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ACOUSTIC ANALYSIS OF MONTENEGRIN ENGLISH L2 VOWELS: PRODUCTION AND PERCEPTION

IVANA LUCIC

ABSTRACT

This study provides an acoustic analysis of Montenegrin vowels, in order to make a comparison with the already existing measurements of General American English (GAE) vowels. Also, a production analysis is done on Montenegrin (MTN) learners of English, which shows the vowels that are the most problematic in their L2 pronunciation. In addition to this, a two-way perception study was conducted with the participants. American native English speakers listened to 11 GAE vowels produced by Montenegrin speakers of English, and tried to indicate which vowels they heard, while Montenegrin speakers of English did the same after listening to native GAE speakers. The study shows that some vowels are easy for Montenegrin speakers to produce and perceive. However, certain vowels (e.g., the ones that are present in English, but not in Montenegrin) cause problems for participants in both production and perception analysis. This research helps determine the causes of miscomprehension between native speakers of GAE and Montenegrin EFL learners. These findings can help learners and teachers of ESL/EFL provide better quality instruction for Montenegrin learners by giving them more information on the problematic differences in the vowel systems of Montenegrin and English.

1.0 Introduction

One of the main goals for second language (L2) learners is to be able to communicate with native speakers and/or non-native speakers of the target language. The most important skill to acquire in order to accomplish that goal is speaking. Speaking combines many aspects of language, and the paramount one, when it comes to intelligibility, is pronunciation. Pronunciation is a very complex area of speaking skills, difficult for both teachers and learners, mostly because it combines both neurological and physical features. It is actually the only part of language that is influenced by one's physical ability—"Pronunciation is not just a cognitive 'knowing-that', it is also a physical 'knowing-how,' similar to playing a sport or musical instrument" (Fraser, 1999, p. 3).

This article provides an explanation of the rationale for the study, a general description of Montenegrin language and the acoustic analysis of its vowels, and an acoustic comparison of native GAE vowel production and Montenegrin English L2 vowel production. The results are discussed and propositions for future studies are made.

1.1 Rationale for the Study

According to Warsi (2001), adult language learners cannot achieve native-like phonology in their L2, and he attributes that failure principally to language transfer and

age-dependent factors. Warsi (2001) cited Selinker (1972), who claimed that the essential fact concerning L2 phonology is fossilization, “a widely known but poorly understood characteristic of the majority of adult L2 learners: failure to achieve target-like competence despite continuous exposure to the target language, adequate motivation to learn, and sufficient opportunity for practice” (Selinker, 2005, p. 1). Another author cited by Warsi (2001) is Lenneberg (1967), who contended that it is impossible to achieve native-like fluency after puberty, because a critical period in brain maturation causes language development to freeze—he called this phenomenon brain lateralization. For example, Fledge, Yeni-Komshian, and Liu (1999) mentioned a study where the researchers found that “older children received higher morphosyntax test scores than did younger children, whereas the reverse held true for pronunciation” (p. 81).

The main purpose of the research presented in this article is to find out the challenges Montenegrin learners face when learning English pronunciation, in order to help them surpass those challenges on their way toward more accurate pronunciation.

1.2 Research Questions, Participants, and Methodology

This study addresses the following research questions:

1. What are the differences and similarities between the acoustic characteristics of Montenegrin vowels and General American English vowels?
2. Which English vowels cause miscomprehension to Montenegrin speakers of English?
3. Which Montenegrin English vowels cause miscomprehension to native speakers of English?

It must be noted that no known research on this topic existed prior to this research, and no acoustic data on Montenegrin vowels or Montenegrin-accented English vowels had been gathered prior to this research.

The methodology of this study is similar to that of Peterson and Barney in 1952. They chose the /hVd/ context to create an optimal environment for the vowel. This environment reduces the effect of preceding and following consonants on the acoustic characteristics of the target vowels. The initial /h/ is a voiceless consonant that makes a weak sound, and the acoustic energy generated during its production is on a very low level (Khalil, 2013). It does not affect the following vowel in a negative way. In addition, the final /d/ is a stop consonant that makes it easy to determine the offset of the previous vowel on the spectrogram (Khalil, 2013). These two factors contribute to greater validity of the study. Montenegrin vowels were measured from the middle point, as it is impossible to satisfy the /hVd/ environment in Montenegrin.

The recordings for the acoustic analysis of Montenegrin-accented English gathered through the data collection process were also analyzed through Praat. The measurements analyzed for this study are F0 (the fundamental frequency or pitch), F1 (vowel height), F2 (vowel frontness), F3 (the degree of lip rounding), and duration. These

values were also taken from the middle point of the vowel, for the sake of consistency. In order to provide a reliable comparison between the production of GAE vowels and Montenegrin English vowels, Ladefoged (2001) recommended plotting them within the same vowel quadrant. The measurements that proved to be important for this study are F1 and F2. Those values were plotted through a website called NORM.

1.2 Participants

The study involves five male and five female Montenegrin speakers of English.¹ They display no hearing or speech disabilities. Each of the participants has spent at least a year studying abroad in a university program in the United States. All of them have studied English for 10 to 12 years, and all of them have had instruction in another foreign language, either French, Russian, or Italian. Participation in the study was voluntary.

For the acoustic analysis of Montenegrin vowels, five male and five female Montenegrin speakers participated, and each produced five Montenegrin words (one for each vowel). All speakers ranged from age 15 to 55, and all are native speakers of Montenegrin. They have never lived outside of Montenegro and all of them are from the central area of the country. None of them has a speech or hearing impairment. The participants' production was recorded using a PC computer (HP Pavillion DV5), a headset (Microsoft LifeChat LX-3000), and the computer software Praat (version 2011), which was also used for analyzing the recordings. The words that were analyzed were <hlad>, <hljeb>, <hor>, <hir>, and <huk>. Each participant provided fifteen tokens, as they repeated each of the five words three times.

1.3 Materials

In order to conduct the production analysis of GAE and Montenegrin vowels by Montenegrin speakers, audio recordings were made of all participants reading the list of words used in the study by Peterson and Barney (1952): <heed>, <hid>, <head>, <had>, <hawed>, <hod>, <hood>, <who'd>, and <hud>; in addition, two more words, <hayed>, and <hoed>, were included from the Hillenbrand, Getty, Clark, and Wheeler (1995) study. Each word was repeated three times. Reading a list of words ensures that all the vowels are stressed and clearly pronounced, which makes measuring their acoustic characteristics easier and more reliable.

2.0 General Introduction to Montenegrin Language

This section will provide a sociolinguistic review of the language that is the focus of this research, Montenegrin. It is spoken in Montenegro, which is situated in the Southeastern part of Europe. It is a small country, approximately the size of Connecticut. One of the former states of Yugoslavia, Montenegro gained independence in 2006 through a democratically-held referendum. It is necessary to know a portion of Montenegrin history in order to understand the linguistic issues, so a brief historical review is provided.

¹ These participants are different from those who participated in the production study of Montenegrin English vowels.

The historical events of the Balkans affected Montenegro, even though it is known to be a neutral (in conflict-related situations) country in the Balkans. The linguistic issues, such as the never-ending dispute over official language in education, are very much discussed, especially since independence. These issues arise from the fact that all the mutually intelligible languages of the region (Montenegrin, Serbian, Croatian, and Bosnian) used to be considered one language, Serbo-Croatian. Following the political events of 1990s (the dismantling of Yugoslavia), every state, now an independent country, wanted to have a separate language, as it was very important for the identity of their citizens. Montenegro was no different. Montenegrin was proclaimed the official language in the 2007 Constitution of the new, independent Montenegro. Nevertheless, the government went a little further than giving it a unique name. In addition to the dialectal differences, two new letters were included in the alphabet: <Š> and <Ž> (/ʃ/ and /ʒ/). These two letters emphasized the dialectal differences, as these two sounds are used colloquially in every-day conversations. For example, the Serbian word for the imperative “sit” would be “sedi,” and the Montenegrin equivalent would be “sjedi.” However, since the two new letters have been added to the Montenegrin alphabet, what originally was “sjedi,” is now “šedi.”

Considering how young the Montenegrin language is officially, little linguistic research has been done on it. Considering the fact that there are only five vowels in Montenegrin (/a, ε, i, ɔ, u/), and that this research considers a total of eleven English vowel sounds (/i, ɪ, e, ε, æ, u, ʊ, ɔ, o, ʌ, ɑ/), it seems appropriate to look into the influence that Montenegrin can have on L2 acquisition of English vowels. The goal of this study is to examine the acoustic characteristics of Montenegrin vowels and Montenegrin-accented English vowels, and to see which English vowels cause the most difficulties for Montenegrin speakers of English.

2.1 The Acoustic Vowel Space of Montenegrin

The Montenegrin language is the representation of what is called the Ijekavian dialect of Serbo-Croatian (Bethin, 1998), which means that the reflex of <e> in Serbian (or Serbo-Croatian) is <ije> in Montenegrin, with very few exceptions to the rule. In addition, Montenegrin has a highly transparent orthography, to the point where each letter stands for a sound; therefore, <ije> is pronounced as [ije], with two vowel sounds, separated by the glide consonant [j]. The Serbo-Croatian vowel system contains five vowels, as can be seen in Figure 1 below. The vowel sounds are as follows: [a], [ε], [i], [ɔ] and [u]. This system is the same in Montenegrin. All of these vowels can be found in the initial, medial, or final position of the word.

The measurements analyzed are F0, F1, F2, F3, and duration. Female and male production was analyzed separately. The values were taken from the middle point of the vowel, because the <hVd> environment was not fully met. The values measured can be seen in Tables 1 and 2 below.

No.	Word	Vowel	F0	F1	F2	F3	Duration
1	<hlad>	[a]	217	845	1299	1840	287
2	<hljeb>	[ɛ]	224	650	1534	2461	168
3	<hir>	[i]	234	457	2549	3209	278
4	<hod>	[ɔ]	234	640	986	2428	257
5	<huk>	[u]	208	503	928	2460	236

Table 1: Acoustic Measurements of Montenegrin Vowels for Female Speakers

No.	Word	Vowel	F0	F1	F2	F3	Duration
1	<hlad>	[a]	106	636	1283	2198	237
2	<hljeb>	[ɛ]	106	459	1641	2138	129
3	<hir>	[i]	112	330	1969	2381	256
4	<hod>	[ɔ]	109	433	822	2124	237
5	<huk>	[u]	106	349	754	2216	181

Table 2: Acoustic Measurements of Montenegrin Vowels for Male Speakers

The F0 value serves to distinguish the gender. Male speakers tend to pronounce vowels with lower F0 value, while female speakers have higher F0 value in their pronunciation. This is visible when comparing Tables 1 and 2. The analysis also shows that male speakers produce shorter vowels than female speakers. The difference in duration between male and female Montenegrin speakers varies from 20 ms to 55 ms, and does not affect intelligibility.

The values that give important features to vowels are F1 and F2. Figure 1 shows Montenegrin vowels in the acoustic vowel space. Formant values F1 and F2 of both male and female Montenegrin production were plotted and normalized to create this vowel space. Montenegrin speakers produce the vowel [i] as a high front vowel and [a] as a central low vowel. [ɛ] is positioned in the mid-central quadrant space, and [ɔ] is a mid-back vowel. The vowel [u] is a high back vowel.

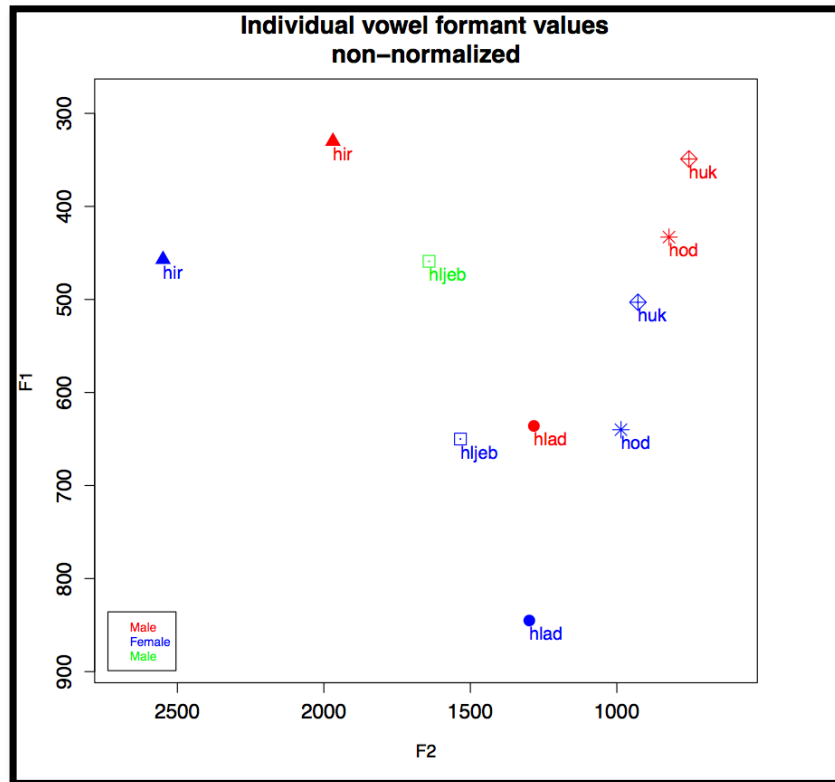


Figure 1: Montenegrin Vowels

Red and green words represent male Montenegrin participants' production, whereas blue words represent female Montenegrin participants' production. The first noticeable thing about Figure 1 is the difference in vowel height between male and female production. Male vowels are much higher in the acoustic vowel space than female vowels. Unlike F1 values, F2 values of male and female production are quite consistent, except for [i], meaning that female [i] is fronted when compared to the male counterpart. F3 values seem to have an interesting correlation with F1, as F3 value lowers with lower vowels.

3.0 The Acoustic Vowel Space of Montenegrin-Accented English

The main goal of this research is to investigate Montenegrin speakers' production of GAE vowels. Its results show the main challenges they face in the process of acquisition of English vowels.

3.1 Production Analysis of Male Vowels

The data was compared in a straightforward way, using the formant values (specifically F1 and F2) of GAE vowels and Montenegrin English vowels. This method is the most reliable for answering the research questions posed in this study. Table 3 summarizes the data discussed in this section. It shows the means of F0, F1, F2, F3, and duration.

Lexical Set	heed	hid	hayed	head	had	hod	hawed	hoed	hood	hood	hud
Vowels	[i]	[ɪ]	[e]	[ɛ]	[æ]	[ɑ]	[ɔ]	[o]	[ʊ]	[u]	[ʌ]
GAE F0	136	135	129	130	127	124	129	129	137	141	130
MTN F0	115	119	110	114	112	107	110	113	201	119	117
GAE F1	270	390	476	530	660	730	570	497	440	300	640
MTN F1	475	485	430	647	654	785	710	510	500	422	689
GAE F2	2290	1990	2089	1840	1720	1090	840	910	1020	870	1190
MTN F2	2213	1903	2111	1680	1659	1117	961	1166	1190	1123	1352
GAE F3	3010	2550	2691	2480	2410	2440	2410	2459	2240	2240	2390
MTN F3	2864	2485	2619	2493	2490	2448	2580	2441	2265	2274	2434
GAE DUR	243	192	267	189	278	267	283	265	192	237	188
MTN DUR	212	120	244	127	132	284	255	241	137	181	108

Table 3: Male Talkers

The acoustic vowel space of both GAE vowels and Montenegrin English vowels of male speakers can be seen in Figure 2. The circled words identify Montenegrin English vowels.

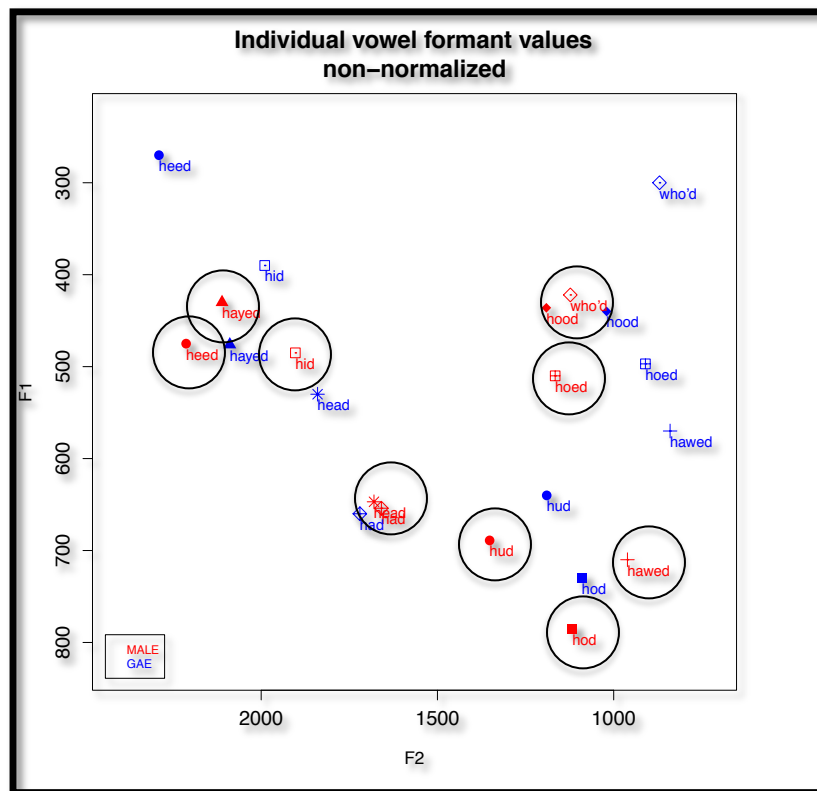


Figure 2: Male GAE-accented Vowels

As mentioned earlier, a higher F0 value indicates that the speaker is female, while a lower F0 value indicates that the speaker is male. On the other hand, F3 did not prove to be significant for any section of this research, as it does not contribute to forming the

vowel quadrants that are important for a study of this nature. As seen in Figure 2, the phonological processes that distinguish Montenegrin English vowels from GAE vowels are vowel merger, vowel lowering, and vowel fronting.

Vowel merger is a phonological process in which two or more phonemes are pronounced and perceived acoustically as the same (Koffi, 2013). Koffi stated that the rate of confusion is higher when the acoustic difference between vowels is 60 Hz or less. In addition, he adds that if the distance between two vowels is less than 20 Hz, hearers will perceive them as the same. The Montenegrin English pronunciation of [æ] has merged into GAE pronunciation of [ɛ]. The distance between GAE [ɛ] and [æ] is 130 Hz for F1, and 120 Hz for F2. Similarly, the distance between Montenegrin English [ɛ] and GAE [ɛ] is 117 Hz for F1 and 160 Hz for F2, which means that Montenegrin speakers of English highly differentiate in the pronunciation of the same vowel. However, the distance between Montenegrin English pronunciation of /ɛ/ and GAE pronunciation of [æ] is only 13 Hz for F1, and 40 Hz for F2. In addition, the Montenegrin English pronunciation of both [ɛ] and [æ] is very similar, with a distance of 7 Hz for F1 and 21 Hz for F2. This means that male Montenegrin speakers of English do not differentiate between the vowels [ɛ] and [æ], and unintelligibility is absolute.

Vowel lowering can be seen by analyzing the F1 value. The acoustic vowel space in Figure 2 shows that Montenegrin speakers of English tend to lower specific vowels in comparison with the GAE pronunciation. The vowel that is lowered quite significantly is [i]. Along with it, and in the close acoustic space is also [ɪ]. Montenegrin pronunciation of both [i] and [ɪ] interferes with the acoustic space of [e]. The distance of F1 values among these three vowels is below 60 Hz. The distance between Montenegrin English pronunciation of [i] and GAE pronunciation of [e] is only 1 Hz. Furthermore, the distance between Montenegrin English pronunciation of [ɪ] and GAE pronunciation of [e] is 9 Hz. According to Ferrand (2007), human ears are unable to detect frequencies below 20 Hz, so these sounds are evidently perceptually indistinguishable, and are likely to cause miscomprehension. Another example of vowel lowering when comparing Montenegrin English vowels and GAE vowels is the lowering of [ɔ]. The F1 value of Montenegrin English [ɔ] is incredibly close to that of GAE vowel [ɑ], causing interference in the acoustic vowel space. The distance between these two values is only 20 Hz. The lowering of the vowel [u] is present as well. Its F1 value for GAE is 300 Hz, and its value for Montenegrin English is 422 Hz. Considering the fact that the F1 for GAE vowel [ʊ] is at 440 Hz, it means that the distance of only 18 Hz causes interference within the acoustic vowel space, and unintelligibility is highly possible.

Vowel fronting is a phonological process where the vowel is produced in a more frontal area of the mouth, and therefore, the F2 measurement displays a higher value. Fronting of the vowel [o] is present with a distance of 246 Hz (F2). However, this distance does not cause interference of acoustic vowel space with any other vowel. Therefore, unintelligibility is unlikely. The case is the same with the Montenegrin English vowel [ʌ], which has a distance of 162 Hz (F2) from the correspondent GAE

vowel, but it also does not interfere with any other acoustic vowel space. Fronting of Montenegrin English vowel [ʊ] is the one that can cause unintelligibility. Compared to its GAE counterpart, the distance is 170 Hz in F2 value. This fronting obstructs the acoustic vowel space of Montenegrin English [u]. The distance between Montenegrin English [ʊ] and [u] is only 67 Hz. Even though it is slightly higher than 60 Hz, by looking at the Figure 2, one can see that this obstruction in the acoustic vowel space would only cause slight unintelligibility.

When it comes to vowel duration, male Montenegrin speakers of English produce shorter GAE vowels than native GAE speakers. However, duration does not seem to cause unintelligibility. The following spectrograms represent data of a Montenegrin male participant for vowels found in <had> and <head>.

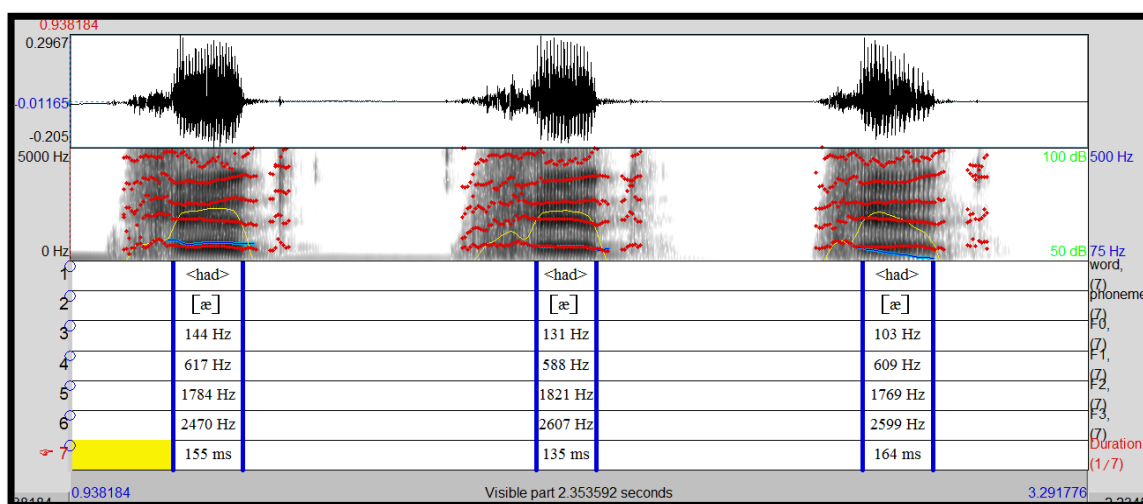


Figure 3: Spectrogram of the GAE Word <had>, Montenegrin Male Speaker No. 1

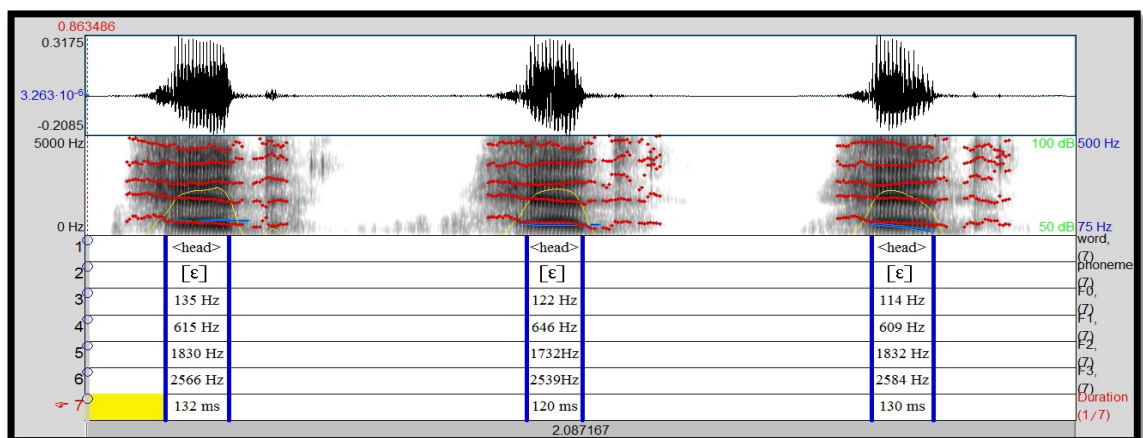


Figure 4: Spectrogram of the GAE Word <head>, Montenegrin Male Speaker No. 1

3.2 Production Analysis of Female Vowels

Female Montenegrin participants’ vowel production also distinguished similar phonological processes as seen in the previous part where male Montenegrin vowel production was described. Table 4 is given to present all the data this research produced, including F0, F1, F2, F3, and duration, in order to have a better overview of the measurements.

Lexical Set		heed	hid	hayed	head	had	hod	hawed	hoed	hood	hood	hud
Vowels		[i]	[ɪ]	[e]	[ɛ]	[æ]	[ɑ]	[ɔ]	[o]	[ʊ]	[u]	[ʌ]
GAE	F0	235	232	219	223	210	212	216	217	232	231	221
MTN	F0	194	193	178	183	180	196	178	181	201	195	180
GAE	F1	310	430	536	610	860	850	590	555	470	370	760
MTN	F1	388	498	440	713	785	804	802	490	500	448	769
GAE	F2	2790	2480	2530	2330	2050	1220	920	1035	1160	950	1400
MTN	F2	2664	2264	2446	1892	1812	1268	1200	1093	1190	1248	1431
GAE	F3	3310	3070	3047	2990	2850	2810	2710	2828	2680	2670	2780
MTN	F3	3247	2928	2969	2845	2689	2546	2628	2861	2715	3021	2520
GAE	DUR	306	237	320	254	332	323	353	326	249	303	226
MTN	DUR	291	140	319	167	213	284	313	328	141	258	145

Table 4: Female Talkers

Vowel lowering, vowel merging, and vowel raising are noticeable in the acoustic vowel space shown in Figure 5 in which female GAE and Montenegrin English vowels are plotted and normalized. The circled words symbolize Montenegrin English vowels.

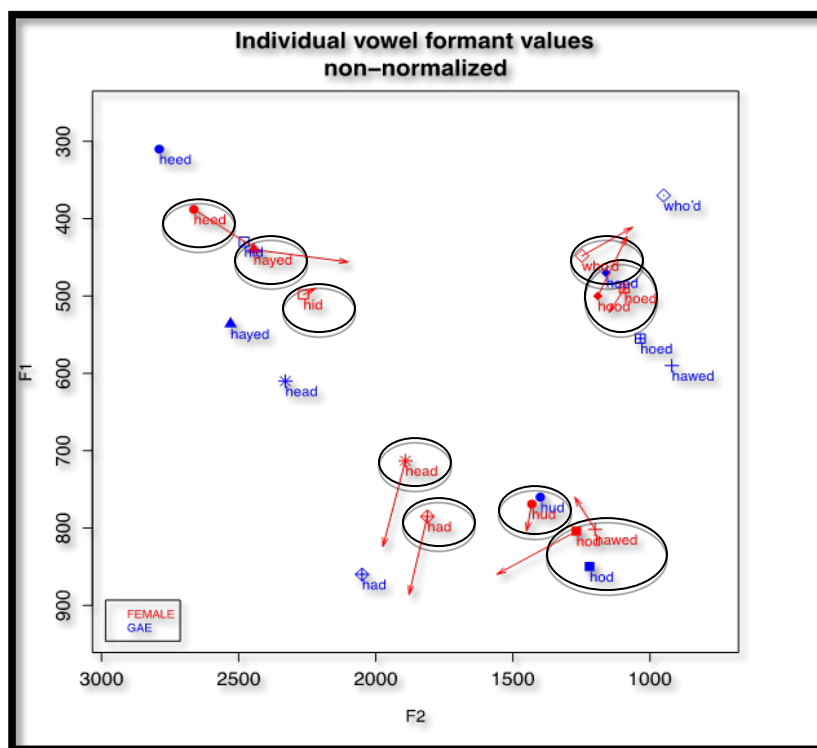


Figure 5: Female GAE-accented Vowels

Vowel lowering is slightly present with the vowels [i] and [ɪ]. The distance between the GAE and Montenegrin English F1 values is 78 Hz for [i] and 68 Hz for [ɪ]. It is obviously very low and, in addition, none of these vowels interfere with any other acoustic vowel space, which means that Montenegrin participants did not mistake them for any other vowel. The same is the case of [ɛ], which is lowered with a distance of 103 Hz when compared to the GAE F1 value of the same vowel, but also does not obstruct any other acoustic vowel space.

The confusion is three-way when it comes to the vowels [ʊ], [u], and [o]. Montenegrin English [ʊ] is only 30 Hz away from its GAE counterpart. However, the distance of Montenegrin English [u] is 52 Hz and the distance of Montenegrin English [o] is 10 Hz, when compared to Montenegrin English [ʊ]. This causes the vowels to obstruct the acoustic vowel space of one another, as they overlap. Considering the fact that Montenegrin English [o] is only 20 Hz away from GAE [ʊ], the acoustic vowel space of GAE [ʊ] is also hindered. The Montenegrin English [u] is lowered by 78 Hz when compared to its GAE equivalent, while Montenegrin English [o] is slightly raised by 65 Hz in comparison with GAE [o]. It seems as if GAE hearers would have a hard time distinguishing [o] from [ʊ], [ʊ] from [u], and [o] from [u]. Vowel [o] is one of the two Montenegrin English vowels that is raised. The other one is [e], and it is raised with a difference of 96 Hz, which causes interference with GAE [ɪ], making the distance between these two vowels only 10 Hz.

Vowel merging occurred with the vowels [ɑ] and [ɔ]. The distance between GAE [ɑ] and Montenegrin English [ɑ] is 46 Hz, while the distance between GAE [ɑ] and Montenegrin English [ɔ] is 48 Hz. This can easily cause miscomprehension for GAE hearers/listeners. The following spectrograms show the data for one female Montenegrin participant for vowels found in <had> and <head>.

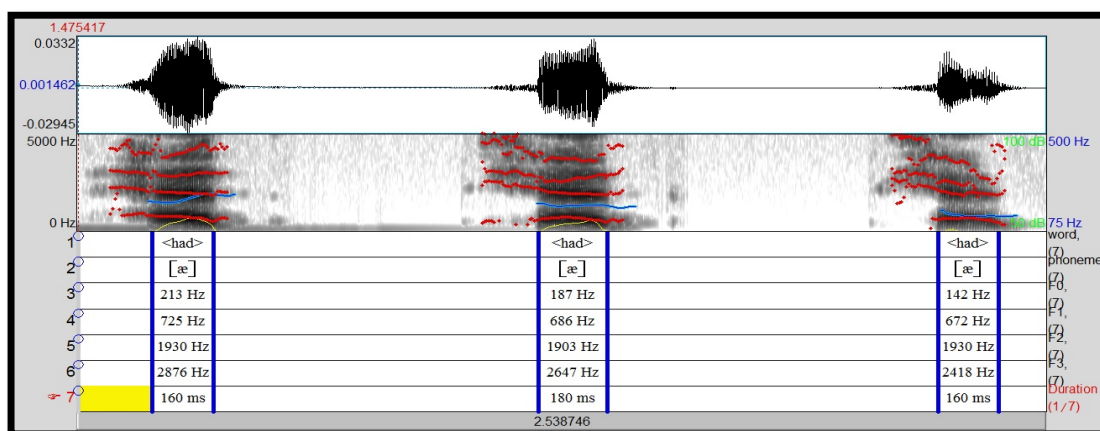


Figure 6: Spectrogram of the GAE Word <had>, Montenegrin Female Speaker No. 1

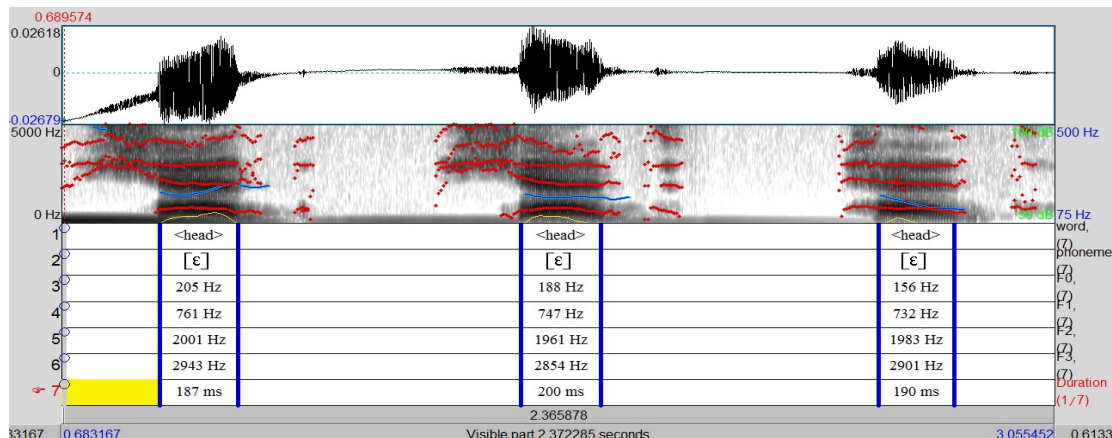


Figure 7: Spectrogram of the GAE Word <head>, Montenegrin Female Speaker No. 1

4.0 Vowel Quality Analysis

One of the distinctive features of English vowels is the contrast between tense and lax vowels. The tense vowels in English are [i], [u], [ɑ], [ɔ]², [o], and [e], while [ɪ], [ʊ], [ʌ], [ɛ], and [æ] are lax. The Montenegrin vowel system consists mostly of tense vowels, [ɑ], [i], [ɔ], and [u], and only one lax vowel [ɛ]. By looking at the results of the production analysis, Montenegrin speakers are more successful in producing English tense vowels, possibly due to the similarities to their native language.

Male Montenegrin speakers confuse [æ] with the acoustically closest Montenegrin vowel, [ɑ]. The F1 value for male production of Montenegrin English [æ] is 654 Hz, while the F1 value of Montenegrin [ɑ] is 636 Hz. The difference is nonexistent to human ear. Similarly, male Montenegrin speakers confuse vowel [ɪ] (Montenegrin production F1 value equals 485 Hz) with GAE vowels [e] (F1 = 476 Hz) and [ɛ] (F1 = 530 Hz). Montenegrin vowel [ɛ] native production is calculated at 459 Hz for F1 value. Being in such a close acoustic range, these vowels can cause confusion for male speakers of Montenegrin. These are the vowels that seem to cause the most challenges for the male Montenegrin learners of English.

Female Montenegrin speakers also have troubles accurately producing lax GAE vowels. For example, Montenegrin English [o] and [ʊ] are produced with a slight difference of 10 Hz for F1 (490 Hz for [o], and 500 Hz for [ʊ]). That is very close to the Montenegrin vowel [u] produced at 503 Hz for F1. Another confusion seen in the data is between GAE [ɪ] produced at 430 Hz in F1 value, and Montenegrin English [e] with 440 Hz for F1 value. This is very close to the production of Montenegrin vowel [i], which is produced at 457 Hz in F1 value.

This confusion Montenegrin speakers have with lax vowels seems to be due to the fact that most are nonexistent in Montenegrin. Considering there are only five vowels in

² It is very hard to characterize this vowel. Some researchers claim it is tense, some claim it is lax. I used Fromkin et al's classification, as cited.

the Montenegrin language and many more in the English language, there is a lot of room for confusion and unintelligibility with Montenegrin speakers when trying to produce GAE vowels.

5.0 Pedagogical Implications

The lack of research on pronunciation acquisition leaves instructors to their own intuition as to how to go about teaching pronunciation to ESL learners (Derwing & Munro, 2005). However, one cannot question the importance of pronunciation for both comprehensibility and intelligibility. Instructors usually lack time to devote to instruction of pronunciation, and it is necessary to provide them with information that can help them be both efficient and successful in teaching pronunciation. This study helps instructors obtain a better overall idea of pronunciation instruction, and to better know the needs of Montenegrin ESL learners. The results of this research clearly show the obstacles Montenegrin speakers of English face in their L2 acquisition of pronunciation. Instructors of Montenegrin learners of English need to accommodate for the needs that this research proves exist. The vowels should be taught explicitly, taking into account the differences between the vowel systems of English and Montenegrin. Teaching IPA should be seriously considered, as students could then visualize their speech. Also, computer-assisted language learning tools continue to develop each year. Now learners can benefit from a great number of helpful resources which can be used for self-evaluation of pronunciation. It is necessary to provide learners with such resources, as self-evaluation is an important part of language acquisition. The online resources are especially practical for Montenegrin learners who are in Montenegro, as the lack of teachers who are native speakers of English deprives the learners of that interaction. In addition, speech recognition software can be a good tool for practicing pronunciation, and it also provides informal feedback. Also, computer programs, such as Praat, can be very beneficial, especially for higher-level learners. They are not only useful for acoustic analysis, but also for self-evaluating one's speech characteristics by making comparisons. Providing more input that facilitates perceptual learning could also be beneficial in a classroom of Montenegrin speakers.

The results of this research prove that Montenegrin learners have few or no obstacles when it comes to most tense vowels, such as [i], [u], [o], and [e], and the lax vowel [ʌ]. However, lax vowels [ɪ], [ʊ], [ɛ], and [æ], and tense vowels [ɑ] and [ɔ] are problematic. This study shows that learners' confusion is high among these vowels, especially the vowels [ɛ] and [æ]. Instructors should focus their pronunciation instruction specifically on these two vowels. With this focus, more accurate production should follow naturally, providing learners with a better chance to improve their pronunciation skills.

6.0 Further Research Opportunities

It was not possible to compare Montenegrin vowels and English vowels exactly in the same /hVd/ environments because Montenegrin vowels do not occur in this environment. The words used to study Montenegrin vowels occurred in more than one

environment, as seen in these examples: <hlad>, <hljeb>, <hor>, <hir>, and <huk>. However, this distributional constraint, notwithstanding, the measurements provided here for Montenegrin vowels are reliable because they were taken at the midway point. Future studies will do well to investigate Montenegrin vowels in a variety of environments. The intelligibility issues discussed here focus narrowly on the acoustic measurements. Future studies will also benefit from incorporating relative functional load information in assessing the severity of the intelligibility issues raised in this study.

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