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COMPARISON OF CZECH AND ENGLISH RHYTHM
Bakalářská práce

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Prohlášení:

Prohlašuji, že jsem závěrečnou práci vypracoval samostatně a použil jen v bibliografii uvedených pramenů a literatury.

V Olomouci ....

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vlastnoruční podpis

I would like to thank Mgr. Jaroslava Ivanová, M.A., Ph.D. for her support and patience altogether with her valuable advice and comments on the content (both theoretical and practical) and style of my Bachelor Thesis. I would also like to thank Mgr. Kamila Ivanová, the editor of Český Rozhlas Olomouc, who made the recording of the Czech speech sample available for the purpose of phonetic analysis.

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ABSTRACT

The purpose of this thesis is to compare speech rhythm of two languages, English and Czech. This is tackled from theoretical and practical point of view. The theoretical part deals with the main factors that influence the rhythm of both languages and the acquired knowledge is used to formulate some basic hypotheses.

These are examined in the practical part devoted to speech analysis of two recordings of Czech and English speech. The analysis is conducted by means of Praat which is a freeware developed for the purpose of speech analysis by Paul Boersma and David Weenink of the University of Amsterdam. Research results show that certain regularities can be noticed in either language.

INTRODUCTION

The process of learning and acquiring a language, any language, is a difficult one. Since language is a complex discipline that constitutes many others like knowledge of vocabulary, knowledge of grammar and its correct application, ability to understand to a spoken word not only written and of course production of speech itself, one cannot simply dismiss any of them in order to achieve fluency in the language. The main reason why this topic was chosen is to find out what can contribute to make English language sound more natural and fluent to the ear of a native speaker.

This bachelor thesis, therefore, deals with some of those disciplines which are usually not given much attention to within the learning process, however, their importance is reflected in the way the language is perceived on one hand and produced on the other – the disciplines are called phonetics and phonology and this piece of writing is only concerned with some of the major issues that seem to cause differences between Czech and English rhythm.

The comparison of the two languages itself is performed from both theoretical and practical point of view. In the former the factors that influence the rhythm are dealt with to achieve some general ideas concerned with this rather complex issue of rhythmical perception and production and since the two languages vary a great deal from each other their rhythmical patterns seem to be driven by various principles. In the latter knowledge gathered in theory are applied into practice by formulating some basic hypotheses which could play a certain role in the difference between the rhythm patterns of Czech and English rhythm and these are used as a general guideline in further analysis of two speech recordings of either language.

THEORETICAL PART

1 The importance of syllables

Speech according to Štekauer represents a flow of articulation which is organized into a collection of suprasegmental components. Such collection is known as the **phonological hierarchy**. In accordance with this hierarchy ***a sentence*** constitutes a number of ***intonation-groups***, which constitutes a number of ***stress-groups***, which constitutes a number of ***words***, which constitutes a number of ***syllables*** (Štekauer, 2005, p. 30). Therefore, it is important to start with the syllables because as Štekauer puts it, they seem to represent an elementary rhythmical phonic unit as well as an elementary unit of prosody as one of the suprasegmental features like stress, tone and rhythm (Štekauer, 2000, p. 45-46). Syllables can be generally divided into stressed (also called strong) and unstressed (also called weak) syllables (ibid., p. 46). For further comments on stressed and unstressed syllables see *sections 1.2* and *1.3*.

1.1 The structure of syllables

Richards defines a syllable as “a unit of speech consisting minimally of one vowel and maximally of a vowel preceded by a consonant or consonant cluster and followed by a consonant or consonant cluster” (Richards, 2010, p. 576).

Roach comments further on the structure of syllables in terms of pronunciation as follows: (a) **a minimum syllable** would be an isolated single vowel preceded and followed by silence (e.g. or /ɔː/, err /ɜː/); (b) syllables with **an onset** where centre of a syllable is preceded by either one or more consonants (e.g. bar /bɑː/, tree /triː/, straw /strɔː/); (c) syllables with **a coda** and **no onset** in this case the centre of a syllable is followed by either one or more consonants (e.g. am /æm/, act /ækt/, elks /elks/); (d) combination of both **an onset and a coda** (e.g. cat /kæt/, flask /flɑːsk/, prompt /prɒmpt/) (Roach, 2009, p. 56).

With respect to spelling, at the beginning of an English syllable can be either a vowel or one to three consonants and at the end of a syllable can appear either a vowel or up to four consonants (ibid., p. 57).

As to the structure of Czech syllables, Holub presents a very brief description, defining an onset which can have up to four consonants as in words "pštros" and "vzplane". Zero onset is rare and usually it is accompanied with a glottal stop as in "ˀokno" and "poˀotočit" and finally a coda which can have up to three consonants as in words "zábst" and "pomst" (Holub, 2005, p. 369).

Roach (2009) also mentions another approach to the structure of syllables shown in *Figure 1.1*, in which the peak, which is usually a vowel, along with the coda, which does not have to be necessarily present, form a rhyme (ibid., p. 60).

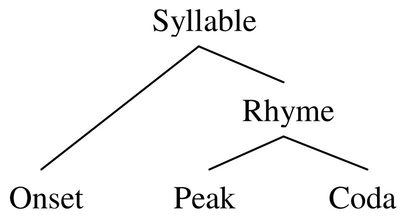

Figure 1.1 The structure of a syllable (adopted from Roach, 2009)

1.1.1 Vowels

Vowels, as Roach puts it, are sounds that in contrast to consonants cause a minimum obstruction to the air flow and they are commonly present in the centre of syllables. Another important feature of vowels is that they are capable of making syllables on its own. Vowels differ from each other in their quality (i.e. shape of mouth and position of a tongue) and quantity (i.e. length) (*EPP – Glossary*, 2009[1]).

Ladefoged compiles a list of rules regarding vowels and states that the same vowel is longest if it appears in, what he calls, an "open syllable" (i.e. not followed by a coda), then it is shorter if it is followed by a voiced consonant and the shortest vowel appears if it is followed by a voiceless consonant (e.g. sigh /saɪ/, side /saɪd/, site /saɪt/). Very similar it is in terms of a number of syllables in a word; the same vowel tend to be the longest in one-syllable word, then in two-syllable word and it is shortest if the word consists of three syllables or more (e.g. speed /spiːd/, speedy /ˈspiːdi/, speedily /ˈspiːdɪli/). Also, in relation to the length of vowels, the same vowel appears longer in stressed syllables and shorter in unstressed syllables (e.g. below /biˈləʊ/, billow /ˈbɪləʊ/) (Ladefoged, 2011, p. 100-101).

Cruttenden also mentions sonority hierarchy and claims that some phonemes have generally greater prominence than others and classifies them from the most sonorous to the least as follows: open vowels > close vowels > glides (/j/, /w/) > liquids (/l/, /r/,) > nasals > fricatives > affricatives > plosives (Cruttenden, 2011, p. 48).

[1] Vowel

1.1.1.1 Monophthongs

Wells (2008, p. 233) describes a monophthong as "a vowel whose quality remains constant". Thus in English we can distinguish twelve different monophthongs (i.e. /iː/, /ɪ/, /e/, /æ/, /ʌ/, /ɑː/, /ɒ/, /ɔː/, /ʊ/, /uː/, /ə/, /ɜː/). See *section 1.2*.

Holub describes the vocal system of Czech as being composed of five monophthongs (i.e. a, e, i, o, u), which can appear in two different variants, in this respect he refers to short and long versions, therefore it is possible to recognize ten different monophthongs (Holub, 2005, p. 363).

With respect to the quality, Holub (2005) states that it in terms of the short and long monophthongs remains the same with only one exception and that is the pair of vowels "i" and "í", where there is possible to distinguish a slight change in quality (ibid., p. 365).

1.1.1.2 Diphthongs

A diphthong, as Roach explains, is a combination of two vowels that are pronounced with a glide from one vowel quality to another. The quality of the two vowels, however, is not the same. There is a tendency for the first vowel in the pair to be more prominent than the second and in quantity they are compared to long vowels (i.e. /iː/, /ɑː/, /ɔː/, /uː/, /ɜː/) (Roach, 2009, p. 17).

Ladefoged provides a further explanation and claims that the quality of the individual vowels are not comparable with their monophthongal counterparts and that the second parts are in most cases very difficult to distinguish in terms of their qualities, which is caused due to their sonorous subtlety (Ladefoged, 2011, p. 92).

Distinction between monophthongs and diphthongs can also be speculative in some cases. Wells states that some speakers may pronounce /eə/ as /ɜː/ and, on the other hand, some words consisting of monophthongal long vowels /iː/ or /uː/ can have diphthong-like /ɪi/ or /ʊu/ instead. (Wells, 2008, p. 233)

Finally the total number of English diphthongs is eight and they can be divided into three groups as can be seen in *Figure 1.2*.

According to Holub, in Czech it is possible to distinguish only three different diphthongs (i.e. au, ou, eu). Their quality remains the same as the quality of the monophthongs they are composed of and both of the components are pronounced fully. When it comes to their quantity, their duration is comparable to long monophthongs (Holub, 2005, p. 363).

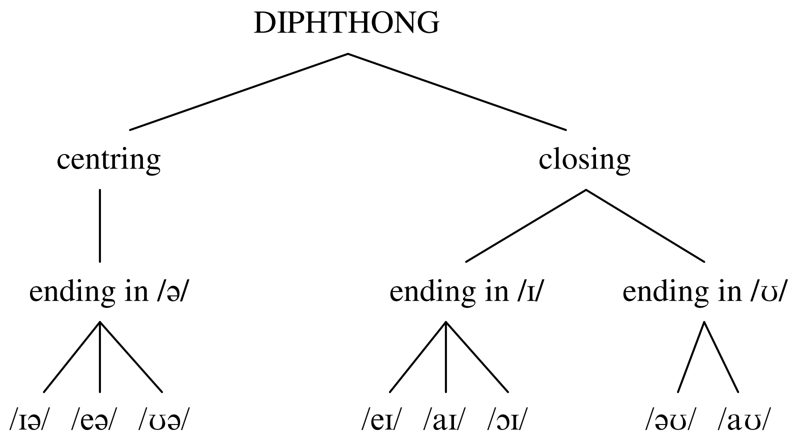

Figure 1.2 Division of diphthongs (adopted from Roach, 2009)

1.2 Stressed (strong) syllables

Roach remarks that vowels in strong syllables have a tendency to be longer, louder and they also differ in their quality (Roach, 2009, p. 64), however, according to Ladefoged, the stressed syllables do not necessarily have to appear louder than the ones which do not receive stress, nor even higher in pitch. He also emphasizes the importance of the length of vowels which would, in case of stressed syllables, appear longer than when the same syllables were pronounced as unstressed (Ladefoged, 2011, p. 111).

Another, yet very important aspect regarding this matter according to Ladefoged (2011) seems to be that not every long vowel is stressed. There are occasions when neighbouring syllables of a word can have relatively the same length but the stressed syllable would be the one which had an extra respiratory energy produced by exhaled air from lungs (ibid.).

Cruttenden, on the other hand, disputes the usage of the term stress, using terms as prominence and accent with respect to syllables and considers a change in pitch as a major factor that distinguishes stressed syllables from those unstressed (Cruttenden, 2008, p. 23).

Richards (2010) defines the term accent as “greater emphasis on a syllable so that it stand out from the other syllables in a word” (ibid., p. 3) while prominence as “greater stress on the words or syllables which the speaker wishes to emphasize” (ibid., p. 468) and finally stress as “the pronunciation of a syllable or word with more respiratory energy or muscular force than other syllables or words in the same utterance” (ibid., p. 560).

Richards also claims that a syllable or word influenced by stress appear to a listener with higher intensity, pitch and length than neighbouring syllables or words which, on the contrary, lack the influence of stress (Richards, 2010, p. 560). For further reference on stress as one of the prosodic features of speech see *section 2.1*.

In addition to strong syllables, Roach states that a peak of any strong syllable would be either a vowel (except for /ə, i, u/) or a triphthong, then a coda is always present if one of the vowels is /ɪ, e, æ, ʌ, ɒ, ʊ/ (Roach, 2009, p. 64). Wells stresses that for strong syllables it is necessary to contain strong vowels, which could be any of the English vowels or diphthongs apart from already mentioned /ə, i, u/ (Wells, 2008, p. 892).

1.3 Unstressed (weak) syllables

According to Roach the vowels in weak syllables in contrast to strong syllables are likely to be shorter, less loud and often of different quality (Roach, 2009, p. 64). Ladefoged asserts that the quality of the vowels in weak syllables does not have to be reduced and that any of the English vowels can appear in a syllable that is not stressed in its "full form" as shown in *Table 1.1* (Ladefoged, 2011, p. 97).

Vowels	Stressed Syllable	Unstressed Syllable	Reduced Syllable
/i/	appr**e**ciate /iː/	cr**e**ation /i, iː/	depr**e**cate /ə/
/ɪ/	impl**i**cit /ɪ/	s**i**mplistic /ɪ/	impl**i**cation /ɪ/
/ɔ/	c**au**se /ɔː/	c**au**sality /ɔː/	bec**au**se* /ə/
/ʊ/	h**oo**dwink /ʊ/	neighbourh**oo**d /ʊ/	
/ʌ/	confr**o**nt /ʌ/	**u**mbrella /ʌ/	confr**o**ntation /ə/
/ɜ/	conf**i**rm /ɜː/	v**e**rbose /ɜː/	conf**i**rmation /ə/
/aɪ/	rec**i**te /aɪ/	c**i**tation /aɪ/	rec**i**tation /ɪ/
/ɔɪ/	expl**oi**t /ɔɪ/	expl**oi**tation /ɔɪ/	
/u/	comp**u**te /uː/	comp**u**tation /u/	Circ**u**lar /ə/

Table 1.1 Examples of vowels in stressed, unstressed and reduced syllables (adopted from Ladefoged, 2011 and modified after Wells, 2008*)

Cruttenden comments on reduced syllables and claims that they are “the least prominent syllables” and they are realized by means of any of the three reduced vowels with centre quality (i.e. /ə/, /ɪ/, /ʊ/) (Cruttenden, 2008, p. 154).

In this respect Skaličková explains that Czech language does not use reduction of vowels in unstressed syllables and, therefore, their vowels do not lose almost anything from their acoustic features, whereas in English any full vowel or a diphthong can be reduced

(Skaličková, 1979, p. 148). Furthemore, according to Holub reduction of vowels in either position of words reduces intelligibility of the Czech language, thus vowels in Czech unstressed syllables are suggested to be pronounced fully without any exceptions (Holub, 2005, p. 364).

On the other hand, Roach states that reduction of syllables is one of the key features of English which also influences the rhythm, therefore, distinction between stressed-time and syllable-timed languages (see *sections 3.1* and *3.2*) can be linked to whether languages use vowel reduction or not. Such reduction of syllables is performed by centralizing the vowel quality to sounds that are similar to schwa. This set of words is provided as an example: photograph /ˈfəʊtəgrɑːf/, photography /fəˈtɒgrəfi/ and photographic /ˌfəʊtəˈgræfɪk/ (*EPP – Glossary*, 2009[2]).

Wells adds that it is reasonable to distinguish between unstressed syllables that have strong vowels as their centre and those that contain weak vowels because such differences also affect the rhythm (Wells, 2008, p. 892).

1.3.1 Weak vowels /ə/, /i/, /u/

Roach describes schwa /ə/ as one of the most common vowels which is constantly linked to weak syllables. The schwa has a quality of mid-central and there is very little energy needed to produce it. For a foreign learner, however, it is important to be familiar with the correct usage of this vowel in terms of its occurrence (Roach, 2009, p. 65).

Another example of weak vowels presented by Roach (2009) is /i/. Quality of this vowel is somewhere between /ɪ/ and /iː/ and is described as close front unrounded. It can appear (a) as a word-final of words ending in "-y" or "-ey" following one or more consonants (e.g. busy /ˈbɪzi/, alley /ˈæli/) and as a morpheme-final of words with suffixes starting with a vowel (e.g. easier /ˈiːziə/, funniest /ˈfʌniəst/, carrying /ˈkæriɪŋ/); (b) if unstressed prefixes like "pre-", "re-", "de-" appear before a vowel (e.g. reorganize /riˈɔːgənaɪz/, preamble /priˈæmbᵊl/, deactivate /diˈæktɪveɪt/); (c) as the suffixes "-ious", "-iate" if they are pronounced as two syllables (e.g. negotiate /nɪˈgəʊʃieɪt/, various /ˈveəriəs/); (d) as unstressed personal pronouns "he /hi/", "she /ʃi/", "we /wi/", "me /mi/", as well as the word "be /bi/" and also the determiner "the /ði/" when used before a vowel (ibid., p. 66-67).

Finally, in relation to weak syllables, Roach (2009) describes the vowel /u/ as close back rounded and it does not appear very often. Most of its occurrences is in unstressed words

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[2] Reduction

“you /ju/”, “to /tu/”, “into /ˈɪntu/”, “do /du/” with restriction of not being directly before consonants. It is also present in words “through /θru/” and “who /hu/” if they are not stressed and when it is preceded by other vowel as in “evaluation /iˌvæljuˈeɪʃᵊn/” (ibid., p. 68).

1.3.1 Syllabic consonants /ᵊl/, /ᵊn/, /ᵊm/, /ᵊŋ/, /ᵊr/

Syllabic consonants are, according to Roach, regarded as weak syllables and they represent the centre of syllables instead of the vowels (Roach, 2009, p. 68). In order to distinguish the syllabic consonants from their non-syllabic partners, they will be marked with superscripted schwa (i.e. /ᵊl/ for syllabic “l”, /ᵊn/ for syllabic “n” etc.), such identification of syllabic consonants is adopted from *Longman Pronunciation Dictionary 3rd edition* by Wells.

Wells adds that it is also possible to pronounce the vowel “schwa /ə/” together with a non-syllabic consonant as an alternative to the syllabic consonant (e.g. suddenly /ˈsʌdᵊnli/ or /ˈsʌdənli/). However, the latter case does not happen very often (Wells, 2008, p. 799).

Another aspect that Wells (2008) considers is that syllabic consonants may become non-syllabic consonants if one of the weak vowels appears directly after them. This effect is described as “compression” thus the following word “threatening” can be pronounced as three-syllable word /ˈθret ᵊn ɪŋ/ or it can be compressed and pronounced as having only two syllables /ˈθret nɪŋ/ (ibid.).

2 Stress

Stress according to Roach represents one of the prosodic or suprasegmental features of speech. The terms prosodic and suprasegmental are used interchangeably in English phonetics, where the term suprasegmental is preferred more by American phoneticians (*EPP – Glossary*, 2009[3]). Richards describes prosodic features as “sound characteristics which affect the whole sequences of syllables” (Richards, 2010, p. 470). Roach (2009) also states that it is still not clear how many of the prosodic features there are in speech and provides only the most commonly discussed such as pitch, loudness, stress and rhythm (ibid.).

As it was already stated in section *1.2*, there are some disputes about the correct usage of terminology with respect to phenomenon generally called “stress”. For the purpose of this thesis the word “stress” is used to refer to greater prominence of a syllable in order to make it more noticeable from the others as well as applying more muscular and respiratory energy on strong syllables.

[3] Suprasegmentals

When dealing with stress, it is also important to consider its different categories and their concepts by different authors. Richards distinguishes different types of stresses as follows: (a) ***word stress*** – stress pattern within a word, so in polysyllabic words it is possible to distinguish different levels of stress e.g. primary and secondary etc. (see *section 2.1*); (b) ***sentence stress*** – only some words in an utterance are stressed, such words are described as "content words"; (c) ***emphatic stress*** – used whenever a speaker wishes to emphasize any word within an utterance (Richards, 2010, p. 561). Roach, however, describes the above mentioned "sentence stress" as being old-fashioned and rather calls it as "accentual function of intonation" where he refers to tonic stress within a tone-unit (Roach, 2009, p. 153); see *section 2.3*.

Ladefoged asserts that in English and other languages that are thought of as being stress-timed it is the stress that governs the rhythm of speech by means of variations in its usage. He further explains that stress in English words is unpredictable and one cannot simply decide in accordance to the phonological structure of a word (Ladefoged, 2011, p. 249) and, therefore, Roach suggests that learners should, when learning vocabulary, learn also the stress pattern of individual words (Roach, 2009, p. 76).

According to Ladefoged, the stress in Czech words is described as being "fixed", where he points out that it is commonly being found on first syllables of words (Ladefoged, 2011, p. 249). Krčmová explains that this seems to be true for words in isolation, however, in connected speech, this does not have to necessarily apply to each word, thus some stresses do not have to be realized and such words can be unified with others forming a foot (Krčmová, 2008[4]). See *section 3.2*.

2.1 Levels of stress

In previous sections of this thesis stressed and unstressed syllables were dealt with while mentioning the term "stress". In English, however, it is possible to recognize several levels of stress according to their "levels of prominence".

For the purpose of demonstration of different levels of stress Roach recommends dealing with words pronounced in their citation forms (i.e. pronounced in isolation rather than in connected speech) (Roach, 2009, p. 75).

[4] Slovní přízvuk – www.http://is.muni.cz/do/1499/el/estud/ff/js08/fonetika/ucebnice/ch07s02s01.html

Stress levels are closely linked to a number of syllables within a word. Roach (2009) states that if there is only one syllable in a word and the word is pronounced in its citation form, the syllable receives stress (ibid., p. 76).

Roach further explains that in two-syllable words one of the syllables is either stressed or unstressed. When it is stressed, it also receives primary stress. In polysyllabic words it is possible to recognize another level of prominence which is called the secondary stress. It appears in words such as “photographic /ˌfəʊt ə ˈgræf ɪk/” and is marked by a lower vertical line before the syllable in consideration (ˌ). The primary stress, on the other hand, is marked by an upper vertical line before the syllable which it applies to (ˈ). Thus the syllable /ˌfəʊt/ receives secondary stress and the syllable /ˈgræf/ receives primary stress. The syllables /ə/ and /ɪk/ are unstressed (ibid., p. 75).

Another point still needs to be mentioned and that is according to Roach (2009) the importance of recognizing also unstressed syllables that contain vowels /ə/, /ɪ/, /i/, /u/ or syllabic consonants since those unstressed syllables will appear less prominent than those that have any other vowels at their centres. In relation to this matter he also provides examples of two words, one of them being the word “poetic /pəʊˈetɪk/” and the other “pathetic /pəˈθetɪk/”. Both of these words have their first syllable unstressed but more prominence will carry the first syllable of the word “poetic /pəʊ/” than the one of the word “pathetic /pə/” because the latter contains a weak vowel commonly known as schwa (ibid.); see also *section 1.3*.

According to Krčmová, in Czech there is also certain notion of different levels of stress, but since Czech belongs to languages that she describes as being "weak" in terms of stress, the difference between stressed and unstressed syllables is subtle, therefore unimportant. Generally stressed and unstressed syllables have certain prominence and height, but the stressed syllable is somewhat more prominent and higher in pitch than the unstressed syllable, which on the other hand is described as having a level tone (Krčmová, 2008[5]).

In addition Krčmová (2008) states that occurrence of primary and secondary stresses is mostly detectable in long words on their odd syllables in slow and careful speech as in the word "ˈpomíjejíˌcnost" and the secondary stress can be also noticed in compound words such as "ˈpoliticko͵ekonomický" (ibid.).

[5] Slovní přízvuk – www.http://is.muni.cz/do/1499/el/estud/ff/js08/fonetika/ucebnice/ch07s02s01.html

Finally, according to Skaličková, the main function of stress in Czech is connected solely with defining the boundaries of words (Skaličková, 1979, p. 148).

2.1.1 Morphologically simple words

Let us now inspect the pronunciation of some words which are taken from online *Oxford Learner's Dictionaries* (henceforth OLD).

All the words dealt with are written in capital letters (e.g. "key" = KEY) and are pronounced in their citation form by a male speaker of General British which is an accent not associated with any particular region (OALD, 2010, p. R45).

The following *Figures 2.1 – 2.3* are generated by Praat and each of them represents a waveform (at the very top) of a particular word as well as its intensity (in the middle) along with the pitch (at the bottom). The horizontal axes of all the individual segments represent time in seconds; the vertical axis of the waveform represents amplitude which represents the amount of air pressure and it is measured in Pascal [Pa]; the vertical axis of the intensity represents loudness which is measured in decibels [dB]; and finally the vertical axis of the pitch is measured in Hertz [Hz].

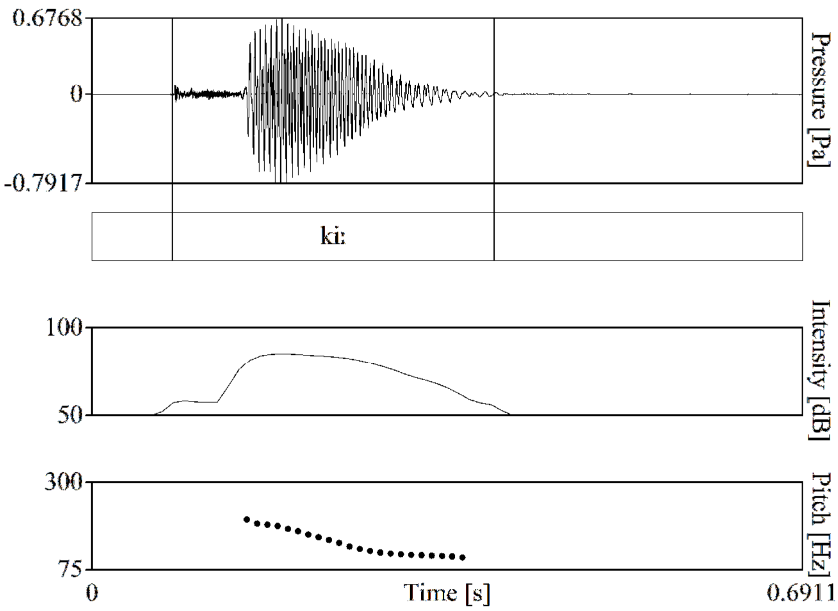

Figure 2.1 One-syllable word KEY

In *Figure 2.1* deals with the word KEY. Because it is a one syllable word, the stress seems to fall on the only syllable available; therefore, it receives primary stress (Roach, 2009, p. 76).

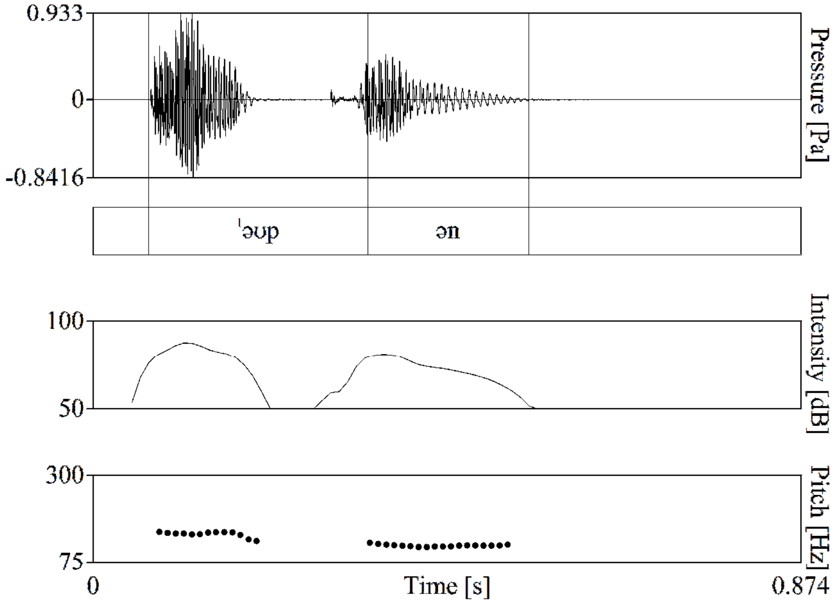

Figure 2.2 Two-syllable word OPEN

Figure 2.2 shows a two-syllable word OPEN. The first syllable appears to be higher in pitch and intensity as well as longer than the second syllable; it is pronounced with more energy involved and receives stress. Also the second syllable cannot receive stress because it contains a weak vowel /ə/.

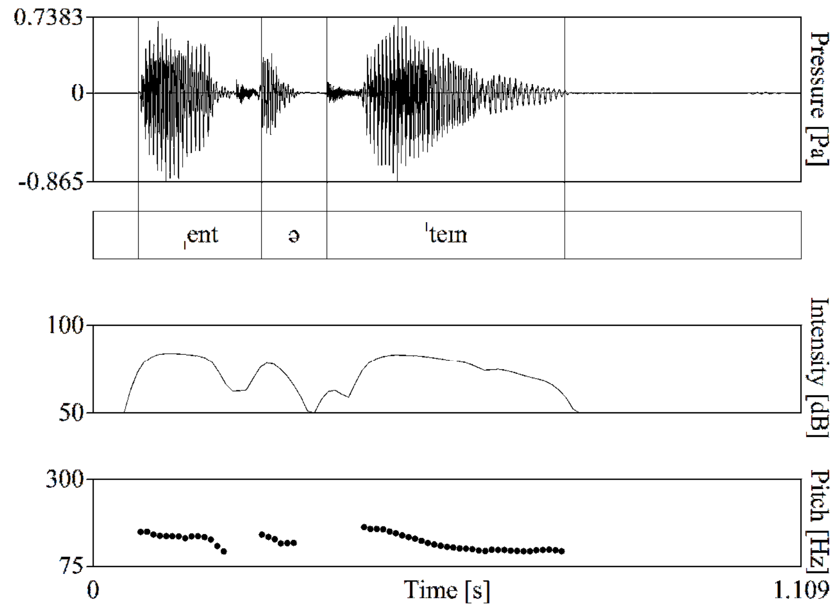

Figure 2.3 Three-syllable word ENTERTAIN

A three-syllable word ENTERTAIN in *Figure 2.3* shows more levels of stress. Here it is possible to notice that the first syllable and third syllable are more prominent than the second syllable /ə/, which is weak and, therefore, unstressed. However, the third syllable is slightly higher in pitch and is also longer in duration than the first syllable. The first syllable receives secondary stress and the third has primary stress.

2.1.2 Morphologically complex words

Morphologically simple words have been dealt with in the previous section so far, so let us now have a look at words whose structure is somewhat more sophisticated.

Roach defines complex words as "being composed of more than one grammatical unit" and he also stresses the importance of distinguishing between two types of complex words of which the first type are words created by a means of affixes (i.e. prefixes, suffixes or combination of both) and the second type are words commonly known as compound words which are, on the other hand, created by a means of two, and in some occasional cases more, individual words (Roach, 2009, p. 82).

For the first case Roach divides affixes into suffixes and prefixes, where suffixes can be divided into three categories from the point of view of their stress influence. In this respect we, therefore, recognize suffixes that are stress carrying, which means the suffix itself receives primary stress. Such suffixes are: "-ee as in evacuee /iˌvækjuˈiː/", "-eer as in pioneer /ˌpaɪəˈnɪə/", "-ese as in Chinese /ˌtʃaɪˈniːz/", "-ette as in usherette /ˌʌʃəˈret/", "-esque as in Romanesque /ˌrəʊməˈnesk/" (Roach, 2009, p. 83-84).

The second type of suffixes which Roach provides is the one which do not affect position of stress within a word so the word's stress remains in the same position as if the suffix were not there; examples of such suffixes are as follows: "-able in fashionable /ˈfæʃᵊnəbᵊl/", "-age in baggage /ˈbægɪdʒ/", "-al in magical /ˈmædʒɪkᵊl/", "-en in wooden /ˈwʊdᵊn/", "-ful in beautiful /ˈbjuːtəfᵊl/", "-ing in drinking /ˈdrɪŋkɪŋ/", "-like in birdlike /ˈbɜːdlaɪk/", "-less in hopeless /ˈhəʊpləs/", "-ly in hurriedly /ˈhʌridli/", "-ment in development /diˈveləpmənt/", "-ness in blindness /ˈblaɪndnəs/", "-ous in poisonous /ˈpɔɪzᵊnəs/", "-fy in glorify /ˈglɔːrɪfaɪ/", "-wise in clockwise /ˈklɒkwaɪz/", "-y in sunny /ˈsʌni/" and "-ish when the words are adjectives as in devilish /ˈdevᵊlɪʃ/" (Roach, 2009, p. 84).

And last but definitely not least which Roach (2009) mentions are the suffixes that do not carry stress themselves but they cause stress shift within the stems of the words they are applied to. Such suffixes are: "-eous in advantageous /ˌædvənˈteɪdʒəs/", "-graphy in photography

/fəˈtɒɡrəfi/", "-ial in adverbial /ədˈvɜːbiəl/", "-ic in economic /ˌiːkəˈnɒmɪk/", "-ion in hesitation /ˌhezɪˈteɪʃᵊn/", "-ious in injurious /ɪnˈdʒʊəriəs/", "-ty in tranquillity /træŋˈkwɪləti/" and "-ive in reflexive /riˈfleksɪv/"; these suffixes shift the stress of the stem to its last syllable (ibid.). For graphical images of words with and without suffixes of each of the three categories see *appendices 1-3*.

Now let us have a look at the second type of complex words which according to Roach are compound words. There are, however, several types of them. Mostly they constitute two individual English words capable of having their own meaning themselves. Compound words also differ in the way they are written. They can be written as one word as in "armchair /ˈɑːmtʃeə/" or "blackbird /ˈblækbɜːd/", they can be separated by a hyphen as in "fairy-tale /ˈfeəriteɪᵊl/" or they can be written as two separate words as in "business card /ˈbɪznəskɑːd/". Roach in respect to the latter case stresses the difficulties this may cause to foreign learners because it is not always clear whether the words are compounds or not (Roach, 2009, p. 85).

When it comes to stress patterns in compound words, Wells notes that it is to some point necessary to distinguish between compounds and phrases, which can, in some cases, resemble compound words. In this respect, compound words have usually "early stress" which means their first part is more prominent than the other as in "blackbird /ˈblækbɜːd/" or "business card /ˈbɪznəskɑːd/" . On the other hand, the phrases have in most occasions "late stress" which means the second part is more prominent than the first one as in "next time /ˌneksˈtaɪm/". However, the rules mentioned above are general and theoretical, while in practice, the speakers can, if they wish so, emphasize any part of the compound or phrase by pronouncing either word with primary stress (Wells, 2008, p. 171).

2.2 Stress shift

It is quite common in English that the stress pattern of words can change according to contexts. Wells argues that words which are pronounced in connected speech have in some situations different stress patterns as if they were pronounced in their citation form. This phenomenon is called stress shift (Wells, 2008, p. 784) and as Roach explains, the purpose of its occurrence is probably to avoid having stressed syllables too close to each other in order to maintain regular rhythm; however, he claims that the reason for the existence of stress shift is only speculation and also has not been scientifically proved yet (*EPP – Glossary*, 2009[6]). Wells provides the word "Japanese" as an example and explains that in citation form it is pronounced

[6] Stress-shift

with primary stress on the third syllable and secondary stress occurs on the first syllable thus “ˌJapaˈnese” but when there is another word added to form the phrase “Japanese language”, the stress pattern of the word “Japanese” changes forming phrase “ˌJapanese ˈlanguage” (Wells, 2008, p. 784). Similarly it is with the words “ˌthirˈteen” and “ˈpeople” when they are said together in a phrase “ˌthirteen ˈpeople” the stress pattern changes. In addition to this Wells (2008) also remarks that stress-shift is more likely to occur in words which have secondary stress before primary stress (ibid.).

2.3 Word stress within a tone-unit

In the previous sections of this thesis we dealt with stressed and unstressed syllables within words spoken in isolation. Now let us have a look at larger units which can be recognized in continuous speech. Roach explains that speech is composed of “a number of utterances” which are composed of minimally one or a number of “tone-units” which are then composed of minimally one or a number of feet which are then composed of minimally one or a number of syllables (Roach, 2009, p. 130).

According to Cruttenden, in connected speech there are certain words which are likely to receive stress and, therefore, be felt as more prominent than others that surround them; such words are called "lexical words" and they constitute of nouns, main verbs, adjectives, adverbs and demonstrative pronouns. On the other hand, words which are rarely to receive stress are described as "function words" and they are auxiliary verbs, conjunctions, pronouns, relative pronouns, prepositions and articles. Function words, however, can be pronounced as stressed if it is appropriate to the meaning they should convey (Cruttenden, 2008, p. 263).

In addition, Ladefoged explains that in continuous speech it is possible to find certain words (or rather syllables) that are even more prominent than other prominent syllables. These are called “tonic syllables”. He, therefore, distinguishes syllables within an utterance as either being stressed or unstressed. The unstressed then can be either with or without a weak vowel and the stressed syllables may either have tonic stress or may not. If they do, they become the tonic syllables (Ladefoged, 2011, p. 114). See *Figure 2.4*.

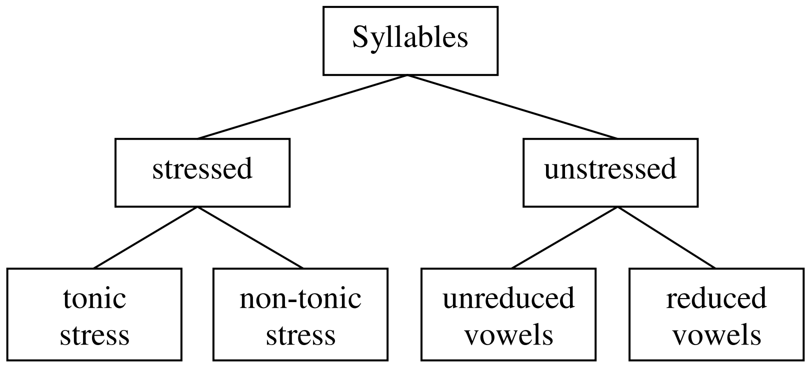

Figure 2.4 Division of syllables within an utterance (adopted from Ladefoged, 2011)

Roach asserts that a tonic syllable is a compulsory component of a tone-unit. And that each tone-unit consists of only one tonic syllable. A tone-unit is generally divided into a pre-head, head, tonic syllable and tail. The pre-head is to be found at the very beginning of the tone-unit and it consists of all the unstressed syllables. After the pre-head follows the head which starts with the first stressed syllable within the tone-unit and it extends up to the tonic syllable. And finally the tail consists of any other syllables stressed or unstressed following the tonic syllable. However, it is important to say that the above mentioned components of the tone-unit, apart from the tonic syllable, do not have to be necessarily present (Roach, 2009, p. 130-131).

In addition Roach (2009) claims that the placement of the tonic syllable would be most likely in the last lexical word of the tone-unit (or its stressed syllable if the word is polysyllabic). However it is also important to note that any word of the tone-unit can acquire tonic stress since it is claimed to be connected with "the focus of information" (ibid., p.153).

The tone-unit itself is rather connected with intonation than with rhythm, however, it is deliberately mentioned in this thesis due to three main reasons. The first being the purpose of completeness in terms of levels of stress so there is some notion about tonic stress which, as Ladefoged (2011, p. 250) puts it, is "more primary level of stress". The second is that according to Skaličková stress, intonation and rhythm are all parts of suprasegmental features of the language and the intonation seems to be connected with the stress because, in certain contexts, stressed syllables receive different pitch height than unstressed syllables would receive if they appeared at the same position (Skaličková, 1979, p. 158). And the last reason is in this case also relevant to the rhythm issue and that concerns the tone-unit boundaries.

The boundaries of the tone-unit can be in some occasions very difficult to distinguish. Cruttenden claims that they can be decided according to different factors of which one of the most noticeable are the pauses in speech. Other factors comprise of lengthening of the last syllable (whether stressed, unstressed or even reduced) of the tone-unit. The boundaries can be also signalled by means of change in speed of unstressed syllables being pronounced much quicker at the beginning of the next tone-unit (Cruttenden, 2008, p. 270-271). Roach comments on tone-unit boundaries and states that they can be identified in accordance with the rhythm "discontinuity" (*EPP – Glossary*, 2009[7]). However, within the tone-unit the rhythm seems to be somewhat isochronous (Roach, 2009, p. 142).

Therefore, the factors mentioned above shall be also considered in practical part of this thesis since they may to a certain extent influence the results of regularity in the rhythm of the speech sample.

3 Rhythm

Roach claims that "speech is perceived as a sequence of events in time" and that "the timing of speech is not random" (*EPP – Glossary*, 2009[8]). According to Skaličková acquisition of correct rhythm contributes a great deal to intelligibility of speech, even more than correct production of individual phonemes (Skaličková, 1979, p. 153).

Since *Oxford Advanced Learner's Dictionary* generally defines rhythm as "a strong regular repeated pattern of sounds or movements" (Hornby, 2010, p. 1314), thus in order to be able to experience the rhythm of speech there is a need for the speech to evince some sort of regularity within it. Therefore, in connection with this, the mentioned regularity can be, according to Ladefoged, recognized by means of different timings, where English rhythm is described as being stress-timed and Czech, on the other hand, as being syllable-timed (Ladefoged, 2011, p. 249).

3.1 Stress-timed rhythm

Cruttenden (2008, p. 264) explains that English speech rhythm is thought to be connected to "stress-timing". Roach describes the stress-timed rhythm as a "rhythmical type" which is realized by means of regularly occurring stressed syllables where the time durations between stressed syllables have a tendency to be of approximately the same length, this enables speech to be separated into individual feet (*EPP – Glossary*, 2009[9]).

[7] Tone-unit

[8] Rhythm

[9] Stress-timing

A foot is described by Roach as a "unit of rhythm" and it always contains only one stressed syllable which at the same time identifies the beginning of the foot. One stressed syllable is a minimum number of syllables within one foot; however, the stressed syllable can be also followed by a number of unstressed syllables. The main point here is that English feet have a tendency to have approximately the same length regardless the number of syllables they contain, therefore, when one foot contains only one syllable (in such case stressed) and next foot contains three syllables of which only the first is stressed, for example; there is a need of syllable "compression" of the two unstressed syllables in order to compensate the total duration of the foot (*EPP – Glossary*, 2009[10]).

Roach (2009, p. 108) provides the following sentence as an example:

'Walk 'down the 'path to the 'end of the ca'nal

Above it is possible to notice that several stresses appeared within the sentence. Based on this we are now able to divide the sentence into feet by putting vertical lines before the stress marks, thus:

|ˈwɔːk |ˈdaʊnðə |ˈpɑːθtəði |ˈendəvðəkə |ˈnæl |

By theory each of the feet above should take roughly the same amount of time, however, as Roach (2009) points out, any attempts of proving such regularity instrumentally have not been very satisfactory (ibid., p. 110), however, from psychological point of view it seems that our brain tends to notice such regularities even where there are almost none (*EPP – Glossary*, 2009[11]).

Ladefoged is concerned that there are other factors than stress that play an important role in order to preserve the rhythm of speech. He argues that it is also important to bear in mind that some of the stresses within an utterance may not be realized to avoid too many of them appearing next to each other. Furthermore, composition and number of syllables within a foot seem to be also important as well as emphasis that the speaker gives to certain words (Ladefoged, 2011, p. 118).

Roach further explains that since stresses can vary in accordance to context there is a need of further research in order to fully explain the principles of speech rhythm. It seems clear, however, that in some situations speech shows a great deal of regularity, which is a case of

[10] Foot

[11] Rhythm

controlled public speech, and in other cases it proves the opposite; this may be the cases when the speakers are nervous or hesitant (Roach, 2009, p. 110).

3.2 Syllable-timed rhythm

Previous section dealt with stress-timed rhythm which is generally associated with English. Ladefoged states that in Czech the rhythm of speech is governed by syllables, thus syllable-timed (Ladefoged, 2011, p. 249) and it appears that all syllables tend to be of the same length (ibid., p. 252). According to Roach, total durations of feet in syllable-timed languages depend on the number of syllables they contain (Roach, 2009, p. 108).

Individual feet can be divided according to basic rules which are described by Holub as follows: (a) polysyllabic words occurring next to each other create individual feet, e.g. ǀˈZítra ǀˈpřijedeme ǀˈdomů ǀˈpozdějiǀ; (b) a monosyllabic word can appear as an individual foot, usually can be found in final position of a tone-unit, e.g. ǀˈZítra ǀˈpřijede ǀˈdomů ǀˈsámǀ; (c) a monosyllabic word is usually linked to the preceding word forming one foot e.g. ǀˈZítrasetam ǀˈpojede ǀˈpodívatǀ; (d) a monosyllabic word can be linked to the following word as an unstressed anacrusis, e.g. ǀˈPřišel ǀˈpozdě ǀa ˈanise ǀˈneomluvilǀ; (e) a monosyllabic word can be linked to the following word and become a stressed syllable, this is a standard case of monosyllabic prepositions (i.e. na, nad, pod, u, za, před, do, ve, při, přes, se, ze, o), e.g. ǀˈZítra ǀˈpojedou ǀˈsevšemi ǀˈdětmi ǀˈnavýlet ǀˈdoPrahyǀ (Holub, 2005, p. 371).

Feet, according to Holub (2005), do not tend to equalize their durations and their length is dependent on the number of syllables that appear within. The length of syllables is then dependent on the individual segments (ibid.).

Roach in this respect also claims that in syllable-timed languages durations of syllables (whether they are stressed or unstressed) is approximately the same, however, he also adds to this point that "many phoneticians doubt whether any language is truly syllable-timed" (*EPP – Glossary*, 2009[12]).

In addition Roach further explains that it is also believed that all languages show certain attributes of both syllable and stress-timed rhythms but some may relate more either to the former or to the latter type of rhythm (Roach, 2009, p. 116).

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[12] Syllable-timing

PRACTICAL PART

4 Introduction to speech analysis

The purpose of the practical part of this thesis is to analyze speech recordings of both languages (English and Czech) and compare them. The recording of the English speech is taken from the website *UCL – Speech, Hearing & Phonetic Sciences* and the recording of the Czech speech is provided by Mgr. Kamila Ivanová, the editor of Český Rozhlas Olomouc.

In order to be able to perform the actual comparison some data need to be obtained first. This is done by uploading each recording inside of Praat and measuring individual syllables of either language. By doing this we get some primary data in form of individual syllable durations. For the purpose of the actual comparison Standard Deviation method is chosen. Firstly, the mean (average) is calculated from the primary data. This information is then used to calculate the Standard Deviation (henceforth SD). Such procedure is performed for both languages separately. Similarly the same procedure is done for the duration of each foot.

The SD is calculated according to the following formula:

$$s = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$$

4.1 Hypotheses

First of all let us start by formulating some basic hypotheses which are based on the findings from the theoretical part of this thesis and since the two languages should prove some sort of isochrony based on the type of their timing it is possible to deduce that:

1) In English the length of unstressed syllables should depend on whether unstressed syllables contain full or weak vowels, thus, unstressed syllables containing weak vowels should be shorter than those containing full vowels.

2) Unstressed syllables in English should be shorter than unstressed syllables in Czech, because unstressed syllables in Czech always contain full vowels since reduction of vowels is not appropriate for this language.

3) Stressed syllables in English should be longer than stressed syllables in Czech. This is because there should not be any significant difference between Czech syllables whether stressed or unstressed, however, in English the stressed syllables are supposed to be longer than unstressed syllables.

4) Individual feet in English should be more or less the same in length, this is caused by the tendency of stressed syllables to appear in regular intervals of time.

5) Individual feet in Czech should differ in length because the rhythm is said to be syllable-timed, therefore syllables should appear in regular intervals of time and the feet should be somewhat equal in length in accordance to a number of syllables they contain.

6) Tonic syllables should be the longest.

It is, therefore, possible to expect that the SD for syllable duration should evince lower value for Czech syllables than for the English syllables which, on the other hand, should prove greater variance, whereas the SD of foot duration should show lower value for English feet than for the Czech feet, because according to the theory Czech feet do not tend to equalize their duration as they seem to do in English.

5 Speech samples

5.1 English speech sample

The following extract is spoken by Susan Ramsaran, a female RP speaker (Wells, 2013[13]).

“One day last year, when I was driving back to work after I'd had lunch, I had an amazing and unforgettable experience. It must have been two o'clock — or perhaps a quarter of an hour later, a quarter past two. It was an incredible thing, really: I was sitting there at the steering wheel of my new car, waiting for the lights to change, when all of a sudden the car started to shake this way and that, rocking from side to side, throwing me backwards and forwards, up and down. I felt as if I was riding a bucking horse. Worse than that, some mysterious spirit or hostile force seemed to be venting its vast fury upon the earth. And the noise! — there was a kind of deep groaning and horrible awesome grinding which seemed to fill the air. And then, a short while after, the whole paroxysm had stopped, just as suddenly. Everything was calm and smooth again, quiet and peaceful once more. I put my foot down, just a gentle pressure on the accelerator (or the gas pedal, as it's known in America), and drove off. Everything was utterly normal once more.”

[13] www.phon.ucl.ac.uk/home/wells/accentsanddialects/

“So then — was this some very local and momentary earth tremor which had struck us? Or, I ask myself, was it a supernatural visitation, some fiery storm of diabolical wrath? Or was it, rather, merely that I'd drunk a double vodka or two during my lunch?” (Wells, 2013).

5.1.1 English sample transcription

First of all it is worth noting some remarks for this particular speaker.

As Wells explains, in this particular speech sample the speaker uses non-rhotic /r/ and as a result there is dropped /r/ in the word utterly /ʌtəli/ which results in having a syllabic /ᵊl/ thus /ʌtᵊli/. Linking /r/ appears in sets of words like “after I’d”, “quarter of”, “or I” and there is also one example of intrusive /r/ in the phrase “vodka or two” and of an intrusive /j/ as in the phrase “I ask myself”. Smoothing appears in the words “diabolical /ˌdaəˈbɒlɪkᵊl/ instead of /ˌdaɪəˈbɒlɪkᵊl/”, “throwing /ˈθrəɪŋ/ instead of /ˈθrəʊɪŋ/” and in the phrase “two o’clock /ˈtʊəˈklɒk / instead of /ˈtuː əˈklɒk /”. The word “wrath” is here pronounced with a long vowel /ɔː/ instead of /ɒ/ thus /rɔːθ/ and semivowel /j/ appears in words like “new /njuː/”, “during /ˈdjʊərɪŋ/” and “supernatural /ˌsjuːpəˈnætʃᵊrəl/”. It also seems that words like “really”, “fiery”, “utterly”, “fury” end with a short vowel /ɪ/ in this particular case instead of usual /i/ (Wells, 2013).

I myself listened to the recording countless times and I took the advantage of LPD 3rd edition to transcribe the following speech sample.

Tone-units in the transcription below are divided by a double slash (perceived as shorter or longer pauses). Individual feet are divided by a single slash beginning with a stressed syllable and containing all the unstressed syllables that follow it up to another stressed syllable which belongs to another foot. Primary and secondary stresses are marked by (ˈ) for primary stress and (ˌ) for secondary stress. Tonic syllables are in bold and they are identified according to their pitch change. After the end of the tone-unit some unstressed syllables are surprisingly identified with hardly noticeable secondary stress. For more information on the speech sample see *Table 4.1*.

‖ ˈwʌndeɪ |ˌlɑːst |ˈ**jɪə** ‖ ˌwenaɪwəz |ˈdraɪvɪŋ |ˌbæktə |ˈ**wɜːk** ‖ ˈɑːftə$_{r}$aɪd |ˌhæd |ˈ**lʌntʃ** ‖ aɪ |ˈhæd^{ə}nə |ˈ**meɪzɪŋən** ‖ ˌʌnfə |ˈ**get**əb^{ə}lɪk |ˈspɪəriən^{t}s ‖ ˌɪtməstəbɪn |ˈ**tʊə** |ˈklɒk ‖ ˌɔːpə |ˈ**hæps**ə ‖ ˈkwɔːtə$_{r}$əvən |ˈaʊə |ˈ**leɪt**ə ‖ ə |ˈkwɔːtə |ˈ**pɑːs** |ˈtuː ‖ ˌɪtwəzənɪn |ˈ**kred**əb^{ə}l |ˈθɪŋ ‖ ˈ**rɪə**lɪ ‖ aɪwəz |ˈ**sɪt**ɪŋ |ˈðeə ‖ ətðə |ˈ**stɪər**ɪŋwiː^{ə}ləv ‖ ˌmaɪ |ˌnjuː |ˈ**kɑː** ‖ ˈweɪtɪŋfəðə |ˈlaɪtstə |ˈ**tʃeɪndʒ** ‖ wen |ˈɔːləvə |ˈ**sʌd**^{ə}n ‖ ðə |ˈkɑː |ˈstɑːtɪdtə |ˈ**ʃeɪk** ‖ ˌðɪsweɪən |ˈ**ðæt** ‖ ˈrɒkɪŋfrəm |ˈsaɪtə |ˈ**saɪd** ‖ ˈθrəɪŋmi |ˈbækwədzən |ˈ**fɔː**wədz ‖ ˌʌpən |ˈ**daʊn** ‖ aɪ |ˈ**felt**əzɪf ‖ aɪwəz |ˈraɪdɪŋə |ˈ**bʌk**ɪŋ |ˈhɔːs ‖ ˈwɜːsðən |ˈ**ðæt** ‖ ˌsʌmmɪ |ˈstɪəriəs |ˈ**spɪr**ɪt ‖ ˌɔː |ˈhɒstaɪ^{ə}l |ˈ**fɔːs** ‖ ˌsiːmdtəbɪ |ˈventɪŋɪts |ˈ**vɑːst** |ˈfjʊərɪə ‖ ˈpɒnði |ˈ**ɜːθ** ‖ ənðə |ˈ**nɔɪz** ‖ ðəwəzə |ˈkaɪndəv |ˈdiːp |ˈ**grəʊn**ɪŋ ‖ ənd |ˈhɒrəb^{ə}l |ˈɔːsəm |ˈ**graɪnd**ɪŋ ‖ wɪtʃ |ˈsiːmdtə |ˈfɪlði |ˈ**eə** ‖ ən |ˈ**ðen** ‖ ə |ˈʃɔːt |ˌwaɪ^{ə}l |ˈ**ɑːft**ə ‖ ðə |ˈhəʊl |ˈpærək |ˌsɪzəmhəd |ˈ**stɒpt** ‖ **dʒʌst**ə |ˈsʌd^{ə}nlɪ ‖ ˈevriθɪŋwəz |ˈ**kɑːm**ən |ˈsmuːðə |ˈgen ‖ ˈkwaɪətən |ˈ**piːs**f^{ə}l |ˌwʌn^{t}s |ˈmɔː ‖ aɪ |ˈpʊtmaɪ |ˌfʊt |ˈ**daʊn** ‖ ˈdʒʌstə |ˈdʒent^{ə}l |ˈpreʃə$_{r}$ɒnðiək |ˈ**sel**əreɪtə ‖ ˌɔːðə |ˈ**gæsp**ed^{ə}l ‖ əzɪts |ˈ**nəʊn**ɪnə |ˈmerɪkə ‖ ən |ˌdrəʊv |ˈ**ɒf** ‖ ˈevriθɪŋwəz |ˌʌt^{ə}lɪ |ˈ**nɔːm**^{ə}l ‖ ˌwʌn^{t}s |ˈ**mɔː** ‖ ˌsəʊ |ˈ**ðen** ‖ ˈwɒzðɪs |ˈ**sʌm** ‖ ˌverɪ |ˈ**ləʊk**^{ə}lən ‖ ˈməʊməntrɪ |ˈ**ɜːθ** |ˌtremə ‖ wɪtʃəd |ˈ**strʌk** |ˌʌs ‖ ˌɔː$_{r}$aɪ |ˈ$_{j}$ɑːskmaɪ |ˈ**self** ‖ ˌwɒzɪtə |ˌsjuːpə |ˈnætʃ^{ə}rəl |ˌvɪzɪ |ˈ**teɪʃ**^{ə}n ‖ ˌsʌm |ˈfaɪ^{ə}rɪ |ˈ**stɔːm**əv ‖ ˌdaə |ˈbɒlɪk^{ə}l |ˈ**rɔːθ** ‖ ˌɔː |ˈwɒzɪt |ˈ**rɑːð**ə ‖ ˈ**mɪə**lɪ ‖ ðətaɪd |ˈdrʌŋkə |ˌdʌb^{ə}l |ˈ**vɒd**kə ‖ $_{r}$ɔː |ˈ**tuː** ‖ ˌdjʊərɪŋmaɪ |ˈ**lʌntʃ** ‖

<table>
<tr><th>1-syllable words</th><th>2-syllable words</th><th>3-syllable words</th><th>4-syllable words</th><th>5-syllable words</th><th>Total</th></tr>
<tr><td>180</td><td>45</td><td>6</td><td>8</td><td>2</td><td>241</td></tr>
<tr><td colspan="5">Total number of syllables</td><td>330</td></tr>
<tr><td colspan="6">5 longest syllables</td></tr>
<tr><td>nɔɪz (837,617)</td><td>fɔːs (620,03)</td><td>hɔːs (596,5)</td><td>tʃeɪndʒ (591,438)</td><td colspan="2">stɒpt (535,633)</td></tr>
<tr><td colspan="6">5 shortest syllables</td></tr>
<tr><td>ə (31,516)</td><td>ə (35,446)</td><td>ə (38,241)</td><td>ə (42,021)</td><td colspan="2">ə (42,261)</td></tr>
<tr><td colspan="6">Most frequent words</td></tr>
<tr><td>and (11)</td><td>was (10)</td><td>the (9)</td><td>a (9)</td><td colspan="2">I (9)</td></tr>
</table>

Table 4.1 Additional information on the English speech sample

5.2 Czech speech sample

The following extract is spoken by a Czech actress Hana Maciuchová and it was provided by Mgr. Kamila Ivanová, the editor of Český Rozhlas Olomouc.

„Víte, že o soukromých záležitostech nemluvím. Ani při procházkách. Ale je pravda, že jsme se s Johnem spřátelili. Hodně mi pomohl i při natáčení. Je skvělé, když máte hereckého partnera, s nímž si rozumíte jen mrknutím oka. Zase ten váš ironický úsměv, mladíku. Nemluvím o sexu. Mluvím o tom, že v herecké práci jste často před kamerou s někým, kdo je vám nesympatický. Lidsky vám vůbec nekonvenuje. Ale scénář předepisuje hluboké souznění a pak je to opravdu těžká práce. Ale když máte štěstí na člověka, s nímž vám to hraje i lidsky, pak je to úplně něco jiného. A my jsme spolu před kamerou nehráli, my jsme spolu před kamerou žili."

„Vlastně ani nevím, kolikrát mě požádal o ruku. Třikrát, možná čtyřikrát. Vymýšlel bláznivé cesty. Jednou se chtěl ženit dokonce v Mexiku, jindy na jachtě v moři. Hodně jsme si rozuměli. Ale byly věci, v nichž jsme se nedokázali shodnout. John miloval Hollywood. Miloval ty tisíce dopisů od fanynek, které týden co týden dostával. Miloval blesky fotoaparátů. Miloval celou tu „show". Všechno to, co mě nahánělo husí kůži. Jednou jsem mu řekla, že se tedy vezmeme a odjedeme někam farmařit. Jen my dva. A možná pak nějaké děti, pokud je budeme mít. Nechtěl."

5.2.1 Czech sample transcription

ǁ ˈviːtɛ ǁ ˈʒɛˀo |ˈsoukromiːx |ˈzaːlɛʒɪtostɛx |ˈnɛmluviːm ǁ ˀˈaɲɪ |ˈpr̝̊ɪproxaːskaːx ǁ ˈalɛjɛ |ˈpravda ǁ ˈʒɛsmɛsɛ |ˈzdʒonɛm |ˈspr̝̊aːtɛlɪlɪ ǁ ˈɦodɲɛmɪ |ˈpomoɦl̩ˀɪ |ˈpr̝ɪnataːtʃɛɲiː ǁ ˈjɛ |ˈskvjɛlɛː ǁ ˈgdɪʒ |ˈmaːtɛ |ˈɦɛrɛtskɛːɦo |ˈpartnɛra ǁ ˈsɲiːmʃsɪ |ˈrozumiːtɛjɛn |ˈmrknuciːm |ˀˈoka ǁ ˈzasɛ ǁ ˈtɛnvaːʃ |ˀˈɪronɪtskiː |ˈuːsmjɛf ǁ ˈmlaɟiːku ǁ ˈnɛmluviːm |ˀˈosɛksu ǁ ˈmluviːm |ˀˈotom ǁ ˈʒɛ |ˈvɦɛrɛtskɛː |ˈpraːtsɪ ǁ ˈstɛ |ˈtʃasto |ˈpr̝̊ɛtkamɛrou |ˈsɲɛkiːm ǁ ˈgdojɛvaːm |ˈnɛsɪmpatɪtskiː ǁ ˈlɪtskɪvaːm |ˈvuːbɛts |ˈnɛkonvɛnujɛ ǁ ˈalɛ |ˈstsɛːnaːr̝ ǁ ˈpr̝̊ɛdɛpɪsujɛ |ˈɦlubokɛː |ˈsouzɲɛɲiː ǁ ˈa ǁ ˈpak ǁ ˈjɛto |ˀˈopravdu ǁ ˈcɛʃkaː |ˈpraːtsɛ ǁ ˈalɛ |ˈgdɪʒ |ˈmaːtɛ |ˈʃcɛsciː |ˈnatʃlovjɛka ǁ ˈsɲiːmʃ ǁ ˈvaːmto |ˈɦrajɛˀɪ |ˈlɪtskɪ ǁ ˈpakjɛto |ˀˈuːpl̩ɲɛ |ˈɲɛtso |ˈjɪnɛːɦo ǁ ˀˈamɪsmɛ |ˈspolu |ˈpr̝̊ɛtkamɛrou |ˈnɛɦraːlɪ ǁ ˈmɪsmɛ |ˈspolu ǁ ˈpr̝̊ɛtkamɛrou |ˈʒɪlɪ ǁ ˈvlastɲɛ |ˈaɲɪ |ˈnɛviːm ǁ ˈkolikraːt |ˈmjɛ |ˈpoʒaːdal |ˀˈoruku ǁ ˈtr̝̊ɪkraːt ǁ ˈmoʒnaː |ˈtʃtɪr̝ɪkraːt ǁ ˈvɪmiːʃlɛl |ˈblaːzɲɪvɛː |ˈtsɛstɪ ǁ ˈjɛdnousɛ |ˈɣcɛl ǁ ˈʒɛɲɪt ǁ ˈdokoŋtsɛ |ˈvmɛksɪku ǁ ˈjɪŋdɪ |ˈnajaɣcɛ |ˈvmor̝ɪ ǁ ˈɦodɲɛsmɛsɪ |ˈrozumɲɛlɪ ǁ ˀˈalɛ |ˈbɪlɪ |ˈvjɛtsɪ ǁ ˈvɲɪɣʃ ǁ ˈsmɛsɛ |ˈnɛdokaːzalɪ |ˈsɦodnout ǁ ˈdʒon |ˈmɪloval |ˈɦalɪvuːt ǁ ˈmɪloval ǁ ˈtɪcɪsiːtsɛ |ˈdopɪsuː |ˈodfanɪnɛk ǁ ˈktɛrɛː |ˈtiːdɛntso |ˈtiːdɛn |ˈdostaːval ǁ ˈmɪloval |ˈblɛskɪ |ˈfotoaparaːtuː ǁ ˈmɪloval |ˈtsɛloutu |ˈʃou ǁ ˈfʃɛɣno |ˈto ǁ ˈtso |ˈmɲɛ ǁ ˈnaɦaːɲelo |ˈɦusiː |ˈkuːʒɪ ǁ ˈjɛdnousɛm |ˈmu |ˈr̝ɛkla ǁ ˈʒɛsɛ |ˈtɛdɪ |ˈvɛzmɛmɛ ǁ ˈa ǁ ˀˈodjɛdɛmɛ |ˈɲɛkam |ˈfarmar̝̊ɪt ǁ ˈjɛn |ˈmɪ |ˈdva ǁ ˀˈamoʒnaː |ˈpak ǁ ˈɲɛjakɛː |ˈɟɛcɪ ǁ ˈpokutjɛ |ˈbudɛmɛ |ˈmiːt ǁ ˈnɛɣcɛl ǁ

<table>
<tr><th colspan="2">1-syllable words</th><th colspan="2">2-syllable words</th><th colspan="2">3-syllable words</th><th colspan="2">4-syllable words</th><th colspan="2">5-syllable words</th><th colspan="2">6-syllable words</th><th colspan="2">Total</th></tr>
<tr><td colspan="2">80</td><td colspan="2">66</td><td colspan="2">37</td><td colspan="2">8</td><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">197</td></tr>
<tr><td colspan="12">Total number of syllables</td><td colspan="2">386</td></tr>
<tr><td colspan="14">5 longest syllables</td></tr>
<tr><td colspan="3">ʃou
(726,547)</td><td colspan="3">sɲiːmʃ
(685,063)</td><td colspan="2">kraːt
(613,35)</td><td colspan="3">vuːt
(578,149)</td><td colspan="3">ɣcɛl
(535,251)</td></tr>
<tr><td colspan="14">5 shortest syllables</td></tr>
<tr><td colspan="3">a
(53,13)</td><td colspan="3">to
(57,71)</td><td colspan="2">lɛ
(58,626)</td><td colspan="3">a
(59,642)</td><td colspan="3">pɪ
(60,95)</td></tr>
<tr><td colspan="14">Most frequent words</td></tr>
<tr><td colspan="5">je
(6)</td><td colspan="4">jsme
(5)</td><td colspan="5">s, v, ale, se, a, o, ze, to
(4)</td></tr>
</table>

Table 4.2 Additional information on the Czech speech sample

6 Evaluation of the analysis

As it was already stated in the introduction to speech analysis, the SD method was used in order to compare the individual languages (English and Czech).

From the theoretical part it is known that these two languages show examples of two different kinds of speech rhythm. Czech language belongs to a category commonly known as syllable-timed, which means that the rhythm is governed by syllables which should have similar length. English, on the other hand, is an example of a stress-timed rhythm, which is characteristic of syllables having different durations and that the rhythm itself is governed by stress, which basically means that duration between stressed syllables within an utterance should have approximately the same length.

The SD method was used for the purpose of examining the difference of syllable duration variance for both samples of speech data. In both cases all syllables of either extracts of speech were carefully measured in Praat, however, it is in some cases very speculative since determining the correct boundaries of individual syllables may be, in some occurrences, a very challenging task to do. For English, therefore, the syllables were divided according to *Longman Pronunciation Dictionary, 3rd edition* by Wells (2008). For Czech the syllables were divided in accordance to their structure.

6.1 The Standard Deviation results

The results were surprising in a way that the SD of syllable duration calculated for Czech language is 103 milliseconds per syllable and for English it is 124 milliseconds per syllable, which makes it a difference of 21 milliseconds (henceforth ms) per syllable.

In Czech the longest syllable is the word “show” with the length of 726,547 ms and the shortest is a conjunction “a” with the length of 53,13 ms. These are the two extremes that occur in the Czech sample. When these two values are subtracted it makes a difference of 673,417 ms.

In English the difference between the longest and shortest syllable was even higher. The longest syllable is the word “noise” with its length of 837,617 ms, while the shortest is the article “a” with its length of 35, 446 ms. The difference between these two values is 802,171 ms.

Theoretically the duration of Czech syllables should be more or less equal in length, be them stressed or unstressed, and in English it should vary a great deal. From the data examined it is clear that the differences in syllable lengths vary in both languages, however, the difference is greater in English.

By comparing the SD values of the feet durations it is possible to notice that the value is lower for English foot duration with a value of 133 ms per foot, where the longest foot contains three syllables | spɪər i ənᵗs | and has a value of 849 ms, the shortest foot comprises of one-syllable word | ɔː | with a value of 143 ms. When the two values are subtracted from each other we get a difference of 706 ms.

In Czech the SD of the foot has a value of 219 ms per foot, which makes it a difference of 86 ms in comparison with the SD of the English foot. The longest foot in Czech has a value of 1088 ms and contains a five-syllable word | nɛsɪɱpatɪtskiː |, whereas the shortest foot contains only one-syllable word | jɛ | with its duration of only 75 ms. The difference between the longest and shortest foot is 1013 ms.

From this point it is possible to state that greater variance in foot duration can be noticed in Czech language.

For complete data and calculation of the SD for both English and Czech see *Appendices 4-5*.

6.2 Comparison of unstressed syllables

In order to be able to compare durations of English and Czech unstressed syllables, only the first 150 unstressed syllables of either language are taken in consideration. The main purpose of this is that there is an equal amount of occurrences for both languages.

Duration (ms)	700 - 600	600 - 500	500 - 400	400 - 300	300 - 200	200 - 100	100 - 0
EN	0	0	1	1	16	82	50
CZ	1	1	4	9	43	72	20
EN	0%	0%	1%	1%	11%	55%	33%
CZ	1%	1%	3%	6%	29%	48%	13%

Table 6.1 Occurrence of unstressed syllables according to their duration

From *Table 6.1* it is possible to derive that most of the unstressed syllables of both languages cumulate in the range between 300 to 0 ms. English, however, shows the highest occurrence in the range between 200 to 0 ms in total number of 132 occurrences out of 150, whereas in the range between 700 to 200 ms it shows only 18 occurrences. On the other hand, unstressed syllables in Czech show 82 occurrences in the range between 200 to 0 ms and 58 occurrences in the range between 700 to 200 ms. The unstressed syllables in Czech also account for the extreme values ranging from 700 to 400 ms in total number of 5 occurrences, whereas English accounts for only one. For further comparison see also *Table 6.2* which shows that ten longest unstressed syllables in Czech are on average longer than the English ones and, similarly, ten shortest unstressed syllables in Czech are longer than the English ones.

Ten longest unstressed syllables				***Ten shortest unstressed syllables***			
EN		CZ		EN		CZ	
ən^{t}s	449,978	kraːt	613,35	ə	52,507	kɪ	90,688
səm	380,14	kaːx	534,034	ən	50,426	vɛ	89,247
wədz	297,636	viːm	474,243	^{ə}n	49,872	ka	78,517
əv	280,808	xaːs	469,875	ə	49,133	tɛ	77,863
aɪ^{ə}l	260,604	lu	459,849	ði	48,609	lɛ	76,582
məst	254,991	kraːt	426,348	tə	46,647	ka	76,292
reɪt	234,926	nɛm	393,633	ə	42,261	ɲɛ	67,001
ɪŋ	234,672	naːr̝	391,858	ə	42,021	ka	66,871
wiː^{ə}l	230,148	ksu	386,174	ə	38,241	pɪ	60,95
ɪts	229,353	vaːʃ	327,024	ə	35,446	lɛ	58,626

Table 6.2 Overview of ten longest and shortest unstressed syllables of Czech and English

6.3 Comparison of stressed syllables

For the purpose of comparing the stressed syllables of both languages, the same approach is chosen as for the unstressed syllables. A number of occurrences is 150 stressed syllables of both languages.

Duration (ms)	900 - 800	800 - 700	700 - 600	600 - 500	500 - 400	400 - 300	300 - 200	200 - 100	100 - 0
EN	1	0	1	5	19	43	49	29	3
CZ	0	1	1	1	5	19	40	69	14
EN	1%	0%	1%	3%	13%	29%	33%	19%	2%
CZ	0%	1%	1%	1%	3%	13%	27%	46%	9%

Table 6.3 Occurrence of stressed syllables according to their duration

Table 6.3 shows that most of the stressed syllables of both examined languages appear in the range from 400 to 100 ms. Range between 900 to 400 ms is mostly occupied by English syllables, where they account for 26 occurrences, while Czech shows only 8 occurrences. Czech has most of its stressed syllables in the range between 300 to 0 ms, total number of 123 out of 150, whereas English has 81 stressed syllables within the same range.

Altogether with the previous *section 6.2* where unstressed syllables of both languages were compared, we can notice some sort of tendency for English unstressed syllables to be of relatively shorter duration than Czech unstressed syllables. In case of the stressed syllables the tendency is other way round. English stressed syllables seem to be relatively longer than Czech ones. For an overview of the longest and shortest stressed syllables in either language see *Table 6.4*.

Ten longest stressed syllables				Ten shortest stressed syllables			
EN		CZ		EN		CZ	
nɔɪz	837,617	**ʃou**	726,547	**nəʊn**	143,114	a	79,695
fɔːs	620,03	**sɲiːmʃ**	685,063	ɔːl	142,873	ko	79,694
hɔːs	596,5	**miːt**	525,804	bɒl	138,814	do	79,614
tʃeɪndʒ	591,438	spr̝̊aː	470,056	vɪz	129,739	ɦɛ	77,863
stɒpt	535,633	**spo**	441,66	wen	121,472	vɪ	77,863
saɪd	527,961	**za**	438,782	mer	120,786	jɛ	75,115
rɔːθ	515,686	**vɲɪɣʃ**	412,837	ev	115,29	a	69,619
stɪər	495,066	**lɪts**	409,599	ver	86,646	a	63,926
lʌntʃ	492,593	**blaːz**	376,49	ɪt	82,427	a	59,642
ɜːθ	484,587	**ʃcɛs**	353,852	ɪt	77,578	a	53,13

Table 6.4 Overview of ten longest and shortest stressed syllables of Czech and English

Tonic syllables are presented in *Table 6.4* above and are printed in bold. It is evident, that most of the longest stressed syllables of both languages are the tonic syllables.

7 Conclusion of the speech analysis

After all what has been already said it is still possible to draw some conclusion. Even though the difference in SD value of the both languages is subtle (21 ms), it is necessary to bear in mind that the results are per syllable which can make a significant difference in polysyllabic words. Another point to be made is that the range between the longest and shortest stressed or unstressed syllable is higher in English by 128,754 ms, which proves, to some extent, that the English syllables have greater variance than the Czech syllables.

In terms of feet, the SD has lower values for English foot duration and greater for Czech. The difference here is greater than it was in the case of syllables. The SD of a Czech foot has a value of 219 ms and in English 133 ms. These results show that English feet are closer to the average duration of the feet, which means that Czech feet have greater variance.

As Volín argues, similar research was performed by Roach who also measured syllables to ascertain the variance of syllables of various languages and his findings were not as clear as expected. Languages that are clearly stress-timed varied in the length of their feet duration and, on the other hand, languages with syllable-timed rhythms varied in their syllable durations (Volín, 2007, p. 61).

Volín (2007) further explains that the main problem is probably in the way the syllables were measured. It proved ineffective to measure syllables from their actual beginning to their actual end. He also states that syllables as a means of rhythmical pulses appear in a listener's mind approximately at the moment of the beginning of their sonorous nuclei – calculation of such perception momentum has been already suggested and it appears to be of a great interest of further research in the field of phonetics and, furthermore, in order to be able to experience the stress-timed rhythm it is also necessary to bear in mind its global phonotactic qualities (ibid.).

In relation to this Volín refers to the study conducted by Ramus, Nesporová and Mehler. They presumed that presence of consonant clusters and vocal reductions could play a certain role for a better approach of the syllable timing. It proved appropriate for them to calculate a proportion of the vocal parts of the sample speech and the SD of the consonant clusters within the same sample. One or more consonants between two vowels or between a vowel and a pause are regarded as the consonantal part. A great advantage of this method is that defining the boundaries of individual syllables is not necessary at all (Volín, 2007, p. 62).

Volín (2007) then explains that by using this method, the results of the syllable-timed languages should show the proportion of vowel duration as being higher than those of the stressed-timed rhythm. On the other hand the results of the SD of the consonants in syllable-timed rhythm should have lower values than those of the stress-timed rhythm. This is caused due to the phonotactics of stress-timed rhythm which allows consonant clustering (ibid., p. 62).

And finally Volín (2007) presents another approach which is suggested by a German phonetician, Volker Delwo, who asserts that instead of the SD it is beneficial to use variation coefficient because it normalizes the SD in relation to the mean, therefore, enables to compare parameters of various speech pace (ibid., p. 63).

CONCLUSION

The aim of this bachelor thesis was to compare two different types of rhythm. Syllable-timed, which is associated with Czech language on one hand, and stressed-timed, which is associated with English, on the other.

Differences that could be noticed between these two languages are mainly connected with the perceived length of syllables, where it is stated that in Czech the syllables should prove relatively more or less the same values in duration irrespectively whether they are stressed or not. In English, however, the stressed syllables should be longer than their unstressed counterparts.

These findings are important, since reduction of vowels of unstressed syllables is directly responsible for the phenomenon of unstressed syllables being shorter in length and it helps to compensate the overall length of individual feet. At the same time the reduction of vowels is an important feature of English language and it seems to contribute significantly in the way the English rhythm is perceived and produced.

Czech language, on the other hand, does not use reduction of vowels in any position and vowels in Czech unstressed syllables are pronounced in their full unreduced form, which makes them longer in duration than they would be if they were reduced, therefore, it may seem that syllables tend to have more or less the same quantity. Such differences were partially proven in the practical part of this thesis, where the lengths of stressed and unstressed syllables were analyzed and the results showed that Czech stressed syllables were rather shorter than English, whereas unstressed syllables were rather longer.

Since English belongs to languages that are described as being stress-timed, the importance of stress has to be also emphasized. Stress in English words is described as being variable, which means one cannot simply decide which syllable of the word should be stressed. This can cause some difficulties to foreign learners and it is suggested that the stress pattern of the English words should be learnt together with the meaning of the word itself. In longer utterances, however, some of the stresses does not have to be realized in order to preserve the regularity in rhythm and it seems that the stressed syllables are spread equally within an utterance. This is different in Czech, where stress seems to always fall on the first syllable of a word. Such stress pattern is described as being fixed and it was stated that its main functionality is to identify word boundaries. In Czech, therefore, the stressed syllables within an utterance are spread unequally and their positions are influenced by a number of syllables that words are composed of.

Practical part of this work was devoted to comparison of two recordings of which one being spoken by an RP speaker of English and the other was spoken by a Czech actress.

The actual comparison was concentrated mainly on the length of syllables and feet of either language, since it is said that syllable-timed languages are characteristic by more or less equal duration of syllables no matter whether stressed or unstressed, whereas stress-timed languages are described as having duration of their feet more or less equal.

The results, however, showed that feet durations in English in some instances varied from each other in length, while in others they were almost identical. In Czech much greater duration variance among feet was measured and the length of each foot seems to be rather driven by the number of syllables within each foot.

By comparing values of Standard Deviations of syllables and feet of both languages, the results showed that Czech syllables were closer to the average duration of their syllables than they were in English language, while, on the other hand, English feet were closer to the average duration of their feet than they were in Czech language.

After all it seems that the issue of speech rhythm is not as easy and straightforward as it may seem and many authors agree on that there is still a great deal of research to be done in order to be able to fully explain this rather complex phenomenon of speech. However, the already gathered pieces of knowledge seem to be solid fundamentals in further phonetic investigation.

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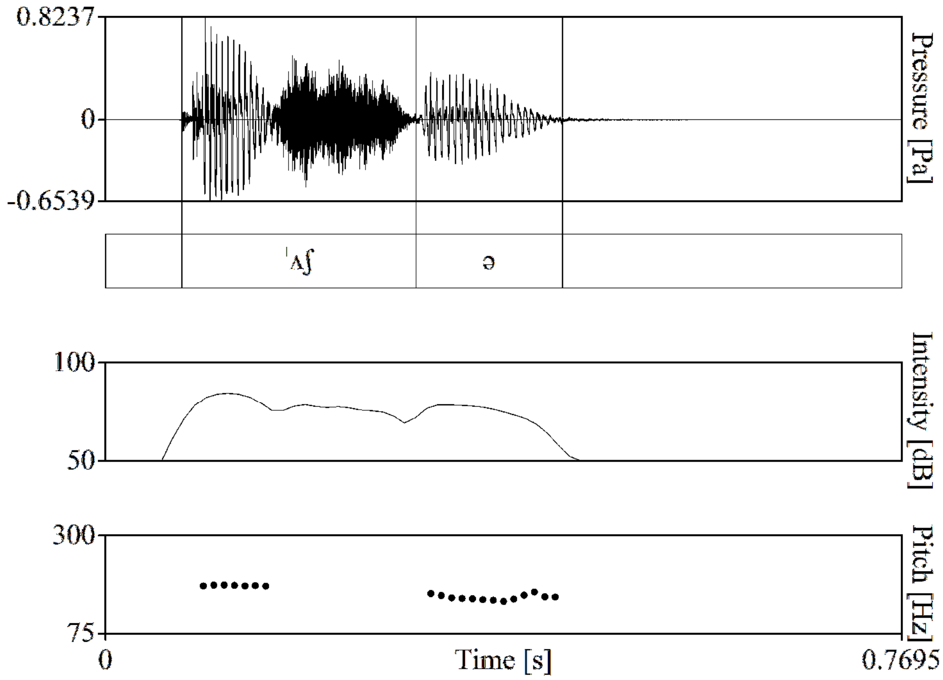
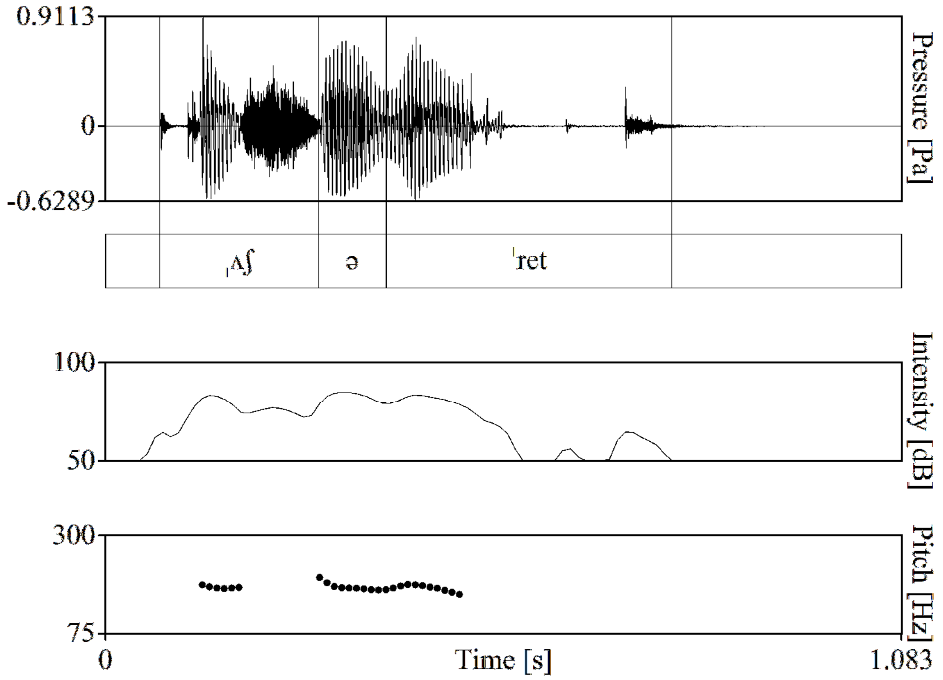
LIST OF APPENDICES

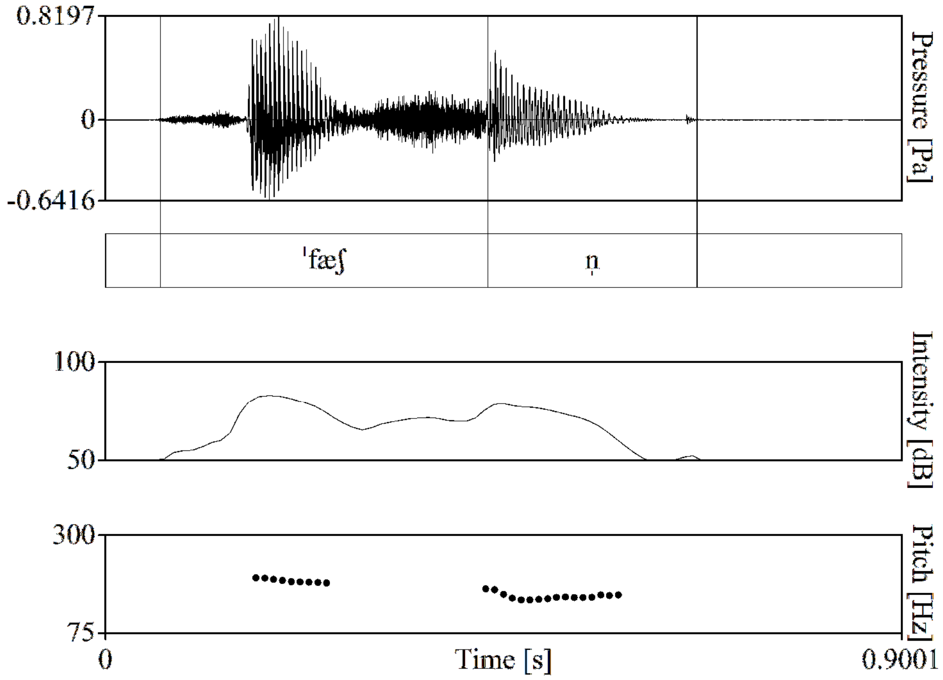
APPENDICES

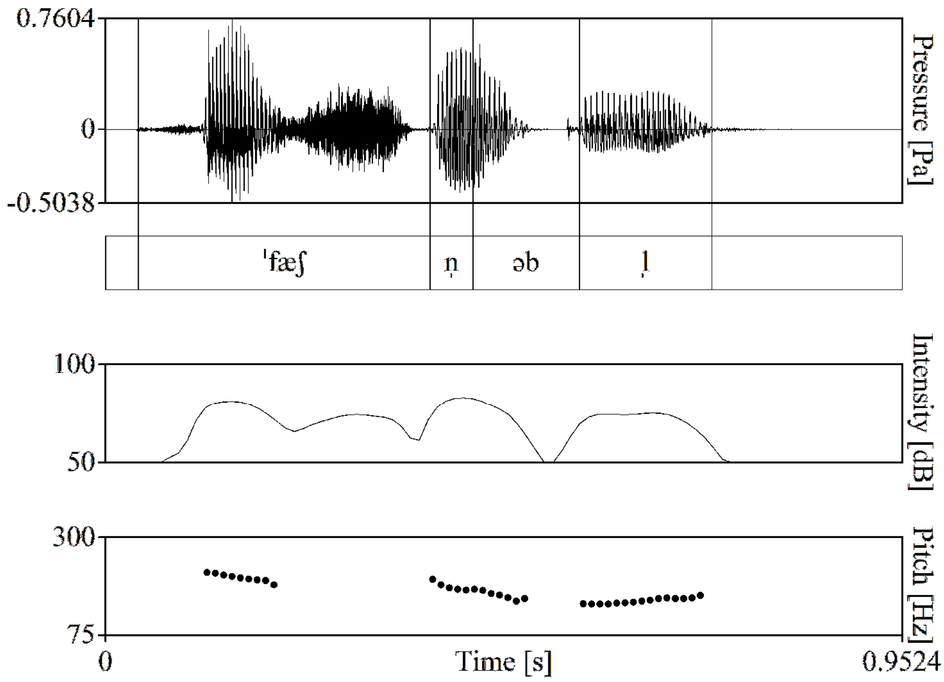
Appendix 1: Complex word stress: USHER and USHERETTE – stress carrying suffix "-ette"



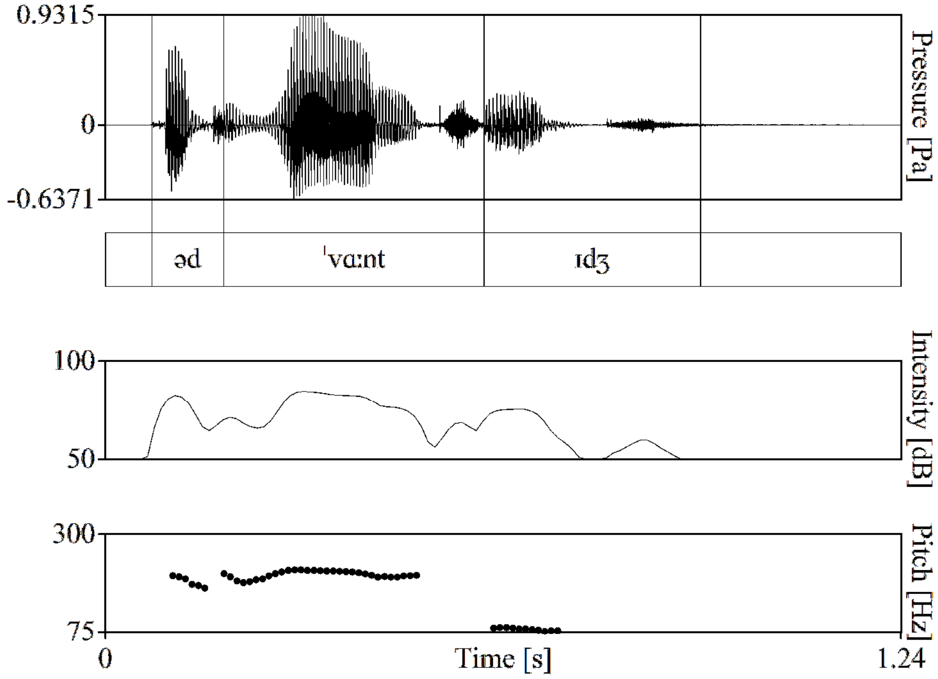


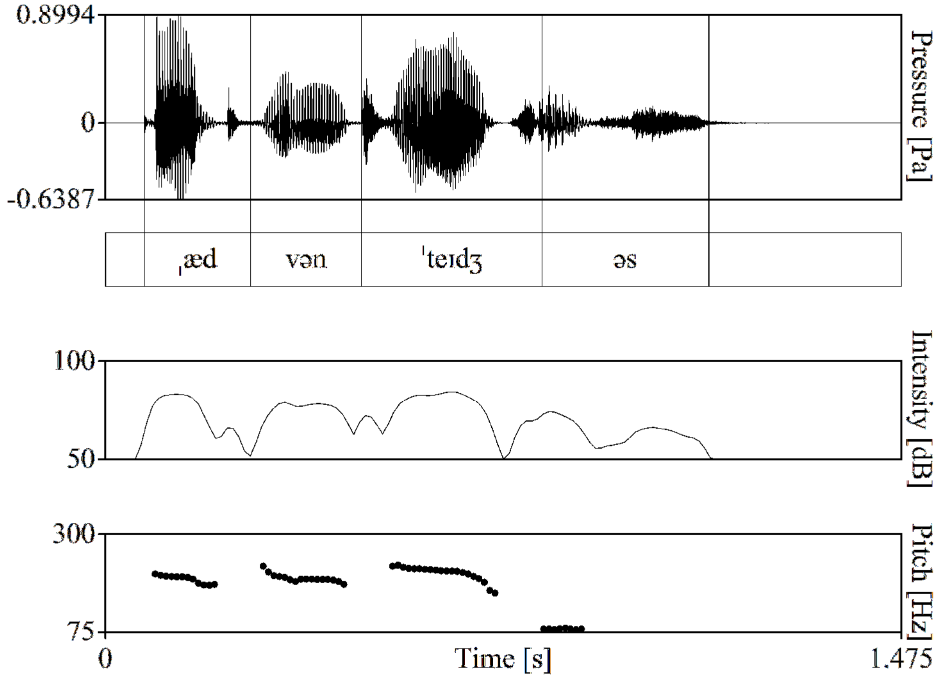
Appendix 2: Complex word stress: FASHION and FASHIONABLE – suffix "-able" no influence on stress position





Appendix 3: Complex word stress: ADVANTAGE and ADVANTAGEOUS – stress shifts onto the last syllable of the stem





Appendix 4: Data of the English speech sample and calculation of the SD for syllable and foot

Syllable Count (n)	Syllable	Syllable duration [ms](x)	Foot duration [ms]	Deviation about the mean: x-mean	Deviation about the mean: $(x\text{-mean})^2$
1	wʌn	236,819	395,559	15,0080000	225,2400640
2	deɪ	158,74		-63,0710000	3977,9510410
3	lɑːst	420,289	420,289	198,4780000	39393,5164840
4	jɪə	366,721	366,721	144,9100000	20998,9081000
5	wen	121,472	397,349	-100,3390000	10067,9149210
6	aɪ	107,908		-113,9030000	12973,8934090
7	wəz	167,969		-53,8420000	2898,9609640
8	draɪv	189,705	358,749	-32,1060000	1030,7952360
9	ɪŋ	169,044		-52,7670000	2784,3562890
10	bæk	217,183	391,612	-4,6280000	21,4183840
11	tə	174,429		-47,3820000	2245,0539240
12	wɜːk	270,636	270,636	48,8250000	2383,8806250
13	ɑːft	242,564	476,048	20,7530000	430,6870090
14	ə	42,261		-179,5500000	32238,2025000
15	ʳaɪd	191,223		-30,5880000	935,6257440
16	hæd	233,839	233,839	12,0280000	144,6727840
17	lʌntʃ	492,593	492,593	270,7820000	73322,8915240
18	aɪ	128,756	128,756	-93,0550000	8659,2330250
19	hæd	191,749	303,878	-30,0620000	903,7238440
20	ᵊn	49,872		-171,9390000	29563,0197210
21	ə	62,257		-159,5540000	25457,4789160
22	meɪz	423,676	596,492	201,8650000	40749,4782250
23	ɪŋ	91,801		-130,0100000	16902,6001000
24	ən	81,015		-140,7960000	19823,5136160

25	ʌn	190,619	400,817	-31,1920000	972,9408640
26	fə	210,198		-11,6130000	134,8617690
27	get	177,367	505,866	-44,4440000	1975,2691360
28	əb	152,616		-69,1950000	4787,9480250
29	^{ə}l	56,613		-165,1980000	27290,3792040
30	ɪk	119,27		-102,5410000	10514,6566810
31	spɪər	324	849,109	102,1890000	10442,5917210
32	i	75,131		-146,6800000	21515,0224000
33	ən^{t}s	449,978		228,1670000	52060,1798890
34	ɪt	77,578	646,574	-144,2330000	20803,1582890
35	məst	254,991		33,1800000	1100,9124000
36	ə	115,074		-106,7370000	11392,7871690
37	bɪn	198,931		-22,8800000	523,4944000
38	tʊə	308,53	308,53	86,7190000	7520,1849610
39	klɒk	483,939	483,939	262,1280000	68711,0883840
40	ɔː	299,503	358,333	77,6920000	6036,0468640
41	pə	58,83		-162,9810000	26562,8063610
42	hæps	273,462	315,483	51,6510000	2667,8258010
43	ə	42,021		-179,7900000	32324,4441000
44	kwɔːt	198,273	398,111	-23,5380000	554,0374440
45	ə	38,241		-183,5700000	33697,9449000
46	$_{r}$əv	111,171		-110,6400000	12241,2096000
47	ən	50,426		-171,3850000	29372,8182250
48	aʊə	190,435	190,435	-31,3760000	984,4533760
49	leɪt	321,312	465,174	99,5010000	9900,4490010
50	ə	143,862		-77,9490000	6076,0466010
51	ə	49,133	49,133	-172,6780000	29817,6916840
52	kwɔːt	155,954	208,461	-65,8570000	4337,1444490
53	ə	52,507		-169,3040000	28663,8444160
54	pɑːs	324,995	324,995	103,1840000	10646,9378560
55	tuː	289,625	289,625	67,8140000	4598,7385960

56	ɪt	82,427	465,837	-139,3840000	19427,8994560
57	wəz	124,725		-97,0860000	9425,6913960
58	ən	57,537		-164,2740000	26985,9470760
59	ɪn	201,148		-20,6630000	426,9595690
60	kred	220,216	386,335	-1,5950000	2,5440250
61	əb	94,827		-126,9840000	16124,9362560
62	ᵊl	71,292		-150,5190000	22655,9693610
63	θɪŋ	305,862	305,862	84,0510000	7064,5706010
64	rɪəl	224,135	377,738	2,3240000	5,4009760
65	ɪ	153,603		-68,2080000	4652,3312640
66	aɪ	86,537	188,035	-135,2740000	18299,0550760
67	wəz	101,498		-120,3130000	14475,2179690
68	sɪt	307,989	494,507	86,1780000	7426,6476840
69	ɪŋ	186,518		-35,2930000	1245,5958490
70	ðeə	416,889	416,889	195,0780000	38055,4260840
71	ət	64,002	130,59	-157,8090000	24903,6804810
72	ðə	66,588		-155,2230000	24094,1797290
73	stɪər	346,39	762,01	124,5790000	15519,9272410
74	ɪŋ	125,165		-96,6460000	9340,4493160
75	wiːᵊl	230,148		8,3370000	69,5055690
76	əv	60,307		-161,5040000	26083,5420160
77	maɪ	172,353	172,353	-49,4580000	2446,0937640
78	njuː	241,6	241,6	19,7890000	391,6045210
79	kɑː	441,824	441,824	220,0130000	48405,7201690
80	weɪt	242,338	509,354	20,5270000	421,3577290
81	ɪŋ	97,988		-123,8230000	15332,1353290
82	fə	92,836		-128,9750000	16634,5506250
83	ðə	76,192		-145,6190000	21204,8931610
84	laɪts	384,933	522,263	163,1220000	26608,7868840
85	tə	137,33		-84,4810000	7137,0393610
86	tʃeɪndʒ	591,438	591,438	369,6270000	136624,1191290

87	wen	137,608	137,608	-84,2030000	7090,1452090
88	ɔːl	142,873	306,433	-78,9380000	6231,2078440
89	əv	85,151		-136,6600000	18675,9556000
90	ə	78,409		-143,4020000	20564,1336040
91	sʌd	355,57	518,577	133,7590000	17891,4700810
92	ᵊn	163,007		-58,8040000	3457,9104160
93	ðə	67,696	67,696	-154,1150000	23751,4332250
94	kɑː	273,924	273,924	52,1130000	2715,7647690
95	stɑːt	334,323	499,823	112,5120000	12658,9501440
96	ɪd	93,094		-128,7170000	16568,0660890
97	tə	72,406		-149,4050000	22321,8540250
98	ʃeɪk	442,101	442,101	220,2900000	48527,6841000
99	ðɪs	225,252	555,606	3,4410000	11,8404810
100	weɪ	194,592		-27,2190000	740,8739610
101	ən	135,762		-86,0490000	7404,4304010
102	ðæt	379,3	379,3	157,4890000	24802,7851210
103	rɒk	267,818	575,737	46,0070000	2116,6440490
104	ɪŋ	127,464		-94,3470000	8901,3564090
105	frəm	180,455		-41,3560000	1710,3187360
106	saɪ	420,037	476,914	198,2260000	39293,5470760
107	tə	56,877		-164,9340000	27203,2243560
108	saɪd	527,961	527,961	306,1500000	93727,8225000
109	θrə	312,111	666,369	90,3000000	8154,0900000
110	ɪŋ	131,76		-90,0510000	8109,1826010
111	mi	222,498		0,6870000	0,4719690
112	bæk	227,205	503,155	5,3940000	29,0952360
113	wədz	155,954		-65,8570000	4337,1444490
114	ən	119,996		-101,8150000	10366,2942250
115	fɔː	189,149	486,785	-32,6620000	1066,8062440
116	wədz	297,636		75,8250000	5749,4306250
117	ʌp	177,17	371,946	-44,6410000	1992,8188810
118	ən	194,776		-27,0350000	730,8912250
119	daʊn	466,275	466,275	244,4640000	59762,6472960

120	aɪ	116,007	116,007	-105,8040000	11194,4864160
121	felt	344,439	583,099	122,6280000	15037,6263840
122	əz	103,218		-118,5930000	14064,2996490
123	ɪf	135,442		-86,3690000	7459,6041610
124	aɪ	119,791	267,305	-102,0200000	10408,0804000
125	wəz	147,514		-74,2970000	5520,0442090
126	raɪd	228,094	489,26	6,2830000	39,4760890
127	ɪŋ	104,957		-116,8540000	13654,8573160
128	ə	156,209		-65,6020000	4303,6224040
129	bʌk	179,022	351,394	-42,7890000	1830,8985210
130	ɪŋ	172,372		-49,4390000	2444,2147210
131	hɔːs	596,5	596,5	374,6890000	140391,8467210
132	wɜːs	408,375	634,759	186,5640000	34806,1260960
133	ðən	226,384		4,5730000	20,9123290
134	ðæt	423,617	423,617	201,8060000	40725,6616360
135	sʌm	243,47	370,427	21,6590000	469,1122810
136	mɪ	126,957		-94,8540000	8997,2813160
137	stɪər	495,066	742,933	273,2550000	74668,2950250
138	i	72,099		-149,7120000	22413,6829440
139	əs	175,768		-46,0430000	2119,9578490
140	spɪr	331,163	547,236	109,3520000	11957,8599040
141	ɪt	216,073		-5,7380000	32,9246440
142	ɔː	143,218	143,218	-78,5930000	6176,8596490
143	hɒst	348,741	609,345	126,9300000	16111,2249000
144	aɪəl	260,604		38,7930000	1504,8968490
145	fɔːs	620,03	620,03	398,2190000	158578,3719610

146	siːmd	319,171	499,011	97,3600000	9478,9696000
147	tə	58,821		-162,9900000	26565,7401000
148	bɪ	121,019		-100,7920000	10159,0272640
149	vent	300,654	659,414	78,8430000	6216,2186490
150	ɪŋ	129,407		-92,4040000	8538,4992160
151	ɪts	229,353		7,5420000	56,8817640
152	vɑːst	427,503	427,503	205,6920000	42309,1988640
153	fjʊər	369,564	593,492	147,7530000	21830,9490090
154	ɪ	92,475		-129,3360000	16727,8008960
155	ə	131,453		-90,3580000	8164,5681640
156	pɒn	210,53	299,389	-11,2810000	127,2609610
157	ði	88,859		-132,9520000	17676,2343040
158	ɜːθ	484,587	484,587	262,7760000	69051,2261760
159	ən	158,357	233,75	-63,4540000	4026,4101160
160	ðə	75,393		-146,4180000	21438,2307240
161	nɔɪz	837,617	837,617	615,8060000	379217,0296360
162	ðə	93,808	376,867	-128,0030000	16384,7680090
163	wəz	127,668		-94,1430000	8862,9044490
164	ə	155,391		-66,4200000	4411,6164000
165	kaɪnd	293,39	574,198	71,5790000	5123,5532410
166	əv	280,808		58,9970000	3480,6460090
167	diːp	335,404	335,404	113,5930000	12903,3696490
168	grəʊn	300,04	534,712	78,2290000	6119,7764410
169	ɪŋ	234,672		12,8610000	165,4053210
170	ənd	118,871	118,871	-102,9400000	10596,6436000
171	hɒr	261,809	575,508	39,9980000	1599,8400040
172	əb	167,355		-54,4560000	2965,4559360
173	əl	146,344		-75,4670000	5695,2680890
174	ɔː	195,492	575,632	-26,3190000	692,6897610
175	səm	380,14		158,3290000	25068,0722410
176	graɪnd	415,943	608,366	194,1320000	37687,2334240
177	ɪŋ	192,423		-29,3880000	863,6545440

178	wɪtʃ	182,704	182,704	-39,1070000	1529,3574490
179	siːmd	357,941	404,588	136,1300000	18531,3769000
180	tə	46,647		-175,1640000	30682,4268960
181	fɪl	338,709	435,381	116,8980000	13665,1424040
182	ði	96,672		-125,1390000	15659,7693210
183	eə	348,632	348,632	126,8210000	16083,5660410
184	ən	181,171	181,171	-40,6400000	1651,6096000
185	ðen	344,847	344,847	123,0360000	15137,8572960
186	ə	35,446	35,446	-186,3650000	34731,9132250
187	ʃɔːt	406,277	406,277	184,4660000	34027,7051560
188	waɪᵊl	291,959	291,959	70,1480000	4920,7419040
189	ɑːft	367,125	542,769	145,3140000	21116,1585960
190	ə	175,644		-46,1670000	2131,3918890
191	ðə	58,003	58,003	-163,8080000	26833,0608640
192	həʊl	388,222	388,222	166,4110000	27692,6209210
193	pær	167,686	346,453	-54,1250000	2929,5156250
194	ək	178,767		-43,0440000	1852,7859360
195	sɪz	207,973	469,652	-13,8380000	191,4902440
196	əm	142,808		-79,0030000	6241,4740090
197	həd	118,871		-102,9400000	10596,6436000
198	stɒpt	535,633	535,633	313,8220000	98484,2476840
199	dʒʌst	262,089	318,25	40,2780000	1622,3172840
200	ə	56,161		-165,6500000	27439,9225000
201	sʌd	291,633	558,462	69,8220000	4875,1116840
202	ᵊn	142,514		-79,2970000	6288,0142090
203	li	124,315		-97,4960000	9505,4700160

204	ev	115,29	627,553	-106,5210000	11346,7234410
205	ri	95,341		-126,4700000	15994,6609000
206	θɪŋ	198,458		-23,3530000	545,3626090
207	wəz	218,464		-3,3470000	11,2024090
208	kɑːm	329,809	510,264	107,9980000	11663,5680040
209	ən	180,455		-41,3560000	1710,3187360
210	smuːð	362,339	437,323	140,5280000	19748,1187840
211	ə	74,984		-146,8270000	21558,1679290
212	gen	298,711	298,711	76,9000000	5913,6100000
213	kwaɪ	257,28	640,387	35,4690000	1258,0499610
214	ət	204,802		-17,0090000	289,3060810
215	ən	178,305		-43,5060000	1892,7720360
216	piːs	285,719	467,809	63,9080000	4084,2324640
217	fəl	182,09		-39,7210000	1577,7578410
218	wʌnts	338,096	338,096	116,2850000	13522,2012250
219	mɔː	289,196	289,196	67,3850000	4540,7382250
220	aɪ	163,268	163,268	-58,5430000	3427,2828490
221	pʊt	151,81	312,93	-70,0010000	4900,1400010
222	maɪ	161,12		-60,6910000	3683,3974810
223	fʊt	327,355	327,355	105,5440000	11139,5359360
224	daʊn	409,397	409,397	187,5860000	35188,5073960

225	dʒʌst	265,669	326,229	43,8580000	1923,5241640
226	ə	60,56		-161,2510000	26001,8850010
227	dʒent	213,373	326,778	-8,4380000	71,1998440
228	ᵊl	113,405		-108,4060000	11751,8608360
229	preʃ	240,202	607,568	18,3910000	338,2288810
230	ə	60,873		-160,9380000	25901,0398440
231	ᵣɒn	150,064		-71,7470000	5147,6320090
232	ði	48,609		-173,2020000	29998,9328040
233	ək	107,82		-113,9910000	12993,9480810
234	sel	152,769	559,404	-69,0420000	4766,7977640
235	ə	53,028		-168,7830000	28487,7010890
236	reɪt	234,926		13,1150000	172,0032250
237	ə	118,681		-103,1300000	10635,7969000
238	ɔː	319,376	455,329	97,5650000	9518,9292250
239	ðə	135,953		-85,8580000	7371,5961640
240	gæs	310,781	568,981	88,9700000	7915,6609000
241	ped	131,555		-90,2560000	8146,1455360
242	ᵊl	126,645		-95,1660000	9056,5675560
243	əz	132,477	302,598	-89,3340000	7980,5635560
244	ɪts	170,121		-51,6900000	2671,8561000
245	naʊn	143,114	298,93	-78,6970000	6193,2178090
246	ɪn	88,795		-133,0160000	17693,2562560
247	ə	67,021		-154,7900000	23959,9441000
248	mer	120,786	394,764	-101,0250000	10206,0506250
249	ɪk	147,3		-74,5110000	5551,8891210
250	ə	126,678		-95,1330000	9050,2876890
251	ən	157,54	157,54	-64,2710000	4130,7614410
252	drəʊv	246,539	246,539	24,7280000	611,4739840
253	ɒf	370,746	370,746	148,9350000	22181,6342250

254	ev	161,12	530,39	-60,6910000	3683,3974810
255	ri	69,461		-152,3500000	23210,5225000
256	θɪŋ	178,306		-43,5050000	1892,6850250
257	wəz	121,503		-100,3080000	10061,6948640
258	ʌt	224,637	355,074	2,8260000	7,9862760
259	ᵊlɪ	130,437		-91,3740000	8349,2078760
260	nɔːm	265,008	422,451	43,1970000	1865,9808090
261	ᵊl	157,443		-64,3680000	4143,2394240
262	wʌnᵗs	332,571	332,571	110,7600000	12267,7776000
263	mɔː	230,069	230,069	8,2580000	68,1945640
264	səʊ	274,262	274,262	52,4510000	2751,1074010
265	ðen	269,658	269,658	47,8470000	2289,3354090
266	wɒz	213,395	395,282	-8,4160000	70,8290560
267	ðɪs	181,887		-39,9240000	1593,9257760
268	sʌm	424,332	424,332	202,5210000	41014,7554410
269	ver	86,646	219,839	-135,1650000	18269,5772250
270	ɪ	133,193		-88,6180000	7853,1499240
271	ləʊk	322,649	598,381	100,8380000	10168,3022440
272	ᵊl	177,629		-44,1820000	1952,0491240
273	ən	98,103		-123,7080000	15303,6692640
274	məʊm	205,912	498,579	-15,8990000	252,7782010
275	əntr	205,912		-15,8990000	252,7782010
276	ɪ	86,755		-135,0560000	18240,1231360
277	ɜːθ	339,118	339,118	117,3070000	13760,9322490
278	trem	148,024	299,291	-73,7870000	5444,5213690
279	ə	151,267		-70,5440000	4976,4559360
280	wɪtʃ	184,034	307,201	-37,7770000	1427,1017290
281	əd	123,167		-98,6440000	9730,6387360
282	strʌk	367,454	367,454	145,6430000	21211,8834490
283	ʌs	300,552	300,552	78,7410000	6200,1450810

284	ɔː	143,724	324,307	-78,0870000	6097,5795690
285	ʳaɪ	180,583		-41,2280000	1699,7479840
286	ʲɑːsk	298,002	402,55	76,1910000	5805,0684810
287	maɪ	104,548		-117,2630000	13750,6111690
288	self	312,214	312,214	90,4030000	8172,7024090
289	wɒz	181,887	369,297	-39,9240000	1593,9257760
290	ɪt	73,552		-148,2590000	21980,7310810
291	ə	113,858		-107,9530000	11653,8502090
292	sjuːp	285,741	317,257	63,9300000	4087,0449000
293	ə	31,516		-190,2950000	36212,1870250
294	nætʃ	275,76	393,343	53,9490000	2910,4946010
295	ᵊrəl	117,583		-104,2280000	10863,4759840
296	vɪz	129,739	220,084	-92,0720000	8477,2531840
297	ɪ	90,345		-131,4660000	17283,3091560
298	teɪʃ	375,109	595,642	153,2980000	23500,2768040
299	ᵊn	220,533		-1,2780000	1,6332840
300	sʌm	288,584	288,584	66,7730000	4458,6335290
301	faɪᵊr	371,164	451,14	149,3530000	22306,3186090
302	ɪ	79,976		-141,8350000	20117,1672250
303	stɔːm	451,543	672,608	229,7320000	52776,7918240
304	əv	221,065		-0,7460000	0,5565160
305	daə	320,8	320,8	98,9890000	9798,8221210
306	bɒl	138,814	388,524	-82,9970000	6888,5020090
307	ɪk	161,025		-60,7860000	3694,9377960
308	ᵊl	88,685		-133,1260000	17722,5318760
309	rɔːθ	515,686	515,686	293,8750000	86362,5156250
310	ɔː	293,597	293,597	71,7860000	5153,2297960
311	wɒz	187,717	360,295	-34,0940000	1162,4008360
312	ɪt	172,578		-49,2330000	2423,8882890
313	rɑːð	244,301	372,106	22,4900000	505,8001000
314	ə	127,805		-94,0060000	8837,1280360
315	mɪə	228,433	404,079	6,6220000	43,8508840
316	li	175,646		-46,1650000	2131,2072250

317	ðət	104,241	403,054	-117,5700000	13822,7049000
318	aɪd	298,813		77,0020000	5929,3080040
319	drʌŋk	202,999	302,999	-18,8120000	353,8913440
320	ə	100		-121,8110000	14837,9197210
321	dʌb	175,07	275,958	-46,7410000	2184,7210810
322	ᵊl	100,888		-120,9230000	14622,3719290
323	vɒd	283,774	371,853	61,9630000	3839,4133690
324	kə	88,079		-133,7320000	17884,2478240
325	ᵣɔː	251,143	251,143	29,3320000	860,3662240
326	tuː	443,36	443,36	221,5490000	49083,9594010
327	djʊər	162,755	401,212	-59,0560000	3487,6111360
328	ɪŋ	56,571		-165,2400000	27304,2576000
329	maɪ	181,886		-39,9250000	1594,0056250
330	lʌntʃ	433,745	433,745	211,9340000	44916,0203560

Sum	69455,487	65849,884	-3742	5070014
Count (n)	330	154	330	330
Average (mean)	210,4711727	427,5966494		
Varience (s^2)				15410,37634

Standard Deviation (s)	**Foot**	**Syllable**
	132,8016319	124,1385369
	133 [ms]	**124 [ms]**

Appendix 5: Data of the Czech speech sample and calculation of the SD for syllable and foot

Syllable Count (n)	Syllable	Syllable duration (x)[ms]	Foot duration [ms]	Deviation about the mean: x-mean	Deviation about the mean: $(x\text{-mean})^2$
1	viː	240,808	339,233	44,16923834	1950,921616
2	tɛ	98,425		-98,21376166	9645,942979
3	ʒɛ	129,004	235,074	-67,63476166	4574,460985
4	o	106,07		-90,56876166	8202,700588
5	sou	253,229	582,496	56,59023834	3202,455076
6	kro	125,727		-70,91176166	5028,477941
7	miːx	203,54		6,901238342	47,62709065
8	zaː	262,376	909,305	65,73723834	4321,384505
9	lɛ	76,582		-120,0567617	14413,62602
10	ʒɪ	165,316		-31,32276166	981,1153979
11	tos	205,724		9,085238342	82,54155573
12	tɛx	199,307		2,668238342	7,11949585
13	nɛ	121,757	830,254	-74,88176166	5607,278229
14	mlu	234,254		37,61523834	1414,906156
15	viːm	474,243		277,6042383	77064,11315
16	a	124,226	312,477	-72,41276166	5243,608051
17	ɲɪ	188,251		-8,387761658	70,35454563
18	pr̝̊ɪ	230,432	1372,627	33,79323834	1141,982958
19	pro	138,286		-58,35276166	3405,044793
20	xaːs	469,875		273,2362383	74658,04194
21	kaːx	534,034		337,3952383	113835,5469

22	a	63,926	254,068	-132,7127617	17612,67711
23	lɛ	58,626		-138,0127617	19047,52238
24	jɛ	131,516		-65,12276166	4240,974086
25	prav	229,728	337,558	33,08923834	1094,897694
26	da	107,83		-88,80876166	7886,996147
27	ʒɛ	133,741	549,489	-62,89776166	3956,128422
28	smɛ	214,351		17,71223834	313,7233871
29	sɛ	201,397		4,758238342	22,64083212
30	zdʒo	325,584	719,217	128,9452383	16626,87449
31	nɛm	393,633		196,9942383	38806,72994
32	spr̩̊aː	470,056	958,27	273,4172383	74756,98622
33	tɛ	127,589		-69,04976166	4767,869585
34	lɪ	149,314		-47,32476166	2239,633066
35	lɪ	211,311		14,67223834	215,274578
36	ɦod	186,872	480,003	-9,766761658	95,38963328
37	ɲɛ	109,924		-86,71476166	7519,449889
38	mɪ	183,207		-13,43176166	180,4122212
39	po	94,35	500,656	-102,2887617	10462,99076
40	mo	99,848		-96,79076166	9368,451542
41	ɦl	167,483		-29,15576166	850,0584379
42	ɪ	138,975		-57,66376166	3325,109409
43	pr̩ɪ	169,989	952,642	-26,64976166	710,2097964
44	na	148,004		-48,63476166	2365,340042
45	taː	214,058		17,41923834	303,4298644
46	tʃɛ	175,093		-21,54576166	464,2198454
47	ɲiː	245,498		48,85923834	2387,225171
48	jɛ	75,115	75,115	-121,5237617	14768,02465
49	skvjɛ	283,056	430,538	86,41723834	7467,939083
50	lɛː	147,482		-49,15676166	2416,387217

51	gdɪʒ	173,653	173,653	-22,98576166	528,345239
52	maː	198,78	290,863	2,141238342	4,584901637
53	tɛ	92,083		-104,5557617	10931,9073
54	ɦɛ	77,863	526,328	-118,7757617	14107,68156
55	rɛts	185,04		-11,59876166	134,531272
56	kɛː	100,37		-96,26876166	9267,674471
57	ɦo	163,055		-33,58376166	1127,869047
58	**part**	255,049	511,244	58,41023834	3411,755943
59	nɛ	146,303		-50,33576166	2533,688902
60	ra	109,892		-86,74676166	7525,000658
61	sɲiːmʃ	350,972	456,707	154,3332383	23818,74846
62	sɪ	105,735		-90,90376166	8263,493884
63	ro	120,917	695,793	-75,72176166	5733,785189
64	zu	134,003		-62,63576166	3923,238638
65	miː	194,853		-1,785761658	3,188944699
66	tɛ	92,781		-103,8577617	10786,43466
67	jɛn	153,239		-43,39976166	1883,539312
68	**mrk**	338,671	638,214	142,0322383	20173,15673
69	nu	126,412		-70,22676166	4931,798053
70	ciːm	173,131		-23,50776166	552,6148582
71	o	202,443	447,025	5,804238342	33,68918273
72	ka	244,582		47,94323834	2298,554103
73	**za**	438,782	759,787	242,1432383	58633,34787
74	sɛ	321,005		124,3662383	15466,96124
75	tɛn	214,22	541,244	17,58123834	309,0999416
76	vaːʃ	327,024		130,3852383	17000,31038
77	ɪ	200,35	803,1	3,711238342	13,77329003
78	ro	105,343		-91,29576166	8334,916097
79	nɪts	288,552		91,91323834	8448,043383
80	kiː	208,855		12,21623834	149,2364792
81	**uːs**	338,671	622,249	142,0322383	20173,15673
82	mjɛf	283,578		86,93923834	7558,431163

83	mla	266,565	763,186	69,92623834	4889,678809
84	ɟiː	258,845		62,20623834	3869,616089
85	ku	237,776		41,13723834	1692,272378
86	nɛ	146,566	592,021	-50,07276166	2507,28146
87	mlu	141,331		-55,30776166	3058,9485
88	viːm	304,124		107,4852383	11553,07646
89	o	104,166	788,182	-92,47276166	8551,211649
90	sɛ	297,842		101,2032383	10242,09545
91	ksu	386,174		189,5352383	35923,60657
92	mlu	185,956	473,721	-10,68276166	114,1213966
93	viːm	287,765		91,12623834	8303,991314
94	o	170,644	367,329	-25,99476166	675,7276337
95	tom	196,685		0,046238342	0,002137984
96	ʒɛ	156,249	156,249	-40,38976166	1631,332847
97	vɦɛ	164,887	585,346	-31,75176166	1008,174368
98	rɛts	216,183		19,54423834	381,9772524
99	kɛː	204,276		7,637238342	58,32740949
100	praː	229,008	387,089	32,36923834	1047,767591
101	tsɪ	158,081		-38,55776166	1486,700984
102	stɛ	191,582	191,582	-5,056761658	25,57083847
103	tʃas	189,62	311,844	-7,018761658	49,26301521
104	to	122,224		-74,41476166	5537,556753
105	pr̥̊ɛt	218,278	551,977	21,63923834	468,256636
106	ka	76,292		-120,3467617	14483,34304
107	mɛ	113,589		-83,04976166	6897,262911
108	rou	143,818		-52,82076166	2790,032862
109	sɲɛ	306,74	553,808	110,1012383	12122,28268
110	kiːm	247,068		50,42923834	2543,10808

111	gdo	138,583	424,254	-58,05576166	3370,471462
112	jɛ	104,689		-91,94976166	8454,758669
113	vaːm	180,982		-15,65676166	245,1341856
114	**nɛ**	112,149	1088,117	-84,48976166	7138,519825
115	sɪŋ	285,149		88,51023834	7834,062291
116	pa	129,552		-67,08676166	4500,63359
117	tɪts	287,636		90,99723834	8280,497386
118	kiː	273,631		76,99223834	5927,804765
119	lɪts	309,621	578,02	112,9822383	12764,98618
120	kɪ	90,688		-105,9507617	11225,5639
121	vaːm	177,711		-18,92776166	358,2601614
122	vuː	136,096	273,502	-60,54276166	3665,425989
123	bɛts	137,406		-59,23276166	3508,520054
124	**nɛ**	137,797	788,279	-58,84176166	3462,352915
125	kon	182,911		-13,72776166	188,4514401
126	vɛ	89,247		-107,3917617	11532,99047
127	nu	137,406		-59,23276166	3508,520054
128	jɛ	240,918		44,27923834	1960,650948
129	a	69,619	170,383	-127,0197617	16134,01985
130	lɛ	100,764		-95,87476166	9191,969923
131	**stsɛː**	346,784	738,642	150,1452383	22543,5926
132	naːr̩	391,858		195,2192383	38110,55102

133	pr̥ɛ	141,068		-55,57076166	3088,109551
134	dɛ	145,911		-50,72776166	2573,305803
135	pɪ	60,95	627,711	-135,6887617	18411,44004
136	su	167,372		-29,26676166	856,5433379
137	jɛ	112,41		-84,22876166	7094,48429
138	ɦlu	141,855		-54,78376166	3001,260541
139	bo	171,299	449,511	-25,33976166	642,1035209
140	kɛː	136,357		-60,28176166	3633,890789
141	sou	242,88		46,24123834	2138,252123
142	zɲɛ	228,093	667,004	31,45423834	989,3691097
143	ɲiː	196,031		-0,607761658	0,369374233
144	a	276,643	276,643	80,00423834	6400,678153
145	pak	303,076	303,076	106,4372383	11328,88571
146	jɛ	272,193	502,38	75,55423834	5708,442931
147	to	230,187		33,54823834	1125,484296
148	o	192,368		-4,270761658	18,23940514
149	prav	306,61	737,278	109,9712383	12093,67326
150	du	238,3		41,66123834	1735,65878
151	cɛʃ	299,543	596,928	102,9042383	10589,28227
152	kaː	297,385		100,7462383	10149,80454
153	praː	263,034	530,254	66,39523834	4408,327674
154	tsɛ	267,22		70,58123834	4981,711206
155	a	81,921	181,244	-114,7177617	13160,16484
156	lɛ	99,323		-97,31576166	9470,357467
157	gdɪʒ	208,31		11,67123834	136,2178044
158	maː	179,281	465,454	-17,35776166	301,2918898
159	tɛ	77,863		-118,7757617	14107,68156
160	ʃcɛs	353,852	455,007	157,2132383	24716,00231
161	ciː	101,155		-95,48376166	9117,14874
162	na	168,551		-28,08776166	788,922355
163	tʃlo	191,058	681,53	-5,580761658	31,14490068
164	vjɛ	209,773		13,13423834	172,5082168
165	ka	112,148		-84,49076166	7138,688806

166	sɲiːmʃ	685,063	685,063	488,4242383	238558,2366
167	vaːm	222,333	313,151	25,69423834	660,193884
168	to	90,818		-105,8207617	11198,0336
169	ɦra	173,131	429,751	-23,50776166	552,6148582
170	jɛ	123,665		-72,97376166	5325,169891
171	ɪ	132,955		-63,68376166	4055,621499
172	lɪts	409,599	613,089	212,9602383	45352,06311
173	kɪ	203,49		6,851238342	46,93946682
174	pak	107,176	455,531	-89,46276166	8003,585723
175	jɛ	95,268		-101,3707617	10276,03132
176	to	253,087		56,44823834	3186,403612
177	uː	135,572	320,612	-61,06676166	3729,149379
178	pl̩	91,604		-105,0347617	11032,30116
179	ɲɛ	93,436		-103,2027617	10650,81001
180	ɲɛ	179,543	314,46	-17,09576166	292,2650667
181	tso	134,917		-61,72176166	3809,575862
182	jɪ	111,757	640,309	-84,88176166	7204,913462
183	nɛː	206,108		9,469238342	89,66647478
184	ɦo	322,444		125,8052383	15826,95799
185	a	59,642	355,24	-136,9967617	18768,1127
186	mɪ	97,493		-99,14576166	9829,882055
187	smɛ	198,105		1,466238342	2,149854875
188	spo	198,716	315,601	2,077238342	4,314919129
189	lu	116,885		-79,75376166	6360,662499
190	pr̝̊ɛt	237,121	595,683	40,48223834	1638,811621
191	ka	66,871		-129,7677617	16839,67197
192	mɛ	125,497		-71,14176166	5061,150252
193	rou	166,194		-30,44476166	926,8835124
194	nɛ	103,512	603,013	-93,12676166	8672,593737
195	ɦraː	275,727		79,08823834	6254,949444
196	lɪ	223,774		27,13523834	736,3211599

197	mɪ	109,924	397,56	-86,71476166	7519,449889
198	smɛ	287,636		90,99723834	8280,497386
199	spo	441,66	901,509	245,0212383	60035,40724
200	lu	459,849		263,2102383	69279,62957
201	pr̥ɛt	223,904	718,301	27,26523834	743,3932218
202	ka	78,517		-118,1217617	13952,75058
203	mɛ	132,824		-63,81476166	4072,323805
204	rou	283,056		86,41723834	7467,939083
205	ʒɪ	237,252	386,566	40,61323834	1649,435129
206	lɪ	149,314		-47,32476166	2239,633066
207	vlast	327,025	394,026	130,3862383	17000,57115
208	ɲɛ	67,001		-129,6377617	16805,94925
209	a	79,695	205,192	-116,9437617	13675,84339
210	ɲɪ	125,497		-71,14176166	5061,150252
211	nɛ	195,116	516,079	-1,522761658	2,318803067
212	viːm	320,963		124,3242383	15456,51624
213	ko	79,694	509,314	-116,9447617	13676,07728
214	lɪ	157,558		-39,08076166	1527,305932
215	kraːt	272,062		75,42323834	5688,664882
216	mjɛ	152,197	152,197	-44,44176166	1975,070179
217	po	83,228	489,947	-113,4107617	12862,00086
218	ʒaː	215,269		18,63023834	347,0857807
219	dal	191,45		-5,188761658	26,92324754
220	o	156,38	578,541	-40,25876166	1620,76789
221	ru	172,215		-24,42376166	596,5201335
222	ku	249,946		53,30723834	2841,66166
223	tr̥ɪ	322,782	936,132	126,1432383	15912,11658
224	kraːt	613,35		416,7112383	173648,2562

225	moʒ	210,689	413,133	14,05023834	197,4091975
226	naː	202,444		5,805238342	33,70079221
227	tʃtɪ	208,07	827,702	11,43123834	130,67321
228	rɪ̯	193,284		-3,354761658	11,25442578
229	kraːt	426,348		229,7092383	52766,33418
230	vɪ	77,863	600,593	-118,7757617	14107,68156
231	miːʃ	299,15		102,5112383	10508,55399
232	lɛl	223,58		26,94123834	725,8303234
233	blaːz	376,49	701,551	179,8512383	32346,46793
234	ɲɪ	123,665		-72,97376166	5325,169891
235	vɛː	201,396		4,757238342	22,63131664
236	tsɛs	291,3	408,813	94,66123834	8960,750044
237	tɪ	117,513		-79,12576166	6260,886158
238	jɛd	114,505	345,213	-82,13376166	6745,954804
239	nou	104,428		-92,21076166	8502,824566
240	sɛ	126,28		-70,35876166	4950,355342
241	ɤcɛl	316,033	316,033	119,3942383	14254,98415
242	ʒɛ	244,582	414,571	47,94323834	2298,554103
243	ɲɪt	169,989		-26,64976166	710,2097964
244	do	187,525	446,763	-9,113761658	83,06065156
245	koŋ	133,741		-62,89776166	3956,128422
246	tsɛ	125,497		-71,14176166	5061,150252
247	vmɛ	240	782,031	43,36123834	1880,196991
248	ksɪ	287,636		90,99723834	8280,497386
249	ku	254,395		57,75623834	3335,783067
250	jɪŋ	229,925	309,226	33,28623834	1107,973663
251	dɪ	79,301		-117,3377617	13768,15031
252	na	156,904	572,391	-39,73476166	1578,851284
253	jaɤ	290,384		93,74523834	8788,169712
254	cɛ	125,103		-71,53576166	5117,365196
255	vmo	322,051	684,932	125,4122383	15728,22953
256	rɪ̯	362,881		166,2422383	27636,48181

257	ɦod	164,834	686,405	-31,80476166	1011,542864
258	ɲɛ	131,195		-65,44376166	4282,88594
259	smɛ	196,792		0,153238342	0,023481989
260	sɪ	193,584		-3,054761658	9,331568787
261	ro	126,461	686,375	-70,17776166	4924,918231
262	zu	141,287		-55,35176166	3063,817519
263	mɲɛ	201,396		4,757238342	22,63131664
264	lɪ	217,231		20,59223834	424,0402799
265	a	123,01	264,996	-73,62876166	5421,194543
266	lɛ	141,986		-54,65276166	2986,924357
267	bɪ	161,09	264,602	-35,54876166	1263,714455
268	lɪ	103,512		-93,12676166	8672,593737
269	vjɛ	184,124	331,342	-12,51476166	156,6192594
270	tsɪ	147,218		-49,42076166	2442,411683
271	vɲɪɤʃ	412,837	412,837	216,1982383	46741,67826
272	smɛ	179,804	307,655	-16,83476166	283,4092001
273	sɛ	127,851		-68,78776166	4731,756154
274	nɛ	165,803	648,921	-30,83576166	950,844197
275	do	99,454		-97,18476166	9444,877899
276	kaː	161,593		-35,04576166	1228,20541
277	za	100,238		-96,40076166	9293,106848
278	lɪ	121,833		-74,80576166	5595,901977
279	sɦod	332,259	851,782	135,6202383	18392,84905
280	nout	519,523		322,8842383	104254,2314
281	dʒon	281,094	281,094	84,45523834	7132,687283
282	mɪ	137,535	391,8	-59,10376166	3493,254642
283	lo	106,783		-89,85576166	8074,057903
284	val	147,482		-49,15676166	2416,387217
285	ɦa	139,499	854,267	-57,13976166	3264,952362
286	lɪ	136,619		-60,01976166	3602,371789
287	vuːt	578,149		381,5102383	145550,062

288	mɪ	207,286	614,005	10,64723834	113,3636843
289	lo	116,337		-80,30176166	6448,372925
290	val	290,382		93,74323834	8787,794735
291	tɪ	133,741	561,136	-62,89776166	3956,128422
292	cɪ	101,679		-94,95976166	9017,356334
293	siː	160,307		-36,33176166	1319,996905
294	tsɛ	165,409		-31,22976166	975,2980132
295	do	236,991	517,69	40,35223834	1628,303139
296	pɪ	67,787		-128,8517617	16602,77648
297	suː	212,912		16,27323834	264,8182861
298	od	141,986	810,822	-54,65276166	2986,924357
299	fa	178,234		-18,40476166	338,7352517
300	nɪ	130,993		-65,64576166	4309,366024
301	nɛk	359,609		162,9702383	26559,29859
302	ktɛ	136,096	321,136	-60,54276166	3665,425989
303	rɛː	185,04		-11,59876166	134,531272
304	tiː	142,769	445,06	-53,86976166	2901,951221
305	dɛn	140,154		-56,48476166	3190,5283
306	tso	162,137		-34,50176166	1190,371558
307	tiː	196,032	372,914	-0,606761658	0,36815971
308	dɛn	176,882		-19,75676166	390,3296312
309	do	79,614	777,951	-117,0247617	13694,79484
310	staː	343,125		146,4862383	21458,21802
311	val	355,212		158,5732383	25145,47192

312	mɪ	139,238	434,202	-57,40076166	3294,847439
313	lo	114,505		-82,13376166	6745,954804
314	val	180,459		-16,17976166	261,7846873
315	blɛs	300,59	370,731	103,9512383	10805,85995
316	kɪ	70,141		-126,4977617	16001,6837
317	fo	174,047	849,011	-22,59176166	510,3876948
318	to	57,71		-138,9287617	19301,20082
319	a	151,931		-44,70776166	1998,783952
320	pa	98,016		-98,62276166	9726,449117
321	raː	268,508		71,86923834	5165,18742
322	tuː	98,799		-97,83976166	9572,618961
323	mɪ	183,576	521,331	-13,06276166	170,6357421
324	lo	101,68		-94,95876166	9017,166416
325	val	236,075		39,43623834	1555,216895
326	tsɛ	110,054	385,345	-86,58476166	7496,920951
327	lou	199,696		3,057238342	9,34670628
328	tu	75,595		-121,0437617	14651,59224
329	ʃou	726,547	726,547	529,9082383	280802,7411
330	fʃɛɤ	232,673	370,47	36,03423834	1298,466333
331	no	137,797		-58,84176166	3462,352915
332	to	283,056	283,056	86,41723834	7467,939083
333	tso	217,231	217,231	20,59223834	424,0402799
334	mɲɛ	305,04	305,04	108,4012383	11750,82847
335	na	126,804	545,3	-69,83476166	4876,893936
336	ɦaː	221,811		25,17223834	633,6415831
337	ɲɛ	115,158		-81,48076166	6639,11452
338	lo	81,527		-115,1117617	13250,71767
339	ɦu	126,413	371,778	-70,22576166	4931,6576
340	siː	245,365		48,72623834	2374,246303
341	kuː	212,258	484,451	15,61923834	243,9606064
342	ʒɪ	272,193		75,55423834	5708,442931

343	jɛd	131,909	472,675	-64,72976166	4189,942044
344	nou	140,154		-56,48476166	3190,5283
345	sɛm	200,612		3,973238342	15,78662292
346	mu	172,215	172,215	-24,42376166	596,5201335
347	r̝ɛk	192,759	325,672	-3,879761658	15,05255052
348	la	132,913		-63,72576166	4060,972699
349	ʒɛ	122,749	304,777	-73,88976166	5459,696878
350	sɛ	182,028		-14,61076166	213,4743562
351	tɛ	81,527	156,38	-115,1117617	13250,71767
352	dɪ	74,853		-121,7857617	14831,77174
353	vɛz	239,086	689,381	42,44723834	1801,768043
354	mɛ	152,453		-44,18576166	1952,381533
355	mɛ	297,842		101,2032383	10242,09545
356	a	220,045	220,045	23,40623834	547,8519933
357	od	119,738	411,168	-76,90076166	5913,727144
358	jɛ	116,337		-80,30176166	6448,372925
359	dɛ	62,42		-134,2187617	18014,67598
360	mɛ	112,673		-83,96576166	7050,249131
361	ɲɛ	152,062	309,882	-44,57676166	1987,08768
362	kam	157,82		-38,81876166	1506,896257
363	far	266,958	896,755	70,31923834	4944,795281
364	ma	198,78		2,141238342	4,584901637
365	r̝̊ɪt	431,017		234,3782383	54933,15861
366	jɛn	242,749	242,749	46,11023834	2126,15408
367	mɪ	186,478	186,478	-10,16076166	103,2410775
368	dva	330,951	330,951	134,3122383	18039,77737
369	a	53,13	640,439	-143,5087617	20594,76467
370	moʒ	204,276		7,637238342	58,32740949
371	naː	383,033		186,3942383	34742,81209
372	pak	334,267	334,267	137,6282383	18941,53199

373	ɲɛ	126,543	451,866	-70,09576166	4913,415802
374	ja	135,703		-60,93576166	3713,167049
375	kɛː	189,62		-7,018761658	49,26301521
376	ɟɛ	160,698	344,035	-35,94076166	1291,738349
377	cɪ	183,337		-13,30176166	176,9368632
378	po	110,841	393,896	-85,79776166	7361,255906
379	kut	152,978		-43,66076166	1906,262109
380	jɛ	130,077		-66,56176166	4430,468115
381	bu	95,528	306,216	-101,1107617	10223,38612
382	dɛ	76,947		-119,6917617	14326,11781
383	mɛ	133,741		-62,89776166	3956,128422
384	miːt	525,804	525,804	329,1652383	108349,7541
385	nɛ	171,778	707,029	-24,86076166	618,0574702
386	ɤcɛl	535,251		338,6122383	114658,248

Sum	75902,562	75902,562	0	4123376
Count (n)	386	163	386	386
Average (mean)	196,6387617	465,6598896		
Varience (s^2)				10710,06781

Standard Deviation (s)	**Foot**	**Syllable**
	219,1763028	103,4894575
	219 [ms]	**103 [ms]**

RESUMÉ

Tato bakalářská práce se soustředí na porovnání českého a anglického rytmu řeči. Samotné srovnání je realizováno z hlediska teoretického a získané poznatky jsou dále využity v praktické části této práce.

Teoretická část práce se zabývá přízvučnými a nepřízvučnými slabikami, redukcí vokálů, dále pak některými suprasegmentálními rysy jazyka jako je například přízvuk a jeho různé úrovně a samozřejmě samotnou rytmizací promluvy.

Praktická část se věnuje podrobné analýze dvou audio nahrávek, z nichž jedna je v jazyce českém a druhá v anglickém. Na základě měření délky stop a slabik v případě obou jazyků a jejich směrodatné odchylky bylo zjištěno, že SO délky slabik je vyšší v angličtině a SO délky stop v češtině vykazuje vyšší hodnoty.

ANOTACE

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Katedra:	Anglického jazyka PdF UP Olomouc
Vedoucí práce:	Mgr. Jaroslava Ivanová, M.A., Ph.D.
Rok obhajoby:	2014

Název práce:	Srovnání českého a anglického rytmu
Název v angličtině:	Comparison of Czech and English Rhythm
Anotace práce:	Tato práce se soustřeďuje na rozdíly mezi českým a anglickým rytmem řeči. Teoretická část se zabývá přízvučnými a nepřízvučnými slabikami, redukcí samohlásek, rozdílnými úrovněmi přízvuku, úseku promluvy a rytmem řeči. Praktická část se věnuje analýze dvou nahrávek mluveného projevu v obou jazycích.
Klíčová slova:	Rytmus, přízvučná slabika, nepřízvučná slabika, přízvuk, taktová izochronie, slabičná izochronie, tónická slabika, stopy (takty), promluvový úsek
Anotace v angličtině:	The focus of this work is on the differences between Czech and English rhythm. Theoretical part deals with stressed and ustressed syllables, vowel reduction, various levels of stress, tone-units and rhythm of speech. Practical part is devoted to speech analysis of two recordings of speech in either language.
Klíčová slova v angličtině:	Rhythm, stressed syllable, unstressed syllable, stress, stress-timed rhythm, syllable-timed rhythm, tonic syllable, feet, tone-unit
Přílohy vázané v práci: **30 stran**	**Appendix 1:** USHER and USHERETTE **Appendix 2:** FASHION and FASHIONABLE **Appendix 3:** ADVANTAGE and ADVANTAGEOUS **Appendix 4:** Data of the English speech sample **Appendix 5:** Data of the Czech speech sample
Rozsah práce:	72 stran
Jazyk práce:	Angličtina