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## ACOUSTIC ANALYSIS OF POST-ACCENTUAL QUANTITY IN SERBIAN

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Abstract. Due to its inconsistency, the prosodic norm of the Serbian language has generated a lot of discussion within the linguistic community. What has particularly been obvious in recent times is the major discrepancy between the prescribed and the actual language in use. Deviations from the norm relate to the sequence of accents and the repertoire of prosodic units. However, one of the most unstable positions is considered to be the pronunciation of the post-accentual length, which, based on this research, is often equalized with post-accentual shortness in younger people. This paper studies the pronunciation of post-accentual length in the speech of Western Serbia, and employs an acoustic analysis of duration and listening perception to examine the patterns of the disappearance of post-accentual length (depending on the position within a word, type of syllable, type of accent, etc.).

**Key words**: acoustic analysis, duration, post-accentual length, post-accentual shortness

#### 1. Introduction

When it comes to the Serbian accent, there are two roles of prosodic units – accents and post-accentual lengths, which are most often emphasized. The first is prosodic, which stems from their very nature, and the second is differential, which acts as a deciding factor in identical examples: grad - grad; sestre (Gsg) – sestre (Npl) (Peco 1985: 76).

When they have a differential or contrastive role, post-accentual lengths cause a change in the lexical, basic meaning of words, e.g. podići (podilaziti = to flatter) – podići (podignuti = to raise, to lift), and a change in their grammatical meaning radi (present) – radi (imperative). However, regardless of whether the length in the given examples is pronounced or not, no sound will appear in the communication channel, since the context will most often provide for the understanding of the exact meaning of an expression, e. g. On ima pravo da odlučuje o svemu (He has the right to decide on everything); Nije im bilo pravo što su izgubili utakmicu (They felt bad about losing the game); Bilo je to pravo vreme za velike promene (It was the right time for big changes) (Peco 1985: 77).

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It is well-known that the repertoire of accents in Serbian varies depending on the region or dialect, and that certain speeches possess different accent systems – from the dynamic system, with a single, expiratory accent (the Prizren-Timok dialect), to the tonal one, with four accents typical of Neo-Shtokavian speeches (Eastern Herzegovinian and the Šumadija-Vojvodina dialect). Thus certain speeches are characterized by the existence of post-accentual length, while in others it does not appear at all, with a concluding fact that it is gradually disappearing in the majority of dialects.

The topic of this paper is the acoustic analysis of vowels with post-accentual length and post-accentual shortness, and the aim of the research is to examine the patterns of loss, i.e. preservation of the post-accentual length. Material comprising 20 words spoken by 20 respondents from the region of Western Serbia (Užice) was used to measure the duration of post-accentual vowels in open and closed syllables. All of the examples were positioned within short sentential frames, in which attention was paid to the analyzed vowels being located in similar consonant surroundings. Since the acoustic impression led to the conclusion that post-accentual length is reduced in the speech of younger people, the research included two categories of speakers – the first comprised respondents between 50 and 60 years of age, while the second included respondents between 18 and 25 years of age. Recording was carried out in studio conditions, and the spectrograms were analyzed in the Speech Filing System program. The quantity of the accented and post-accentual vowel was measured, as well as the frequency of the basic tone monitored at three points of the observed vowels. Statistical processing of the data was performed in Excel, and due to spatial limitations the paper only provides the group average values for the above categories of speakers.

### 2. POST-ACCENTUAL QUANTITY IN THE SERBIAN ORTHOTONE TRADITION

Vuk Karadžić's accentuation, which was further developed by Đura Daničić in the second edition of the Serbian Dictionary and his accent studies, offers a safe starting point for diachronic and synchronic research into Serbian accents, where one already encounters grammatical categories and positions in which post-accentual lengths appear.

Pavle Ivić was the first to shift the focus of observing literary language in relation to the Vuk-Daničić accent system, particularly concerning the length of the accent. He managed to "linguistically justify the lack of lengths, by shifting the focus of the Serbian diasystem from the Shtokavian centre to the Shtokavian east" (Đurović 1997:52). As it is almost impossible to ascertain the chronology, Ivić states that some old texts contain examples of length marking, however, those texts usually come from regions where quantity is consistently preserved. According to Ivić, a region characterized by at least a partial removal of quantity oppositions encompasses almost all speeches in Serbia, excluding the most western ones (Ivić 1991a:124). The removal of quantity, as Ivić claims, can be "merely phonetic" (Ivić 1994a: 165) or can appear as the shortening of lengths in certain morphological categories. Similar conclusions have been reached by other authors who have analyzed the prosodic system of the modern Serbian language (Dragin 2000: 358, Ivić 1994b: 95, Petrović 1996, Petrović—Subotić 1982, Subotić 1995).

The removal of long post-accentual prosodemes is, according to Petrović, a characteristic which has clearly made its way into the modern prosodic system,

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<sup>&</sup>lt;sup>1</sup> The radical loss of quantity oppositions behind accents has been conditioned by the following factors: 1) sound, 2) generation, 3) sentence intonation, 4) phonology and morphology, 5) position within a word, and 6) speaker's origin (Dragin 2009, 131).

particularly in the last several decades. "This phenomenon has, namely, spread to such an extent among the pupil and student Ekavian population, that it can be said that its realization of the standard Serbian language practically no longer contains the post-accentual quantity" (Petrović 1996: 93).

The results of the above research show that: 1) the length behind an accent is first lost if it is in the open ultima; 2) the quantity of the post-accentual prosodeme is first neutralized in the speech of the younger urban population; 3) the post-accentual length appears in the words of the ultimate non-final clause, rather than at its very end; 4) phonological and morphological factors are realized separately and in combination; 5) a long post-accentual prosodeme is more easily lost if it is more removed from the accent, meaning that out of the two, the first lost is the second one; and 6) the dialect base of speakers affects the degree of the reduction of the length behind an accent (Ivić 1994b: 95; Dragin 2005: 279).

The insisting of the Novi Sad linguistic school on the facultative standardization of the post-accentual quantity, in the positions of etymological or analogical quantity, would to a certain extent represent the suppression of the Vuk-Daničić system by dynamic accentuation, which is used by a minority of the Serbian people.

Regardless of the different standpoints, when considering the question of the status of the post-accentual length in standard orthoepy it would seem to be most convenient to follow Belić's conclusions that no change can be justified "until the entire accent territory has been well studied" (Belić 1991). When it comes to the speeches of Western Serbia, such studies have not been conducted thus far, and this paper represents a contribution to the research into the status of the post-accentual quantity in modern speech practice.

#### 3. ACOUSTIC ANALYSIS OF POST-ACCENTUAL QUANTITY

The corpus used to analyze the material comprises words systematized according to grammatical categories and certain noun suffixes. The duration of the vowel quantity was analyzed to determine the positions and certain tendencies and patterns of loss, i.e. preservation of the post-accentual length (depending on the position in a word, accent, type of syllable). Lengths were monitored in short sentential frames in the neutral position as follows:

- 1. behind the non-rising length in the open final syllable (mazi);
- 2. behind the non-rising length in the closed final syllable (*radnik*);
- 3. behind the non-rising length in the medial syllable (*radnici*);
- 4. behind the long-rising length in the open final syllable (*trpi*);
- 5. behind the long-rising length in the closed final syllable (*trpim*);
- 6. behind the long-rising length in the medial syllable (*spavanje*);
- 7. behind the non-rising shortness in the open final syllable (*vidi*);
- 8. behind the non-rising shortness in the closed final syllable (*oblak*);
- 9. behind the non-rising shortness in the medial syllable (*oblaka*);
- 10. behind the short-rising length in the open final syllable (sedi);
- 11. behind the short-rising length in the closed final syllable (junak);
- 12. behind the short-rising length in the medial syllable (*devojka*).

The average measurement results for the entire population examined are given in the following tables<sup>2</sup>:

<sup>&</sup>lt;sup>2</sup> Vowel duration is expressed in milliseconds.

 $\textbf{Table 1} \ Post-accentual \ length \ (the \ 1^{st} \ group \ of \ speakers)$ 

Example	Syllable	Duration	Pitch movement		
_	-	·	1	2	3
Mazi	ma	185.2	193.5	185.7	174.3
	zi	51.4	201.3	206.4	180.8
Radnik	rad	165.3	215.9	188.2	172.2
	nik	38.8	169.5	160.5	151.3
Radnici	rad	148.4	200.6	183.1	178.5
	ni	54.2	178.2	170.4	155.7
Trpi	tr	120.9	207.1	210.5	209.5
•	pi	66.7	202.7	185.5	178.1
Trpim	tr	115.3	199.2	188.3	185.1
-	pim	44.7	174.1	168.7	160.2
Spavanje	spa	163.7	183.4	184.3	187.5
	va	61.4	186.2	183.2	180.5
Vidi	vi	72.3	202.1	194.5	176.7
	di	58.8	181.2	169.5	166.4
Oblak	0	89.6	189.2	173.4	167.7
	blak	52.3	167.4	165.3	158.8
Oblaka	0	93.6	188.2	186.4	180.5
	bla	61.6	176.4	178.1	183.5
Sedi	se	102.5	202.3	205.6	208.5
	di	52.1	187.2	180.5	173.2
Junak	ju	65.4	193.4	196.6	198.8
	nak	66.8	188.4	174.5	170.2
Devojka	de	95.8	183.5	185.2	188.9
	voj	49.3	83.5	82.1	85.6

**Table 2** Post-accentual shortness (the 1<sup>st</sup> group of speakers)

Example	Syllable	Duration	Pitch movement		
Mazi	ma	151.2	185.6	186.1	187.2
	zi	27.8	185.4	183.6	180.7
Trpite	tr	130.4	195.3	187.2	197.1
-	pi	49.5	225.2	216.5	197.8
Vidi	vi	88.6	199.4	207.1	186.3
	di	36.5	180.6	164.7	160.4
Otok	0	60.5	205.3	202.2	192.5
	tok	29.6	164.8	161.5	150.5
Reci	re	91.2	180.4	192.7	198.1
	ci	37.5	198.5	184.4	180.8
Junačina	na	71.2	174.1	178.2	188.3
	či	50.3	178.3	140.7	158.3
Moba	mo	172.3	184.1	171.6	155.5
	ba	48.6	161.5	149.5	140.6
Doboš	do	140	195.5	170.8	162.3
	boš	41	175.6	165.1	152.4

In order to compare the duration of the phonologically long and short post-accentual vowels, the second table also shows words of a very similar phonetic structure (two-syllable and three-syllable words with the first syllable stressed, realized in the same sentential position, as well as vowels in an open and closed syllable). Based on the selected corpus how often the speakers in the study realize the post-accentual length can be determined, as well as how long it is with regard to the type of accent in the previous vowel.

The results obtained by analyzing the relation between the duration of post-accentual vowels and accented ones show that the duration in milliseconds for the post-accentual long vowel is 52.3 ms on average, while it is 39.4 ms on average for the post-accentual short vowel.

The longest duration of the post-accentual long vowel was measured in final closed syllables, with an average value of 55.6 ms, followed by final open syllables with 53.7 ms, and, finally, medial syllables with 47.8 ms. The measurement data on the duration of the long post-accentual quantity refute the phonetic universal that a vowel lasts longer in an open syllable.

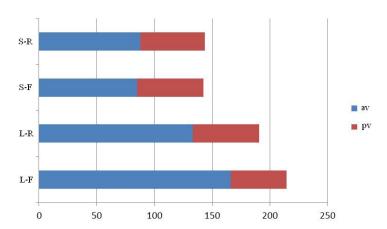
The duration of post-accentual vowels was also analyzed with regard to specific accents, and their variations depend on the type of accented vowel as well. The relation between the duration of the phonologically long post-accentual vowel and the long-falling accent is 28.9%, the long-rising 43.2%, the short-falling 67.56%, and the short-rising 63%.

On the basis of these values it can be concluded that the process of shortening the post-accentual length is most radically performed in the position behind the long-falling accent, where the average relation of the duration of the long post-accentual vowel towards the accented one is 27.7% in the open syllable, 23.4% in the closed syllable, and 36.5% in the medial syllable.

The duration in the final open syllable is best preserved behind the short-falling accent (the relation between the post-accentual and the accented vowel is 81.3%), followed by the long-rising (55.1%) and the short-rising (50.8%).

The duration in the final closed syllable is best preserved behind the short-rising accent (the relation between the post-accentual and the accented vowel is 102.1%), followed by the short-falling (58.3%), the long-rising (38.7%), and the long-falling (23.4%).

The duration in the medial syllable is best preserved behind the short-falling accent (the relation between the post-accentual and the accented vowel is 65.8%), followed by the short-rising (51.4%), the long-rising (37.5%), and the long-falling (36.5%).



**Table 3** The average duration of the accented and post-accentual vowel with regard to the phonological characteristics of the post-accentual vowel length and shortness (in young people)<sup>3</sup>

Type of accent	Type of post- accentual vowel	Duration of accented vowel	Duration of post-accentual	Relation between the duration of post-
		(ms)	vowel (ms)	accentual and accented
				vowel (%)
l-f	long (o.s)	185.2	51.4	27.7 %
	long (c.s)	165.3	38.8	23.4 %
	long (m.s)	148.4	54.2	36.5 %
	short (o.s)	172.3	48.6	28.2 %
	short (c.s)	140	41	29.2 %
l-r	long (o.s)	120.9	66.7	55.1 %
	long (c.s)	115.3	44.7	38.7 %
	long (m.s)	163.7	61.4	37.5 %
	short (o.s)	151.2	27.8	18.3 %
	short (c.s)	130.4	49.6	38.03 %
s-f	long (o.s)	72.3	58.8	81.3%
	long (c.s)	89.6	52.3	58.3 %
	long (m.s)	93.6	61.6	65.8 %
	short (o.s)	88.6	36.5	41.1 %
	short (c.s)	60.5	29.6	48.9 %
s-r	long (o.s)	102.5	52.1	50.8 %
	long (c.s)	65.4	66.8	102.1 %
	long (m.s)	95.8	49.3	51.4 %
	short (o.s)	91.2	37.5	41.1 %
	short (c.s)	71.2	50.3	70.6 %

<sup>&</sup>lt;sup>3</sup> Legend: o.s. = open syllable; c.s. = closed syllable; m.s. = medial syllable.

**Table 4** Post-accentual length (the  $2^{nd}$  group of speakers)

Example	Syllable	Duration	P	itch movemen	t
_		-	1	2	3
Mazi	ma	122.4	200.5	194.5	190.7
	zi	66.7	226.2	200.0	190.6
Radnik	rad	139.5	198.6	191.4	180.3
	nik	57.9	187.6	183.4	170.5
Radnici	rad	137.5	200.5	170.5	176.6
	ni	39.6	180.1	168.6	160.4
Trpi	tr	68.7	204.6	200.5	188.3
	pi	65.9	196.3	188.4	179.5
Trpim	tr	79.8	183.6	161.5	154.5
	pim	59.6	172.4	165.5	160.6
Spavanje	spa	149.5	198.7	180.5	170.1
	va	60.3	190.5	174.5	165.6
Vidi	vi	82.3	199.1	184.5	180.5
	di	55.4	188.2	179.6	170.4
Oblak	0	108.5	202.6	187.4	178.8
	bla	65.4	183.5	179.1	170.6
Oblaka	0	111.8	212.6	175.5	173.2
	bla	54.9	216.4	204.2	180.5
Sedi	se	112.3	204.7	201.2	204.1
	di	61.5	199.4	195.5	194.3
Junak	ju	56.4	201.5	203.4	205.7
	nak	65.3	220.5	210.4	198.6
Devojka	de	87.1	192.4	190.8	192.6
	voj	78.6	181.6	178.6	175.5

**Table 5** Post-accentual shortness (the 2<sup>nd</sup> group of speakers)

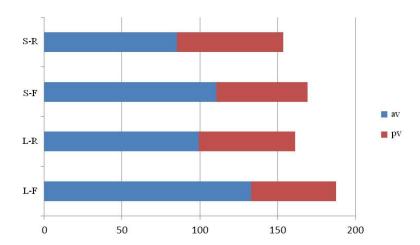
Example	Syllable	Duration	I	Pitch movemen	t
Mazi	ma	154.1	198.6	190.4	190.3
	zi	44.2	198.7	191.5	185.5
Trpite	tr	75.6	205.4	218.1	220.8
	pi	36.4	235.3	224.1	210.6
Vidi	vi	82.3	220.5	250.2	229.4
	di	33.6	233.3	207.3	199.6
Otok	О	110.5	195.4	197.1	200.4
	tok	40.4	207.5	200,5	187.4
Reci	re	96.7	203.6	223,6	237.4
	ci	31.5	242.1	232,3	230.1
Junačina	na	110.6	184.4	182,3	180.5
	či	35.1	82.4	80,4	78.6
Moba	mo	149.3	197.5	194,2	189.8
	ba	46.4	194.2	192,7	182.9
Doboš	do	137.8	199.3	187,3	163.4
	boš	44.8	177.5	172,4	168.5

The results obtained by analyzing the relation between the duration of post-accentual vowels and the accented ones show that the lengths have been completely preserved by the respondents. The duration in milliseconds for the post-accentual long vowel is 61 ms on average (which is 10 ms more than for the younger respondents), while it is 39.5 ms on average for the post-accentual short vowel (which is identical to the results for the other group of speakers). The total results of the vowel duration point to the tendency of young people towards shortening long vowels.

The identical duration of the post-accentual long vowel of 62.5 ms was measured in both final closed and final open syllables. The duration of the post-accentual vowel in medial syllables is 58.3 ms. As with the first group of examples, the measurement data on the duration of the long post-accentual quantity refute the phonetic universal that a vowel lasts longer in an open syllable.

The duration of post-accentual vowels was also analyzed with regard to specific accents, and their variations depend on the type of accented vowel as well.

The relation between the duration of the phonologically long post-accentual vowel and the long-falling accent is 41%, with the long-rising 62.3%, the short-falling 52.7%, and the short-rising 80.2%.



A recent study entitled "The quantity of long post-tonal vowels in Novi Sad speech" (Kvantitet dugih postoničnih vokala u govoru Novog Sada) co-authored by Marković and Bjelaković shows that "among post-tonal vowels one can observe an inherent property of all vowels – the longer duration of open vowels. The relation between long accented vowels and long post-accentual vowels ranges from 1.55 to 1.8 in both groups examined, while the values of short accented and long post-accentual vowels are similar, with all long post-accentual vowels apart from the vowel /u/ somewhat shorter than those with a short accent" (Marković, Bjelaković 2009: 145).

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<sup>&</sup>lt;sup>4</sup> The above vowel properties were not considered in this research.

**Table 6** The average duration of the accented and post-accentual vowel with regard to the phonological characteristics of the post-accentual vowel length and shortness (older respondents)

Type of accent	Type of post- accentual vowel	Duration of accented vowel (ms)	Duration of post- accentual vowel (ms)	Relation between the duration of post-accentual and accented vowel (%)
1-f	long (o.s)	122.4	66.7	54.4
	long (c.s)	139.5	57.9	41.5
	long (m.s)	137.5	39.6	28.8
	short (o.s)	149.3	46.4	31.0
	short (c.s)	137.8	44.8	32.5
l-r	long (o.s)	68.7	65.9	95.9
	long (c.s)	79.8	59.6	74.6
	long (m.s)	149.5	60.3	40.3
	short (o.s)	154.1	44.2	28.6
	short (c.s)	75.6	36.4	48.1
s-f	long (o.s)	82.3	55.4	67.3
	long (c.s)	108.5	65.4	50.8
	long (m.s)	111.8	54.9	49.1
	short (o.s)	82.3	36.3	44.1
	short (c.s)	110.5	40.4	36.5
s-r	long (o.s)	112.3	61.5	54.7
	long (c.s)	56.4	65.3	41.15
	long (m.s)	87.1	78.6	90.2
	short (o.s)	96.7	31.5	32.5
	short (c.s)	110.6	35.1	31.7

By comparing the values obtained in this research with those obtained by P. Ivić and I. Lehiste (Ivić i Lehiste 1963: 44–46), one can observe great similarities when it comes to the relation between long post-accentual and accented vowels. Namely, Ivić and Lehiste's values show that the long vowels found in the syllable immediately behind the short-rising accent are on average slightly longer than vowels with a short-rising accent. The same conclusion was reached during this research. In two-syllable words with a short-rising accent, whose average value of vowel duration is 56.4 ms, the duration of the long post-accentual vowel is 65.3 ms.

#### 4. CONCLUSION

Duration is an acoustic category which accounts for the difference between the accented and post-accentual syllables, the difference between long and short accented vowels, and the difference between long and short post-accentual vowels. The results of the research into the duration of post-accentual length point to its disappearance in modern speech, and the duration of certain segments is subject to the influence of tempo, number of syllables in a word, and type of accent in a syllable.

When it comes to the realization of the post-accentual quantity, the majority of dialectical research which deal with accents is limited to listening assessment, without measuring the

duration values of a vowel.<sup>5</sup> On the basis of the acoustic analysis and average statistical values obtained in this research, it can be safely concluded that the younger respondents from Užice show a highly pronounced tendency to shorten the post-accentual length in their speech. The research results show that in the pronunciation of this group of speakers the post-accentual length is often equalized with post-accentual shortness. The length does not disappear equally, in all categories, but its shortening is rather realized in certain positions, depending first on the length of the accented syllable, and then on the position of the length in the accented word. This speech primarily shows the tendency to remove the quantity from the final syllable in the word, as well as to avoid aggregated lengths. In the speech of the older respondents (the 2<sup>nd</sup> group of speakers) the post-accentual quantity is more stable in all positions, with a similar duration in open and closed syllables.

If one bears in mind that prior to the Neo-Shtokavian transfer the length behind the rising accent was the one which carried the accent impact, it is clear why the length is today most resistant in that position. This simultaneously implies that the length behind rising accents is secondary and can easily be explained as a result of the transfer of the long-falling accent to the previous syllable ( $\varepsilon y v \varepsilon M = \varepsilon y v \varepsilon M$ ), while it is new behind the falling accents ( $\varepsilon p \alpha \partial u M$ ,  $n \varepsilon \varepsilon M$ ).

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<sup>&</sup>lt;sup>5</sup> This is why this opportunity will be used to draw attention to one of the very few papers on the acoustic analysis of vowels with post-accentual quantity, the paper in case being the study of the Novi Sad speech (Бјелаковић–Марковић 2009, 110). The paper states that "the process of shortening post-accentual lengths is completely finished in the position behind the falling accents and post-accentual length and shortness, while it occurs only facultatively behind the rising ones." As expected, the length is much better preserved behind the short-rising than the long-rising accent.

# AKUSTIČKA ANALIZA NEAKCENTOVANOG KVANTITETA U SRPSKOM JEZIKU

U radu se pomoću metoda eksperimentalne fonetike proverava realizacija neakcentovanog kvantiteta u savremenoj govornoj praksi srpskog jezika, i to u regionu zapadne Srbije, gde se po pravilu dobro čuva četvoroakcenatski sistem sa neakcentovanom dužinom. Nakon detaljno prikazanih rezultata istraživanja ostvarivanja neakcentovane dužine uočava se da u govornom ostvarenju ova prozodijska jedinica postepeno nestaje, a njeno skraćivanje ostvaruje se u određenim pozicijama, u zavisnosti od dužine naglašenog sloga, a zatim i od položaja dužine u naglašenoj reči.

Ključne reči: akustička analiza, trajanje, neakcentovana dužina, neakcentovana kratkoća