

PERCEPTUAL SPACES OF THE RUSSIAN VOWELS

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ABSTRACT

The aim of this work is to analyse the perception of non-native vowels by the native speakers of Russian. The main tasks are: 1) the establishment of perceptual spaces of the Russian vowels under different conditions; when identifying non-native vowels a) isolated from the phonetic context; b) in CV and VC syllables; 2) the definition of the number of the distinguished vowels. The results allow us to maintain that untrained speakers of Russian are able to identify reliably 8 non-native vowels and to distinguish 18 vowels.

1. INTRODUCTION

It's well-known that the number of Russian vowel allophones which the native speakers of Russian are able to distinguish is much greater (n=18) than the number of the Russian vowel phonemes is (n=6) [1]. Numerous experimental studies of late assure us of the fact that Russian listeners possess a highly developed system of perception of phonetic features of vowels. One of the latest works in this field is that fulfilled by Tchernova and colleagues [3]. The authors investigated the perception of 20 cardinal vowels by the untrained speakers of

Russian. In the first experiment the listeners were asked to identify all the cardinal vowels using only 10 symbols (the letters of the Russian alphabet) as possible answers. It was revealed that listeners were able to distinguish about 17 vowels among the 20. In the second experiment the listeners were preliminarily taught to transcription, then they listened to a vowel "sample" marked by a certain transcription sign. The listeners were able to discriminate all the 20 vowels. The number of identified vowels however increased but little (n=9-10). The problems raised in such works seem to be very actual both from the viewpoint of establishing the correlation between the perceptual and the phonological units, and from the viewpoint of elaboration of the strategy of foreign language teaching.

2. PROCEDURE

At different periods of time three groups of untrained speakers of Russian were asked to identify the vowels of English, Spanish and German. English and Spanish vowels were isolated from the words within which they were pronounced, the German vowels were presented for identification

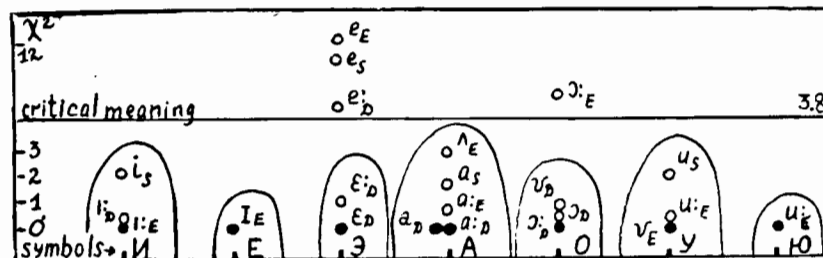


Fig. 1. The distribution of the listeners' answers (by the  $Y^2$  criteria) on the vowels which give the most reliable identification.

within CV and VC syllables. The number of listeners was 43, and the total number of vowels and syllables was 161. In all the experiments we received from the listeners 1947 answers. The listeners knew neither of the above mentioned languages, and they also didn't know the sounds of what languages they were listening to. They were asked to write what they heard by means of the letters of the Russian alphabet.

3. THE CHOICE OF THE LANGUAGES

The choice of the languages under study was not accidental. It was conditioned by the facts that, on the one hand, the vowel systems of English and German are more numerous than that of Russian (English and German contain practically all the possible types of vowels), on the other hand, the vowel system of Spanish very much resembles that of Russian (as far as the number of vowel phonemes is concerned). All these facts are of great interest from the viewpoint of the study of the mechanisms of phonological hearing.

4. RESULTS

The results of the identification test are presented in Table 1. In its ver-

tical column the table contains only 20 types of answers given by the Russian speakers, though the total number being 36. As it's seen from the Table, the listeners use the Russian letter <math>\langle \mathcal{E} \rangle</math> more frequently than other letter-symbols to mark the vowels they were presented to. The <math>\langle \mathcal{E} \rangle</math> space includes 6 vowels: /e, e\_s, e\_i, e\_d, e\_d, e\_d/. The spaces of the Russian <math>\langle A \rangle</math> and <math>\langle O \rangle</math> include 5 vowels: <math>\langle A \rangle</math> - /a, a\_s, a\_s, a\_d, a\_d/; <math>\langle O \rangle</math> - /o, o\_s, o\_d, o\_d, o\_d/. Then come the Russian <math>\langle U \rangle</math> and <math>\langle Y \rangle</math> including 3 vowels each: <math>\langle U \rangle</math> - /u, u\_s, u\_d/; <math>\langle Y \rangle</math> - /y, u\_s, u\_d/. The most narrow are the spaces of <math>\langle E \rangle</math> and <math>\langle O \rangle</math> including only one vowel each: <math>\langle E \rangle</math> - /I\_E/; <math>\langle O \rangle</math> - /U: E/. One can also see from the Table, on which vowels the greatest number of answers marked by one letter-symbol falls. These are the following vowels: /I: E/, /I\_E/, /E\_D/, /a\_d/, /a\_d/, /o\_d/, /u\_d/, /u: E/. n = 8. All of them are reliably identified by the Russian listeners. Fig. 1 shows the results of comparison of answers' distributions on those vowels which were marked in most cases by one letter-symbol. The difference between the distributions of answers for each pair of vowels was

estimated by means of  $\chi^2$  criteria. The comparison of the distributions shows that the listeners are able to distinguish not 8 but at least 12 vowels. As it is seen, 4 vowels are placed higher than the critical meaning of the  $\chi^2$  criteria is. Thus, these vowels are very well distinguished by the listeners too. The vowels placed below the critical meaning of the criteria on one vertical line with the vowels marked (•) (see Fig.1), to all appearance, seem to be identical for the Russian listeners as far as their phonetic features are concerned. Fig.1 gives the opportunity to represent, firstly, the width of the perceptual boundaries of the Russian vowels, and, secondary, the remoteness of non-native vowels from the centre formed by the native vowel in the linguistic consciousness of the Russian speakers.

Let's analyse another group of vowels. While identifying these vowels the listeners do not take unanimous decisions. The vowels are: /æ/, /ɔ/, /ɜ:/, /ɔ:/, /ɪ:/, /y:/, /y:/, /ɔ:/, /ɜ:/ (see Table 1). The task which the listeners had to fulfil was undoubtedly very difficult: to place the vowel they heard into a certain sphere of a perceptual space formed in their memory by the native sounds and to correlate the articulation with the unknown vowel stimuli. Let's consider the vowels which differ only in one step of openness articulatory similar to each other. Thus, mistakes to within one step of openness are considered to be possible. Then the identifica-

tion of some of the above mentioned vowels improves. For example, the English /æ/ and /ɜ:/ are identified mostly as <Eɜ> (70% and 60% of all the answers correspondingly). Comparison of the answers' distributions shows that these two vowels form one perceptual sphere for the speakers of Russian and they may be placed in the space of <Eɜ> in Fig.1. German /ɪ/ is identified in the 50% of all the answers as <ɪ> and in the 50% as <Eɜ>. Thus, it may be placed in the space of <UEɜ> on Fig.1. English /ɔ/ and Spanish /o/ are identified as the Russian <O> and <A> (50% of all the answers correspondingly). The analysis of the distributions shows that these vowels stay close to each other as far as their phonetic properties are concerned and they form a common sphere /ɔ/ which can be placed in the space of <AO> on Fig.1. While identifying the German /y, y:, œ, ø:/ the Russian listeners use from 8 to 14 symbols and combinations of symbols. These are mostly the combinations of a front close vowel with a back rounded vowel. This fact testifies to the phonological character of the operation: the mechanism of the front rounded vowel identification resembles that used by the native speakers of Russian when identifying the Russian vowel allophones in the position between or after palatalised consonants [2].

The analysis of the distribution of inadmissible answers shows that the vowels /y/ and /œ/ are most similar in the space of phonetic features from the viewpoint of the Rus-

Table 1. Identification of English, Spanish and German vowels by the native speakers of Russian.

Vowels Symbol	English										Spanish				German																			
	ɪ	I	E	æ	a	ʌ	ɔ	ɜ	u	ɜ:	ɪ	e	o	u	ɪ	I	e	ɛ	e	a	ɔ	ɜ	ʊ	ʏ	ʏ	œ	ø							
Э	10	50	30						30	3,8	57,6	1,8	35	66	91	82	4,8	3,6	1,8	1,8	5,4	2,0												
A		10	5	90	80	35					8,6	7,4	2,2	100	100									81	86	75	2,9	1,4	6					
И	85	5								6,7	11	0,4											83	45	8,6									
У	10		10	5			40	70	20			6,7	5,8										4,8	1,4	1,4	6,9	1,7	2,0	2,4					
Ю									75																		19	3,7	2,9	4,1				
E	5	60	25	40					30	1,7	7,8					14	11	9	1,2									5,7	1,4					
б		10							5	5	1,3	8,3	2,1	7	7													2,4	5,7					
Е									25																			8,6	2,9	4,3				
ОА				5	10	10																						3,6	1,2	2,9				
УЭ																														2,9	2,4			
ИЭ																														2,9	5,7	2,4		
ИО																														5,7				
ЕО																														5,7	2,4			
ЮУ																														2,9				
УУ																														2,9				
ОЕ																															6,5			
ИО																															4,8			
УУ																																4,8		

sian speakers. The vowels /y:/ and /ø:/ are well distinguished by the listeners.

## 5. DISCUSSION

The results of the investigation allow us to maintain that in the case of a non-native vowel identification the Russian listeners are able to identify reliably 8 vowels. The number of distinguished vowels is equal to 18; [12 (Fig.1) /ɪ:/, /æ:/, /ɔ:/, /yæ:/, /y:/, /ø:/]. All the vowels can be divided into 3 groups as far as their perceptual estimation by the native speakers of Russian is concerned: 1) the vowels which are placed reliably in a perceptual space of a definite Russian vowel. Their number is 18 and they form vertical spheres in Fig.1; 2) The vowels which are placed in a perceptual space, formed in a linguistic consciousness of the Russian spea-

kers by several symbols: 1) /ɜ:/ - <UEɜ>, /æ:/ - <Eɜ>, /ɔ:/ - <AO>; 3) the vowels which are not placed in a perceptual space ("alien" to it). These are the German front rounded vowels.

## 6. REFERENCES

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