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Stress “Deafness” of Czech Learners of English

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Abstract in English: The purpose of this master thesis is to explore the perception of lexical stress of Czech learners of English, more specifically their difficulty with perceiving lexical stress in non-existing English words. On the following pages I describe the topic of perception of stress, the phenomenon called stress "deafness" as well as the factors that might have impact on this phenomenon. The acquisition of first language is described as well and also the influence of L1 on L2. In the theoretical background there are also found subchapters about stress in English, Czech and in Spanish, since these languages are relevant to my paper. The second part includes experiments conducted by me to answer the research questions stated in this master thesis. I used two methods of experiments to this goal. The first method was an AXB discrimination perception task conducted with a group of 32 Czech learners of English as L2 and a small group of 6 Spanish speakers. The second experiment was an identification test in which the same groups of English learners was supposed to identify the stressed syllable. Only non-existing English words were used as stimuli in the two experiments to ensure that the performance of the participants is not dependent on knowledge of the stimuli. From the two experiments it is visible that the percentage of correct responses was higher in the easier, identification, task. In both tasks there was a tendency for L1 stress pattern preference in both Czech and Spanish. In Czech, the listeners made the smallest amount of mistakes on the words in stress on the first syllable. While in Spanish, the penultimate syllable obtained the smallest amount of incorrect responses. Spanish participants had higher score of correct responses as expected.

Key words in English: perception of lexical stress, stress "deafness", stress, perception of L2 stress, Czech, English, Spanish

Abstract in Czech: Cílem této práce je prozkoumat percepci slovního přízvuku Čechů, kteří se učí anglicky, konkrétně se práce zaměřuje na jev zvaný „stress deafness“. Na následujících stranách je popsát tento fenomén, percepce důrazu v angličtině, češtině a španělštině a také popis tohoto suprasegmentálního jevu ve zmíněných jazycích. Dále se práce zabývá osvojováním mateřského jazyka a jeho následným vlivem na učení a percepci druhého jazyka. Práce je rozdělena na dvě části. První část je teoretická. Druhá část obsahuje popis metody, průběhu a výsledků pokusů, které proběhly s cílem odpovědět na výzkumné otýzky formulované v této diplomové práci. První pokus byl AXB diskriminační test, kterého se účastnilo 32 Čechů a 6 Španělů, kteří se učí anglicky. Druhý pokus byl založel na identifikaci přízvučné slabiky v neexistujícíh slovech a účastnili se ho ti samí posluchači. Jako stimuly byla použita pouze neexistující anglická slova, aby bylo zajištěno, že testy neprozkoumávají znalost slov, ale skutečnou percepci. Z výsledků provedených experimentů vyplývá, že celková procentuální úspěšnost byla u snadnějšího, identifikačního, testu. Z obou provedených experimentů vyplývá, že mateřský jazyk skutečně ovlivňuje percepci přízvuku v cizím jazyce. V češtině byl zaznamenán nejmenší počet chyb u slov s důrazem na první slabice. Zatímco u španělských účastníků pokusu bylo nejméně chybných odpovědí u slov s přízvukem na předposlední slabice, což odpovída většinovému umístění přízvuku ve španělštině. Španělé měli podle očekávání vyšší úspěšnost než Češi.

Key words in Czech: percepce přízvuku, stress „deafness“, slovní přízvuk, percepce přízvuku v cizím jazyce, čeština, angličtina, španělština

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Contents

1 Introduction

The main purpose of this thesis is to explore the perception of English lexical stress by Czech learners of English, more specifically their difficulty with perceiving lexical stress in English. Stress is, together with length, tone and intonation, one of the suprasegmental features of speech. This means, it is a feature that expands over more than one segment of speech (Ladefoged & Johnson 2011). "Stress is the relative degree of force used by a speaker on the various syllables he is uttering. It gives a certain basic prominence to the syllables, and hence to the words, on which it is used, and incidentally assists in avoiding monotony" (Kingdon 1965, 1).

Generally speaking, in L2 phonology, suprasegmental features have not been given as much attention as segmental features of languages. Numerous studies demonstrated that second language (henceforth L2) learners "experience difficulty in perceiving phonological contrasts that are not used in their native language" (henceforth L1) (Peperkamp, Vendelin, & Dupoux 2010). Czech learners of English have difficulty in distinguishing some English vowels, e.g. ([træp]- [dres]), since the phonemic repertoire of Czech vowels does not include this contrast (Šimáčková 2003). Thus perceptual experiments focused on foreign accent concentrate for example on distinguishing minimal pairs that differ only in one vowel or, in the case of consonants, in voicing for example. However, "in addition to differences in the repertoire of phonemes, languages differ in their suprasegmental properties" (Yu & Andruski 2009, 2). Similarly, as every language divides its segmental space differently, the same applies to suprasegmental space as well (Yu & Andruski 2009). That is to say, not only phonemic differences but also prosodic characteristics are important when learning a foreign language.

Prosodic features seem to be omitted from L2 learning (e.g. Boula de Mareüil & Vieru-Dimulescu 2006). Usually, speakers only copy the prosodic system of their L1 into L2 learning and so accented speech appears. There have been some attempts to categorize pronunciation errors that cause accented speech and to create a hierarchy, nevertheless, no definite conclusion has been reached. "Several researchers have found evidence that prosodic errors are more serious than segmental errors. On the other hand, others argue that segmental errors have more detrimental effects on comprehension" (Munro & Derwing 1995, 76). However, from the experiment conducted by Boula de Mareüil and Vieru-Dimulescu (2006) with Spanish and Italian speakers, for the identification of foreign accent, prosody seems to be even more reliable cue than articulation of phonemes.

Other things being equal, prosody played fundamental role in the experiment. The fact that conflicting segmental and prosodic features prevented listeners from identifying the native language of the speakers, challenges commonly held view that prosodic differences are secondary in the field of L2 acquisition (Boula de Mareüil & Vieru-Dimulescu 2006).

This thesis is inspired by results of a long-time experimental work of Dupoux, Sebastián-Gallés, Peperkamp and their colleagues (e.g. Dupoux *et al.* 1997; Dupoux, Peperkamp, & Sebastián-Gallés 2001; Dupoux & Peperkamp 2002; Dupoux *et al.* 2007; Peperkamp, Vendelin, & Dupoux 2010) who conducted a series of experiments results of which showed that speakers of some languages had difficulty with hearing stress in words that differed only in stress placement. Their experiments included speakers of various L1s since the purpose of the experiments was to explore whether speakers with different language backgrounds exhibit different degrees of inability to hear word stress.

The phenomenon of "stress deafness" could affect speakers of Czech language as well considering that Czech language belongs to the class of languages that have a very regular stress pattern (Palková 1994). Czech speakers are expected to exhibit the difficulty "in discriminating non-words that differ only in the location of stress" (Dupoux & Peperkamp 2002, 2). Nevertheless, in an experiment conducted in 2015 as part of my bachelor thesis, Czech listeners of English as L2 did not exhibit great difficulty with hearing English word stress. They had significantly greater difficulty with assigning stress to a syllable based on their memory or intuition. In other words, the results suggested that the Czech learners of English were able to perceive stress but did not store the stress pattern of a word as a part of lexical entry when learning it (Tlolková 2015). This discrepancy between Dupoux and Peperkamp's (2002) findings for speakers of languages with predictable non-contrastive stress and results of my experiment is the bases for the topic of my master thesis.

In this master thesis I want to extend findings about stress "deafness" and conduct an experiment with Czech speakers who study English as a foreign language. The perceptual abilities might be influenced by the proficiency in English of Czech learners, therefore the participants of the experiment are of various proficiency levels of English. A small group of Spanish speakers will participate as well. Given that Spanish is typologically distinct language from Czech, I want to compare the performances of the two groups of non-native speakers of English. I want this paper to be another step to more

comprehensive examination of perception of suprasegmental features of L2 acquisition of various languages.

The outline of this master thesis is as follows. The first part of the paper is the literature review. In the second chapter, the attention is payed to the perception of stress, third chapter describes the phenomenon of stress "deafness", the acquisition of L1 and how it reflects on L2 learning, the chapter also deals with Stress parameter and the typologies of languages based on stress perception, together with various models created to account for perception of L2. In the fourth chapter I describe stress in English, Czech and Spanish to see the differences. Based on the findings I formulate a hypothesis and predictions about the performance of Czech and Spanish speakers.

The second part of the thesis describes the experiments I conducted with a group of Czech and Spanish learners of English as L2. The main goal was to see if Dupoux's stress "deafness" hypotheses based on the typology of the native language works for speakers of Czech as well (Dupoux & Peperkamp 2002). The data were obtained from two experiments based on the perception task. The first task was AXB discrimination task. In this experiment the participants were asked to listen to a triplet of non-existing words. On the bases of similarity of stress pattern, the participants decided whether the second sound (X) is more similar to the preceding (A) or to the following word (B). The second experiment was an identification task in which the participants listened to two- and three-syllabic words and decided which syllable was the most prominent. A small group of Spanish speakers was tested as well, to prove if they would score significantly better than Czech speakers as was suggested by Dupoux and Peperkamp (2002). Based on the results I formulated a conclusion and compared the data to the findings of other studies of L2 perception of stress. It should be mentioned that the term stress "deafness" is used rather loosely in this paper in relation to the present experiments conducted with Czech listeners of English, since I do not follow Dupoux and Peperkamp's (2002) procedure of the experiments.

2 Perception of stress

Stress can be approached from two perspectives, from the perspective of its production and from the perspective of its perception. In other words, one can ask what a speaker must do in order to create a stressed syllable and what characteristics are needed to make a syllable perceived as stressed by the listener. The process of production is simplistically described as follows. When producing a sound, greater respiratory energy is needed. Respiratory system pushes air out of lungs, through trachea, into larynx. At that place the stream of air passes through vocal folds. Vocal folds can be apart or adjusted, when air passes through them, it produces voiceless or voiced sound respectively (Ladefoged & Johnson 2011).

The process on the listener's part is different. The following comments are relevant for English, since acoustic correlates of stress seem to be language specific. Roach (1998) explains that what makes one syllable more prominent than the others for the listener of English is a combination of four factors. First of all, it involves perception of loudness. Most people perceive the stressed syllable as louder than unstressed. However, while increasing loudness, many other factors are changed as well. Among those, for example, length of the syllables. Stressed syllables are perceived as longer than unstressed. Another factor that makes a syllable more prominent is its pitch. Pitch is closely related to the frequency of vibration of the vocal cords and belongs to essential perceptual characteristics of speech. When one syllable differs from the rest by different pitch, hearer perceives it as the stressed one. Even more so when there is some movement of pitch (rising or falling) within the syllable. Similarly, when a vowel in a syllable differs from the rest by its quality, the listener will mark the syllable as the prominent one. All these four factors usually work in combination but sometimes a syllable can be prominent by means of only one or two of them (Roach 1998).

It seems that no cue is universally the most important for perceiving stress (Lehiste & Fox 1992). Not all acoustic correlates of stress are used to an equal extent when perceiving stress and the reliance on one cue rather than the other is language specific. As Roach says "the strongest effect [in English] is produced by pitch, and length is also a powerful factor. Loudness and quality have much less effect" (Roach 1998, 86). Cruttenden (2001) also explains that although any of the four factors may render a syllable more prominent, mainly pitch change marks and accented syllable (2001). On the other hand, according to Peter Ladefoged (2011), for English listener, the most reliable

perceptual cue is the length of the stressed syllable. The stressed one appears to be longer that the unstressed syllables (Ladefoged & Johnson 2011). However, Cruttenden (2001) opposes that "loudness is not by itself an efficient device for signalling the location of the accent in English" (2001, 223).

According to Palková (1994), when Czech is considered, the most frequent acoustic correlate of stress is a change in F0. She also adds that the change can be in either direction; syllable can be marked by higher or lower frequency than the following syllable (Palková 1994). Duběda and Votrubec (2005) investigated the acoustic correlates of stress in Czech in detail by means of a neural network. Considering the neural network was a reasonable copy of the human perceptual system, they investigated how prosodic parameters can predict whether the syllable is stressed or not. Stress assignment by a human listener was used as a reference. The neural network had about 80% of correct responses in localization of stress without any lexical information being considered. From an acoustic analysis of Czech stress, it is obvious that "fundamental frequency seems to be the best predictor of stress, both alone and combined with other parameters" (Duběda & Votrubec 2005, 1429).

Similarly, when Spanish is considered, syllabic prominence is mainly achieved through variations in fundamental frequency F0, intensity and duration. Specifically, in Spanish "stress is usually the result of a combined increase of duration and F0 values" (Schwab & Llisterri 2015, 301).

With regard to non-native speakers, they do not rely on one specific cue in the perception of L2. Lehiste and Fox (1992) in their study pointed out that when listening to L2, speaker's native language is an important factor in perceiving non-native suprasegmental information (1992). This was proved in an experiment with native English and native Estonian listeners in which acoustic cues (duration and amplitude) were manipulated (Lehiste & Fox 1992). The participants were asked which syllable appears to be more prominent. The result of the experiment supported the hypothesis that speakers rely more on a cue that they have in their native language. Estonian speakers were naturally more sensitive to duration cues since Estonian is a quantity-sensitive language (Lehiste & Fox 1992). The results support the idea that the prosodic structure of a native language can influence the perception of suprasegmental stimuli in L2. This hypothesis was further supported by a cross-language study of perception of lexical stress

in English with native English speakers and also with Chinese speakers of English as L2 (Yu & Andruski 2009). An acoustic analysis showed that listeners of the two languages used different acoustic cues to process lexical stress.

Similarly, when listening to isolated Spanish words, French speakers relied on increase in F0 as the privilege cue to detect accentual prominence. While Spanish speakers relied on the combination of changes in F0 and either duration or intensity, or all combined together, to be able to identify the position of lexical stress, since in Spanish, stress is usually the result of the combination of these acoustic cues (Schwab & Llisterri 2015).

As Schwab and Llisterri (2015) mention, apart from the language background, results of perception experiments might depend also on the nature of the task participants are supposed to do (2015). In identification task, French listeners identified lexical stress in approximately 70% of the cases, however, when a shape-pseudoword matching task was adopted, the accentual representation acquired and stored by French speakers seemed to be more rigid (Schwab & Llisterri 2015). In accord with this finding, Dupoux and his colleagues (2007) questioned their findings of research conducted in 1997 and 2001 (Dupoux *et al*. 1997; Dupoux, Peperkamp, & Sebastián-Gallés 2001; Dupoux *et al.* 2007). When stress "deafness" of French speakers was tested in speeded ABX task, in discrimination task and in short term memory sequence repetition task, Dupoux and his colleagues (2001) found out that stress "deafness" of French speakers crucially depend upon a combination of memory load and phonetic variability in F0 (Dupoux, Peperkamp, & Sebastián-Gallés 2001). In simple AX discrimination task, French subjects discriminated stimuli that differ in the position of stress or in phoneme very successfully, with only 3.2% of errors, while in speeded ABX discrimination task, their error rate was 19% (Dupoux *et al*. 1997). It was deduced that French speakers probably process the acoustic information on a different level from Spanish speakers (Dupoux *et al*. 1997). In 2007 the findings were upgraded. The results from sequence recall task show that stress "deafness" effect extends to lexical access (Dupoux *et al.* 2007).

Furthermore, the level of proficiency in L2 might be reflected on the results as well. "Participants with an advanced level of Spanish performed better than those with basic or intermediate knowledge of the language" (Schwab & Llisterri 2015, 302). In addition, the difference in the level of proficiency was observed also in connection to

manipulation of separate parameters (F0, duration, intensity). Surprisingly, according to the results, French participants with no knowledge of Spanish are more sensitive to the manipulation of duration parameter than French advanced learners of Spanish as L2 (Schwab & Llisterri 2015). Interestingly, Dupoux and his colleagues (2007) came to a different conclusion. In the sequence recall test, there was no difference between French beginner, intermediate and advanced learners of Spanish (Dupoux *et al.* 2007). It can be deduced that French learners simply do not enhance their perceptive skills throughout the process of learning L2.

In an experiment conducted by Guion, Harada and Clark (2004), it was examined whether lexical class and syllable structure of English non-words have significant effects in production and perception of native speakers of English and Spanish-English bilingual speakers (Guion, Harada & Clark 2004). 40 non-words were used in the experiment. The participants listened to two frame sentences: *I'd like a*_____ and *I'd like to*_____. In both tests, native speakers of English preferred bisyllabic non-words presented in a noun frame with initial stress than those presented in a verb frame. In general, late bilinguals showed greater first syllable preference. It can be concluded that non-phonological information about lexical class was very important factor in both production and perception test in all three groups of native English speakers, early Spanish-English bilinguals and even late Spanish-English bilinguals. Interestingly, late Spanish-English bilinguals over-rely on lexical class, especially in perception test. Hence, it can be concluded that speakers who begin L2 learning in younger age later use different stress strategies in L2 than late L2 learners. This is only supported by the fact that the tendency to stress long vowel at the end of a word was not found within the group of early Spanish-English bilinguals. This final long vowel effect was, on the other hand, found within the group of late Spanish-English bilinguals together with native English speakers (Guion, Harada & Clark 2004).

In all three groups, the strongest effect had the phonological similarity to already known word. It can be deduced that while speakers perceive L2 speech, phonological associations to familiar expressions are activated (Guion, Harada & Clark 2004).

Empirical studies confirm that listeners' native language affects the way they perceive non-native suprasegmental information (Yu & Andruski 2009). Additionally, language background influences not only perception but also speech production. From

various experiments it has been concluded that "speakers of stress languages are more likely to show patterned stress behaviour than speakers of non-stress languages" (Yu & Andruski 2009, 2). Polish speakers consistently transferred their L1 stress pattern (stress on the penultimate) to the production and perception of bisyllabic English words. So did Spanish speakers. It has been proposed that the errors are caused by speakers' L1 (Yu & Andruski 2009). These findings correlate with the results of an experiment in 2015 as part of my bachelor thesis (Tlolková 2015). It was concluded that Czech learners of English as L2 also demonstrate patterned stress behaviour. The obtained data show that stress on the first syllable was the most frequent option for Czech learner of English, which correlate with Czech stress pattern. On the other hand, speakers of non-stress languages, like Chinese or Japanese, did not follow any consistent pattern, their errors in experiments were more random and unsystematic (Archibald 1997).

Interestingly, even though L1 influences both perception and production of L2, from the data of Altmann's experiment (2006) it can be deduced that production and perception processes are not interconnected. Speakers of languages who showed lower success rate in the production experiment showed relatively good performance in the perception task. And vice versa, those who had very good results in perception task, like Spanish speakers for example, had very poor performance in the production part of the experiment (Altmann 2006). One can conclude that even though both processes are influenced by native language, in L2 acquisition these two abilities are not dependent.

3 Stress “deafness”

As stated in the introductory part of the paper, the topic of this thesis was chosen because of my curiosity if Czech speakers truly exhibit stress “deafness”. Generally, the term “deafness” is used to describe “the effect of listeners having difficulties in discriminating non-words that form a minimal pair in terms of certain non-native phonological contrasts, be it segmental or suprasegmental” (Dupoux & Peperkamp 2002, 2). The term “deafness” is, however, only figurative because the listeners do not fail to hear the contrast completely. The phenomenon of stress “deafness” could be defined as “the difficulty with the perception of stress at a phonological level” (Dupoux, Peperkamp, & Vendelin 2010, 423).

Speakers of only certain languages exhibit the above mentioned difficulty. Stress “deafness” might be connected with non-contrastive character of stress in a particular language. For example, French listeners expressed a great difficulty in perceiving where the stress is located, whereas Spanish speakers did not (Dupoux & Peperkamp 2002).

Further, stress “deafness” is not either present or absent, all-or-none phenomenon. It was found out that according to the regularity of stress pattern in particular language, language speakers exhibit stress “deafness” to a lesser or greater extent. Based on the results of cross-linguistic experiment, Dupoux and Peperkamp (2002) created a stress “deafness” typology of languages. In their study, the speakers of languages with non-contrastive stress but with some irregularities in stress assignment, like Polish for example, do not exhibit great difficulty with differentiating minimal pairs differing only in stress placement. On the other hand, the speakers of languages with non-contrastive and/or stress fixed on a particular syllable in a word without any exceptions, like Finnish and French, exhibit a significant difficulty in differentiating these words. Spanish speakers are frequently used as a control group in stress “deafness” experiments, since they seem to be resistant to stress “deafness”, in other words, they do not exhibit difficulty with hearing stress at all. This is not surprising, given that stress in Spanish is contrastive *bebé* (‘a baby’) – *ˊbebe* (‘he/she drinks’) and is not firmly located on one particular syllable (*válido – vaˊlido – validó*). It can be concluded that the more regularity is to be found in the prosodic system of native language, specifically in the stress pattern, the lower success these learners have in perceiving stress in foreign languages.

In order to be able to compare different languages, Dupoux and Peperkamp (2002) defined stress "deafness" index. It is "the mean percentage of errors made with the stress contrast minus the mean percentage of errors made with the phonemic contrast" (Dupoux & Peperkamp 2002, 17). The stress "deafness" index gradually rises across languages from Spanish through Polish, Hungarian, Finnish to French on the top of the scale, showing the strongest effect. Hence, Dupoux and Peperkamp (2002) concluded that "the gradual nature of the "deafness" effect goes in the direction of our language typology, in that the strongest "deafness" is found in a Class I language, i.e. French, and the weakest "deafness" effect is found in a Class IV language, i.e. Polish" (Dupoux & Peperkamp 2002, 17). Spanish speakers were not included in the hierarchy for the contrastive character of stress in Spanish. Spanish speakers were out of the hierarchy as a control group.

Later Dupoux, Peperkamp and Vendelin (2010) went further and asked "how does linguistic knowledge impact on our speech perception system" (2010, 422). It has been proposed that there are "two types of accounts regarding language-specific effects in the perceptual processing of consonants and vowels" (Dupoux, Peperkamp, & Vendelin 2010, 422). First, according to the functional role accounts, the dimensions that play a functional role in the language are amplified, and dimensions that are non-functional are attenuated. This leads to a good perception of the former and poor perception of the latter. Dimensions can be expressed either in terms of acoustic or phonetic cues or in terms of phonological features. Second, "lexical statistics accounts suppose that phonological grammar emerges from generalizations about phonological regularities across the lexicon. In particular, the more regular or predictable, the less the pattern needs to be specified in the lexical representation" (Dupoux, Peperkamp, & Vendelin 2010, 422).

Dupoux, Peperkamp and Vendelin (2010) came to an interesting conclusion. Based on the above mentioned accounts, they proposed four new factors that may influence stress "deafness". The first two, namely the level on which stress is realized and the lexical use of stress correlate, fall under the functional role account. The other two factors, including variability in the position of stress and the presence of lexical exceptions, correspond to lexical statistics accounts (Dupoux, Peperkamp, & Vendelin 2010). However, in their study, the predictions based on the first three factors were ruled out, only the fourth one was confirmed. Only the presence of lexical exceptions to the stress regularity had an effect on stress "deafness" of speakers of a particular language. Spanish

speakers, having almost 20% of exceptions, exhibit no stress "deafness", Polish speakers with 0.1% of exceptions show some stress "deafness" and speakers of languages without any lexical exceptions show great stress "deafness" (Dupoux, Peperkamp, & Vendelin 2010).

3.1 First language acquisition

From numerous experiments it is obvious that the difficulty of speakers with hearing stress in a non-native language is connected with their native language (e.g. Dupoux, Peperkamp, & Vendelin 2010, Schwab & Llisterri 2015). In the following section I briefly mention L1 acquisition of stress by children. I also provide some studies that showed L1 plays an important role in L2 learning of stress. Since non-native speakers from different languages appear to exhibit different degrees of stress "deafness", there are some factors that might be crucial.

In the course of time, several hypotheses about how words are stored in the mental lexicon were created. The hypothesis generally accepted in literature is a theory that there is an abstract phonological format that is shaped into the properties of the maternal language (Werker & Tees 1984; Polka & Werker 1994; Dupoux & Peperkamp 2002). The hypothesis states that infants while acquiring language store the words in the language-specific format (Mehler & Christophe 1994).

Mehler and Christophe (1994) state that "the child is born with the endowment to operate all the contrasts that arise in natural language. During the first year of life the baby is sensitized to the sounds of the native language" (Mehler & Christophe 1994, 14). On the segmental level, it was proved that infants are born more sensitive to various sounds, even to sounds that infants do not hear in the language of their parents (e.g. Mehler & Christophe 1994; Werker & Tees 1984; Polka & Werker 1994). According to studies of early language acquisition, infants start to lose their sensitivity for non-native vowel contrast at about 6 months of age, while consonant contrast between 10 and 12 months (Werker & Tees 1984; Polka & Werker 1994). The results of an experiment showed that as opposed to infant "adult speech perceptual ability is more limited, reflecting discrimination of only those contrasts which are phonemic in the listener's native language" (Werker & Tees 1984, 56). It can be concluded that existing knowledge of vowels and consonants in one language leads to difficulties in learning of L2 sounds in case phonemic inventory of L2 differs from L1 (Werker & Tees 1984).

Regarding suprasegmental features, infants are shown to learn them even earlier than segmental features (Mehler *et al*. 1988). It was demonstrated that very young infants can recognize their L1 based on suprasegmental features only, i.e. when all segmental cues were removed from the stimuli and only the prosodic structure, namely rhythm and melody, remained, French four-day-old new-borns discriminated between Russian and French utterances. Similarly, two-month old American babies discriminated between English and Italian utterances. The prosodic features were the fundamental cue to discriminating their native language (Mehler *et al*. 1988). When children learn the first language, they extract the rhythmical-periodical properties from it. These properties help them with the acquisition of L1, its perception as well as production (Dupoux *et al.* 1997).

With respect to lexical stress, Skoruppa and her colleagues (2009) explain that contrastive character of lexical stress in L1 obligates infants to process stress not only at the acoustic level but also at the abstract (phonological) level (2009). Studies using varied stimuli suggest that processing of stress at an abstract level may not evolve until later, "6-month-old American infants do not show any preference between lists of disyllabic stress-initial and disyllabic stress-final words. At 9 months of age a preference for predominant stress-initial pattern of English emerges" (Skoruppa *et al*. 2009, 915).

It can be concluded that from 9 months of age the preference of native language's pattern is visible. Skoruppa and her colleagues (2009) demonstrate that infants learning German, a language with contrastive stress, but with predominantly initial stress in bisyllabic words, show divergent responses if a pseudo-word is stressed on the final syllable (/*ba΄ba*/) in the paradigm. Conversely, infants learning French, a language with final stress, show chaotic responses if the word is stressed on the initial syllable (/*΄baba*/) (Skoruppa *et al*. 2009). On the other hand, Catalan and Spanish infants seem to lack any preference when presented with both stress-initial and stress-final realisations given that in Spanish and Catalan stress is rather irregular and contrastive and the preference for stress-initial realisation is less strong than in German or in English (Skoruppa *et al*. 2009).

In a cross-linguistic perception experiment, "Spanish 9-months-old infants successfully distinguish between stress-initial and stress-final pseudo-words, while French infants of the same age show no sign of discrimination" (Skoruppa *et al*. 2009, 914). The authors of the experiment conclude that it "reflects an inability to process stress at an abstract, phonological level" (2009, 914), given that in French, stress is not

contrastive. These findings are in line with the results of experiment with adult French and Spanish speakers conducted by Dupoux, Peperkamp and Sebastián-Gallés (2001). It is apparent that the difficulty of French speakers in distinguishing minimal pair of non-words differing only in stress placement was set within the first year of life. Spanish infants, having listened to their native language with contrastive lexical stress, on the other hand, spontaneously follow the placement of stress in pseudo-words (Skoruppa *et al*. 2009).

Stress-placement regularities acquired in L1 influence later learned L2. Adult Czech learners of English as L2 showed preference for initial-stress rather than stress on the second or third syllable in both perception and stress placement task. Moreover, they had the smallest proportion of correct responses with end-stressed compounds, probably because this stress pattern is the most different from Czech word-initial stress pattern (Tlolková 2015).

The influence of Czech as L1 was tested on students of English as L2 for example by Skarnitzl and Volín (2010a). What codes Czech accent in English is still unanswered question. However, in general, seven out of eight features influencing foreign accent were defined segmentally (alteration of phones), only one feature was characterized suprasegmentally (Brennan & Brennan 1981). This is an interesting fact considering that some segments do not appear in a language or appear very sporadically, whilst melody, intonation or tempo is present in every utterance in every language. Based on the results of analysis of suprasegmental acoustic cues of foreignness in Czech English, Skarnitzl and Volín (2010a) indicate that foreignness of Czech English is usually connected to slower speech, "smaller differences between stressed and unstressed syllable, smaller pitch range and smaller variation in duration of vocalic intervals in-between consonantal intervals" (Skarnitzl & Volín 2010a, 275).

As described above, stress pattern of L1 influence L2 perception and production. When non-stress languages are considered, the impact of one's L1 suprasegmental inventory on L2 acquisition is demonstrated by the data from the experiment with Chinese subjects who learn English as L2 (Yu & Andruski 2009). It was explained that languages like Chinese, in other words tone languages, use variation in pitch to distinguish different lexical levels (Wang *et al*. 1999). Whilst English speakers use combination of three acoustic correlates (pitch, duration and intensity). The results indicate that speakers of

non-stress languages have difficulties placing the stress correctly in English. They do not show any preferred pattern while stress languages tend to perform stress patterned speech similar to their native language (Yu & Andruski 2009).

Language background seems to be very important factor; hence it has to be taken into consideration when studies are created. In the experiment conducted in 2002 by Dupoux and Peperkamp, they intentionally avoided duration as a correlate of stress in the experiment with Hungarian speakers, since in Hungarian (and Finnish) vowel length is contrastive. Speakers of such languages might mistake long vowels for stressed vowels (Dupoux & Peperkamp 2002).

3.2 Stress Parameter

It is believed that during the first two years of life infants tune the phonological representation of words to the properties of their L1 (e.g. Werker & Tees 1984; Mehler *at al*. 1988; Polka & Werker 1994). "Such tuning is based on an analysis of distributional regularities of the phonetic stream, rather than on a contrastive analysis involving minimal pairs" (Dupoux & Peperkamp 2002, 3). Nevertheless, information about contrastive features is also stored (Dupoux & Peperkamp 2002).

Within the first two years of infants' lives, because of the limited amount of information about their native language, it is problematic for infants to decide whether stress is contrastive or non-contrastive in their L1. Consequently, based on this knowledge, they must decide whether stress should be stored as a part of the phonological information of the lexical entry. Dupoux and Peperkamp (2002) called this binary contrastive vs non-contrastive option the Stress Parameter. They claim that the Stress Parameter is set during the first two years of native language acquisition. "In its default setting, stress is encoded in the phonological representation" (Dupoux & Peperkamp 2002, 4). In case their L1 has regularities in the stress system that children can observe, they will not encode the information about stress as part of the lexical word (Dupoux & Peperkamp 2002). Dupoux and Peperkamp (2002) suggest that "in order to set the Stress Parameter, infants rely on cues concerning the distribution of stresses at the utterance boundaries. If word stress is regular, then this regularity will be present at either the beginning or the end of utterances, depending on whether stress is assigned at the left or the right edge of the word, respectively" (Dupoux & Peperkamp 2002, 4).

In Czech, for example, stress is very transparent. It is regularly assigned to the beginning of an utterance; hence Czech infants can deduce that stress is always at the beginning of a word. In French, stress is also surface observable, infants can easily deduce its regular word-final position. In Spanish, by contrast, stress is largely irregular, unpredictable, and falls on one of the last three (or four) syllables. "Hence, utterances neither begin nor end consistently with a main stressed syllable. Neither utterance edge thus presents a regular surface stress pattern, and infants therefore decide to keep stress in the phonological representation" (Dupoux & Peperkamp 2002, 4).

Dupoux and Peperkamp (2002) distinguish three cases regarding the setting of the Stress Parameter. Suppose a language with non-contrastive stress, if an infant observes the stress regularity, the Stress Parameter is set in the following form: stress is not encoded as part of the lexical entry. However, there are languages like Hungarian, in which stress is regularly on the first syllable. However, there are exceptions of unstressed function words. In languages with exceptions to stress regularity, infants might fail to spot non-contrastive character of stress. Hence, the information about stress will be redundantly kept in the phonological representation. Finally, in languages with contrastive stress without any stress regularity, infants do not see any regular pattern and consequently correctly keep stress in the phonological representation (Dupoux & Peperkamp 2002).

3.3 Typologies of languages according to the Stress Parameter

Results of perception studies dealing with word stress in L2 show regularities among speakers of various L1 backgrounds. One of the typologies that were created is Dupoux and Peperkamp's typology based on the contrastiveness of stress and its predictability in the native language, so called Stress "Deafness" Model (Dupoux & Peperkamp 2002). Even though the idea of stress "deafness" was first formulated within the field of L1 perception, Dupoux and his colleagues continued long-term experimental work and widened the topic of stress "deafness" to L2 perception as well (Dupoux *et al*. 2007). The other typology originated is Altmann and Vogel's typology that includes greater amount of languages and specifically considers L2 acquisition (in Altmann 2006). It was labelled Stress Typology Model (Altmann 2006). This study is described in detail, especially the creation of the stimuli, since I decided to use the same syllable structures as Altmann did. It is worth mentioning that in 1990 a different model was presented by Dresher and Kaye (Dresher, Kaye 1990 in Gillis *et al.* 1995). Nevertheless, this model was originally meant

to account for L1 acquisition and includes a great amount of parameters to be considered, unlike in previous two models, which take into consideration primary stress only (Altmann 2006).

3.3.1 The Stress "Deafness" Model

Dupoux and his colleagues (1997) conducted four experiments in which they tested perceptual abilities in L1 of French and Spanish speakers (Dupoux *et al*. 1997). They used various designs of experiments of different difficulty levels. They proved that French speakers really have more difficulties with differentiation non-existing words that differ only in stress placement, while Spanish speakers did not have such difficulties. On the other hand, French speakers proved not to be "deaf" on segmental level. Unlike French, Spanish speakers seem to be unable to detach acoustic correlates of stress from the lexical entry. They concluded that French subjects are unable to recode the information they want to keep into a more abstract level. They suggest that this inability is language specific (Dupoux *et al*. 1997).

Based on the previous findings Dupoux and Peperkamp (2002) widened the experiment to more languages. The experiment was conducted with speakers of four distinct languages with non-contrastive stress and speakers of one language with contrastive stress, Spanish (Dupoux & Peperkamp 2002).

Based on the results of experiments conducted by Dupoux and his colleagues (e.g. Dupoux *et al*. 1997; Dupoux, Peperkamp, & Sebastián-Gallés 2001; Dupoux & Peperkamp 2002;) they created a stress typology of languages (Dupoux & Peperkamp 2002). Dupoux and Peperkamp (2002) explain that "this typology distinguishes four classes of languages with a phonological stress rule, corresponding to four types of information that are needed to correctly set the Stress Parameter" (Dupoux & Peperkamp 2002, 6).

They defined four possible hypotheses of perception of lexical stress depending on the moment when the Stress Parameter gets set (Dupoux & Peperkamp 2002). The first of their hypotheses is so called *Lexical Parameter Setting hypothesis*. It supposes that the Stress Parameter is set late, after much of the lexicon is acquired. According to this hypothesis, the phonological representation of a word encodes only contrastive features, hence the stress "deafness" should be attested for speakers of any of the four classes of languages (Class I-IV), since in all the languages there is non-contrastive stress.

Contrary to this hypothesis, there are theories generally called *Non-lexical Parameter Setting hypotheses*. They predict that there are languages that encode stress in the phonological representation even though they have non-contrastive stress. One hypothesis suggests that the Stress Parameter is set after the acquisition of all the phonological properties but before the acquisition of a full word form lexicon. According to this, only Classes I-III are expected to exhibit stress "deafness". Another non-lexical hypothesis says that the Stress Parameter is set before function words are acquired. That would assign stress "deafness" only to classes I and II. And the last non-lexical hypothesis claims that Stress Parameter could be set only on the bases of phonetic information, hence only Class I should yield stress "deafness". Basically, the hierarchy is based on the findings that the more predictable the language is, the worse speakers of the given language would score in perception test based on distinguishing word stress. In other words, speakers of languages with predictable stress will exhibit greater stress "deafness". Dupoux and Peperkamp (2002) hierarchically organized languages into classes, from Class I, where speakers of the language have major problems with recognizing stress, to Class IV where speakers have very few, basically no problems, with distinguishing words according to stress.

3.3.1.1 Classes according to the Stress "deafness" typology

Class I consists of languages with fixed stress. For example, in French stress is regularly on the ultimate syllable (*cou'pez* 'cut$_{\text{IMP-PL}}$', *coupez'les* 'cut$_{\text{IMP-PL}}$ them') or in Finnish where stress is regularly word-initial. According to Dupoux and Peperkamp (2002), because of this regularity, infants can deduce non-contrastive character of stress before the Stress Parameter is set. The speakers of languages belonging to this class are the most prone to exhibit stress "deafness" since there is no need to remember the placement of stress as part of the lexical entry. According to the criteria, Czech language would also belong to this class, for its regular stress on the first syllable of a word. Moreover, there is another feature that Czech has in common with Finnish, non-contrastive character of stress but contrastive vowel length. Consequently, Czech speakers are expected to exhibit stress "deafness" similarly as Finnish speakers.

As an example of Class II, Dupoux and Peperkamp (2002) state Fijian. In this Austronesian language, word stress falls on the final syllable, in case it is heavy, otherwise on the penultimate. Once infants acquire the distinction between heavy and light syllable, they observe the regularity of the stress pattern. Hence, they are expected to be stress

"deaf". Nevertheless, this language is part of the hierarchy only as an example, speakers of such a language were not part of the experiment and hence the results are not available to be compared to the rest of the languages and more conclusions to be made (Dupoux & Peperkamp 2002).

In languages belonging to Class III, stress pattern is observable and predictable. This pattern is seen in Hungarian. Regularly the stress falls on the first syllable of a word. However, in case that an utterance begins with a function word, the stress falls on the second syllable of a word (*'emberek* 'men'- *az'emberek* 'the men'). If infants of Hungarian acquire the knowledge of functional words before the Stress Parameter is set, they are predicted to the stress "deafness". Nevertheless, if the set of function words is not available by that time, Hungarian speakers are not expected to be stress "deaf" in their adult lives (Dupoux & Peperkamp 2002).

Class IV consists of languages that have stress pattern that is observable but only when content word boundaries are available. For instance, in Polish, stress is regularly on the penultimate syllable (*gázet* 'newspaper$_{\text{GEN-PL}}$'– *gazéta* 'newspaper$_{\text{NOM-SG}}$' – *gazetámi* 'newspaper$_{\text{INST-PL}}$'). Nevertheless, there are exceptions to this rule, since in Polish there exist many monosyllabic content words that take the stress. When the monosyllabic content words meet, stress clash appears and the first of the two words is destressed. Hence, if an utterance ends in monosyllabic word, the final syllable is stressed. In case of Polish, *Lexical Parameter Setting hypothesis* predicts stress "deafness", while none of *Non-lexical Setting hypotheses* does, as opposed to the other classes. If a full word segmentation is available by the time the Stress Parameter gets set, adult Polish speakers are said to be stress "deaf" (Dupoux & Peperkamp 2002).

Considering that only languages with non-contrastive stress are included in the typology, Spanish speakers are out of the typology used only as a control group. Since Spanish is a language with contrastive stress, Spanish infants must be careful while learning the language. The meaning of the words changes when stress is moved. For example, meaning of *´baile* ('a dance') – *bailé* ('I danced.') is different. Furthermore, in Spanish, stress is unpredictable, it can fall on any of the three (four) final syllables (Čermák 2009). Moreover, Spanish does not significantly prefer main stress on the first or final syllable, unlike other languages where such a tendency can be noticed. Hence, native Spanish learners are more likely to remember stress placement as part of a word in

the phonological representation than speakers of languages with regular stress pattern on utterance edges. Consequently, according to the hypotheses native Spanish speakers are not expected to exhibit stress "deafness" (Dupoux & Peperkamp 2002).

The hypotheses about presence or absence of stress "deafness" of speakers belonging to various classes of languages (Class I-IV) and a language with contrastive stress are summarized by Dupoux and Peperkamp (2002), their summary is demonstrated in **Table** 1.

Language Class	Language example	Lexical Parameter	Non-lexical Parameter Setting		
			Phonetics, phonology, and function words available	Phonetics and phonology available	Phonetics only available
Class I	French	+	+	+	+
Class II	Fijian	+	+	+	-
Class III	Hungarian	+	+	-	-
Class IV	Polish	+	-	-	-
Contrastive stress	Spanish	-	-	-	-

Table 1: Hypotheses regarding stress "deafness" in speakers of languages belonging to Classe I-IV and contrastive stress language

3.3.1.2 The findings of Stress "deafness" studies

For the experiment in 2002 Dupoux and Peperkamp created two series of minimal pairs of possible bisyllabic non-existing words for discrimination task. In the first series of minimal pairs the contrast was in a segment (*kupi-kuti*). In the other series there was a stress contrast (*ˊmipa-miˊpa*). Native speakers of Finnish, French, Hungarian, Polish and Spanish were asked to distinguish between the pairs of non-words. Finnish subjects made significantly more errors in the perception of stress contrast than in the perception task with segmental contrast (Dupoux & Peperkamp 2002). From a post-hoc analysis of variance comparing Finnish and Spanish speakers, it was apparent that there is a significant interaction between language and contrast, there was an effect of contrast for the Finnish but not for the Spanish speakers. The results of Finnish speakers were similar to those of French speakers. Consequently, these results are interesting since they show that stress "deafness" is not restricted to speakers of a single language, and moreover they

show that stress “deafness” is not dependent on the position of word stress in the given language.

Ten native speakers of Hungarian, belonging to Class III, and ten Polish native speakers, belonging to Class IV proved that stress “deafness” is not either present or absent feature. The results show that both Hungarian and Polish speakers exhibit stress “deafness” to some extent and so they fall in between the two ends of the stress “deafness” scale. The results discard the hypothesis that all the languages with non-contrastive stress should yield the same amount of stress “deafness”. It was correctly predicted that the lower number of the class (Class I), the higher probability to exhibit stress “deafness”. Based on the results they designed the stress “deafness” hierarchy (Dupoux & Peperkamp 2002).

It was hypothesized that if speakers fail to hear the stress contrast in their native language, they automatically fail to perceive this contrast also in L2. Truly, similarly as French listeners failed to hear the stress contrast in their L1 (Dupoux & Peperkamp 2002), they proved to be stress “deaf” also in L2 perception (Dupoux *et al.* 2007). In sequence recall task, French learners of Spanish showed much difficulty in the use of stress to access the lexicon. It was proposed that the difficulty is a lasting processing problem. The problem is probably the result of impossibility of French speakers to encode contrastive stress in the phonological representation of words (Dupoux *et al.* 2007).

Later on, Peperkamp and her colleagues (2010) raised the possibility that functionality of stress might play a role. This time, new predictions were made stemming from four factors for the perception of stress. Factor 1 is the domain of stress. They divided languages according to the fact whether stress is a property on the level or a word, whether stress is assigned at the phrase level. Factor 2 divides languages into three groups according to the lexical use of phonetic correlates of stress. The languages can use none of the phonetic correlates of stress and consequently exhibit stress “deafness”, or they can use vowel duration lexically, hence weak stress “deafness” is expected. Or, like in the case of Spanish speakers, languages can lexically use duration, F0 and intensity for contrastive stress, and so they are expected to exhibit no stress “deafness”. As Factor 3, variability in stress position was used. Languages were classified as regular, regular with some irregularities or variable. Factor 4 is based on the presence or absence of lexical exceptions to the stress rule. The first group does not allow any exceptions even if the

word is a loanword, like in Standard French, South-eastern French, Hungarian and Finnish. Polish belongs to the second group since there are exceptions in stress patterns, especially in the case of loanwords, even though not very frequent (0.1%). The last group is represented by Spanish language in which stress can be considered regular to a certain extent but has almost 20% of lexical exceptions (Peperkamp *et.al.* 2010). The percentage slightly differ throughout literature. The results show that only prediction based on factor 4 was correct. Speakers of languages with more lexical exceptions to stress rules had higher scores than speakers of languages with no exceptions. All the other hypothesises were not testified (Peperkamp *et.al.* 2010).

Even though the stress "deafness" typology of languages brings more answers to the field of stress perception, it is argued by Altmann (2006) that it has some flaws (Altmann 2006). First of all, not all languages can be organized according to stress. The theory does not take into account other types of languages than stress languages, for example tone languages. Furthermore, from the hierarchy it is not very clear how certain other languages which have predictable stress would be classified. Take the example of Turkish and Arabic. These languages are claimed to have predictable stress patterns, but they would fall into different classes (Altmann 2006). Moreover, stress "deafness" typology addresses only general perceptual ability, it is not originally targeted specifically to the L2 acquisition. Perhaps, another imperfection can be the fact that this typology deals only with primary stress and completely ignores secondary stress. Moreover, Dupoux and Peperkamp's study (2002) is criticized also for using two sets of experimental stimuli. The difference in sets of stimuli could influence the results as well (Altmann 2006).

3.3.2 The Stress Typology Model

In 2002 Altmann and Vogel published a modification of a classification published in 2000 (Altmann 2006). This language classification is called *Stress Typology Model*. In a certain aspect it is in accordance with Dupoux and Peperkamp's *Stress "Deafness" Model* (2002). *Stress Typology Mode*l uses the notion of the Stress Parameter as well; however, the typology is based on binary branching. This model takes into consideration also languages with prosodic phenomena other than stress, such as tone for example. Similarly, like Dupoux and Peperkamp's model (2002), it also deals with surface-observable pattern of each language alone and focuses solely on the primary stress, however, as opposed to Dupoux and Peperkamp's typology (2002), *Stress Typology*

Model considers the perceptibility of stress specifically within the field of L2 acquisition, not in general (Altmann 2006).

The first information to consider in *Stress Typology Model* is whether the language is stress language or whether it is a language with a different prosodic phenomenon, so called non-stress language. Hence it takes into consideration languages that do not have stress on the word level at all. In case the language is a non-stress language, the next step of branching is pitch or no pitch language. In the case of pitch languages, there are two general subcategories of languages, either tone language, "where syllable within a word carry lexical tone" (Altmann 2006, 24), or pitch accent language, "where a pitch contour spans across the whole word" (Altmann 2006, 24). If a language is identified as a stress language, the next step to consider is if the stress is predictable or not predictable. In the languages where stress is not predictable, the location of stress must be specified and encoded in the lexical representation of words (Altmann 2006). In case we can predict the stress placement, lexical representation of stress is not necessary. However, there are other parameters relevant. One of the parameters to be considered is the sensitivity to syllable weight, hence the languages can be quantity sensitive or quantity insensitive. The last level of the branching of stress languages is whether stress is assigned to left or right edge of the word (Altmann 2006). All the above mentioned is summarized in Table 2. The table is used from Altmann's (2006) dissertation.

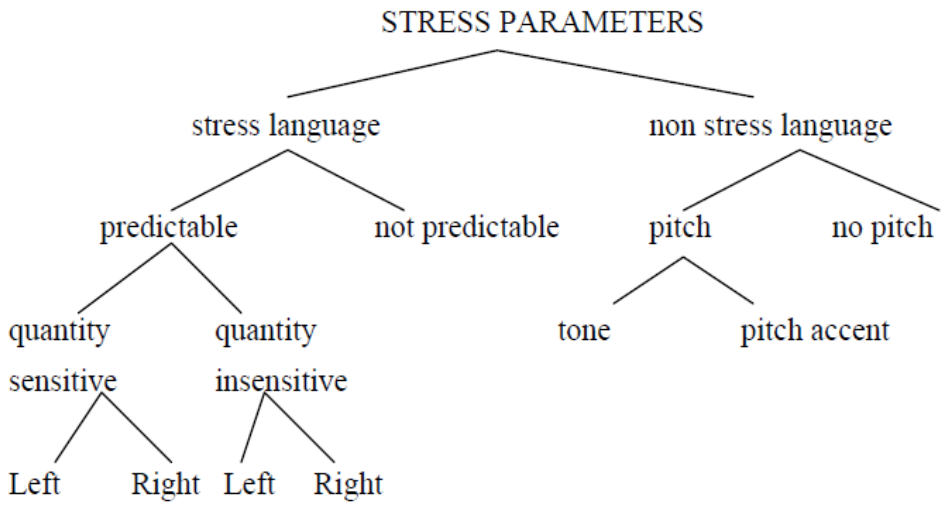

Table 2: Typology of stress parameters (Altmann &Vogel 2000 in Altmann 2006)

According to the presented hierarchy, one can predict difficulties learners of various L1 backgrounds might face during the acquisition of primary stress in certain L2s.

Altmann (2006) predicts the best performance of L2 stress for speakers whose L1 is not a stress language. Logically, in that case, there are no parameter settings that could be transferred from L1 to L2. Similarly, speakers with predictable stress in L1 are expected to show the greatest difficulty. Altmann explains that "there are several positively set stress parameters required to accommodate properties like quantity sensitivity or edge demarcation, which may impede the ability to acquire L2 stress, especially if the L2 has fewer positive settings that the L1" (Altmann 2006, 32). However, Altmann does not consider positive transfer of L1 to L2. The best performance in L2 stress would then be expected for speakers of L1 with the same stress parameter as in the target language.

3.3.2.1 The findings of the Stress Typology Model study

The purpose of Altmann's study (2006) was to map the effect of stress properties of L1 on the acquisition of L2. She studied whether L2 learners of English are able to locate the position of stress when they hear non-existing English word. It consisted of both perception and production part, since the author wanted to conclude whether production and perception are mutually interconnected. Advanced learners of English as a L2 of seven languages took part in the study, namely French, Turkish, Arabic, Spanish, Mandarin Chinese, Tokyo Japanese and Seoul Korean (Altmann 2006). Ten speakers of each language participated in the experiment. The task was to listen to nonce words and to mark which syllable they perceive as the most prominent. The participants listened to 125 two, three or four syllabic non existing words. Only open syllables were used.

From the results it is obvious that there is a tendency towards an English-like perception of stress of speakers whose L1 is either without word-level stress like Japanese, Korean, Chinese, or of speakers of languages with non-predictable stress like Spanish. These speakers had higher scores than the rest of the participants. On the other hand, native speakers of Arabic, Turkish, and French, that is to say, the languages with predictable stress, showed poorer results. The hypothesis was correct in the sense that the languages with predictable stress would behave differently that those without predictable stress. Spanish speakers performed very similarly to English speakers. Languages without stress also performed very well (Altmann 2006).

Hypothesis of both *Stress "deafness" Model* and *Stress Typology Model* turned out to be true. French speakers truly had one of the lowest scores in the perception task. It was found out that "the type of native language has a direct effect on the perception of

stress in a second language". It was concluded that only "the presence (or positive setting) of predictable stress in the native language seems to have a detrimental influence on the listeners' ability to identify the location of primary stress in a word" (Altmann 2006, 95).

Production experiment brought interesting results. None of the L2 speakers had difficulties to stress the penultimate syllable, if the following vowel was a schwa. Only Spanish speakers were either undecided or expressed the tendency to stress the final vowel. This is a surprising finding, considering that it does not correlate with the most common Spanish stress pattern. If a word ends in a vowel, stress is expected to fall on the penultimate syllable (Guion, Harada & Clark 2004). Incidentally, stress on the final syllable was the most common choice across all L2 speakers (Altmann 2006). Interestingly, Spanish and Chinese speakers showed similar pattern in their responses, even though these languages belong to typologically distinct groups.

Comparing the results of both Altamnn's experiments (2006), it seems that "good perception of L2 stress does not necessarily lead to good production of L2 stress. Furthermore, bad perception does not entail bad production" (Altmann 2006, 159). The subjects who reached very poor results in the perception experiment scored average results in the production part. And vice versa, Spanish speakers who did very good, almost native-like, performance in the perception part were under average, maybe even poor when it came to the production of the words. Consequently, it may be deduced that perceiving stress and actually articulating stress are two absolutely independent abilities (Altmann 2006).

3.3.3 Computational Learning Model for Metrical Phonology

It is worth mentioning that in 1990 Dresher and Kaye created a model called *Computational Learning Model for Metrical Phonology* (Dresher & Kaye 1990 in Gillis *et al.* 1995). However, this model is only briefly mentioned in this master thesis since its parameters do not meet exactly the topic of my paper.

The bases for this model is *Universal Metrical Parameter*, based on Hayes (1981), to be able to account for the first language acquisition of all possible natural languages (Dresher & Kaye 1990 in Gillis *et al.* 1995). They implement Chomsky's well-articulated theory of Universal Grammar. "Under the Principles and Parameters approach, Universal Grammar consists of a finite number of principles, each of which involves a finite number

of parameters. The parameters can take only a finite number of settings, so that the set of possible target grammars is restricted" (Dresher & Kaye 1990 in Gillis *et al.* 1995, 2).

They defined eleven binary branching parameters and, with all possible interdependencies between parameters, they came to a total sum of 216 possible stress systems. The computational model restricts both the number and the form of possible stress system (Dresher & Kaye 1990 in Gillis *et al.* 1995).

No matter how interesting the model is and how vast number of language stress systems possibly learned in L1 acquisition may be yielded, no more attention will be paid to this model since it was not created to account for perception of stress, let alone perception of stress in L2 acquisition.

4 Stress in English, Czech and Spanish

Obviously, L1 is reflected on L2 perception (Mehler & Christophe 1994). Speakers of different languages perceive different molar structures and use them to create routines for rhythmic regularity in the respective maternal language. For example, speakers of Romance languages are sensitive to syllables, while Japanese speakers are sensitive to moras (units smaller than syllables) and speakers of English to the distribution of strong and weak vowels (Mehler & Christophe 1994).

Therefore, it is necessary to dedicate some attention to the suprasegmental features of English, Czech and Spanish (e.g. Dupoux & Peperkamp 2002; Schwab & Llisterri 2015; Yu & Andruski 2009). Guion and her colleagues (2003) explain that "Cross-linguistically, it is common for stress placement to be determined by foot structure and for words to be footed and stressed in either a right-to-left or left-to-right manner with main stress falling on either the first or last foot in the word" (2003, 405).

Since the purpose of this paper is to examine the perception of stress in non-existing English words, in this paper I describe lexical stress. "Stress cannot be defined in a local sense: a syllable is stressed if it is more prominent than another syllable" (Giegerich 1992, 193). Across languages the base of word stress is the contrast, not any absolute values of acoustic qualities (Palková 1994). It should be mentioned that this paper is concerned with primary stress only.

Usually, stress languages are described in terms of regularity of stress. Languages with predictable location of stress are denominated fixed stress languages, while languages with unpredictable location of stress are called free stress languages (Ladefoged & Johnson 2011).

In the following subchapters I provide information about stress in English, Czech and Spanish in order to see the differences and similarities of examined languages. The languages vary in the specific syllable structure for example, however, every syllable must have a nucleus (Palková 1994). In some languages, there is a correlation between stress and syllabic structure. Stress languages differ in terms of sensitivity to syllabic structure. Therefore, languages can be either sensitive or insensitive to syllable weight (Guion *et. al.* 2003).

4.1 Stress in English

English is defined as stress-timed language. Stressed syllables in English are said to appear at roughly equal intervals of time (Ladefoged & Johnson 2011). Even though the number of unstressed syllables between stresses is variable, isochrony, in other words, equality of time, holds. The main function of stress in English is then the maintenance of rhythm in connected speech (Giegerich 1992). Every lexical word in English has a stressed syllable, if there is more than one syllable bearing stress, only one stress will be the main, the others will be subordinated (Giegerich 1992).

In comparison to Czech lexical stress, stress in English is variable or "free, in the sense that the main accent is not tied to any particular point in the chain of syllables constituting a word, as it is in some languages" (Cruttenden, 2001, 221). The cause of the variability of stress is an etymological one. "[…] vocabulary has drawn from two principal sources, in one of which Teutonic, the tendency is towards early word stress, while the other, the Romanic, late word stress prevails" (Kingdon 1965, 12). The interaction of these two opposite tendencies has led to the variability of stress placement in English.

To certain extent, English lexical stress is phonemic. There are pairs of words that are segmentally identical but in terms of stress placement they are distinct (*ˊdiffer* vs. *deˊfer*). In Dupoux and Peperkamp's experiment (2002) they use a term "contrastive" to refer to the quality of stress to create minimal pairs (2002). There are also pairs of words where stress placement signals its syntactic category (Giegerich 1992), as will be commented on later in the subchapter 4.1.2. Nevertheless, only a relatively small number of such pairs exist in English. Moreover, stress can also distinguish a two-word expression form a compound (*to ˊpush ˊover - a ˊpushover*) (Ladefoged & Johnson 2011).

English stress is not firmly attached to a particular syllable; it can be moved. It is caused either by other stress in the vicinity, or because of speakers' agreement to place the stress in some other word (Roach 1998). It is the result of connected speech phenomenon. In connected speech the utterances consist of parts that include one stressed syllable and undefined number of unstressed syllables (Dušková 1994). For rhythmic reasons stresses differ in citation form from stresses in connected speech. In citation form all these words have stress on the 1st syllable (*ˊKaty, ˊolder, ˊsister, ˊwant, ˊmany, ˊbirthday, ˊpresents*) however, in connected speech some of the words lose word stress

(*´Katy's older ´sister wanted ´many birthday ´presents*.) As the example shows, stresses tend to recur at regular intervals of time (Ladefoged & Johnson 2011).

4.1.1 Stress patterns

Even though English stress is not as regular as stress in Czech, there are stress patterns to be observed. Stress pattern is "the arrangement of stressed and unstressed syllables in a given word, the type of stresses used, and the relative pitches of the various syllables when a given kinetic stress is used" (Kingdon 1965, 13). Despite some exceptions, each word has a single possible stress pattern, predictable or unpredictable (Giegerich 1992). Undoubtedly, there exist stress patterns that appear with higher frequency than the rest, or, on the other hand, there are stress patterns that seem to be rather rare. In order to decide which stress pattern is to be used, one has to consider some of the following information. Namely, they are morphological complexity of a word, part of speech of the word, number of syllables as well as the phonological structure of the syllables (Roach 1998).

Stress patterns in English reflect the syllable structure of lexical words. It is mainly the status of the final syllable that governs the stress pattern in English (Cruttenden 2001). Syllables are considered heavy if they contain a long (or tense) vowel or a diphthong or a short vowel and two consonants, otherwise they are considered light (e.g. Blevins 1995, Cruttenden 2001). Generally, two stress patterns are differentiated in English, final and non-final. The stress patterns depend on both non-phonological as well as phonological information.

4.1.1.1 Final stress

One of the conditioning factors of a stress pattern of a word is its part of speech (Giegerich 1992). Final stress is quite common in verbs (*o´bey)* and adjectives (*ob´scene*). If the final syllable is heavy, it takes the primary stress (Cruttenden 2001). Unlike nouns, if the initial syllable of an adjective or verb is heavy, it does not necessarily take secondary stress (*ˌ*ob´scure*). Final stressed nouns are rather uncommon in English. As Cruttenden (2001) explains, if the final syllable is heavy, it is optionally stressed (*i´dea*) (2001). These exceptional nouns are usually loan words. Nouns with final stress are unstable and may join more stable group of nouns with primary and secondary stress respectively, such as (*´synˌtax*). If the first syllable of an end-stressed noun is heavy as well (*ˌho´tel, ˌar´cade*), it takes secondary stress. Only in the examples with two heavy syllables (with secondary and primary stress respectively) it is possible to have varying stress (*´arˌcade* - *ˌar´cade*).

However, even in words without varying stress, stress may be shifted in certain contexts, for example when stressed syllable immediately follows (*ˌho´tel → ´hoˌtel ´management*) (Giegerich 1992).

4.1.1.2 Non-final stress

For nouns, non-final primary stress is more common stress pattern than the previous one. Nouns are governed by rather general rule based on syllable weight, "The penultimate syllable is stressed if it is heavy (*a´roma*, *a´genda*); otherwise, stress falls on the antepenultimate syllable (*A´merica*)" (Giegerich 1992, 187). Nevertheless, even within this more common subclass of nouns there are exceptions like (*´badminton*) where penultimate syllable is heavy and hence could be stressed, but it is not (Giegerich 1992).

4.1.2 Non-phonological structure of stress

Back to the factors that influence the stress pattern in English, non-phonological information is one of them. From noun-verb pairs such as (*´digest – to di´gest*) it is obvious that syntax is important for stress pattern. Moreover, only certain syntactic categories take stress. Lexical words like nouns, verbs, adjectives, adverbs are stressed, however functional words, like articles, prepositions, pronouns, etc. are not. Nevertheless, even these functional words can be stressed in case of emphatic speech (*It's ´on the table not ´under the table*.) (Ladefoged & Johnson 2011).

As explained in the subchapter 4.1.1, nouns are mostly stressed on the non-final syllable, on the penultimate like in (*a´roma*) or on the antepenultimate like in (*A´merica*). On the other hand, verbs (*o´bey)* and adjectives (*ob´scene*) commonly take final stress (Giegerich 1992).

Various studies conducted on this topic demonstrated that the distribution pattern of nouns and verbs is not only known to native speakers of English but also to non-native speakers and serve as one of the factors that influence stress placement decisions (e.g. Guion *et. al.* 2003; Guion, Harada, & Clark 2004).

Other important non-phonological factor is morphology. One aspect that needs to be taken into account is whether the word is morphologically simple or complex. The morphological complexity can be the result of a word being a compound (*´blackˌbird - ˌblack ´bird*) (Giegerich 1992). In general, English words may be divided into roots (*fool*) and affixes, both suffixes (*fool-ish*) and prefixes (*dis-respect*) (Cruttenden 2001). In the case of words consisting of roots and suffixes, one has to distinguish inflectional and

derivational suffixes. Those that create only a different form of a word, inflectional suffixes, do not shift stress, they are stress neutral (*´camera -´cameras*). Those that produce a new word, derivational suffixes, might change it. Consequently, derivational suffixes might be divided into stress-shifting and stress-neutral. Stress-neutral never change the stress pattern of the base like for example *–less, -hood, -ly, -able, -ness* and others. Moreover, they do not shift the stress even though more suffixes are joined (*´penny- ´penniless- ´pennilessness*). Additionally, such suffixes are always unstressed (Giegerich 1992). On the other hand, stress-shifting suffixes can bear main stress of the word. Such suffixes are *–ee, –ette, –ese, –esque*. Expectedly, the presence of such suffixes always mean heavy syllables. It was concluded that "words containing stress-shifting suffixes behave like morphologically simple words in that their stress patterns are always also possible as stress patterns of simple words (*va´nilla – Chi´nese*)" (Giegerich 1992, 192). On the other hand, by adding a stress-neutral suffix, phonological shape of a word changes but its stress pattern does not. Problems with distinction between the two classes of suffixes is that they do not behave like we expect in all cases (Giegerich 1992).

4.1.3 Phonological structure of stress

Languages that are sensitive to internal structure of syllables are sometimes referred to as quantity-sensitive languages. English is one of the languages where syllable weight is reflected in the stress assignment (Guion *et. al*. 2003). In general, in English, a stressed syllable must be heavy while unstressed syllable might be light (Giegerich 1992).

The rules that assign feet to syllables and thus decide what syllables bear stress are called *foot-level rules*. *Foot-level rules* make reference to syllable weight as well as to morphological and syntactic information (Giegerich 1992). Rules that "assign structure above the foot level and thereby provide the differentiation between primary and secondary stresses are called *word-level rules*" (Giegerich 1992, 198).

First, nouns are considered. Even though final stress is not usual with nouns, it may seem that if the final syllable contains a long vowel, it is stressed (*Ju´ly*). The penultimate syllables are stressed if they are heavy (*a´roma*) and unstressed if they are light (*A´merica*). "Heavy penults are evidently not stressed if the final syllable has stress, […] a foot aligned with the penultimate syllable has to be bisyllabic, also including the final syllable" (Giegerich 1992, 199). Nevertheless, even monosyllabic feet appear on the penultimate but it has to be the first one of the word at the same time. Cases like (*´camera,*

a´roma, ca´det) are not constrained by syllable-weight requirement. "[…] these are the contexts in which heaviness is produced as a result of stress, through ambisyllabicity" (Giegerich 1992, 200). By ambisyllabicity it is meant "the association of a consonant with two syllables at the same time" (Giegerich 1992, 182). In these default cases, the strings of syllables are grouped from right to left (*A´merica*) into bisyllabic or trisyllabic feet. Hence, every lexical word must have a foot. All these findings about foot assignments in English nouns might be generally called *Foot Assignments in Nouns* (Giegerich 1992, 200, 201):

1. Assign a foot to the final syllable if it contains a long vowel, or exceptionally, if it is otherwise heavy.
2. Assign a bisyllabic foot to the penultimate syllable if it is heavy.
3. Assign a foot to the penultimate syllable if it is heavy and initial.
4. Assign a maximal bi- or trisyllabic foot to any remaining string of syllables from right to left, and ensure that the word has at least one foot.

"These assignments, or rules apply from right to left: first the final syllable is checked by rule 1.; then the penult is checked by 2.; and the default rule 4. also assigns feet from right to left" (Giegerich 1992, 200, 201).

Giegerich (1992) further explains that *the word-level rules* build metrical structure on the word level (1992). The principle that governs such structures is therefore *Word Structure Assignment*. It is common for nouns to have their main stress on the right if the noun has two feet and the right foot has more than one syllable (*intro´duction*) (Giegerich 1992).

Words in English behave differently depending on their syntactic category. While final stress is rather exceptional in nouns, for verbs it is probably the most usual stress pattern (*o´bey, inter´vene*). The opposite pattern (*´dele˛gate*) is exceptional. *Word Prominence Rule* (Giegerich 1992, 204) expresses these facts as:

In a pair of sister nodes $[N_1N_2]_L$, where L is a lexical word, N_2 is strong if:

1. It branches above the syllable level, or
2. L is an exceptional noun, or
3. L is a verb

Thus, it is obvious that such rules include phonological variables. By the phonological variables it is understood the syllable count and syllable weight. Moreover, there rules include the syntactic and morphological structure as well (Giegerich 1992). Undoubtedly, stress rules have many exceptions as well.

It is questionable how much speakers really rely on the analysis of syllable structure when assigning stress pattern. Pater (1997) draws attention to the fact that the factors that influence the decisions concerning stress rules are not frequently tested on native speakers. Moreover, when the subjects of an experiment are native speakers of English, they do not follow many of the predictions for stress placement based on phonology. Even native speakers of English rather base their decisions on analogy (Pater 1997).

Guion and her colleagues (2003) examined the factors that affect perception of English non-words on English native speakers. They found that syllable structure actually played a role. It was proved that syllable quantity was more important than presence or absence of coda consonant. English speakers preferred syllables with a long vowel rather than with a short one to receive main stress. From their findings it can be concluded that long vowels are almost twice as likely to be stressed as short vowels (Guion *et al*. 2003). The distribution of main stresses was dependent on the lexical class as well; nouns are more likely to have stress on the first syllable rather than verbs. The results also indicate that main stress is often assigned to non-existing words on the basis of phonological similarity to already known words. Interestingly, these findings also work when syllabic structure of non-word and already known word differ (Guion *et al.* 2003).

This section refers to phonological properties of stress, in other words, the properties that are predictable. As Giegerich (1992) writes it is assumed that such properties speaker does not learn individually with every word. Syllabification is one of the properties speakers are said to automatically assign to syllable structures. Nevertheless, there are properties that are unpredictable, phonemic ones. Looking at the predictable and unpredictable properties, English stress has an interesting status. On the one hand, it is possible to formulate the rules that govern stress contours of English words, on the other hand, nearly every rule contravenes the assumption that the phonological theory makes about phonological rules: they refer to non-phonological properties and they have exceptions. By all means, “stress in English is phonemic: the phonemic level

of representation therefore contains some suprasegmental information" (Giegerich 1992, 206-207).

4.2 Stress in Czech

Czech is typologically different language than English. Czech differs from English in many respects, for example, Czech is defined as so called syllable-timed language, which indicates that syllables tend to reappear at regular intervals of time (Ladefoged & Johnson 2011).

Stress in Czech is unanimously described as regularly word-initial (e.g. Palková 1994, Duběda 2005). In majority of cases, in Czech, main stress falls on the first syllable of a lexical word. The only exception is when preceded by a monosyllabic word, be it conjunction ('*žepřijde*), adverb ('*užodešel*) or preposition ('*kestolu*, '*navýlet*). In that case, the stress falls on the monosyllabic expression itself since it creates a single prosodic unit. However, not even this principle is always used, like in poetry for example (Palková 1994). Despite some doubts about actual existence of Czech stress, Duběda (2005) proves that word stress exists in Czech. It is demonstrated by emphatic speech and poetry, by the fact that stress is neither random nor arbitrary in Czech and also by the sensitivity of Czech speakers for wrong stress placement or wrong realization of stress in non-native speech (Duběda 2005).

Owing to the predictable character in Czech, stress is not phonologically active; it is not used to create a contrast between two words differing only in the position of stress (*ˊkala – * kaˊla*).

The main function of stress in Czech, at least for the listener, is that stress serves as a reliable cue of a word boundary, even though it does not reveal the part of speech of the word. This is also referred to as delimitative function of stress, according to which one can distinguish ('*tabulka*) and (*ta 'bulka*) in a stream of speech. Kijak (2009) argues that in Czech stress is used crucially for word segmentation, which is used to explain why Czech speakers are better than French speakers at perceiving L2 stress. Stress in Czech actually has some lexical function. For French speakers, stress may be a more phrasal phenomenon and lack function at the word level (Kijak 2009). Nevertheless, not even the delimitative function of stress can be taken as absolute but only as a theoretical option that exists in the given language, in connected speech it does not have to be expressed (Palková 1994).

Unlike stress, vowel duration is a phonologically functional feature. It means that in Czech, there are word paradigms differing only in the duration of a vowel used (*víla-vila, rada-ráda*) (Dušková 1994). Because length is one of the acoustic correlates of stress, greater duration in Czech can be misunderstood as a signal of stress. Dupoux and Peperkamp (2002) state that this so called lengthening of stressed vowels should be taken as such only in languages without duration as a phonologically active feature (2002). While manipulating acoustic correlates of stress in the perception experiment, duration should be avoided as a correlate of stress in languages with contrastive vowel length such as Czech, Finnish or Hungarian for example. Otherwise, the results could be biased. As Dupoux and Peperkamp explain "speakers of languages with contrastive length might map stressed vowels onto long vowels and unstressed vowels onto short vowels. Thus, they can assimilate stress to length, and consequently, stress "deafness" will not be observed" (Dupoux & Peperkamp 2002, 10).

Czech stress is usually described as very weak and subtle (Duběda & Votrubec 2005). It was explained that "the difference in the prominence between stressed and unstressed syllable is greater in English than in other languages. This applies equally to word stress and to sentence stress" (Kingdon 1959, 160). This is also in agreement with Volín and Skarnitzl's (2010) findings based on which they state that "the pairwise variability index of high-energy regions was lower in Czech than in English" (Volín & Skarnitzl 2010a, 277). Czech is definitely one of the languages where the difference between stressed and unstressed syllable is not so great as in English. Hence, all other things being equal, Czech English seems to be more monotonous and flat. In words of Volín and Skarnitzl (2010b) "Czech English typically sounds 'disinterested' or even 'bored'. Excursions in the F0 contours of Czech English are smaller or somehow less extreme than those of native English" (Volín & Skarnitzl 2010b, 6). It could be useful to notice that the more variation in duration of vocalic intervals as well as between stressed and unstressed syllable Czech speaker performs, the more native-like his/her overall English performance is. Volín and Skarnitzl (2010a) concluded that foreign accentedness of Czech English is best predicted by "the variation in F0 tracks, SPL [Sound Pressure Level] difference between stressed and unstressed syllable, and PVI [Pairwise Variability Index] of vocalic intervals in speech" (2010a, 278). Furthermore, "both overall tempo as such and rhythmicity of the speech can apparently jointly contribute to the detection of

Czech accent in English" (Volín & Skarnitzl 2010a, 274). Interestingly, all these findings work even under severe listening conditions (Volín & Skarnitzl 2010b).

4.2.1 Syllable structure

As opposed to English, segmental correlates of stress are said to be very weak in Czech (Duběda & Votrubec 2005). Duběda and Votrubec (2005) state that stress placement in Czech is not dependent on the syllable weight, syllable number neither on the morphological structure of words. The word is stressed on the first syllable no matter if it starts in a short vowel (*ˊdomů*), long vowel (*ˊvíla*), whether the first syllable is an open syllable (*ˊzelený*), or a closed syllable (*ˊčervený*), part of a prefix (*ˊnezajímavý*) or whether the first syllable is part of a word root (*ˊvoda*). Undoubtedly, Czech is then one of quantity insensitive languages (Duběda & Votrubec 2005).

Based on the data from *Fonologický lexikální korpus češtiny* it is obvious that majority of Czech syllables is open (69.99%) (Bičan 2015). As Ludvíková (1987) states 71% of Czech words end in a vowel and 88% of words begin with a consonant (1987). When syllable structure is considered, English has considerably higher number of complex syllables than Czech. Czech data show that simple syllable structure V, CV, VC represent 65% of all syllables used in a language (Dankovičová & Dellwo 2007). The total number of possible syllable types in Czech is 20. The most frequent type of syllable is CV, the percentage differ throughout literature, some authors state 48.05% (Bičan 2015), others state even higher percentage of 60% of CV (Ludvíková 1987). In general, the hierarchy of the most frequent syllables in Czech is CV (59.76%), CVC (17.18%,) CCV (10.06%), V (4.54%), CCVC (3.76%).

4.3 Stress in Spanish

Phonetically, stress in Spanish is dynamic, stressed syllable is pronounced with greater effort than unstressed one (Čermák 2009).

Most of Spanish words originated from Latin. The stress placement in Spanish is based on the stress pattern of corresponding Latin word. Although, there are many exceptions to this Latin pattern principle (Alarcos Llorach 2006). Exceptions may be, for example, caused by diachronic shortening of the word forms in the course of the evolution of Spanish language (Čermák 2009). This results in stress on the ultimate syllable, which was not originally a stress pattern in Latin. Like many Romance languages, Spanish is a syllable-timed language.

Stress in Spanish is lexical, it has to be memorized as a part of the word representation when acquiring language (Čermák 2009). In Spanish, stress is free in the sense that it is not firmly tied to one specific syllable within a word: *célebre* ('famous') – *ce´lebre* ('subjunctive mood of 1st or 3rd p. sg. of the verb *celebrate*') – *celebré* ('I celebrated.') (Čermák 2009). Nevertheless, the freedom of the position of stress is limited to the last three syllables of the word (Alarcos Llorach 2006).

Logical consequence of so called "freedom" of Spanish stress is the contrastiveness. That is to say stress in Spanish is phonemic. By moving stress to a different syllable one changes the whole meaning of the word. For example, a word *bebé* with stress on the ultimate syllable means 'a baby', while if stress is moved to the penultimate syllable like in *´bebe* the meaning changes to 'he/she drinks'. In Spanish, even minimal triplets appear (*célebre- ce´lebre- celebré)* (Gibson 2011).

4.3.1 Stress patterns

In fact, four possible stress patterns are seen in Spanish. First, there are words stressed on the last syllable. These words are called "oxytone" or "agudas", for example *papel* ('paper'*), habitación* ('room'). Another type of words is called "paroxytonas" or "llanas", these words are stressed on the penultimate syllable, like *casa* ('house')*, cárcel* ('jail'). The third possible stress pattern are words stressed on the antepenultimate syllable, so called "proparoxytonas" or "esdrújulas" for example *rápido* ('quick')*, química* ('chemistry') (e.g. Alarcos Llorach 2006; Čermák 2009). In addition, there is one more type, "superproparoxytonas", "sobresdrújulas", words that are stressed on the forth syllable from the end of the word. However, it should be mentioned that no Spanish non-verb expression will receive stress on the fourth syllable. Superproparoxytonas are not frequent and, usually, they are compound words only, for example expressions like *explícaselo* ('Explain it to her/him.'), or *cuéntamelo* ('Say it to me.'). For its rare character and rather limited usage they are not even included among types of stress patterns of Spanish by some linguists (Čermák 2009).

As already stated, if stress is unpredictable in a language, the location of stress must be lexically specified and encoded in the representation of a word (Altmann 2006). Therefore, some words in Spanish require a written stress mark called *tilde*. As Čermák (2009) explains, it is necessary to put the orthographic stress mark to polysyllabic words in the following cases (2009). The written stress mark is required if a word is stressed on

the last syllable and ends in a vowel, *-n* or *–s*, for example, *café* ('coffee'), *habitación* ('room'), *además* ('in addition'). It is also necessary to write a stress mark upon the penultimate syllable if a word is stressed on the penultimate syllable but ends in a consonant other than *–n* or *–s*, for example *cárcel* ('jail') or *difícil* ('difficult'). In the case of "esdrújulas" or "sobresdrújulas", the word always bears the orthographic stress mark, for example *músico* ('musical') or *rápido* ('quick') or *explícaselo* ('Explain it to her/him.') (Čermák 2009). "In Spanish, the normal and most common stress patterns is for stress to fall on the final syllable of a word if it ends in a consonant and on the penultimate syllable if the final syllable ends in a vowel. Notable exceptions include some inflectional endings (i.e. nominal plural /-s/ and verbal third person plural /-n/, which do not condition stress on the final syllable)" (Guion, Harada & Clark 2004, 211). This claim was supported by the results of an experiment, where Spanish listeners' performance correctness decreased by almost 10% with three-syllabic words that ended in a vowel but were stressed on the final syllable (Altmann 2006).

Based on corpus data, it is concluded that most words (73%) in Spanish end in a vowel (Guion, Harada & Clark 2004). According to Čermák (2009), statistically, words stressed on the penultimate syllable are the most frequent, about 80% of all Spanish words use this stress pattern (2009). This claim is in accordance with Guion, Harada and Clark (2004), they state that "given the regular pattern of Spanish stress in which words ending in a vowel will have penultimate stress, most words of two syllables or more will have penultimate stress" (2004, 211). Hence, according to the statistics, stress in Spanish may be considered regular to a certain extent. The default stress pattern would be that the stressed syllable is the penultimate one and resting 20% are exceptions. According to Peperkamp and her colleagues (2010), "the more numerous the exceptions are, the more advantageous it is to reliably encode stress in the phonological representation" (2010, 424). The existence of lexical exceptions and their frequency in the given language is one of the factors Peperkamp and her colleagues researched in 2010. This prediction was borne out by their test, "at least if predictability is construed as being related to the number of lexical exceptions" (Peperkamp *et al*. 2010, 429).

4.3.2 Non-phonological structure of stress

In Spanish, non-phonological information might play a role in the stress assignment as well. Different syntactic categories seem to be subjects to different rules. In nouns, stress is regularly assigned to the penultimate syllable (*mo´neda* 'coin'), although there are

numerous exceptions (*pájaro* 'bird', *café* 'coffee'). Mark Gibson (2011) explains that when non-verbs are considered "there is a general consensus in the phonological literature that Spanish is a trochaic language, meaning that stress can be described in terms of a disyllabic pattern, known as a foot, in which primary stress falls on the leftmost syllable" (2011, 4). Gibson (2011) claims that 88% of all non-verbs ending in a vowel exhibit paroxytone (trochaic) stress, the most common word final vowels are *–a, –o* (Gibson 2011).

In the category of verbs, stress assignment is rather prescriptive and morphologically generated (Gibson 2011). There is a number of verbal paradigms, certain verbal classes and particular conjugations that decide on the position of stress (e.g. *terminé* 'I finished', *hablé* 'I said' – 1st sg of past simple regularly requires stress on the final syllable) or (*terminábamos* 'we finished', *hablábamos* 'we talked'– 1st pl of imperfectum regularly requires antepenultimate stress).

4.3.3 Syllable structure

In general, syllables in Spanish tend to be open. According to Králová-Kullová (1992) 56.52% of all syllables is CV, 19% of Spanish syllable is CVC, 9.57% is V, 8.34% of syllables is VC, 3.17% is CVV (with diphthong) and 3.06% of syllables have form of CCV (1992, 48). It can be deduced that truly nearly 80% of all Spanish syllables are open.

Since in many Spanish words stress can fall on various syllables, Spanish does not seem to be sensitive to syllable weight. In other words, stress assignment in Spanish is quantity insensitive (Baković 2016). Although, because of its provenance from Latin, the character of Spanish was doubted with respect to the syllable weight-sensitivity (Harris 1983), the evidence was not satisfyingly strong and Spanish keeps the status of quantity insensitive language (e.g. Baković 2016, Gibson 2011).

In an experiment conducted by Guion, Harada and Clark (2004) the effect of Spanish as L1 on Spanish-English bilinguals was proved in both production and perception. Both early and late bilinguals differ from native English speakers in the syllabic structure effect. In both, production and perception, late Spanish-English bilinguals preferred initial stress in bisyllabic non-words. This pattern is in agreement with the most common penultimate stress in Spanish lexicon, hence one may conclude that it might be a transfer effect from L1 (Guion, Harada & Clark 2004, 216-218).

5 My experiments

In the following chapter I describe the experiments that were created as part of this master thesis in order to examine L2 perception. Specifically, I examined the perception of English lexical stress of Czech learners of English as L2. The methodology of the experiment will be described in detail, the results will be analysed and their implications will be provided and discussed.

5.1 Research questions and hypotheses

This thesis will address the following questions: Do Czech learners of English exhibit the difficulty with perceiving stress in L2? In other words, is Dupoux's typology of languages universal and can be applied to any language with similar criteria? Based on the findings of Dupoux and his colleagues (e.g. Dupoux et al. 1997; Dupoux & Peperkamp 2002; Dupoux, Peperkamp, & Vendelin 2010) Czech speakers are expected to show the above mentioned difficulty. On the other hand, as Kijak (2009) argues, lexical stress has a function in Czech, therefore, Czech speakers are more sensitive to this suprasegmental. Alongside, I am also interested if a group of Spanish speakers will have better scores than Czech speakers. Various studies demonstrate that Spanish speakers truly should have better results than speakers of any languages with regular stress (e.g. Dupoux & Peperkamp 2002; Altmann 2006; Peperkamp *et al.* 2010).

Based on the results, I attempt to answer whether stress preferences of Czech subjects correlate with stress pattern of their native language, that is to say, does L1 stress pattern reflect on L2 stress preferences? My hypothesis is that Czech listeners will prefer stress on the first syllable more than on the second or third. In the experiments I expect that stimuli with stress on the first syllable will have higher score of correct responses than stimuli with other stress placement. The group of Spanish listeners of English is expected to exhibit higher score of correct responses in general. Among the preferred stress patterns, Spanish learners of English are expected to prefer stress on the penultimate syllable, since this is the most frequent stress pattern in Spanish when a word ends in a vowel (Čermák 2009).

According to the previous studies the perception of stress in L2 is influenced by the proficiency in L2 or on the age of the first extensive exposure to L2 (Guion, Harada, & Clark 2004). Therefore, another research question in this paper is whether there is a correlation between Czech learners' proficiency in English and their perception of lexical

stress in English. The assumption is based on the fact that the more vocabulary participants know, the more stress patterns they have encountered and hence they would be more sensitive to various stress patterns. Similarly, it is assumed that listeners of English with lower proficiency in English will have worse results than learners of English with higher proficiency, because of the limited amount of vocabulary encountered during their lifetime. On the other hand, Spanish learners of English are expected to have a high score of correct responses independently on the proficiency in English.

Two experiments were conducted in order to examine the importance of the nature of the given task. As described in chapter 2 some authors imply that listeners can be marked as stress "deaf" in one experiment while in other they may have very high score (Schwab & Llisterri 2015). Therefore, two tasks of varying difficulty were employed. An AXB discrimination task during which a lot of memory load must be carried was used as a very demanding task. After this task, the participants were asked to do an identification experiment which is generally considered easy, moreover when only two and three syllable words were used.

Within the AXB task the question I am asking if one of AX and BX combinations will differ in number of correct responses. My hypothesis is that AX combination will be easier for the listeners since, after hearing AX the participants already know the correct answer, while with BX response the participants have to keep 3 items in the short term memory and compare them.

5.2 Experimental background

I mention some findings from the previous studies that were inspirational for me and results of which are relevant to my paper (e.g. Dupoux & Peperkamp 2002; Guion, Harrada, & Clark 2004; Altmann 2006; Peperkamp *et.al.* 2010). The purpose is to compare their findings to results of Czech speakers and to find out if Czech speakers turn out to have the difficulty with perceiving stress. Moreover, I want to examine a small group of Spanish speakers and see if the results differ. My experiment is not a replication of either of the studies mentioned, however I use the same syllable structures and criteria for the creation of the stimuli as Altmann did in her experiment (Altmann 2006).

The results of some previous studies concerned with perception of L2 were criticized because of the use of common real-existing words in the stimulus set. In such cases, it can be assumed that the recognition of stress patterns is influenced by the

familiarity with already known words. It is never clear if the results show what the listeners actually perceived or if it shows the memory of the learners (Archibald 1997). Consequently, the results of identification perception task of Czech learners of English as L2 could be influenced by learners' knowledge as well (Tlolková 2015). Tested words were real words and compounds and moreover they were very frequent expressions (Tlolková 2015). This could influence the surprisingly high score of correct responses. Therefore, in the present experiments, non-existing English words were created in order to prevent such inconveniences. The stimuli were created in compliance with English phonotactic rules, so they look like and sound like possible English words.

It was important for the goals of the experiments to divide the participants according to the level of proficiency in English since, as mentioned in chapter 2, the level of proficiency in L2 might be reflected on the results of perception as well (Schwab & Llisterri 2015). Since the more proficient the participants are in English the more likely they are to have developed better perceptive skills. To that goal speakers of various levels of English proficiency were recruited to participate in the experiments. To objectively measure English language proficiency of the participants a standardized test of English Vocabulary Size (Nation & Beglar 2007) was administered to all participants. It should be mentioned that this test measures receptive skills of the participants only. This particular test was chosen because of it availability online, easy procedure and ability to test all levels of proficiency. Monolingual version of the test was chosen. The participants were presented with relatively context-free vocabulary in a multiple-choice format. The test incorporates items according to the frequency in individual levels based on the British National Corpus (Nation & Beglar 2007). After completing all 14 levels of the vocabulary test, the participants saw the score in number of word classes. They were asked to mark down the number because it was later used in identification of the participants in perception experiments. In the analysis of the results, the correlation between the proficiency in English and success in perception tests was searched for.

In the preparation of the AXB task, findings of previous studies were considered. Dupoux and his colleagues conducted an experiment with ABX task (Dupoux *at al.* 1997). A-responses yielded significantly more errors than B-responses. It was also found out that the subjects were slower on A-responses. They concluded that the judgement of B-responses was probably based on the short-term memory encoding of stress (Dupoux *at al.* 1997). The participants probably hold the stimuli very shortly in their memory and

compared it with the X stimuli. Whereas when judging A-responses, different strategies may be used. With A-responses the participants have to keep the information for a longer time in the memory and keeping track of other stimuli as well (Dupoux *at al.* 1997). Therefore, a different order of the stimuli was used and AXB discrimination test was chosen for the present experiment. Both A and B items were neighbouring with the X sound. Moreover, after each triplet of non-existing words, a beep sound was played in order to prevent clicking on the A button before the whole triplet was played.

5.3 Experiment 1 – AXB discrimination task

AXB discrimination task involving stress contrast was created for the experiment. Subjects of the experiments were presented with three items. The items were all three syllabic non-existing words consisting of open syllables only. In each trial, the second item X had the same stress pattern as either A or B. The participants were supposed to click on the button A if they perceive the stress pattern of X similar to the preceding word, and B if they perceive X to have the same stress pattern as the following word.

5.3.1 Method

5.3.1.1 Stimulus set

For the discrimination task, three syllable non-existing English words were used. The stimuli participants heard in each trial were each recorded by a different native speaker of English. They were never presented with A, B and X being recorded by one person not to rely on one specific voice as a cue for perception of stress.

5.3.1.1.1 Three syllabic non-words

Twelve three syllabic items were created for the stimulus set. The items were created in accordance with English phonotactic rules. I decided to use some of the syllabic patterns of three syllabic non-words as Altmann (2006) did in her experiment. The syllable structures are available in Table 3.

1st syllable stress	**2nd syllable stress**	**3rd syllable stress**
CV-Cə-CV	**Cə- CV-CV**	**CV-Cə-CV**
CVG-Cə-CV	**Cə-CVG-CV**	**CVG-Cə-CV**
CV-Cə-CVG	**Cə-CV-CVG**	**CV-Cə-CVG**
CV-Cə-CVG	**Cə-CV-CVG**	**CV-Cə-CVG**

Table 3: Altmann's syllabic structures of three syllabic words used in the present experiment

These patterns were chosen because it allows the non-existing words being segmentally the same, differing only in stress placement. One pattern was excluded for time-saving reasons as well as for rather low frequency of English words with structure Cə- CV-CV.

Twelve non-existing English words were then combined into triplets. In each triplet two non-words had the same stress pattern. In total, 144 stimulus triplets were used, 72 of them being AX, 72 of them BX. Within AX stimuli, 24 of them were stressed on the first syllable, 24 triplets on the second and 24 were stressed on the third syllable. The same applies to BX stimuli. A complete list of three syllabic non-existing English words created together with their syllabic structure and example word is available in section Appendices.

5.3.1.2 The criteria for the construction of stimuli

I decided to use the same criteria as Altmann did in her experiment (2006). Each word consisted of three syllables. The syllables used were only open syllables; they were never closed by a consonantal segment. There are restrictions in consonant clusters in English syllable, therefore only open syllables were chosen. Syllables containing lax vowels are indicated CV, syllables containing schwa Cə, heavy syllables either contained tense vowel signalled CV or a diphthong signalled CVG. In neither of the words two schwas appeared in one word. Furthermore, three syllabic patterns with two diphthongs were excluded for their unnaturalness and rather low frequency in English. The words were created to appear to be monomorphemic, without any prefix or suffix (Altmann 2006).

Hence non-existing words of the following syllable patterns were created, exemplar real English words were found in order to help the native speakers with the recording. The stress pattern was easier to simulate after the real word was pronounced. The list of all words used is available in section Appendices.

5.3.1.2.1 Recording of stimuli

The stimuli were recorded by three native speakers of English. All of them men, aged 24, 24, 55. One speaker was from Canada; the two other native speakers were from England. They were informed in advance about the purpose of the experiment. They were sent the table of non-existing words in advance so they could practise the pronunciation and the stress patterns. They were instructed that the words should have English stress, however, the realization should be natural, not exaggerated. Each speaker recorded stimuli individually, each item was recorded more than twice by each native speaker. The

recording took place in Audio-visual studio in Zbrojnice. All the sounds were recorded on H4next Handy Recorder in sound attenuated room. The participants were asked to read the non-existing words in isolation as well as in a phrase *Now I say*.

The recorded streams of non-words were then cut in Praat (Boersma & Weenink, 2018). The sounds used in the experiment were then adjusted to the standard intensity value of 70dB SPL. The actual experiment was also created in Praat (Boersma & Weenink, 2018). Multiple Forced Choice Experiment in Praat was used since the scripts of the programme allow easy adjustments for the goals of the experiments. This program was also chosen because of the fact that some participants were already familiar with Praat software and therefore the testing was easier.

5.3.1.3 Participants

The participants who took part in the experiment were all between 21 and 34 years old. They all took part in the experiment voluntarily without any financial benefit. The participants were of various proficiency levels in English, therefore they were asked to do a vocabulary size test online before the actual perception testing started.

The total number of Czech listeners of English taking part in the experiment was 33. Nine of the participants were males, 24 females. Because of various proficiency levels of the Czech participants, the task was explained to them in Czech, so everybody understood the procedure of the task. They were explained that the purpose of the experiment is to map the perception of Czech learners of English. They all understood that the experiment is targeted to stress.

A small group of six Spanish learners of English took part in the experiment as well. Five of the participants were males, one participant was female. As explained in the theoretical part of the thesis, they usually serve as a control group in the perception experiments. All Spanish subjects were between 24 and 34 years old, neither of them has lived in an English speaking country more than 6 months. Half of the Spanish listeners who took part in the experiment was instructed orally since we met personally, the other half was instructed via email with the instructions in Spanish. The experiment was also adjusted to Spanish, so they had the same conditions as Czech learners of English.

5.3.1.3.1 Baseline data

One native speaker of English was asked to control the data. The native speaker was male, originally from England, currently living in the Czech Republic. He was instructed via

email with the instructions in English. He did the experiment on his personal computer with headphones and sent the results back via email.

5.3.2 Procedure

All the participants did the experiment on individual computers with headphones in a silent room. Czech participants who were tested as a group in a classroom at UPOL were instructed orally in Czech about the procedure of the experiment. The subjects who did the experiments on their own were instructed via email also with the instructions in Czech. The participants were instructed to pay attention to the stress pattern of the non-existing words. They were explained that they were going to listen to three non-existing English words. Their task was to decide whether the stress pattern of the second word, so called X, was more similar to the preceding word A or to the following word B. After hearing a beep sound they were required to press the button A or B whether X was similar to the preceding word or to following word, respectively. The participants were familiar with one-time option of replay. The screen the participants saw is in the *Figure* 1: *Screen during AXB discrimination task*. They were instructed that first there was a practise test, after that they would be instructed to click to proceed to the actual experiment. After completing the first half of the AXB test, there was a notice on the screen to have a break. During the break, they were given a link to funny videos or they could go for a coffee, walk or just relieve their eyes and ears. When they were ready to continue, they clicked on the screen and the test continued. During the test no feedback was given to the participants.

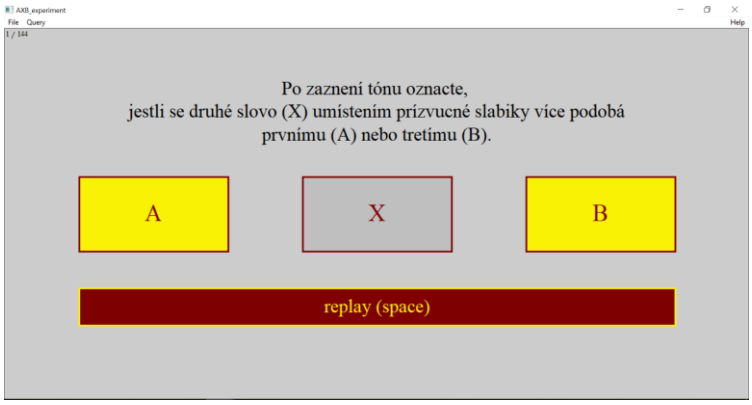

Figure 1: Screen during AXB discrimination task

After the experiment the results were saved as tab-separated file, collected from all participants and evaluated.

5.3.3 Analysis

In order to compare all the obtained data, a table of results was made. The correct response percentage as well as error response percentage was generated at every participant. Each participant was identified with his/her Vocabulary score in order to be able to examine the correlation. The errors where further subdivided into subcategories A-errors, B-errors. The errors were also organized according to the syllable on which the stress was situated to be able to conclude if there are tendencies of L1 transport in L2 perception.

5.3.4 Results

One participant was excluded from the final data analysis, since she probably did an old version of an experiment available to her and which differed from the experiment presented here. After the removal of her data, 32 Czech listeners of English was a total number of participants.

From the final results it is observable that the overall percentage of Czech participants is 77.6% of correct responses. The error rate is then 22.4% of incorrect responses. The Spanish participants truly scored better than Czech participants, their overall percentage of correct responses is 87.73% of correct responses. Spanish overall error rate is 12.27%. Comparing the percentages of errors in stress assignment by the Czech listeners of all vocabulary sizes and Spanish listeners, there was not a significant difference found p=0.996.

However, the group of Czech participants is very variable, therefore only the results of Czech speakers of comparable Vocabulary size were considered. T-test for independent means was conducted. The results just miss the 0.5 significance indicating that Spanish speakers show the tendency towards better results in perception of English lexical stress (p=0.059). Nevertheless, even within the group of Czech speakers with comparable vocabulary size test score there is too much variation; standard deviation of Czech speakers is 14.47, while standard variation of Spanish participant is 3.798. See *Figure* 2.

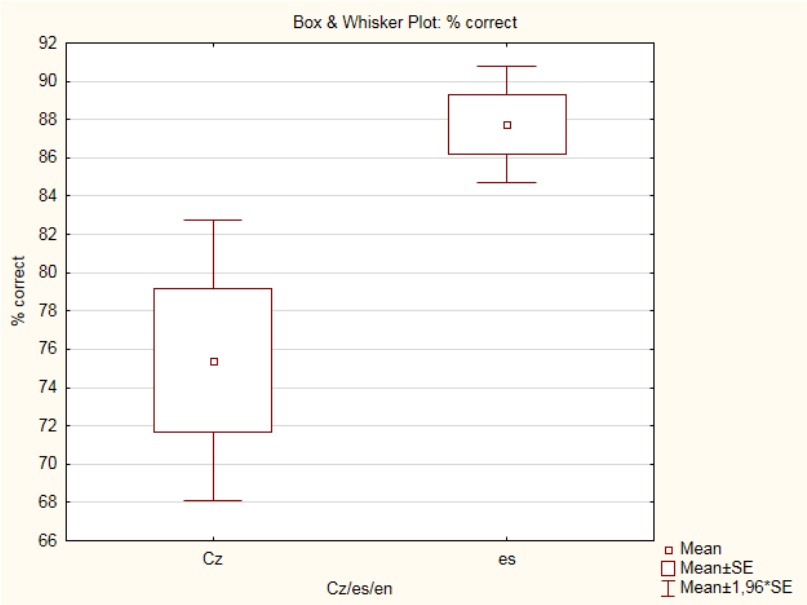

Figure 2: Boxplots of the percentage of correct responses of Czech listeners and Spanish listeners of English with comparable vocabulary size.

Within the group of Czech and Spanish learners of English with a similar vocabulary size score errors were analysed. An independent sample t- test was conducted to compare percentages of errors in stress assignment by the Czech listeners and Spanish listeners. There was a near significant difference between the Czech mean percentage of errors (M= 24.6%, std. 14.43) and Spanish mean percentage of errors (M =12.3, std. 3.8); t (19) = 2.03, p = 0.057. See *Figure* 3.

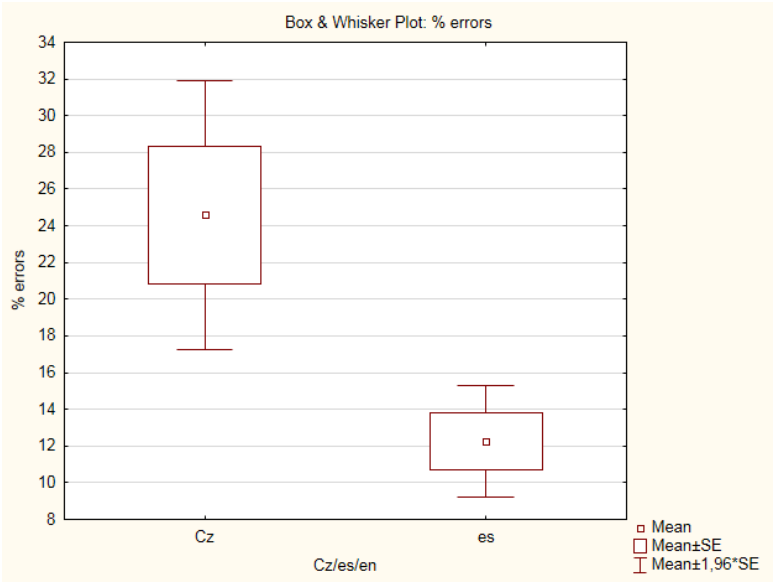

Figure 3: Boxplots of the percentage of error responses of Czech listeners and Spanish listeners of English with comparable vocabulary size.

The correlation between the proficiency in English and perceptual skills brought interesting results. After removing the data of one participant for the above mentioned reasons, the weak correlation between the level of proficiency in English and the success in the perception task became non-significant.

Analysing the error tendencies of the two languages, the influence was confirmed in both Czech listeners' results and Spanish listeners' results. The words were subdivided into 3 groups of stress on the first, second and third syllable to see the tendencies of errors. Within the group of Czech listeners of English, the smallest number of errors was detected in the category of non-words with stress on the first syllable (see Table 4) which is the default stress pattern in Czech, hence an influence of L1 is truly spotted.

Stressed syllable	**1st**	**2nd**	**3rd**
errors	308	386	339
correct	1228	1150	1197
total	1536	1536	1536

Table 4: Distribution of stress in the stimuli with number of errors, correct responses and total number of responses of Czech listeners of English

Chi-square test was calculated comparing the frequency of stress placement errors in stress on the first, on the second and on the third syllable. The result turned out to be significant $\chi 2\ (2) = 11.55$, $p < .01$.

The error tendencies were also examined at Spanish participants of the listening experiment. As it was hypothesized based on the most frequent Spanish stress pattern, Spanish listeners of English lexical stress had the smallest number of errors on the penultimate syllable (see Table 5). Chi-square test was calculated also with the results of Spanish listeners comparing the frequency of stress placement errors in stress on the first syllable, on the second and on the third. The result turned out to be significant $\chi 2\ (2) = 38.86$, $p < .0001$.

Stressed syllable	**1st**	**2nd**	**3rd**
errors	59	10	37
correct	229	278	251
total	288	288	288

Table 5: Distribution of stress in the stimuli with number of errors, correct responses and total number of responses of Spanish listeners of English

Further on, the results confirm that in AXB, the AX responses have more correct responses. Based on the data from the group of Czech listeners of English it can be assumed that AX responses were easier than BX responses. Chi-square test was calculated and the difference was significant at $p < .0001$. Moreover, taking AX responses and BX responses separately, in AX stimuli stress on the first is easier both compared to stress on the second and on the third syllable. Interestingly, in BX responses, stress on the first syllable turned out to be easier only compared to the words with stress on the second syllable, not to words with stress on the third syllable.

Surprisingly, this effect was not found among the results of Spanish listeners of English. Spanish listeners did not make less mistakes in AX responses than in BX responses. Chi square test was calculated and the difference was not found significant $p=0.7518$.

5.4 Experiment 2 – Identification task

This experiment was employed to examine whether Czech learners of English perceive stress when no demanding memory load operations are required. Even though an identification experiment with Czech learners of English was already conducted as part of my bachelor thesis (Tlolková 2015), I decided to conduct a new one. In the present experiment, as explained above, only non-existing English words were used. To create an English-like environment, the non-words are not said in isolation but in an English phrase *Now I say* _____, so the participants consider the presented words as English words. This task was used since it is easier task than AXB discrimination experiment and therefore can show different results and eliminate other problems like using a short term memory when listening to three items in one stimulus.

5.4.1 Method

5.4.1.1 Stimulus set

I used the same set of three syllabic stimuli for both experiments. However, in an identification task, there was a set of bisyllabic non-existing words added.

5.4.1.1.1 Bisyllabic non-words

I decided to use some of the bisyllabic structures that were used in Altmann's dissertation (2006). The structures were chosen because in the pair of bisyllabic words of the same syllabic structure, they allow the words to be segmentally the same but different only in

the position of stress. Structures that do not allow stress on both, the first and the second syllable, were excluded. The syllabic structures that were used in the present experiment are available in Table 6. A complete list of bisyllabic non-existing English words created together with their syllabic structure and example word is available in section Appendices. The total number of stimuli created for the identification task was 28, 12 three syllabic words and 16 bisyllabic words. The stimuli were replicated therefore the participants heard each item twice in randomized order.

1st syllable stress	**2nd syllable stress**
ˊCV – C<u>V</u>	CV - ˊC<u>V</u>
ˊCV - CVG	CV - ˊCVG
ˊC<u>V</u> - Cə	Cə - ˊC<u>V</u>
ˊC<u>V</u> – C<u>V</u>	C<u>V</u> – ˊC<u>V</u>
ˊC<u>V</u> - CVG	CVG – ˊC<u>V</u>
ˊCVG - Cə	Cə - ˊCVG
ˊCVG – C<u>V</u>	C<u>V</u> - ˊCVG
ˊCVG - CVG	CVG - ˊCVG

Table 6: Altmann's syllabic structures for bisyllabic words used in the present experiment

5.4.1.1.2 Three syllabic non-words

For the identification task the same set of three syllabic non-existing English words was used as in the AXB discrimination task. For more detail see 5.3.1.1.1.

5.4.1.2 The Criteria for the construction of stimuli

For the identification task, the same criteria for the construction of stimuli were used as for the previous experiment, for more detail see 5.3.1.2.

5.4.1.2.1 Recording of stimuli

The stimuli for both experiments were recorded at once with three native speakers of English in Audio-visual studio in Zbrojnice. For more detail see 5.3.1.2.1.

5.4.1.3 Participants

The same participants took part in the identification task as in the AXB discrimination task, data of 32 Czech listeners of English and 6 Spanish listeners of English were then analysed.

5.4.1.3.1 Baseline data

The same native speaker of British English as in the previous AXB discrimination experiment controlled the data in this experiment.

5.4.2 Procedure

All the participants did the identification test on a personal computer with headphones in a silent room. The participants who took part in the experiment in a bigger group in a computer classroom at UPOL were instructed orally in Czech. The participants who did the experiment at home at their personal computers were instructed via email, the instructions were also in Czech. The subjects of the experiment were explained that the purpose of the experiment is to map the perception of English stress of Czech learners of English as L2. They were said that in each trial they would hear a phrase *Now I say* _____. They were explained that the word after the phrase *Now I say*_____ is a non-existing English word. They were asked to listen to two and three syllabic non-existing words and to mark the syllable they perceive as the most prominent within the word by clicking on the relevant button with a number 1, 2, 3. Only relevant number of buttons was visible in each trial, two buttons for bisyllabic words, three buttons for three syllabic words. In this experiment, there was no option of replay or of a pause. The participants were not given any feedback during the testing. After the experiment, the results were saved as tab-separated file, collected and analysed.

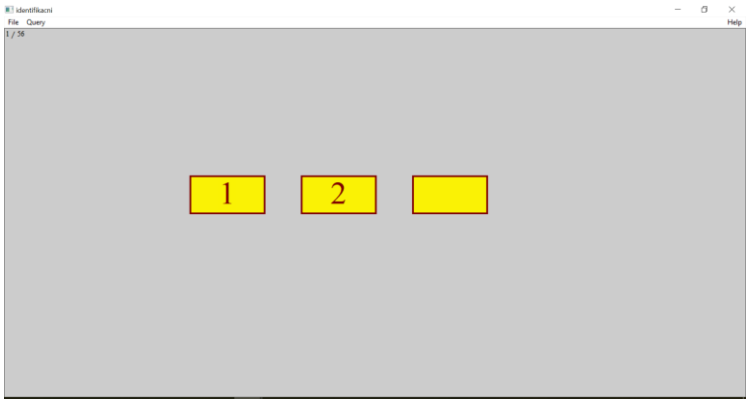

Figure 4: Screen during the identification task for a bisyllabic word.

5.4.3 Analysis

In order to compare all the obtained data, a table of results was made. The correct response percentage as well as error response percentage was generated at every participant. Each participant was identified with his/her Vocabulary score in order to be able to examine the correlation. The errors where further subdivided into subcategories bisyllabic word

and three-syllabic words. The errors were also organized according to the syllable on which the stress was situated to be able to conclude if there are tendencies of L1 transport in L2 perception.

5.4.4 Results

From the final results it is observable that the overall percentage of the Czech participants of the identification task is 86.94% of correct responses. The overall error rate is then 13.06% of incorrect responses. The Spanish participants again scored better than the Czech participants in identifying the stressed syllable, their overall percentage of correct responses is 91.67% of correct responses. Spanish overall error rate is 8.33%. Comparing the percentages of errors in stress assignment by the Czech listeners of all vocabulary sizes and Spanish listeners, there was not a significant difference p=0.43.

Analysing the error tendencies of the two languages, again the influence of L1 was confirmed in both Czech listeners' results and Spanish listeners' results. The words were subdivided into 3 groups of stress on the first, second and third syllable to see the distribution of errors in words with a particular stress. The number of stimuli with stress on the third syllable differs from the number of stimuli with stress on the first syllable and the second syllable, therefore the percentage of errors within the particular group was generated. Within the group of Czech listeners of English, the smallest number of errors was detected in the category of non-words with stress on the first syllable (see Table 7) which is the default stress pattern in Czech, hence the influence of L1 is spotted again. In this task, the errors on the first syllable did not differ significantly from the errors in the stimuli stressed on the second and third syllable (p=0.24).

Stressed syllable	**1st**	**2nd**	**3rd**
errors	83	101	49
correct	685	667	207
total	768	768	256
% of errors	10.81	13.15	19.14

Table 7: Distribution of stress in the stimuli with number of errors, correct responses, total number of responses and percentage of errors within the type of stress of Czech listeners of English

The same analysis was done with the data of Spanish listeners of English (see Table 8). Based on the analysis of errors it is visible that the Spanish speakers made the smallest percentage of errors on the words stressed on the second syllable, which again correlates

with the most frequent Spanish stress pattern. They were wrong in only 4.167% of the words stressed on the second syllable. However, chi-square test did not show a significant difference between the three groups of words stressed on the first syllable, second and third (p=0.325).

Stressed syllable	**1st**	**2nd**	**3rd**
errors	15	6	6
correct	129	138	42
total	144	144	48
% of errors	10.42	4.167	12.5

Table 8 Distribution of stress in the stimuli with number of errors, correct responses, total number of responses and percentage of errors within the type of stress of Spanish listeners of English

The stimuli were subdivided into two categories of bisyllabic and three-syllabic words. The errors in the categories were analysed. Czech speakers made a mistake in bisyllabic non-existing words in 10.45% of cases, while in three-syllabic non-existing words in 16.15% of cases. Chi-square test was calculated and the difference was significant at p=< .0005. The same was procedure was applied to analysing the data of the Spanish listeners of English. The results revealed that the Spanish speakers made less mistakes in bisyllabic non-existing words with the percentage of errors 5.73% than in three syllabic non-existing words with the error rate 11.8%. Again, chi-square test was calculated but the difference did not turn out to be significant at p=0.07.

5.5 Discussion

The results of the conducted experiments showed that Czech speakers truly have more difficulties with perceiving stress in English words that Spanish listeners. These results correspond to the data of reviewed studies in the theoretical part of the paper (e.g. Dupoux *et al*. 1997; Dupoux & Peperkamp 2002; Skoruppa *et al*. 2009). Comparing the results of the two experiments, Czech listeners had more difficulties with hearing stress in the AXB discrimination task than in the identification experiment. Submitting the data to chi-square test, the difference of errors in the two experiments turned out to be significant (p=<.0001).

Nevertheless, it is impossible to state whether the Czech listeners of English exhibit stress "deafness" in the sense Dupoux and his colleagues use the terms (e.g. Dupoux *et al*. 1997; Dupoux & Peperkamp 2002). They use stress "deafness" index which

is a difference between the mean percentage of errors made in stimuli with stress contrast minus the mean percentage of errors made in the phoneme contrast (Dupoux & Peperkamp 2002). Considering the experiments conducted as part of this master thesis did not incorporate the stimuli differing in the phonemic contrast, only the percentage of errors made with stimuli differing in stress can be compared. The percentage of errors varies according to the task, in ABX discrimination task French listeners had 20% of incorrect responses, while in AX task the percentage of errors was only 3.2% (Dupoux *et al.* 1997). In short term memory sequence repetition task the error rate of French participants was 43.2%, when phonetic variability was added to the stimuli the error rate ranged between 24.4% and 76.7% of incorrect responses depending on the type of variability added (Dupoux, Peperkamp, & Sebastián-Gallés 2001). Hence in the literature there is not a universal percentage of errors that defines the degrees of stress "deafness" in general.

It is difficult to compare this number to the results of one particular experiment since none of the experiments used the same type of task. Dupoux and his colleagues (1997) used ABX discrimination task in which French speakers had around 20% of incorrect responses (Dupoux *et al*. 1997). The fact they found striking was that there was a significant difference between French and Spanish speakers who had only 4 % of incorrect responses. Interestingly, in the present AXB task, the overall Czech speakers' error rate was 22.4% in AXB discrimination task, while Spanish speakers had 12.27% of incorrect responses. Although the numbers differ, comparing the percentages of errors in stress assignment by the Czech listeners of all vocabulary sizes and Spanish listeners, the difference is not significant p=0.996. Considering that the percentage of errors of Spanish listeners is three times bigger than in Dupoux's experiment (Dupoux *et al*. 1997), it can be concluded that one of the factors that influenced the score was the difficulty of the task. Various participants gave me the feedback that they found the task very was difficult. On the other hand, the task was of the same difficulty for both groups of speakers, hence one can assume that with easier task the percentage of errors would decrease in both groups. Therefore, I claim that Czech speakers would have a lower score of error responses or in other words, would not show such a difficulty with perceiving stress as typologically similar French or Finnish speakers if they were asked to do the same task. In my opinion, the Czech speakers are more sensitive to stress, even though we do not use it in the language contrastively. I agree with Kijak (2009) that Czech lexical

stress has some function in the language and therefore, Czech speakers are not so indifferent to stress as for example French speakers (Kijak 2009). The delimitative function of stress is important for Czech speakers and the lack of this function in English is one of the factors that make comprehension to English utterance complicated for some Czech learners, in my opinion.

More detailed data from AXB discrimination task was supplied. The group of Czech listeners had too much variability in their responses, therefore for some analysis only the speakers of comparable vocabulary score were compared to Spanish speakers. The difference of percentages of errors between these two groups was near significant $p = 0.057$ in AXB task.

However, the overall correlation between the level of proficiency and the perception skills was not found. The lack of this correlation was very surprising to me. One would expect that the bigger vocabulary the participants have the more stress patterns they have encountered during their experience with English and the more successful they would be in the perception tasks. No matter how unexpected these results are, they correspond to the results acquired by Dupoux and his colleagues (Dupoux *et al.* 2007). They found out that there was no significant improvement of advanced learners, they did not score significantly higher than beginners. They concluded that stress "deafness" of French speakers emerges as a robust processing limitation that does not seem to be eliminated with an extensive exposure or practise (Dupoux *et al.* 2007).

Doubtlessly, there exists an option that the vocabulary test does not provide a true image of the reality of the participants' vocabulary size since the participants could guess the correct answer and artificially improve their score. Therefore, they would naturally have lower vocabulary score and the results would be different.

The factor I definitely find relevant for the success in the perception test is having so called "ear for music". In AXB discrimination task, out of 9 participants scoring above 90% of correct responses, three of them are very musical and play various musical instruments. I reckon that this could have an impact on the perception of lexical stress. Five other Czech participants scoring above 90% were all students of English Masters' Degree programme at Palacký University. Overall success of the subjects who study English Philology at Palacký University and thus have certain awareness of phonetics and

phonology is 90.77%. Furthermore, it is assumed that they are more trained for similar perception tasks than the respondents from the general public.

Looking at the analysis of AXB discrimination task, AX responses was easier for Czech listeners than BX response. It is a logical consequence of the order of the stimuli. After hearing the A and X item the participants already knew the correct answer. While when the correct answer was B, they had to recall the previous items. The items were difficult to recall given that they were made up words and they did not see the word on the screen. The participants relied on the short term memory of the sound only.

Based on the error tendencies in both experiments, it is assumed that L1 truly reflects on L2 perception. As it was indicated in various studies, speakers of stress languages exhibit patterned behaviour in L2 stress perception (Yu & Andruski 2009). The pattern is usually the reflection of the pattern present in mother tongue. This was supported by the lowest error rate of the words stressed on the first syllable in the group of Czech listeners of English, which is Czech stress pattern. It was further supported by the lowest error rate of the words stressed on the penultimate syllable in the case of Spanish listeners of English which is the most common stress pattern in Spanish non-verb words.

Undoubtedly, higher number of errors in words stressed on the second and third syllable during the AXB discrimination task could be caused by the listeners' difficulty to syllabify the given words. With non-words with initial stress, the participants did not have to divide the words, this could play a role. In the identification task, the tendencies towards L1 stress pattern were also noted, though the differences were not significant.

Analysing the stimuli in the identification task, the bisyllabic non-existing words reached smaller percentage or errors than three syllabic stimuli. The difference within the group of Czech speakers was significant, while in the group of Spanish listeners it was not. The results could be again influenced by the syllabification problems that occur with longer words.

Comparing the data from the two experiments, especially the error rate, it only proves that the type of the task is reflected on the percentage of correct responses. A universal test should be created and speakers of various languages should be examined in order to define the percentage of incorrect responses in the given test to mark speakers of particular language as stress "deaf".

6 Conclusion

To conclude, the topic of this master thesis was aimed to the perception of English lexical stress by Czech learners of English.

In the first part of the paper relevant literature was reviewed. Based on the literature the research questions were formulated. To examine the perception of Czech speakers two experiments were conducted with a group of 32 Czech speakers and a small group of 6 Spanish learners of English. All the participants were instructed in their native languages. They were asked to participate since in various studies (e.g. Dupoux & Peperkamp 2002; Peperkamp, Vendelin, & Dupoux 2010) Spanish speakers had the highest score of correct responses. The speakers were first asked to do a vocabulary size test online (Nation & Beglar 2007). A possible correlation of the proficiency in English and success rate in the perception tasks was searched for. Two methods were used in this thesis. The first method was an AXB discrimination experiment. The design of the experiment was Multiple Forced Choice Experiment conducted in Praat (Boersma & Weenink 2018) with the stimuli recorded with three native speakers in Audio-visual studio in Zbrojnice on H4next Handy Recorder in a sound attenuated room. The participants were instructed that in each trial, the second item X had the same stress pattern as either A or B. They were supposed to click on the button A if they perceive the stress pattern of X similar to the preceding word, and B if they perceive X having the same stress pattern as the following word.

The result of the experiment revealed that Czech speakers truly had more difficulties with perceiving stress in English non-existing words than Spanish speakers although the difference was not significant. Even though there was not found a correlation between the proficiency in English and the perception of stress, a group of Czech speakers with similar vocabulary score was compared to Spanish speakers and the difference between the two groups reached near significance. In both, Czech and Spanish data, there was a L1 influence. Czech speakers had the lowest error percentage on the stimuli with stress on the first syllable, which correlates with Czech stress pattern. Similarly, Spanish speakers had the lowest error rate on the stimuli with stress on the penultimate syllable which again correlated with the most frequent Spanish stress pattern. Analysing AX and BX responses, AX responses were more successful than BX responses, which had been expected. Also within these subcategories, the L1 tendencies were observed. It is impossible to state whether Czech speakers exhibit stress “deafness” in Dupoux’s sense

(Dupoux *et al*. 1997), however it can be concluded that although Czech speakers truly had certain difficulties, they were undeniably partially caused by the difficulty of the task. This assumption is also supported by higher percentage of error responses of Spanish speakers than reported in other studies (e.g. Dupoux & Peperkamp 2002; Peperkamp, Vendelin, & Dupoux 2010).

The second method used in the practical part of this master thesis was the Identification task. Again the design of the experiment was Multiple Forced Choice Experiment conducted in Praat (Boersma & Weenink 2018) with the stimuli recorded with three native speakers in Audio-visual studio in Zbrojnice on H4next Handy Recorder in a sound attenuated room. In this task two- and three-syllabic non-existing words were used. The participants were supposed to listen to the non-word after the phrase *Now I say*___ and mark the most prominent syllable by clicking on the relevant button with 1 (stress on the first syllable), 2 (stress on the second syllable) and 3 (stress on the third syllable). The analysis revealed that the error percentage is smaller in the group of both Czech listeners and Spanish listeners. In this task Czech listeners scored nearly 87% of correct responses which can hardly ever be interpreted as stress "deafness". Again, the influence of L1 was indicated in the results, Czech speakers had the smallest score of errors on the stimuli with stress on the first syllable, while Spanish speakers on the stimuli with stress on the second syllable. In general, more errors were recorded on the three-syllabic stimuli compared to bisyllabic stimuli in both language groups.

Comparing the data of the two experiments, it is sure, that the difficulties with perceiving stress depend also on the nature of the experiment. AXB was intentionally incorporated as generally demanding task, while identification task is considered easy especially when only two- and three-syllable words are used. Czech speakers proved no to have such a difficulty with perceiving lexical stress in English in the identification task. From the data of both experiments one can conclude that Spanish speakers are truly more sensitive to the lexical stress in English because of the nature of stress in Spanish.

7 Resumé

Cílem této magisterské diplomové práce je prozkoumat, jestli Češi vnímají slovní přízvuk (důraz) v angličtině. Přízvuk (důraz) patří společně s délkou, tónem a intonací mezi suprasegmentální jevy řeči. Suprasegmentální jevy jsou jevy, které se rozpínají na více než jeden segment řeči (Ladefoged & Johnson 2011)[1]. Přízvuk je relativní míra síly, kterou mluvčí vyvine na různé slabiky v promluvě. Dává tak slabice určitou prominenci, tím pádem i slovu, ve kterém se slabika nachází, a zároveň tak pomáhá zabránit monotónní řeči (Kingdon 1965).

Obecně lze říci, že ve fonologii druhého jazyka se suprasegmentálním jevům nedostává tolik pozornosti jako segmentálním jevům. Mnohé studie ukázaly, že lidé učící se druhý jazyk (dále pouze L2) mají značné problémy s fonologickým kontrastem, který ale není používaný v jejich mateřském jazyce (dále jen L1) (Peperkamp, Vendelin, & Dupoux 2010). Češi učící se angličtinu jako L2 mají problémy rozlišit některé anglické samohlásky např. [træp]- [dres], protože repertoár českých samohlásek nezahrnuje takovýto kontrast (Šimáčková 2003). Proto se pokusy věnující se percepci v cizím jazyce zaměřují především na rozlišení minimálních párů, které se liší segmentálně, například pouze jednou slabikou, nebo v případě souhláskového kontrastu například ve znělosti konsonanty. Nicméně, stejně tak, jak se liší repertoár fonémů v různých jazycích, stejně tak se liší i suprasegmentální vlastnosti jednotlivých jazyků (Yu & Andruski 2009). Tak jako každý jazyk má své specifické segmenty, stejně tak má i své suprasegmentální specifikace (Yu & Andruski 2009). Z toho vyplývá, že při učení cizího jazyka nejsou důležité pouze jeho segmentální rozlišnosti, ale také prozodické charakteristiky daného jazyka.

Prozodické prvky se zdají být opomíjené při učení L2 (Boula de Mareüil & Vieru-Dimulescu 2006). Mluvčí většinou pouze aplikují prozodický systém svého L1 do L2, a tak vzniká řeč s cizím přízvukem, jinak řečeno, řeč lišící se znatelně od řeči rodilého mluvčího. Jsou popsány pokusy, které se snaží kategorizovat výslovností chyby, které způsobují tuto akcentovanou řeč a vytvořit tak jakousi hierarchii chyb, nicméně žádného závěru zatím nebylo dosaženo. Někteří odborníci našli důkaz, že prozodické změny jsou závažnější než ty segmentální. Na druhou stranu, jiní odborníci argumentují, že segmentální chyby mají mnohem závažnější dopad na porozumění (Munro & Derwing

[1] Většina literatury zmíněná v sekci Resumé je psána v anglickém originále.

1995). Nicméně, z pokusů provedených se španělskými a italskými mluvčími vyplývá, že pro identifikaci cizího přízvuku se zdá být prozodie mnohem spolehlivější než artikulace fonémů. Zjištění, že díky pouhému střetu segmentálních a suprasegmentálních jevů nebyli posluchači schopni identifikovat mateřský jazyk mluvčího, zpochybňuje mnohými uznávaný názor, že suprasegmentální jevy hrají v učení druhého jazyka až vedlejší roli (Boula de Mareüil & Vieru-Dimulescu 2006).

Téma této diplomové práce bylo vytvořeno na základě výsledků dlouhodobé výzkumné činnosti Dupouxa a jeho kolegů (např. Dupoux *et al.* 1997; Dupoux, Peperkamp, & Sebastián-Gallés 2001; Dupoux & Peperkamp 2002; Dupoux *et al.* 2007; Peperkamp, Vendelin, & Dupoux 2010). Tito odborníci provedli sérii pokusů, jejichž výsledky ukazují, že mluvčí některých jazyků mají problém s percepcí slovního důrazu ve slovech, které se liší pouze tímto důrazem. Jejich experimenty zahrnovaly množství mluvčích různých jazyků, protože na základě poznatků o různých jazycích chtěli vyzkoumat, jestli mluvčí různých L1 vykazují problémy se slyšením slovního důrazu do různé míry.

Jev zvaný „stress deafness“[2] by se mohl projevit také u Čechů, vzhledem k tomu, že čeština patří mezi jazyky s velmi striktně definovaným umístěním přízvuku (Palková 1994). U Čechů se očekává, že budou vykazovat podobné obtíže s rozlišením slov lišících se pouhým umístěním důrazu (Dupoux & Peperkamp 2002). Nicméně, z výsledků pokusu provedeného jako součást mé bakalářské práce vyplývá, že Češi neměli problém s percepcí přízvuku, větší problém měli při přisuzování přízvuku na základě vlastní intuice nebo paměti (Tlolková 2015). Jinými slovy, výsledky nasvědčují tomu, že Češi důraz slyší, jen si ho nepamatují jako součást slova při učení. Tato nesrovnalost výsledků mého pokusu (Tlolková 2015) a pokusů výše zmíněných (Dupoux & Peperkamp 2002) o jazycích s nekontrastním pravidelně umístěným důrazem je základem pro tuto magisterskou práci.

V této diplomové práci rozšiřuji své dosavadní poznatky o slyšení a neslyšení přízvuku u českých posluchačů angličtiny jako cizího jazyka. Cílem této práce je prozkoumat jejich percepční dovednosti a to u širšího vzorku posluchačů než v roce 2015.

[2] Pro lepší srozumitelnost (a nešikovnost českého překladu) nechávám termín stress „deafness“ v anglickém originále.

Z různých zdrojů vyplývá, že by mohla existovat korelace mezi dosavadní znalostí angličtiny a percepční úspěšností (Schwab & Llisterri 2015).

Práce je rozdělena do dvou částí. První část slouží jako teoretické pozadí. V této části popisuji poznatky týkající se percepce přízvuku, jev „stress deafness“, dále pak se věnuji osvojování si mateřského jazyka a jak se L1 projevuje na učení L2. Stručně jsou zde popsány i modely, které slouží k popisu jazyků podle slovního důrazu. V této části se objevují i kapitoly věnující se ústřednímu suprasegmentálnímu jevu a tím je přízvuk (důraz). Tento jev má svá specifika v jednotlivých jazycích, proto je zde popsán jednotlivě v angličtině, češtině a španělštině.

Druhá část této diplomové práce je praktická část. Jsou zde popsány výzkumné otázky a pokusy, pomocí kterých se snažím na výzkumné otázky odpovědět. Jako součást této práce byly provedeny dva pokusy s cílem prozkoumat percepci Čechů na příkladech neexistujících anglických slov. Byla analyzována data 32 Čechů a 6 Španělů, 1 rodilý mluvčí angličtiny se účastnil jako kontrolní subjekt.

Jednou z výzkumných otázek byla i korelace mezi jazykovou znalostí a percepčními dovednostmi. Proto byli všichni účastnici požádáni, aby vyplnili test měřící jejich slovní zásobu (Nation & Beglar 2007). Po vyplnění testu se přistoupilo k samotným percepčním experimentům. První experiment byl tzv. AXB diskriminační experiment, kdy posluchači slyšeli trojici neexistujících slov a měli rozhodnout, zda se druhé slovo (X) umístěním přízvučné slabiky podobá více předcházejícímu slovu (A) nebo následujícímu slovu (B). Jako druhý experiment byl proveden identifikační test, kde úkolem posluchačů bylo poslouchat dvoj- a troj- slabičná slova a rozhodnout, na které slabice slyší důraz.

Z výsledků pokusů vyplývá, že Češi skutečně měli jisté obtíže se slyšením důrazu v anglických slovech, ale spíše v návaznosti na typ pokusu. Prokázalo se, že Španělé měli skutečně vyšší celkovou úspěšnost v obou percepčních testech. Dále pak se projevil efekt L1 při percepci přízvuku v L2. U Čechů bylo zaznamenáno nejméně chyb v případě slov s přízvukem na první slabice, což odpovídá umístění přízvuku v češtině. U španělských posluchačů byl zaznamenán stejný efekt, ti měli nejméně chyb na předposlední slabice od konce, což také odpovídá umístění přízvuku ve většině španělských slov. Překvapivé byla zjištění, že hledaná korelace mezi znalostí angličtiny a percepčními dovednosti se neprokázala. Další z výzkumných otázek byla potvrzena vyšší úspěšností při AX

odpovědích než u BX, a i v detailní analýze těchto dvou podskupin se projevil vliv L1. Jak v případě Španělů, tak v případě Čechu byla větší četnost správných odpovědí zaznamenána v identifikačním pokusu, cože jen dokazuje, že typ a provedení experimentu má také vliv na výslednou úspěšnost a následné označení „stress deafness“.

8 Works cited:

Altmann, Heidi. 2006. “Perception and Production of Second Language Stress: A Cross-linguistic Experimental Study.” PhD diss., University of Delaware.

Archibald, John. 1997. “The acquisition of English stress by speakers of nonaccentual languages: Lexical storage versus computation of stress.” *Linguistics* 35: 167-181.

Baković, Eric. 2016. “Exceptionality in Spanish Stress.” *Catalan Journal of Linguistics* 15: 9-25. https://doi.org/10.5565/rev/catjl.182.

Bičan, Aleš. 2015. “Kvantitativní analýza slabiky v českém lexikonu.” www.ujc.cas.cz/phword/bican_kvant-anal-slab-v-ces-lex.pdf.

Blevins, Juliette. 1995. “The Syllable in Phonological Theory.” In *The Handbook of Phonological Theory,* edited by J. Goldsmith, 206-44. Oxford/Cambridge, MA: Blackwell.

Boersma, Paul, and David Weenink. 2018. Praat: doing phonetics by computer [Computer program]. Version 6.0.40. retrieved 1 May 2018 from http://www.praat.org/.

Boula de Mareüil, Philippe, and Bianca Vieru-Dimulescu. 2006. “The contribution of Prosody to the Perception of Foreign Accent.” *Phonetica* 63: 247-267. DOI: 10.1159/000097308.

Brennan, Eileen M., and John S. Brennan. 1981. “Measurements of accent and attitude toward Mexican-American speech.” *Journal of Psycholinguistic Research* 10/5: 487-501.

Dankovičová, Jana, and Volker Dellwo. 2007. “Czech Speech Rhythm and the Rhythm Class Hypothesis.” *ICPhS* 16: 1241-1244. Saarbrücken.

Dresher, B.E., and J.D. Kaye. 1990. “A Computational Learning Model for Metrical Phonology.” *Cognition 34,* 137-195.

Duběda, Tomáš, and Jan Votrubec. 2005. “Acoustic Analysis of Czech Stress: Intonation, Duration and Intensity Revisited.” *Interspeech* 2005, 1429-1432.

Dupoux, Emmanuel., Sharon Peperkamp, and Nuria Sebastián-Gallés. 2001. „A robust paradigm to study stress 'deafness'." *Journal of the Acoustical Society of America*, 110, 1606-1618.

Dupoux, Emmanuel, and Sharon Peperkamp. 2002. "A Typological Study of Stress "Deafness"." *Laboratory Phonology* 7. 203-240.

Dupoux, Emmanuel, Núria Sebastián-Gallés, Eduardo Navarrete, and Sharon Peperkamp. 2007. "Persistent Stress 'deafness': The Case of French learners of Spanish." *Cognition* (2007): 682–706. doi:10.1016/j.cognition.2007.04.001.

Dušková, Libuše. 1994. *Mluvnice současné angličtiny na pozadí češtiny*. Prague: Academia Praha.

Giegerich, Heinz J. 1992. *English Phonology. An Introduction*. Cambridge: Cambridge University Press.

Harris, James W. 1983. *Syllable Structure and Stress in Spanish: A Nonlinear Analysis*. Bloomington: Indiana University Linguistics Club.

Kijak, Anna. 2009. "How Stressful if L2 Stress? A Cross-linguistic Study of L2 Perception and Production of Metrical Systems." PhD diss., Utrecht University.

Kingdon, Roger. 1965. *The Groundwork of English Stress*. London: Longman.

Kingdon, Roger. 1959. *The Groundwork of English Intonation*. London: Longman

Králová-Kullová, Jana. 1992. *Kapitoly ze zvukového rozboru španělštiny (na pozadí češtiny)*. Praha: Karolinum.

Ladefoged, Peter, and Keith Johnstone. 2011. *A Course in Phonetics*. 6th ed. Boston: Wadsworth/Cengage Learning.

Lehiste, Ilse, and Robert Allen Fox. 1992. "Perception of Prominence by Estonian and English Listeners." *Language and Speech*. journals.sagepub.com/doi/abs/10.1177/002383099203500403.

Liberman, Mark, and Alan Prince. 1977. "On Stress and Linguistic Rhythm." *Linguistic Inquiry* Vol. 8 Num. 2: 249-336.

Mehler, Jacques, Emmanuel Dupoux, Christophe Pallier, and Ghislaine Dehaene-Lambertz. 1994. “Cross-linguistic approaches to speech processing.” *Current Opinion in Neurobiology* 4: 171-176.

Mehler, Jacques, Peter W. Jusczyk, Ghislaine Lambertz, Nilofar Halsted, Josiane Bertoncini, and Claudine Amiel-Tison. 1988. “A precursor of language acquisition in young infants.” *Cognition*, 29: 143-178.

Munro, Murray J., and Tracey M. Derwing. 1995. “Foreign Accent, Comprehensibility, and Intelligibility in the Speech of Second Language Learners.” *Language Learning*: 73-97.

Nation, Paul, and David Beglar. 2007. “A Vocabulary Size Test.” *The Language Teacher*, 31: 9-13.

Palková, Zdena. 1994. *Fonetika a fonologie češtiny s obecným úvodem do problematiky oboru*. Prague: Karolinum.

Pater, Joseph. 1997. “Metrical Parameter Missetting in Second Language Acquisition.” In *Focus on Phonological Acuisition*, edited by Hannahs, S. J., and Martha Young-Scholten. 235-261. Amsterdam/Philadelphia: John Benjamins.

Peperkamp, Sharon, Inga Vendelin, and Emmanuel Dupoux. 2010. “Perception of Predictable stress: A cross-linguistic investigation.” *Journal of Phonetics* 38: 422-430.

Polka, Linda, and Janet F. Werker. 1994. “Developmental changes in perception of non-native vowel contrasts.” *Journal of Experimental Psychology: Human Perception and Performance* 20: 421-435.

Roach, Peter. 1998. *English Phonetics and Phonology*. Cambridge: Cambridge University Press.

Schwab, Sandra, and Joaquim Llisterri. 2015. “Discrimination of Spanish lexical stress contrasts by French-speaking listeners.” *International Symposium of Monolingual and Bilingual Speech 2015*. http://archive-ouverte.unige.ch/unige:87696.

Skarniztl, Radek, and Anders Eriksson. 2017. “The Acoustics of Word Stress in Czech as a Function of Speaking Style.” *Interspeech* 2017.

Skoruppa, Katrin. et al. 2009. “Language-specific stress perception by 9-month-old French and Spanish infants.” *Developmental Science*. 914-919.

Šimáčková, Šárka. 2003. ““Engela’s Eches”: Cross-linguistic perception and production of English [æ] and [ɛ] by Czech EFL learners trained in phonetics.” In Solé, Maria-Josep, Daniel Recasens and Joaquín Romero (eds.), *Proceedings of the 15th International Congress of Phonetic Sciences* (ICPhS 2003), Barcelona, 3-9 August, 2003, 2293-2296.

Werker, Janet, and Richard C. Tees. 1984. “Cross language speech perception: Evidence for Perceptual Reorganization During the First Year of Life.” *Infant Behavior and Development*, 7: 49-63.

Yu, Y.Vickie, and Jean E. Andruski. 2009. “A Cross-Language Study of Perception of Lexical Stress in English.” *Journal of Psycholinguistic Research*. DOI: 10.1007/s10936-009-9142-2 · Source: PubMed.

9 Appendices

In the section bellow you can find the data I referred to in my thesis. The data are organised as follows.

Appendix A: Complete list of bi-syllabic non-existing words with the syllabic structure and example existing word,

Appendix B: Complete list of three syllabic non-words with the syllabic structure and example existing word,

Appendix C: Complete table of average results of all participants of AXB discrimination task,

Appendix D: Complete table of average results of all participants of Identification task,

Appendix E: Both experiments including Praat script and folder with results could be found in more convenient form in attached CD.

Appendix A: Complete list of bi-syllabic non-existing words with the syllabic structure and example existing word

1st syllable stress		
Syllable structure	**Non-word (orthographic form)**	**Example word**
ˊCV – CV	ˊdʌ-li (dal-lee)	ˊstudy
ˊCV - CVG	ˊpɪ-leɪ (pil-lay)	ˊpillow
ˊCV - Cə	ˊnu- bə (noo-ba)	ˊtuna
ˊCV – CV	ˊru-li (roo-lee)	ˊmeanie
ˊCV - CVG	ˊzi-nəʊ (zee-no)	ˊhero, ˊzero
ˊCVG - Cə	ˊbeɪ-pə (bay-pa)	ˊbacon, ˊpaper
ˊCVG – CV	ˊmeɪ-li (may-lee),	ˊbaby, ˊlady
ˊCVG - CVG	ˊroʊ-loʊ (row-low)	ˊmayday, ˊphoto
2nd syllable stress		
Syllable structure	**Non-word**	**Example word**
CV - ˊCV	dʌ -ˊli (dal-lee)	imˊprove
CV - ˊCVG	pɪ-ˊleɪ (pil-lay)	beˊside
Cə - ˊCV	bə-ˊnu (ba-noo)	coˊllect, aˊbove
CV – ˊCV	li-ˊru (lee-roo)	me ˊtoo
CVG – ˊCV	nəʊ -ˊzi (no-zee),	Beiˊrut, myˊself
Cə - ˊCVG	pə-ˊbeɪ (pa-bay)	Oˊbey
CV - ˊCVG	li- ˊmeɪ (lee-may)	bufˊfet
CVG - ˊCVG	loʊ-ˊroʊ (low-row)	My ˊname, nearˊby

Appendix B: Complete list of three syllabic non-words with the syllabic structure and example existing word

1st syllable stress		
Syllable structure	Non word (orthographic form)	*Example word*
CV-Cə-CV	ˊnɛ-tə-ri (net-ta-ree)	*ˊmystery* *ˊgalaxy*
CVG-Cə-CV	ˊkoɪ-də-li (coi-da-lee)	*ˊbakery*
CV-Cə-CVG	ˊdɛ-tə-maɪ (det-to-my)	*ˊpatronise*
CV-Cə-CVG	ˊsi-mə-laɪ (see-ma-lie)	*ˊrealize* *ˊdetonate*

2nd syllable stress		
Syllable structure	Non word (orthographic form)	Example word
Cə- CV-CV	tə-ˊnɛ-ri (ta-ner-ry)	*Casˊsandra*
Cə-CVG-CV	də-ˊkoɪ-li (de-coi-lee)	*Poˊlitely*
Cə-CV-CVG	tə-ˊdɛ-maɪ (to-de-my)	*Oˊlympia*
Cə-CV-CVG	mə-ˊsi-laɪ (ma-see-lie)	*Plaˊcebo* *Mosˊquito*

3rd syllable stress		
Syllable structure	Non-word (orthographic form)	*Example word*
CV-Cə-C<u>V</u>	nɛ-tə-ˊri (net-ta-ree)	*Japaˊnese* *Kangaˊroo*
CVG-Cə-C<u>V</u>	koɪ-də-ˊli (coi-da-lee)	*Pioˊneer*
CV-Cə-CVG	dɛ-tə-ˊmaɪ (det-to-my)	*Immaˊture*
C<u>V</u>-Cə-CVG	si-mə-ˊlaɪ (see-ma-lie)	*Anna-ˊRose*

Appendix C: Complete table of average results of all participants of AXB discrimination task

participant	Cz/es/en	f/m	Voc. score	maturita	age of 1. learning	English major	engl.use/lear	n. corr.	% correct	n. errors	% errors	A errors	B errors	A1 errors	A1-2	A1-3	A2 errors	A2-1	A2-3	A3 errors	A3-1	A3-2	B1 errors	B1-2	B1-3	B2 errors	B2-1	B2-3	B3 errors	B3-1	B3-2	144
JL	Cz	f	9500	Yes	10	no	no	86	59,72222	58	40,27777778	30	28	7	5	2	11	7	4	12	7	5	9	5	4	12	8	4	7	3	4	
AD	Cz	f	10800	yes	10	no	yes	91	63,19444	53	36,80555556	26	27	9	6	3	8	4	4	9	4	5	11	8	3	9	4	5	7	3	4	
MB	Cz	f	9600	yes	11	no	yes	120	83,33333	24	16,66666667	9	15	1	1	0	3	3	0	5	1	4	2	2	0	10	8	2	3	1	2	
MT	Cz	m	10500	yes	10	yes	yes	141	97,91667	3	2,083333333	1	2	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	1	0	
JP	Cz	f	9200	yes	8	no	yes	119	82,63889	25	17,36111111	9	16	0	0	0	5	0	5	4	1	3	7	5	2	6	4	2	3	1	2	
TM	Cz	f	9400	yes	10	no	yes	134	93,05556	10	6,944444444	4	6	2	1	1	1	1	0	1	1	0	5	2	3	0	0	0	1	0	1	
MV	Cz	f	10600	yes	10	yes	yes	138	95,83333	6	4,166666667	1	5	0	0	0	0	0	0	1	1	0	3	1	2	2	0	1	1	0	1	
NH	Cz	f	8900	yes	10	no	no	101	70,13889	43	29,86111111	22	21	8	6	2	11	6	5	3	2	1	10	5	5	7	4	3	4	1	3	
VP	Cz	f	10400	yes	9	no	yes	112	77,77778	32	22,22222222	10	22	3	2	1	5	4	1	2	0	2	6	2	4	8	4	4	8	5	3	
BL	Cz	f	9800	yes	10	no	no	109	75,69444	35	24,30555556	16	19	5	4	1	4	4	0	7	0	7	6	3	3	3	2	1	10	2	8	
DC	Cz	m	11700	yes	10	yes	yes	100	69,44444	44	30,55555556	18	26	3	3	0	8	4	4	7	2	5	8	4	4	11	7	4	7	4	3	
NJ	Cz	f	10300	yes	11	no	yes	107	74,30556	37	25,69444444	9	28	2	1	1	4	3	1	3	1	2	11	6	5	8	5	3	9	4	5	
AV	Cz	f	7900	yes	10	no	no	103	71,52778	41	28,47222222	12	29	4	4	0	4	4	0	4	1	3	5	2	3	13	9	4	11	4	7	
AV	Cz	f	10800	yes	10	yes	yes	136	94,44444	8	5,555555556	3	5	0	0	0	2	2	0	1	0	1	4	3	1	1	0	1	0	0	0	
MT	Cz	f	10100	yes	11	no	no	143	99,30556	1	0,694444444	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	
JD	Cz	m	10600	yes	9	yes	yes	127	88,19444	17	11,80555556	6	11	1	0	1	1	0	1	4	2	2	3	1	2	3	2	1	5	4	1	
MB	Cz	m	9100	yes	11	no	yes	122	84,72222	22	15,27777778	10	12	4	4	0	0	0	0	6	5	1	5	1	4	1	0	1	6	4	2	
JD	Cz	m	6300	yes	11	no	no	110	76,38889	34	23,61111111	18	16	3	3	0	7	3	4	8	2	6	7	3	4	4	3	1	5	1	4	
AM	Cz	f	11400	yes	9	no	yes	104	72,22222	40	27,77777778	15	25	5	2	3	6	4	2	4	2	2	6	5	1	11	6	5	8	5	3	
VV	Cz	f	6300	yes	10	no	no	131	90,97222	13	9,027777778	7	6	1	1	0	4	2	2	2	1	1	1	0	1	4	2	2	1	0	1	
TB	Cz	f	8800	yes	10	no	no	111	77,08333	33	22,91666667	17	16	1	0	1	10	6	4	6	3	3	2	1	1	11	7	4	3	0	3	
MP	Cz	m	9400	yes	10	no	no	69	47,91667	75	52,08333333	37	38	13	7	6	16	10	6	8	4	4	12	7	5	13	8	5	13	7	6	
LP	Cz	f	3400	no	11	no	no	80	55,55556	64	44,44444444	37	27	15	7	8	9	5	4	13	4	9	6	5	1	16	9	7	5	3	2	
RB	Cz	m	4400	yes	11	no	no	79	54,86111	65	45,13888889	33	32	13	6	7	9	7	2	11	4	7	7	2	5	13	7	6	12	8	4	
RK	Cz	f	10500	yes	10	no	yes	124	86,11111	20	13,88888889	8	12	5	5	0	2	1	1	1	0	1	3	2	1	4	2	2	5	2	3	
LS	Cz	f	8100	yes	10	no	yes	132	91,66667	12	8,333333333	5	7	1	0	1	2	1	1	2	1	1	2	1	1	3	0	3	2	0	2	
HD	Cz	f	7700	no	9	no	no	100	69,44444	44	30,55555556	22	22	5	2	3	5	3	2	12	2	10	7	5	2	10	7	3	5	2	3	
KO	Cz	f	10700	yes	8	yes	yes	139	96,52778	5	3,472222222	2	3	0	0	0	2	2	0	0	0	0	0	0	0	3	3	0	0	0	0	
LK	Cz	m	10000	yes	10	no	no	78	54,16667	66	45,83333333	18	48	4	2	2	5	4	1	9	2	7	17	10	7	14	8	6	17	7	10	
AN	Cz	f	10700	yes	10	yes	yes	135	93,75	9	6,25	6	3	1	0	1	2	1	1	3	1	2	0	0	0	3	1	2	0	0	0	
DD	Cz	m	8800	no	10	no	yes	96	66,66667	48	33,33333333	26	22	9	4	5	7	5	2	10	1	9	5	1	4	9	5	4	8	1	7	
MH	Cz	f	10400	yes	9	yes	yes	99	68,75	45	31,25	13	31	3	3	0	7	3	4	3	1	2	9	6	3	13	7	6	10	5	5	
DC	es	m	7900	yes	8	no	no	121	84,02778	23	15,97222222	6	17	5	5	0	0	0	0	1	0	1	10	6	4	2	1	1	5	2	3	
JR	es	m	9100	yes	9	no	yes	135	93,75	9	6,25	6	3	4	4	0	0	0	0	2	1	1	1	0	1	0	0	0	2	0	2	
JS	es	m	9200	yes	9	no	yes	131	90,97222	13	9,027777778	5	8	2	0	2	0	0	0	3	2	1	5	2	3	1	1	0	2	1	1	
MAL	es	m	9500	yes	9	no	yes	123	85,41667	21	14,58333333	13	8	5	1	4	4	1	3	4	1	3	5	3	2	0	0	0	3	2	1	
AL	es	m	8700	yes	8	no	yes	125	86,80556	19	13,19444444	11	8	6	3	3	1	1	0	4	2	2	4	2	2	0	0	0	4	3	1	
ML	es	f	10300	yes	9	no	yes	123	85,41667	21	14,58333333	14	7	8	3	5	2	1	1	4	1	3	4	3	1	0	0	0	3	2	1	
JC	en	m	14000					139	96,52778	5	3,472222222	2	3	1	1	0	1	1	0	0	0	0	3	2	1	0	0	0	0	0	0	
											716,6666667																					
								over. n. c	erall % corr	ver.n.e	overall % error	error	errors																			
								3576	77,60417	1032	22,39583333	451	580																			
								overall % correct Spar		overall % error Span																						
									87,73148		12,26851852																					

Appendix D: Complete table of average results of all participants of Identification task

participant	Cz/es/en	f/m	Voc. score	maturita	age of 1. learning	English major	engl.use/lear	n.correct	% correct	n.errors	%errors	2 syll. Errors	1.syll-2	2.syll-1	3.syll.errors	1.syll-2	1.syll-3	2.syll-1	2.syll-3	3.syll-1	3.syll-2
JL	Cz	f	9500	Yes	10	no	no	55	98,21428571	1	1,785714	0	0	0	1	0	0	0	1	0	0
AD	Cz	f	10800	yes	10	no	yes	49	87,5	7	12,5	5	5	0	2	0	0	2	0	0	0
MB	Cz	f	9600	yes	11	no	yes	54	96,42857143	2	3,571429	2	1	1	0	0	0	0	0	0	0
MT	Cz	m	10500	yes	10	yes	yes	55	98,21428571	1	1,785714	1	0	1	0	0	0	0	0	0	0
JP	Cz	f	9200	yes	8	no	yes	55	98,21428571	1	1,785714	0	0	0	1	0	0	0	0	1	0
TM	Cz	f	9400	yes	10	no	yes	55	98,21428571	1	1,785714	1	0	1	0	0	0	0	0	0	0
MV	Cz	f	10600	yes	10	yes	yes	54	96,42857143	2	3,571429	2	1	1	0	0	0	0	0	0	0
NH	Cz	f	8900	yes	10	no	no	49	87,5	7	12,5	5	4	1	2	0	0	1	1	0	0
VP	Cz	f	10400	yes	9	no	yes	56	100	0	0	0	0	0	0	0	0	0	0	0	0
BL	Cz	f	9800	yes	10	no	no	52	92,85714286	4	7,142857	3	1	2	1	0	0	1	0	0	0
DC	Cz	m	11700	yes	10	yes	yes	43	76,78571429	13	23,21429	7	7	0	6	0	0	0	1	1	4
NJ	Cz	f	10300	yes	11	no	yes	39	69,64285714	17	30,35714	8	2	6	9	1	3	0	2	1	2
AV	Cz	f	7900	yes	10	no	no	43	76,78571429	13	23,21429	5	2	3	8	0	3	4	1	0	0
AV	Cz	f	10800	yes	10	yes	yes	56	100	0	0	0	0	0	0	0	0	0	0	0	0
MT	Cz	f	10100	yes	11	no	no	56	100	0	0	0	0	0	0	0	0	0	0	0	0
JD	Cz	m	10600	yes	9	yes	yes	56	100	0	0	0	0	0	0	0	0	0	0	0	0
MB	Cz	m	9100	yes	11	no	yes	53	94,64285714	3	5,357143	1	1	0	2	0	0	1	0	0	1
JD	Cz	m	6300	yes	11	no	no	40	71,42857143	16	28,57143	3	0	3	13	7	0	0	1	0	5
AM	Cz	f	11400	yes	9	no	yes	47	83,92857143	9	16,07143	4	3	1	5	1	2	0	1	0	1
VV	Cz	f	6300	yes	10	no	no	53	94,64285714	3	5,357143	1	0	1	2	0	0	1	0	1	0
TB	Cz	f	8800	yes	10	no	no	36	64,28571429	20	35,71429	5	1	4	15	3	0	5	0	1	6
MP	Cz	m	9400	yes	10	no	no	30	53,57142857	26	46,42857	10	2	8	16	4	1	3	1	2	5
LP	Cz	f	3400	no	11	no	no	29	51,78571429	27	48,21429	16	4	12	11	1	4	2	1	2	1
RB	Cz	m	4400	yes	11	no	no	43	76,78571429	13	23,21429	7	2	5	6	0	0	2	0	0	4
RK	Cz	f	10500	yes	10	no	yes	56	100	0	0										
LS	Cz	f	8100	yes	10	no	yes	56	100	0	0										
HD	Cz	f	7700	no	9	no	no	48	85,71428571	8	14,28571	3	0	3	5	1	0	0	0	2	2
KO	Cz	f	10700	yes	8	yes	yes	56	100	0	0										
LK	Cz	m	10000	yes	10	no	no	45	80,35714286	11	19,64286	5	4	1	6	3	0	1	1	0	1
AN	Cz	f	10700	yes	10	yes	yes	54	96,42857143	2	3,571429	0	0	0	0	0	1	0	0	1	0
DD	Cz	m	8800	no	10	no	yes	35	62,5	21	37,5	9	3	6	11	4	0	3	0	2	2
MH	Cz	f	10400	yes	9	yes	yes	50	89,28571429	6	10,71429	4	0	4	2	1	0	0	0	0	1
DC	es	m	7900	yes	8	no	no	51	91,07142857	5	8,928571	2	0	2	3	1	2	0	0	0	0
JR	es	m	9100	yes	9	no	yes	51	91,07142857	5	8,928571	1	0	1	4	0	1	0	0	1	1
JS	es	m	9200	yes	9	no	yes	52	92,85714286	4	7,142857	2	0	2	2	1	0	0	0	0	1
MAL	es	m	9500	yes	9	no	yes	51	91,07142857	5	8,928571	2	1	1	3	1	1	0	0	0	1
AL	es	m	8700	yes	8	no	yes	51	91,07142857	5	8,928571	2	2	0	3	0	2	0	0	1	0
ML	es	f	10300	yes	9	no	yes	52	92,85714286	4	7,142857	2	2	0	2	0	1	0	0	1	0
JC	en	m	14000					55	98,21428571	1	1,785714	0	0	0	1	0	0	0	1	0	0
													43	64		26	14	26	11	14	35
*								n correo	overall % correct	error	erall % errors		5	6		3	7	0	0	3	3
								1558	86,94196429	234	13,05804										
								n correct	all % correct spa	rs sp	% errors spanish										
								308	91,66666667	28	8,333333										
											2 syll.errors			3 syll.errors							
												107			124						
											2 syll.errors sp			3 syll errors sp						
												11			17						