

# ENGLISH RHYTHM AND THE SLOVAK SPEAKER

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## ABSTRACT

It has been hypothesized that since in Slovak the difference in durations between stressed and unstressed syllables is not maximized in the same way as in English, Slovak speakers of English will tend to make insufficient differences between the two groups of syllables. Thus Slovak speakers' utterances in English will be perceived by native speakers as having non-native-like rhythm.

Spontaneous utterances of native and non-native speakers have been analyzed through segmentation of sonorous nuclei of stressed and unstressed syllables and through measurements of their durations. In mathematical processing methods of descriptive statistics and probability t-test have been applied. The results indicate a stable difference in durations of sonorous nuclei of stressed and unstressed syllables in native speakers and significantly varied difference in non-native speakers.

## 1. INTRODUCTION

Rhythm is an important part of language communication, serving as an organizing principle, helping to spread out important bits of information in roughly equal intervals of time. Effective, recognizable rhythm is essential for native listeners (Taylor, 1981). An important part of rhythmical patterning in English is stress the correlates of which are (Fry, 1955): pitch, syllable duration, intensity and vowel quality.

Similarly, in Slovak stress correlates are: pitch, syllable duration and intensity (Sabol, 1986; Zimmermann, 1994) whereas vowel reduction is not maximized like in English and, consequently, does not operate as a stress correlate.

## 1. RESEARCH PROJECT

1.1. It is hypothesized that due to the perception differences between the rhythmical patterning in English and Slovak, oral productions of Slovak learners of English are perceived as having a non-native like rhythm. Slovak speakers do not maximize the differences in duration of stressed and unstressed

syllables, which results in the fact that native speakers perceive them as having a non-native like rhythm.

Research studies on stress report the following differences in durations of stressed and unstressed syllables: i/ in English: stressed syllables being 1.5 times longer than their unstressed counterparts (Laver, 1996), the most frequent vowel is schwa; ii/ in Slovak: stressed syllables being 1.2 times longer than their unstressed counterparts (Sabol, Zimmermann, 1994), the most frequent vowel – [a].

1.2. The above-mentioned theoretical basis has led to the research project, which has been carried out in the Faculty of Arts Phonetics Lab. Spontaneous utterances in English (both monologues and dialogs, spot the difference pictures and strip stories) have been analyzed. Three native speakers' and five non-native speakers' – first-year English language teacher trainees' productions have been recorded. The whole recording lasts twenty-two minutes.

The focus of the research project is an investigation of the differences in durations of stressed and unstressed syllables in native and non-native speakers' productions. Since duration of a syllable is determined by the duration of its nucleus it is obvious that sonorous nuclei have been subject to the analysis.

1.3. Syllables and their sonorous nuclei have been analyzed on the PC with CSL 4300 system (produced by KAY Elemetrics Corporation, U.S.A). In segmentation three subanalyses have been applied: duration of the speech signal amplitude, sonagram and auditory perception of the speech signal. This stage of the project has been the most time-consuming. 2 – 4 syllables have been analyzed simultaneously on the screen, the number of syllables varying according to the fact whether the transients on the vowel – consonant borderline have been clear or have been continuous and, consequently, more difficult to identify.

The quantity of a nucleus has been measured by reading the relative duration which depends on the position of the cursor in window A. Stressedness has been determined on a perception basis by means of dichotomic yes/no.

1.4. Analyzed data have been processed statistically by means of Spreadsheet EXCEL 97 and software Statgraphics. The total number of analyzed nuclei was 2,988. The numbers in individual speakers are shown in the following table:

	Native speakers			Non-native speakers – English language teacher trainees				
	Scott	Paul	Arthur	Ervin	Viktoria	Michaela	Frantisek	Laura
Stressed syllables	183	319	237	179	183	155	162	183
Unstressed syllables	108	272	191	161	184	149	151	171

Nuclei of all timbres are included, ie long monophthongs (369), diphthongs (476) and triphthongs (5). Specialized investigation of the above-mentioned nuclei will be subject to further investigation.

1.4.1 By means of first statistical investigation – classification of data – we have obtained frequency tabulation suitable for the preparation of histograms. The investigation has been based on the assumption that the ratio of durations in stressed and unstressed syllables in native speakers' productions is 1.5

whereas in Slovak speakers it is 1.2. A frequency tabulation has been generated for each individual speaker and for stressed and unstressed syllables. Figure 1 illustrates a situation where a non-native speaker (Viktoria) produces the stressed syllables with a considerably shorter duration than a native speaker.

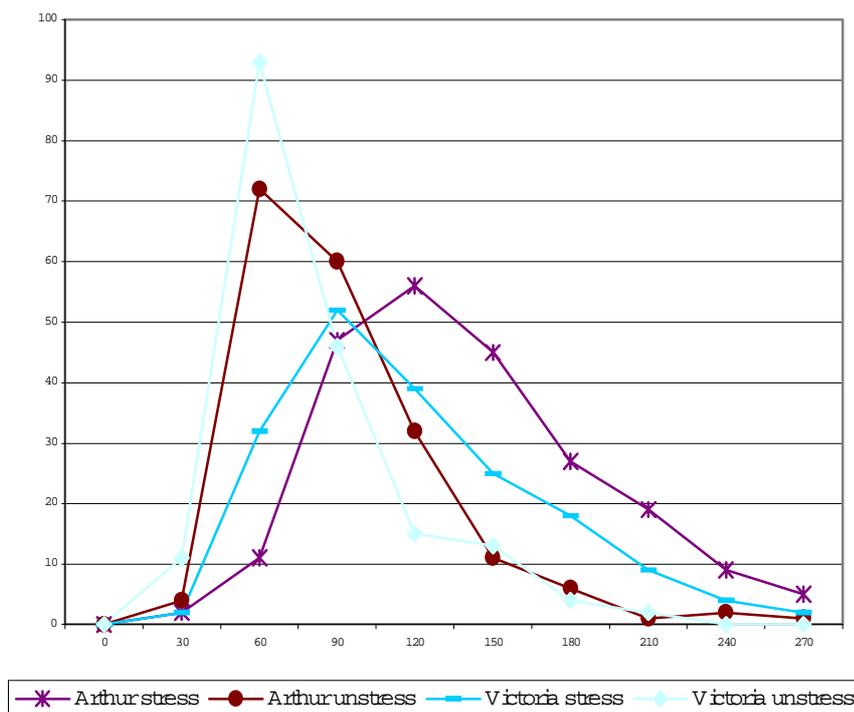


Figure1. Frequency histogram durations of stressed and unstressed syllable nuclei in native (Arthur) and non-native speaker (Viktoria).

1.4.2. Naturally, these data are insufficient. More exact results have been obtained from summary statistics, first of all arithmetic average, standard deviation, maximum, minimums

and variance range. Summary statistics are shown in the following table:

	Average	Stand. deviation	Minimum	Maximum	Variance range
Scott stress	149.83	72.33	45	485	440
Scott unstress	78.92	31.56	26	192	166
Paul stress	128.73	62.41	44	386	342
Paul unstress	62.68	26.04	20	219	199
Arthur stress	140.72	77.30	22	683	661
Arthur unstress	78.63	44.53	15	318	303
Ervin stress	125.68	55.62	43	342	299
Ervin unstress	72.22	32.60	16	206	190
Viktoria stress	104.14	48.52	23	270	247
Viktoria unstress	66.66	34.17	20	193	173
Michaela stress	123.99	62.07	30	343	313
Michaela unstress	67.31	35.99	26	234	208
Frantisek stress	118.08	52.16	40	288	248
Frantisek unstress	64.94	36.87	23	344	321
Laura stress	118.97	50.79	40	313	273
Laura unstress	76.60	31.21	28	226	198

In order to obtain a survey of these features, a box plot has been prepared (Figure 2). It follows from the graph that the native speakers (S – Scott, P – Paul, A – Arthur) have the same ratio (average and standard deviation) of stressed and unstressed syllables. A difference can be observed in Paul whose spontaneous performance has a higher tempo than Scott's and

Arthur's. Despite this individual difference, the ratio of stressed and unstressed syllables is maintained. The investigated ratio of durations is considerably different in non-native speakers (E – Ervin, V – Viktoria, M – Michaela, F – Frantisek, L – Laura). The smallest difference in durations of stressed and unstressed syllables can be observed in Viktoria.

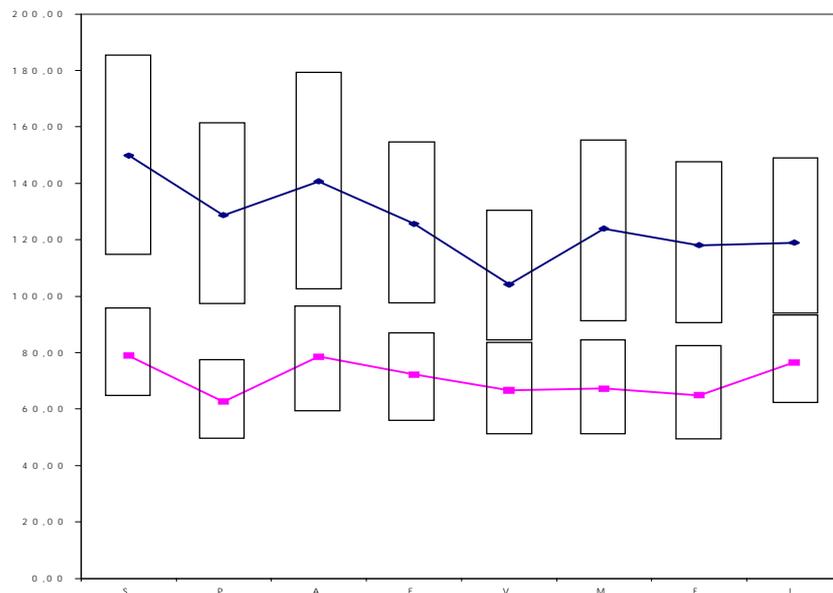


Figure 2. Graph of averages and standard deviations of durations of stressed (upper curve) and unstressed (lower curve) syllables in all speakers (height of boxes indicates standard deviation).

**1.4.3.** The articulatory process, one of the stages of speech communication process with a considerable portion of redundancy, has a stochastic character. The histogram and graph of arithmetic averages (see Figure 2) appear to be exact results of analysis. In the study concerned, only 8 speakers have been analyzed, which should be regarded as a representative sample, a representative statistic sample. Therefore, the results of the analysis should be expressed by application of probability. Thus, at the

end of the experiment, a statistic test of hypothesis has been applied, namely two sample Student t-test in order to achieve estimation of differences in average durations in stressed and unstressed syllables. This difference has been tested by means of confidence intervals at the significance level  $\alpha = 0.05$ . The results of the tests are statistically significant and numerically expressed intervals in ms, stated in the following table:

Native speakers	Scott	58.80 – 83.02 ms
	Paul	58.50 – 73.58 ms
	Arthur	50.35 – 73.81 ms
Non-native speakers	Ervin	43.83 – 63.07 ms
	Viktoria	28.84 – 46.09 ms
	Michaela	45.27 – 68.09 ms
	Frantisek	43.14 – 63.13 ms
	Laura	33.60 – 51.12 ms

These intervals (in Scott for example) are interpreted in the following way: it can be stated with 95% reliability that the difference of average values of durations of stressed and unstressed syllables is in the interval 58.80 – 83.02 ms, etc. This is a relative difference of averages (for example in the native speaker Paul) which is maintained even at a different tempo.

It follows from the last table that native speakers maintain the assumed difference. This difference varies in non-native speakers, being of lowest value in Viktoria. Consequently, the statistic tests confirm and at the same time refine the analyses introduced in 1.4.1 and 1.4.2.

2. In this investigation monophthongs, diphthongs, long monophthongs and triphthongs have not been differentiated; no analysis has been carried out for each specific kind of vowel in terms of its timbre. This differentiated approach will be subject to further investigation and similar analysis of difference of stressed and unstressed syllables at the level of basic tone and intensity will be conducted.

This research project seems to support some earlier findings, namely that maintaining appropriate difference in duration of stressed and unstressed syllables in English is one of the most widely experienced challenges for non-native speakers of English.

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