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ACOUSTIC ANALYSIS OF ENGLISH VOWELS PRODUCED BY AMERICAN SPEAKERS AND HIGHLY COMPETENT SERBIAN L2 SPEAKERS

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Abstract. *The paper submits the findings of the research which explored the acoustic properties of highly competent Serbian L2 speakers' vowels and the vowels produced by American native speakers in two reading tasks. The study involved four participants: two female native speakers of English and two highly proficient female Serbian speakers of English. The participants were instructed to read a dialogue and a story, after which the duration and the quality of the vowels produced were measured. Based on the analysis of the collected data, the results showed that there were differences in the production of vowels between the two groups of speakers, but it was concluded that, despite these differences, the Serbian participants did not have any major issues with the production of vowels that would significantly, or at all, afflict their intelligibility. Neither the vowel quality nor the vowel duration was critical for the Serbian participants compared to that of the American speakers. What the research instead inferred was that the American participants displayed a strong tendency to reduce their vowels, while the Serbian participants did not reveal such a marked tendency to do the same.*

Key words: *duration, quality, intelligibility, reduce*

1. INTRODUCTION

English comprises twelve monophthongs or 'relatively' pure vowels[1] which can be divided into tense and lax, or short and long vowels. Serbian, on the other hand, contains only five vowels among which one cannot make the same distinction as among English vowels, for they merely occur in long or short syllables. Therefore, it is not unexpected that certain issues occur with Serbian speakers of English when they produce English vowels. It is maintained that the vowel quality and the vowel duration produced by

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[1] These will be referred to as *vowels* in the rest of the paper.

Serbian speakers can influence the aspects of intelligibility and "accentedness" during the process of acquisition of L2 (Paunović, 2009). Even though there has been a limited amount of research on the quality and duration of English vowels produced by different groups of Serbian L2 speakers, several studies, such as those of Marković (2009, 2015) Jakovljević & Marković (2015), Paunović (2009) and Savić (2009) indicate that Serbian speakers generally tend to display different kinds of issues in the production of English vowels. Namely, Paunović (2009) investigated possible implications for pronunciation teaching and the question of intelligibility which was set as the final outcome by the curricula, i.e. the intended result of the curricula was for the non-native speakers to sound intelligible rather than native. The paper analyzed vowel production in terms of neighbouring categories of vowels based on the projections by Neel (2008), and concluded that the Serbian subjects displayed certain problems regarding the distribution of the vowels in the acoustic vowel space, where vowels such as /i:/ and /ɪ/ were grouped close together. Additionally, another problem was discovered – that of the quality of certain vowels such as the vowel /æ/. The subjects were reported to have assimilated this vowel into the category of their L1 sound /a/. Hence, it was ascertained by Paunović that there remained serious doubt as to whether the participants had indeed acquired the English vowels, albeit their vowels had stable and delimited tokens during the production process. The study concluded that the duration of the vowels produced by the Serbian EFL speakers was not an impediment to their acquiring the L2 vowel quality. However, it was determined that their vowel quality did not exhibit stable consistency in different speaking contexts and thus the speakers' quality of vowels was claimed to have retained L1 vowel features. Furthermore, research undertaken by Marković (2009) deduced that the interference of the speakers' L1 sounds influenced the production of high English vowels /i:, ɪ, u:, ʊ/. The impact was predicted to have led to the speakers' retention of their 'foreign accent' (though the paper itself claimed that there might have been other reasons for this kind of accent, too). The paper strongly supported both Flege's and Best's models which had hypothesized about the interference of L1 vowel acquisition with that of L2 vowel acquisition. It supported Flege's prediction 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" (Marković, 2009, p. 4). The study also reinforced Best's assumption that L1 could largely impact the discriminability of L2 vowels if the categories of L1 and L2 sounds were close. The closer the categories in both languages, the poorer the discrimination. In another study, Marković (2015), investigated the acquisition of the contrast between the English vowels /e/ and /æ/, which is claimed to be one of the most difficult to acquire (for Serbian speakers), concluding that this distinction was not completely acquired, due to the incongruence in the quality of the vowels produced. The paper showed that this distinction was based chiefly on the duration of the vowels.

What is quite clear from some of the aforementioned studies and what ought to be underlined is that different groups of Serbian speakers of English display different kinds of problems during the production of English vowels. While the previous studies mainly explored the production of English vowels produced by Serbian native speakers comparing the results with one of the standard vowel classification charts[2] (figure 1)

[2] E.g. Ladefoged's "Vowels and Consonants: An Introduction to the Sounds of Language" (Ladefoged, 2001).

(Ladefoged, 2001, p. 43), the present study investigates how both highly proficient Serbian speakers of English and American native speakers produce English vowels. The paper endeavours to answer the main question: *What kind of problems do highly competent Serbian speakers have when producing English vowels, and how do the quality and duration of the vowels produced by the Serbian speakers differ from those of the American speakers*? The paper analyzes the length and the quality of English monophthongs in a given context, i.e. in two different reading assignments in order to answer this question.

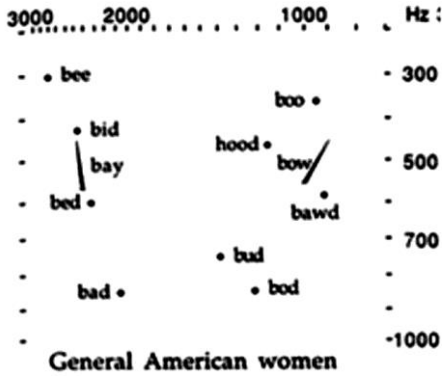

Fig. 1. The frequency values of the vowels produced by American women

The hypothesis was that the vowels produced by the highly proficient Serbian L2 speakers would be significantly different from the vowels of the American native speakers. It was predicted that the production of the vowels by the Serbian L2 speakers (subjects) would manifest certain problems regarding their duration and quality, such as unclear distinctiveness and delimitation of the vowels in Neel's sense and an unstable production of the vowels in different reading contexts which could ultimately be vital in vowel intelligibility.

The aim was to observe the vowel production "as such" (Paunović, 2009, p. 358) and not compared to their values determined by earlier studies. Therefore, the present study focuses on the neighbouring vowels and their production within different reading contexts for the purpose of obtaining an acoustic comparison of the two systems (those of the American and Serbian participants), which were quite crucial for establishing vowel intelligibility.

2. METHOD

2.1. Corpus selection

During the selection of the corpus, i.e. the collection of the written texts and thereby the necessary lexical items that would incorporate the targeted vowels, the items were chosen in two different *domains*. The first text was a dialogue borrowed from the late ESL language lab instructor, John Robinson's blog "ESL audio files" (2016). The dialogue, which was carefully analyzed and slightly modified for the present research,

exemplified a written form of three telephone calls. The calls take place in the following order: between a class teacher and a parent of a student; between the school counsellor and a parent of a student; and between an English teacher and a parent of a student. The second text was extracted from David Detering's paper (Detering, 2006). It is the story "The Boy who Cried Wolf", quite meticulously devised by Detering (2006), containing all the necessary elements for the analysis of the produced vowels.

The targeted lexical items that contain the necessary vowels can be found in any dictionary. The phonemic transcriptions of the lexical items were checked in the Oxford Advanced Learner's Dictionary. The dictionary displays two phonemic transcriptions, British and Northern American. Both of these were taken into consideration upon determining which lexical items were to be measured.[3]

The participants can be categorized into two groups: the American (native) speakers and the Serbian speakers (of English). The Serbian speakers were two female students of English at the Faculty of Philosophy, University of Nis. They completed all eight semesters at the Department of English, thus their English proficiency level was C1 to C2 (CEF), which further indicates that these participants were highly competent. The second group comprised two American female students who had come to Serbia as Fulbright scholars. All the participants were between 23 and 27 (average age 25.5).

2.2. Procedures

The research required the two tasks already mentioned to be read by the participants. The participants were told to relax as much as possible and to read the texts as many times as they needed, for the participants' most optimal performance was desired. The purpose of the first text, that is, the dialogue, was to enable the participants to produce the vowels by reading usual, 'every-day' sentences in a given context. The first text was systematically and carefully formulated to cover all the (pure) vowels. The second text was part of the research because it offered the participants the opportunity to read a story, which was not only different from the dialogue in its structure (form), but it was also logically structured for the purposes of any research that would involve reading.

The participants read the first text at the same time. They assumed roles A and B and they did not switch roles during the recordings. As regards the second text, the participants read the story one after another.

As advised by Detering, the study strived to measure the vowels which did not occur after the approximants /w/, /r/, and /j/, or before /l/, "as these approximants would have severe coarticulatory effects on the locations of the first three formants" (Detering, 1997, p. 47). Nevertheless, certain measured vowels assumed the position next to these consonants, as there were not enough 'clear' tokens to be found in the texts. With a view to thoroughly analyzing the produced vowels by utilizing many different tokens, the research required these examples as well.

In order for the research to be conducted and the results measured, it was not possible to include other effects on the production of vowels. Namely, the study performed the

[3] Based on the production of the vowels during the recordings, it was determined which version of the phonemic transcription would be used. For example, "flock" is transcribed in the dictionary as /flɒk/ (BrE) and /fla:k/ (NAmE). Both versions were considered during the analysis depending on how the speakers pronounced the lexical item. Additionally, both the strong and the regular version of the vowels were taken into consideration.

analysis by not taking into account the influence of the participants' speech rate, their physiological and/or emotional states, and the discrimination of the stressed and unstressed vowels within the two reading tasks. Even though it is maintained that the vowel production can be influenced by the aforementioned effects, it was beyond the purview of the research to include them.

2.2.1. Texts

The dialogue

"A: This is Mrs. Adams. I'm concerned about my son's grades.
B: Would you like us to schedule a conference with his teachers?
A: Yes, that would be great.
B: We'll go ahead and schedule the meeting.
A: Will you call me when it's been set up?
B: Yes, I'll call you tomorrow and let you know what time.

A: I'm mostly worried about his mark in English.
B: I agree, it's quite bad. I'll make sure that his English teacher is present.
A: He did rather well in math. If his math teacher can't take part in it, that's okay.
B: I'll try my best to notify all his teachers.
A: I can come to a meeting any day except Thursday.
B: All right. I won't ask them to come on Thursday.

A: Hello, Mrs. Adams. I'm Tom Parker the school counsellor.
B: Mr. Parker. I want to do what I can to help my son.
A: We're all trying to help him. He's having trouble with English.
B: I know that. I see him struggling with it.
A: His teacher tells me that John turns in homework late.
B: It's very difficult for him to finish his homework on time.

A: I'm Judy Wells, John's English teacher.
B: What can we do to bring up John's grades?
A: For one thing, he should turn in all his homework and do more exercises before the classes.
B: Has he missed any tasks?
A: Yes, he has. Last week he failed to finish a book report.
B: Oh, dear. I didn't know that.
A: Also, John is not very good at group work.
B: I will talk to him about group work, no problem" (Robinson, 2016).

Table 1 Lexical items included in the dialogue which contain the vowels that were analyzed[4]

	Participant A	Participant B
Vowel	Lexical items	Lexical items
/iː/	teacher, meeting, week	teachers, meeting, see
/ɪ/	This, Mrs., his, did, been	his, English, notify, Mr.
/e/	set, well, except, tells, yes;	ahead, schedule, yes, present
/æ/	Adams, can't, having, last	ask, bad, that,
/ʌ/	son's, up, come, trouble	come, son, struggling,
/ɑː/	mark, (rather), part, not	Parker, problem
/ɒ/	Tom, John	want, conference, John's
/ɔː/	call, more, before;	all, talk,
/ʊ/	book, good	(would), do
/uː/	school, group	schedule, group
/ɜː/	turn, concerned, Thursday, work	Thursday, homework, work

2.2.2. The story

The Boy who Cried Wolf

"There was once a poor shepherd boy who used to watch his flocks in the fields next to a dark forest near the foot of a mountain. One hot afternoon, he thought up a good plan to get some company for himself and also have a little fun. Raising his fist in the air, he ran down to the village shouting "Wolf, Wolf." As soon as they heard him, the villagers all rushed from their homes, full of concern for his safety, and two of his cousins even stayed with him for a short while. This gave the boy so much pleasure that a few days later he tried exactly the same trick again, and once more he was successful. However, not long after, a wolf that had just escaped from the zoo was looking for a change from its usual diet of chicken and duck. So, overcoming its fear of being shot, it actually did come out from the forest and began to threaten the sheep. Racing down to the village, the boy of course cried out even louder than before. Unfortunately, as all the villagers were convinced that he was trying to fool them a third time, they told him, "Go away and don't bother us again." And so the wolf had a feast" (Detering, 2006).

Table 2 Lexical items from the story which comprise the vowels that were analyzed

Vowel	Lexical items
/iː/	even, sheep, (feast)
/ɪ/	little, fist, this
/e/	shepherd, next, pleasure, successful
/æ/	plan, exactly, ran
/ʌ/	up, company, fun, cousins, much.
/ɑː/	dark, afternoon, not, (after)
/ɒ/	flocks, long
/ɔː/	(poor), thought, short, more
/ʊ/	foot, good, looking
/uː/	afternoon, soon, two, zoo
/ɜː/	heard, concern, third

[4] The underlined vowels were measured.

2.3. Measurements

A laptop and a Microsoft lx-3000 headset microphone were used to conduct the recordings, which were made in the sound recorder and then analyzed in PRAAT, speech analysis computer software (Boersma & Weenik, 2015). The vowel duration in seconds (s) and the quality of the vowels expressed in formant frequencies were measured in this software, and the results can be seen in the tables below. Mean formant values, F1 and F2 (for vowel quality), were plotted into an Excel file for plotting the vowels by entering the formants of each vowel separately, with one worksheet for each English vowel. After calculating the average formant values expressed in Hz, these were converted into the Bark scale using the formula of Zwicker and Terhardt (2010) and then added onto a chart of F1 (y-axis) against F2 (x-axis) in order to provide an image of the distribution of the vowels in the articulatory space; that is, to display the quality of the vowels by illustrating whether and how much they were open or close (high or low) and front or back. The Bark auditory scale was used in order for the research to follow the formant-based normalization method vital for the authentic representation of the speakers' auditory and perceptual domains.

3. RESULTS

3.1. Vowel quality

Table 3 shows the vowel quality produced by both American participants who read the dialogue.

Table 3 Mean formant values of the vowels produced by the American participants while reading the dialogue

	(Hz)	iː	ɪ	e	æ	ʌ	ɑː	ɒ	ɔː	ʊ	uː	ɜː
A	F1	570	555	879	1001	1001	1088	1010	970	673	609	803
	F2	2492	2014	1708	1980	1616	1763	1572	1855	1692	1689	1847
B	F1	628	729	982	1166	1070	1094	1052	1192	690	1032	989
	F2	2712	1945	2202	1844	2068	1925	1969	1873	2680	2329	1657

Table 4 illustrates the formant values produced by the American participants while reading the second text, that is, the story.

Table 4 Mean formant values produced by the American participants while reading the story

	(Hz)	iː	ɪ	e	æ	ʌ	ɑː	ɒ	ɔː	ʊ	uː	ɜː
A	F1	483	679	811	872	835	937	897	825	572	541	784
	F2	2823	1866	1820	1981	1708	1705	1623	1557	1675	2035	1785
B	F1	432	720	893	905	924	1063	996	952	732	605	844
	F2	2753	1776	1872	2065	1717	1699	1750	1821	1780	2237	1753

F1 and F2 values for the vowel quality, produced by the Serbian participants are illustrated in Tables 5 and 6.

Table 5 Mean formant values of the vowels produced by the Serbian participants while reading the dialogue

	(Hz)	iː	ɪ	e	æ	ʌ	ɑː	ɒ	ɔː	ʊ	uː	ɜː
A	F1	346	397	692	673	588	640	724	471	504	372	551
	F2	2937	2398	1738	1763	1342	1369	1232	962	1494	1115	1487
B	F1	459	447	763	963	883	916	813	940	620	650	717
	F2	2741	2472	2075	1976	1602	1524	1313	1294	2092	1196	1648

Table 6 Mean formant values of the vowels produced by the Serbian participants while reading the story

	(Hz)	iː	ɪ	e	æ	ʌ	ɑː	ɒ	ɔː	ʊ	uː	ɜː
A	F1	330	440	687	804	635	734	550	554	463	319	582
	F2	3013	2193	2033	2017	1353	1287	1255	1104	1370	1935	1765
B	F1	507	497	913	928	1004	1075	935	1000	538	688	835
	F2	2463	2275	2032	2037	1501	1543	1327	1663	1267	1382	1760

The average values were plotted into the Bark scale and the results can be observed in figure 2 (for each participant) and in figure 3 (for the two groups of participants). The values of the first formant (F1) of each vowel are placed on the vertical axis and they show the degree of openness or raising of the tongue during the production process. F2 (second formant) values specify the location of the vowel on the horizontal axis and thereby indicate the part of the tongue most involved in the production of a vowel: front, central or back part. A wide range of approaches to a vowel's front-back quality hold that the difference between F2 and F1 ought to indicate the true quality of a vowel in terms of it being front, central or back. From the research it can be inferred that only the mean F2 values were measured and that no difference between the second and the first formant was looked for. Even though these contemporary approaches claim that the "front-back dimension has a more complex relationship to formant frequencies," (Paunović, 2009, p. 361) the traditional approach of selecting F2 only was preferred to the modern one, because of the already-applied normalization technique used in the Bark scale.

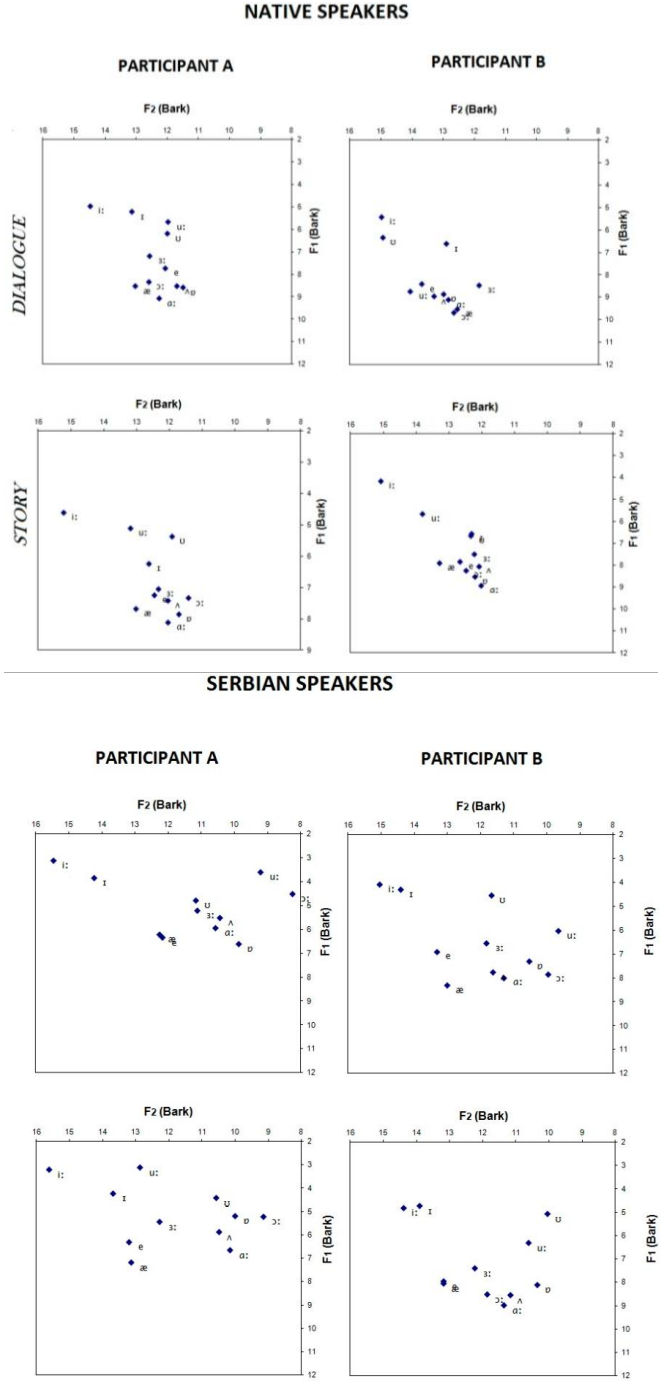

Fig. 2 Values plotted into the Bark chart

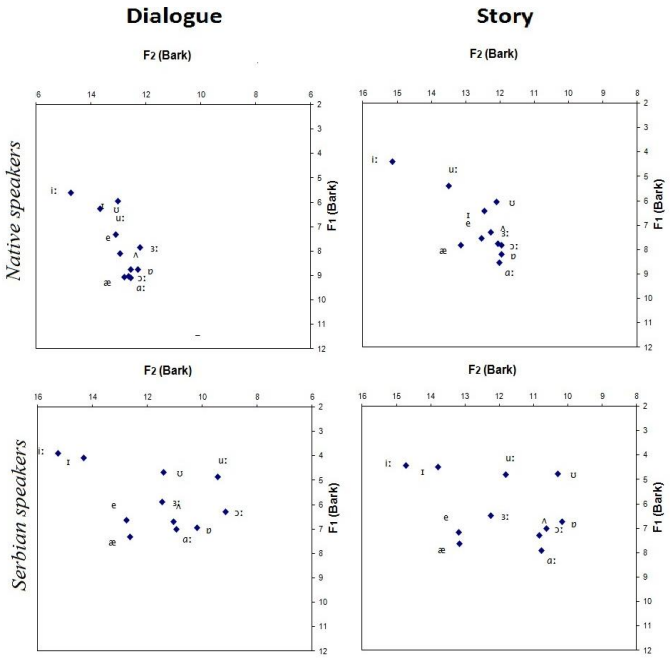

Fig. 3 Average formant values plotted into the Bark scale for both groups of participants

3.2. Vowel duration

The vowel duration was as important for the research as the vowel quality. Therefore, the following tables present the results of the measurements.

Table 7 The average duration of the vowels produced by the American participants while reading the dialogue

	Participant A	Participant B
vowel	average duration in seconds	average duration in seconds
iː	.072005	.065983
ɪ	.059841	.050042
e	.082886	.045932
æ	.092175	.124988
ʌ	.064315	.034117
ɑː	.098777	.075132
ɒ	.071880	.052901
ɔː	.032548	.076686
ʊ	.036688	.030580
uː	.060417	.071567
ə	.077662	.078723
ɜː	.087877	.070783

Table 8 The average duration of the vowels produced by the American participants while reading the story

	Participant A	Participant B
vowel	average duration in seconds	average duration in seconds
iː	.062101	.084739
ɪ	.030625	.065822
e	.051370	.063038
æ	.135898	.134467
ʌ	.044486	.052213
ɑː	.091766	.116445
ɒ	.077012	.084271
ɔː	.080012	.106511
ʊ	.060303	.065049
uː	.127712	.112315
ə	.059533	.064712
ɜː	.087877	.109958

Table 9 The average duration of the vowels produced by the Serbian participants while reading the dialogue

	Participant A	Participant B
vowel	average duration in seconds	average duration in seconds
iː	.093882	.091379
ɪ	.061465	.046579
e	.081274	.147734
æ	.100718	.172460
ʌ	.082571	.125025
ɑː	.119958	.163769
ɒ	.083571	.125277
ɔː	.083198	.110603
ʊ	.061542	.110663
uː	.091332	.135445
ə	.060622	.083146
ɜː	.097867	.125785

Table 10 The average duration of the vowels produced by the Serbian participants while reading the story

	Participant A	Participant B
vowel	average duration in seconds	average duration in seconds
iː	0.073427	0.075945
ɪ	0.063159	0.093585
e	0.082901	0.083980
æ	0.136878	0.119719
ʌ	0.066239	0.086178
ɑː	0.141557	0.131523
ɒ	0.102837	0.129087
ɔː	0.132676	0.124757
ʊ	0.057158	0.080261
uː	0.132133	0.168861
ə	0.057086	0.083146
ɜː	0.121676	0.122134

Table 11 The average duration of the vowels

	American	Serbian
vowel	average duration in seconds	average duration in seconds
iː	0.071207	0.083658
ɪ	0.051582	0.066197
e	0.060806	0.098972
æ	0.121881	0.132439
ʌ	0.048782	0.090003
ɑː	0.095529	0.139201
ɒ	0.071516	0.110193
ɔː	0.073939	0.112808
ʊ	0.048154	0.077406
uː	0.093002	0.131942
ə	0.070157	0.070998
ɜː	0.089123	0.116865

4. DISCUSSION

4.1. Vowel quality

The results obtained can be used with the objective of testing the working hypothesis of this paper. The starting assumption regarding the difficulties that the highly proficient Serbian L2 speakers would have during the production of English vowels is most certainly challenged, if not entirely disproved, by the results of the research. Namely, it is evident that there are differences between the two groups of participants in the production of the vowels, but what inter- and intra-speaker variation acoustic analyses indicate is that the highly competent Serbian L2 speakers are not beset with serious issues with respect to

the quality of the vowels in the reading tasks. Distinctiveness between the neighbouring vowels, which might negatively affect the participants' intelligibility, does not represent a problem for the Serbian subjects involved in the research.

In view of the analysis of the quality of the vowels produced by the Serbian participants, the conclusion can be made that there are, albeit not in all cases, difficulties with respect to their distinguishing between the English vowels /æ/ and /e/. Based on the plotting in Bark's scale, it is evident that Marković's (2015) prediction, arguing that these two vowels were not entirely acquired by the highly competent Serbian L2 speakers, cannot be contradicted.

On the other hand, Marković's research (2009) on the production of high vowels (iː, ɪ, uː and ʊ) that corroborated Flege's and Best's models is not supported by the present research. The results that her research revealed are not in accordance with the results yielded by the present study. The difference between the short and long /i/ sound produced by the Serbian participants is manifested both at the level of front-back and at the level of high-low vowel quality. Thus, it can be claimed that the Serbian participants do distinguish between these two, not only in terms of their length, but also in terms of their formant frequency values.[5]

The production of the /ɑː/ vowel which chiefly occurred in the central position quite close to the vowel /ʌ/ can be said to have been a problem for the Serbian participants. Based on the degree of openness and the degree at which the tongue was raised during the production of the vowel, the values indicate centralization of the vowel. Instead of being open or low and back, this vowel was produced as central and open-mid. Therefore, it may be inferred that the Serbian participants have not completely acquired the vowel /ɑː/ in terms of its quality. There are also quite prominent variations in their production of the vowels /ɔː/ and /ɒ/. The participants exhibited a tendency to slightly centralize these vowels, but they still produced them with the back part of the tongue and the vowels were close-mid towards open, which implies that the speakers did not have significant problems with the production of these two vowels.

What is essential to note here is that the results demonstrate quite an unorthodox 'image' of the vowels produced by the American participants. The received values and their being plotted onto the chart indicate that the American participants tended to centralize almost all of their vowels, while the Serbian subjects did not centralize their vowels to that extent. The vowels produced by the Serbian participants suggest that the wide distribution of the vowels in the acoustic space in terms of their quality does exist in their acquired phonological structure, which means that the hypothesis stating that the highly competent Serbian speakers of English tend to have issues with the production of vowels, which generally affects their intelligibility, can be rejected at this stage.

In view of the acoustic analysis, the results show that certain patterns can be observed. The participants' values for the vowel /iː/ point to the fact that this vowel is still produced by the majority of speakers of English as a close, high, and front vowel. All the participants pronounced it in this way, too.

The English vowel /ɪ/ is, according to the traditional views, descriptions and features, a front to central and above close-mid vowel. These distinctive features were retained in the production of this vowel by the Serbian participants. However, it can be seen from the

[5] The production of /uː/ and /ʊ/ has yielded different results which are discussed later in the paper.

results that there is a difference between the F1 and F2 values between the two groups. The degree of the raising of the tongue varies and it can be observed that it is mostly at a high position with the Serbian participants, while it is central, or between the open-mid and close-mid position with the American participants. Additionally, the vowel produced by the American participants is much more centralized than that of the Serbian participants.

When it comes to the rest of the high vowels /uː/ and /ʊ/, the results revealed that these are still relatively high, but they are not back vowels anymore. In almost every case, these vowels were produced either by the central part of the tongue or even by the front part of the tongue, which is altogether atypical. This raises another crucial question for the future investigation of vowel quality: *Why are these vowels centralized?*

4.2. Vowel duration

The results show that the vowel length is not an issue for the Serbian participants. Namely, they made a significant distinction between the duration of short and long vowels during their production. A distinction was also made between /æ/ and /e/ in duration, where ash was usually longer than /e/, which again indicates that the differentiation between these two is chiefly made in terms of their duration, but not (always) in terms of their quality. It can also be noticed that /e/ and /ɒ/ are longer than the rest of the short vowels and even longer than some long vowels. This again might suggest that the /e/ vowel has retained the quality of the Serbian vowel /e/, while the vowel /ɒ/, based on its duration, has not been entirely acquired by the highly competent Serbian L2 speakers.

The tables reveal some other quite interesting aspects of vowel duration, too. When it comes to variations among the groups of participants, it can be said that surprisingly every single vowel produced by the American participants is shorter than those of the Serbian subjects. While these differences are not quite significant in some vowels such as /iː/, /ɪ/, /æ/ and /ə/, the vowels such as /ʌ/ and /ʊ/ produced by the American speakers are almost two times shorter.

5. FUTURE IMPLICATIONS

Based on the results of the duration and the quality of the vowels produced, the study is obliged to ask another question: *Why are the vowels produced by the American speakers more centralized and shorter than those produced by the Serbian participants?* The answer does not lie in the present study, but the present study might be a solid basis for new research that would provide an answer to this question. In the last two decades, there have been numerous research papers on the habitual feature, regularly exhibited by native speakers, called v*owel centralization* or *vowel reduction*. Vowel reduction is present today in the native speakers' production of vowels to such an extent that the charts of vowels presented in twentieth century books and papers are close to being entirely modified. This study, albeit narrow in scope, has proved that native speakers tend to reduce their vowels in terms of their quality and their length. In her study, Marković (2009, p. 5) argued that the high vowels /uː/ and /u/ should not be plotted in the back auditory space of the vowel chart, but that they should be central to front vowels as much novel research has indicated. Based on the plotting done in the Bark scale, it is evident from the present study that most of the vowels produced by the American speakers have gained a schwa-like characteristic, called by some authors the *schwa phenomenon* in

English vowels (Ahn, 1997). Moreover, languages are conventionally divided into stress-timed and syllable-timed languages according to certain rhythmic features. Stress-timed languages tend to manifest accentual isochrony, while syllable-timed languages display syllable isochrony. English, all Germanic languages, and Russian are typical stress-timed languages, while French, Japanese, Spanish, and Finnish belong to the category of syllable-timed languages. This categorization has an impact on the phenomenon of vowel reduction, since a large number of studies suggest that the unstressed syllables of the stress-timed languages tend to be reduced, whereas the syllables of the syllable-timed languages do not usually exhibit such a tendency. Ahn Soo-Woong argues that the "English vowels tend to be reduced to schwa systematically when they are in unstressed syllables. This is characteristic of the English language. In many other languages like Italian, Spanish, Korean, Japanese, etc. vowels are not reduced to schwa in any situation. Those foreign language learners whose native language does not have the schwa phenomenon tend to mispronounce the unstressed English vowels. This makes their pronunciation sound foreign" (1997, p. 257). The present study cannot reveal whether Serbian vowels are reduced in unstressed syllables, and so this issue remains to be explored. What can be observed in the present study, though, is that even the highly proficient Serbian L2 speakers have a tendency to centralize their vowels, especially the high vowels /i:/ and /I/ and sometimes a low one /o:/, which might imply that they have also begun to attain native-like pronunciation patterns to some extent. Nevertheless, their centralization is not as striking or graphic as that of the American participants. Jakovljević and Marković (2015), analyzing the acquisition of clipping of English vowels by advanced Serbian learners, obtained results that showed "a significantly lower degree of vowel clipping in Serbian" (Jakovljević & Marković, 2015). Interpreting the results, they concluded that there was the transfer from the Serbian vowel structure to the English one regarding the production of English monophthongs.

Therefore, it should be noted that vowel reduction occurred with the American participants to a high degree, while the degree of vowel reduction in the vowels produced by the Serbian participants is quite low. Still, no conclusive interpretation of this phenomenon can be made based merely on this study, which is why the paper suggests that future studies should investigate both the analysis of inter- and intra-speakers variations of the reduction of the vowels produced by the Serbian and American speakers.

6. CONCLUSION

From the analysis of the data collected the research paper came to two important conclusions. First of all, the assumption that the highly competent Serbian L2 speakers tend to exhibit problems which may affect their intelligibility cannot be validated by this research. Furthermore, with respect to the previous research papers[6] which confirmed the two models mentioned above, it ought to be said that their postulated principles cannot be supported by this research. The present study clearly showed that the highly proficient Serbian speakers of English do not display major (or any) issues when producing the vowels. In addition, their sounding non-native, or their retaining 'accentedness', if important at all for the modern approaches to phonological and acoustic analysis, does

[6] The research already mentioned in the paper.

not ensue from the Serbian speakers' incomplete acquisition or 'poor' production of the vowels, but it is an effect of other possible traits in their speech (consonant production, suprasegmentals, etc.).

The second conclusion that can be reached from the present study is that the American speakers manifest, judging by the traditional categorization of vowels, atypical features during the production of vowels. One of these features, which is becoming an intrinsic quality in the native speakers' speech, is called vowel reduction. Moreover, it is often argued that due to certain clipping effects upon the vowels, the vowels produced develop a schwa-like output form. Whether the phonological structure of the Serbian language tends to have these characteristics is still a debatable question, but what is apparent from the present research paper is that the schwa-like feature was not markedly manifested during the production of vowels by the Serbian participants. In most cases, the Serbian participants did not reduce or obscure their vowels and thus the produced vowels were not made centralized; whereas this was not the case with the American participants. Whether this lack of vowel reduction is a consequence of the Serbian speakers' incomplete acquisition of the English vowel system or there is certain interference of the Serbian vowel system upon the English one is a matter of further discussion. The question might be answered by future research papers.

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AKUSTIČKA ANALIZA ENGLESKIH SAMOGLASNIKA KOJE SU IZGOVORILI AMERIČKI GOVORNICI I SRPSKI GOVORNICI VEOMA NAPREDNOG ZNANJA ENGLESKOG

Rad predstavlja nalaze dobijene prilikom istraživanja koje se bavilo ispitivanjem akustičkih osobina vokala srpskih govornika veoma naprednog znanja engleskog jezika i osobina vokala koje su izgovorili američki govornici, prilikom čitanja dva teksta. Istraživanje je uključilo četiri učesnika: dve osobe ženskog pola iz Amerike i dve osobe ženskog pola iz Srbije koje poseduju veoma napredno znanje engleskog. Učesnicima je rečeno da pročitaju dijalog i priču nakon čega je izmerena dužina trajanja određenih vokala kao i kvalitet istih. Na osnovu analize skupljenih podataka, rezultati su pokazali da su razlike u izgovorenim vokalima izmedju ove dve grupe govornika postojale, ali se moglo zaključiti da, uprkos tim razlikama, srpski učesnici nisu imali nikakvih problema koji bi u velikoj meri, ili uopšte, negativno uticali na razumnjivost njihovog engleskog. U poređenju sa američkim govornicima, ni kvalitet ni dužina vokala nisu bili kritični za srpske učesnike. Umesto problema, ono što je istraživanje zaključilo je da srpski učesnici nisu bili preterano skloni da centralizuju svoje vokale, dok je ova tendencija kod američkih učesnika bila prisutna u velikoj meri.

Ključne reči*: samoglasnici, dužina trajanja, kvalitet, razumljivost.*