Dorota Szymaniuk
The University of Białystok
d.szymaniuk@uwb.edu.pl

PITCH PATTERNS ACROSS DIRECTIVES IN ENGLISH, RUSSIAN AND POLISH

Abstract. So far, there has been very little contrastive research on the prosody of directive speech acts. In the present paper an attempt is made to establish differences and similarities between pitch patterns in English, Russian and Polish orders, requests, suggestions and warnings. The speech material comes from dialogues which took place in the adult-child and child-adult communication context. The preliminary results of acoustic and perceptual analyses reveal both language specific and universal features of the intonation contour. In addition, the relationship between the type of directive and pitch pattern modifications is observed.

Keywords: pitch; directive speech acts; acoustic measurements; auditory analysis.

1. Introduction

During the past decade the study of the relationship between prosody and the pragmatics of spoken language within the framework of speech act theory has enjoyed considerable popularity manifested by hot debates in scientific literature. Researchers focus on such questions as the prosodic structure of speech acts, the role of intonational meaning in discourse, the ways prosodic components contribute to the illocutionary force of an utterance, or intonation as the key factor in speech act detection (see WENNERSTROM 2001, VELIZ 2004, HIRSCHBERG 2006, WANG 2006, BARTH-WEINGARTEN ET AL. 2009, BARTH-WEINGARTEN et al. 2010).

A survey of current linguistic studies shows, however, that research on correlations between prosody and pragmatics still remains an open field and many more issues continue to be unresolved. One such broad question is cross-language comparison of prosodic variation determined by the type of speech act. Prosodic organization of English, Russian and Polish directive speech acts

with pitch as its first rank component, which has not yet engaged the attention of scholars, seems particularly interesting.

Traditionally, pitch is considered one of the acoustic correlates of stress (UNDERHILL 1994:57). CRUTTENDEN (1986:3) highlights its physiological aspect indicating that "pitch is primarily dependent on the rate of vibration of vocal cords". When the vocal cords are stretched, the pitch of voice increases. LADEFOGED (1982:226) adds that pitch variations in speech are realized by the alteration of the tension of vocal cords.

However complex the prosodic phenomenon pitch is, different approaches applied to analyze its nature as well as to describe its critical role in the prosodic structure of an utterance declare unanimously that linguistically relevant pitch parameters comprise pitch range, pitch level and the direction of pitch variations (see among others discussion in SVETOZAROVA 1982, BOLINGER 1988, 'T HART et al. 1990). Hence, the current analysis also focuses on the related components.

The aim of the paper is two-fold: first, to reveal pitch characteristics of what SEARLE (1979: 12–20) defines as illocutionary acts by which the speaker attempts to get the hearer to do something, and second, to compare and contrast pitch patterns between categories (order, request, and warning) and languages under investigation to test their potential distinctness.

2. Method

2.1. Speech material

The experimental material came from several films with English, Russian and Polish dubbing, which made it possible to obtain speech samples expressing the same linguistic and extralinguistic meaning. In other words, recorded spontaneous exchanges in each language represented the same category of directive: request, order, or warning, e.g.: request: *Please, try to understand*, *Proszę zrozum mnie*, *Пожалуйста постарайся понять*. It should be added that selected speech stimula included adult-child and child-child communicative context. From the recordings only clear-cut directives that did not overlap with other speech acts and were contained within a single intonational phrase were chosen. After the selective perception of 240 dialogues (80 in every language), the collected data involved 37 orders, 32 requests, and 42 warnings.

2.2. Equipment and procedure

The task of examining pitch characteristics was difficult mainly due to the lack of common theoretical framework for prosodic analysis of English, Rus-

sian and Polish. In the experiment which consisted of both auditory analysis and acoustic measurements, I selectively employed approaches of different researchers. All of the speech samples were annotated and analyzed using Praat software (www.praat.org). Pitch calculations were done with PRAAT's autocorrelation method (BOERSMA 1993) for the entire sound files representing separate directives, and checked manually. The same settings were used for all speakers (Time step automatic, pitch floor 75 Hz, pitch ceiling 600 Hz). Pitch was measured both in Hertz (Hz) and in semitones (ST). In order to calculate minimum, maximum and mean pitch, range and standard deviation, a script was prepared. Additionally, pictures of pitch contours for each directive were drawn and compared.

As for the transcription systems, labeling of local events (types of pitch accents in nuclear part of the intonational phrases) was carried out in accordance with ToBI (BECKMAN et al. 2005) for English, ToRI (Ode 2003) for Russsian, and the convention used by DEMENKO (1999) and WAGNER (2006) for Polish.

In the experiment I focused on the identification of the values of the following phonetic points:

1. onset pitch (of the first syllable in an intonational phrase)
2. the highest-pitched syllable and the lowest-pitched syllable
3. the pitch of the last syllable in an intonational phrase
4. pitch range
5. pitch register
6. types of nuclear pitch accents.

2.3. Results

The findings imply that pitch patterns across directives share many characteristics but also involve language-specific components. In what follows separate pitch parameters are discussed.

Pitch maxima and minima

In order to calculate *global* pitch range expressed as the difference of maximal and minimal fundamental frequency (Fo) across a given stretch of speech, pitch maxima and minima for intonational phrases were established first. The values of the three categories of directives in English, Russian and Polish[1] are shown in Table 1.

[1] In tables and figures, to indicate the direction of communication, I use AC for adult – child, CC for child – child context.

Table 1. Mean pitch maxima and minima and respective standard deviation in directives expressing orders, requests and warnings in Hertz

Hz	English						Russian						Polish					
	Order		request		warning		order		request		Warning		order		request		warning	
	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC
Max	323	386	398	398	367	364	355	427	412	446	386	298	342	419	433	458	357	456
Sd	85	77	36	70	74	24	93	51	83	52	73	25	101	79	57	35	112	36
Min	181	226	194	222	202	260	176	236	184	197	191	230	106	239	218	179	178	366
Sd	74	75	62	94	64	27	72	34	79	62	48	24	105	49	49	59	58	27

Table 1 suggests that there are no serious cross-language contrasts in the top and bottom pitch limits in English, Russian and Polish directives. As regards utterance maxima, the differences reach not more than 1,5–2,5 semitones. The highest Fo values were identified in Russian orders and Polish requests. In terms of pitch minima, Russian and Polish bottom Fo varies from English bottom Fo of as many as 6–9 semitones.

The comparison of data across types of speech acts has resulted in more promising findings (Fig. 1).

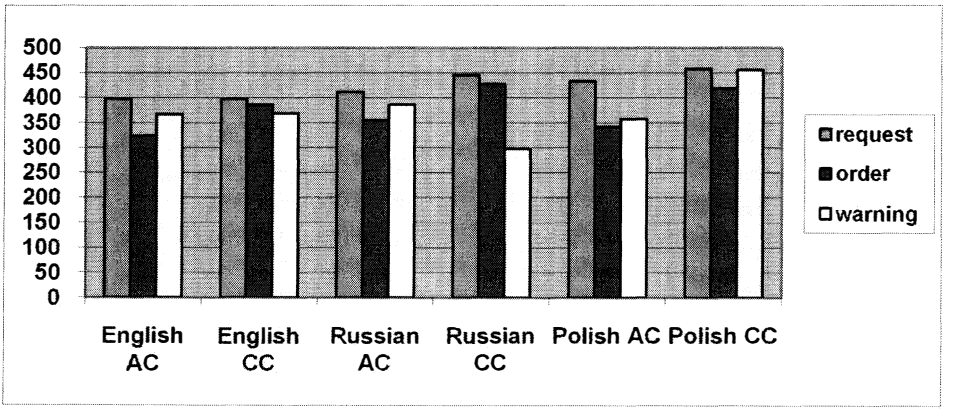

Figure 1. Pitch maxima comparison across types of speech acts

Looking at the results for pitch maxima, it is obvious that when female speakers or children direct requests to children, their tone of voice reaches the higher values than when they order or warn.

The striking fact is that in all three languages observed bottom pitch has the lowest level in requests in child – child context and in orders in adult – child context (Fig 2.).

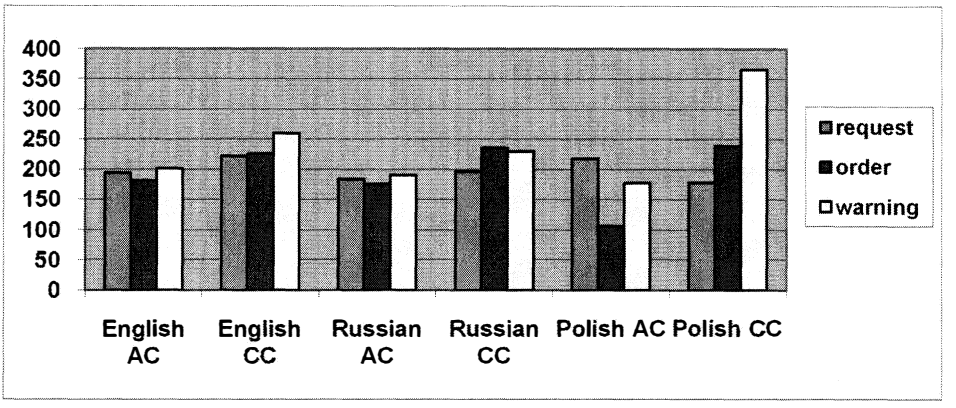

Figure 2. Pitch minima comparison across types of speech acts

Pitch range

Pitch ranges are presented in Table 2. In order to eradicate errors which could be performed due to individual characteristics of a speaker, Fo values were normalized by converting Hz to semitones.[2] It should also be highlighted that all directives representing adult – child context were realized by young female speakers. The restriction is justified by the obvious fact that women and children speak with higher pitch than men, whereas older people speak using lower pitch than younger people.

Table 2. Mean pitch range and respective standard deviation in directives expressing orders, requests and warnings in Hertz and semitones

	English						Russian						Polish					
	order		Request		warning		order		request		Warning		order		request		warning	
	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC
Hz	143	160	154	176	165	104	179	191	228	248	195	68	157	180	215	219	179	90
St	10	9,2	10,1	0,1	10,3	5,8	12,1	10,2	13,9	14,1	12,1	4,4	10,7	9,7	12	16,2	11,8	3,8
Sd (in St)	6,69	6,74	5,85	7,23	3,01	1,17	6,5	3,29	6,47	5,57	5,36	1,53	8,09	3,26	6,17	6,59	1,3	1,2

The pitch range of speakers in three types of directives varies according to the language and the type of communicative context (adult – child or child – child). Table 2 shows a comparison of different values captured by linear (Hertz scale) and logarithmic (semitones scale) measurements. It is clear that widest pitch range marks Russian orders and requests as well as Russian and English

[2] at: http://users.utu.fi/jyrtuoma/speech/semitone.html 10.01.2012.

warnings (adult to child in Russian and child to child in English). Significantly, a narrow pitch range was revealed in English requests and orders. Taking the three languages together, it becomes obvious that in intonational phrases in Russian directives the pitch range is wide, in English it is narrow, and in Polish – mean. As regards cross-type differentiation, in requests speakers use a wider pitch range (in 83% of all investigated types) than in orders or warnings.

Pitch register

Considering the pitch parameter of register, it can be concluded that there exists a relationship between directive speech act of a particular type and the value of register (Table 3). In the three languages, orders, requests and warnings given by children have higher mean pitch than those given by adults. This is largely for the apparent reason that children's overall speech level is higher than that of adults. Mean pitch of intonational phrases in adults' orders is higher than in requests and warnings.

As regards language contrasts, it was found that Polish warnings differ significantly from Russian warnings – they are higher of roughly 5,3 semitones and from English warnings – of 3,5 semitones. The same is true for pitch register in Polish orders when compared to English and Russian orders. It tends to be higher of about 1,6 semitones regarding English speech acts and of 2,2 semitones regarding Russian speech acts.

Table 3. Mean pitch height and respective standard deviation in directives expressing orders, requests and warnings in Hertz

	English						Russian						Polish					
	order		request		warning		order		request		warning		order		request		warning	
	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC	AC	CC
Hz	272	333	283	313	291	330	263	327	282	316	257	297	300	345	287	312	262	404
Sd	89	57	26	63	69	26	79	43	52	28	47	12	77	51	52	71	92	6

To further illustrate the findings concerning pitch patterns, an attempt was made to draw a prototypical pitch contour for each type of directive (examples in Figures 3–5).

The analyzed types of directives display considerable variation as far as the pitch curve is concerned. Indeed, the general pattern[3] of orders across English, Russian and Polish (Fig. 3) is initiated by the fall from the onset to the first stresses syllable. Then, there is a rise to the nucleus which is followed by

[3] ONSET – the first syllable in an intonational phrase, FSS – the first stressed syllable, USPN – unstressed syllable preceding the nucleus, NS – nuclear syllable, PNS – post-nuclear syllable.

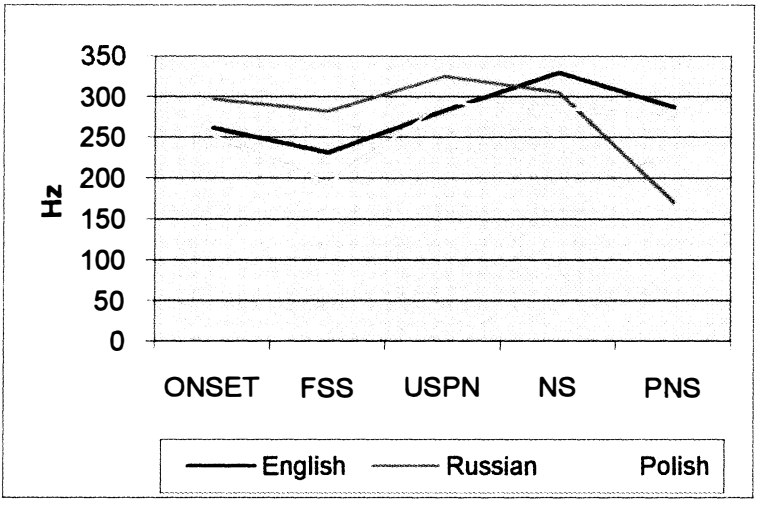

Figure 3. Pitch contour of orders

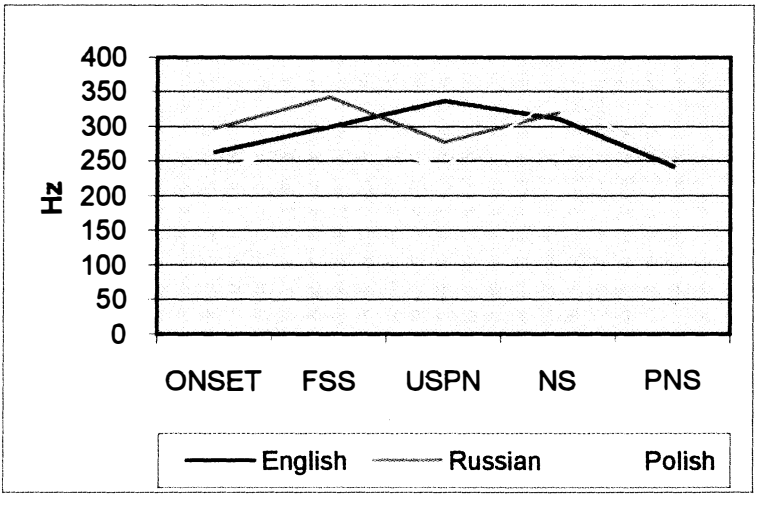

Figure 4. Pitch contour of requests

a post-nuclear fall. Pitch contour in Russian and Polish requests with its initial rise to the FSS followed by the pitch decrease and subsequent high nucleus differs from smooth rising-falling tone English intonation phrases are composed of. Warnings are represented by contrasting tone patterns (Fig. 5). English utterances have a gradually ascending tone, in Russian the speech melodic pattern resembles a concave line, and, finally, in Polish there is a steadily falling contour. Looking at the prototypical patterns, we can observe that rapid and steep changes in the melodic line of requests make this type of speech act more sug-

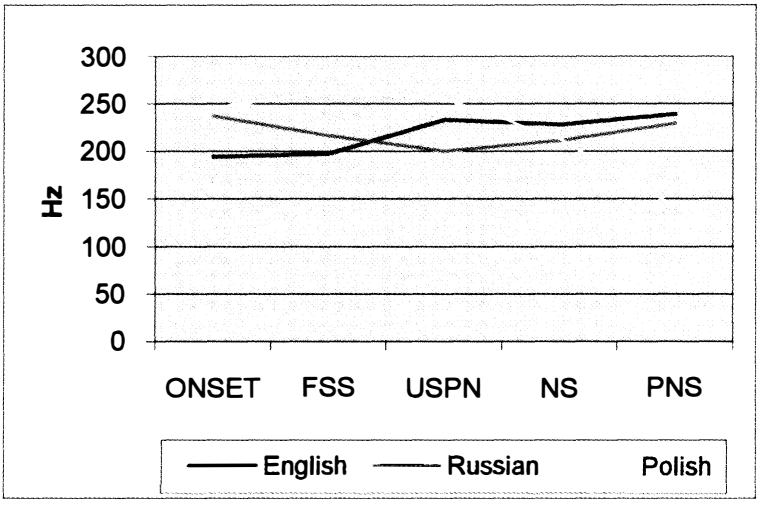

Figure 5. Pitch contour of warnings

gestive. This reinforces the belief that the more pitch modifications you use, the more complete and meaningful your expression is (see STEFFEN-BATOGOWA 1996, SENDLEMEIER and PAESCHKE 2000).

Nuclear pitch accents

The approach applied in the experiment made it possible to identify nuclear pitch accents inspite of the fact that the inventory of accents established for the investigated languages differs. Accordingly, to identify nuclear accent types in directives I used approaches by PIERREHUMBERT (1980) for English, ODE (2008) for Russian and DEMENKO (1999) for Polish.

Tables 4–6 show the distribution of nuclear accent types in English, Russian and Polish directives. The data reveal that the number of nuclear pitch accents varies. Four types have been identified in English directives (H*, H*L, L*, L*H), seven – in Russian (H*, H*L, L*, L*H, HL*, H*H, H*M), and six – in Polish (HL, HM, MM, MH, ML, xL).

As for English directives, certain regularities can be found for orders in which H* nuclear pitch accent dominates as well as for requests marked by frequent occurence of L*H accent. English warnings predominantly end in H* (see Figure 6[4]) or H*L.

[4] All figures displaying the waveform, the f0 contour, the spectrogram and the first two tiers of utterances included in the article were prepared with Praat; they serve as examples of how experimental material was labelled.

Table 4. Distribution of nuclear accent types in English directives, in percent

	AC order	CC order	AC request	CC request	AC warning	CC warning
H*	**57**	**75**		14,5	**56**	
H*L	15		25	28,5	14	**85**
L*	14	12,5				
L*H	14	12,5	**75**	**57**	28	15

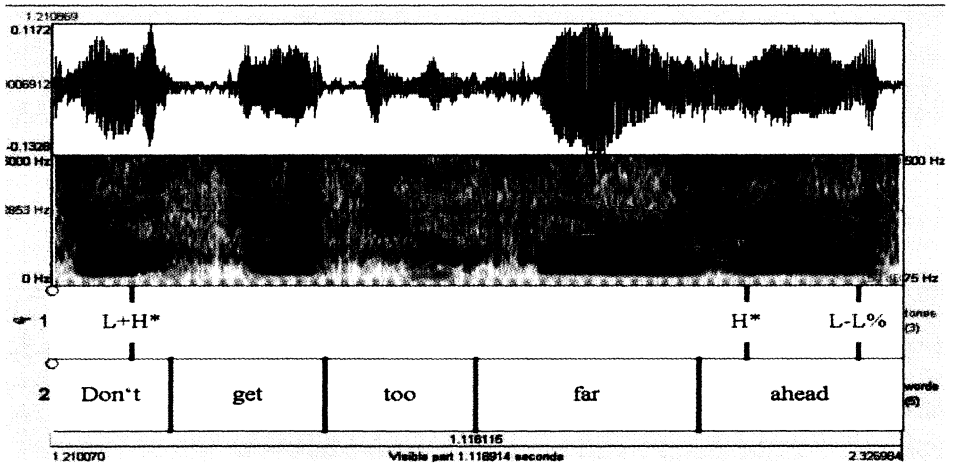

Figure 6. H* nuclear pitch accent in an English warning

Table 5. Distribution of nuclear accent types in Russian directives, in percent

	AC order	CC order	AC request	CC request	AC warning	CC warning
H*L	**50**	11	**50**	16,5	**70**	**85**
L*			25			
L*H	25	11		17,5		
HL*	25	22		16		15
H*H		22				
H*M		**33**	25	**50**	30	

Falling nuclear accents (H*L, H*M) prevail in all types of Russian directives. L* occurs only in adults' requests directed to children (see Figure 7) whereas H*H can be found only in child – child orders (see Figure 8).

Regarding Polish nuclear pitch accents, the findings show, likewise in Russian, a variegated collection of possible options distributed across types of directives.

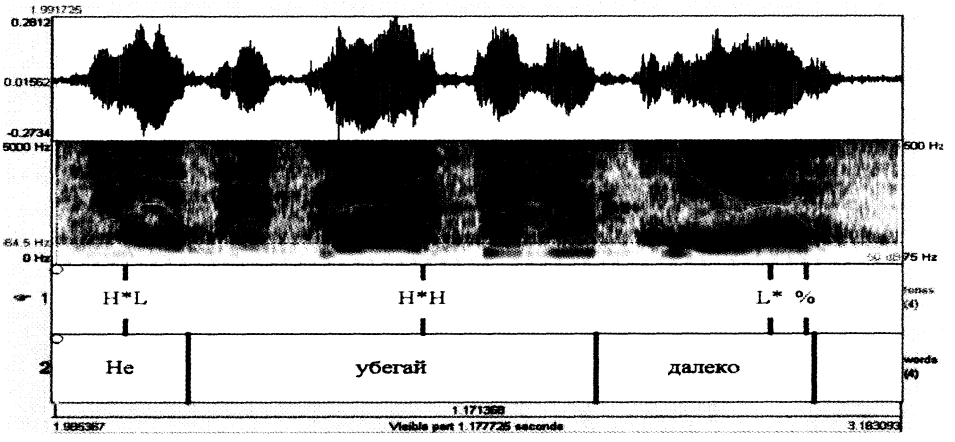

Figure 7. L* nuclear pitch accent in a Russian request

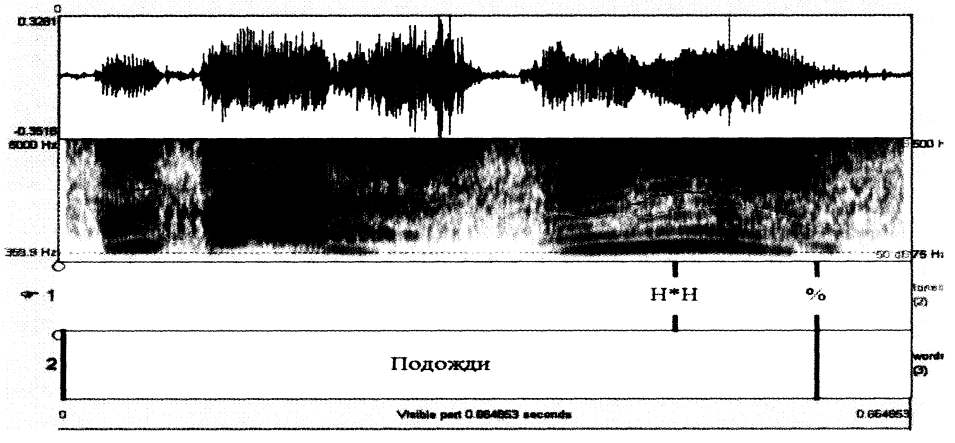

Figure 8. H*H nuclear pitch accent in a Russian order

Table 6. Distribution of nuclear accent types in Polish directives, in percent

	AC order	CC order	AC request	CC request	AC warning	CC warning
HL		11		15	**43**	
HM		**44**	34	20		**75**
MM		22				
MH	**62,5**	11	**66**	**50**		
ML	25	11		15	**43**	25
xL	12,5				14	

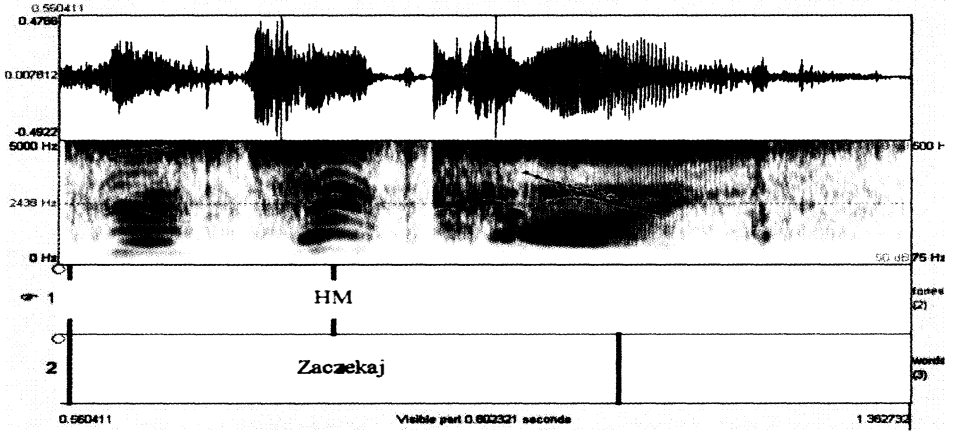

Figure 9. HM nuclear pitch accent in a Polish order

Polish orders in child – child communication usually end in fall (see Fig. 9) while in adult-child context they predominantly end in rise.

In both types of Polish requests, speakers use falling and rising contours. The most intriguing discovery is that a final fall appears in 93 percent of all Polish warnings: HL, HM, ML, and in 92,5 percent of all Russian warnings: H*L, H*M (see Fig. 7 and Fig. 10).

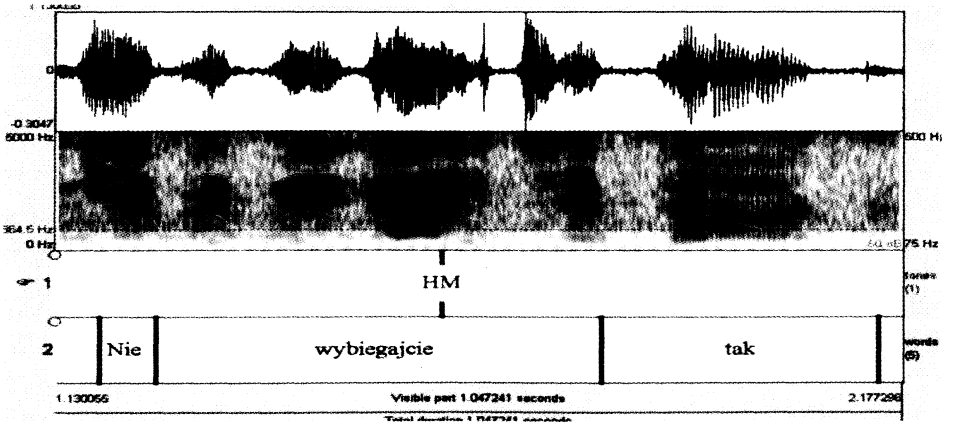

Figure 10. HM nuclear pitch accent in a Polish warning

In addition, certain irregularities in the location of nuclear pitch accents were diagnosed. In English, Russian and Polish directives very often they are shifted to the beginng of an utterance. This tendency can obviously be explained by at least two facts. Firstly, directives are associated with imperative sentence type in which verbs that, as a rule, occupy initial position in the syntactic structure are alligned with pitch prominence. Secondly, directives are emotionally marked

because the speaker who wants to impose his will on a listener tries to sound authoritative, patronizing or submissive. Consequently, pitch prominent nuclear syllables do not occupy neutral (final) position in an intonational phrase.

3. Conclusion

The results of the current experiment generally conform to my tentative expectations that although English as a Germanic language and Russian and Polish as Slavic languages are characterized by language specific differences, significant universals will also be found. Based on the preliminary results, it seems to be justified to conclude that:

1. Pitch representation of intonational phrases in directive speech acts of the three languages are affected by four factors:
   a) the type of directive,
   b) direction of communicative context and its target recipient, i.e. adult – child or child – child,
   c) speaker's sex and age
   d) degree of emotional involvement expressed in a particular type of directive.
2. Pitch register in orders is higher than in requests and warnings.
3. Requests are marked by relatively sharp modifications of the pitch contour, which might signal the complexity of emotions a speaker needs to exploit to attain his target. The greater the speaker's personal desire to see the action effected is, the more complicated melodic line becomes.
4. Both Russian and Polish intonational phrases share the characteristics as regards pitch maxima and minima, pitch range and register. Pitch parameters in English directives are comparatively lower and narrower.

Although these findings provide remarkable insights into the pitch representation of three types of directives, more research is needed to enhance the understanding of the prosodic structure of speech acts. Further studies should concentrate on duration, tempo and rhythm.

References

BARTH-WEINGARTEN D., DEHE N., WICHMAN A. (eds.) (2009), *Where Prosody Meets Pramatics*, Emerald Group Publishing Limited.

BARTH-WEINGARTEN D., REBER E., SELTING M. (eds.) (2010), *Prosody in Interaction*, John Benjamins Publishing Company.

BECKMAN M. E., HIRSCHBERG J., SHATTUCK-HUFNAGEL S. (2005), "The original ToBI system and the evolution of the ToBI framework" in: Sun-Ah J. (Ed.), *Prosodic Typology – The Phonology of Intonation and Phrasing*, Oxford University Press, 9–54.

BOERSMA P. (1993), "Accurate short-term analysis of the fundamental frequency and the harmonics-to-noise ratio of a sampled sound" in: IFA Proceedings 17, 97–110 (at: http://www.fon.hum.uva.nl/paul/papers/Proceedings_1993.pdf, 16.02.2012).

BOLINGER D. (1988), *Intonation and its Uses*, Stanford Univerity Press.

CRUTTENDEN A. (1986), *Intonation*, Cambridge University Press.

CRYSTAL D. (1969), *Prosodic Systems and Intonation in English*, Cambridge University Press.

DEMENKO G. (1999), *Analiza cech suprasegmentalnych języka polskiego na potrzeby technologii mowy*, Wydawnictwo Naukowe Uniwersytetu im. Adama Mickiewicza.

LADEFOGED P. (1982), *A Course in Phonetics*, Harcourt College Publishers.

ODE C. (2008), "Transcription of Russian intonation, ToRI. An interactive research tool, and learning module on the Internet" in: *Dutch Contributions to the Fourteenth International Congress of Slavists*, Linguistics (SSGL 34) 2008, 431–449.

't HART J., COLLIER R., COHEN A. (eds.) (1990), *A Perceptual Study of Intonation*, Cambridge University Press.

HIRSCHBERG J. (2006), "Pragmatics and intonation" in: *The Handbook of Pragmatics*. (L. R. Horn and G. Ward eds.), Blackwell Publishing, 515–537.

PIERREHUMBERT J. (1980), *The Phonology and Phonetics of English Intonation*, (at: www.faculty.wcas.northwestern.edu/~jbp/publications/Pierrehumbert PhD.pdf, 20.01.2011).

SEARLE J. (1979), *Expression and Meaning: Studies in the Theory of Speech Acts*, Cambridge University.

SENDLEMEIER W. F., PAESCHKE A. (2000), *Prosodic Characteristics of Emotional Speech: Measurements of Fundamental Frequency Movements* (at: http://www.speech.kth.se/prod/publications/files/3042.pdf, 15.01.2012).

STEFFEN-BATOGOWA M. (1996), *Struktura przebiegu melodii polskiego języka ogólnego*, Adam Mickiewicz University Press.

SVETOZAROVA N. D. (1982), *Intonacionnaja sistema russkogo jazyka*, LGU.

UNDERHILL A. (1994), *Sound Foundations: Living Phonology*, Heinemann.

WAGNER A. (2006), "A phonological model of intonation and intonation transcription system ToBI for Polish – a preliminary study" in: Speech and Language Technology 8, 137–162.

WANG D. (2006), *A Study of Meta-linguistic Features in Spontaneous Speech Processing*, ProQuest.

WENNERSTROM A. (2001), *The Music of Everyday Speech. Prosody and Discourse Analysis*, Oxford University Press.

VELIZ M. (2004), "Intonational devices used in the distinction of speech acts", at: http://redalyc.uaemex.mx/pdf/352/35201513.pdf (15.02.2012).