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FORMANT MEASUREMENTS OF SERBIAN SPEAKERS' ENGLISH VOWELS

ANDREJ BJELAKOVIĆ[1]
English Department
Faculty of Philology
University of Belgrade

U radu se predstavljaju rezultati akustičkog ispitivanja produkcije vokala engleskog jezika u govoru izvornih govornika srpskog jezika, studenata Katedre za anglistiku Filološkog fakulteta Univerziteta u Beogradu. Broj učesnika ispitivanja bio je 26 (13 studenata prve godine i 13 studenata završnih godina). Mereni su F1 i F2 naglašenih vokala — 11 monoftonga (KIT, DRESS, TRAP, FOOT, STRUT, LOT, FLEECE, PALM, GOOSE, THOUGHT i NURSE) i 4 diftonga (GOAT, PRICE, MOUTH i FACE). Takođe su mereni vokali u L1 ispitanika, koje smo poredili sa vokalima u njihovom L2, to jest engleskom. Ispitanici su snimljeni dok čitaju izabrane odlomke vesti Bi-Bi-Sija i dve kratke priče na srpskom. Broj analiziranih primera je 7534 na engleskom (oko 305 vokala po govorniku), i 4266 na srpskom. Rezultati pokazuju da učenici engleskog jezika čiji je maternji jezik srpski, na nivou znanja naših ispitanika, načelno ne zamenjuju vokale L2 vokalima svog L1; s druge strane, ne može se reći da dosežu vrednosti karakteristične za izvorne govornike, već kompromisne vrednosti. Izuzeci, kada je reč o zameni jesu vokal DRESS, i bar za neke govornike, vokal TRAP (oba su supstituisana srpskim kratkim /e/). Vokali kod kojih se javila najveća razlika između dve podgrupe ispitanika bili su GOAT, GOOSE, MOUTH, PRICE, i u manjoj meri THOUGHT, pri čemu su stariji, iskusniji studenti proizvodili vrednosti više nalik onima kod izvornih govornika.

Ključne reči: kvalitet vokala, usvajanje L2, L2 izgovor, EFL izgovor, vokali engleskog, frekvencija formanata, srpski.

1 Contact information: b.andrej@fil.bg.ac.rs

1. INTRODUCTION

The aim of the present paper is to add to the store of acoustic data pertaining to the vowels of English as produced by native speakers of Serbian. These data can shed light on how L1 phonology affects learners' acquisition of L2 phonology. Previous studies which acoustically investigated Serbian speakers' production of English include Marković (2007) and Marković (2012) (the results of which have also been partially presented in Marković 2009a, Marković 2009b, and Marković & Jakovljević 2013), Mlinar (2011), Paunović (2002) and Paunović (2011), Sudimac (2016), Marković & Jakovljević (2016), Dančetović & Nešić (2017); a subset of these involve Serbian speakers who had been living in an English speaking country prior to participating in the experiment, such as Krebs-Lazendic 2008, Krebs-Lazendic & Best 2007, Krebs-Lazendic & Best 2013, Čubrović 2016 and Čubrović 2017.

Our approach will consist of comparing the Serbian speakers' English vowels on the one hand with their L1 vowels (vowels of contemporary Belgrade Serbian), which we also analysed, and on the other hand with vowels of English native speakers (as presented in Bjelaković 2017).

We shall look at the results in the light of, on the one hand, Flege's Speech Learning Model (SLM) (Flege 1988, Flege 1990, Flege 1995, Flege 2005), especially hypotheses 3–7 (Flege 1995: 239), which together predict that L2 phonemes that are phonetically more dissimilar to L1 phonemes will more readily develop as new categories for learners; on the other hand, we will test the hypothesis that learners' experience will have effect on their L2 production (Bohn & Flege 1992, Flege et al. 1997, Munro & Derwing 2008, Derwing et al. 2007). This hypothesis has been confirmed in the papers cited, however, given the relatively small gap between our two groups of participants (only 3 years of learning and speaking English), we want to see if any measurable effect of this gap can be detected. Furthermore, in relation to that, we are interested to see which sounds will exhibit this effect, as Bohn and Flege's (1992) hypothesis predicts that groups with different experience levels will not exhibit differences when producing 'similar' sounds, whereas they will exhibit them when producing 'new' sounds.

2. METHOD

The participants in the present study (n=26) were all students of the English Department at the Faculty of Philology, University of Belgrade[2]. They were divided into two groups of equal size (each group had 7 female and 6 male participants), with the first group comprising freshmen (S1–S13), and the second group comprising fourth year and MA students (S14–S26). All participants grew up in Belgrade and are consequently speakers of the same L1 variety. All participants had been learning English formally between 10

2 Participant selection involved a survey with questions "Which do you prefer listening to?" and "Which do you prefer using?", the aim of which was to ensure participants preferred British as opposed to American pronunciation. This was done due to the fact that reference native speaker vowels from Bjelaković (2017) are vowels of Standard British English.

and 15 years, and none of them had ever lived in an English-speaking country (though some of the participants had visited English speaking countries briefly, on holiday).

The participants were recorded while performing reading tasks, using the Tascam DR-100mkII digital recorder, placed around 40 cm away from the participant's mouth.

The first reading task involved two short stories in Serbian (327 words and 263 words, respectively). The number of analysed vowel tokens ranged between 159 and 169 per speaker, yielding a total of 4266 analysed tokens. The number of analysed vowels for each vocalic category was as follows[3]: 18 /a/, 15 /a:/, 27 /e/, 18 /e:/, 13 /i/, 12 /i:/, 31 /o/, 8 /o:/, 15 /u/, 12 /u:/.

The second reading task involved paragraphs of BBC news copy, taken from Bjelaković (2017) (a total of 1923 words). The number of analysed vowel tokens was around 307 per speaker, with a total of 7534 analysed tokens. The following English vowels were analysed (the number of tokens is in parentheses): DRESS[4] (28), FACE (21), FLEECE (20), FOOT (14), GOAT (17), GOOSE (17), KIT (22), LOT (21), MOUTH (16), NURSE (22), PALM (19), PRICE (23), STRUT (17), THOUGHT (26) and TRAP (24).

Only stressed vowels were analysed. Regarding the phonetic environment, vowels that were either before or after /w/, /r/, /j/ or /l/ were completely avoided (see Deterding 1997: 49), as these approximants would most likely have noticeable coarticulatory effects. Other sonorants (i.e. nasals or other vowels) were also avoided whenever possible. The above conditions were somewhat relaxed with the FOOT vowel, due to its relative infrequency.

All tokens were analysed manually with Praat, v. 5.4 (Boersma and Weenink 2014), using the get formant function for F1 and F2. As is customary (Boersma 2013: 395), the settings with the cut-off at 5,500 Hz, were used for tracking all female speakers' formants, and the cut-off was lowered to 5,000 Hz for the analysis of the recordings from the male speakers.

A steady-state area around the temporal midpoint of the vowel was where measurements were taken for monophthongs. In cases where no steady state was present, as with some short monophthong tokens, measurements were made at the exact midpoint of the vowel's duration. Regarding diphthongs, to avoid the most obvious consonant coarticulation effects, measurements of the onset part were typically made after the first 12–16 per cent of the vowel's duration, while the glide was analysed by taking measurements at around 79–85 per cent of the vowel's duration, i.e. close to the endpoint of the vowel. The exact point of measurement was determined taking into account the central tendency of the vowel in question and the maximal value reached (e.g. for MOUTH onsets both F1 and F2 were measured at the point of highest F1 reached) (see Labov et al. 2006: 38).

The same method for analysing vowel formants was used in Bjelaković (2017), which analysed the speech of BBC newsreaders, the results of which will serve as reference values throughout the present paper.

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3 Previous studies (e.g. Lehiste & Ivić 1986: 67) have found that vowel length in Serbian has an effect on vowel quality (in non-high vowels), which is why we analyse the Serbian vocalic system as having five short and five long vowels. This approach was originally proposed by Jakobson (1937 [1962]).

4 As per usual, lexical set keywords originally proposed in Wells (1982) are used.

3. RESULTS

For each set of vowels, the following pattern will be used: the first figure will show Serbian speakers' L1 and L2 vowels, while the next figure will show Serbian speakers' English vowels and BBC newsreaders' vowels (adapted from Bjelaković 2017). As mentioned before, Serbian speakers comprised two groups: a less experienced first-year student group, and a more experienced fourth year/fifth year group; however, the two will be conflated in most figures, except for those vowels where the difference between two groups is noteworthy. Figures will show mean values normalized according to Lobanov (1971) and will be created using NORM (Thomas & Kendall 2007); ellipses will represent one standard deviation. Finally, a table with raw Hertz values will also be provided for each vowel.

3.1 MONOPHTHONGS

3.1.1 FLEECE[5] and KIT vs. Serbian /i/

Figure 1 displays the Serbian speakers' L1 vowels (/i/ and /i:/) and their L2 vowels (KIT and FLEECE). The Serbian vowels show little overlap with the English vowels (especially with KIT), and occupy the space between them. In other words, Serbian speakers' FLEECE vowel is more peripheral than their Serbian /i/~/i:/, while their KIT vowel is more centralised.

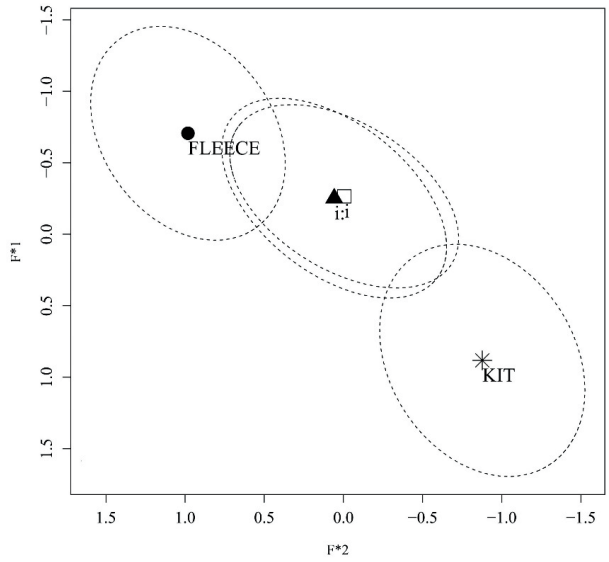

Figure 1. Mean formant values of Serbian speakers' L1 and L2 vowels, normalised according to Lobanov (1971)

5 Vowels FLEECE and GOOSE are treated as monophthongs in this analysis. In other words, the slight degree of diphthongisation present was not analysed, and measurements of F1 and F2 were made at one point only.

The following figure (Figure 2) shows BBC newsreaders' vowels (labelled FLEECEn and KITn) alongside Serbian speakers' KIT and FLEECE. As is apparent, FLEECE and FLEECEn overlap, with FLEECEn having a smaller ellipse, indicating less variation. On the other hand, the native KIT value (KITn), in addition to also having a smaller ellipse, is more centralised. This indicates that not all Serbian speakers have adequately acquired a native-like quality of KIT.

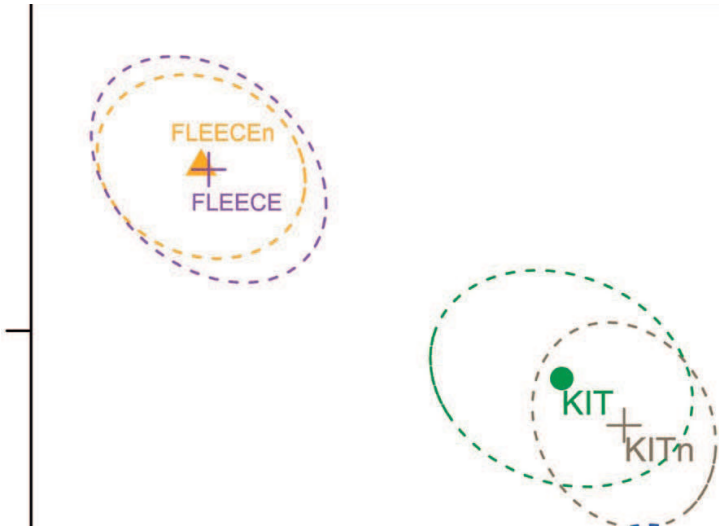

Figure 2. Mean formant values of Serbian speakers' (KIT, FLEECE) and BBC newsreaders' (KITn, FLEECEn) English vowels, normalised according to Lobanov (1971)

However, looking at individual vowel charts (not shown here) we see that only three Serbian speakers (two younger (S2 and S5) and one older (S25)) display a certain degree of overlap of KIT and FLEECE.

On the whole, the older and the younger student group displayed very similar results when it came to these two vowels.

	FLEECE		KIT		/i:/		/i/	
BBCM	290	2367	394	1830				
BBCF	348	2623	458	2073				
M	329	2199	413	1825	355	2039	347	2038
F	391	2633	476	2120	413	2355	420	2318

Table 1. Raw mean F1 and F2 frequencies of BBC male and female newsreaders (BBCM, BBCF), and Serbian speakers (M – male, F – female).

3.1.2 DRESS and TRAP vs. Serbian /e/

It is generally acknowledged that Serbian learners of English have difficulties acquiring the TRAP/DRESS opposition (Marković 2007, 2009, 2012; Paunović 2011, Marković & Jakovljević 2016). The same is true of native speakers of other languages, like Spanish or German (Flege et al. 1997).

In the figure below (Figure 3) it can be seen that the Serbian short /e/ largely overlaps with the Serbian production of the DRESS vowel. This tallies well with the predictions of Flege's Speech Learning Model (Flege 1995), as well as the results in Marković (2012: 105). Specifically, DRESS is categorised as a 'similar' vowel, and thus assimilated to the L1 category of /e/. On the other hand, the Serbian /eː/ is closer and fronter, and a clear separation is maintained. As regards TRAP Serbian participants show a degree of overlap with DRESS.

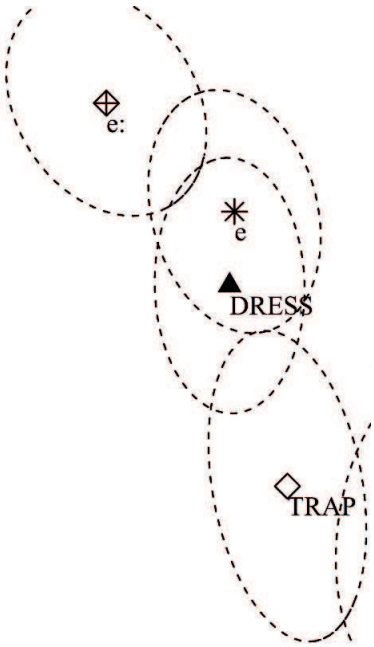

Figure 3. Mean formant values of Serbian speakers' L1 and L2 vowels, normalised according to Lobanov (1971)

The native TRAP/DRESS configuration is shown against that of the Serbian participants' in Figure 4. It is apparent that the native DRESS vowel (DRESSn) is somewhat closer and fronter than the Serbian learners' DRESS vowel, while the native TRAP vowel (TRAPn) is more open than the Serbian learners' TRAP vowel. Consequently, the native TRAP and DRESS display quite a clear separation, which is not the case with those produced by the Serbian participants.

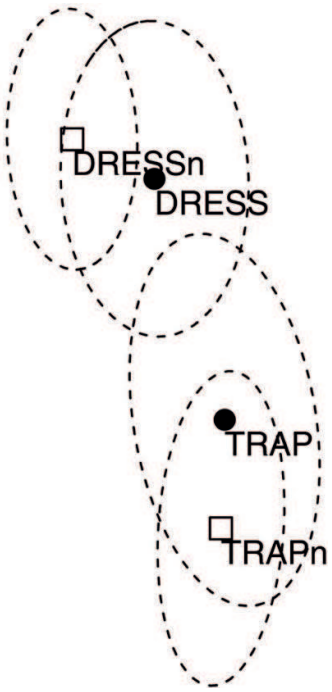

Figure 4. Mean formant values of Serbian speakers' (DRESS, TRAP) and BBC newsreaders' (DRESSn, TRAPn) English vowels, normalised according to Lobanov (1971)

When it comes to mean values, especially for TRAP, the older and the younger group, as with FLEECE and KIT, showed very similar results (the statistical analysis in Section 4 below confirms this). However, looking at individual vowel charts (not shown here), we can divide the Serbian participants into three groups: ellipses of TRAP and DRESS show a slight degree of overlap (four younger participants, S1, S4, S7 and S10, and five older participants S17, S19, S20, S22 and S24); ellipses of TRAP and DRESS show a large degree of overlap (two younger participants, S2 and S5, and three older participants, S16, S23 and S25); there is no overlap of TRAP and DRESS ellipses (seven younger participants S3, S6, S8, S9, S11, S12 and S13, and five older participants S14, S15, S18, S21 and S26) (see section 4).

	DRESS		TRAP		/e:/		/e/	
BBCM	544	1722	699	1546				
BBCF	615	1913	841	1665				
M	567	1582	673	1504	494	1769	525	1593
F	714	1824	830	1703	582	2046	676	1801

Table 2. Raw mean F1 and F2 frequencies of BBC newsreaders and Serbian speakers

3.1.3 PALM and STRUT vs. Serbian /a/

In this section we will be comparing the English PALM vowel with the Serbian /a:/ and the English STRUT vowel with the Serbian /a/. Figure 5 displays the Serbian participants' English and Serbian vowels.

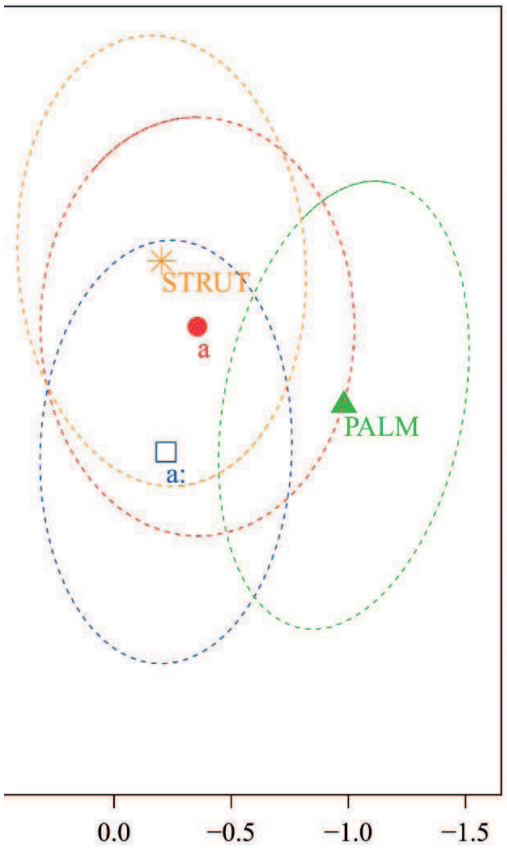

Figure 5. Mean formant values of Serbian speakers' English and Serbian vowels, normalised according to Lobanov (1971)

It is apparent that there is a large degree of overlap between the Serbian /a/ and the Serbian speakers' STRUT vowel, with the latter being somewhat more centralised. On the other hand, the PALM vowel does not overlap with the Serbian /a:/ quite as much, and is more retracted, as well as somewhat raised.

In Figure 6 we compare the Serbian speakers' PALM and STRUT with the BBC newsreaders' PALM and STRUT ('PALMn' and 'STRUTn').

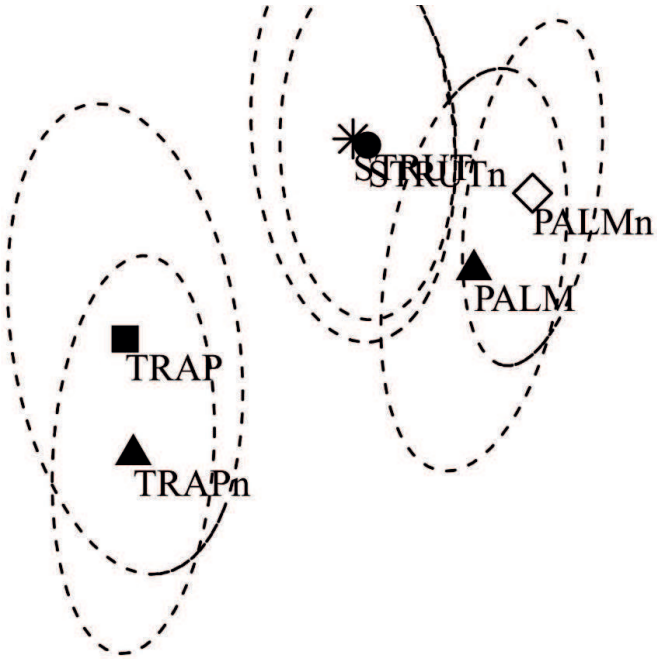

Figure 6. Mean formant values of Serbian speakers' (PALM, STRUT, TRAP) and BBC newsreaders' (PALMn, STRUTn, TRAPn) English vowels, normalised according to Lobanov (1971) (ellipses of other vowels, such as LOT, have been removed for the sake of clarity).

As before, the native speakers' ellipses are somewhat smaller. The STRUT vowel is remarkably similar (the mean values of STRUT and STRUTn are virtually the same). The mean value of the native speakers' PALM vowel ('PALMn'), however, is more retracted and raised. In other words, Serbian participants seem to produce an intermediate quality, one between the Serbian /a:/ and the native quality of PALM.

	STRUT		PALM		/a:/		/a/	
BBCM	611	1264	625	1120				
BBCF	697	1418	719	1191				
M	623	1263	674	1165	653	1266	619	1243
F	736	1438	782	1271	818	1432	781	1409

Table 3. Raw mean F1 and F2 frequencies of BBC newsreaders and Serbian speakers

3.1.4 LOT and THOUGHT vs. Serbian /o/

It is worth noting at the outset that a minority of Serbian participants tended to use a quality for LOT that was more like that found in North American English, i.e. more open and less rounded, especially in frequent words such as *not*, *body*, *God*, *job* and *shot*. These tokens were also analysed, primarily because it was difficult to draw the line and decide which tokens were to be inadmissible.

In Figure 7 we can see that the difference between Serbian /o/ and /o:/ is smaller than the difference between their /e/ and /e:/ (see Figure 3 above), and that this Serbian vowel is situated between the Serbian speakers' LOT, which is noticeably more open, and their THOUGHT, which is decidedly closer and retracted.

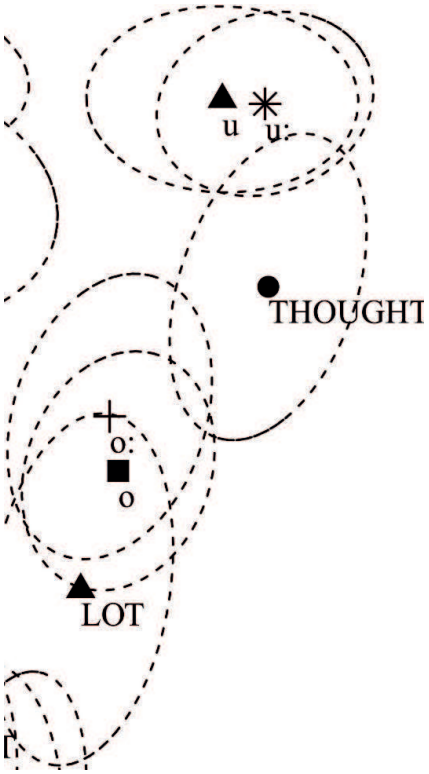

Figure 7. Mean formant values of Serbian speakers' English and Serbian vowels, normalised according to Lobanov (1971)

However, looking at the individual vowel charts, not shown here, we can see that the Serbian speakers' LOT vowel differs from their THOUGHT in one respect. Namely the LOT vowel shows much more individual variation, so that some speakers display the configuration as the one in Figure 7, while others display a great degree of overlap between their LOT vowel and the Serbian /o/ and/or /o:/ (two younger speakers, S1 and

S5, and three older speakers, S17, S18 and S22). On the other hand, all speakers showed a clear separation of their THOUGHT vowel from the Serbian vowels, indicating that this category is better acquired.

Figure 8 shows the Serbian speakers' and the BBC newsreaders' English vowels (LOT, THOUGHT, and LOTn, THOUGHTn, respectively). The native speakers' ellipses are yet again smaller, and this is especially true of THOUGHTn (the centre of which is a triangle in Figure 8). Native speakers had closer qualities of both LOT and THOUGHT.

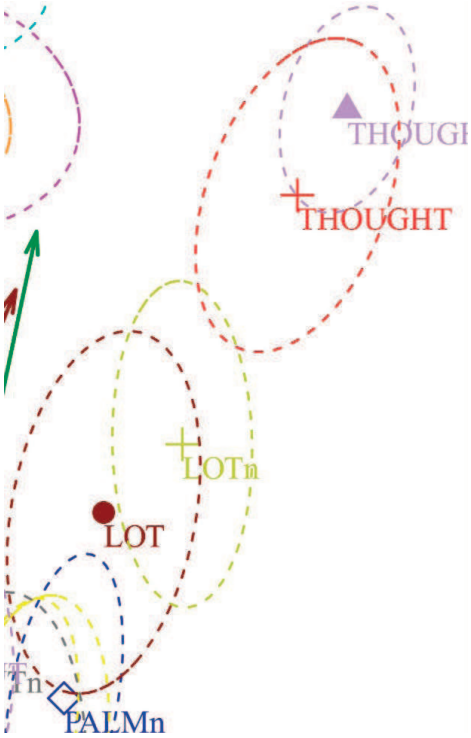

Figure 8. Mean formant values of Serbian speakers' (LOT, THOUGHT) and BBC newsreaders' (LOTn, THOUGHTn) English vowels, normalised according to Lobanov (1971)

In Figure 9 we split the Serbian participants into two subgroups, the younger, first-year student group (LOTml, THOUGHTml), and the older, more experienced group (LOTst, THOUGHTst), in addition to the BBC newsreaders (LOTn, THOUGHTn). There we can see that for each of the vowels the older students' vowel qualities were closer to those of the native speakers.

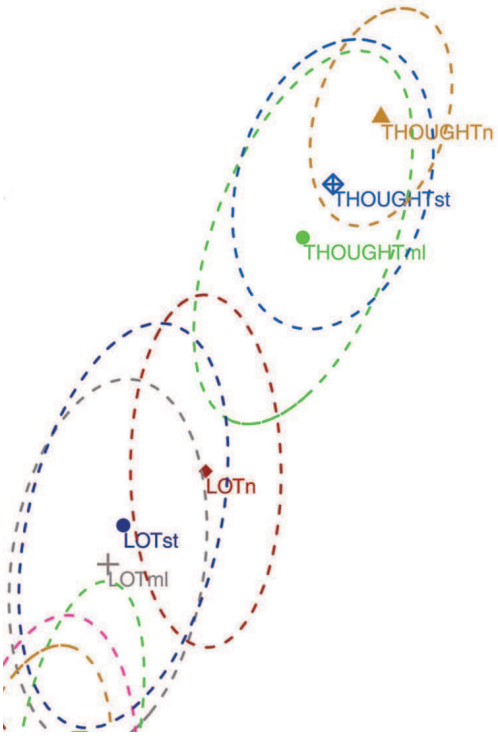

Figure 9. Mean formant values of less experienced (LOTml, THOUGHTml) and more experienced (LOTst, THOUGHTst) Serbian speakers' English vowels, as well as BBC newsreaders' (LOTn, THOUGHTn) vowels, normalised according to Lobanov (1971)

	LOT		THOUGHT		/o:/		/o/	
BBCM	547	959	407	750				
BBCF	577	1039	419	821				
M	574.2	1072	472.3	819.4	497	1023	514	1014
F	665.9	1181	506.6	922.5	594	1155	626	1139

Table 4. Raw mean F1 and F2 frequencies of BBC newsreaders and Serbian speakers

3.1.4 FOOT AND GOOSE VS. SERBIAN /U/

The Serbian /u/ is a back vowel, whereas the English GOOSE vowel, although once back, has been fronting for much of the 20th century (Wells 1997), so that now, at the beginning of the 21st century this is a central vowel, with a tendency to become a front vowel for some speakers (Windsor Lewis 1995, Cruttenden 2014: 133). The FOOT vowel seems to have been following this fronting, albeit to a lesser degree.

In Figure 10 we can see that Serbian participants do not, on the whole, exhibit any overlap between their Serbian back /u/ and their English FOOT and GOOSE vowels. The latter two, however, do partly overlap, indicating an imperfect acquisition of the FOOT vowel's centralisation. Also apparent is that their GOOSE ellipse is remarkably wide, indicating a great deal of variation.

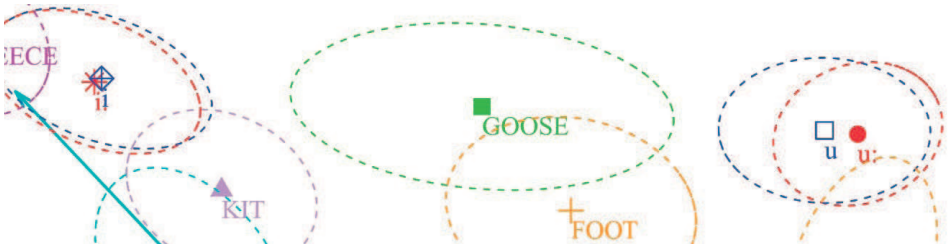

Figure 10. Mean formant values of Serbian speakers' English and Serbian vowels, normalised according to Lobanov (1971)

Looking at individual charts (not shown here) we can see that the Serbian and English vowel ellipses barely overlap for two younger (S2 and S7) and two older speakers (S20 and S25), whereas they overlap considerably for two younger (S5 and S11) and one older speaker (S16).

Figure 11 shows Serbian speakers' and BBC newsreaders' English vowels (FOOT, GOOSE, and FOOTn, GOOSEn, respectively). Apparent is the fact that the native speakers' GOOSE vowel (GOOSEn) has a much smaller ellipse and that its mean F2 value is much higher, that is to say the native speakers' GOOSE vowel is consistently fronter. In addition to this, the native speakers' FOOT and GOOSE show very clear separation, with GOOSE being not only fronter but more peripheral, as expected.

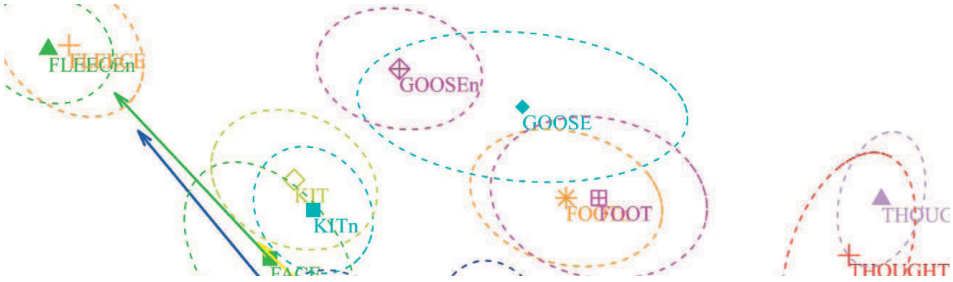

Figure 11. Mean formant values of Serbian speakers' (FOOT, GOOSE) and BBC newsreaders' (FOOTn, GOOSEn) English vowels, normalised according to Lobanov (1971)

Next, in Figure 12, we will split the Serbian participants into two subgroups, the younger, first-year student group (FOOTml, GOOSEml), and the older, more experienced group (FOOTst, GOOSEst).

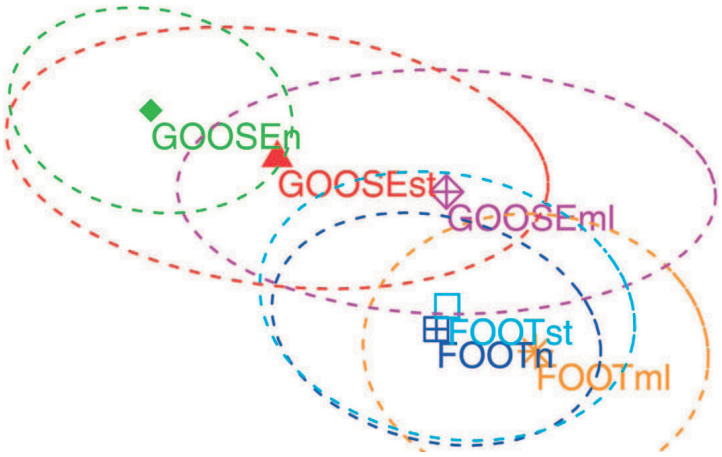

Figure 12. Mean formant values of less experienced (FOOTml, GOOSEml) and more experienced (FOOTst, GOOSEst) Serbian speakers' English vowels, as well as BBC newsreaders' (FOOTn, GOOSEn) vowels, normalised according to Lobanov (1971) (ellipses of other vowels, such as KIT, have been removed for the sake of clarity)

Figure 12 shows that older, experienced students exhibit FOOT qualities very close to those of the native speakers, while younger students' FOOT is more retracted. However, the difference between the two groups is larger when it comes to the GOOSE vowel. Namely, the mean quality of the older students' GOOSE (GOOSEst) is halfway between the rather front qualities of native speakers, and the backer qualities of younger students. Still, the older students' ellipse is not smaller than that of the younger speakers, indicating that they too exhibited a large degree of variation.

Looking at individual charts (not shown here) we can see that the following Serbian speakers reached native-like GOOSE qualities: two younger participants (S8 and S12), and four older participants (S14, S19, S20 and S21).

	GOOSE		FOOT		/u:/		/u/	
BBCM	317	1681	391	1349				
BBCF	343	1849	448	1490				
M	365	1373	420	1267	386	859	379	907
F	430	1683	491	1483	440	903	444	965

Table 5. Raw mean F1 and F2 frequencies of BBC newsreaders and Serbian speakers

3.1.5 NURSE

Vowels of Serbian that are closest in terms of quality to the mid-central RP NURSE are the short /e/ (which is front, but of appropriate height), and short /a/ (which is central but more open than NURSE).

Figure 13 shows that the mean value of Serbian speakers' NURSE was somewhat more open and front that the native speakers' NURSE. Individual vowel charts show that for native speakers the one standard deviation ellipse of NURSE does not overlap at all with any other monophthong; on the other hand, for the majority of Serbian speakers (14 out of 26) there is at least a slight overlap between NURSE and the Serbian short /e/ (and for some speakers the DRESS vowel as well).

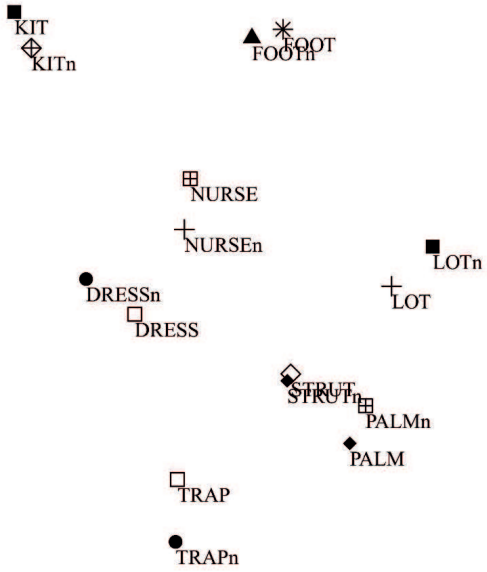

Figure 13. Mean formant values of Serbian speakers' and BBC newsreaders' English vowels, normalised according to Lobanov (1971)

	NURSE	
BBCM	505	1489
BBCF	597	1684
M	504	1434
F	605	1719

Table 6. Raw mean F1 and F2 frequencies of BBC newsreaders and Serbian speakers

3.2 DIPHTHONGS

3.2.1 PRICE and MOUTH

We will begin by comparing the lower section of the vowel space of the BBC newsreaders (Figure 14, top) and Serbian participants (Figure 14, bottom).

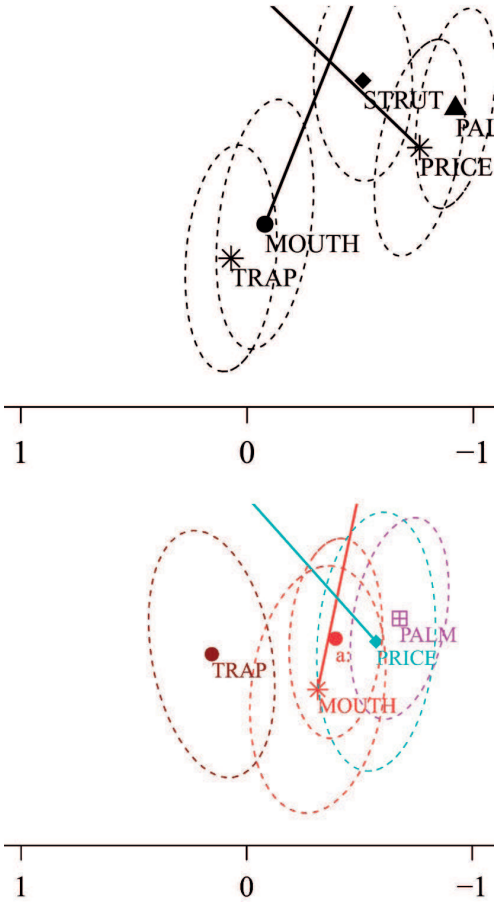

Figure 14. The lower section of the vowel space of the BBC newsreaders (top) and Serbian participants (bottom); the mean formant values were normalised according to Lobanov (1971) and the ellipses are one standard deviation (ellipses of other vowels, such as DRESS and the Serbian STRUT and short /a/ etc., have been removed for the sake of clarity).

In terms of similarities we can note that both native speakers' and Serbian speakers' onset of MOUTH is fronter than their onset of PRICE, or at least the mean values thereof; however, the onset of MOUTH is not as front as TRAP, nor is the onset of PRICE as back as PALM. The Serbian long /a:/ is between these two onsets, for our Serbian speakers.

On the other hand the one standard deviation ellipses are much larger for the Serbian speakers, and overlap with one another. The reason for this is that for many of the Serbian participants the onsets of these two diphthongs are very close to one another.

Looking at the individual charts not shown here we can see that the PRICE and MOUTH ellipses do not overlap for the following Serbian participants: one younger (S12) and eight older (S14, S17, S18, S19, S21, S22, S24 and S26) (these participants are also the ones whose PRICE and MOUTH display the least degree of overlap with the Serbian long /a:/).

In Figure 15 we separate the Serbian participants into two subgroups, the younger, first-year student group ('ml'), and the older, more experienced group ('st'). There we can see that the onset of MOUTH for older participants is halfway between the onset of native speakers and that of the younger, first-year participants. Similar is true for PRICE, at least when it comes to F2 values, i.e. the horizontal dimension. In other words, the distance between the onsets of PRICE and MOUTH is the greatest for native speakers, followed by the more experienced students, with the first-year students displaying the shortest distance between the two.

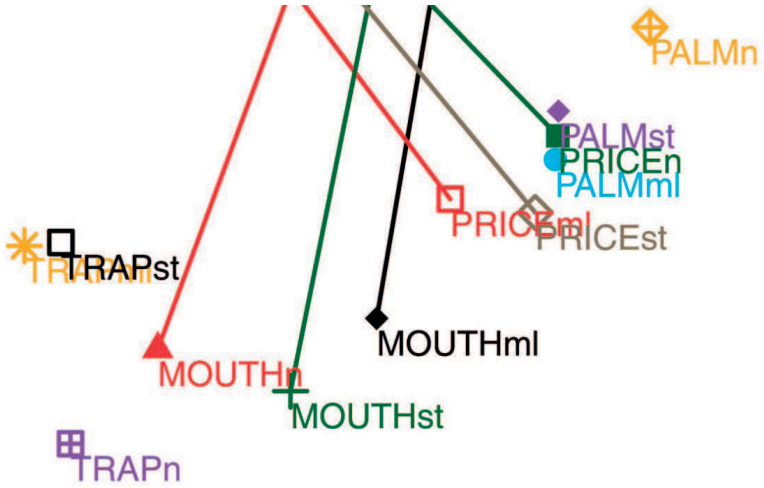

Figure 15. Mean formant values of less experienced (TRAPml, MOUTHml, PRICEml, PALMml) and more experienced (TRAPst, MOUTHst, PRICEst, PALMst) Serbian speakers' English vowels, as well as BBC newsreaders' (TRAPn, MOUTHn, PRICEn, PALMn) vowels, normalised according to Lobanov (1971)

	PRICE ons.		PRICE glide	
BBCM	635	1177	396	1946
BBCF	769	1277	496	2178
M	686	1200	485	1702
F	793	1332	560	2033
	MOUTH ons.		MOUTH glide	
BBCM	659	1440	435	1118
BBCF	824	1622	539	1303
M	699	1293	474	1158
F	844	1478	539	1272

Table 7. Raw mean F1 and F2 frequencies of BBC newsreaders and Serbian speakers

3.2.1 FACE

In Figure 16 we display the BBC newsreaders' front mid portion of the vowel space. As is apparent, the onset of FACE overlaps with the DRESS vowel. Its glide ends between their KIT and FLEECE monophthongs.

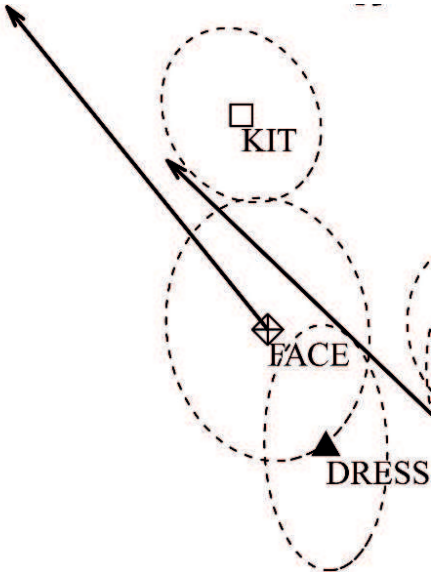

Figure 16. BBC newsreaders' front mid portion of the vowel space; mean formant values were normalised according to Lobanov (1971); ellipses are one standard deviation.

Figure 17. Serbian participants' front mid portion of the vowel space; mean formant values were normalised according to Lobanov (1971); ellipses are one standard deviation.

On the other hand, in Figure 17, which displays the Serbian participants' front mid portion of the vowel space, we can see that their FACE overlaps neither with their DRESS nor with their Serbian short /e/, but rather with their KIT and the Serbian long /e:/. Its glide enters the FLEECE and Serbian long /i:/ territories. Comparing Figures 16 and 17 it can also be noticed that the Serbian participants' FACE is a narrower diphthong (i.e. there is less distance between its onset and the end of its glide).

The same can be seen in Figure 18, which shows both the Serbian speakers' and the BBC newsreaders' English vowels. Specifically, it is apparent that DRESSn i FACEn are fairly close to one another, whereas the Serbian speakers' DRESS is more open and their FACE onset closer.

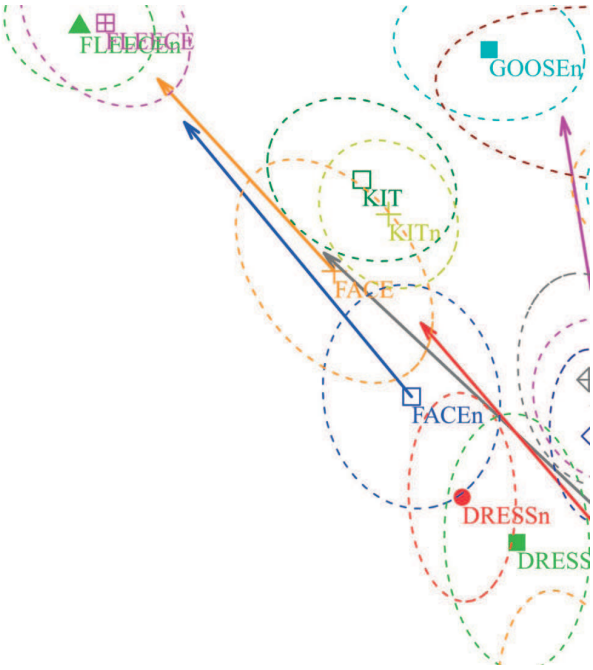

Figure 18. Mean formant values of Serbian speakers' (DRESS, FACE, KIT) and BBC newsreaders' (DRESSn, FACEn, KITn) English vowels, normalised according to Lobanov (1971)

In charts with separated younger and older Serbian speakers (not shown here) it can be seen that the two subgroups display very similar FACE qualities. It seems, then, that Serbian learners of English tend to substitute the onset of this diphthong with their L1 long /e:/ (the fact that their FACE onset tends to be closer still would be due to the coarticulation with the closing glide).

	FACE ons.		FACE glide	
BBCM	493	1761	341	2204
BBCF	565	2067	404	2416
M	463	1854	366	2127
F	528	2186	415	2529

Table 8. Raw mean F1 and F2 frequencies of BBC newsreaders and Serbian speakers

3.2.3 GOAT

Looking at Figure 18 we can see that the BBC newsreaders' GOAT onset is in the centre of the vowel space, overlapping with NURSE. Its glide also ends in a central position, only slightly fronter than the onset.

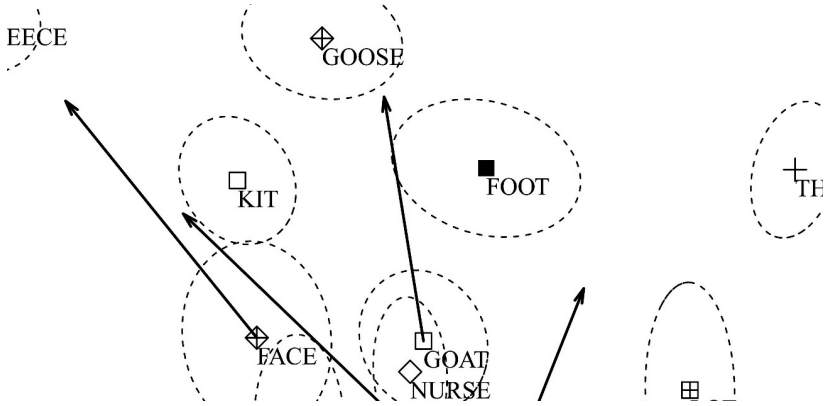

Figure 19. BBC newsreaders' front mid portion of the vowel space; mean formant values were normalised according to Lobanov (1971); ellipses are one standard deviation

On the other hand, as Figure 20 shows, the Serbian speakers' GOAT is retracted, both in terms of the nucleus and in terms of the glide. This can be ascribed either to the influence of North American English, or perhaps to L1 influence combined with the spelling (i.e. identification of the onset with the Serbian /o/), or to both.

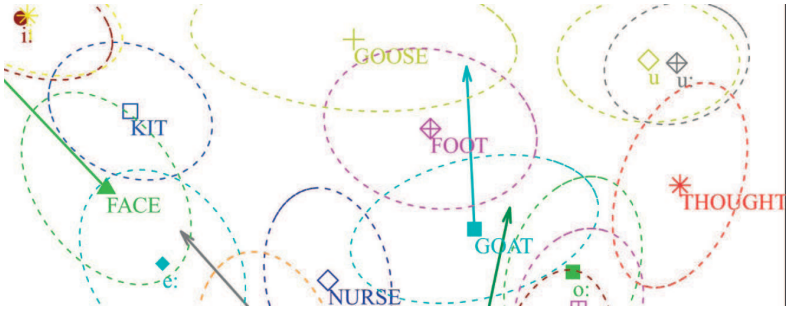

Figure 20. Serbian participants' vowels; mean formant values were normalised according to Lobanov (1971); ellipses are one standard deviation.

Looking at individual charts not shown here we see, similar to what we saw with PRICE/MOUTH, that Serbian participants who display fronter, more native-like GOAT quality are S12, S14, S15, S17, S19 and S21 (these all belong to the older, more experienced group except S12). This is confirmed in Figure 21, where we separate the two groups of Serbian participants.

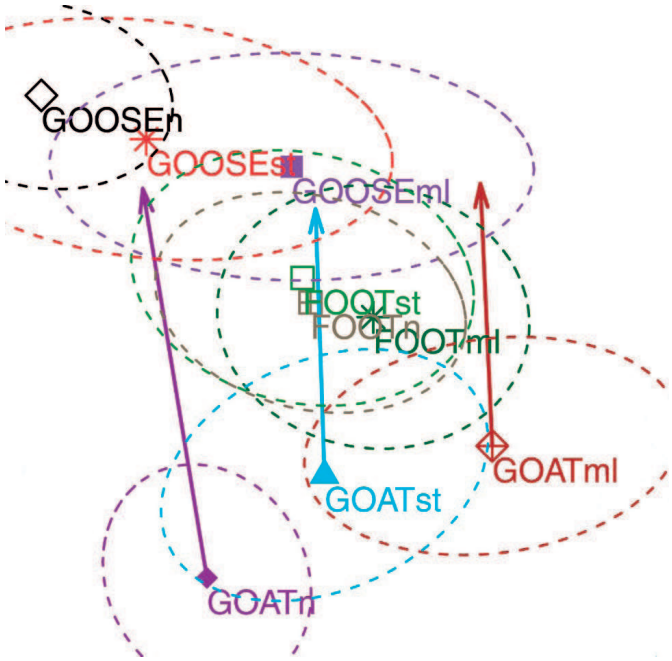

Figure 21. Mean formant values of less experienced (GOATml, FOOTml, GOOSEml) and more experienced (GOATst, FOOTst, GOOSEst) Serbian speakers' English vowels, as well as BBC newsreaders' (GOATn, FOOTn, GOOSEn) vowels, normalised according to Lobanov (1971) (ellipses of other vowels, such as LOT and THOUGHT, have been removed for the sake of clarity).

Figure 21 shows that both in terms of the onset and in terms of the glide the older, more experienced students' GOAT vowel (GOATst) is more like that of the native speakers, and halfway between theirs and the GOAT vowel of the first-year participants.

	GOAT ons.		GOAT glide	
BBCM	493	1437	349	1523
BBCF	568	1685	388	1752
M	487	1200	392	1190
F	555	1380	439	1414

Table 9. Raw mean F1 and F2 frequencies of BBC newsreaders and Serbian speakers

4. STATISTICAL ANALYSIS

Here we show the results of the statistical analysis that aimed to determine the strength of the effect of belonging to the first-year participant group as opposed to the final year student group. Rbrul, v. 3.1.2 (Johnson 2009, Johnson 2017) was used, with the independent variable being whether a speaker was 'ml' (S1–S13) or 'st' (S14–S26), and the dependent variables being normalised F1 and F2 values.

Table 10 shows p values (for $p<0.001$) in ascending order, as well as R^2 values; in other words, vowels that are near the top of the table were significantly different in the speech of two participant groups.

	p	R2
GOAT F2	0.000000000000000000278	0.173
GOATgl F2	0.0000000000000000192	0.156
PRICE F2	0.00000000289	0.064
GOOSE F2	0.00000000314	0.0784
PRICEgl F1	0.0000000185	0.0576
PRICEgl F2	0.0000000531	0.054
MOUTHgl F1	0.0000000807	0.0696
THOUGHT F2	0.000000244	0.0441
MOUTH F2	0.00000167	0.0559
FACE F1	0.0000234	0.0333
MOUTHgl F2	0.0000371	0.0417
THOUGHT F1	0.0000499	0.0275
KIT F1	0.0000671	0.0263
FOOT F2	0.000103	0.0412
STRUT F1	0.000336	0.0295
NURSE F2	0.000359	0.0248
LOT F2	0.000859	0.0205

Table 10. Formants of vowels arranged from the smallest to the largest p value, for $p<0.001$ (the independent variable was group membership).

5. DISCUSSION AND CONCLUSION

Table 10 above shows that where the two groups of student participants differed the most was the following: the F2 of GOAT (both onset and glide), with the more experienced students showing fronter, more native-like values; F2 of GOOSE of which the same is true; F2 of the PRICE and MOUTH onsets, with the older group having a fronter MOUTH onset and backer PRICE onset (again, more native-like and showing a clear separation of the two); and to a somewhat lesser degree F2 of THOUGHT (with older students again showing somewhat closer and more retracted, i.e. more native-like qualities)

On the whole, our results suggest that Serbian-speaking learners, at the proficiency level of our participants, do not on the whole substitute their L2 vowels with L1 vowels; on the other hand, they also do not quite reach the qualities characteristic of native speakers, but rather reach compromise values. Exceptions, regarding substitution, are DRESS, and for some informants at least, TRAP (both are substituted by the Serbian short /e/). The LOT vowel occasionally exhibited American influence, which resulted in a more open quality (more open than both the closest Serbian equivalent and the contemporary British quality); this is perhaps due to the American LOT quality being more readily perceived as a 'new' quality, which according to Flege's Speech Learning Model, is acquired more readily (Flege 1995). Regarding diphthongs, a certain degree of substitution was noticed, with the nucleus of FACE being substituted with the Serbian /e/ by some of the informants, and the nuclei of PRICE and MOUTH being substituted with the Serbian /a/.

As regards Flege and Bohn's hypothesis (Bohn and Flege 1992) that predicts that 'similar' sounds will be acquired more or less equally well by more experienced and less experienced learners, while 'new' sounds will be acquired better by more experienced learners, our results only partially confirm it. Namely, FLEECE and DRESS, being very similar to the Serbian /i:/ and /e/ are indeed much the same for our two groups of participants; on the other hand our more experienced participants acquired the GOOSE vowel better, and [ʉ] is indeed a 'new sound' for Serbian speakers. However, our results regarding TRAP and THOUGHT do not confirm this hypothesis — we would classify the latter as a 'similar' sound (very close to the Serbian /o:/) and yet the more experienced group had a more native-like THOUGHT; on the other hand the TRAP vowel, albeit a 'new' sound, is very similar for our two groups of participants. Finally, our results regarding NURSE are inconclusive, as it is a 'new sound' for Serbian speakers, but the difference between the two groups of participants is fairly slight (more experienced participants' NURSE is somewhat fronter, reaching the native speakers' values, but the F1 difference, characteristic of less experienced speakers, largely remains).

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SUMMARY

FORMANT MEASUREMENTS OF SERBIAN SPEAKERS' ENGLISH VOWELS

We present the results of an acoustic investigation of English vowels as produced by Serbian speakers, students in the English Department, Faculty of Philology, University of Belgrade. The number of participants was 26 (13 first-year students, and 13 fourth-year/MA students), and measured were F1 and F2 of stressed vowels — 11 monophthongs (KIT, DRESS, TRAP, FOOT, STRUT, LOT, FLEECE, PALM, GOOSE, THOUGHT and NURSE) and 4 diphthongs (GOAT, PRICE, MOUTH and FACE). Measurements were also made of the participants' L1 vowels, with which their L2 vowels were compared. Participants were recorded reading BBC news copy in English, and two very short stories in Serbian. The number of tokens analyzed was 7534 for English (around 305 per speaker), and 4266 for Serbian. The results show that Serbian-speaking learners, at the proficiency level of our informants, do not on the whole substitute their L2 vowels with L1 vowels; on the other hand, they also do not quite reach the qualities characteristic of native speakers, but rather reach compromise values. Exceptions, regarding substitution, are DRESS, and for some informants at least, TRAP (both are substituted by the Serbian short /e/). The vowels that exhibited the largest intergroup differences were GOAT, GOOSE, MOUTH, PRICE, and to a lesser degree THOUGHT, with older students showing more native-like qualities.

KEYWORDS: RP vowels, L2 production, vowel quality, EFL students' vowels, formant frequency, Serbian.

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