

Maja Marković¹, Bojana Jakovljević

doi: 10.19090/gff.2016.1.215-227

Odsek za anglistiku

UDK: 811.111'342.4:811.163.41'243

Filozofski fakultet Univerziteta u Novom Sadu

Originalni naučni rad

Primljeno: 8. 7. 2016.

Prihvaćeno: 8. 11. 2016.

PHONETIC CUE INTERPRETATION IN THE ACQUISITION OF A NON-NATIVE VOCALIC CONTRAST

The study deals with the acquisition of the English vocalic contrast /e/ vs. /æ/ by native speakers of the Serbian language, in which this contrast is unfamiliar, and one of the most difficult among monophthongs to be acquired in English as L2 (cf. Paunović 2002; Marković 2007; 2009; 2012). The authors specifically address the questions of how the categories of /e/ and /æ/ are developed in the interlanguage of relatively proficient learners of English. We hypothesize that the acquisition of this contrast is a stage-like process, which starts from a complete assimilation to the category of the L1 vowel /e/, and is further developed on the basis of durational, rather than spectral cues. In order to test this hypothesis, perception and production experiments were carried out in which different durational contexts were observed.

Key words: vowels, L2 phonological acquisition, English, Serbian

1. INTRODUCTION

„Foreign accent” is the phenomenon made up of deviations from the native norm in the speech of a second language (L2). A number of studies have shown that the source of difficulty often comes from the characteristics of the learners’ first language (L1). Thus speakers of one language commonly employ a number of categories and patterns of their L1 when producing L2. This phenomenon is known as phonological “transfer” (term introduced by Selinker, 1969) and it has been widely studied and explained by using various theories of L2 acquisition. Transfer is, however, not necessarily involved in all learners’ L2 production, since the acquisition of L2 phonology depends on a wide array of factors, such as length of learning, amount of exposure, phonetic aptitude, age of the beginning of learning an L2, etc. The amount of transfer tends to change over time, and gradually, providing an appropriate amount of exposure to good L2 models, speakers of L1 are likely to develop the new categories in L2 which do not exist in their L1 and thus reorganize their system of phonological contrasts. The purpose of this study is to examine some aspects of this process of the English /e/ : /æ/ contrast by native speakers of Serbian. In other words, the goal of this study is to investigate how first language phonological knowledge affects the learners’

¹ majamarkovic@ff.uns.ac.rs

acquisition of phonological contrasts and phonetic realizations in English as a second language, on the example of the English vowels /e/ and /æ/.

The paper is organized in the following chapters: after the introduction, we give a more detailed overview of the theoretical models investigated; the next chapter contains the relevant facts about the vocalic systems of English and Serbian; the main part of the paper provides the information about the empirical research conducted, including the methodology section and results of the experiments. The paper is closed by general discussion and conclusions which also include guidelines for further research and pedagogical implications of the findings.

2. THEORETICAL BACKGROUND

A number of previous studies have examined the perception and production of L2 sounds by adult learners, in relation to various factors affecting the acquisition of L2 phonological system. The acquisition of vowels has been the focus of a number of recent studies, and has opened up various issues regarding the categorical perception and production of L2 sounds.

In this paper, we rely on several theoretical frameworks. Those are mainly Flege's Speech Learning Model (SLM) and Best's Perceptual Assimilation Model (PAM). Within the Flege's SLM model, we investigate the "feature" hypothesis, which states that an L2 phonetic category formation may be blocked if the L2 speakers do not discern a mismatch between the phonetic features used to signal a contrast in the L1 and the L2. In other words, L2 features not used to signal a phonological contrast in L1 will be difficult to perceive in L2, and ultimately result in unsuccessful production. This hypothesis is relevant for the contrast we are investigating, since the vowels with the feature [+front] do not contrast in the feature [+low] in Serbian, whereas they do in English. Another significant hypothesis implied by SLM is that a phonetic category may be established for an L2 sound, but based on different features than the features used by native speakers, and that such an alternative strategy would be reflected in the production of the contrast. As for the other model considered, Best's PAM, we claim that the lack of the contrast in L1 results in the assimilation of the L2 contrasting sounds in the area of a single significant phonemic element in L1.

Since speakers of a language are "attuned" to their native language phonological systems, L2 learners commonly have difficulty perceiving and producing L2 phonological contrasts. The results of a number of studies have also showed that, in establishing the new categories in the foreign language, non-native speakers may resort to different phonetic cues from the native speakers (Flege, Bohn & Jang, 1997, who investigated the acquisition of English by native speakers of German, Spanish, Mandarin and Korean; Escudero, 2002, who studied the perception of Scottish English vowels by speakers of Spanish; Smith, Bradlow & Bent, 2003, where the Chinese and English sound systems are investigated; Rauber, Escudero, Bion & Baptista 2005, studying the acquisition of English by

speakers of Brazilian Portuguese; Cebrian, 2006, who examined the acquisition of English vowels by speakers of Catalan). Studies by Bohn (1995), Flege, Bohn & Jang (1997) and Escudero (2002), for example, suggest that non-native speakers' strategy in developing new categories for /i:/ : /ɪ/ and /e/ : /æ/ in English is different from that of native speakers' due to heavier reliance on the durational cue than the spectral information on these vowels.

Two of the most influential models of L2 vowel perception, Flege's *Speech Learning Model* – SLM (Flege, 1995) and Best's *Perceptual Assimilation Model* – PAM (Best, 1995) explain the perception of L2 phoneme categories in relation to the categories found in the learners' native language. Flege's model predicts that the L2 sounds which are sufficiently phonetically different from L1 targets are perceived as "new" or "foreign" and are more likely to be earlier developed into new categories by non-native speakers. Best's model predicts that the discriminability of L2 vowels greatly depends on L1 assimilation possibilities. If a foreign category is close to an L1 target, it will be assimilated to it. Therefore, if two distinct L2 sounds are good candidates for a single L1 category, discrimination is expected to be poor.

In this study we investigate the role of prior L1 phonological knowledge in the acquisition of a "new" contrast in L2 by relatively proficient speakers of English whose native language is Serbian. The paper presents the results of perception and production experiments where we investigated the acquisition of the English phonemes /e/ and /æ/ by a group of first year students of English at Novi Sad University.

3. ENGLISH AND SERBIAN VOWELS

English has twelve monophthongs or 'relatively' pure vowels (Cruttenden, 2008: 97), traditionally divided into 'long' and 'short', or 'tense' and 'lax' categories. The vowels produced with a relatively front tongue position are the high vowels /i:, ɪ/, the mid /e/ and the low-to-mid /æ/. In the central region there are mid vowels /ɜ:, ə/ and the low-to-mid /ʌ/. The back region of the traditional vowel quadrilateral is occupied by high vowels /u:, ʊ/,² high-to mid /ɔ:/, low-to-mid /ɒ/ and the low vowel /ɑ:/.

The two vowels examined in this study /e, æ/ are both front vowels and are traditionally subsumed in the group of short vowels. Yet, apart from the distinct heights of the tongue, they are characterized by substantial difference in duration as well, although the degree of this distinction varies across dialects (Collins & Mees, 2013: 159). The low-to-mid vowel /æ/ is characterized by longer duration compared to the other short vowels in the same phonological environment, its length amounting to that of long vowels if it is followed by a voiced consonant. The length difference is not as striking when the vowel /æ/ occurs in front of

² Recent studies have shown that the high "back" vowels /u:, ʊ/ have undergone dramatic changes in contemporary English, both in the American and British varieties, as the two high back vowels have been shifted to a much more anterior position. The change is even more striking in the long vowel, especially in the pronunciation of younger speakers of British English (Cf. Hawkins & Midgley, 2005).

a fortis consonant, where its duration is significantly reduced. However, since it is disallowed from the word final position, unlike the other long vowels, it is traditionally placed in the group of short, or lax, vowels.

In contrast to the complex vowel system of English, Serbian has a typical five vowel system attested in a number of other worlds' languages (Lass, 1991: 143), where all vocalic phonemes are evenly distributed in the vowel space. The front vowels are /i, ε/; the only central vowel is the low vowel /a/; and the back ones are /u, o/. Serbian is also characterized by a very complex accentuation system, where both length and tone are traditionally analyzed under the same token, i.e. accent.

A closer analysis reveals that length, i.e. the quantity of a sound, to a great extent affects the quality of some of the vowels. The front vowel /e/ and the back /o/ exhibit the most conspicuous effects of this influence. This was shown in the series of works by P. Ivić and I. Lehiste (Ivić and Lehiste, 1967; Ivić, 1996), but is generally neglected in the phonetic and phonological literature on the Serbian language. The degree to which quantity affects the quality of vowels varies across dialects, but is strongly manifested in the dialect of the subjects of this study (Ivić & Lehiste, 1967; Ivić, 1996; Marković & Bjelaković, 2006; Marković, 2007; Marković, 2012).

Thus the front vowel space in the standard Serbian variety examined in this study possesses three vocalic targets: /i/, /e/ and /ε/. The high vowel quality /e/ is found in long syllables, whereas the mid quality /ε/ typically occurs in short syllables. The close vowel /e/ is much higher than either of the English vowels /e/ and /æ/, while the more open /ε/ roughly occupies the same area as the English vowel /e/ (Ivić & Lehiste, 1967: 62; Marković, 2012: 104).

From the facts mentioned about the vocalic systems of the two languages, several predictions can be made about the potential transfer by native speakers of Serbian in the perception and production of the English vowels /e/ and /æ/: (1) Since the low front region of the vowel space is unoccupied in Serbian, poor distinction is expected in terms of quality of the two L2 vowels; (2) as duration is an important cue in Serbian, it can be expected that the length difference is to be the predominant factor in distinguishing the two English vowels.

4. EMPIRICAL STUDY

4.1. Perception task

4.1.1. Methods and results

The perception task was a word identification test. This experiment was conducted over 3 subsequent years (from 2013 to 2015), during which 65 first year students of English at Novi Sad University (48 female and 17 male) took part in the perception test. The level of English language knowledge of the participants according to the CEFR is B2 and higher, since B2 is the level required at the enrolment in the English Department. The subjects were asked to circle

the appropriate word they heard in one of 63 words uttered by a male native speaker of British English. Among these, 36 words contained the target vowels. The answer sheet consisted of pairs of words (minimal pairs) they were to choose from. At the time of testing the students had not had a course in phonetics, or any previous pronunciation training. No participants had knowledge of any other foreign language above the A2 level according to the CEFR, nor had any experience in oral communication in the third language, which excluded the possibility of transfer from languages other than L1 in their English.

The goal of this test was to investigate the discrimination between the two vowels in pre-fortis and pre-lenis positions. The rationale for this experiment was the fact that previous studies (Marković 2007; 2009; 2012) showed that the contrast between /e/ and /æ/ was the least acquired one among the English monophthongs by advanced learners whose L1 is Serbian. In order to test whether there is any significant difference in the perception of the two target vowels before lenis and fortis consonants, the recorded material contained an even number of words with a pre-fortis and pre-lenis target vowel, which were uttered twice in a random order.

The analysis was made on the basis of error counts, where the numbers of errors were compared depending on the environment they occurred in. These occurrences were then statistically analyzed using the chi-square test. Tables 1 and 2 present the raw data on error counts with their percentage in the total of answers.

	PRE-LENIS	%	PRE-FORTIS	%
1-syll words	66	24.5	44	16.4
2-syll words	47	17.5	49	18.2
TOTAL:			206	76.6

Table 1: The data on errors when /æ/ was misinterpreted as /e/.

	PRE-LENIS	%	PRE-FORTIS	%
1-syll words	29	10.8	8	3.0
2-syll words	13	4.8	13	4.8
TOTAL:			63	23.4

Table 2: The data on errors when /e/ was misinterpreted as /æ/.

These results are not entirely in line with the expected outcome, since the highest numbers of errors was made in the misinterpretation of /æ/ as /e/ in a pre-lenis occurrence. However, we account for this unexpected result as a consequence of the order in which the words occurred – the pair in which the highest number of errors occurred was the first one with the target vowels and the high number of errors made here may simply have arisen from the fact that the subjects had not had the chance to familiarize with the pronunciation of the reader. This suggests that a different test design should be used, where the order of production would be completely randomized for each participant.

The other results are more conclusive, and are in line with the previous findings and hypotheses made in the course of this research. The high number of errors in both directions in disyllables (45.3%) corroborates the hypothesis that the reduced duration of vowels in polysyllabic words obliterates the durational distinction that L2 learners may rely on. The comparison of pre-fortis misinterpretations in monosyllables (16.4% in Table 1 vs. 3% in Table 2) points to a statistical difference indicative of relevance of durational cues. The result of the χ^2 test conducted shows the significance at level $p < 0.0001$, $df = 1$. The general tendency noticed was that most errors were made in the words where the vowel /æ/ occurs before a voiceless (fortis) consonant. Before such consonants the duration of the vowel is substantially reduced, and the listener therefore loses this bit of information when differentiating between the two vowels. The data obviously corroborate the previous findings (Marković 2007; 2009; 2012) that the vocalic duration plays a significant role in the perception of the two vowels investigated, suggesting that the native speakers of Serbian, not having fully developed the new vocalic contrast investigated, rely on the duration as the main distinguishing feature between the two vowels.

4.1.2. Discussion

The results of the perception task reveal a relatively poor discrimination level between the English vowels /e/ and /æ/ in the perception of the native speakers of Serbian even at a high level of knowledge of English as a second language. In each of the environments tested the number of correct answers is higher than the number of incorrect ones, which indicates that the subjects have developed a new category in the foreign language, but that it has not been acquired fully.

In terms of the two models presented in the introductory part of the paper, Flege's SLM and Best's PAM, we can conclude that both models have been confirmed. The results of the perception test comply with Best's model, since the poor discrimination level indicates that the two distinct L2 vowels have been assimilated in the perception of our subjects to one category, notably, L1 vowel /ɛ/.

The results also indicate that the subjects have partly developed a new category, which agrees with the model proposed by Flege. However, they also suggest that the native speakers of Serbian examined in this study to a great extent rely on the durational cue as a significant indicator of the vowel in question. Such findings are in line with the results of Escudero (2002), where the author concludes that non-native speakers, even after having developed a new category, may still rely on different cues from the native speakers, i.e. durational, rather than spectral cues. In our case, the results proved that the distinction between /e/ and /æ/ has not been adequately acquired in terms of spectral differences where the subjects had no obvious durational distinction to help them categorize the two vowels. In this sense we may conclude that the subjects have not acquired the distinction in terms of the primary cue, i.e. the spectral differences between

the two vowels. In some of the words analyzed, where the lengthening of the vowel /æ/ was significant, preceding a voiced (lenis) consonant, all the subjects performed much better. This was also the case in words containing the vowel /e/ with significant duration reduction in the pre-voiceless (fortis) environment. All these data indicate that the categorical distinction does exist in the subjects' interlanguage, but that it has been developed on the basis of the secondary cue, i.e. the durational characteristics of the vowels examined.

4.2. Production experiments

4.2.1. Methods

In order to test the production of the two target vowels two experiments were conducted. The goal of the production experiments was to compare the acoustic properties of the English vowels /e/ and /æ/ in the production of advanced English learners whose L1 is Serbian. The goal of the first experiment was to test whether the two target vowels differ in their spectral values in the subjects' production, and the goal of the second task was to compare the durational characteristics of the vowels investigated.

The subjects of the first experiment were 15 female first year students of English. The criterion for choosing the subjects was the same regional background, i.e. that the subjects speak the same dialect (standard urban variety of the city of Novi Sad). The subjects were recorded reading 7 words containing the vowel /æ/ and 7 words containing /e/.

The recordings were acoustically analyzed using Praat 5.2.28 program for speech analysis (Boersma and Weenink 2011). For the purpose of this research, the frequencies of the first two formants (F1 and F2) were extracted manually at the midpoint of the steady-state section of the vowels. The values were statistically analyzed (using t-test) and the average values and standard deviations obtained for each speaker. The values of F1 and F2 were then plotted in the F1-F2 graph in order to show whether the two vowels are spectrally differentiated.

The goal of the second production task was to compare the durational characteristics of the target vowels in pre-fortis and pre-lenis environments. For this purpose, 10 first year students were recorded reading 20 monosyllabic words containing the vowels /e/ and /æ/ before voiced and voiceless consonants. In order to compare the subjects' durational features with those of native speakers' we had a control speaker, who read the same list of words. The control speaker is a male British speaker, a trained phonetician, whose pronunciation is characterized by a marked length difference between the target vowels.

4.2.2. Results of the first production task

The mean values of F1 and F2 of the target vowels are shown in Table 3.

	F1	F2
/e/	779	1985
/æ/	818	1998

Table 3: The mean values of F1 and F2 of the target vowels.

Even judging from the mean values, it is obvious that the vowels /æ/ and /e/ are overall poorly distinguished, and that their vocalic space overlaps in the production of our subjects. This is clearly seen in the plotted F1-F2 graph (Fig. 1), representing the mean values for each participant.

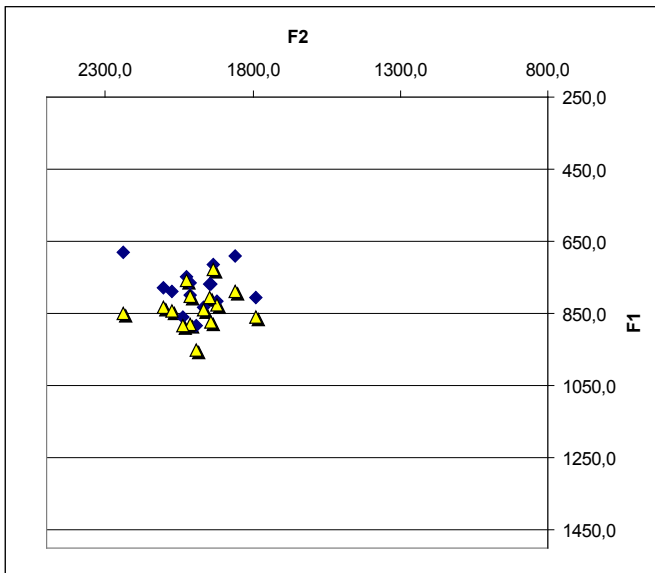


Figure 1: Graph of plotted F1:F2 of the vowels /e/ (symbol ♦) and /æ/ (symbol Δ) produced by the subjects.

The graph in Fig. 1 indicates that, despite certain individual differences, the subjects generally have not acquired the distinction adequately, and that the areas of the two vowels greatly overlap. On the whole, both vowels occupy the area of the subjects' L1 vowel /ε/, i.e. the Serbian vowel /e/ in the short stressed realization (Ivić – Lehiste, 1967: 62; Marković, 2012: 90–105). Such findings show a great degree of assimilatory effect of the L1 vowel in the production of our subjects.

The results of the t-test also point to the partial acquisition level of the

contrast investigated. Despite the small difference in the values of F1 of /æ/ and /e/, t-test revealed a statistical difference in the F1 of the two vowels for the total population investigated ($t = -5.52419$, $p < 0.001$). Formant values of F2, on the other hand, show no statistical difference between the two vowels ($t = -0.904547$, $p > 0.05$).

Such results may again be interpreted as a stage in the acquisition of the unfamiliar contrast of L2, where the degree of openness is beginning to be acquired as the distinguishing factor in the spectral difference between the two vowels. Alternatively, the difference in F1 values might be interpreted as the consequence of durational features employed by our subjects, which remain the dominant distinguishers for the two vowels. Since the vowel /æ/ is consistently pronounced with longer duration, the lower F1 values may thus be the result of its hyperarticulation, typical of the articulation of longer vowels (Lindblom, 1963).

4.2.3. Results of the second production task

The analysis of the recorded material of the first production task indicated that the subjects did signal the difference between the two vowels, but mainly by pronouncing /æ/ as a longer vowel. The duration of the open vowel /æ/ was markedly longer than that of the mid /e/ in the production of our subjects, even in the contexts of pre-fortis realization, which requires significant length reduction in English.³

The results of the measurements of the durational features produced by the control speaker of British English reveal a rather robust pattern (Table 4). While in the pre-fortis environment the difference in the duration of the two vowels is not so conspicuous, in pre-lenis environment it is rather marked.

Phon. context	/e/ pre-fortis	/e/ pre-lenis	/æ/ pre-fortis	/æ/ pre-lenis
Mean duration (msec)	122.5	188.2	137.4	266.0

Table 4: Mean values of the duration of vowels uttered by the control native English speaker (in msec).

The mean values of the duration of the two vowels produced by the subjects (Table 5) point to an entirely different pattern. Apparently, the subjects are sensitive to the effect of environment on the vocalic duration – pre-fortis realizations are consistently shorter in duration than pre-lenis ones. However, the mid vowel /e/ is consistently shorter than the open vowel /æ/ regardless of the phonological context.

³ Since all the words examined were monosyllables of the same length (CVC), and considering the large number of examples (200 words), tempo normalization was not necessary and was therefore not performed in the test.

Phon. context	/e/ pre-fortis	/e/ pre-lenis	/æ/ pre-fortis	/æ/ pre-lenis
Average duration (msec)	150.8	174.7	202.5	243.5

Table 5: Mean values of the duration of vowels uttered by the subjects (in msec).

The comparison of the data in Tables 4 and 5 reveals that the subjects have not acquired the same durational relations as those of the native speaker. Firstly, the results of the measurements indicate that reduction in length is much greater in front of a voiceless consonant in the production of the native speaker both in /e/ and /æ/ than in the production of our subjects. Secondly, while the native speaker has the shortest realizations of both /e/ and /æ/ in front of a voiceless consonant, the subjects seem to categorize between the two vowels by using the difference in duration, so that both realizations of /e/ are shorter than those of /æ/. These findings also corroborate some of our hypotheses – that the development of a new contrast is founded on a cue which is secondary in L2.

5. GENERAL DISCUSSION AND CONCLUSIONS

The results of the experiments carried out reveal that the vocalic contrast between the English vowels /e/ and /æ/ poses a serious problem to the native speaker of Serbian and seems to be one of the last L2 monophthong contrasts to be acquired. The results of the perception tests indicated a high level of perceptual substitution between the two vowels, signalling that the new category of /æ/ has not been adequately developed.

The results of the production experiment show even more clearly that the subjects have assimilated the new L2 category, i.e. vowel /æ/, into one of the L1 categories, i.e. in the vocalic space of the L1 vowel /ɛ/.

Both perception and production experiments also suggest that the subjects have begun to develop the distinction between the two L2 vowels, but relying significantly on duration as the major distinguishing factor.

We may conclude that the findings of our study fully corroborate Flege's feature hypothesis – since vowels with the feature [+front] do not contrast in the feature [+low] in the front area of the vocalic space of the subjects' L1, the learners' category formation is significantly hindered. This is in line with previous studies in which the feature hypothesis was tested (notably, McAllister, Flege & Piske, 2002).

The complexity of vocalic acquisition, usually neglected in the study of L2 phonological research, is not only the result of various spectral differences, i.e. place and labialization features, but also the fact that vowels are the domain in which prosodic properties of a language operate. Among those, duration is a rather significant one. In learners whose L1 durational features operate along different rules from L2, vocalic duration may become a primary cue a learner may resort to in developing a new phonemic contrast. It may thus at the same time facilitate the

development of a new contrast and hinder the acquisition of primary cues in L2 at certain stages of phonological acquisition. Although this study has for the first time shown the effect of mistaking a secondary phonetic cue for the primary one, similar findings are found for different languages in Flege et al., 1997; Escudero, 2002; Smith et al., 2003; Rauber et al., 2005; Cebrian, 2006; Bohn, 1995.

These observations should still be tested in further longitudinal studies with the subjects at various levels of L2 knowledge. Although we did not examine the effect of the length of learning L2 in this study, the results obtained open up some space for the analysis of this factor in acquiring L2 vocalic categories. Further implications are that developing a new category may involve various mechanisms for an L2 language learner. Thus the learner should be encouraged to perceive both secondary and primary phonetic cues in order to categorize L2 targets more adequately. Drawing the students' attention to the primary distinctive cues through a lot of practice certainly helps raise their awareness and „attunes“ them to some subtler contrasts they may not have been capable of noticing earlier.

Maja Marković, Bojana Jakovljević

FONETSKI FAKTORI KOJI UTIČU NA USVAJANJE VOKALSKIH KONTRASTA ENGLESKOG JEZIKA KAO STRANOG

U radu se ispituje usvajanje kontrasta engleskih vokala /e/ i /æ/ kod izvornih govornika srpskog jezika u kome ovaj vokalski kontrast ne postoji. Iz tog razloga, ovi vokali usvajaju se sa velikim teškoćama (cf. Paunović 2002; Marković 2007; 2009; 2012). Posebna pažanja posvećena je razvoju fonetskih kategorija /e/ i /æ/ u međujeziku srpskih izvornih govornika sa veoma visokim nivoom znanja engleskog jezika. Početna hipoteza bila je da usvajanje pomenutog vokalskog kontrasta počinje potpunim stapanjem oba vokala u srpski vokal /e/, da bi se kasnije vokali diferencirali na osnovu razlika u trajanju. U skladu s tim, sprovedeni su eksperimenti koji su podrazumevali kako testiranje percepcije, tako i procenu produkcije engleskih vokala /e/ i /æ/ kod srpskih izvornih govornika, a dobijeni rezultati naknadno su statistički obrađeni. Nakon statističke analize, potvrđena je početna hipoteza. Drugim rečima, analiza je ukazala da prilikom usvajanja vokalskog kontrasta /e/ i /æ/ kod srpskih izvornih govornika sam kvalitet vokala nije adekvatno usvojen, dok su kvantitativne odlike vokala, odnosno trajanje, od presudnog značaja.

Ključne reči: vokali, usvajanje fonologije stranog jezika, engleski, srpski

REFERENCES

- Best, C. (1995). A direct realist view of cross-language speech. In: Strange, W. (Ed.) *Speech perception and linguistic experience*. Baltimore: York Press. 171–204.
- Boersma, P. & Weenink, D. (2011). *Praat: doing phonetics by computer* (Version 5.2.28) [Computer program]. Retrieved 28 June 2011 from <http://www.praat.org>.

- Bohn, O. S. (1995). Cross Language Speech Perception in Adults First Language Transfer Doesn't Tell It All. In: Strange, W. (Ed.) *Speech Perception and Linguistic Experience: Theoretical and Methodological Issues*. Baltimore: York Press. 279–304.
- Bohn, O. S.–Flege, J. E. (1992). The production of new and similar vowels by adult German learners of English. *Studies in Second Language Acquisition* 14, 131–158.
- Cebrian, J. (2006) Experience and the use of non-native duration in L2 vowel categorization. *Journal of Phonetics* 34/3, 72–387.
- Collins, B.–I. M. Mees. (2013). *Practical Phonetics and Phonology*. London: Routledge.
- Cruttenden, A. (2008). *Gimson's Pronunciation of English*. London: Edward Arnold.
- Escudero, P. (2002). The Perception of English vowel contrasts: acoustic cue reliance in the development of new contrasts. In: James, A.–Leather, J. (Eds.) *New sounds 2000: Proceedings of the fourth international symposium on the acquisition of second language speech*. Klagenfurt: Universitätsverlag Carinthia. 122–131.
- Flege, J. E. (1995). Second language speech learning: Theory, findings and problems. In: Strange, W. (Ed.) *Speech perception and linguistic experience: Issues in cross-language speech research* Timonium MD: York Press. 233–277.
- Flege, J. E., Bohn, O. S. & Jang, S. (1997). Effects of experience on non-native speakers' production and perception of English vowels. *Journal of Phonetics* 25, 437–470.
- Hawkins, S. & Midgley, J. (2005). Formant frequencies of RP monophthongs in four age groups of speakers. *Journal of the International Phonetic Association* 35/2, 183–199.
- Ivić P. & Lehiste, I. (1967). Prilozi ispitivanju fonetske i fonološke prirode akcenta u savremenom srpskohrvatskom književnom jeziku. *Zbornik za filologiju i lingvistiku* X, 55–95.
- Ivić, P. (1996). *Prozodija reči i rečenice u srpskohrvatskom jeziku*. Prevod Lj. Subotić. Sremski Karlovci – Novi Sad: Izdavačka knjižarnica Zorana Stojanovića.
- Lass, R. (1991). *Phonology: An Introduction to Basic Concepts*. Cambridge: CUP.
- Lindblom, B. (1963). Spectrographic study of vowel reduction. *Journal of the Acoustical Society of America* 35: 1773–1781.
- Marković M.–Bjelaković, I. (2006). Neke akustičke karakteristike vokala u govoru Novog Sada. *Godišnjak Filozofskog fakulteta u Novom Sadu* XXXI, 327–246.
- Marković, M. (2007). *Kontrastivna analiza akustičkih i artikulacionih karakteristika vokalskih sistema engleskog i srpskog jezika*. PhD thesis. Novi Sad: Filozofski fakultet.
- Marković, M. (2009). The Perception and production of the English vowels /e/ and /æ/ by native speakers of Serbian. In: Tsangalidis A. (Ed.) *Selected Papers from the 18th International Symposium of Theoretical and Applied Linguistics* Thessaloniki: Aristotle University of Thessaloniki. 253–262.
- Marković, M. (2012). *Uporedna proučavanja vokala engleskog i srpskog jezika: između univerzalnog i specifičnog*. Novi Sad: Filozofski fakultet.
- McAllister, R., Flege, J & Piske, T. (2002). The influence of the L1 on the acquisition of

- Swedish vowel quantity by native speakers of Spanish, English and Estonian. *Journal of Phonetics* 30, 229–258.
- Paunović, T. (2002). *Fonetsko-fonološka interferencija srpskog jezika u percepciji i produkciji engleskih vokala*. PhD thesis. Niš: Filozofski fakultet.
- Rauber A. S., Escudero, P., Bion, Ricardo A. H. & Baptista, B. (2005). The Interrelation between the Perception and Production of English Vowels by Native Speakers of Brazilian Portuguese". *Proceedings of the Interspeech 2005 – Eurospeech*, 2913–2916.
- Selinker, L. (1969). Language transfer. *General Linguistics* 9, 67–92.
- Smith, B., Bradlow, Ann R. & Bent, T. (2003). Production and Perception of Temporal Contrasts in Foreign-Accented English. In: Sole, M. J., Recasens, D. & Romero, J. (Eds.). *Proceedings of the XVth International Congress of Phonetic Sciences*. Barcelona, Spain. 519–522.