Polar question intonation in Russian speech from Moscow and Perm

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ABSTRACT

In Central Standard Russian, polar (yes/no) questions are typically pronounced with a high rise on the nuclear syllable, followed by a fall to low level, starting immediately or shortly after the nuclear syllable. Recent studies suggest that the pitch peak in the rising pitch accent is moving to the first postnuclear syllable in the speech of younger Russians. The difference in peak alignment might be both generational and regional. Most young urban Russians speak with little or no regional traits, but speech from Perm (Ural) is known for a comparably strong local colouring, partly due to its intonation. We compared the prosodic realisation of polar questions produced by 33 adolescents in the capital Moscow and in Perm. In our data, most renderings from both cities have their pitch peak on the first posttonic syllable, but on average, the boys from Perm align the peaks later and use a lower F0 maximum and an overall narrower pitch span than their peers in Moscow. No such significant differences could be found between the girls from Moscow and Perm, suggesting that the girls tend to use an intonation closer to a non-local norm than the boys, at least in this reading task.

Key words: prosody, intonation, regional variation, Russian, polar questions

1. Introduction

Russian is a language in a centralised country with a strong standard language ideology. Most young urban Russians speak with little or no local colouring in their Russian pronunciation, but we can expect to find regional variation in prosody. However, with very few exceptions – among them [1] and [2] – regional prosodic variation in modern Russian urban speech is rather an unexplored field.

The present study investigates the prosodic realisation of polar questions in the speech of today's youth in different parts of Russia – in the capital Moscow and in Perm, a city in the Ural region, on the border with Siberia. Speech from Perm is known for a comparably strong local colouring; cf. [3], [4], *inter alia*. Linguists from Perm have the impression that the Perm local accent can to a large extent be attributed to its intonation [5].

Russian has a question particle, *li*, but most polar (yes/no) questions are marked by intonation only. In Central Standard Russian, polar questions are typically pronounced with a high, steep rise on the nuclear syllable, and, if postnuclear syllables are available, followed by a fall to low level, starting immediately or shortly after the nuclear syllable [6], [7], [8], [9]. Odé observed that the perceptually most relevant intonational form of questions has a rising accent with great excursion and a low posttonic part, where the excursion size itself is less perceptually relevant than the pitch level reached relative to the lowest level of the speaker [6]. According to perception tests by Rathcke [10], the primary perceptual cues for polar questions in Russian are a steep rise and a late peak alignment at the offset of the accented vowel, the height of the F0 peak playing a minor role. Meyer and Mleinek [11] and Makarova [12] found that high, delayed peaks unambiguously serve as acoustic cues in perception and production of polar questions.

This tonal configuration has received different labels. Within an Autosegmental-Metrical tonal approach, the typical nuclear accent and boundary tones in Russian polar questions is analysed as L*+H L% [10], L+H*..L..L% [13], L+H* L-L% [14], L+H* L(*) [11] or H*L L% (in [8], the most recent version of ToRI, *Transcription of Russian Intonation*).[1] In broad focus questions, the nuclear accent is typically carried by the finite verb [15], [11].

The prenuclear part is typically a few semitones (ST) higher than the postnuclear part; cf. [7], [11], [16], [17]. The pitch span of the rise in the high rising accents in [6, p. 12] was, on average, 13 ST, reaching a high peak of 17 semitones above the speaker's lowest level. Wenk [18], referring to the author's work published in 1968] found an excursion size 15 to 16 ST, but Rathcke [16]

[1] For examples with sound cf. accent H*L on the ToRI website at www.fon.hum.uva.nl/tori/

found a much smaller pitch span of on average 7-8 ST, similar to the 8 semitones in Fig. 1 in [19, p. 58]. Both [6] and [19] show there is considerable variation in actual excursion size. The different results might be explained by differences in data sets and methodology. According to Wenk [18], the slope of the fall is highly variable and dependent on the segmental composition of the postnuclear part.

The scarce literature on Russian intonation in traditional rural dialects and on regionally coloured speech suggests that the same pitch accent, with nuclear rise and postnuclear fall, is predominant in regional varieties of Russian as well, with some variation in the phonetic implementation of the rise-fall, although in some regions, alternative pitch accents (rise only, or fall only) have a broader distribution than in Central Standard Russian (CSR) [20], where they can occur as well, under specific pragmatic conditions (cf. [20] and refs. therein). In part of the Northern rural dialects the postnuclear fall can have a late association, on or close to the final syllable of the utterance [21], [22].

Recent studies – [23], [24], [25] – suggest that the pitch peak in the rising-falling pitch accent is moving to the first posttonic syllable in the speech of young Russians, irrespective of their regional adherence. Posttonic peaks had already been observed in data on CSR; cf. [11], [12], [18]. In [11], based on data from four speakers, the peak was in polar questions on average aligned to the first posttonic syllable. Posttonic peaks are frequent among young adult speakers recorded in St Petersburg, , especially among female speakers [23, 25] and they are also observed among students from cities in regions far from Moscow [24].[2] Peaks with late alignment appear to be spreading also outside of Russia.[3] Accents with considerable peak delay can be misinterpreted by older generations as having strong emotional connotations [23].

More research is needed to find out whether late peaks are mainly age-related or if regional provenance plays a role as well. A recent study found a regional difference in timing of the peak in a different pitch accent: the high turning point in the falling pitch accent that is used in *wh*-questions and in corrective focus statements was reached earlier in Central Standard Russian spoken in Moscow than in Northern Standard Russian spoken in urban areas of the Vologda region [2]. In this case, age does not explain the difference, since the speakers from Moscow, who had the earliest peak alignment, were younger (mean age: 22 years) than the Northern participants (mean age: = 29 years). Possibly, we are dealing with an underlying regional difference in peak alignment, to which a wave of a trendy way of speaking with delayed peaks is added.

As a basis for the direct comparison of the regional and gender variation in prosody, we compare Russian polar questions in the speech of younger male and female speakers from two large Russian cities: Russia's capital Moscow, where people are expected to have a pronunciation close to the normative standard, and in Perm, a city in the Ural region on the border of Europe, which is known for its comparably strong local accent, containing traits of northern Russian. The authors of [5] have the impression that the local accent might to a large extent be due to its intonation. In earlier studies, some local features have also been observed in the expression of polar questions in Perm speech [1], [27]. These are formulated impressionistically: Part of the polar questions in Perm speech are claimed to have two pitch accents [27], others have an "insufficient rise", compared to standard Russian pronunciation [27], and some have an "insufficient fall" or level tone towards the end [1].

Our study addresses the following research questions:

RQ1: Are other intonation patterns used than the canonical rising nuclear pitch accent on the finite verb, followed by a low boundary tone?

RQ2: What are the differences (if any) in the frequency and time domains between the polar question intonation in Moscow and in Perm?

RQ3: Is the pitch peak aligned to the nuclear syllable, as in most descriptions of Central Standard Russian, or is it usually found in the first posttonic syllable, as in the speech of the adolescents studied earlier?

RQ4: Are there differences between male and female speakers in the realization of polar questions?

2. Method

2.1. Data

The data that were used in this study were taken from an existing speech corpus consisting of read and spontaneous speech by adolescents from Novosibirsk, Perm and Moscow; cf. [28]. The recordings were made at a local school, using head mounted microphones. The participants were asked to read short dialogues, containing different polar questions, from paper. Some of these dialogues were based on earlier dialect recordings of spontaneous speech.[4] The participants were asked to read the way they would normally speak. We analysed the following three polar questions, read by 15 adolescents from Moscow (7 boys and 8 girls) and 20 from Perm (10 boys and 10 girls).

(1) *A Vy býli v Moskvé?*[5]
PRT you were in Moscow
'Have you (ever) been in Moscow?'

(2) *Vy býli v Vólogde?*
youwere in Vologda
'Have you been in Vologda?'

(3) *(…), nedávno?*
recently
'(…), recently?'

Utterance (1) and (2) carry the nuclear accent on the verb *byli* ('were'), (3) is a tag question, following a *wh*-question (*Kogda on tam rodilsja, nedavno?* – 'When was he born, recently?'), which the

[2] The studies [24] and [25] describe rise-falls not in polar questions, but in non-final clauses, signalling continuation, but the same accent can be used in both contexts. Corpus data in [26] shows that late peaks appear in both contexts.

[3] Marion Krause (p.c.) on Russian speech in Germany.

[4] The participants were told that some of the recordings were from natural speech, but not that they had been uttered by speakers of dialect. Dialectisms were removed.

[5] The acute accent marks the position of word stress. Cyrillic is transliterated to Latin script following Comrie & Corbett's transliteration system [29], apart from toponyms, where we use the usual English forms (Moscow, Perm).

participants were told was uttered to a child. The participants read the whole utterance, but only the tag was analysed.

Utterance (1) and (2) differ in their information structure: The argument *v Moskve* ('in Moscow') was new in the context, but the city Vologda in utterance (2) had just been introduced: The previous utterance the participants read was *Zavtra ja poedu v Vologdu.* 'Tomorrow I will travel to Vologda.' The literature suggests that this difference between new and given does not affect the intonational structure in questions [11], [18].

2.2. Measurements

Utterance boundaries were segmented and the nuclear accented and the first posttonic syllable, as well as linguistically relevant tonal landmarks (L and H aligned with the accented syllable), were labelled manually in *Praat* [30]. An example of the labelling is provided in Fig. 1.

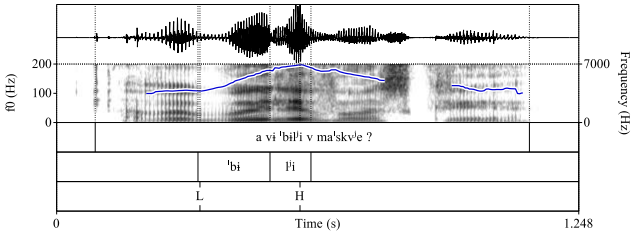

Figure 1: *Waveform, spectrogram, and F0 contour of utterance (1), produced by a male speaker from Moscow.*

Pitch values were collected at 5 ms time steps using the RAPT algorithm [31] implemented in the program 'get_f0' from the ESPS software package. A manual inspection and correction of the extracted pitch contours was performed in Praat. From the cleaned data the following F0 long-term distributional (LTD) measures per utterance and speaker were calculated using Praat scripts: mean, median, minimum, maximum, standard deviation (SD), and span. A Praat script was used to calculate the F0 value of each labelled tonal landmark (L vs. H of the rising nuclear pitch accent).[6] We also calculated the span between the low and the high tonal target of the pitch accents. The obtained Hertz measurements for span were additionally converted to semitones by means of the formula [32]:

$$39.863 * \log10(\text{Maximum}/\text{Minimum})$$

As a measure of peak alignment (PA), the absolute temporal distance from the F0 peak to the accented syllable offset was calculated. In order to compensate for the influence of segmental durations on peak alignment, these absolute measures were converted to relative measures, taken as a proportion of the posttonic syllable duration:

$$\text{relative PA} = (\text{absolute PA}/\text{posttonic syllable duration}) * 100$$

In addition, we calculated the articulation rate in syllables per second (AR = the number of canonical syllables divided by the utterance duration).

2.3. Statistical analyses

For statistical validation, we used the software JMP 17.0.0 [33] to perform Linear mixed models (LMMs). We calculated two different models: one comparing Moscow and Perm girls and one comparing Moscow and Perm boys with the respective measure as dependent variable, speaker and utterance as random factors, and location (Moscow/Perm) as fixed factor. The significance level was set at $\alpha=0.05$.

3. Results

3.1. Type and position of the nuclear accent

Some speakers produced utterances twice. We discarded all utterances of one male speaker from Perm and one female speaker from Moscow, because of several misreadings and disfluencies. Three additional renderings were removed, because of creaky voice, disfluencies or misreadings.

With respect to the pitch accent type, only 6 renderings were produced with a nuclear accent other than the canonical nuclear rise with postnuclear fall. Five productions of the tag question *nedavno?* 'recently?' in (3) ('When was he born, recently?) were not interpreted as a question: They carried a falling accent, continuing the fall of the preceding falling accent on the *wh*-question. In this interpretation, the speaker signals that (s)he already knows that the child was born recently, but only wants to know the answer to the *wh*-question, i.e. when exactly it happened. One rendering, of question (1), had a final rise. Data from the CoRuSS corpus [26] suggest that this rising accent is indeed rare in spontaneous speech [20], but it can be used under specific pragmatic conditions, among others, in certain echo and confirmation questions [34] and in emotionally loaded questions expressing surprise [35]. The exact pragmatic conditions for the rising intonation contour in polar questions remain to be described.

Before performing the statistical analysis, we took out these 5 non-questions and the single question produced with a different pitch accent type. This left us with a total of 122 segmented utterances (51 for Moscow and 71 for Perm).

The predominance of the rise-fall is in line with earlier findings; cf. [20].

With respect to the position of the nuclear pitch accent, all renderings of question (1) and (2) had their nuclear accent on the verb. This is in line with earlier findings [11] that the finite verb is the default locus of the nuclear pitch accent in polar questions. An auditory analysis of the recordings and an inspection of the pitch contours reveal that our data do not contain falls with a late association to the last or penultimate syllable of the utterance, which have been observed in some rural northern dialects [21], [22].

[6] H was the highest pitch level of the rise; L was defined as the visual low turning point in the nuclear syllable, which need not be the lowest point of the rise.

3.2. LTD and durational measurements

Means and standard deviations (in parentheses) of the LTD and durational measures are presented in Table 1, organized by location and speaker sex.

Table 1: *Means and standard deviations of the LTD and durational measures by location and speaker sex. Values for the LTD measures are in Hz except for the span measures, which are in semitones (ST). Values for the peak alignment (PA) are in %, and for the articulation rate (AR) are in syllables per second.*[7]

	Moscow		Perm	
	male	female	male	female
mean	147 (18)	256 (25)	129 (18)	259 (21)
median	130 (16)	226 (31)	119 (14)	233 (20)
minimum	95 (9)	162 (39)	92 (11)	180 (22)
maximum	231 (38)	420 (78)	181 (41)	399 (50)
SD	44 (11)	78 (21)	29 (13)	67 (19)
span min-max	15 (3)	17 (6)	11 (3)	14 (4)
local L	108 (13)	194 (40)	99 (11)	201 (20)
local H	231 (37)	406 (53)	180 (40)	398 (49)
span L-H	13 (2)	13 (4)	10 (3)	12 (3)
norm. PA	36 (32)	57 (41)	59 (46)	56 (44)
AR	6.4 (1.0)	6.0 (0.5)	6.3 (0.6)	5.9 (0.7)

Following Ladd [15], we consider the measures for mean and median (related to pitch level) and span to be attributes of pitch range, and the standard deviation (SD) – an attribute of pitch variation.

3.2.1. Female speakers

No statistically significant differences were found in our data between the girls from Moscow and Perm, apart from the duration of the first posttonic syllable, which was longer in Perm ($F [1, 19.8] = 5.3337$, $p<0.05$).

3.2.2. Male speakers

For the boys' data set, location has a significant main effect on maximum F0 ($F [1, 13.8] = 5.5447$, $p<0.05$), span ($F [1, 13.8] = 8.0733$, $p<0.05$), and SD ($F [1, 13.9] = 5.2276$, $p<0.05$), with boys from Moscow having significantly higher values (cf. Fig. 2 for F0 maximum, Fig. 3 for standard deviation, Fig. 4 for local span). Boys from Moscow and Perm did not differ in their level. With respect to the tonal landmarks associated with the accented syllable the boys from Moscow revealed significantly higher values of the H target ($F [1, 13.8] = 5.5564$, $p<0.05$) and also significantly higher span between the low and the high tonal target ($F [1, 13.7] = 5.1231$, $p<0.05$).

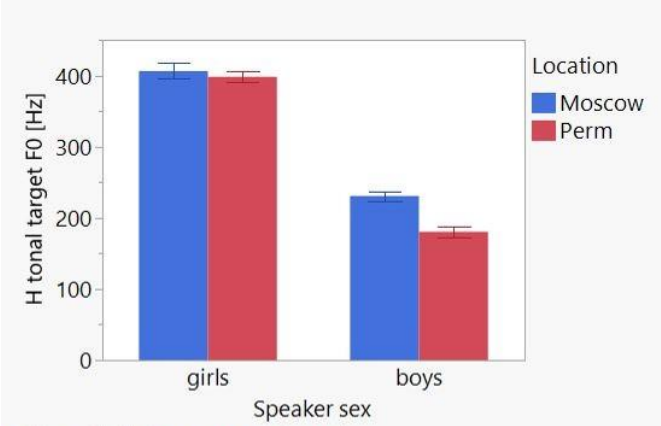

Figure 2: *Mean F0 (in Hz) of the high tonal target of the nuclear pitch accent*

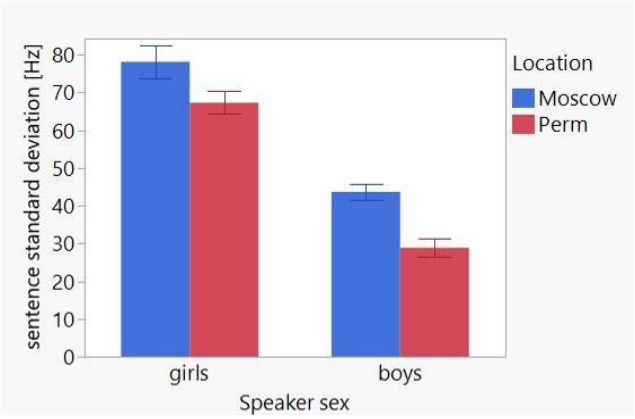

Figure 3: *F0 values for the standard deviation (in Hz) for the boys and girls from Moscow and Perm*

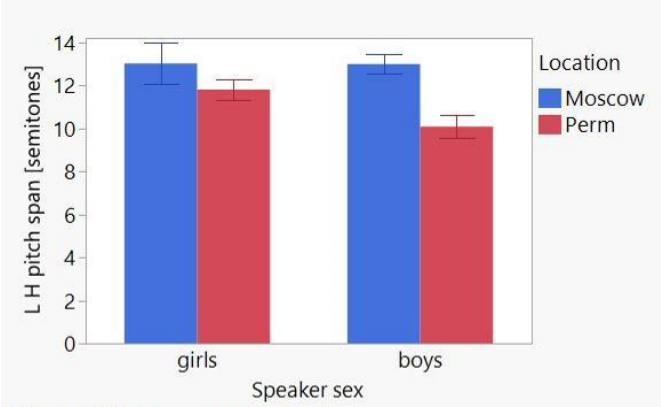

Figure 4: *Pitch span between the low and high tonal landmark of the nuclear pitch accent (in ST) for the boys and girls from Moscow and Perm*

As to temporal measurements, the high target is reached in the first posttonic syllable both among the male and female speakers (Fig. 5). Additionally, there is a main effect of location

[7] The measures of maximum F0 and local H are slightly different, because the maximum was extracted automatically, whereas the local H was marked manually.

on the peak alignment within the male dataset: the Perm boys reached the peak of the nuclear accent significantly later than the Moscow boys (F [1, 13.7] = 6.2031, p<0.05).

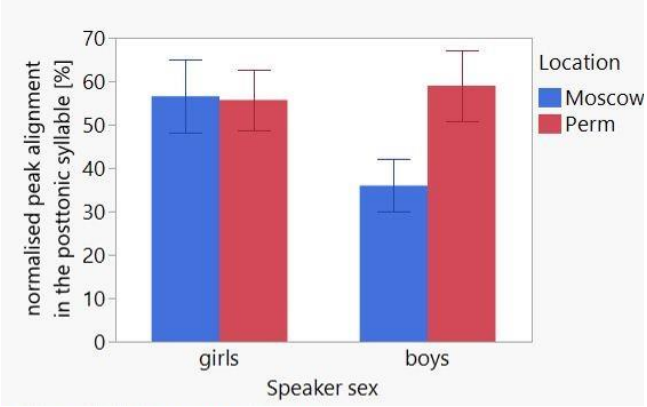

Figure 5: *Normalised peak alignment relative to the first posttonic syllable*

The articulation rate of the speakers from the two locations did not show significant differences (girls: F [1, 13.4] = 0.3934, p=0.5392; boys: F [1, 14.3] = 0.0331, p=0.8581).

4. Discussion

The results of the current study give valuable insights into the production of polar questions by both adolescents from Moscow and Perm.

Regarding our research question on the intonation patterns of polar question produced by younger speakers from Moscow and Perm (RQ1), we found only a single case of a different tonal contour, and the finite verb, if available, was always the locus of the nuclear accent. This is in line with earlier findings on the realization of polar questions in Standard Russian [11], [15], as well as in different Russian regional varieties; cf. [20].

With respect to our research question regarding the differences in the use of the frequency and time domains in the realization of the rising nuclear pitch accent in polar questions in Moscow and in Perm (RQ2), the results show that Perm boys use a narrower span and a lesser pitch variation than the Moscow adolescents. The average span for the Moscow speakers – both boys and girls – is close to the mean of 13 semitones found by Odé [6] for the Moscow speakers, with considerable interspeaker variation, especially among the girls (Fig. 4). The younger male speakers from Perm have, on average, lower F0 values on the high target H and a smaller L-to-H span, although starting from a comparable low level. This might be a reflection of the "insufficient rises" in Perm speech reported in previous literature [1].

This lower span is combined with later peak alignment, compared to the male speech from Moscow. Possibly, late peak alignment is a general feature of more varieties of northern Russian, cf. the later peaks in a falling accent in a Northern city [2].

The combination of lower span and later peak alignment in Perm might be a different strategy to express prominence. Gussenhoven suggests that peak delay can signal high pitch, and thus all the meanings of high pitch, and that high pitch and peak delay can be functionally equivalent manifestations of the so-called effort code [36]. In their perception study of standard Russian, Meyer and Mleinek found that late peak alignment is a robust indicator of questionhood (when used utterance-finally), more so than peak height [11]. So a high peak seems not required to express a polar question, as long as the peak is not aligned early.

Regarding our research question on the peak alignment of the bitonal rising nuclear pitch accent (RQ3), our analysis shows that the H target is normally reached late – in the first posttonic syllable. This is true for all speaker groups, both boys and girls, and not only in Perm, but in Moscow, too. A closer look at the distribution of the alignment measures reveals that the high target is aligned to the nuclear syllable – as in descriptions of Standard Russian – in only a small minority of the cases, both in Perm and in Moscow: It is reached in the nuclear syllable in only 6% of the tokens of questions (1) and (2), all from Moscow, and even in only 24% of the tokens of the short question (3). The earliest alignment is still only 17.8 ms before the offset of the nuclear accented syllable.[8]

This contrasts with most of the earlier literature on the pitch accent in Standard Russian, claiming that the tonal high is reached in the nuclear syllable, cf. [7], [8], [10], [16]. This statement might soon be outdated. The late alignment in our data is in line with the impressions that the pitch peak alignment to the first posttonic syllable is a general feature of young Russians' speech; cf. the preliminary results of [24] on students from various regions of Russia, and on younger speakers in St Petersburg [23], [25]. In [24], the Moscow speaker had the earliest peak alignment, but this speaker was significantly older than the students, so his speech does not indicate whether the earlier alignment was due to region or or age, or to both. A look at Fig. 5 shows that in our data, the male speakers from Moscow have an earlier alignment not only than the male speakers from Perm, but that their average timing differs just as much from both from both the females in both Perm and Moscow. This difference with the Moscow girls did not turn out to be statistically significant, but high variability and a relatively low number of speakers might play a role here.

The actual alignment is dependent on the segmental and suprasegmental context e.g. on the presence of voiceless obstruents [16], the number pre- and posttonic syllables and on the occurrence of additional stressed syllables. Our questions (1) and (2) favour late alignment, which we expect to be due to the relatively short closed central unrounded nuclear vowel /ɨ/ and the number of postnuclear syllables. However, even in question (3), the utterance with earliest alignment (due to its relatively long, nuclear /a/ and only one postnuclear syllable), still a majority of 63% of the tokens reach the high turning point in the postnuclear syllable.

With respect to the gender-specific differences (RQ4), our data show significant differences almost exclusively between the

[8] The F0 peak was reached (at max. 17.8 ms) before the nuclear syllable offset in question (3) in 10 out of 37 tokens (by 3 speakers each of the Perm males, the Perm females and the Moscow men), in 2 out of 43 tokens of question (1) and in 3 out of 42 tokens of question (2), by 4 speakers, all from Moscow (three male and one female speaker), but even these speakers do not have it in all renderings of (1) and (2).

boys from Moscow and the boys from Perm, but not between the girls, and not between the genders in Perm and Moscow. The lack of significant effect for location can be partly explained by a higher degree of interspeaker variation among the girls, but we did not detect clearly audible differences either between the Moscow girls and their peers from Perm. The Perm girls use almost as large pitch variations as the girls from Moscow, and both female groups use similar peak alignment.

Another possible explanation why we have found smaller differences between the girls than between the boys might be the the tendency in many countries of young men to prefer localized variants, whereas young female speakers tend to lead in ongoing changes and use more supra-local forms [37], as part of codified standard norms or modern urban norms. This might be the case in urban Russia as well. The boys from Moscow, being the only group with relatively early peaks (Fig. 5), stay closer to the old local norms, which in the case of Moscow happens to be close to the old norm that is described in the literature on Standard Russian, which is heavily influenced by Moscow speech. Possibly, speech with late peak alignment is a feature of non-central Russian speech – cf. [24] and the late peaks of the Perm boys – and typical for a new, trendy non-local speech norm, to which the girls in both cities adapt more than the boys.

Finally, the data show considerable inter- and intraspeaker variation. The example utterances in Fig. 6 and 7, both from female speakers from Perm, illustrate the interspeaker variability. A comparison between the two figures reveals that both utterances have a similar peak alignment, but the H pitch target in Fig. 6 is much lower and the L-to-H span narrower than in Fig. 7.

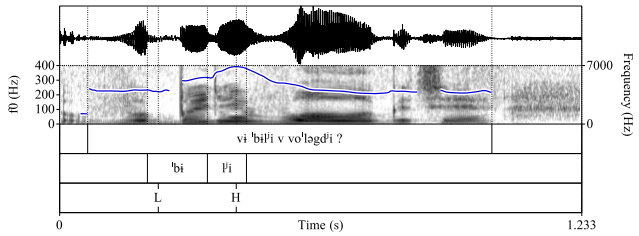

Figure 6: Question (2) by female speaker SP321 from Perm. The F0 maximum is 393 Hz, the L-to-H span is 9.9 semitones and the peak alignment 73.9% into the posttonic syllable

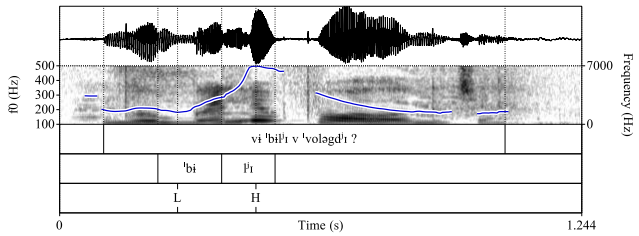

Figure 7: *Question (2) by female speaker SP322 from Perm, with its F0 maximum at 497 Hz, an L-to-H span of 17.4 semitones and a peak alignment of 64.2% into the posttonic syllable*

Interestingly, despite the considerable difference in span, both utterances have a similar peak alignment in the second half of the first posttonic syllable, so they vary more in peak height and span than in peak alignment. As mentioned in the introduction, earlier studies suggest that a late peak alignment is indeed perceptually more important than span and pitch height in the identification of Russian polar questions; cf. [10], [11], [12].

However, the utterance contexts that were given to the speakers were not that explicit as to prevent various pragmatic interpretations. The speakers can have expressed various stances and emotion, for instance, in utterance (3), which the speakers were told was uttered to a child. This can undoubtedly explain part of the observed intra- and interspeaker variation. According to Svetozarova, emotional connotations such as surprise, doubt, distrust, and irony are usually expressed in Russian by various modifications of the question intonation: differences in length of the stressed syllable, the steepness and height of the rise, in addition to different phonation types [7]; for details, see [38], [39]. The differences in height in Fig. 6 and 7 above might be due to a difference in stance.

5. Conclusions

In order to find possible regional prosodic variation in Russian modern urban speech, we examined the choice of nuclear pitch accent types in Russian polar questions, their distribution and realization with respect to F0-related and temporal characteristics in the speech of younger male and female speakers from Moscow and Perm.

In line with the literature, almost all productions of the three polar questions had the canonical rising pitch accent, followed by a postnuclear fall, on the default position. The peak, however, was almost invariably aligned to the postnuclear syllable, and not to the end of the nuclear syllable, as in most previous descriptions of Standard Russian. This corroborates earlier findings suggesting that posttonic peaks in the actual pitch accent are common in the speech of young Russians. It would be interesting to see whether the apparent peak delay is found in other contexts as well, such as in the falling accent recently studied in [2].

Our data show a significant regional difference between the male speakers from Moscow and Perm in both pitch span, peak height and timing, but not between the female speakers. Among the girls we observe both a higher degree of intraspeaker variability and smaller differences between the cities. Possibly, the girls have a lower degree of local colouring and a stronger adaptation to non-local norms in their speech.

We do find a regional difference between the male speakers, even though this is read speech, where people tend to comply more to perceived standard pronunciation than in other speaking styles. The accommodation to normative pronunciation might be even stronger in our study than usual, since the recordings were made in schools, by foreign researchers, to whom the participants might have tried to speak "properly". Russians tend to believe that "correct" Russian must be learnt through education. On the other hand, the 15-16-year-old participants have not finished their education. Future work could compare our results from the reading task with our spontaneous data from the same speakers.

The intonation of the postnuclear stretch also deserves attention, among others, the presence of pitch plateaus and the production of the postnuclear words. Furthermore, other cues

than F0 could be involved in the difference between the realizations of the polar questions in the two cities.

6. Acknowledgments

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7. References

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