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Cross-language phonetic influence in speech of Czech-English bilinguals

(Diplomová práce)

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V Olomouci dne 30.4.2019 Bc. Anna Niesnerová

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Abstract

The general topic of the thesis is the cross-language sound interactions during bilingual production when a speaker has to use two languages in one situation. The first research question asks whether speech of advanced EFL learners (i.e. Czech EFL bilinguals) shows increased phonetic interference during bilingual language production compared to a single language production. The second research question asks whether the cross-language phonetic interference increases when both languages are used in the same utterance compared to switching between languages across utterances. We will look at the types of bilingual production: (1) language switching when the bilingual alternates between utterances in L1 and in L2, e.g. in a picture-naming task, and (2) during code-switching when the bilingual starts an utterance in L2 and finishes it in L1 or other way round, i.e. starts it in L1 and finishes it in L2. The third research question addresses the issue of experience with bilingual language use. Two groups of Czech EFL bilinguals will be compared, (1) students of interpreting and (2) general philology students, in order to see whether intensive training in using two languages improves the ability to separate between then in pronunciation.

Key words

Phonetics, language switching, code switching, VOT, u-fronting

Anotace

Tématem této diplomové práce je fonetická interference v řečové produkci u česko-anglických bilingvních mluvčí. První výzkumná otázka se ptá na to, zda se v řečové produkci pokročilých biligvních mluvčí, jejichž mateřský jazyk (L1) je čeština a druhý jazyk (L2) je angličtina, projevuje zvýšená foneticka interference během bilingvní produkce v porovnání s řečovou produkcí pouze v jednom jazyce. Druhá výzkumná otázka se ptá, zda se fonetická interference zvyšuje, když jsou oba jazyky použity ve stejném projevu oproti tomu, když jsou oba jazyky přepínány napříč jednotlivými projevy. V této diplomové práci jsou použity následující druhy úkolů imitující bilingvní prudukci: (1) přepínání jazyků, kdy bilingvní mluvčí střídá jazyky mezi L1 a L2 v úkolu, ve kterém se pojmenovávají obrázky, a (2) přepínání kódů, kdy bilingvní mluvčí začne číst větu v L2 a dokončí ji v L1, nebo větu začne v L1 a dokončí ji v L2. Třetí výzkumná otázka se zabývá vlivem rozdílné zkušenostni bilingvního používání jazyka, tzn. zda intenzivní trénink v používání dvou jazyků zlepšuje schopnost bilingvních mluvčích lépe rozdělovat tyto dva jazyky i ve výslovnosti. Z toho důvodu jsou zde porovnány dvě skupiny česko-anglických bilingvních mluvčích, a to (1) studenti překladatelství a tlumočnictví a (2) studenti filologie z Univerzity Palackého.

Klíčová slova

Fonetika, přepínání jazyků, přepínání kódů, doba nástupu hlasivkového tónu, u-fronting

CONTENTS

1 INTRODUCTION

The question of how languages work in bilingual mind has been at the centre of interest of many linguists. Their fascination for bilingual people very likely arises from the fact that bilinguals, despite having more than one lexicon in their mind, are perfectly capable of keeping the two lexicons apart without totally mixing them together. This is a very demanding ability of bilingual mind given the fact the language works on several levels such as lexical, syntactic, morphologic or phonetic levels and all those levels are kept separated (Olson, 2013).

This thesis focuses on the phonetic level of language and tries to find answers for questions regarding the phonetic interference of two languages during the speech production of bilinguals who switch between them. In this thesis, we try to find the answer for the question whether there is an increased phonetic interference during bilingual language production compared to a single language production in the speech production of the Czech-English bilinguals. Based on the previous phonetic studies, our hypothesis is that there will be some level of a phonetic transfer, we expect the English target sounds to become more Czech-like and the Czech target sounds to become more English-like, e.g. an increased voice onset time (henceforth VOT) of the Czech voiceless stop /k/.

In the previous phonetic studies, two types of switching between languages were described and discussed. The first type is a language switching (i.e. switching across utterances) and the second type is a code switching (both languages are used in the same utterance). Since they are two different types of switching, two different experiments are conducted in this research to see if there is a different level of phonetic transfer depending on the type of the switching task. The language switching is when the bilingual alternates between utterances in L1 and in L2 – for this type of switching, we used a picture-naming task. The code switching is when the bilingual starts an utterance in L2 and finishes it in L1 or other way round, i.e. starts it in L1 and finishes it in L2 – for this type of switching, we used a sentence-reading task.

In this thesis, we would also like to find out whether the level of experience with bilingual language use affects the level of phonetic interference when switching between languages. For this reason, two groups of Czech-English bilinguals will be

compared – the students of philology and the students of interpreting who have undergone an intensive training in using two languages. This research question is based on the hypothesis that the students of interpreting might show a greater ability to switch languages with no phonetic interference, i.e. they are more able to keep the Czech and English phonetic level completely separated as compared to the philology students with no or minimal interpreting training.

The first part of this thesis summarizes literature regarding the general topic of this work that serves as a foundation for the research presented here. It focuses not only on the subject of a bilingual mind, but also on what the bilingual mode is including what type of tasks have been used in the previous phonetic studies dealing with the question of bilingualism in terms of switching between languages and its possible interference.

In Methodology, the whole procedure of the research experiments including the choice of participants, the types of tasks and stimuli is described in detail. The first part deals with a choice of participants. The participants of this research are Czech-English speakers whose first language (L1) is Czech and the second language (L2) is English. All participants are high-proficient C1 English speakers and all of them are students from the department of English and American Studies at University of Palacký in Olomouc. The students were divided into two groups depending on their field of study – a group of English philology students and a group of English interpreting-translating students. The main difference between the two groups is how the students have been trained to use L1 and L2. Whereas the philology students were trained to use L1 or L2 separately with no switching between them, the students of interpreting have been intensively trained to use both languages at the same time and also to be able to switch between them. All participants had to fill in a self-assessing questionnaire where they had to answer questions regarding their previous experience with using two languages as well as their experience with switching between them. There are also questions to find out if they are early or late second language learners or if they were raised in a bilingual family. The answers of both groups are also stated and compared in this section.

Next part of the Methodology section focuses on two experiments that were conducted in order to answer the three research questions mentioned above. The first experiment deals with the Language-switching task, i.e. the picture-naming task,

inspired by the experiment by Olson (2013). In this task, the stimuli of /k/ word-initial words that were used in this experiment were chosen in order to measure their henceforth VOT. The criteria determining the words that were suitable for this research are also introduced in this part. The following part deals with the whole procedure of the first experiment. Next part tries to explain how the experiment was created and why some methods that were used in some previous phonetic studies such as pre-teaching the vocabulary containing target words used in the experiment by Goldrick (2014) were not used in this study. The second experiment is described in a very similar way as the first experiment is. The code-switching task that was chosen for this part of experiment is the sentence-reading task. The second experiment uses the stimuli already used in the first experiment; however, a new type of stimuli is added. The possible phonetic interference is measured not only on VOT of a voiceless stop /k/, but also on the height of the second formant F2 of the GOOSE vowel /u:/. Therefore, the new set of criteria for the words containing new target sound is presented this section. Then the whole procedure of how the experiment was conducted is described and the methods that were considered when creating this experiment are also mentioned with a short explanation why they were not suitable for this research.

Next chapter deals with the process of how the data were analysed. For both types of tasks, a set of coding was created so that the results could be used and analysed in further research. All coding is described in detail and is also explained well for possible further studies based on this research.

The results from the data analysis are then presented in the following chapter. This chapter is dived into several parts depending on what type of task it describes. Firstly, it focuses on the results regarding the Code-switching task with two types of target sounds, and then on the Language-switching task, where only one type of stimuli was used. In each part, the presented results are not only for all participants but also for the two groups of the students of interpreting and the students of philology. The comparison of their result can be also found there. The last part of the chapter with results is the overall comparison of the results of the Language-switching task and the Code-switching task as well as their comparison in terms of the philologists versus the interpreters.

All results are then summarized in Discussion. The main goal of this part of this thesis is to find the answers on the research questions and see if our hypothesis

were correct or not. Furthermore, it tries to propose possible further research questions that could employ the outcome of my research.

This works is then summarized in Conclusion All sources mentioned and used in this paper can be found in the part Works Cited. In Appendix, there is all extra material that was mentioned in this thesis.

To sum up, in this thesis the increased phonetic interference is measured using the VOT of the voiceless stop /k/ in the initial-word position and also using the second formant F2 of the GOOSE vowel /u:/. In both experiments, target words with target sounds are located in switch and stay positions in order to make possible to compare the target sounds and answer the first research question that asks if the increased phonetic interference is present in switches or non-switches and what is the direction of the interference. To answer the second research questions whether the type of switching (the code switching vs language switching) has any impact on the phonetic interference, two types of switching tasks are conducted, i.e. the picture naming task for the language-switching; and the sentence-reading task for the code-switching. All results of all experiments are then analysed for two groups of participants who are the students of philology or the students of interpreting to find out whether the level of training of switching between languages anyhow affects the results of the first two research questions. The study is, therefore, unique in looking at the phonetic consequences of the code switching and language switching in the same bilinguals.

2 LITERATURE REVIEW

2.1 Bilingual mind

Bilinguals represent a very interesting subject to study due to their unique way of keeping their two languages separated. Many linguistic studies have tried to describe and understand bilinguals' mind from different point of views. Some studies deal with the second language acquisitions (e.g. Bialystok, 2009; Flege, Munro, and MacKay, 1995), i.e. how the second language is learned and consequently stored. Other studies try to answer the question of how bilinguals' languages are accessed and how they compete in a bilingual mind (e.g. Olson, 2016a; Costa, Caramazza, and Sebastian-Gallés, 2000). Given the language complexity, bilinguals must keep their languages separated not only on a lexical level, but also on other linguistic levels, such as a syntactic or a morphological level, as well as phonetic and phonological ones (Olson, 2013). Despite the bilinguals' ability to control the two systems and to choose efficiently between them, interlingual interactions of different kinds may occur. Those interactions have been widely investigated in literature focusing on interaction in switching conditions.

2.2 Bilingual mode

In literature, Grosjean (1994, 2001) defines bilingualism in terms of a movement along a language mode continuum depending on the amount of language activation. On each end of the continuum, there is a monolingual mode[1]. (In some literature "unilingual" is used instead of "monolingual". Antoniou et al. (2011) explains that their choice is based on Grosjean's (1989) statement that "the bilingual is not two monolinguals in the one person".) A bilingual mode can be found in the middle of this abstract line. The monolingual mode represents a situation when only one language (A or B) is being activated, meaning the second language (B or A) is not. It is, however, said that the second language is never fully deactivated (Grosjean, 2001; Antoniou et al., 2011; Blumenfeld & Marian, 2007). In the bilingual mode, both languages receive similar amount of activation given the fact that both languages are used – the speaker chooses, i.e. switches, between them. [1] Bilinguals move along this continuum and their bilingual mind chooses how much each language is activated

[1] Olson (2012) distinguishes between language context and language mode. While language mode considers linguistic and sociolinguistic variables, language context only expresses how much present/activated each language is in a given discourse.

depending on several factors. Since language represent one of the most important means of communication, first it must fulfil its communicative functions. Therefore, bilinguals choose how much and which language they will use depending on the participants of the communication, the situation or the message to be conveyed (Grosjean, 2001). This thought was supported by Hasselmo (1970) who described three different modes among a continuum of Swedish-English bilinguals living in the United States. These bilinguals chose between a monolingual mode in English, a bilingual mode of English-Swedish and a bilingual mode of Swedish-English. Each language was activated to such extent that was the most appropriate for a given situation and fulfilling its communication needs between interlocutors.

When moving in one of the monolingual modes (especially in non-switched productions), languages do not have much opportunity to influence each other, however, the interaction is possible (Caramazza et al., 1973). In contrast, due to the similar level of activation and possible switching between the two languages in the bilingual mode, interlingual interactions are more likely to occur. Even though there are a lot of studies dealing with the effects, triggered by the switching, on lexical or grammatical levels (Li, 1996; Myers-Scotton, 1997; Poplack, 1988; Olson, 2016a; Jacobs, 2015) there are fewer studies investigating influence of switching on a phonetic transfer.

2.3 Types of switching tasks in phonetic studies

The uniqueness of a bilingual mind has raised many questions about how it works especially from the linguistic point of view. Many studies have been concerned with the question how the two (or more) languages are stored in one mind and how each language is then accessed (f.e. Costa et al., 2000).

Based on the results from previous studies dealing with the interlingual interaction on higher linguistic levels (lexical, morphological or syntactical levels) (Poplack, 1988; Li, 1996, Myers-Scotton, 1997), new studies focusing on phonetic transfer have emerged. However, not many studies have focused on possible phonetic interaction of bilinguals' two languages when switching (Olson, 2013). To find out whether bilinguals' languages interact with each other (and if so to what extent and how), previous studies have employed different types of tasks performed under different conditions. The varying conditions, such as a type of language mode, a language dominance of participants or the age of acquisition of L2, result in

different outcomes of the studies. For example, Grosjean & Miller (1994) showed no interaction when switching, (Bullock et al. 2006; Antoniou et al. 2011, Balukas & Koops, 2015) presented results showing unidirectional interaction when only one language was affected or bidirectional (Bullock & Toribio, 2009; Olson, 2016b).

The tasks used for the phonetic studies are based on studies such as the one by Meuter & Allport (1999) that are concerned with other parts of linguistics where interlingual interaction between languages has been proved in switching paradigm (Antoniou et al., 2011). Speakers are manipulated into such conditions where they have to switch from one language to another. The switching tasks are used to minimize possible influence of planning which was discussed by Bullock et al. (2006) whose results showed changes in voiced onset time in a position before a code-switched target (Olson, 2013). Planning is a natural part of bilinguals' mind where the speech production is being planned and their mind must decide about how much each language will be activated (Griffin and Block, 2000).

In literature, there are two widely discussed types of switching tasks – Language-switching tasks and Code-switching tasks. In both types, voiced onset time (VOT) is examined due to its different length in different languages. Most studies distinguish between short-lag languages such as Spanish or Greek and long-lag languages such as English. In short-lag languages, VOT of voiceless stops lasts usually between 0-30ms, in long-lag languages it is 30-120ms. (In English the length of VOT voiceless stops reflects the presence of aspiration (Amengual, 2012)). Any changes or shifts in VOTs point to a phonetic transfer. The VOT can be defined as the time measured from the moment when the burst of air for a stop consonant is released to the moment when a following vowel appears (signalled by the onset of periodicity) (Lisker & Abramson, 1964).

2.3.1 Language-switching

Language-switching is a type of switching between languages which does not occur within connected speech, i.e. it takes place in an experimental paradigm. In the language switching studies, a picture-naming task is usually used (Goldrick, 2014; Olson, 2013; Olson, 2016a). A set of pictures of unambiguous objects starting with a desired phoneme (usually voiceless or voiced stops) is presented to a selected group of bilinguals. Their task is to name the pictures depending on the colour of the

background. One colour represents one language and when this colour changes, the bilingual switches into the language corresponding to the given colour. As already mentioned, in natural productions bilinguals plan which language they will produce. This planning affects the phonetic result of a spoken language. Due to the arbitrary distribution of languages in the target words, the picture-naming task has been employed in some of the bilingual phonetic studies to avoid this planning.

2.3.1.1 The language-switching studies

The picture naming tasks have not been used only in the language-switching studies studying phonetic interaction, but they have been used in other linguistic studies to better understand how lexical systems of bilinguals are separated (Costa et al, 2004; Meuter & Allport, 1999) or to see how language switching affects lexical access (Olson, 2016a). Despite dealing with the subject of lexical system, Meuter & Allport (1999) found certain amount of phonetic transfer in their study. Later the picture-naming task was used in phonetic studies, where the experimental design of the language-switching studies was used in order to see "a clear view of the underlying nature of phonetic transfer" which is something code-switching cannot fully offer because of its occurrence in a connected speech (Olson, 2013, p. 409).

The differences of VOTs in Spanish L1 dominant and English L1 dominant speakers in various conditions were studied by Olson (2013). Using a picture-naming task, he tried to prepare such conditions where speakers could not plan their productions ahead (as mentioned in Bullock et al., 2006). In this study, Olson searched for differences of voiced onset times in switch and stay trials, where stay trials are those trials when two following pictures are named in the same language and switch trials are those when the second picture is named in a different language than the first one. He also tried to find out if the language context affects phonetic transfer. Speakers were manipulated into three different language contexts – an English monolingual (with 95% pictures in English, 5% in Spanish), a Spanish monolingual (with 95% in Spanish and 5% in English) and a bilingual context (with 50% English and 50% Spanish pictures). Using the division of the three language contexts, Olson could examine if the amount of language activation affects phonetic transfer in bilinguals' production. The results showed an asymmetrical pattern of a unidirectional transfer from the non dominant language L2 to the dominant language L1. This transfer occurred only in switch trials in a monolingual context, i.e. English

L1 in a monolingual switched context had shorter VOTs (more Spanish-like) than in a monolingual stay context. Spanish L1 in a monolingual switched context had longer VOTs (more English-like) than in a monolingual stay context. Bilingual context, however, showed a symmetrical patter. No difference between switch or stay trials were found in bilingual context in neither of the two dominant groups. However, there was a difference between VOTs in monolingual and bilingual context in English L1 speakers' productions when switching from Spanish L2 to English L1. Their VOTs was overall shorter VOTs in bilingual context than monolingual context (but there were no differences between switch and stay trials in bilingual context). To explain the asymmetry found in his study, Olson uses ICM (Inhibition Control Model). Even though, the ICM has been used mostly only for the research on the lexical level, Olson extends the findings of this method from the lexical level (asymmetrical switch costs) on the phonetic level. He says that while in a bilingual context similar amount of inhibition is employed (leading to symmetrical results in phonetic transfer), there is an asymmetrical level of inhibition in a monolingual context (leading to asymmetrical phonetic transfer).

Goldrick and Costa (2014) focus not only on differences between voiced onset time in switching trials of a voiceless stop /t/, but also of a voiced stop /d/. In their research, they compare Spanish and English productions of Spanish L1 and English L2 speakers. The target words were presented in the picture-naming task with the focus of switch versus stay trials and related versus unrelated trials. Related trials correspond to trials where the word-initial phoneme was the same as the phoneme in the previous trial, unrelated trials are those trials where the word-initial phoneme was different from the one on previous trial. However, the results showed significant difference only between switch and stay trials. There was no effect found in related or unrelated trials. Unlike Olson (2013), only balanced bilingual context was employed. The results proved that both voiced /d/ and voiceless stops /t/ in English productions were more accented on switch trials than on stay trials. In other words, English voiced and voiceless stops /t/ and /d/ had shorter VOTs (more Spanish-like) when switching. In contrast, there were no effects observed at neither of the trials in Spanish productions. In comparison to Olson (2013), the results proved that non-dominant L2 English was affected by L1 Spanish in bilingual context.

2.3.2 Code-switching

Unlike the language-switching, the code-switching appears in connected speech, i.e. it occurs within a larger conversational context or an utterance (Olson, 2013; Antoniou et al. 2011). In the code-switching, speakers can plan their production as proved in Griffin and Bock (2000). This was also proved by Bullock et al. (2006) who studied effects of code-switching in different position (see below). She found the phonetic transfer before the switching position suggesting the bilinguals' ability of planning. The code-switching studies are, however, widely spread. The types of tasks they use are for example sentence-reading tasks (Antoniou et al., 2011; Amengual, 2012) or telling-stories tasks (Grosjean, 1994).

2.3.2.1 The code-switching studies

As already mentioned, when code-switching, languages are switched in a utterance (or a short sentence) or in a longer paragraph (Bullock et al., 2006; Olson, 2016b). Even though, switching helps to increase the factor of planning, some studies prove that the effect of planning is present (Bullock et al., 2006).

Bullock et al.(2006) conducted two experiments using sentence-reading task. VOTs were measured at voiceless stops /p,t,k/ that were evenly distributed in monolingual Spanish sentences, monolingual English sentences and bilingual sentence where the first half of the sentence was in Spanish and the second on in English and vice versa. The changes of VOTs were observed at three different positions in a sentence – pre-switch, switch and post-switch positions. The results of the first experiment with Spanish L1 and English L2 speakers showed difference between VOTs of Spanish and English voiceless stops in monolingual context, i.e. Spanish voiceless stops were app. 25ms, English voiceless stops were app. 55ms. Due to no difference between the voiceless stops /p,t,k/, their results were merged. While there was no effect found between monolingual and bilingual context in Spanish L1 productions, English L2 productions showed differences between monolingual VOTs and VOTs in pre-switch and switch position which were shorter (more Spanish-like). The monolingual and post-switch VOTs were almost the same, however, pre-switch and switch values were shorter than those in post-switch position. In the second experiment, where speakers were English L1 dominant and Spanish L2, monolingual VOTs values were 5ms longer in both English and Spanish voiceless stops than in previous case of the Spanish L1 speakers. English L1

productions showed the same differences in VOTs just like English L2 productions in the first experiment, i.e. pre-switch and switch VOTs were shorter (more Spanish-like) than in monolingual English VOT. The post-switch VOT was also the same as the one in the monolingual context. In contrast to the first experiment, Spanish L2 productions revealed differences between monolingual VOT and pre-switch position (the VOT values were lower). (Due to the excessive deviation in the switch position, results showing no difference in Spanish L2 monolingual and switch condition are not reliable). Both experiments showed no difference in post-switch positions, which indicates a quick ability to return to monolingual values after code-switching. The results also showed an asymmetrical pattern caused by code-switching. In the first experiment, the effect of convergence was found in English L2, in the second one in English L1. The effect of code-switching affected only long-lag language English making it more Spanish-like. Bullock finds an explanation of this asymmetry in "inherent differences" between short-lag and long lag languages. Since English (a long-lag language) has longer VOT, there is more room to move within and more "gestural precision" is needed in short-lag languages. The overall results proved that language dominance does not ultimately decides about the outcome of code-switching.

Antoniou et al. (2011) elaborated his previous study (Antoniou et al., 2010) where he studied possible interaction of the two languages between early Greek L1 nondominant and English L2 dominant speakers in monolingual mode. In his current study, the same speakers participated in a new research and their results from monolingual mode were compared with the results from a code-switched context. Like (Goldrick, 2014), the stimuli were not only voiceless stops /p,t/ but also voiced stops /b,d/. The target sounds were examined in three different positions – word-initial, medial post-vocalic and medial post-nasal position. The sounds were used in non-existent words that were embedded in an English or Greek carrier phrase: Say /xy/ again (and in its equivalent in Greek). In word-initial positions, Greek voiced stops are prevoiced and are produced with voicing lead, English voiced stops are short-lag (due to its lack of aspiration). Greek voiceless stops are also short-lag, English voiceless stops are long-lag due to its aspiration. Word-initial productions revealed difference between Greek and English. English L2 dominant was affected and both voiced and voiceless stops became more Greek-like, i.e. voiced stops had more lead VOT and voiceless stops had shorter VOT. Greek L1 non-dominant was

not affected by code-switching. Therefore, asymmetrical unidirectional transfer of L1 to L2 occurred regardless of the language dominance. In medial post-vocalic positions, English voiced stops have voicing lead and can be affected by stress position just like English voiceless stops (their VOT stays long in this position). Due to a possible influence of stress, targets were produced in both stressed and unstressed positions. Results showed a different pattern for targets in the medial-post-vocalic positions. Both English and Greek were affected by code-switching. English VOTs became more Greek-like, Greek VOTs became more English-like. The effect of phonetic transfer was more obvious in voiced stops than in voiceless stop (Greek voiced stops had shorter voicing lead, English voiced stops had a longer lead). The stressed syllables affected both English and Greek VOTs in comparison to unstressed syllables. The bidirectional transfer between L1 and L2 occurred in this case, however, Antoniou remarks that the difference in Greek voiced stops may result from the fact that non-nasalised medial voiced stops are not frequent in Greek. In medial-post nasal position, unidirectional transfer is again observed. English VOTs are affected by code-switching, but Greek ones are not. The difference was more pronounced for voiced stops that became longer in switched context (English voiceless stops were, however, also affected – shorter VOT than in monolingual mode). Overall, English stops were affected in all three positions, except for voiceless medial post-vocalic stop. Greek productions were affected only if the targets were voiced stops in medial post-vocalic context. A strong effect of L1 on L2 was apparent in all three experiments, reflecting the same direction of the phonetic transfer. The changes in Greek voiced stops in medial post-vocalic stops are not reliable, as mentioned before, therefore mostly effects on English L2 dominant productions should be taken into consideration. Antoniou suggests that the fact, that there are effects in pronunciation when code-switching, proves that some phonetic categories are considered as similar which leads to a possible phonetic transfer.

The research in the study by Balukas (2015) is unique for its focus on spontaneous code-switching in Spanish-English bilinguals (most participants were Spanish L1 speakers). The research was based on New Mexican Spanish English Bilingual Corpus (NMSEB). Target words contained voiceless stops /p,t,k/ and their VOT was measured with respect to how far they appeared after switch. The most targets were produced immediately after the switch, the rest appeared within a 5s to 15s range. English monolingual VOTs were significantly shorter than in a typical

monolingual English speaker – a possible consequence of long-term contact with a short-lag language. English VOTs were shorter (more Spanish-like) after switching. The VOTs, however, increased with increasing time which indicates an ability to quickly recover as suggested by (Bullock et al., 2006). Spanish VOTs showed no difference in bilinguals' speech in a monolingual context nor in a switch context. Also in this study unidirectional phonetic transfer occurs in the direction of a short-lag language affecting a long-lag language. However, Balukas offers several possible explanations. One of them is a theory of inherent differences between languages developed by (Bullock et al., 2006). Another theory says that it is because L2 English was learned later than L1 and therefore is more accented (Flege, Munro, MacKay 1995). Other theories were based on overall lower English VOT in monolingual context, saying English VOT and Spanish VOT were getting closer, erasing the difference between VOT of short-lag languages and long-lag languages (Lisker & Abramson, 1964; Michnowicz & Carpenter, 2013; Nagy & Kochetov, 2013).

A code-switching study was also conducted by Olson (2016b) with focuses on Spanish L1 dominant and English L2 speakers versus English L1 dominant and Spanish L2 speakers. Unlike Olson (2013), a code-switching type of task was used in this study. Three different types of contextualizing paragraphs containing target tokens were employed depending on a desired context – monolingual non-switched context, monolingual switched context or bilingual code-switched context. The VOTs of voiceless stops /p,t,k/ that were followed by point vowels /i,a,u/ were measured in target words. The results showed that English L1 dominant speakers had shorter VOTs in switch contexts (both monolingual and bilingual) in English productions. However, there was no difference between VOTs in monolingual switched context and bilingual switched context. They also showed no difference in Spanish productions in any of the contexts. Spanish L1 dominant speakers showed the same pattern as English L1 speakers in English productions, i.e. in Spanish productions there was difference between switched and non-switched context. In both monolingual and bilingual switched context, VOTs were longer (more English-like) than in monolingual non-switched context. There was not a difference between bilingual and monolingual switched context. However, English productions in Spanish-dominant speakers revealed different results than in English L1 group. In this case, Spanish L1 VOTs differed in switched context (shorter VOTs) in

comparison to monolingual non-switched context, but there was a difference between monolingual switched and bilingual switched context. In bilingual switched context, Spanish VOTs in English productions were longer. Overall, English tokens in both Spanish and English productions showed greater changes in VOTs. The results confirmed that switched context causes phonetic transfer in bilinguals. The direction of the transfer is, however, asymmetrical. In English L1 dominant speakers the transfer was unidirectional from L2 to L1 (shorter VOT – more Spanish-like). In Spanish L1 dominant speakers the transfer was bidirectional. While results in English L1 speakers correspond with previous studies where a long-lag language become more like a short-lag one, the bidirectional transfer in Spanish L1 speakers is in accordance with (Bullock 2009).

3 METHODOLOGY

A part of the experiment was prepared in cooperation with my colleague Bc. Markéta Levá who was working on her own thesis at the same time when this research was being prepared. Since both theses were concerned with the phonetic research focused on the difference between English philology and English interpreting students, the Experiment 1 was created in such way that would fulfil the requirements of both researches so that the data corresponding to the given thesis could be later extracted and analysed on its own. The whole experiment included five different parts: a questionnaire, a LexTale test, a picture-naming task, a sentence-reading task and Simon's task. The picture-naming task as well as the sentence-reading task was done twice in two different language versions. Not all parts of the experiment are, however, being discussed in this section or this thesis. This chapter focuses only on those parts that were relevant to this research. The remaining part of the experiment was described and discussed in "Ability to switch in linguistic and non-linguistic tasks: Interpreters vs Non-interpreters" by Bc. Markéta Levá (2019).

3.1 Participants

Twenty-eight bachelor or master degree programme students of University of Palacký (6 males and 22 females) volunteered for this research. All of them had at least C1 level of English according to CEFR standard (Common European Framework of Reference for Languages at Verhelst et al. 2009) as they all had passed C1 exam at university which was a compulsory exam in their study programmes. The participants were students of English philology (20 students) or English translating-interpreting programme (8 students). One student of the master's degree programme in English translating-interpreting studies was, however, excluded from the group of English interpreters for her lack of experience in interpreting from her previous studies because her bachelor's field of study was French philology and not English interpreting. Therefore, the total of 21 philology students and 7 interpreting students participated in the experiment.

Despite the fact that there was enough volunteers, due to the very limited number of the interpreting students who volunteered for this research, only a part of

the philology students (corresponding to the number of the interpreters) was chosen for the analysis of results.

All twenty-eight participants took a LexTALE (Lexical Test for Advanced Learners of English) test which was introduced by Lemhöfer and Broersma (2012) as a tool for researches in experimental setting. Based on the LexTALE results, seven philology students with the highest score were chosen for this research. The subject of research in this thesis are, therefore, two groups of 7 participants (7 philology students: 5 females and 2 males; 7 interpreting students: 6 females and 1 male).

All participants (henceforth 14 participants chosen for this research) were asked to fill in a questionnaire available online (see Appendix). The average age of the participants was 24. The first language (L1) of all participants was Czech and the second language (L2) was English. All participants were also speakers of other languages such as German, Russian, Italian, French, Spanish, Japanese, Polish, Latin, Greek and Korean. None of the participants had ever lived in an English-speaking country and none of them was raised in a Czech – English bilingual environment. On average, all participants started learning English in the second or third grade of primary school, i.e. their average age was 7.5. Out of 14 participants, four students (3 philology students and 1 interpreting student) attended a grammar school with extended language programme. Two out of seven philology students had taken a course in interpreting.

On scale 1-9 (1 = not much, 9 = very much), the participants were asked to mark how much they were used to communicating in English outside school. Based on the results, the interpreters (mean = 6.57) use English for communication outside school more often than philology students (mean = 4.86). Four participants stated that they generally feel more confident when speaking English than Czech.

All participants stated on scale 1-9 (1 = none, 9 = on daily basis) that apart from school they translate more often than they interpret (mean = 2.86 for interpreting and mean = 5.29 for translating). However, the interpreters translate and interpret more often than the philology students (mean = 4.64 for the interpreters and mean = 3.50 for the philologists).

The total of 5 students (3 interpreters and 2 philologists) stated that they teach English and that they switch to Czech when teaching (scale 1-9, 1 = never, 9 = always; mean = 5.00).

On scale 1-9 (1 = never, 9 = always), the interpreters stated that sometimes they cannot remember a word in Czech when speaking English (mean = 5.14) and sometimes they cannot remember a word in English when speaking Czech (mean = 5.00). The philologists usually have more problems to remember a word in Czech when speaking English (mean = 6.71) than other way round (mean = 5.29). All participants admitted that when speaking Czech they are likely to say the word they cannot recall in English (mean = 6.43), however, they are not likely to say Czech word instead of the English word they cannot remember (mean = 3.5).

On scale 1-9 (1 = never aware of switching, 9 = always do it consciously), the philologists stated they are less aware of the fact they are switching from Czech to English or the other way round (mean = 4.71) than the interpreters (mean = 5.29). All participants switch between languages when speaking with their friends or schoolmates. Moreover, eight of them switch when speaking with their teachers, two of them switch when speaking to foreigners, one participant also switches when talking to a family member and one participant also switches when speaking to his/her students.

When asked what they think about people who use Czech words when speaking English and other way round, on the scale 1-9 (1 = I hate it; 9 = it is perfectly normal), the interpreters are more prone to hate it in both language environments (mean = 4.78), especially when English words are used in Czech speech production (mean = 3.86 for English words in Czech speech; mean = 5.71 for Czech words in English speech). The philologists think it is more normal (mean = 6.07; mean = 6.29 for English words in Czech speech and mean = 5.86 for Czech words in English speech). Both groups stated they feel quite comfortable when they switch between Czech and English in conversation (mean = 7.86 for both groups).

3.2 Experiment 1: Language-switching task

The Experiment 1 tries to find the answer for the research questions stated in the previous parts of this thesis by measuring using the length of VOT of the voiceless stop /k/ in word-initial position in Czech and English words. Whereas the Czech /k/ word-inital has short VOT, the English /k/ word-initial has longer VOT due to the presence of aspiration (Amengual, 2012). Based on this distinguishing phonetic

feature, the possible interference of both languages was measured in this Experiment.

The first experiment consisted of a language-switching task, namely a picture-naming task which is a type of task that was already used in previous phonetic studies such as in the one by Olson (2013). This experiment was inspired by this phonetic study. This picture-naming task enabled to make the participants say isolated words with no further context which is the main difference when compared to the code-switching task where the context is important.

3.2.1 Stimuli

For the Experiment 1, twenty words were chosen to be used as VOT /k/ stimuli. Ten of them were in Czech and ten in English. They were further divided into pairs of target words and their control words. Each pair was chosen based on the following criteria.

The first condition was the number of syllables. Only the monosyllabic or disyllabic words were used. Whereas all the Czech target words were disyllabic, English ones were monosyllabic except for one pair where both the target and its control word were disyllabic.

The second condition put stress on a frequency of target words and their control words just like it is done in Olson (2013). In order to choose the words with similar frequency, the Czech National Corpus – Corpus Oralv1 was used for Czech words; and BNC2 corpus on sketchengine.co.uk was used for English words. When working with BNC2, three categories "Spoken demographic, Written books and periodicals and Written miscellaneous" were chosen to make both corpora similar in terms of incorporating a similar range of data from the similar sources. Moreover, to assure the frequencies of the pairs of words were consistent across both languages, the words were chosen to match in frequency, i.e. if there is a pair of words in Czech of a higher frequency, there is also a pair of word of higher frequency in English. This was important to try to keep a similar lexical access to these words in both languages in order to eliminate the possible influence of non-consistent frequencies of the chosen words.

The third condition taken into account was the quality of vowels. The fundamental difference was made between high and mid/low vowels. In both

languages, there was a pair containing a high vowel, the rest of the words in the pairs had similar quality of vowel as much as it was possible. Furthermore, the pairs with the high vowels were at the same time the pairs of the highest word frequency.

The last criterion considered the fact how easy it would be to depict the word in an easy black and white drawing so that most of the participants would name the picture correctly and therefore would say the target word with the target sound. For this reason, all stimuli used in the Experiment 1 were nouns. The list of stimuli is stated in the Appendix.

3.2.2 Procedure

The Experiment 1 consisted of two contrastive mirror picture-naming tests - one that was Czech-biased and the second that was English-biased. The ratio of the pictures in one language and the other language was kept for the second test; however, the languages used for naming the pictures were switched. The tests were not taken in a single session, but in two separate sessions that were at least a week and at most two weeks apart. Depending on the predominant language of the test, the session was conducted only in Czech or in English.

In the beginning of the session, the participants were seated in front of a computer and were asked to go through a PowerPoint presentation on their own without the presence of an experimenter. The presentation instructed the participants to name pictures using one word without using articles. They were explained that before each picture a black cross (i.e. a fixing point) in the middle of the screen would be displayed accompanied with a short tone.

Then a picture would appear on the screen of red (English) or blue (Czech) colour together with the British or Czech flag located in the centre above the picture in order to ensure the participant will know which colour represent what language. In Olson (2013), the language of the displayed picture was also indicated by the colour of the screen, but the colour was not the same for everyone, i.e. English language was indicated with red or blue colour depending on what group the participant was in. In this study, the colours and the languages were fixed.

In this experiment, each picture was displayed on the screen for precisely 3000ms and then was automatically replaced by a blank screen with the fixation cross in the middle for 500ms and the beep sound before the following picture was

displayed. Before taking the real picture-naming test, the participants took a trial test. It consisted of 20 pictures to be named in Czech or English and six pictures to be named in English or Czech depending on the main language of the experiment. No words used in the trial test were used in the real test to avoid possible pre-teaching effect. After finishing the trial test, the first recorded test consisting of 200 pictures started. In the real test, after every 50 pictures there was a short break when the participants got chance to drink some water or make themselves more comfortable. However, it was also possible to stop the test manually in case of emergency. If this situation occurred, the picture that preceded the forced break was displayed again and then a new picture appeared on the screen. Both the trial test and the real test were conducted in Praat (vers.6.0.15., Boersma and Weeenik, 2016). For the sound recording, the Handy 4next Zoom recorder was used.

The first session of the Experiment 1 was led either in English (3 English philology and 4 interpreting students) or in Czech (4 English philology and 3 interpreting students). If the session was English-biased, the language used for communication between the participant and the experimenter was English. The PowerPoint presentation with instructions was also in English. The real test consisted of the total of 200 words, 75% of English words (150 words) and 25% of Czech words (50 words). Inspired by the research conducted by Olson (2013), the ratio of the Czech and English words was chosen in order to imitate the monolingual context (Olson (2013) uses the ratio 95% - 5%; with the ratio used in this research we were only trying to approach the monolingual context).

Out of 50 Czech words, 40 words were fillers and 10 words were the /k/ word-initial stimuli – the target words appeared in a switch position from English to Czech and their control words appeared in a stay position. In this research, the stay position is defined as the position after the switch, i.e. the position where the word is preceded and followed by the word in the same language as itself. The switch position is when the language of the target word differs from the language of the preceding word.

Out of 150 English words, 140 words were fillers and 10 words were /k/ word-initial stimuli. The /k/ stimuli were also divided into the switch and stay positions according to the same criteria as mentioned above, i.e. the target words were used in the switch position, the control words used in the stay position. The

switch position with an English target word was preceded by a word in Czech, the stay position was preceded and followed by English words.

The order of the words was quite complicated, given the fact that part of the words was used for the purposes of Markéta Levá's research. Only the rules important for this research are mentioned here. The first displayed picture was always a filler word. The Czech or English control words could not appear right after the switch position, at least two fillers had to precede them. However, they could appear (but not necessarily) before the Czech or English switch position. The Czech or English target word in the switch position had to be preceded at least by two fillers or control words. No target word in the switch position could appear right after the short break, i.e. after every fifty words when there was a break, the first word that would appear after this short break must not have been one of the target words.

The procedure of the Czech biased session completely copied the English one, i.e. 75% of 200 words were in Czech words and 25% were in English. In this test, out of 50 English words, 10 words were stimuli and 40 words were fillers. Out of 150 Czech words, only 10 words were the target words, the rest of 140 words were fillers. The Czech and English target and control words were the same in both experiments, i.e. the pictures were to be named in Czech or English. Stimuli in this test had to also fulfil the same conditions as those in the first test including the rules for the order of the words.).

In both tests, at least two stay positions and at most six stay positions randomly followed the switch position. Then another switch position appeared. Each target or control word appeared in each test only once, i.e. in Czech biased test, 10 Czech stimuli and 10 English stimuli were presented. The same pictures were then used in the English biased test.

3.2.3 Stimuli and procedure discussion

For the Experiment 1, it was decided to use VOT of voiceless stops such as /p,t,k/ for measuring the interference between languages because it is a feature that can be measured and compared easily. After spending some time on choosing the right stimuli, the /k/ sound turned out as the most suitable one because there was the biggest number of /k/ word-initial words meeting the criteria mentioned above.

However, not only voiceless stops and their VOTs were taken into consideration. In the beginning, there was an idea to use also words with GOOSE vowel /u:/ to assess this interference when switching between the languages. Since these words did not fulfil the criteria set for Experiment 1 such as simple depiction of the words or similar frequency, they were not included in the Experiment 1.

Amengual (2012) and Goldrick and Costa (2014) focused in their studies also on possible phonetic transfer in VOTs when the targets were cognate and non-cognate words. Cognates were defined as the words that have "phonological, semantic and orthographic overlap" in the two bilinguals' languages (Amengual, 2012, p. 518). Their possible effect in language production was already studied in previous studies where the results proved that the cognate words were translated more quickly than non-cognate word (De Groot, 1992) or the lexical access of cognates was faster (Caramazza & Brones 1979). Overall, cognates are believed to be easier to learn and remember. The language-switching study conducted by Goldrick and Costa (2014) showed that there was an effect on voiced and voiceless stops in switch trials in English productions and the code-switching study by Amengual (2012) proved that the /t/ word-initial Spanish cognates had longer, i.e. more English-like, VOTs than non-cognates. For this reason, it was considered employing cognates and non-cognates in this research as well. Unfortunately not enough possible cognates starting with the voiceless stop /k/ were convenient for this experiment. Furthermore, the possible influence of cognates was already being explored in the part of the experiment conducted by my colleague Bc. Markéta Levá, who was a co-creator of the experiment used for this study. Since the Experiment 1 consisted of my stimuli used for this research as well as the ones by Markéta Levá's, the majority of possible cognates that could have been used in this research was already used by her. Therefore, the possible comparison between cognates and non-cognates was eliminated from the original hypothesis of this research.

Subsequently, based on the decisions mentioned above, only voiceless stop /k/ word-initial words were included in the language-switching study. When searching for suitable stimuli, choosing the right corpora for word frequency was essential. Since each corpus focuses on different language production environment it was important to find such English and Czech corpora that would correspond to each other with their content. After discussing this topic with Mgr. Michaela Martinková,

Ph.D., a specialist on Corpora studies, from University of Palacký, the Czech National Corpus – Corpus Oralv1 and BNC2 (with narrowed criteria) were used.

After having chosen all possible words fulfilling the criteria, a group of bilinguals who were not familiarized with the purpose of the research and were not to participate in the real experiment, were asked to name the chosen pictures to verify if the pictures evoked the target words. If some pictures were repeatedly not named correctly, the words were eliminated or the pictures were changed to reduce a possible error rate during the real experiment.

When preparing the methodology for the Experiment 1, a possibility of pre-teaching the words with the target sounds was considered. This idea based on Goldrick (2014) study was, however, dismissed. This decision was motivated by the fact that most language-switching studies such as Olson (XY) or (XY) did not pre-teach the words in order to eliminate the possibility of faster lexical access which could have an effect on the results that were important to Bc. Markéta Levá's research (2019).

3.3 Experiment 2: Code-switching task

The second experiment was also designed to find the possible phonetic interference instigated by switching between two languages. However, this time a code-switching task was employed instead of the language-switching task. This experiment was also projected to see if the type of the environment or condition where the target sound is located influences the possible interference caused by switching between languages. Unlike the previous experiment where the picture-naming task was used in order to create the language-switching environment, the reading task was used for the code-switching setting.

As already mentioned in the theory section, code-switching is the type of switching where two (or possibly more) languages appear in a larger text or longer utterances. This differs from language-switching where isolated words are arbitrarily introduced with no further context. The code-switching tasks, furthermore, enable the participants to plan their speech ahead unlike the language-switching tasks where the feature of planning is missing.

For the analysis, two types of target sounds were used: the voiceless stop /k/ word-initial and a GOOSE vowel /u:/. Whereas at the /k/ word-initial words it was

their VOTs that was measured, at GOOSE /u:/ vowel it was the height of the formant F2. This formant is connected to the vowel quality regarding the backness of a vowel. When /u:/ is compared in English and Czech speech production, the English /u:/ vowel is much more fronted than the Czech vowel /u:/, i.e. its formant F2 of is higher in English than its formant F2 in Czech.

3.3.1 Stimuli

The same /k/ word-initial words used in the Experiment 1 were also used for the code-switching task in Experiment 2, i.e. 20 nouns (5 target and 5 control words in Czech; 5 target and 5 control words in English) with a /k/ initial sound. These stimuli were, however, not the only stimuli used in the second experiment. Even though the stimuli containing GOOSE vowel /u:/ could not have been used in the language-switching task because not enough words that would meet the criteria needed for that type of experiment were found, they met the criteria set by the Experiment 2. Since the Experiment 2 was the reading task, the problem with depicting the words in a drawing did not represent a problem as it did in the previous experiment. Therefore, 20 words (5 target and 5 control words in Czech; 5 target and 5 control words in English) containing GOOSE vowel /u:/ were chosen according to the following criteria: a) the vowel was not preceded or followed by nasals /m, n/, labials /p, b, v, f/ or approximants /j, w, r, l/; b) the number of syllables was the same in the target – control word pair; c) the frequency of the word pairs was similar. The frequency of words was again taken from the Czech National Corpus – Corpus Syn2015 and BNC2 ("Spoken demographic, Written books and periodicals and Written miscellaneous") corpus on sketchengine.co.uk.

The specific part of speech, i.e. nouns, was not included into the criteria for this experiment (the motivation to eliminate this condition is further discussed in 3.3.3 Stimuli and procedure discussion).

3.3.2 Procedure

After finishing the Experiment 1, the participants continued with the Experiment 2. The instructions were also introduced in a PowerPoint presentation with some extra examples for practice. The language of the experiment corresponded to the language

of the session. If the first session was in English, the second one was in Czech and vice versa.

In the presentation, the participants were informed that they were going to read monolingual or bilingual sentences aloud. They were asked to read each sentence for themselves first and then read it out loud and as fluently as possible. They were also instructed to ask for a break if needed because unlike the Experiment 1, this test was not Praat-controlled and moving to next sentence was led by the experimenter. It was conducted in PowerPoint presentation with the total of 203 slides (including the first opening and the last closing slide). Each sentence was presented in the centre of a blank screen, in Calibri Light font, size 49.0. Between each sentence a blank screen with no text was displayed. The experiment was recorded on the Handy 4next Zoom recorder was used.

The task consisted of 100 sentences, all starting in Czech (if Czech-biased session) or in English (if English-biased session). To keep the one language biased environment, 70 sentences were monolingual with no switch and 30 of them were switched into the second language after the target word, i.e. the target word was in the pre-switch position. There were two types of sentences with a switch. In the first type, the half of the sentence which was switched into the second language contained the target sounds /k/ word-initial sound and GOOSE /u:/ vowel (see Ex. 1 and Ex. 2). In the second type, the switched part did not contain these sounds. This was motivated by the question whether an increased phonetic interference in code-switching is due to the articulatory planning or due to planning at some higher level.

Ex. 1: English sentences for the reading-task

Pre-switch 1	Kate must also choose the word "*goose*" a splnit každý úkol.
Pre-switch 2	Kate must also choose the word "*goose*" a pak ho říct nahlas.
No switch	Kate must also choose the word "*goose*" to do the task correctly.

Ex. 2: Czech sentences for the reading-task

Pre-switch 1	Kája dá důraz na slovo "*důchod*" to do the task correctly.
Pre-switch 2	Kája dá důraz na slovo "*důchod*" then she'll say it aloud.
No switch	Kája dá důraz na slovo "*důchod*" a splní každý úkol.

Another feature of the sentences that was considered was their length in terms of number of syllables. To make Czech and English versions comparable all of the sentences had approximately same number of syllables (from 14 to 15 syllables without target or control words).

To make the Experiment 2 parallel to the first experiment, the target words and their control words were divided into the sentences in the following way. The target words that appeared in the switch position in the Experiment 1 (including the target words with GOOSE vowel that were not used in Experiment 1), appeared in the reading task twice, i.e. each target word was used in both types of switch sentences. In other words, there were totally 20 switch sentences with a target word. In the rest of 10 switch sentences, 10 filler words were used to make it less obvious that most of the words in the pre-switch position started with /k/ or contained /u:/ vowel. The control words were used in the monolingual sentences where no switch was present and were completed with 60 fillers (the complete list of fillers used in this experiment can be found in Appendix). All the sentences were distributed arbitrarily. Unlike the picture-naming task, where the order of pictures was unique for each participant, the order of the sentences was arbitrary but the same for all participants.

3.3.3 Stimuli and procedure discussion

The most problematic part of choosing the right stimuli for the reading task was the choice of the target and control words containing the GOOSE vowel /u:/. As it turned out, only a few words met all criteria established in the previous chapter. A common problem was that if a word met for example the first condition, it did not meet the rest of them. This problem emerged especially with the English words where the condition of specific environment of the target sound eliminated most of the possible targets. The frequency of the words caused some problems as well. For this reason, it was decided to incorporate not only nouns but also words from different part of speech categories. Even though this change was reflected in the choice of fillers, it was not reflected in /k/ word-initial words as they were already chosen for the first experiment fulfilling its criteria. The /u:/ words in Czech were not affected either, because the already chosen words were convenient for the purpose of the experiment. However, the frequency of English words was much

higher at verbs or numerals when compared to Czech target nouns. This decision caused a certain inconsistency in terms of frequency across both languages and both stimuli sounds. Despite this fact, the English target and control words fulfilled the first condition of not containing specific sounds before or after the target sound and were, therefore, considered as acceptable.

When thinking about the procedure, a few possible strategies were taken into consideration. The first possibility was a one-word insertion structure of the sentences such as *Kája dá důraz na slovo "king" a splní každý úkol.* or *Kate must also choose the word "kočka" to do the task correctly.* This structure uses monolingual sentences into which a single word in the second languages is inserted. It was used by Amengual (2012) who inserted English target words into a Spanish carrier sentence: "*Yo puedo decir XY*". Due to Bullock et al. (2006) this type was, however, not suitable for this experiment. Moreover, the code-switching task requires a more complex or longer context than a single word switch.

For this reason, another type of structure that would enable to manipulate the position of the words in relation to the switch seemed to fit the purposes of this research better. In this sentence structure (similar to the one that was at last used in the Experiment 2), the utterances would be divided into halves providing two possible outcomes. Half of the sentence would be in Czech or English (depending on the dominant language of the session) with a switch into the second language or both halves would be in the same language. The target and control words would then appear in three different positions - in a pre-switch position, a post-switch position or in a no-switch position (Ex.3 and Ex.4).

Ex. 3: English sentences + post-switch and pre-switch

#Post-switch	Ted must choose the word # "*důchod*" a úkol tak splnit.
Pre-switch#	Ted must choose the word "*goose*" # a úkol tak splnit.
No switch	Ted must choose the word "*goose*" to do the task right.

Ex. 4: Czech sentences + post-switch and pre-switch

#Post-switch	Teď dáte důraz na # "*goose*" and do the task right.
Pre-switch#	Teď dáte důraz na "*důchod*" # and do the task right.
No switch	Teď dáte důraz na "*důchod*" a úkol tak splníte

Motivated by findings of Bullock et al. (2006) where no effect was found in post-switch position due to "a quick ability to return to monolingual values after code-switching this structure was not eventually used for this experiment. Therefore, the third possible structure with two pre-switch types of sentences and no post-switch type of sentences was used in the Experiment 2 as already discussed in chapter 3.3.2 Procedure.

4 DATA ANALYSIS

All recorded data from the Experiment 1 and the Experiment 2 were analysed in a very similar way. They were cut and shortened using Audacity® Cross-Platform Sound Editor to get rid of some redundant parts such as the breaks during the experiment or the moments when talking was not related to the experiment itself. Subsequently, the sound files were converted to mono sound files and their scale intensity was adjusted using scripts in Praat. The sounds were then annotated in Praat.

4.1 Language-switching data analysis and coding

The language-switching task included only /k/ word-initial stimuli words, 10 in Czech and 10 in English. Four different kinds of annotations were created for four different trials: Czech switch trial, Czech stay trial, English switch trial and English stay trial.

When measuring VOTs of /k/, it was very important to define its left and right border and then apply this definition to all sound files during the process of annotation. The definition used by Machač and Skarnitzl (xy) says that the left border of stops corresponds to the first stop release and the right border to the moment when the full formant structure appears. Despite considering this definition, it was not eventually used because the full formant structure was not always easily detectable or visible. For this reason, the VOTs were measured from the point of the first stop release to the first zero crossing of periodicity visible in the waveform. This approach turned out to be more convenient for this research as it was easier to stay much more consistent throughout the whole process of measuring than it was when using the definition by Machač and Skarnitzl (xy). In unclear or ambiguous cases, the waveforms of the recordings from Praat were mutually compared to make sure the VOT was measured consistently and in the same way in all cases.

In Praat, "VOT "and "word" were annotated using a special coding for further analysis of the results. The first letter (or the word) corresponded to the target sound /k/ (or the target word), next two letters stood for the language of the word ("cz/en"), the switch or the stay position was marked by "sw" (for the switch position) or "x" (for the stay/no switch position). The last letter "t" indicated a category of the word, i.e. if the word was a target or not. In other words, if the

sequence was Czech-biased, the Czech target and control words were marked with "t" (indicating the direction of the switch from the minor language of English to the major language of Czech, or the stay position in the major language). The English target and control words in the Czech-biased sequence were not marked with "t" as the switch was directed from the major towards the minor language (Czech -> English) and the stay position was occupied by the word in the minor language (Ex.5). The opposite coding was used in English-biased sequence: English words had "t" in their coding whereas Czech words did not (Ex.6).

Ex. 5: Czech-biased sequence coding:

1. Czech (major language):
    a. *sounds:* *kczxt/kczswt*
    b. *words:* *kureczxt/kureczswt*

2. English (minor language)
    a. *sounds:* *kenx/kensw*
    b. *words:* *kingenx/kingensw*

Ex. 6: English –biased sequence coding:

1. Czech (minor language Czech):
    a. *sounds:* *kczx/kczsw*
    b. *words:* *kureczx/kureczsw*

2. English (major language):
    a. *sounds:* *kenxt/kenswt*
    b. *words:* *kingenxt/kingenswt*

After all VOTs were measured, they were collected using a special script provided by Mgr. Václav Jonáš Podlipský, Ph.D. The data were then statistically analysed in STATISTICA Application using Repeated Measures ANOVA (henceforth RM ANOVA) and are further described in Chapter 5: Results.

4.2 Code-switching coding data analysis and coding

The code-switching experiment was analysed and coded in a very similar way the language-switching task was, however, it had more sounds and more switch positions to be analysed, therefore, the coding had to be slightly adapted. In this experiment, it was also important to set a definition for measuring the GOOSE vowel /u:/ sound. Since the results were not based on the length of the sound like it was in the case of measuring /k/ sound, but rather on the average F2 height of the measured segments (25% from each side of the measured part was ignored, i.e. the

average height of F2 was calculated from the remaining middle part of the measured part, different measuring criteria had to be used in this case. Despite the fact that beginning of the full formant structure was not always easily detectable, the left border of the vowel /u:/ corresponded to the beginning of the full formant structure visible in spectrogram as well as the right border of the vowel that corresponded to the end of the full formant structure.

The coding was parallel to the coding of the Experiment 1, i.e. the first letter (or word) corresponded to the target sound (or word) ("k/u"), next two letters indicated the language of the words ("cz/en"). Next part of coding had to be changed to serve the purpose of the second experiment. Since the reading-task included two types of switch (the switch where the target sounds also appeared in the second half of the utterance and the switch with no target sounds in the second half of the utterance), the coding "x" and "sw" was not sufficient in this case. Despite keeping the letter "x" for indicating the stay/no switch position, "sw" was substituted for "a" (for the switch with the target sounds) and for "b" (for the switch with no target sounds) (Ex. 7, Ex. 8).

Ex. 7: The division of coding in the Czech and English CS task

Pre-switch 1	Kate must also choose the word "*goose*" a splnit každý úkol. = **a**
Pre-switch 2	Kate must also choose the word "*goose*" a pak ho říct nahlas. = **b**
No switch	Kate must also choose the word "*goose*" to do the task correctly.= **x**

Pre-switch 1	Kája dá důraz na slovo "*důchod*" to do the task correctly. = **a**
Pre-switch 2	Kája dá důraz na slovo "*důchod*" then she'll say it aloud. = **b**
No switch	Kája dá důraz na slovo "*důchod*" a splní každý úkol. = **x**

All words were then also marked with "t" indicating the fact they were the target (or their control) words. (The possibility of using "t" coding for further research is discussed in Chapter 6 Discussion).

Ex. 8: /k/ and /u/ coding in the Code-switching task:

1. Czech /k/:
   a. *sounds:* *kczxt/kczat/kczbt*
   b. *words :* *kureczxt/kureczat/kureczbt*

2. Czech /u:/:
   a. *sounds:* *uczxt/uczat/uczbt*
   b. *words:* *duchodczxt/duchodczat/duchodczbt*
3. English /k/:
   a. *sounds:* *kenxt/kenat/kenbt*
   b. *words:* *kingenxt/kingenat/kingenbt*

4. English /u:/:
   a. *sounds:* *uenxt/uenat/uenbt*
   b. *words:* *scooterenxt/scooterenat/scooterenbt*

The measured VOT data were extracted using the same script for VOTs from the Experiment 1. For the data regarding the GOOSE vowel /u:/, a different script focused on vowel quality had to be used. For the purpose of this research, the script for three formants F1, F2 and F3 created by Jakub Bortlík in 2016 was chosen as the most suitable one. The value of the proportion of the initial and the final margin was 0.3, the number of formants was 3, the maximum number of formants was also 3. The female frequency was set to the value 3500 and the male one to the value 3300. The data were then statistically analysed in STATISTICA Application using RM ANOVA and are further described in the following chapter.

5 RESULTS

5.1 Code switching

The code-switching task consisted of the sentence-reading task with the possibility of repeating the sentence if it was not read correctly, therefore, there were no errors that would eliminate some of the target or control words from the analysis.

5.1.1 VOT of voiceless stop /k/

In the RM ANOVA the data of all students was compared for the English-biased sentences, i.e. the sentences that started in English and were finished either in English (monolingual sentences) or in Czech (bilingual sentences of two types: the type A: with the repeating target sounds, the type B: with no target sounds). The VOT of /k/ in the stay position was longer than the VOTs in both switch positions with the statistically significant difference ($F(2, 26) = 6.3246$, $p = .00578$). Then Tukey's honestly significant difference (HSD) post hoc test was conducted and it showed that there was a statistically significant difference betweeen the stay and the switch positions ($p < .05$; $p = .0135$ for the switch vs the stay A and $p = 0.0127$ for the switch vs the stay B), but there was no difference between the two types of the switch positions A and B ($p > .05$).

The opposite result was found when the VOT in the stay position was compared to the switch positions in the Czech-biased sentences. The VOT of /k/ was shorter than the VOTs in both switch positions, where the VOT was longer, i.e. more English-like with the statistically significant difference ($F(2, 26) = 8.8145$, $p = .00120$). Tukey's HSD post hoc test showed there was no statistically significant difference between the types of the English sentence-endings ($p > .05$). The comparison of the VOT in the Czech and English biased sentences is depicted in the Fig. 1.

After having compared the results of all participants, the results of the students of philology (FIL) and the students of interpreting (ATP) were compared separately as well as between themselves. The VOT of /k/ in the English-biased sentences was statistically significant for FIL ($F(2, 12) = 4.8583$, $p = .02847$) in the stay position compared to the switch positions. The VOT was shorter in the switch positions than it was in the stay position. However, Tukey's post hoc test revealed that the statistical significance was only between the stay position and the switch

position B (p < .05; p = .027) and not the stay and the switch position A (p > .05). There was also no statistical difference found between the types of the switch positions A and B (p > .05).

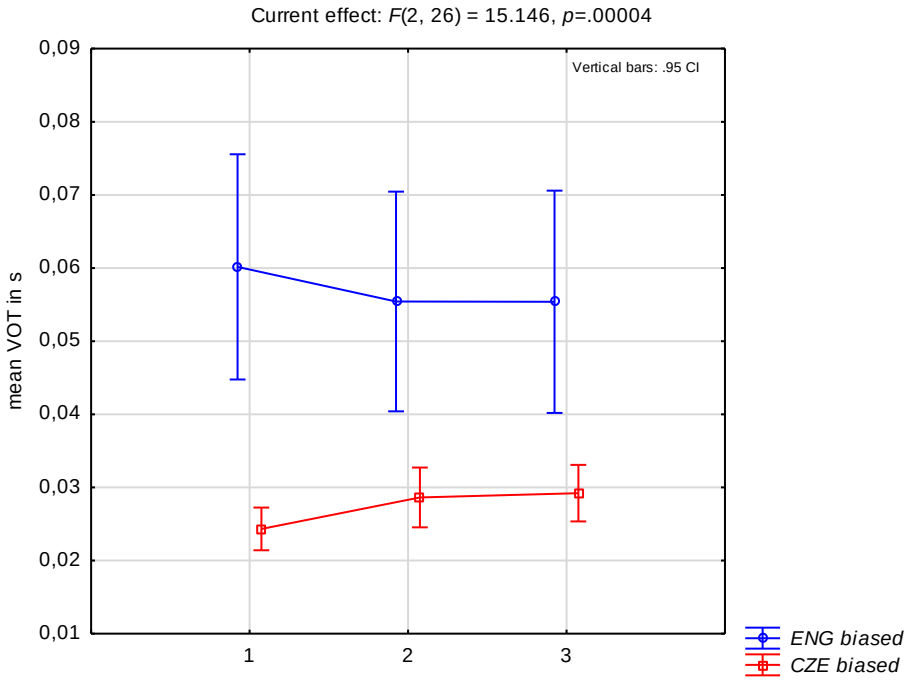

Fig. 1: *This graph shows how the VOT of all participants in the English-biased sentences changes in the stay position (1), in the switch A (2) and the switch B (3) positions and how it differs from the VOT in the same positions in the Czech-biased sentences.*

The results of the English-biased sentences in the group of ATP students revealed no statistically significant difference between the stay and switch positions (F(2, 12) = 2.4970, p = .12397).

When both groups were compared, no statistical difference was revealed between them (F(2, 12) = .44581, p = .65049). Despite the fact, there was no difference between the FIL and the ATP group in terms of the direction of the VOT change, there was a statistically significant difference between the length of /k/ between the groups in all positions. The VOT of the ATP group was longer than was the VOT of FIL group (p < .05) (see Fig. 2).

Unlike FIL's VOT in the Czech-biased sentences, where no statistically significant difference was found (F(2, 12) = 3.7490, p = .05434), the results of the ATP group were found statistically significant (F(2, 12) = 5.0129, p =.02615). However, Tukey's post hoc test showed there was the only statistically significant difference between the stay position and the switch position B (p = .032), where the

VOT is shorter than in the switch position. The difference between the stay position and the switch position A was (p = .066), which did not prove any statistically

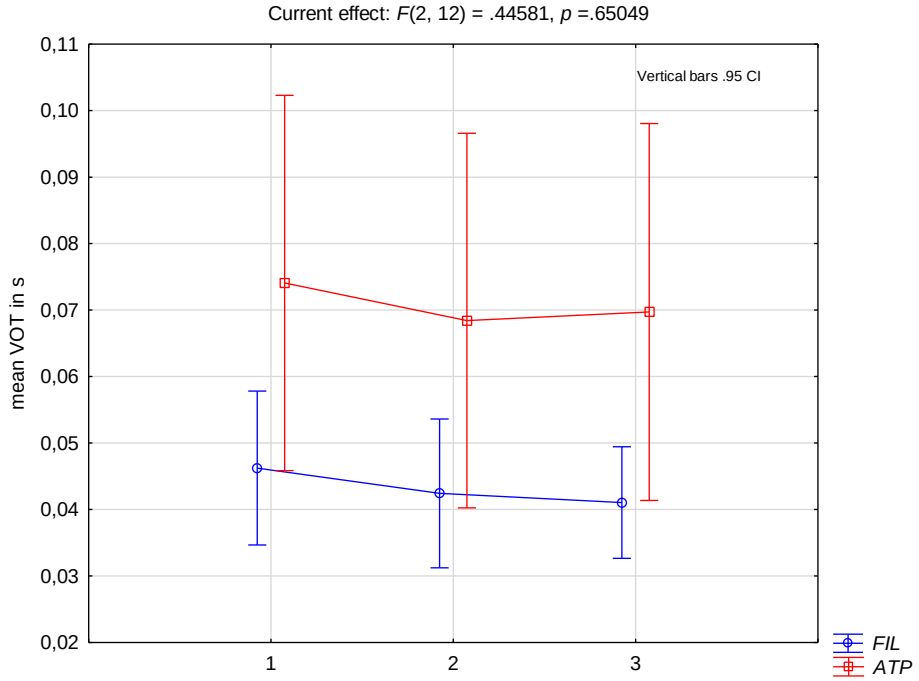

Fig.2: *This graph shows the comparison of the VOT in the English-biased sentences when compared between FIL and ATP students. In the stay position (1), there is longer VOT than it is in the switch position A (2) or B (3).*

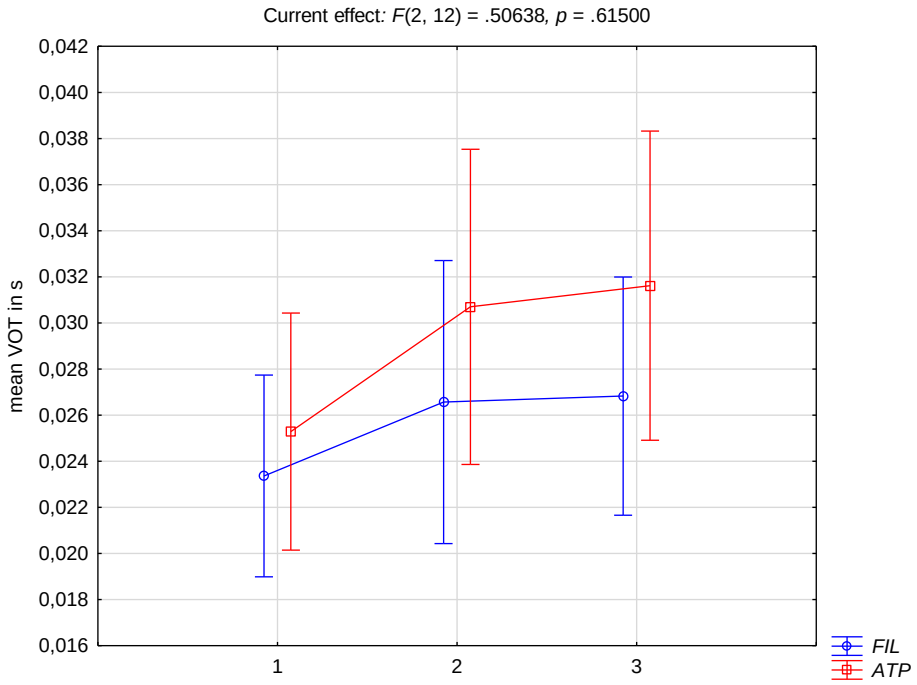

Fig.3: *This graph shows the comparison of the VOT in the Czech-biased sentences when compared between FIL and ATP students. In the stay position (1), there is shorter VOT than it is in the switch position A (2) or B (3).*

significant difference but it indicated a trend of change. The results from the Czech-biased sentences are depicted in Fig. 3. No statistically significant difference was found when the results of the groups from the Czech-biased sentences were compared together.

5.1.2 F2 of GOOSE vowel /u:/

The results for the second target sound /u:/ were measured based on the height of the second formant F2. All data was compared using the RM ANOVA as it was with the data regarding the VOT of /k/.

For the English-biased sentences, there was no statistically significant difference between the stay and switch positions ($F(2, 26) = .42020$, $p = .66130$), however, there was the statistically significant difference in the Czech-biased sentences ($F(2, 26) = 15.983$, $p = .00003$). where the F2 was higher than the F2 in both switch positions. This was also confirmed by Tukey's post hoc test that furthermore showed that there was no statistical difference between the types of the switch ($p > .05$), see Fig. 4.

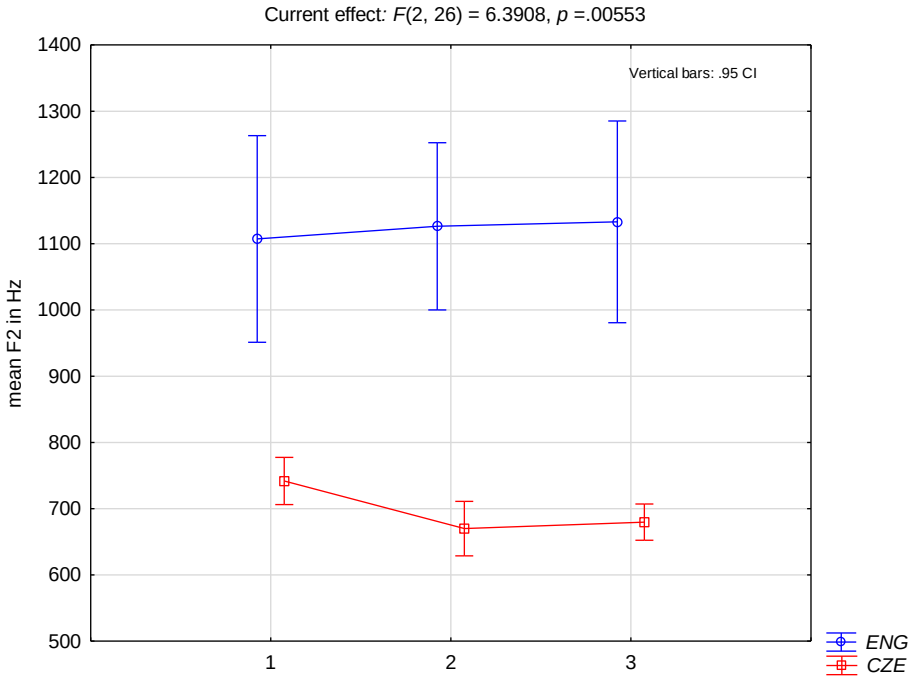

Fig. 4: *This graph shows the comparison of the F2 of /u:/ in the Czech-biased and the English-biased sentences. The only significant difference was in the Czech-biased sentence, where the value of F2 in the stay position (1) was bigger than the one in the switch position A (2) or the switch position B (3).*

In the English-biased sentences, no significant difference was found for the FIL group ($F(2, 12) = .31763$, $p = .73381$). No effect appeared in the ATP group either. ($F(2, 12) = 2.6425$, $p = .11197$). However, when these two groups were coompared together, there was the statistical difference ($F(2, 12) = 4.8877$, $p = .02801$). Tukey's test revealed that there was the statistically significant difference between the switch B position of the FIL students and the switch B position of the ATP students ($p = .005$). As can be seen in Fig. 5, the difference was caused by opposite directions of change in the ATP and the FIL group.

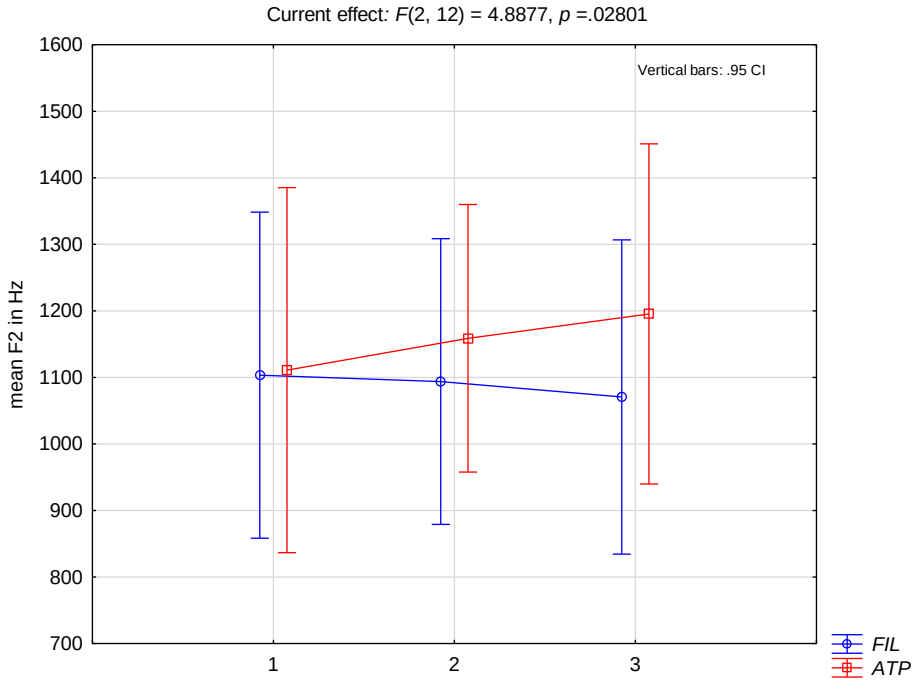

Fig. 5. *This graph compares the English-biased sentences between the group of FIL and ATP students across the stay position (1), the switch position A (2) and the switch position B (3). The different directions of the possible effects can be observed in this graph. Whereas the philologists' F2 of /u:/ seem to have the tendency to be more Czech-like, the interpreters seem to make the F2 even higher.*

In the Czech-biased sentences, the FIL group showed the significant difference ($F(2, 12) = 26.836$, $p = .00004$), Tukey's post hoc test confirmed there is the statistical difference between the stay position and the switch position A ($p = .0002$) and the stay position and the switch position B ($p = .0004$) The value of F2 was lower than the value of F2 in the stay position. No significant difference was found between the switch positions. There was also no statistically significant difference ($F(2, 12) = 2.6175$,$p = .11393$) in the results of the ATP group.

When both results were compared together, it turned out that the FIL group had the highest F2 in the switch position in the Czech-biased sentences. This value

had the significant difference not only with the FIL switch postitions, but also with the ATP switch positions (p = .009 for A; p = .013 for B), see Fig. 6.

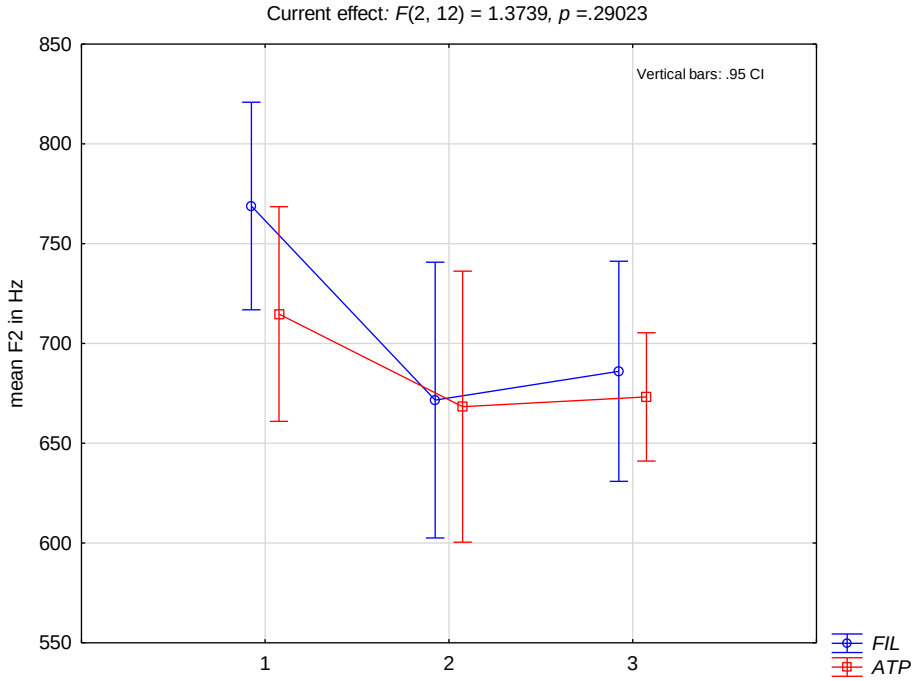

Fig. 6: *This graph shows the difference between two groups of FIL and ATP in the Czech-biased sentences for F2 of /u:/. The signifant difference is between the stay position (1) and the switch position A (2) and the switch postion B (3). It also show that the FIL group had higher F2 in the stay postion than the ATP group did. It can be also observed that there was the tendency to use lower F2 in the switch position in the Czech-biased sentences.*

5.2 Language switching

Due to the nature of the picture-naming task, where the pictures were displayed on the screen for only a few seconds, some errors occurred during the experiment. The total error rate of the philology students was 12.1% (17 words out of 140 in total) and the error rate of the interpreting student was 14.3% (20 words out of 140 in total)

The most common error was when the picture was not named at all or when a different word was used instead of the target/control word. In some cases, the target picture was named with a slight difference from the original target/control word, e.g. “koš” instead of “košík”, “kačena” instead of “kachna” or “kostky” instead of “kostka”. Despite these differences, these words were measured and were included in the final analysis.

5.2.1 VOT of voiceless stop /k/

The RM ANOVA was also used for the language-switching task result analysis. The results of all participants were statistically compared as first. The VOT of the English words in the English-biased test turned out to be statistically different in terms of the comparison between the stay and the switch position ($F(1, 13) = 19.142$, $p = .00075$), the VOT was longer in the stay position than in the switch position. However, the VOT of the same words in the Czech-biased showed no statistically significant difference ($F(1, 13) = 2.9162$, $p = .11145$). When the VOT of the English words in the switch and stay positions was compared across both language settings, no further difference was found.

The VOT of the Czech words in the stay and switch positions in the Czech-biased test showed no statistically significant difference ($F(1, 13) = .05368$, $p = .82039$). There was the statistical significance for the VOT of the same words in the switch and stay position in the English-biased test ($F(1, 13) = 5.40007$, $p = .03698$), where the VOT in the stay position was shorter than in the switch position. However, when both tests with the same words were compared together, there was not any statistical significant difference ($p > .05$).

The comparison of the Czech and English words in both tests can be seen in the graph made by Means with Error Plots in Fig. 7.

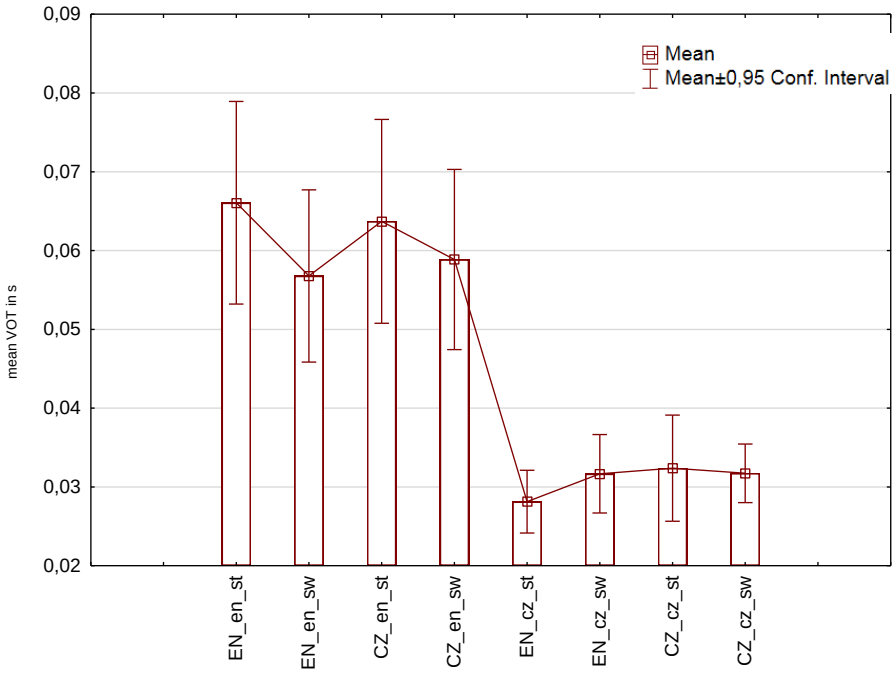

Fig. 7: *This graph shows the comparison of the mean VOTs of the English and Czech words (en/cz) with the target sounds in the English or Czech-biased tests (EN/CZ) in the stay or switch position (st/sw).*

The same results were compared for the FIL group. In the English-biased test the English VOT turned out to be statistically shorter in the switch position than in the stay position ($F(1, 6) = 9.1279$, $p = .02336$), in the Czech-biased test no statistical difference was found for the English VOT ($F(1, 6) = 3.5582$, $p = .10820$). The Czech VOT proved to have no statistical difference in none of the language-biased tests ($p > .05$).

Similar results appeared in the ATP group. The English VOT in the English-biased test showed statistically significant difference between the words in the stay and the switch position ($F(1, 6) = 9.2299$, $p = .02286$), where the VOT in the switch position was shorter than in the stay position. However, no significant difference was found in the Czech biased test ($F(1, 6) = .94733$, $p = .36799$).

The Czech VOT showed no difference in the Czech-biased test ($F(1, 6) = .02639$, $p = .87628$), however, it did show significant difference when comparing the stay and switch position in the English-biased test, where the VOT was longer in the switch position ($F(1, 6) = 6.6410$, $p = .04194$).

The results were also compared between both groups. In Fig. 8 and Fig. 9, there are two different graphs, the one in Fig. 8 is for the English VOT of /k/ and the second in Fig.9 is for the Czech VOT of /k/. In case of the English VOT, Tukey's post hoc test revealed that there is the statistically significant difference between the length of the VOT between ATP and FIL participants, where the ATP group had longer English VOT in the English-biased test in the stay position ($p = .0005$) as well as in the switch position ($p = .0003$) when compared to the FIL group. The ATP students had also the statistically significantly longer VOT in the Czech-biased test, in the stay position ($p = .0003$) and the switch position ($p = .0003$).

Tukey's post hoc test for the Czech VOT did not reveal any further difference between the results of the ATP and FIL participants.

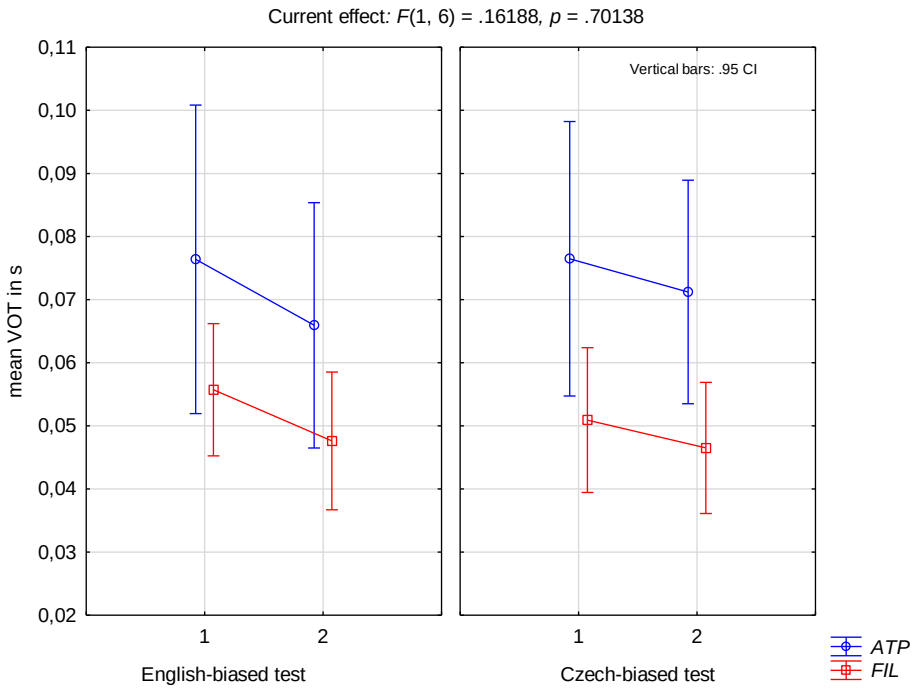

Fig. 8: *This graph shows the differences between the ATP and FIL group for the English VOT /k/ in two language-biased tests. The VOT is longer in the stay position (1) than in the switch position (2) in both test, however, only the results from the English-biased test turned out to be statistically significant.*

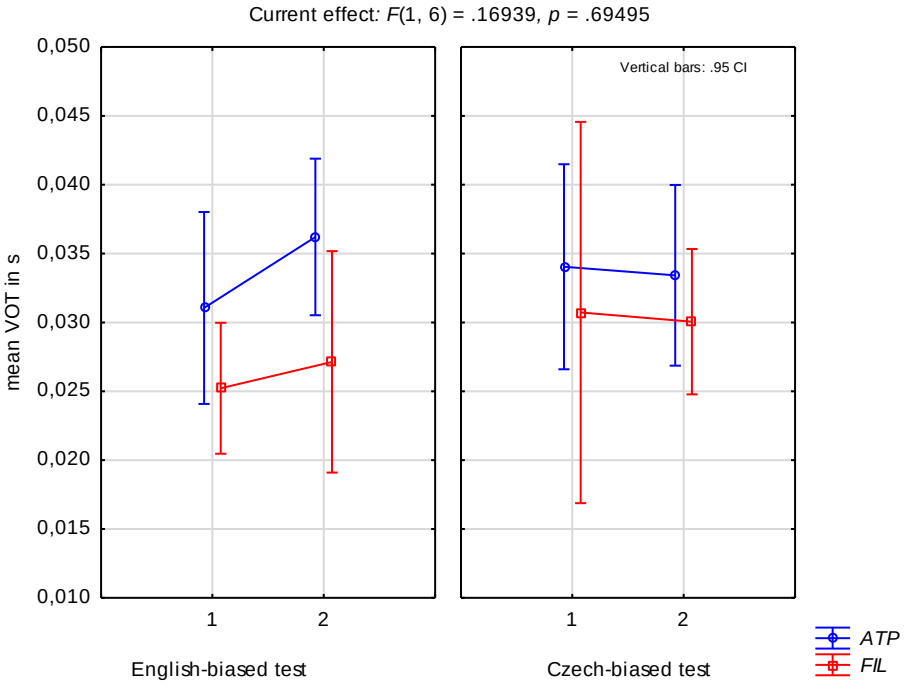

Fig. 9: *This graph shows the differences between the ATP and FIL group for the Czech VOT /k/ in two language-biased tests. The VOT is shorter in the stay position (1) than in the switch position (2) in the English-biased test for ATP and also for FIL (however, for FIL it is not statistically significant). In the Czech-biased test, there is no statistically significant difference between the VOT in the stay and switch position.*

5.3 Code switching x Language switching

One of the research questions asks if there is the same or different increased phonetic interference if the same target sounds in the same target and control words appear in two different environments, i.e. if they are switched across isolated utterances or if they are switch within a single utterance. The following results try to find the answer whether the type of the task affects in any way the VOT of the target sound /k/ word-initial.

5.3.1 VOT of voiceless stop /k/

The RM ANOVA was also used for the comparison of the results across both switching task. First of all, the results of all students were compared, then they were compared with respect to the ATP and FIL group in order to see if there was any difference between the groups and if their different type of language training has any effect on the possible phonetic interference.

The results for the English VOT in different positions were compared across both tasks. No statistically significant difference was found for the comparison between the code-switching task (CS) with two types of switch positions A and B and the language-switching task (LS) where the same English target and control words appeared in two different language-biased test (i.e. the English VOTs in the switch positions A and B in the English-biased CS task were compared to the English VOTs in the switch positions in the English-biased LS task and the Czech-biased LS task) ($F(3, 39) = .38606$, $p = .76364$). The same comparison was done also for the English VOTs in the stay position in the CS and LS tasks but with no statistically significant result ($F(2, 26) = .90956$, $p = .41514$).

Since the previous results proved that in the CS task there was no significant difference between the switch A and B for the English VOTs ($p > .05$), only the switch A was chosen for the comparison of the VOTs in the English-biased tests, i.e. the VOTs in the CS stay, the CS switch A and the LS stay and the LS switch positions were compared ($F(1, 13) = 5.0318$, $p = .04294$). Tukey's test showed that except of the statistical differences between the stay and switch positions in both tasks

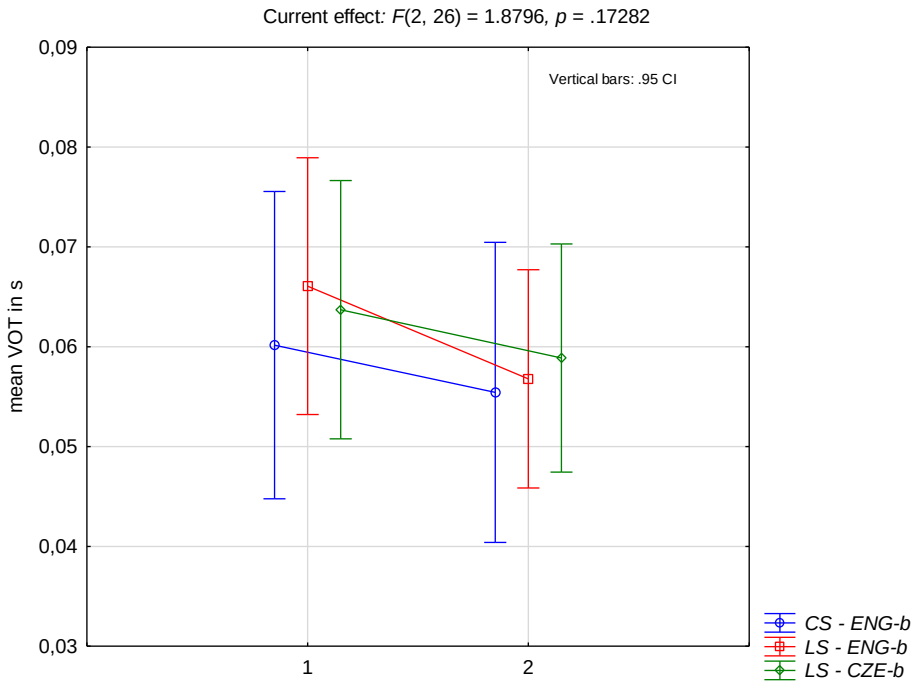

Fig. 10: *This graph compares the English VOTs in the stay (1) and the switch (2) position in the CS and LS tasks. The English VOT appeared in two different LS language-biased tests, in the English-biased (ENG-b) and in the Czech-biased (CZE-b).*

that were already proven in the previous sections, there was the statistically significant difference between the stay position in CS and LS task (p = .006) where the English VOT was longer in the LS English-biased task than in the CS task. When the same CS stay and CS switch A from the English-biased sentences were compared to the English VOT in LS stay and LS switch positions from the Czech-biased test no significant result was found (F(1, 13) = .00111, p = .97398). The comparison of all results can be seen in the Fig. 10, where no further statistical significance was found (F(2, 26) = 1.8796, p = .17282).

The same comparison test was conducted also for the Czech VOT. The test between all types of switches for the Czech VOT showed a statistically significant difference (F(3, 39) = 3.1066, p = .03739), however, Tukey's post hoc test did not reveal any effect at all. The comparison of all stay positions showed the significant result (F (2, 26) = 4.7979, p = .01684), Tukey's post hoc test showed the statistical significance was between the Czech VOT in the stay position in the CS task when compared to the same position in the LS task in the Czech-biased test (p = .013) where the VOT was longer in the stay position in the LS task than in the CS task.. No difference was found between the CS task and the LS task in the English-biased test, nor even between the Czech and English-biased tests (p > .05)

Next test compared the stay and switch positions across both test. For this comparison only the switch A was used as no significant difference was proven between the switch A and B (p >.05). When the VOTs in the Czech-biased tests were compared no significant effect was found (F(1, 13) = 3.4923, p = .08435), however, Tukey's test revealed a significant difference between the stay position in the CS and the LS task as already mentioned in the comparison of all the stay positions for the Czech VOT. The comparison of the Czech VOT in the CS task and the LS English-biased test revealed no significant effect (F(1, 13) = .17132, p = .68569). Tukey's test only confirmed the statistically significant difference between the stay and switch position in the CS task that was already mentioned in the previous sections.

The comparison of all three tests for the Czech VOT (F(2, 26) = 1.7812, p = .18838) can be found in the Fig. 11.

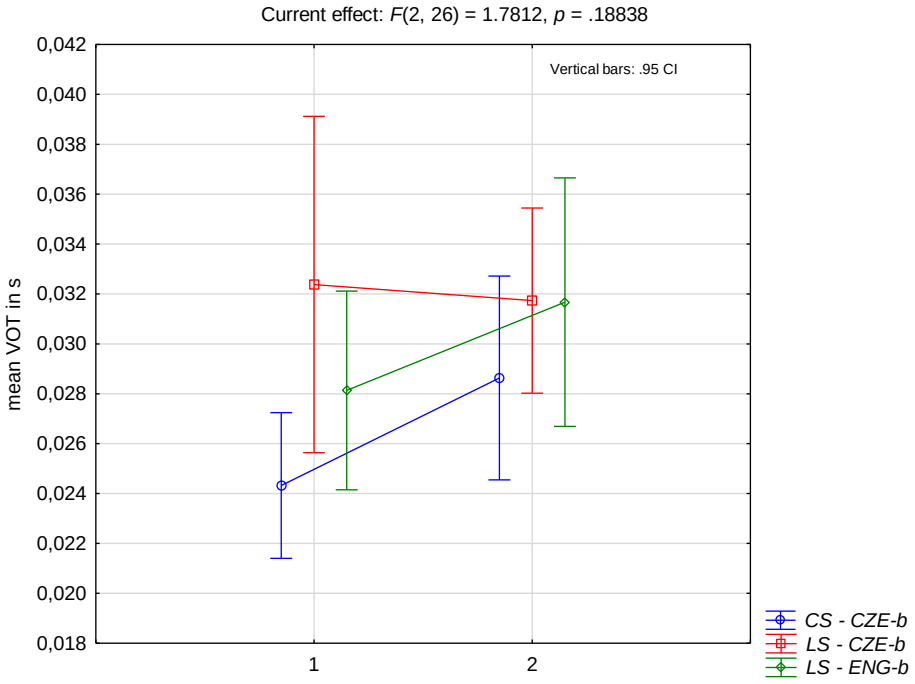

Fig. 11: *This graph compares the Czech VOT in the stay (1) and the switch (2) position in the CS and LS tasks. The Czech VOT appeared in two different LS language-biased tests, in the English-biased (ENG-b) and in the Czech-biased (CZE-b).*

All results were also compared between the group of the ATP and FIL students. First of all, all data for the English VOT was compared. The comparison of the English VOT in all switch position can be seen in Fig. 12. Tukey's test revealed there are statistically significant differences in the lenght of the VOT between the

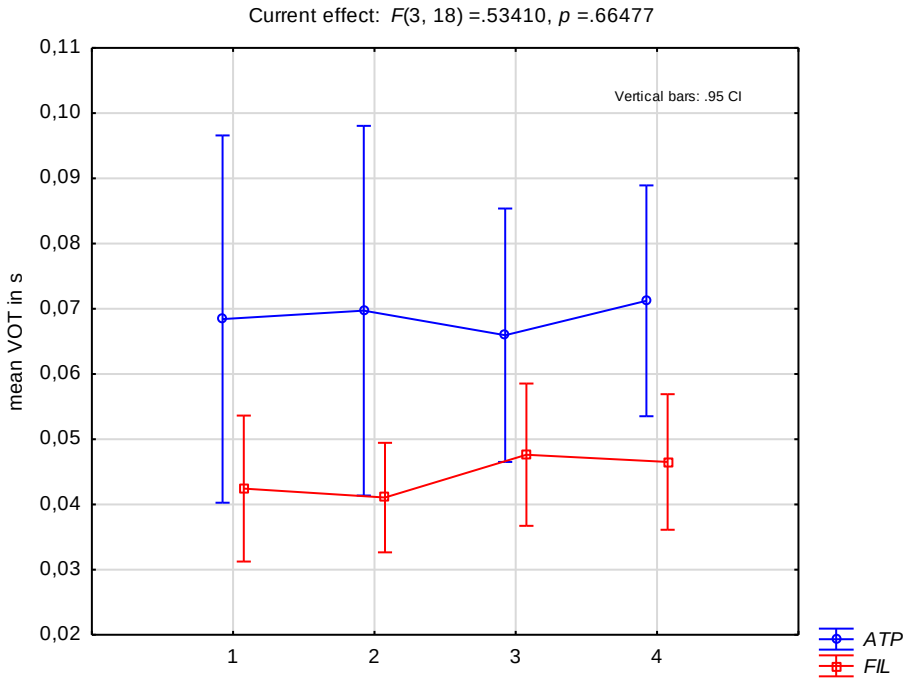

Fig.12: *This graph shows the comparison of the English VOT in the group of ATP and FIL students across all switch positions: the English-biased CS switch A (1), the English-biased CS switch B (2), the English-biased LS switch (3) and the Czech-biased LS switch(4).*

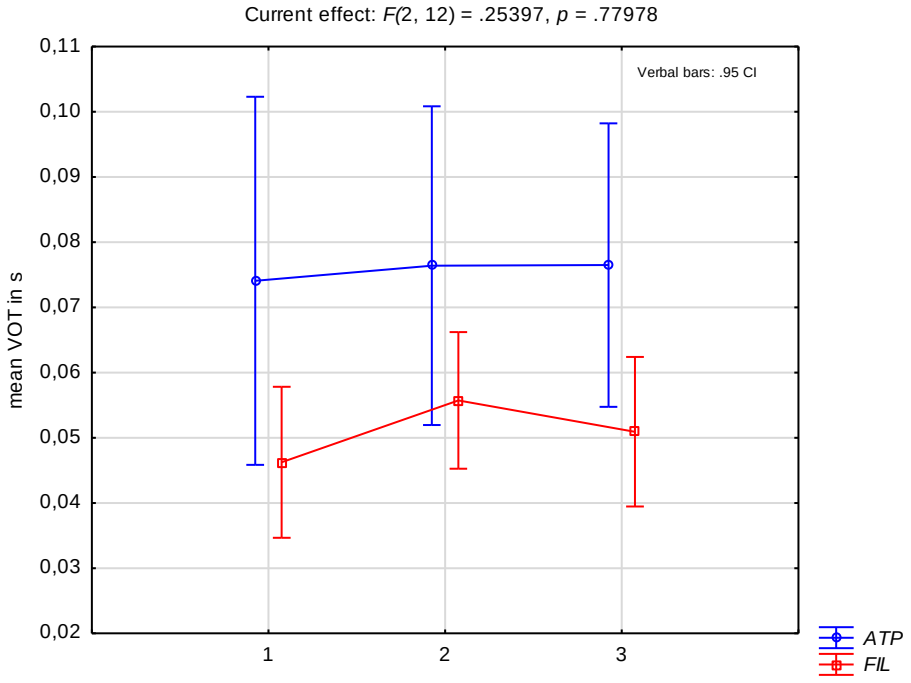

Fig.13. *This graph shows the comparison of the English VOT in the group of ATP and FIL students across all stay positions: the English-biased CS stay (1), the English-biased LS stay (2) and the Czech-biased LS stay (3).*

ATP and FIL students in all switches except for the English-biased LS switch (p < .008 for ATP x FIL in the CS switch A; p < .003 for ATP x FIL in the CS switch B; p < .012 for ATP x FIL in the Czech-biased LS switch). In other words, the VOT of the ATP students was generally longer than the one of the FIL students.

The same was conducted for the English VOT in all stay positions (Fig. 13). Also in the case of the stay positions, Tukey's test revealed the significant difference in the length of the English VOT between ATP and FIL group. The difference was found for the stay position in the CS task (p = .023) and also for the stay position in the Czech-biased LS task (p = .039) . In both cases, the English VOT was longer in the ATP results.

The Fig. 14 shows the comparison of all English VOT across all tasks and all positions. Tukey's test showed that there are statistically significant differences between the English VOT in the results of the ATP group when compared to the FIL group (p < .05). The ATP participants used longer VOT in all positions than the FIL participants. Whereas there was no statistical difference in the results of the ATP participants, Tukey's test revealed that the FIL participants had significantly longer English VOT in the switch position of the LS English-biased task when compared to the English VOT in the switch position of the CS task (p = .040).

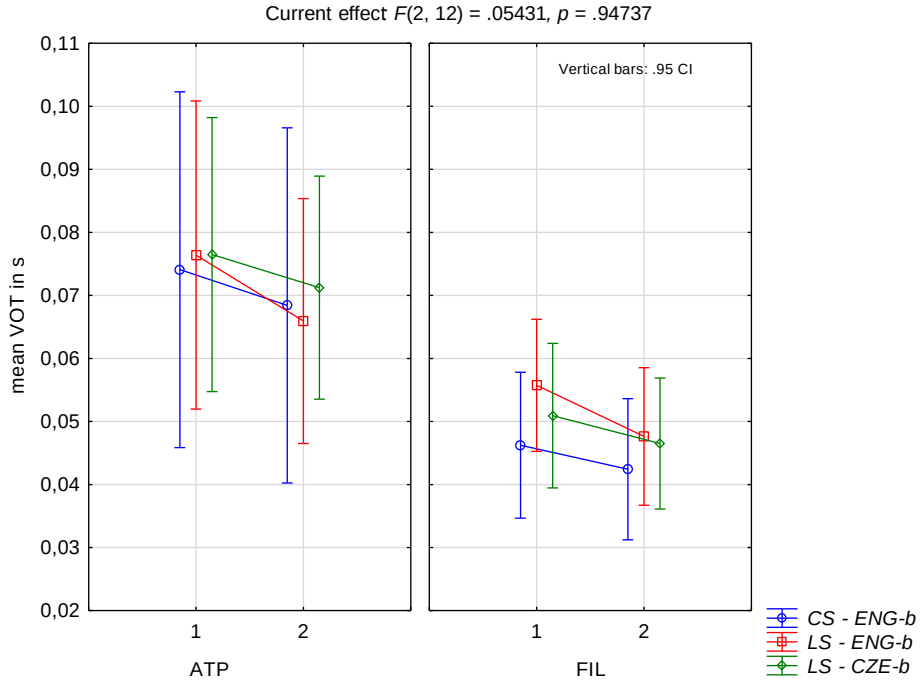

Fig. 14: *The English VOT comparison between the ATP and FIL participants across all the tasks and the stay (1) and the switch (2) position.*

The Czech VOT was also compared with respect to all switch positions between the CS and LS between the ATP and FIL groups. The only significant difference appeared in the switch position of the LS English-biased task. The Czech VOT of the ATP participants was longer than the VOT of the FIL praticipants (p =.0007), see Fig. 15. However, there was no statistically significant effect found for the Czech VOT in the stay positions (F(2, 12) =.21524, p = .80939), see Fig. 16).

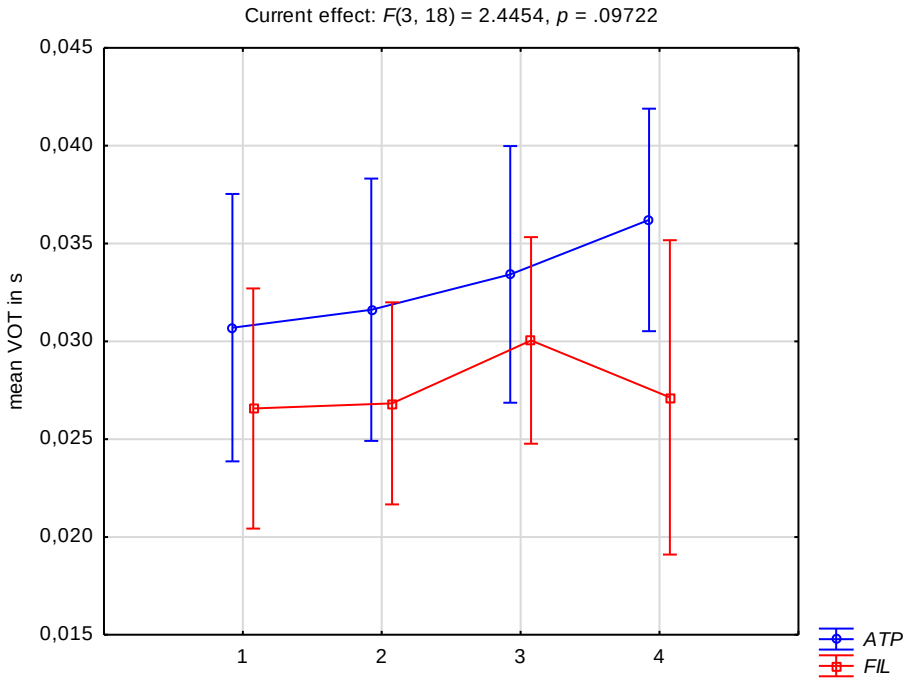

Fig. 15: *This graph shows the comparison of the Czech VOT in the group of ATP and FIL students across all switch positions: the Czech-biased CS switch A (1), the Czech-biased CS switch B (2), the Czech-biased LS switch (3) and the English-biased LS switch(4).*

The Czech VOT was then compared in all positions and types of tasks for the ATP and FIL group. Despite the fact Tukey's test did not reveal any statistically significant difference between the results, the graph in Fig. 17 shows different direction tendency in the LS Czech-biased test when compared to the rest of the tests.

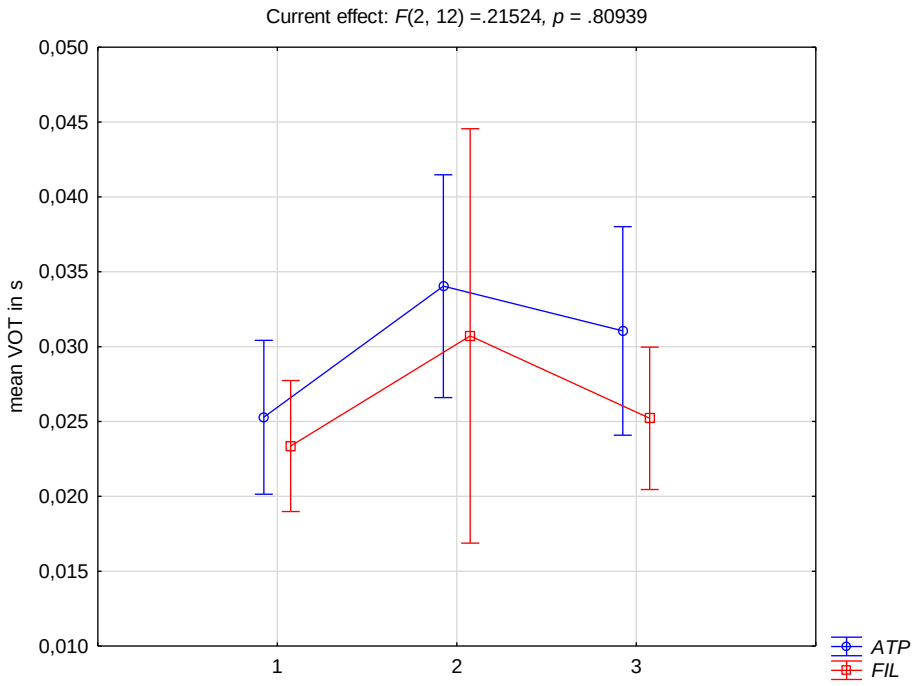

Fig.16: *This graph shows the comparison of the Czech VOT in the group of ATP and FIL students across all stay positions: the Czech-biased CS stay (1), the Czech-biased LS stay (2) and the English-biased LS stay (3).*

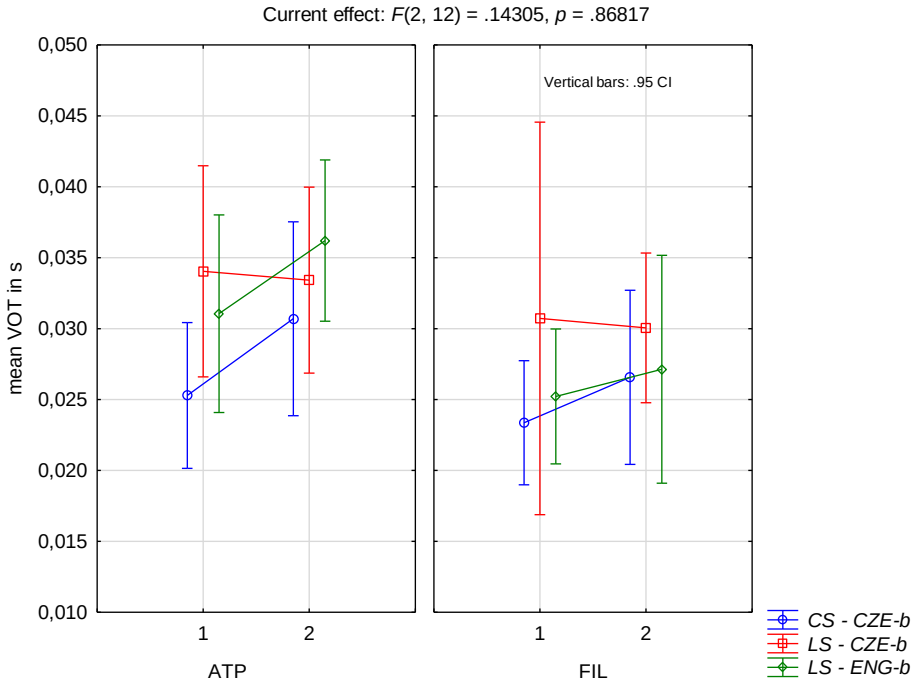

Fig.17: *This graph shows the comparison between the ATP and FIL participants for the Czech VOT in all possible types of tasks and positions – the stay position (1) and the switch position (2).*

6 DISCUSSION

In the code-switching task the direction of the phonetic interference that was symmetrical (it appeared in both languages, making them more-like the second language) caused by the switch was different in both languages. The English VOT was shorter in the switch positions, thus it was more Czech-like. The Czech VOT was longer in the switch positions and became more English-like. No difference between the types of the switches was revealed. This phonetic interference was expected as supported by the findings in Bullock et al. (2006). The expected increase of the phonetic interference in the pre-switch position very likely occurred due to the process when the participants were supposed to read the sentences on their own and then read them aloud, thus they knew that they were about to switch into the second language.

The ATP and the FIL students did not show any difference in terms of the direction of the phonetic interference, however, their results were different in terms of the length of the English VOT – the ATP students had significantly longer English VOT than the FIL students. Since the similar difference in the length of VOT did not occur in the Czech VOT, this difference might be caused by a different level of language training or it might be the outcome of the fact that Czech speakers prone not to pronounce English voiceless stops with aspiration, which makes the English VOTs shorter.

The similar direction of the phonetic interference was expected to occur also in the case of the F2 of GOOSE vowel /u:/, i.e. it was expected that the high English vowel /u:/ would become more Czech-like – it would have lower value and that the Czech vowel /u:/ would become more English-like. Generally, the F2 of /u:/ vowel had higher value in English than in Czech, which suggest that the participants distinguished between the Czech and English /u:/ vowel. However, in the English-biased test no significant difference was found between the switch and the stay position. In the Czech-biased position, the value of F2 was higher in the stay position than it was in the switch position, which shows an opposite direction of the phonetic interference than it was expected. The direction of the interference of the F2 value turned out to be different for the interpreters and for the philologist in the English-biased test. Whereas in case of the interpreters whose F2 was even higher in the

switch position than it was in the stay position, the F2 of the philologists speech was lower in the switch position.

In the Czech-biased test, the philologists produced Czech /u:/ with lower F2 in the switch positions than in the stay position. Despite the lack of statistically significant difference in the speech of the interpreters, the graph depicted that the direction of the interference was the same like in case of the philologists.

When preparing the code-switching experiment, we hoped to be able to analyse also the words in the first half of the sentences that contained the non-target words with the target words, such as Kája/Kate or důraz/choose. Due to the very time-consuming analysing process, this data was not measured which leaves a possibility for further comparison between the sounds of the non-target control words and the words in the switch position in order to see how early the effect of the phonetic interference would appear. In this case, the coding that was developed for this research could be suitable for this extra analysis, as the coding system is designed to distinguish between the target words labelled with "t" and the control words that would not be marked with "t".

In the language-switching task, it was expected that the phonetic interference would be in both language in the direction of the second language, i.e. the English VOT would become shorter (more Czech-like) and the Czech VOT would become longer (more English-like). This turned out to be true for the English VOT in the English-biased test where the VOT was shorter in the switch position than in the stay position. Even though the English VOT had no statistically significant difference in the Czech-biased test, the direction of the phonetic interference was also in the direction of the Czech VOT. It is interesting that the VOT was affected in the English-biased test, which suggests that for the English VOT it does not matter if the main language of the experiment is English or Czech, because the phonetic interference was present in both types of the test, even though the phonetic transfer was not statistically significant for the English VOT in the Czech-biased test.

The Czech VOT in the Czech-biased test was not affected by the preceding word at all, however, the interference was proved to appear in the Czech VOT in the English-biased test. Unlike the English VOT, it seems that the Czech VOT is affected depending on the main language of the test. If the prominent language is Czech, the VOT does not change. On the other hand, if the main language of the test

is English, the Czech VOT seems to be affected by this fact. However, this effect was only present due to the results of the interpreters.

These results show that the phonetic interference in this experiment was not symmetrical. Whereas the phonetic transfer in English VOT occurred in the English-biased test when switching from L1 to L2, the phonetic transfer in Czech VOT appeared also in the English-biased test when switching from L2 to L1. There was no statistically significant effect for the Czech VOT when the main language of the test was Czech, and the effect for the English VOT in the same test was not statistically significant, despite copying the same direction of the interference like the English VOT in the switch position in the English-biased test. From this point of view, it seems like the switching effect was asymmetrical and occurred when the direction of switching was from L1 to L2 or from L2 to L1 when the dominant language of the test was L2. It is possible that the fact the whole test is English-biased affects the speakers mind in such way that the phonetic interference is more likely to happen.

In the language-switching task there was no difference between the interpreters and the philologist in terms of the phonetic interference except for the Czech VOT in the English-biased test that was longer in the switch position than in the stay position which is an effect that was no present in the results of the philologists. The only significant difference was again the length of the English /k/. The ATP students pronounce this voiceless stop with longer VOT than the philology students.

When comparing the code-switching task and the language-switching task, the phonetic interference for the English VOT was of the same nature in all types of the tests – all phonetic effects had the tendency to become more Czech-like in the switch position. The only interesting moment was that in the LS English-biased test in the stay position the English VOT was the longest one when compared to the rest of the English VOTs in the stay positions. Similar effect appeared also during the comparison of all tests for the Czech VOT, where the longest Czech VOT was the one in the stay position in the LS – the Czech-biased test (especially when compared to the CS task). The CS and the LS English-biased test showed the tendency to become more English-like in the switch positions, which was not true for the Czech VOT in the LS Czech-biased where no difference between the stay and the switch

position occurred at all. Our hypothesis that the type of the switching task might have an effect on the phonetic interference of the target sound was not confirmed. Based on the results, we can assume that the phonetic interference does not depend on the form of the switching task because the results from both CS and LS showed to have similar effects on the target sounds. The only exception was the case of the LS Czech-biased test for the Czech VOT where the dominance of L1 very likely caused that no phonetic interference was present in this type of test. The result is probably also influenced by the fact that some Czech speakers (also the FIL participants) forget to say English voiceless stops with aspiration which might have been even more suppressed due the Czech dominance in this test.

No different results occurred when the VOTs were compared between the ATP and the FIL participants. The only difference was once again in the length of the VOT. Since this difference appeared in all types of tasks, we can assume that the interpreters are very likely more used to pronouncing the word-initial voiceless stops with aspiration in comparison to the philologists. Apart from this, it does not seem that the level of training would have any effect on keeping the two different phonetic sets separated from each other especially in terms of the VOT, because the phonetic interference for /k/ was the same for everyone. However, this lack of difference might also result from the lack of volunteers. Different results would might appear if the group of participants had more intensive interpreting training or the participants were the full-time interpreters.

7 CONCLUSION

This thesis tried to answer three research questions regarding the phonetic interference in the speech of bilingual speakers whose L1 is Czech and L2 is English. In order to answer the research questions, the word-initial voiceless stop /k/ was chosen as a good source for possible comparison of the phonetic interference. Since the English /k/ has longer VOT due the presence of aspiration, which is the phonetic feature that the Czech /k/ does not have and therefore its VOT is shorter, it the length of the VOT of /k/ was used for comparing the phonetic interference in words in the switch positions. Their VOT were always compared with the control words that contained the same target sound but it appeared in the stay position. Another target sound – GOOSE vowel /u:/ was chosen, because of the different F2 value in the pronunciation of the Czech and English /u:/ (English /u:/ is more fronted, therefore has higher F2 value).

In order to measure the VOTs and F2 values and find out whether there is an increased phonetic transfer in words that appear in a bilingual utterance where two languages are used in comparison to a monolingual utterance, two types of switching tasks were used - the picture-naming task (representing the language switching) and the sentence-reading task (representing the code switching). These tasks were also used for the comparison of the phonetic effects across these two types switching task and help us to find out the answer for the second research question if there is a difference in phonetic influence if the switching takes place in two different switching environments.

The expected shifts in the values of the VOTs confirmed our hypothesis that there is an increased phonetic transfer when switching between two languages. In the code-switching task, the direction of the shift was always towards the second language, no matter if the switch was from L1 to L2 or from L2 to L2. The English VOT of /k/ was affected by the Czech pronunciation and was therefore pronounced with shorter (more Czech-like) pronunciation and the Czech VOT was pronounced more English-like, i.e. it was longer.

The second target sound /u:/ that was used only in the code-switching task showed different direction of the transfer. Despite our expectations, the Czech F2 was even lower in the switch position than it was in the stay position; however, there was no significant difference in the English F2. This very likely shows a certain

amount of asymmetry, because the shift happened only when switching from F2 to F1.

The results from the language-switching also confirmed the same hypothesis from the code-switching task. In the English-biased test the English VOTs were shorter in the switch position, however, the same direction appeared in the Czech-biased test in the English VOTs, however, the effect was not statistically significant. In the Language-switching task, no effect was found for the Czech VOTs in the Czech-biased test and only a small effect was found in the English-biased test. In case of the language-switching task, the dominance of L1 might have affected the results in terms of that no phonetic interference occurred.

The last research question was dealing with the possible effects of different levels of training for using two languages on phonetic interference in two groups – the philologist with no training and the interpreters. Despite our expectations, no difference in phonetic transfer between the two groups appeared. The only difference was that the interpreters had generally longer English VOT than the philologist due to the lack of aspiration at the latter group.

To sum up, some of the expected outcomes were confirmed, some of them were not. Due to the small number of participants, the results should be considered only as simple indications for the results of further research.

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9 APPENDIX

Tab. 1: Czech and English VOT /k/ stimuli:

CZE					ENG			
TARGET	FQ	CONTROL	FQ		TARGET	FQ	CONTROL	FQ
kuře	33.64	kufr	24.21		king	64.60	key	52.80
kabát	17.76	kachna	17.45		cup	46.90	cat	40.30
kostka	15.56	košík	15.72		cow	19.80	cap	18.10
komín	14.93	kočár	14.78		coffin	10.00	candle	12.70
konev	5.66	kohout	4.72		corn	8.80	kite	6.70

Tab. 2: Czech and English GOOSE vowel stimuli:

CZE					ENG			
TARGET	FQ	CONTROL	FQ		TARGET	FQ	CONTROL	FQ
účet	41.18	důchod	50.14		two	1,364.00	who	1,789.00
úspěch	13.99	úhel	11.32		shoot	68.86	suit	70.24
úklid	6.29	útok	5.03		shoe	39.20	tooth	44.30
úder	2.83	účast	2.99		chew	8.76	goose	7.20
úhoř	1.57	kůzle	1.10		scooter	0.93	hooter	0.36