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Marija N. Janevska[1]
University of Kragujevac
Faculty of Philology and Arts
English Department

THE PRODUCTION OF HIGH BACK VOWELS: A CONTRASTIVE STUDY OF AMERICAN ENGLISH AND STANDARD SERBIAN[2]

This paper reports on the findings of a contrastive study of American English high back vowels /u, ʊ/ and Serbian vowel /u/ produced by ten male native speakers of Serbian. Previous research (Marković 2009a; Bjekić, Čubrović 2021; Čubrović 2019, 2017; Dančetović, Nešić 2017) has indicated that the differences in quality between the English high back vowels /u/ and /ʊ/ are often poorly detected by Serbian speakers. Therefore, the overall aim of the present research is to observe the acoustic properties of high back vowels in the given languages, so as to determine whether or not our subjects can adequately produce the L2 vowels with respect to both quality and quantity, and whether they can differentiate them from their L1 categories. The research subjects were first instructed to read a set of 13 monosyllabic English words representing the high back vowels /u, ʊ/ in different phonetic environments. The second task called for the subjects to read a set of 13 Serbian words representing the vowel /u/ in short and long stressed syllables. The collected speech samples were then analyzed acoustically using *Praat,* version 6.2.13 (Boersma, Weenink 2022). The statistical analysis of the acoustic measurements was performed using *R*, version 4.2.1 (R Development Core Team 2022). The results suggest that, in terms of quantity, in the speech of Serbian students, the lax vowel, in particular, bears more resemblance to the subjects' L1 category, rather than the targeted vowel. The analysis of the formant data indicates that, although our subjects' L2 categories differ from those of native speakers, the quality of GA high back vowels our subjects produce does not reflect the quality of their L1 categories.

Keywords: vowel quality, vowel quantity, monophthong, high back vowels, General American, Standard Serbian

1 marija.janevska@filum.kg.ac.rs

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1. INTRODUCTORY REMARKS

It has been well documented in EFL literature that *Standard*[3] *British* and *Standard American* are the two varieties[4] studied by most foreign learners (Trudgill, Hannah 2008: 6; Algeo 2006: 1). This is partly because these are the reference accents for nearly all teaching materials on English pronunciation, both in the UK and the US, as well as internationally (Ashby 2011: 11). With regard to the Serbian educational context, almost all teaching materials have British English as their reference accent (Paunović 2011; Jerotijević Tišma, Karavesović 2019; Čubrović, Bjelaković 2020). However, in recent years, there has been a growing body of experimental studies (Stojić 2017; Čubrović, Bjelaković 2020; Janevska 2022) reporting the advance of the American variant among Serbian students, not only in informal domains, but also institutionally. This growing exposure to American English has led, at least in part, to a change regarding the students' preferred pronunciation model. Namely, a study carried out by Stojić (2017: 312) showed that up to 61.7% of Serbian students reported using the American variety, compared to the author's earlier study (1997), where only 15.8% of the respondents opted for the said variant. In a more recent study (Janevska 2022: 167), 64% of Serbian students labeled their own accent as American. There are several consequences of this change, one of them being the need to focus more on analyzing our students' success when trying to approximate the American Standard, since, according to the latest data, approximating this particular variety seems to be the students' ultimate objective.

Also, we must not overlook the fact that attaining a native-like accent remains a high priority goal for Serbian students (Janevska 2022: 166), despite the insistence of certain scholars (e.g. Jenkins 2006) that a more simplified variety, such as *ELF* (*English as a Lingua Franca*), should be a more realistic goal for EFL learners. Nevertheless, there is some truth to the general observation that, regardless of the students' inclination towards a specific native model, more often than not, EFL learners fail to attain the preferred English variety. Researchers generally agree that this is partly due to the fairly frequent transfer of L1 categories (Flege 2002: 224; Liu 2011: 118; Chuan 2010: 101). Consequently, vowel studies have

3 *Standard pronunciation* is the pronunciation most commonly taught in formal language instruction, especially in countries where English is a nonnative language (Bussmann 1996: 1117; Quirk et al. 1985: 7). It is the variety which has been codified in dictionaries, grammars and usage handbooks (Biber et al. 1999: 18) and is customarily regarded as the pronunciation of the educated class (Bussmann 1996: 1117).

4 *Varieties* (or *dialects*) differ among themselves in terms of their syntax, lexicon, morphology and pronunciation (Wells 1982: 3; Carr 2008: 8). If we speak of different *accents*, we typically refer solely to pronunciation differences (Wells 1982: 3). However, in this paper, the terms *variety* and *accent* will be used synonymously, since we only wish to describe Serbian and English with respect to their phonetic properties. Also, the term *accent* will not be used here in its other sense, i.e. as a synonym for *stress* (ibid.: 2).

focused on contrasting vowel inventories of various languages in the hopes of getting a better understanding of the nature of such transfer.

Given the prevalence of American English among Serbian students, this research focuses on the analysis of the quality and quantity of *General American* vowels /u/ and /ʊ/ (hereafter *GA*)[5] and Serbian vowel /u/. The analysis carried out in this study focused on these particular vowels since there has been a number of research papers (Marković 2009a; Bjekić, Čubrović 2021; Čubrović 2019, 2017; Dančetović, Nešić 2017) indicating that Serbian students have particularly hard time noting the quality differences between these target sounds. Therefore, we primarily wish to see whether or not our subjects can adequately produce the L2 vowels with respect to both quality and quantity, or whether the reasons underlying their failure stem from the aforementioned phonetic transfer. Before we do so, however, it is necessary to briefly take a closer look at the vowel systems of Standard Serbian and General American, which are discussed in the succeeding segment of this paper.

1.1. THE VOWEL SYSTEM OF GENERAL AMERICAN AND STANDARD SERBIAN

In general, the GA vowel system comprises sixteen vowels /i, ɪ, e, ɛ, ɑ, æ, u, ʊ, o, ɔ, ʌ, ɜ, ə, aɪ, aʊ, ɔɪ/ (Giegerich 1992: 47), although in some dictionaries and usage handbooks (e.g. Wells 1982: 120; Cassidy 1985: xiii) the vowel inventory of GA is described as comprising fifteen vowel phonemes. The difference is essentially made on the basis of whether or not the vowel /ə/, which is restricted to unstressed syllables (Wells 1982: 120), is included. Vowel inventories are custommarily organized into pairs, or sets, in terms of the high–low and front–back dimension, or the long–short opposition (Giegerich 1992: 48). Thus, some scholars (ibid.: 58) have suggested that it may be possible to establish a structured system with the following pairs of GA vowels: /i/-/ɪ/, /e/-/ɛ/, /ɑ/-/æ/, /u/-/ʊ/, /o/-/ʌ/. In each pair, the left-hand member is longer than its right-hand counterpart and can end syllables, while the one on the right cannot. The remaining vowels (/ɔ/, /aɪ/, /aʊ/ and /ɔɪ/) are not organized into pairs, i.e. they do not have a phonetically similar counterpart which is restricted to closed syllables (ibid.). This is why Wells (1982: 120), for instance, distinguishes between *checked vowels* (/ɪ, ɛ, æ, ʌ, ʊ/), which cannot occur in a stressed monosyllable that is open, and *free vowels* (the remainder), on which there are no such constraints.

5 *General American* (abbreviated to *GA*) is a term that denotes a range of American accents which are broadly similar (Carr 2008: 62). This accent conveys almost no information regarding the speakers' regional background and is defined as not being the Southern US accent (which covers the area from Virginia to Texas and southwards), nor the accent spoken in the northeastern seaboard of the USA (New York City, Boston and New England) (Cruttenden 2001: 85; Crystal 2008: 207; Carr 2008: 62; McMahon 2002: 69). It is the most widely spoken variety in the US (applied to the two-thirds of the American population) and the American accent most commonly taught to EFL learners (Wells 1982: 1). Other terms for GA are *Network English* and *Network Standard* (Crystal 2008: 207).

Still, the vowel inventory of GA is more commonly described as consisting of *lax vowels* /ɪ, ɛ, æ, ʌ, ʊ, ə/, *tense vowels* /i, ɑ, ɔ, u, ɜ, e, o/, and *wide diphthongs* /aɪ, aʊ, ɔɪ/ (Jones 2006: x). Lax vowels generally occupy a lower position in the vowel space, they are made with less oral tension and they typically do not end syllables (Yavaş 2011: 79). Conversely, tense vowels have a higher tongue position, are longer compared to the lax vowels, and their production usually involves greater muscular effort (ibid.). As for the front–back dimension, GA vowels can be classified as: *front* /i/, /ɪ/, /e/, /æ/, /ɛ/; *central* /ʌ/; or *back* /u/, /ʊ/, /o/, /ɔ/, /ɑ/ (ibid.: 78). With regard to the high–low dimension, there are: *high* vowels /i/, /ɪ/, /u/, /ʊ/; *mid* vowels /e/, /ɛ/, /o/, /ɔ/; and *low* vowels /æ/, /ɑ/, /ʌ/ (ibid.: 79). Further distinction can also be made on the basis of lip rounding, resulting in categories like *rounded* (/u/, /ʊ/, /o/, /ɔ/) and *unrounded* vowels (the remaining). It is widely observed that dialectal variation in English pertains more to the differences in vowel, rather than consonant inventories (Yavaş 2011: 77). One of the most notable phonemic differences between GB[6] and GA is that the vowel /ɒ/ does not occur in GA. Therefore, words like *lot* or *salt* usually have /ɑ/ or /ɔ/ instead (Cruttenden 2001: 85; McMahon 2002: 75, 95). Moreover, unlike in GB, in GA there are no centering diphthong phonemes (McMahon 2002: 80). In fact, the traditional description of GA vowels lists only three diphthongs: /aɪ, aʊ, ɔɪ/ (Yavaş 2011: 78). Given that the diphthongal movement in /eɪ/ and /oʊ/, although present, is not as noticeable in GA, as it is in GB, these are treated as tense vowels /e, o/, rather than diphthongs (Jones 2006: ix). When it comes to vowel duration, the long/short distinction, typical of GB vowels, is not present. This is quite evident in the symbolization of tense vowels, in that they are represented without the length mark /:/. Namely, the duration is conditioned by phonetic environment (Yavaş 2011: 80; Wells 1982: 120; Jones 2006: ix; Collins, Mees 2013: 159), and so, GA vowels are essentially longer in stressed, open syllables, and before voiced consonants (Yavaş 2011: 80–81). For the present study, it is important to note the following: a) /u/ is classified as tense, while /ʊ/ is a lax vowel; b) the tense vowel is slightly diphthongal (Yavaş 2011: 85); c) the fundamental difference between /u/ and /ʊ/ lies primarily in the way they are positioned in the vowel space, i.e. their spectral features.

The vowel inventory of Standard Serbian is traditionally described as comprising five vowel segments /a, e, i, o, u/, i.e. two *front* vowels /i, e/, two *back* vowels /u, o/, and one *central* vowel /a/. These vocalic segments are additionally categorized according to the high–low dimension, giving rise to two *high* vowels /i, u/, two *mid* vowels /e, o/ and one *low* vowel /a/ (Miletić 1952: 17; Simić, Ostojić 1996: 178). The back vowels tend to be rounded, although this is not their defining feature, it is, in fact, regarded as redundant (Subotić et al. 2012: 44). Although Serbian vowels can all be realized as short and long, their length is not a phonemic feature

6 In this paper, the term *General British* (*GB*, for short) will be used to refer to the Standard British pronunciation model.

(Marković, Sredojević 2021: 53–54). Rather, it is a prosodic phenomenon (ibid.). The accentual system of Standard Serbian comprises four accented prosodimes that are further distinguished on the basis of quantity and quality, giving rise to: *long falling* /˜/, *short falling* /ˇ/, *long rising* /ˊ/ and *short rising* prosodime /ˋ/ (Petrović, Gudurić 2010: 117; Subotić et al. 2012: 98). Falling accents are typically tied to monosyllables, whereas the rising accents stretch over two syllables, with the first one being perceived as stressed (Sredojević, Marković 2020: 35). However, it is important to note that accent type (rising/falling) does not exhibit a substantial influence on the quality of Serbian vowels, while accent quantity does (Lehiste 1977: 31; Marković, Sredojević 2021: 56; Marković, Bjelaković 2006: 342). Consequently, scholars like Čubrović (2015: 203) argue that, when contrasting vowel inventories, it is often advisable to divide Serbian vowels into short and long subsystems, for the sake of ensuring a more reliable comparison with other vowel systems.

Experimental studies (Marković, Sredojević 2021: 70–72; Marković, Bjelaković 2006: 341–342) suggest that the main quality difference between the /u/ vowel in short and long syllables is achieved by a slight centralization of the short variant. Still, this difference is not big enough to yield a substantial quality difference (Marković, Bjelaković 2006: 341), and so, the short and long variant occupy much of the same area in the vowel space (Marković, Sredojević 2021: 71). As a consequence of the insufficient quality differences, the differences in duration between these vowels are much more pronounced (Marković, Bjelaković 2009: 153–155).

2. A REVIEW OF THE RELEVANT LITERATURE

In general, contrastive studies of Serbian and English (Marković 2009a; 2009b; Paunović 2011; Dančetović 2017; Dančetović, Nešić 2017; Bjelaković 2018; Sudimac 2016) have largely shown interest in exploring the Standard British pronunciation model. As mentioned before, in the introductory section of this paper, this can be attributed to the prevalence of the British variant with regard to the teaching materials Serbian students are exposed to through formal education. Although such studies are of great value, this paper will not include a detailed overview of their findings. Rather, we will focus more on the contrastive studies that are of more crucial importance to this particular research, i.e. the studies that pertain to the vocalic system of American English. We will, however, only point to the research findings in relation to the high back vowels.

In one of her papers, Čubrović (2017: 63) explores acoustic features of nine American English monophthongs /i, ɪ, ɛ, æ, ʊ, u, ʌ, ɑ, ɔ/ produced by ten male native speakers of Serbian living in the United States, and four native speakers of American English (AE, henceforth). The subjects' age ranged from 35 to 44. Their task was to read the following monosyllabic

words representing the nine target vowels: *beat*, *bit*, *bet*, *bat*, *but*, *boot*, *put*, *bought* and *pot*. These words were embedded in the frame sentence "Say _____ again". The author's (ibid.: 64–65) findings indicated that Serbian speakers show a strong tendency towards merging the American high back vowels /ʊ/ and /u/. In fact, the subjects were unable to recognize the quality differences between these sounds, which was particularly evident from the lower F_1 values for /ʊ/. Consequently, the vowel /ʊ/ was much higher and closer to /u/ in the vowel space. Another observation made by the author (ibid.: 65) was that the subjects relied more heavily on phonetic duration when trying to differentiate between the two target sounds.

A later study conducted by Čubrović (2019) delves more deeply into the relationship between duration and vowel quality of AE vowels. Nine monophthongs, which were the subject of the author's previous study (2017), were analyzed in the context /bVt/, and were embedded in the same carrier sentence as in the previous research. The original intent of this study (2019) was to observe the role vowel duration plays in distinguishing between AE vowels. Ten male native Serbian speakers residing in the US, as well as five native speakers of AE, took part in the research (ibid.: 19). Somewhat of the same pattern is observed, compared to the earlier study (2017), in that the subjects were unable to produce the AE vowels /ʊ/ and /u/ without a substantial degree of overlap. Namely, the difference between the tense and lax vowel was essentially made on the basis of vowel duration. Average duration for the tense and lax AE vowel in the speech of Serbian informants was 154.5 ms and 80.3 ms, respectively (Čubrović 2019: 22). What was particularly interesting was that the vowels produced by Serbian EFL speakers were consistently longer in duration compared to the measured values for native AE speakers (ibid.: 26). However, the native speakers in this research came from the North-East of the US.

In a study she coauthored with Čubrović, Bjekić (2021) observed the quality of nine AE vowels /i, ɪ, ɛ, æ, ʊ, u, ʌ, ɑ, ɔ/ produced by nine native Serbian speakers. The obtained formant frequencies were compared with the reference values for nine male AE speakers, adapted from an earlier study done by Čubrović (2016). The group of informants was dialectally homogeneous since all subjects came from Čačak, a city in central Serbia (Bjekić, Čubrović 2021: 67). Furthermore, they were all students of Technical College of Vocational Studies, and their age ranged from 19 to 21. The informants produced monosyllabic words with CVC structure, where the initial consonant was either /b/ or /p/ and the final consonant was /t/. The test words were embedded in a frame sentence "Say____again". General conclusion of the authors' (ibid.: 69) findings was that there is no clear distinction between AE vowels /ʊ/ and /u/ since the two categories overlap in the vowel space of Serbian EFL learners. Therefore, Bjekić and Čubrović's (ibid.: 75–76) observation was that their subjects did not produce the appropriate quality of this tense/lax pair. Also apparent was the

speakers' tendency to rely heavily on durational properties, as was reported in the previously discussed studies (Čubrović 2017; 2019).

Differences in the production of high back vowels in native and non-native speech were confirmed in yet another study conducted by Nikolić (2016). The analysis carried out in this research consisted of comparing the acoustic properties of vowels produced by Serbian EFL speakers (n=2) and native AE speakers (n=2). The subjects were instructed to read a short story and a dialogue. Unlike the aforementioned studies, this one did not reveal significant differences in the production of the target vowels, or rather, the differences were not strong enough to afflict the overall intelligibility (ibid.: 96–97). However, it is important to note that the measurements were made from a relatively small group of female informants (only 4 speakers, in total). Therefore, the small number of informants might have yielded such results.

The examination of the existing contrastive studies seems to point to the fact that Serbian EFL speakers essentially do struggle when trying to pronounce the American high back vowels, primarily with regard to vocalic quality. The current findings suggest that, more often than not, in the speech of Serbian learners, there are no clear distinctions between the tense/lax pair. This appears to be attributed, in part, to the issue of L1 transfer. Nevertheless, since there is evidence suggesting that this might not always be the case, an attempt was made in the present study to observe the acoustic properties of high back vowels in Standard Serbian and General American in the hopes of obtaining additional evidence to substantiate the existing claims.

3. METHODOLOGY

3.1. SUBJECTS

The participants were English-major students at the Faculty of Philology and Arts, University of Kragujevac. The total sample size consisted of 10 male students (mean age 20.5), who were all native Serbian speakers. The sample was homogeneous in terms of variables like sex and the participants' native language. However, it was not homogeneous when it came to the level of undergraduate study. More specifically, there were 5 first-year students and 5 second-year students who took part in the present research. Still, since previous studies on the production of English monophthongs by Serbian speakers (Dančetović, Nešić 2017: 278; Dančetović 2017: 366) revealed no noticeable differences in terms of phonological competences for students of different study levels, this particular dissimilarity was disregarded. Moreover, despite the different study level, all students were familiar with the basics of English pronunciation through courses like *English Phonetics* (first-year students) and *English Phonology* (second-year

students). Although the informants had no experience of visiting or living in an English-speaking country, they have spent on average 12.9 years learning English institutionally. In view of the goal of this research, only those students whose preferred pronunciation model was GA were accepted as research subjects. The subjects' participation in the research was voluntary.

3.2. RESEARCH INSTRUMENT AND PROCEDURE

The subjects were first asked to respond to a questionnaire which was designed in order to gather their demographic data. The elicitation of speech data consisted of two tasks: 1) reading a list of monosyllabic English words (n=13) which were embedded within the frame sentence "*I say* ____ *oddly*"; 2) reading a list of monosyllabic (n=6) and disyllabic (n=7) Serbian words embedded within the carrier sentence "*Kaži* ____ *opet*". The frame sentences were used in order to minimize the likelihood of test words being pronounced with the rising intonation pattern, commonly used for reading lists (Ivić, Lehiste 2002: 10; Sredojević 2017: 28). Moreover, when reading a list of words, speakers tend to pronounce the words with a lower pitch and a longer vowel (Ladefoged 2003: 7). Thus, using a carrier sentence guarantees a more stable pronunciation (ibid.: 8). Except for being asked to use a normal speaking rate when reading the sentences, the subjects were not given any special instructions. For both English and Serbian words, the phonetic context was identical. The only difference was that the English words were all monosyllabic, while Serbian words were both monosyllabic and disyllabic. Ideally, it would be best for the words to have the same number of syllables. However, this condition could not be met since, in some instances, there were no Serbian words available where the analyzed vowel was in monosyllables beginning and ending with the same consonant as in the English test words. Therefore, we prioritized controlling for contextual effects on vowels in both languages, since different phonetic context in one language or another can result in a false description in terms of the vocalic quality (Ladefoged 2003: 6; Hillenbrand, Clark 2001: 760). As discussed previously, accent type does not affect the quality of Serbian vowels (Lehiste 1977: 31; Marković, Sredojević 2021: 56; Marković, Bjelaković 2006: 342). Hence, all Serbian words in this research had only falling accents (short and long). The test words were: *cook*, *could*, *stood*, *hook*, *push*, *book*, *took*, *goose*, *soon*, *stoop*, *sued*, *mood*, *boon*, *kȕk*, *kȕd*, *tȕd*, *hȕkće*, *pȕška*, *bȕkva*, *štȕka*, *gûst*, *sûnce*, *tûp*, *sûd*, *mûdro*, and *bûnda*.[7]

Originally, there were two more words – *too* and *tû*. However, these were excluded from the analysis since the syllables were open. Namely, the vowels of the words in the frame sentences would run into the vowels of the test words. As a consequence, there would be no separation between the words, and it would be nearly impossible to determine the boundary

7 On the reading list, these test words were presented in random order.

between the segments (Ladefoged 2003: 8). The exclusion of these words then led to a slight imbalance in the number of test words where the observed vowels were in long (n=6) and short (n=7) syllables. Originally, the number of tokens was 260 (13 English words × 10 speakers + 13 Serbian words × 10 speakers). However, for some words it was difficult to identify a steady-state time for spectral analysis since there were continuous changes in the formant frequencies. For this reason, 24 tokens were excluded from the subsequent analysis, leaving a total of 236 analyzed tokens. Only a single repetition of each vowel (within the frame sentence) per speaker was analyzed.

3.3. MEASUREMENTS AND STATISTICAL ANALYSIS

The collected speech samples were analyzed acoustically using *Praat,* version 6.2.13 (Boersma, Weenink 2022). The first two formants (F_1, F_2) were measured at the most steady-state time, which was, in fact, the interval near the middle of the vowel (Ladefoged 2003: 105; Peterson, Barney 1952: 181–182; Johnson et al. 1993: 704). It is often the case that the first two formants alone are enough for vowel characterization (Gudurić 2004: 51; Ladefoged 2003: 105). Apart from the formant frequencies, we measured vowel duration, i.e. vowel quantity. Vowel duration measurements included only the vocalic segment, i.e. they did not include the initial burst that is associated with the release of a consonant (Hillenbrand, Clark 2001: 750). The segmentation was done manually, referring to the instructions outlined by Ladefoged (2003: 94–103) and, since our informants were all male speakers, we adjusted the frequency range at about 4000 Hz (ibid. 109).

The statistical analysis of the obtained acoustic data was performed in the *R* statistical program (R Development Core Team 2022, version 4.2.1). That included generating descriptive (calculating mean scores and SD), as well as inferential statistics (conducting statistical tests). Since most of the data in our research was not normally distributed[8], the *Mann–Whitney U test*[9] for independent samples was used for determining whether there is statistically significant difference between different sets of data. *The Independent Samples t-test* was used for the comparison of the normally distributed data sets. The differences were considered as statistically significant if the p-value was less than 0.05 (Larson-Hall 2015: 65).

8 The *Shapiro–Wilk test* was used in order to check the data for normality. This test is commonly used with group sizes under 50 (Larson-Hall 2015: 119). The p-value of less than 0.05 indicated that the data were not normally distributed, in which case the non-parametric test was used. By contrast, if the p-value was above 0.05, the data were considered to be normally distributed, which resulted in the use of a parametric test (ibid.).

9 Also known as the *Wilcoxon Rank Sum Test* (Turner 2014: 120).

4. RESULTS AND DISCUSSION

4.1. VOWEL QUANTITY

In order to observe whether there is any evidence favoring the view that the duration of Serbian students' L2 vowels is largely reflective of their L1 vocalic quantity, it is necessary first to turn to the results of the acoustic measurements pertaining to the duration of the Serbian /u/ vowel in long and short syllables. *Table 1* provides an overview of those results.[10]

Table 1. Durational differences between the long and short realization of /u/ in Standard Serbian

parameter	syllable	$\bar{X}$	SD
duration [ms]	short	93.10	30.78
	long	149.43	40.14

The values, shown in *Table 1*, suggest that, in Standard Serbian, there is a durational difference between the long and short realization of the high back vowel. Namely, the duration of the long and short vowel in the speech of our subjects is 149.43 ms and 93.10 ms, respectively. The quantitative difference in duration is 56.33 ms. The findings presented here are consistent with the aforementioned studies on vocalic quantity in Standard Serbian (Marković, Bjelaković 2009), in that they further corroborate the widely held viewpoint that the durational differences between the two variants of the high back vowel are indeed quite pronounced.

The data on the quantity of the tense and lax GA vowel in the speech of our subjects are presented in *Table 2*.

Table 2. Durational differences between the tense/lax GA vowel produced by Serbian speakers

parameter	vowel	$\bar{X}$	SD
duration [ms]	lax	98.19	30.95
	tense	179.8	40.33

As can be seen, in the speech of Serbian students, the tense GA vowel is significantly longer compared to its lax counterpart. More specifically, the measured duration for the lax vowel was 98.19 ms, whereas the length of the tense vowel was 179.8 ms. The quantitative difference in duration is 81.61 ms. It is reasonable to assume then that such results are indica-

10 The results presented in *Table 1* (as well as in *Table 2, Table 4* and *Table 5*) are restricted to the values obtained by calculating descriptive statistics. Namely, the primary purpose of the present research was to contrast the high back vowels in GA and Standard Serbian, which is why the phonetic context was identical for the analyzed words in the given languages. However, the phonetic context was not identical for Serbian words in short and long syllables (nor the GA lax and tense vowels). For this reason, the inferential statistics was left out for these data sets.

tive of the L1 transfer. Namely, the data on the durational characteristics of GA high back vowels produced by native speakers suggest that these vowels are minimally affected by duration, simply because the differences in quality are large enough to yield a successful differentiation between the two vowels (Čubrović 2019: 18). Our subjects, however, show a rather different tendency, i.e. their production of the tense/lax pair mirrors their production of the Serbian /u/ vowel in long and short syllables, which is quite evident in the pronounced durational difference. It is interesting to note that the quantitative difference between the tense and lax GA vowel is even greater than the quantitative difference between the Serbian /u/ vowel in short and long syllables.

However, a closer comparison between the values for Serbian vowels and GA vowels reveals that the transfer is more evident for short vowels (see *Table 3*).

Table 3. Durational differences between Serbian and GA vowels

parameter	**language**	**realization**	**X̄**	**SD**	**U**	**p**
duration [ms]	Serbian	short	93.10	30.78	2063	0.224
	English	lax	98.19	30.95		
	Serbian	long	149.43	40.14	746	**0.009**
	English	tense	179.8	40.33		

Namely, a significant difference (p=0.009) may be observed in the average duration of the Serbian /u/ vowel in long syllables and the GA tense vowel, while the values for the short vowels do not seem to differ significantly. In fact, the GA lax vowel is only 5.09 ms longer compared to the Serbian /u/ vowel in short syllables. Given that the average duration for /ʊ/ for native GA speakers is approximately 166.2 ms (Hillenbrand, Clark 2001: 752), the obtained results seem to suggest that, in terms of quantity, in the speech of Serbian students, the lax vowel bears more resemblance to the subjects' L1 category, rather than the targeted vowel.

The reference durational value for the tense vowel is 203.6 ms (ibid.). The obtained durational value for the tense vowel in our research seems to be indicative of a somewhat successful attainment of the GA tense vowel quantity. More specifically, the difference in duration between the GA tense vowel in the speech of our research subjects and the Serbian /u/ vowel in long syllables is 30.37 ms. Conversely, the difference between the tense vowel produced by our participants and the reference value for native GA speakers is 23.8 ms. It is evident that the durational value for /u/, as produced by Serbian speakers, does differ from the reference value for native speakers, which is why we cannot speak of a conclusively established category. However, since the category is closer to the target value in duration, than it is to the L1 value, we can assume that the subjects are, to a certain extent, capable of differentiating between the L1 and L2 category.

4.2. VOWEL QUALITY

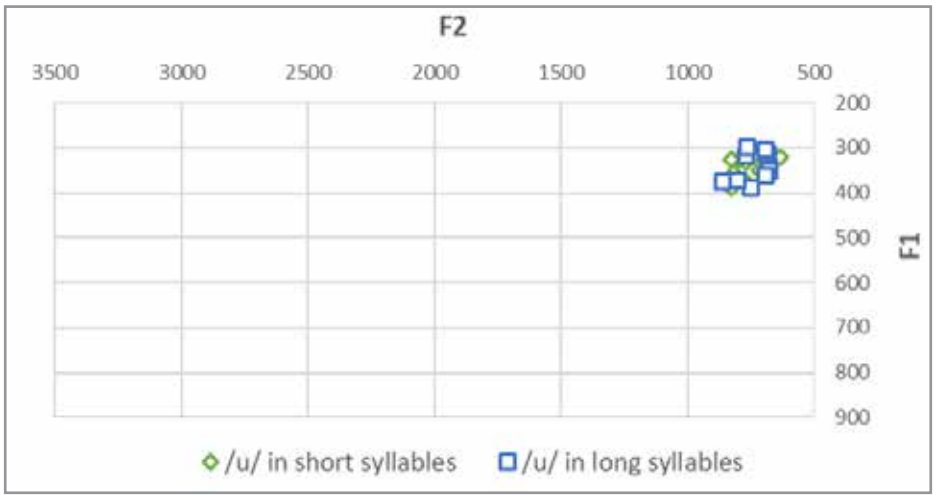
We will first turn to the question of vowel quality in Standard Serbian. Average formant frequencies for the Serbian vowel /u/ in long and short syllables are displayed in *Table 4*.

Table 4. Mean F_1 and F_2 values for Serbian /u/ vowel in long and short syllables

parameter	syllable	$\bar{X}$	SD
F_1	short	340	33.99
	long	340	42.51
F_2	short	761	106.74
	long	736	96.59

In summary, the data in *Table 4* confirms the observations which have previously been reported in studies on vocalic quality of Serbian vowels which suggest that there is only a slight difference in the F_2 values (Marković, Sredojević 2021; Marković, Bjelaković 2006). In other words, the short variant of the /u/ vowel in Standard Serbian is centralized to a small degree, compared to its long counterpart. Nevertheless, the difference (25 Hz) is rather insignificant, and so the long and short realization of the /u/ vowel generally occupy the same area in the vowel space (see *Figure 1*).

Figure 1. Average F_1 and F_2 values for the Serbian /u/ vowel in short and long syllables



As the results concerning the vocalic quality show, the /u/ vowel in short syllables is practically indistinguishable from the realization in long syllables. Since the spectral differences are not as obvious, the distinction between the two realizations is essentially made on the basis of vowel duration (see *Table 1*). As Marković and Bjelaković (2009: 153–155) have previously pointed out, the differences in duration are more pronounced

for those vowels that do not exhibit major quality differences. The results presented here corroborate that claim.

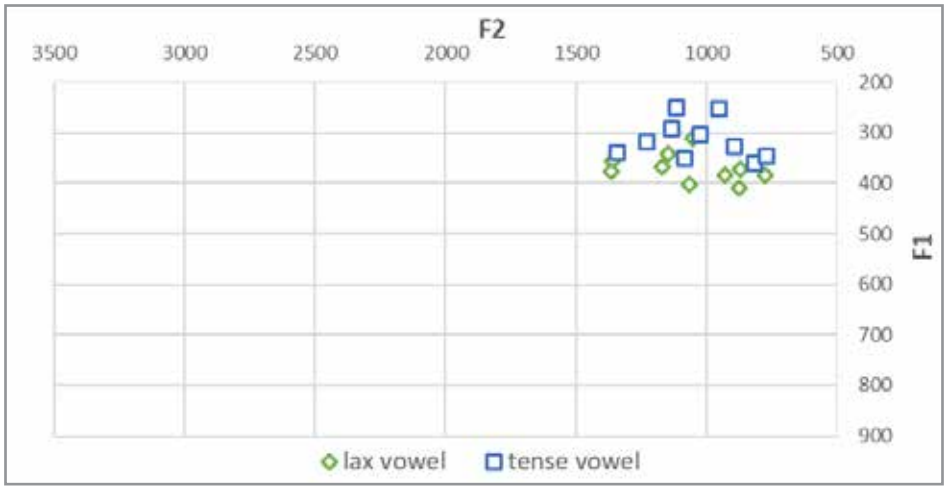
Table 5 compares formant values for the tense/lax GA pair produced by Serbian speakers.

Table 5. Mean F_1 and F_2 values for GA tense and lax vowel in the speech of Serbian students

parameter	vowel	$\bar{X}$	SD
F_1	lax	370	39.87
	tense	314	46.11
F_2	lax	1061	247.48
	tense	1038	268.07

The data presented here indicate that there is a considerable degree of openness when it comes to the GA lax vowel. More specifically, the formant values for the lax vowel are higher than those obtained for the tense vowel, and this difference averages 56 Hz. The values for the second formant are expectedly lower for the tense vowel, suggesting a more peripheral position in the vowel space. Conversely, the lax vowel is slightly more centralized. However, this particular difference (23 Hz) is rather small. Therefore, we can say that our subjects distinguish between the GA tense and lax pair primarily on the basis of tongue height. *Figure 2* presents this data graphically.

Figure 2. Average F_1 and F_2 values for the GA tense and lax vowel produced by 10 Serbian speakers



Despite the higher F_1 values for the lax vowel, which is indicative of a more open articulation, there is still some degree of overlap in F_1–F_2 space. If we were to compare formant frequencies of the tense and lax vowel ob-

tained in our study with those of native GA speakers, we would note that our students generally produce these vowels with a smaller degree of openness. Namely, native GA speakers[11] produce the high back vowels with an average F_1 frequency ranging from 515 Hz to 556 Hz for the lax vowel, and 422 Hz to 478 Hz for the tense vowel (Labov et al. 2006: 90, 102). As for the second formant, our subjects produce the lax vowel with a smaller degree of centralization, compared to native speakers, whose values typically range from 1404 Hz to 1575 Hz (Ibid: 91). With regard to the tense vowel, the average F_2 frequency for native speakers ranges from 1620 Hz to 2000 Hz (Ibid: 103), which is notably higher compared to our subjects' values. This suggests that, like the lax vowel, the tense GA vowel produced by our students is less centralized than the vowel produced by the native speakers.

In order to see whether our subjects' L2 vowels differ from their L1 categories, we compared the results of the acoustic measurements for both languages. Those results are presented in *Table 6*.

Table 6. Mean F_1 and F_2 values for GA tense/lax vowel and Serbian /u/ vowel in short and long syllables

parameter	language	realization	$\bar{X}$	SD	test	p
F_1	Serbian	short	340	33.99	U=1153	**0.002**
	English	lax	370	39.87		
	Serbian	long	340	42.51	t=3.0062	**0.003**
	English	tense	314	46.11		
F_2	Serbian	short	761	106.74	U=545.5	**0.007**
	English	lax	1061	247.48		
	Serbian	long	736	96.59	t=7.5149	**0.003**
	English	tense	1038	268.07		

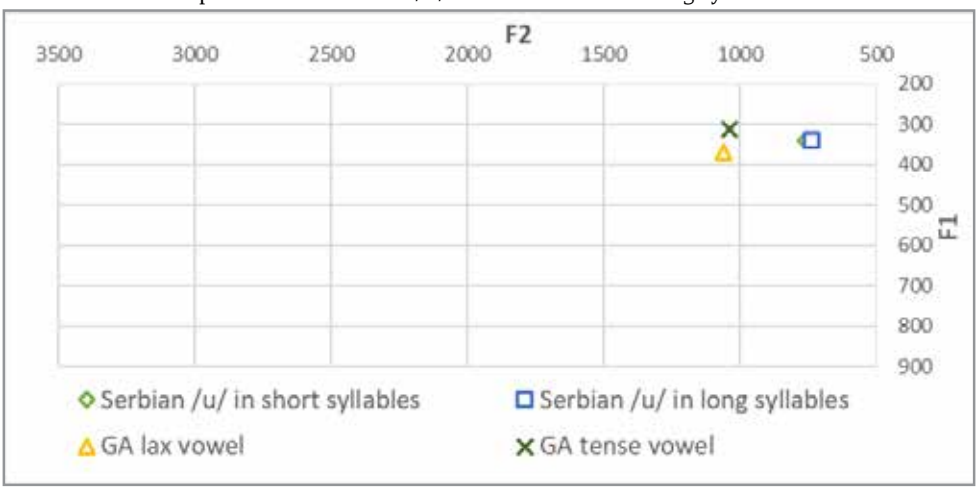
What the values presented here seem to suggest is that the GA lax vowel /ʊ/ is generally more open and centralized than the Serbian /u/ vowel in short syllables. We could argue that the quality difference between the short/lax realization of the high back vowel in Serbian and English could perhaps be attributed to the aforementioned lack of distinction between the two concerning the vocalic quantity. In other words, since there

11 In *The Atlas of North American English*, Labov, Ash and Boberg (2006: 148) list several US dialects: The West, Canada, The South, The Midland, The Inland North and North Central. Zsiga (2013: 432) notes that "if any area [out of these] can be characterized as "General American", it is the Midland" area. The author (ibid.) further states that this particular area "most closely matches the American English vowel charts printed in textbooks". Hence, the F_1 and F_2 values cited here as reference values represent the formant frequencies which predominate in the Midland dialect. The reference values for the tense vowel generally pertain to the contexts where the said vowel follows non-coronal consonants, since most of our test words contained the tense vowel in such consonant environments.

are no notable durational differences (see *Table 3*), the spectral differences are quite pronounced. This is reflective both in the F_1 and F_2 values, i.e. in vowel openness and vowel centralization. The same is true for tense vowels, i.e. the subjects do differentiate between the L1 and L2 category in terms of their spectral characteristics. More specifically, the Serbian /u/ vowel in long syllables is positioned lower in the vowel space compared to the GA tense vowel. Statistical difference is evident, yet again, for the F_2 values, suggesting that the GA tense vowel exhibits greater degree of centralization.

Generally, the short/lax and long/tense realizations of the high back vowels differ both in vowel openness and vowel centralization, which seems to indicate that Serbian EFL students' L2 categories do not, in fact, mirror their L1 categories. This is shown in *Figure 3*.

Figure 3. Average F_1 and F_2 values for the GA tense/lax vowel produced by Serbian speakers and Serbian /u/ vowel in short and long syllables



5. CONCLUDING REMARKS

The fundamental question we sought to address in this research was whether Serbian students are capable of differentiating the GA high back vowels from their L1 categories in terms of both quantity and quality. We also wished to see whether our students can adequately produce the quality and quantity of L2 vowels. The examination of the existing empirical literature points to the fact that Serbian students do not seem to perceive the quality differences between GA vowels /u/ and /ʊ/. Consequently, the differentiation between these target vowels is frequently made with regard to vocalic quantity. So as to find evidence to substantiate these views, recordings of 10 male Serbian speakers producing the high back vowels were analyzed.

Given that the distinction between the long and short variant of Serbian high back vowel /u/ is made on the basis of durational, rather than spectral differences, it was reasonable to assume that our subjects might rely on the exact same strategy when trying to distinguish between the GA vowels. The acoustic analysis revealed that, when it comes to vocalic quantity, our subjects' tense vowel was significantly longer compared to the lax counterpart. The quantitative difference was 81.61 ms. Contrary to our subjects' tendency, the literature on the durational characteristics of GA high back vowels usually reports smaller quantitative differences (37.4 ms) (Hillenbrand, Clark 2001: 752), simply because there are rather prominent quality differences between /u/ and /ʊ/. We then decided to compare the obtained data on duration for Serbian vowels and GA vowels produced by our speakers in order to check if the duration of the GA vowels reflected the duration of our subjects' L1 high back vowels. A significant difference was observed in the average quantity of the Serbian /u/ vowel in long syllables and the GA tense vowel, while the values for the short vowels did not differ significantly. In other words, in the speech of Serbian students, the lax vowel bore more resemblance to the subjects' L1 category, rather than the targeted vowel.

Spectral analysis of our subjects' L1 high back vowels corroborated the findings of several previous studies (Marković, Sredojević 2021; Marković, Bjelaković 2006). More specifically, our results revealed that the long and short realization of the Serbian /u/ vowel occupy much of the same area in the vowel space. Given our subjects' tendency to exhibit a rather large durational difference between GA vowels /u/ and /ʊ/, we assumed that the differences in quality would be minimal, as some previous studies have indicated. Contrary to our expectations, the results of the acoustic analysis showed that our subjects do, in fact, distinguish between the tense/lax pair, however, this distinction is made solely on the basis of vowel openness. Nevertheless, the quality of the tense/lax pair did not mirror the quality of these vowels produced by native GA speakers. Namely, our students generally produced the L2 vowels with a smaller degree of openness. As for the second formant, our subjects produced both the lax and the tense vowel as less centralized, compared to native speakers. Although there are notable differences in terms of the obtained formant frequencies, it is also evident that the L2 categories our subjects produce differ from their L1 categories, both with respect to vowel openness and vowel centralization.

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Марија Н. Јаневска / ПРОДУКЦИЈА ВИСОКИХ ВОКАЛА ЗАДЊЕГ РЕДА: КОНТРАСТИВНА АНАЛИЗА АМЕРИЧКОГ ЕНГЛЕСКОГ И СТАНДАРДНОГ СРПСКОГ ЈЕЗИКА

Резиме / У раду су представљени резултати контрастивне анализе високих вокала задњег реда /u ʊ/ у америчком варијетету енглеског језика и вокала /u/ у српском језику. Анализиране вокале реализовало је 10 информатора мушког пола који су изворни говорници српског језика. Претходна истраживања (Марковић 2009а; Бјекић, Чубровић 2021; Чубровић 2019; 2017; Данчетовић, Нешић 2017) показала су да српски говорници не успевају да препознају квалитативне разлике између енглеских вокала /u/ и /ʊ/. Стога, циљ тренутне анализе био је сагледати акустичке карактеристике поменутих вокала у датим језицима како би се утврдила способност наших студената да адекватно продукују циљне вокале у погледу квантитета и квалитета. Од испитаника се најпре захтевало да прочитају 13 једносложних речи на енглеском језику где су се вокали /u/ и /ʊ/ налазили у различитом фонетском контексту. Затим су испитаници изговарали 13 речи на српском језику у којима се наглашени вокал /u/ налазио под дугим и кратким акцентом. Снимци су акустички анализирани у програму *Praat*, верзија 6.2.13 (Бурзма, Вининк 2022). Вредности добијене на основу акустичке анализе обрађене су статистички у програму *R,* верзија 4.2.1 (R Development Core Team 2022). Резултати показују да је квантитет енглеског вокала /ʊ/ у изговору српских испитаника ближи квантитету српског вокала /u/ него типичној вредности за поменути вокал код изворних говорника енглеског. Резултати анализе вокалског квалитета сугеришу да наши испитаници не супституишу енглеске вокале категоријама из свог матерњег језика, иако квалитет високих вокала не одговара у потпуности квалитету који је типичан за изворне говорнике енглеског.

Кључне речи: вокалски квалитет, вокалски квантитет, монофтонг, високи вокали задњег реда, општеамерички варијетет, стандардни српски језик

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