Vowel Reduction in Russian

Acoustic Phonetics: the final paper

Theoretical background

Standard Russian has the following vowel phonemes: *i, e, a, o, u.*

There are three levels of stress in Russian:

> *Level 1*: the stressed vowels
> *Level 2*: the unstressed vowels in pre-tonic position
> *Level 3*: the unstressed vowels in pre-pre-tonic position and positions prior to it, post-tonic position and positions after it.

Vowel reduction varies for different vowels depending on their quality, stress level and whether preceding consonant is palatalized or not.

In standard Russian /ɑ/ and /o/ have the same allophones after non-palatalized consonants or word-initially: it's [ɐ] for the Level 2 and [ə] for the Level 3.

Modern Russian orthography doesn't reflect vowel reduction, but though at school the students are taught about the phenomenon, what they are told is that <in standard Russian> /o/ becomes [ɑ] when unstressed, which makes them to be unaware of schwa and other vowel allophones' presence in Russian.

In this paper I'd like to show that the reduced /ɑ/ and /o/ in the pre-pre-tonic positions cannot be considered [ɑ] (as most of the speakers think), but they actually become [ə].

The Experiment:

- The speakers

  I used data from two speakers: both of them are male, born in Central Russia, speaking Standard Russian, which immigrated to Israel in their late teen years with a difference of one year.

- The data

  The tested were requested to read out loud a paragraph that included a few words you need to state the number of words in question, and how (if) you calculated averages with /o/ and /ɑ/ in the pre-pre-tonic position, as well as a few words with /ɑ/ in a stressed position for a comparison. And o in stressed position?

The results

In the Tables 1 to 3 I have gathered all formant measurements related to the vowels of my interest:

Table 1. The stressed /ɑ/.

	F1	**F2**
/d**ɑ**n-n-ije/ [ˈd**ɑ.**nɨ.jə] 'data'	608.4725 600.4408[1]	1344.0780 1380.7155
/do-b**ɑ**v-i-tʲ/ [dɐ.ˈb**ɑ**.vʲitʲ] 'to add'	584.1214	1312.9727
/u-kɑz-**ɑ**-l-i/ [u.kɐ.ˈz**ɑ**.lʲi] 'declared, *pl*'	509.4418 542.7170	1511.9736 1449.7723

Is this an exhaustive list of the words, or just an example of each?

Table 2. The unstressed /o/. pretonic or pre-pre-tonic?

	F1	**F2**
/s**o**-xrɑn-on-n-oje/ [s**ə**.xrɐ.ˈnʲo.nə.jə]	534.7490 406.9340	1471.3712 1458.4497

[1] Here and for the following tables the first number in a cell is the first speaker's result and so on. And if there's only one number? Does that mean the second speaker didn't utter this word?

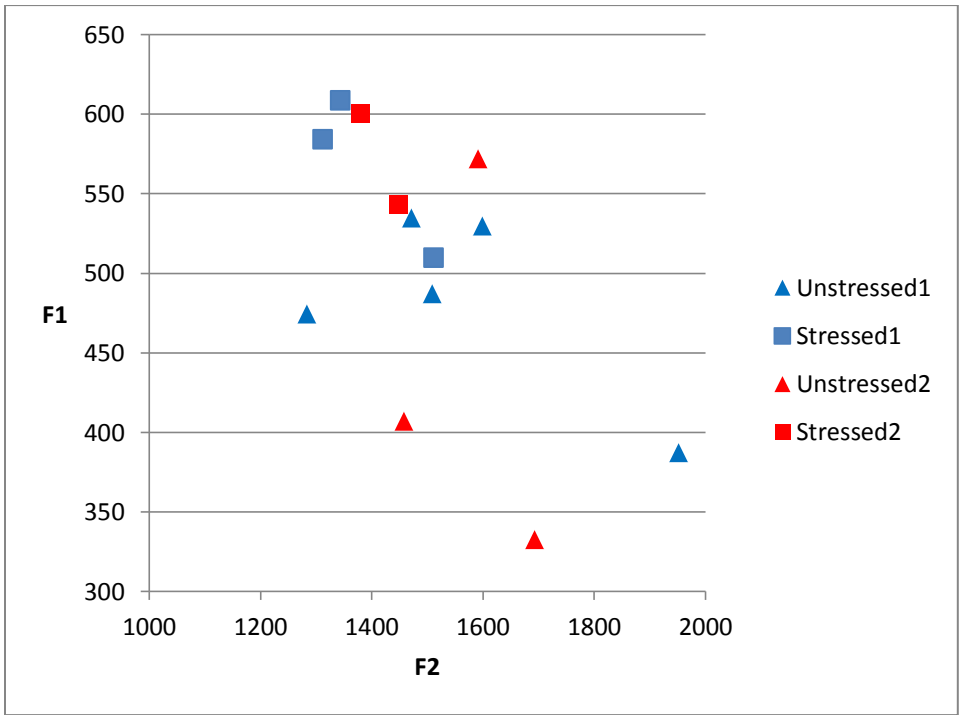
‘saved’		
/d**o**-bɑv-l-ɑ-tʲ/ [d**ə**.bɐ.vlʲatʲ] where is stress? ‘to add repeatedly’	487.1092	1509.5757
/**o**dn-ovo/ [**ə**d.nɐ.ˈvo] ‘of a one’	529.7781 571.9565	1599.2633 1591.9872

Table 3. The unstressed /ɑ/.

	F1	**F2**
/voz-st**ɑ**-n-ovi-tʲ/ [v**ə**.stə.nɐ.ˈvʲitʲ] ‘to recover’	474.5118	1283.4201
/z**ɑ**-jɑv-len-ije/ [z**ə**.i.ˈvlʲe.ni.ə] ‘statement’	387.4031 332.5458	1951.9611 1693.5540

In the following chart (Figure 1) are shown all the results appearing in the tables above. It’s rather clear that unstressed vowels tend to have lower F1 and higher F2 than the stressed [ɑ], which should mean that these vowels are higher and more frontal. It's not clear whether unstressed /o/ and unstressed /a/ are the same or not. You should have separated.

Figure 1. Blue marks stand for the first speaker's results; red marks are for the second speaker.



The Problem

I'd like to emphasize the issue of the vowel length. For instance, in the Figure 2 we may see the two vowels, when the unstressed one is four times shorter than the stressed one. Sometimes the unstressed vowel is even omitted (and this is why for some of the words I only have one measurement and I don't know which speaker it's for. Besides that, the transitions are long in relation to the vowel's length, which makes the measurements not quite faithful, and probably, this is the reason why the results weren't very consistent.

Figure 2.1 Speaker 2: [ˈdɑ.nɨ.jə]. F1=600.4408, F2=1380.7155, length=0.12s

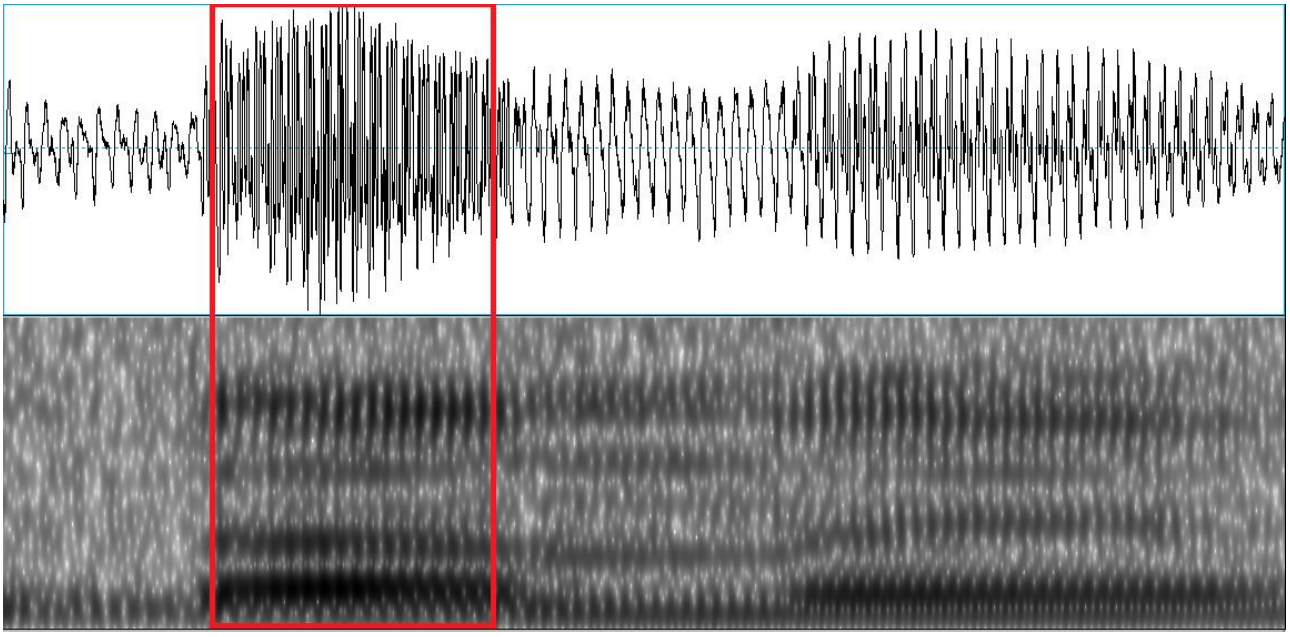
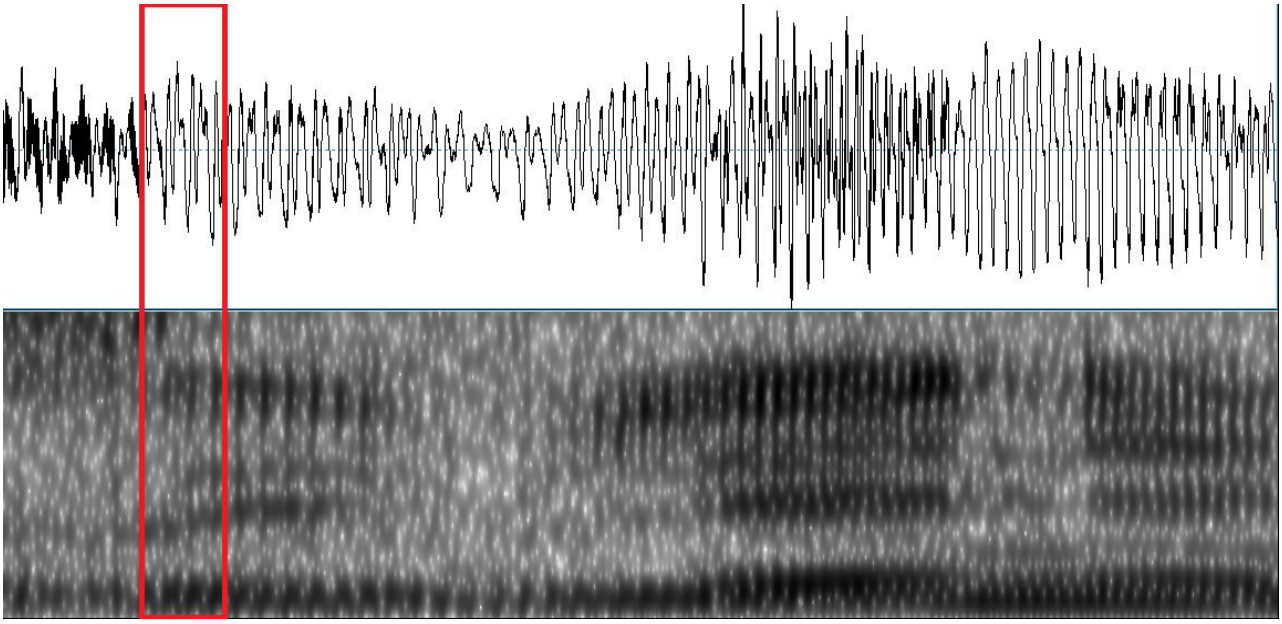


Figure 2.2 Speaker 2: [zə.i.ˈvlʲe.niə]. F1=332.5458, F2=1693.5540, length=0.033s



Note amplitude too, this vowel is much "smaller" than a stressed vowel

Conclusion

After examining a speech of two speakers I have seen that in most of the cases the allophones of /ɑ/ and /o/ in the pre-pre-tonic position tend to have lower F1 and higher F2 than in stressed [ɑ],

which means that the vowel in the unstressed position is higher and more frontal than [ɑ]. Although, I have to admit that better recording devices and/or another way of gathering data could produce better results. Very nice! My major problem (and I'm not discussing methodology here) is that you don't give the amount of data you used. Indeed, you could have actually given us the paragraph itself. Numbers (when it comes to data quantities) are very important.