute most to cluster formation, and which acoustic parameters characterize the resulting clusters. Therefore, the IPs were grouped without specifying the number of clusters in advance.

As shown by the characteristics of the cluster centres and the distribution of IPs across clusters (see Tables 3 and 4), the first cluster, comprising 31% of the analysed IPs, is characterised by higher F0 and intensity values. The differences in intensity between the two clusters are particularly large.

Table 3. Parameters of cluster centres

Feature	**Cluster**	
	1	**2**
Mean F0	1.16	0.96
F0 maximum	1.76	1.31
F0 range	1.41	0.87
Mean intensity	2.29	0.94
Intensity maximum	11.51	4.86
Number of phrases (%)	31	69

The first cluster includes all expressively produced questions (IP11), almost two-thirds of the questions containing the imperative-like verb *reikalauji* ‘you demand’ (IP7), and almost two-thirds of the direct quoted question (IP14).

The second cluster includes all statements (IP0), questions expressing doubt (IP3), echo questions (IP12), and almost all questions containing the interrogative word *kada* (IP4 and IP9), as well as the request-like question IP8. Questions without interrogative words (IP1), questions containing *ar* (IP2), the request-like question with *gal* (IP10), and the alternative question (IP13) also more frequently display the characteristics of the second cluster, accounting for approximately 70–80% of the corresponding productions.

Slightly more than half (55%) of the questions containing the interrogative word *kaip* 'how' (IP5), the verb *siūlai* 'you suggest' (IP6), and rhetorical questions (IP15) belong to the first cluster. The acoustic realisation of these questions may therefore be either more expressive (first cluster) or less expressive (second cluster), depending on the speaker's strategy and the extent to which specific lexical items or the question is assigned prosodic prominence.

In questions without interrogative words, final rising intonation contours did not substantially affect the overall F0 and intensity parameters (cf. Tables 1 and 2). As a result, the cluster analysis does not produce entirely uniform results: some productions of IP6 and IP7 were assigned to the first cluster and others to the second, whereas all productions of IP11 were assigned to the first cluster and all productions of IP12 to the second cluster.

Table 4. Distribution of IPs across clusters (%)

IP	Cluster		IP	Cluster	
	1	**2**		**1**	**2**
IP0		100	**IP8**	10	90
IP1	20	80	**IP9**	5	95
IP2	25	75	**IP10**	30	70
IP3		100	**IP11**	100	
IP4	5	95	**IP12**		100
IP5	45	55	**IP13**	25	75
IP6	45	55	**IP14**	60	40
IP7	65	35	**IP15**	45	55

The cluster analysis reveals one relatively consistent tendency: IPs produced with strong prosodic prominence, whether due to expressive delivery or narrow focus, form a more distinct acoustic group and may therefore be easier to identify as a question. Other questions exhibit less clearly marked acoustic cues. However, expression and narrow focus are not the only features associated with interrogativity. One of the most important cues is the presence of an interrogative word, which partly neutralises the need for strongly marked acoustic features. Consequently, most questions containing interrogative words (IP2–4, IP8–10) were assigned to the second cluster, except for IP5, where the interrogative word itself carries narrow focus.

3.4. The Importance of F0 and Intensity for Question Identification

Previous research by Kazlauskienė and Dereškevičiūtė (2022a) investigated the role of interrogative words in the identification of questions. In their perception experiment, the interrogative words *ar* and *kada* were removed from the questions *Ar galime eiti namo?*

'Can we go home?' and *Kada galėsime eiti namo?* 'When can we go home?', and participants were asked to determine whether the resulting stimuli were question or statement.

The results demonstrated that when the interrogative word *ar* was removed, participants continued to identify the utterance as interrogative. Identification was almost entirely independent of intonation contour: on average, nine out of ten participants classified both questions with rising contours and those with rise–fall contours in which narrow focus was placed on the verb form *galime* as interrogatives. By contrast, questions from which the interrogative word *kada* had been removed were identified as statement in 92% of cases. These findings suggest that the interrogative word, higher IP-final F0, and narrow focus all function as highly significant cues to interrogativity.

In order to clarify which factors contribute to the identification of questions without interrogative words, a perception experiment was conducted among 65 first-year native Lithuanian-speaking students enrolled in the Speech and Language Pathology Programme at Vytautas Magnus University. Participants were asked to indicate whether each auditory stimulus represented an interrogative or a declarative utterance.

Table 5. Results of the experiment (%)

No.	Stimulus	Question	Statement
1	*Perrašyti darbą*? (echo question, original)	99	1
2	*Perrašyti darbą*. (original)		100
3	*Perrašyti darbą* (?/.) (see Figure 17 for the intonation contour)	8	92
4	*Siūlai perrašyti darbą* (?/.) (see Figure 18 for the intonation contour; the intensity of *perrašyti* was reduced to 55 dB)	92	8
5	*Perrašyti darbą* (?/.) (see Figure 19 for the intonation contour)	5	95
6	*Perrašyti darbą* (./?) (see Figure 20 for the intonation contour; the intensity of *perrašyti dar-* was increased to 58 dB)	68	32
7	*Perrašyti darbą* (?/.) (see Figure 21 for the intonation contour; the intensity of *darbą* was reduced to 58 dB)	88	12
8	*Perrašyti darbą*? (original)	95	5
9	*Perrašyti darbą* (./?) (see Figure 20 for the intonation contour)	48	52
10	*Perrašyti darbą* (?/.) (see Figure 21 for the intonation contour)	85	15
11	*Perrašyti darbą* (?/.) (see Figure 17 for the intonation contour; the intensity of *darbą* was reduced to 55 dB)	3	97
12	*Siūlai perrašyti darbą* (?/.) (see Figure 18 for the intonation contour)	89	11
13	*Perrašyti darbą* (?/.) (see Figure 19 for the intonation contour; the intensity of *darbą* was reduced to 60 dB)	9	91
14	*Perrašyti darbą*. (original)	1	99
15	*Siūlai perrašyti darbą*? (original)	99	1

Fifteen stimuli produced by one of the speakers participating in the present study were prepared for the experiment. Five of these were original recordings; the remaining stimuli were acoustically modified, either by manipulating F0 alone or by modifying both F0 and intensity. Intensity was not manipulated independently, since both the analysis presented in Section 3.2 and preliminary testing had shown that such modifications yield inconclusive perceptual effects.

F0 was modified using the "Manipulation function" in the speech analysis software Praat, which makes it possible to raise or lower the pitch of selected segments using the functions "Shift pitch frequencies" and "Multiply pitch frequencies." Intensity was modified using Praat's "Modify function", which allows selected recordings to be amplified or attenuated by means of the "Scale intensity" function.

In Table 5, stimuli 1, 2, 8, 14, and 15 represent original recordings. Stimuli 6 and 9 were created by modifying a statement so that it resembled a question one, whereas stimuli 3–5, 7, and 10–13 were created by modifying questions to resemble statement ones. The stimuli are listed in the order in which they were presented to participants.

As expected, the original control recordings were identified with very high accuracy, ranging from 95% to 100%.

Stimuli 3 and 11 were derived from stimulus 8 (a statement), which originally exhibited a rise–fall contour with a broad F0 peak (see Figure 17). In the modified versions, IP-initial F0 was raised while the middle part of the IP was lowered. Participants classified these modified stimuli as statement in almost all cases. Additional reduction of intensity increased the perceived interrogativity by only 5 percentage points, indicating that intensity played only a marginal role.

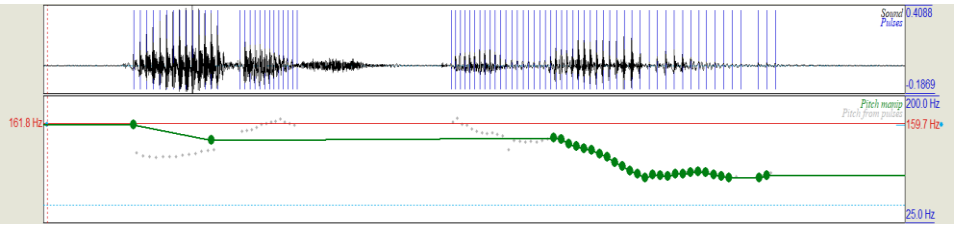

Figure 17. Modified intonation contour of stimuli 3 and 11[4]

Stimuli 4 and 12 were derived from stimulus 15 (a question) by lowering F0 throughout the IP (see Figure 18) and additionally reducing intensity. Despite these modifications, participants continued to identify the stimuli as question in almost all cases. This appears to reflect the semantic contribution of the verb *siūlai* 'you suggest', which itself strongly implies interrogativity, as several participants explicitly noted in their responses.

[4] In this figure and Figures 18–21, the grey curve shows the intonation contour of the original recording, while the green curve shows the modified intonation contour.

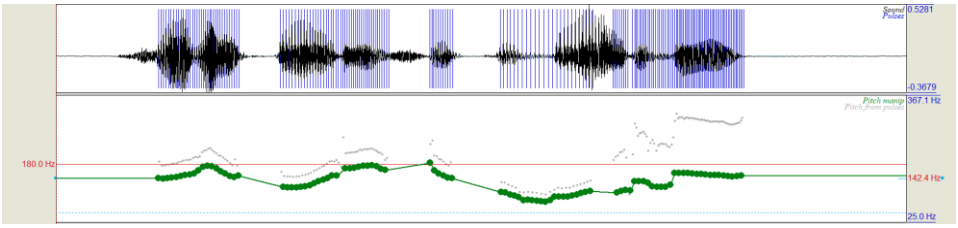

Figure 18. Modified intonation contour of stimuli 4 and 12

Stimuli 5 and 13 were derived from an IP with a final rising contour and elevated IP-final F0 (see Figure 19). In the modified versions, F0 was lowered throughout the IP, particularly towards the end. These modified stimuli were identified as statement by almost all participants. Additional reduction of IP-final intensity only slightly weakened the perception of interrogativity. The final intensity of the statement was somewhat lower than that of the modified versions. However, since further reduction would have compromised the naturalness of the recording, more extreme manipulation was not attempted.

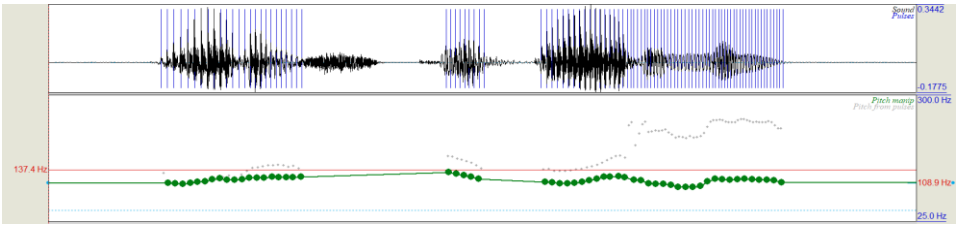

Figure 19. Modified intonation contour of stimuli 5 and 13

The attempt to create a question from a statement (stimulus 9) was less successful. The F0 contour was modified by slightly lowering the first syllable and raising the remainder of the IP while preserving relatively low IP-final F0 (see Figure 20). Fewer than half of participants identified the result as question. However, when IP-initial intensity was additionally increased (stimulus 6), nearly two-thirds of participants classified the stimulus as question.

What could have led to these results, given that the intonation contour is similar to that of the original question (stimulus 8)? It is possible that questions are produced with a slightly faster speaking rate than statements; for example, stimulus 9 is 1.2 times longer than stimulus 8. Upon hearing stimuli 8 and 9 in sequence, several participants noticed the difference in duration and interpreted stimulus 9 as a statement.

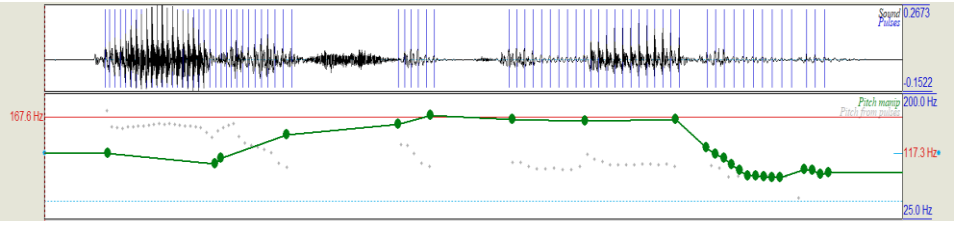

Figure 20. Modified intonation contour of stimuli 6 and 9

Stimuli 7 and 10 were derived from an echo question (original stimulus 1) by lowering F0 throughout the IP and especially at IP end (see Figure 21). Nevertheless, 88% and 85% of participants, respectively, continued to classify the stimuli as question. Reducing intensity slightly increased question judgements.

Why a similar modification applied to stimulus 8 (producing stimuli 3 and 11) yielded statement judgements, whereas stimuli 7 and 10 retained question interpretation? Although the original IPs had similar mean F0 and intensity values (87 st and 65 dB for stimulus 1, versus 88 st and 66 dB for stimulus 8), they differed in F0 range (20 st versus 15 st). This difference most likely accounts for the different perceptual outcomes.

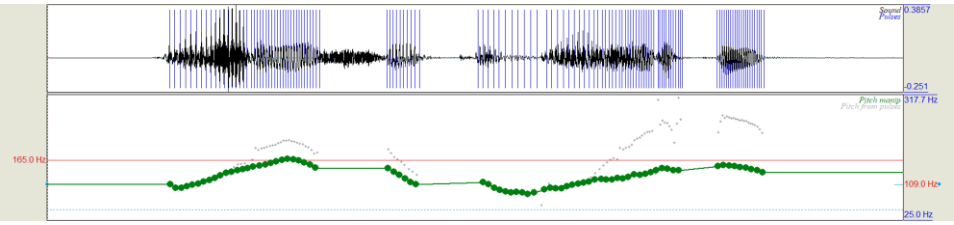

Figure 21. Modified intonation contour of stimuli 7 and 10

To summarise the perception experiment, intonation contour emerges as an important marker of questions without interrogative words. When the contour was modified to become falling or relatively level across the IP, listeners generally identified the result as statement. However, other factors may also contribute significantly, including semantics (as in questions containing *siūlai* 'you suggest') and additional acoustic features.

Although measurable differences in intensity exist between question and statement, intensity does not appear to function as an essential independent cue for the unambiguous identification of interrogativity.

4. Conclusions

The study conducted allows the following conclusions to be drawn:

1. The highest mean F0, F0 maximum, and F0 ranges are characteristic of questions without interrogative words. Questions containing interrogative words exhibit lower F0

values, while statements show the lowest values. F0 therefore constitutes a significant acoustic indicator of interrogativity, particularly in the absence of interrogative lexical marking. However, F0 maximum must be interpreted with caution, since it may also reflect narrow focus in both statements and questions with an interrogative word.

2. Questions are realised with rise–fall, rise–fall–rise, and falling contours. Questions without interrogative words are characterised either by rise–fall–rise contours or by rise–fall contours with elevated F0 throughout the IP but relatively low IP-final F0. Questions containing interrogative words are characterised by a rise–fall contour with either high F0 throughout the IP but low final F0, or by a high F0 peak and low final F0. Since the latter contour is also characteristic of statements, contour shape alone cannot always serve as a reliable indicator of interrogativity.

3. IP-initial and often IP-final F0 are generally higher in questions than in statements. This may facilitate identification of interrogativity even when intonation contours are otherwise similar (e.g. rise–fall). However, in rise–fall–rise contours, final F0 is typically higher than initial F0, a pattern also found in statements, which limits the reliability of this cue in non-rising configurations.

4. Higher mean intensity and higher intensity maximum are more typical of questions without interrogative words, although comparable values are sometimes observed in questions containing interrogative words and even in statements. Intensity therefore cannot be regarded as a reliable independent cue.

5. IP-initial intensity is generally higher in questions than in statements, and both peak and IP-final intensity also tend to be higher in questions. Questions without interrogative words are characterised by higher intensity at IP onset and end than questions containing interrogative words, whereas intensity peaks do not show a consistent pattern. Thus, alongside other acoustic cues, higher IP-initial intensity may serve as a potential indicator of interrogativity.

Overall, questions differ from statements in the following respects: (a) higher overall F0 values; (b) either a rising IP-final contour or a high F0 peak in which the rise begins in the stressed syllable of the narrow-focus word and reaches its maximum in the post-stressed syllable; (c) higher IP-initial and frequently higher IP-final F0; (d) increased IP-initial intensity and, in many cases, also higher IP-final intensity.

The cluster analysis grouped all examples into only two clusters, which did not correspond to the linguistic classification of question types. This finding supports the conclusion that general, alternative, rhetorical, echo, yes/no, and wh-questions do not exhibit consistent acoustic differences. Instead, the clustering suggests that the presence or absence of an interrogative word is one of the main factors influencing the prominence of acoustic features. When an interrogative word is present, acoustic marking of interrogativity appears to be less prominent, whereas questions without interrogative words rely more heavily on prosodic cues.

The perception experiment confirms that intonation contour is an important cue for identifying questions without interrogative words, but not the only one. Speech perception depends on multiple interacting acoustic and contextual cues. Even when clearly defined acoustic parameters are established under controlled experimental conditions, natural speech may contain additional phonetic signals that contribute to listeners' interpretation in ways that exceed those assumed by both researchers and developers of speech-processing technologies.

The present findings should be interpreted in light of the design of the speech corpus. The analysis is based on a relatively small set of read productions by male speakers recorded under controlled laboratory conditions. This design made it possible to

minimise speaker-specific variability and to examine acoustic correlates of interrogativity under comparable conditions. However, the results cannot be assumed to generalise directly to female speakers or to spontaneous conversational speech, where prosodic realisations are likely to be more variable. Future research should therefore examine larger and more diverse speaker populations, including female speakers and naturally occurring speech.

Acknowledgment

This research was funded by a grant (No. S-MIP-24-90) from the Research Council of Lithuania (Project "Intonation of the Lithuanian language: Functional Types and Interference with Prosodic Units"). Sincere thanks are due to the actors whose recordings were used in the analysis, as well as to the colleagues who assisted with the studio recordings, contributed to the statistical analysis, and helped select the most appropriate phrasing for the text. Special thanks go to the students who participated in the survey.

References

Arvaniti, A., Baltazani, M., Gryllia, S. (2014). The pragmatic interpretation of intonation in Greek wh-questions, *Proceedings of the 7th International Conference on Speech Prosody*, 1144–1149.

Baltazani, M., Gryllia, S., Arvaniti, A. (2019). The intonation and pragmatics of Greek wh-questions, *Language and Speech*, **63(3)**, 1–39. doi:10.1177/0023830918823236.

Boersma, P., Weenink, D. (2018). *Praat: doing phonetics by computer*, version 6.035. www.praat.org.

Ekblom, R. (1925). *Quantität und Intonation im zentralen Hochlitauischen*, Uppsala: Lundequist.

Frota, S., Prieto, P. (2015). Intonation in Romance: systemic similarities and differences, in Frota S., Prieto P. (eds.), *Intonation in Romance*, Oxford: Oxford University Press, 392–418.

Gordon, M. K. (2016). *Phonological Typology* (Ofxord Surveys in Phonology and Phonetics), Oxford: Oxford University Press.

Hedberg, N., Sosa, J. (2002). The prosody of questions in natural discourse, *Proceedings of the 1st International Conference on Speech Prosody*, 375–378.

Hedberg, N., Sosa, J. M., Görgülü, E. (2017). The meaning of intonation in yes-no questions in American English: a corpus study, *Corpus Linguistics and Linguistic Theory*, 1–48. doi:10.1515/cllt-2014-0020.

Hedberg, N., Sosa, J. M., Gorgülü, E., Mameni, M. (2010). The prosody and meaning of wh-questions in American English, *Proceedings of the 5th International Conference on Speech Prosody*, 1–4.

Huddleston, R. 2002, Clause type and illocutionary force, *The Cambridge Grammar of the English Language*, Cambridge University Press, 851–946.

IBM Corp. (2020). *IBM SPSS statistics for Windows*, version 27.0, computer software, IBM Corp.

Kazlauskienė, A., (2026). Acoustic Features of Lithuanian Directives, *Baltic J. Modern Computing*, Vol. **14**, No. 1, 27-49 https://doi.org/10.22364/bjmc.2026.14.1.02

Kazlauskienė, A., Dereškevičiūtė, S. (2022a). Observations on basic intonational patterns of questions and statements in Standard Lithuanian, *Studies about Languages / Kalbų studijos*, **40**, 90–102. https://doi.org/10.5755/j01.sal.40.1.30870.

Kazlauskienė, A., Dereškevičiūtė, S. (2022b). Observations on the prosodic marking of narrow focus in Lithuanian. *Baltic J. Modern Computing*, **10**(3), 307–316. doi:10.22364/bjmc.2022.10.3.04

Kazlauskienė, A., Dereškevičiūtė, S., Sabonytė, R. (2023). *Bendrinės lietuvių kalbos intonacija: frazės centras, ribos ir žymėjimas* (Standard Lithuanian intonation: phrase centre, boundaries, and marking), Kaunas: Vytauto Didžiojo universiteto leidykla, https://doi.org/10.7220/9786094675782.

Kundrotas, G. (2018). *Lietuvių kalbos intonacinė sistema* (The intonation system of the Lithuanian language), Utena: Indra.

Mikalauskaitė, E. (1975), *Lietuvių kalbos fonetikos darbai* (Works on Lithuanian phonetics), Vilnius: Mokslas.

Pierrehumbert, J. B., Hirschberg, J. (1990). The meaning of intonational contours in the interpretation of discourse, in Cohen, P. R., Morgan, J., Pollack, M. E. (eds.), *Intentions in Communication,* The MIT Press, Cambridge MA, 271–311.

Pukelis, V. (1968). Komunikatyvinė dabartinės lietuvių kalbos bendrojo klausimo sakinių intonacijos reikšmė (The communicative significance of intonation in interrogative sentences in the contemporary Lithuanian language), *Eksperimentinė ir praktinė fonetika. Eksperimentinės fonetikos ir kalbos psichologijos kolokviumo medžiaga*, **3**, 31–54.

Pukelis, V. (1972). Kai kurie fiziniai pagrindinio tono požymiai lietuvių kalbos patikrinamuosiuose klausimuose (Some physical characteristics of the pitch in Lithuanian yes/no questions), *Garsai, priegaidė, intonacija. Eksperimentinės fonetikos ir kalbos psichologijos kolokviumo medžiaga*, **5**, 161–164.

Talandienė, M. (1970a). Alternatyvinių klausimų loginiai ir komunikaciniai santykiai (The logical and communicative relationships of alternative questions), *Kalbos garsai ir intonacija. Eksperimentinės fonetikos ir kalbos psichologijos kolokviumo medžiaga*, **4**, 155–160.

Talandienė, M. (1970b). Alternatyvinių klausimų intonacijos suvokimas (Perception of the intonation of alternative questions), *Kalbos garsai ir intonacija. Eksperimentinės fonetikos ir kalbos psichologijos kolokviumo medžiaga*, **4**, 161–169.

Talandienė, M. (1972). Alternatyvinių klausimų trukmės ypatybės (Characteristics of the duration of alternative questions), *Garsai, priegaidė, intonacija. Eksperimentinės fonetikos ir kalbos psichologijos kolokviumo medžiaga*, **5**, 184–197.

Vaitkevičiūtė, V. (2021). Sakinio intonacija (Sentence intonation), *Lietuvių kalbos tarties pagrindai ir žodynas,* Vilnius: Pradai, 166–179.

Zapereckaitė-Talandienė, V. (1968). Dėl pasirenkamųjų (alternatyvinių) klausimų struktūros ir intonacijos dabartinėje lietuvių literatūrinėje kalboje (On the structure and intonation of optional (alternative) questions in contemporary Lithuanian), *Eksperimentinė ir praktinė fonetika. Eksperimentinės fonetikos ir kalbos psichologijos kolokviumo medžiaga*, **3**, 55–68.

Received May 29, 2026, accepted July 8, 2026