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PITCH CONTOURS IN RUSSIAN YES/NO QUESTIONS BY FINNS

by

Riikka Ullakonoja 2010

Pitch contours in Russian yes/no questions by Finns

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Abstract

The aim of this paper is to determine the pitch contours Finns use when uttering yes/no questions in Russian. In addition, the pitch contours will be compared to native speech as well as subjected to native speaker evaluation. So far, there has been very little research on the prosody of Russian as a second language. L1 Finnish students are an interesting group to study because intonation in Finnish is not distinctive whereas in Russian it is.

Index Terms: Intonation, Russian, second language

1. Introduction

One of the challenges of L2 (second language) intonation research is identifying what constitutes acceptable variation of pitch contours for non-native speakers. In this study acoustic measurements were made of the pitch contours of Finnish learners which were then subjected to perceptual evaluation by native speakers. The focus is on yes/no questions in Russian that may differ from statements solely by prosodic means. Comparison of Finnish speakers' (L2 learners of Russian) Russian with that of L1 Russian speakers is interesting because in Finnish yes/no questions are marked with the interrogative particle, -ko/-kö, rather than prosody.

Unfortunately, no extensive Finnish-Russian comparative study on native speakers' pitch contours exists. Finnish interrogative intonation is not distinctive. A fall or rise-fall have been said to be common contours for yes/no questions in Finnish read-aloud speech [1] but a typical pitch pattern for such questions has not been defined. In Russian, on the other hand, yes/no questions can take the same lexical and syntactic form as declaratives, but the difference is realized by prosody. Yes/no questions commonly have the so called IK-3 pattern of Bryzgunova's [2] theory. The IK-3 is a pitch pattern that has a sharp rise on the nuclear syllable or, if the nucleus is in the phrase final position, a final rising pitch contour. In addition to that the prenuclear part is typically higher than the postnuclear part [3,4].

Finnish speakers' intonation in Russian has been a subject of a few previous studies. They have concluded that Finnish learners encounter difficulties in pronouncing Russian yes/no questions [5,6]. The present paper is a partial replication of those studies. In this study, however, Finnish students' Russian read-aloud speech will be analyzed acoustically in order to identify the pitch contours they use in Russian yes/no questions. The students' productions will be compared to each other as well as to native Russian speech. The students' speech will be rated by native speakers of Russian.

Table 1. *The yes/no questions (in bold) of the data in context* [7].

	Russian	Russian (in Roman alphabet)	English translation
Q7	A. Со́фья Па́вловна, я вас приве́тствую! B. Почему́ так до́лго не звони́ла? **Су́дя по торже́ственному то́ну, ты хо́чешь сообщи́ть мне не́что ва́жное?**	A. Sof'ya Pavlovna, ya vas privetstvuyu! B. Pochemu tak dolgo ne zvonila? **Sudya po torzhestvennomu tonu, ty khochesh' soobshchit' mne nechto vazhnoye?**	A. Sof'ya Pavlovna, I greet you! B. Why haven't you called me in such a long time? **Judging by your festive tone of voice, you want to tell me something important?**
Q4	A. Угада́ла! Мы сего́дня купи́ли ме́бельный гарниту́р . B. Ну, с тобо́й не соску́чишься! A. **Ты ра́да за меня́?**	A. Ugadala! My segodnya kupili mebel'nyy garnitur. B. Nu, s toboy ne soskuchish'sya. A. **Ty rada za menya?**	A. That's right! We bought a new suite of furniture today. B. Well, you are no bore. A. **Are you happy for me?**
Q5	B. Коне́чно, ра́да. Кста́ти, у меня́ то́же в кварти́ре есть ко́е-что́ новенько́е. A. **Да́?** Что́ же?	B. Konechno, rada. Kstati, u menya tozhe v kvartire yest' koye-chto noven'koye. A. **Da?** Chto-zhe?	B. Of course I'm happy. By the way, I also have something new in my apartment. A. **Yes?** What is it?
Q3	B. Мы купи́ли серви́з. A. **Ча́йный или столо́вый?** (1st dialogue continues…)	B. My kupili serviz. A.**Chainyy ili stolovyy?** (1st dialogue continues…)	B. We bought a service. A. **Tea or dinner?** (1st dialogue continues…)
Q2	A. Алло́! Со́ня?	A. Allo! **Sonya?**	A. Hello! **Is that Sonya?**
Q1	B. Ната́ша, ты? Наконе́ц-то! Что́ случи́лось? Я жду це́лый день. Ты же обеща́ла позвони́ть у́тром. Я не отхожу́ от телефо́на. **У тебя́ со́весть е́сть?**	B. Natasha, ty? Nakonets-to! Chto sluchilos'? Ya zhdu tselyy den'. Ty zhe obeshchala pozvonit' utrom. Ya ne otkhozhu ot telefona. **U tebya sovest' yest'?**	B. Natasha, is that you? Finally! What happened? I have waited all day. After all you promised to call me this morning. I haven't moved away from the phone. **Have you no conscience?**
Q6	A. Со́нечка, дай хоть сло́во вста́вить! У меня́ несча́стье ! B. У́жас ! Что́-то случи́лось? Так я и зна́ла. Я пря́мо как чу́вствовала. **Ты заболе́ла?** Или что́-то с детьми́? (2nd dialogue continues…)	A. Sonechka, day khot' slovo vstavit'! U menya neschast'ye! B. Uzhas! Chto-to sluchilos'? Tak ya i znala. Ya pryamo kak chustvovala.**Ty zabolela?** Ili chto-to s det'mi?	A. Sonechka, let me get a word in! I have had a bit of bad luck! B. That's awful! Did something happen? I thought it must have. I almost felt it. **Were you taken ill?** Or was it something to do with the children? (2nd dialogue continues…)

2. Material and methods

2.1. Speech data

Six native Finnish female university students (Fi1-Fi6) (aged 19-25) and six native Russian female university students (Ru1-Ru6) (aged 19-26) were recorded reading aloud two Russian dialogues in pairs. The Finnish subjects had studied Russian for 3 years prior to university entry and for one year at university as their major. They started their second year with a 3.5-month stay in Russia. This was the longest stay in Russia any of these students had experienced. The dialogues were drawn from Russian as a foreign language teaching material on telephone conversations (texts 46 and 100) [7]. These dialogues form a data set used in other research by the present author and thus they were not chosen on the basis of their phonetic content. The Finns were recorded twice during their second year at university: once during (T1) and once after (T2) their stay in Russia. The recordings of the Russian speakers and Finnish speakers at T1 were made with a Sony TDC-D3 DAT recorder and Roland Edirol 24-bit Wave/MP3 R-09 digital recorder with a Sony ECM-959A microphone in a quiet hotel room. The T2 recordings were done with a computer (program Adobe Audition 1.0 and 2.0) and AKG GN30 microphones. All yes/no questions in the data that can be understood as declaratives if a different pitch contour is used were analysed in this study (Table 1).

2.2. Listening experiment data

To evaluate the successfulness of the learners' productions, the L2 speech data described above were played to a total of 40 native Russian listeners in two groups (one group for the T1 and one for the T2 recordings). The stimuli were presented to the listeners only once in the same randomized order with an 11-second interstimulus interval. After each stimulus the judges were to define whether they heard a question or not. Thus, a recognition rate (RR) for each stimulus was obtained (percentage of positive ratings was calculated). In general, only 57% of the utterances intended as questions by Finns were recognized as such by the Russian speakers. The RR varied across the different questions so that learner productions of Q1, Q2 and Q7 were only recognized as questions in less that 40% of cases, whereas the RR for Q5 and Q6 was nearly 60% and for Q3 and Q4 over 80%. (see [8] for a more detailed description of the task and analysis of the results).

2.3. Methods of acoustic analysis

The annotation and analysis were performed using the Praat program [9]. Pitch calculations were done with Praat's autocorrelation method [10] for the entire sound file of the speaker and checked manually. Before that, the other speaker's voice was removed from the file. The same settings were used for all the speakers (Time step automatic, pitch floor 75 Hz, ceiling 600 Hz). The calculations were influenced by creaky voice, which has previously been found to be a typical feature of Finnish [11] (but not Russian). Creaky voice was manually corrected in PitchObject, if the correction was unmistakably possible on the basis of the spectrogram. In most cases it was not possible and the pitch was unvoiced for that part of the file in which case creaky voice was annotated in the TextGrid.

Pitch was measured in semitones (ST). A script was written by the author to measure mean and maximum pitch, pitch range and standard deviation, and mean absolute slope in pitch of each question as well as automatically to draw a picture of the pitch contour for further analysis. Pitch contours were compared both visually and through calculation in SPSS. Furthermore, the RR for each stimulus obtained in the question evaluation task (see 2.2.) was compared against the pitch measurements.

3. Results

3.1. Shape of the L1 and L2 pitch contours

First, the shape of the pitch contours was studied question by question. In Q1 (*U tebya sovyest yest'?*), all the L1 speakers produced a contour similar to that in Figure 1 (peak and a final rise on *yest'*). None of the L2 speakers showed such a contour. Instead most of them produced a peak on the word *sovyest* (on the first, or more often, on the second syllable) together with a fall or creaky voice on *yest'* (Figure 2). However, in the three L2 contours that were clearly recognized as questions by most natives there was a rise in *yest'* whereas the other L2 patterns lacked this. To summarize, in Q1, it was the rise on the final word that signalled a question to the native ear.
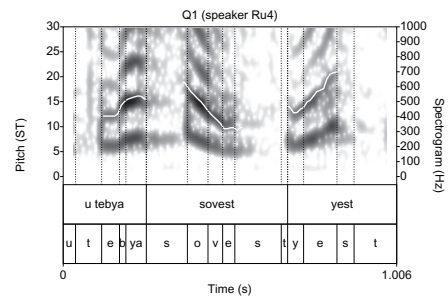

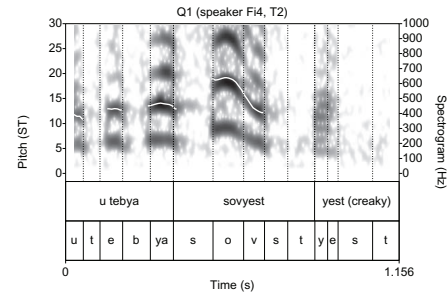Figure 1: *Example of a native contour in Q1.*

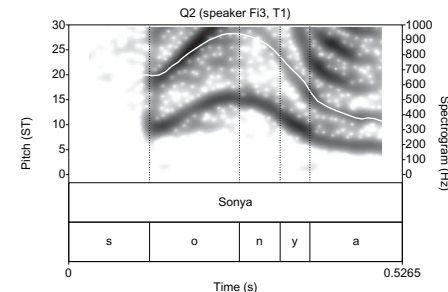Figure 2: *Example of a non-native contour in Q1 (RR=10%).*

Figure 3: *Example of a non-native contour in Q2 (RR 21%).*

Q2 (*Sonya?*) was produced with three different pitch contours by the L1 speakers. There was a sharp or very flat peak or a rise on the last syllable. It was somewhat unexpected that the change occurred during the last syllable, as it is traditionally believed that it should be on the stressed syllable (i.e. here the first one). In the L2 speech, the final rising contour was the only one that was recognized as a question by the majority of the native listeners. The utterances where the L2 speaker had a peak on the first syllable were usually not recognized as questions (Figure 3). Hence, for L2 speakers it is not enough to produce a high peak, but it also needs to be sharp enough and placed on a correct syllable.

Overall in Q3 and Q4 the L2 speakers' pitch contours were very often recognized as questions. In Q3 (*Chaynyy ili stolovyy?*) all the L1 speakers had a sharp peak on the first syllable of *chaynyy*, while 4/6 then had a rise on the final syllable of the last word and 2/6 had a fall. The L2 speakers, on the other hand, rarely produced a rising contour on *stolovyy*. The most important cue for perceiving Q3 as a question would seem to be a peak or a rising contour on the word *chaynyy*. In Q4, most of the L1 speakers produced a contour similar to Figure 4. Most L2 speakers also had a very similar contour and Q4 utterances were mostly recognized as questions by native speakers. However, most L1 speakers had the peak on *za menya* whereas most L2 speakers preferred to place the peak on *rada*.
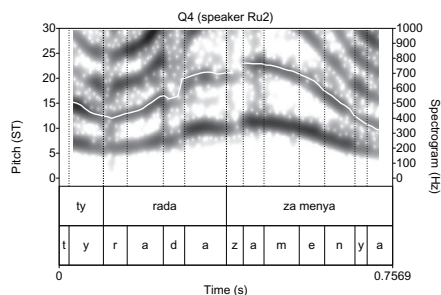

Figure 4: *Example of a native contour in Q4.*

In Q5 (*Da?*) 4/6 of the L1 speakers had a rise and 2/6 a peak. Most of the successful L2 speakers also had a rise. The utterances that were not recognized as questions by the majority had e.g. a flat tone, a small peak or a small rise.

In Q6 (*Ty zabolela?*), most of the L1 speakers had a flat contour with a peak on the stressed syllable *lel* (Figure 5). When the L2 speakers produced a similar contour, it was recognized as a question. Also, when the L2 speakers had a peak on the unstressed syllable *bo* or a final rise on *la*, they were recognized as questions by the majority of the L1 speakers, providing the peak was high enough. Figure 6 gives an example of a rather native-like pitch contour in L2 speech, which, however, received a rather low RR. In this example the peak is slightly flatter, lower and earlier than in the L1 utterances, which, perhaps, resulted in the mediocre RR.

Finally, Q7 (*Sudya po torzhestvennomu tonu, ty khochesh' soobshchit' mne nechto vazhnoye?*) is interesting, because it is a rather long utterance. Here, the L2 speakers' productions were rather poorly recognized as questions. Most of the L1 speakers had two sharp peaks in this utterance, on *tonu* and *vazhnoe* while the rest was rather flat. None of the L2 speakers had a similar contour. The L2 speaker whose utterances were best recognised as questions (RR=89%) had a peak on *tonu* but a final rise in *vazhnoe*. The rest of the successful L2 utterances had peaks on the two words (but sometimes on unstressed syllables) and in addition to that, often, on some other word of the utterance. The unsuccessful L2 realizations

had peaks e.g. on *sudya* or *khochesh*. Hence, the L2 speakers had difficulties in deciding which word to accentuate and sometimes accentuated almost every word.
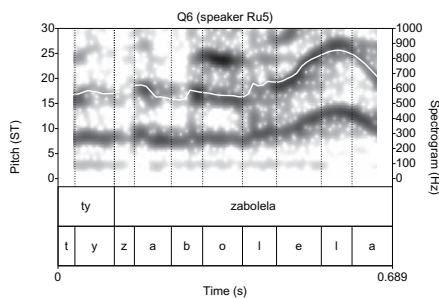

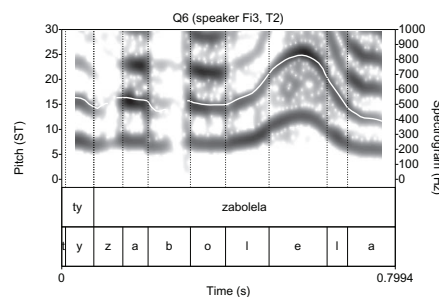Figure 5: *Example of a native contour in Q6.*

Figure 6: *Example of a non-native contour in Q6 (RR 55%)*

3.2. L1 and L2 pitch measurements

Second, pitch values (mean, maximum, std, mean absolute slope and range) were measured in ST and compared between L1 and L2. Also, L2 values were compared to the RR.

Table 2. *The mean pitch values (ST).*

Pitch (ST)	L1 (n=42)	L2 (n=84)	t-test results
Mean	14.53	13.28	t (124)=-6.371, p=0.0001
Max	22.90	21.37	t (124)=-2.412, p=0.017
Std	3.62	3.46	t (124)=-0.685, p=0.495
Range	13.13	12.47	t (124)=-0.705, p=0.482
Slope	53.65	43.34	t (124)=-2.700, p=0.008

Table 2 shows the pitch measurements for the L1 and L2 speakers. All the measured values are higher for the L1 speakers. The L1 speakers speak with a higher pitch, have more variation, a wider range and deeper slopes than the L2 speakers. The statistical significance of the differences was tested by independent samples t-test which yielded the result that mean and maximum pitch and mean absolute slope were significantly different between the two groups. The statistical significances were also tested between T1 and T2 for the L2 speakers, but although mean pitch and mean absolute slope were closer to the L1 values in T2, no significant difference was found.

The correlation between the RR and pitch measurements was calculated for the L2 speakers and verified in scatter plot graphs. Pearson's correlation coefficients (n=84) yielded the following correlations: RR&mean pitch=0.150 (p=0.172),

RR&max pitch=0.221 (p=0.042), RR&slope=0.055 (p=0.621), RR&range=0.127 (p=0.250), RR&std=0.359 (p=0.001). The only statistically significant correlations were between RR and std, and RR and max pitch, but they were very weak. Hence, it can be concluded that no single pitch measurement used here contributes significantly to the recognition of the utterance as a successful interrogative.

4. Discussion and Conclusions

This paper set out to determine what kinds of pitch contours Finns use in Russian yes/no questions as compared to L1 speakers. However, the study also showed that the native speakers sometimes produced pitch contours in a way that did not fully correspond to the norms presented in Bryzgunova's [2] theory of Russian intonation patterns. According to the theory, in IK-3 constructions, the peak should always be on the stressed syllable. However, this study showed that in L1 Russian the most important pitch movements are often realized on the unstressed syllable following the stressed one. This phenomenon has been described in Gussenhoven's [12] theory of Biological Codes as a delayed peak. According to him, this can function as an equally important cue for interrogativity as raised F0, because late peak is perceived as having a higher pitch. Peak delay has also been observed previously in Russian in IK-3 [13].

Consistent with previous studies [5,6] this study has also shown that Finnish L2 speakers of Russian often fail to produce a pitch contour similar to that of L1 speakers. This results sometimes in very low RRs. One of the new findings to emerge from this study is that the peak position seems to be the most important cue for perceiving yes/no questions produced by L2 speakers. It was most difficult for L2 speakers to produce in Q1. Other important cues were the sharpness of the peak and its height. These results cannot be applied to all languages, as e.g. Toivanen [14] found that Finnish students did not encounter difficulties in peak placement in English, despite the fact that it differed from peak placement in their L1.

The second major finding was that L1 and L2 yes/no questions differ in mean pitch and mean absolute slope. A statistically significant difference in mean pitch has been established earlier [15], but mean absolute slope reveals the differences in the variability of L1 and L2 pitch contours. It needs to be pointed out, however, that there was a lot of variation in the L2 group. There were cases where the L2 speaker produced a near-native-like contour, which was, consequently, recognized as a question by all of the L1 listeners. Furthermore, in other cases the L2 pitch contour was rather close to the L1 contour, yet the utterance received a low RR (likely due to peak placement and the height of the peak).

Although it is known that other prosodic factors, such as intensity, also contribute to the perception of question, in this study the pitch contours were used as the sole acoustic indicator of interrogativity. The research could be further supplemented by more detailed analysis of peak placement. Furthermore, it would be useful to study intensity, speech rate and pausing and their relationship to the perception of a question. For example, van Heuven & van Zanten [16] found that, in addition to higher pitch, questions differ from statements by their faster speech rate, whereas House [17] in turn found that pausing affected question perception.

These findings enhance our understanding of L2 prosody in Russian. Furthermore, they indicate a specific theme L2 teachers of Russian could usefully focus on in order to improve their students' speech and thus raise their competence in Russian oral interaction.

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