

Filozofická fakulta Univerzity Palackého

**Variation in Cross-Linguistic Interference
In Monolingual and Bilingual Performance**

(Bakalářská práce)

Olomouc 2015

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V Olomouci dne 10.12.2015

Lucia Šmelíková

Before a word is on my tongue,

You, Lord, know it completely.

The Bible, Psalm 139

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Abstract

Bilinguals, especially those who learned their second language later in life, often experience an influence of one of their languages on the other and vice-versa on all levels of linguistic performance (syntactical, lexical, morphological, phonetic, etc.) This influence is called cross-linguistic interference. Each bilingual speaker also employs his own patterns of switching between the languages according to the situation. It is hypothesized, that language mixing, compared to using only one language at the time, might provoke greater interference on the phonetic level.

The present study examines the effect of language mixing on vowel production of Czech-English bilinguals with English as their second language. An experiment was carried out in two recording sessions. In the first one, only English was used both in perception and production. In the second session, the task required that participants code-switched between English and Czech. The quality of English vowel /u/ produced in both sessions was measured and compared. It was found that the vowel produced by participants in bilingual session was closer in quality to the Czech vowel /u/, compared to more native-like production of the vowel in strictly monolingual (English) recording session.

Key words

interference, phonetic, short-term, dynamic, code-switch, English, Czech, vowel /u/, formant frequency

Anotace

Na bilingvních mluvčích je mnohdy patrné vzájemné ovlivňování jazyků, kterými mluví, a to na syntaktické, lexikální, morfologické i fonetické rovině jazyka. Tento vliv se nazývá *mezijazyková interference*. Každý bilingvní mluvčí užívá jazyků, jimiž mluví, jinými způsoby a přechází z jednoho jazyka do druhého v závislosti na situaci. Přepokládá se, že *interference* je větší při užívání obou jazyků současně než při striktně monolingvním projevu.

Tato práce se zabývá vlivem monolingvní a bilingvní jazykové situace na výslovnost anglického vokálu /u/ v projevu českých rodilých mluvčích, kteří mají angličtinu jako druhý jazyk. Byl proveden experiment, v němž mluvčí absolvovali dvě nahrávání. Při

prvním se mluvilo výhradně anglicky. Při druhém se od mluvčích vyžadovalo soustavné přecházení z jednoho jazyka do druhého. Kvalita vokálu /u/ v obou nahrávaních byla změřena a porovnána. Bylo zjištěno, že /u/ vyslovené za bilingvních podmínek bylo kvalitativně bližší výslovnosti českého /u/. Za monolingvních podmínek byla výslovnost /u/ bližší anglickým rodilým mluvčím.

Klíčová slova

interference, jazykový vliv, fonetika, code-switch, anglický, český, vokál /u/, formantová frekvence

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1 Introduction

It is a well-known fact that bilinguals experience an influence of their first language on their second language. This “accentedness”, or **cross-linguistic interference**, can appear in lexicon, syntactic structures or morphology. It is especially recognizable on phonetic and phonological level.

There are many factors that determine the interference, such as the age of the speaker or his level of proficiency in L2. For many years, the research in this area did not pay much attention to the role of the situation of the speaker and the level of activation of the specific language(s), used by the participant in the moment of performance. In the last years, the difference between the short-term (dynamic) interference and static (long-term) interference started to be recognized and further investigated (Grosjean and Miller 1994, Bullock et al. 2006, López 2012, Simonet 2014, Antoniou 2011, Olson 2013). The first one is connected to speech processing and can differ for a specific speaker with respect to their language mode, i.e. the level of his active use of one or both languages at the moment of speaking. The long-term (static) interference is considered to be a constant influence of L1 on L2 or vice versa, a part of the speaker’s language competence, which is permanent or long-term and does not change with the language mode of the user. (Grosjean 2001, 2004, 2011).

However, the influence of language switching on the pronunciation of bilinguals has been studied only shortly and with various results. As Simonet explains, its effects are not very predictable and further research is needed to help us understand its patterns and its impact on the speech production more deeply. (Simonet 2014, 28)

In this work, I will study the interference of Czech and English in the native Czech bilinguals’ pronunciation of English high back vowel /u/. I will first introduce the topic of interference and describe the difference between long-term (static) and short-term (dynamic) interference. I will then continue with the discussion of monolingual and bilingual mode and the continuous scale of language modes in between these two extremes. Using the examples of studies in this research field, I will investigate findings about the influence of these modes on speech production, especially with respect to phonology.

Because the experimental part of this work is based on comparing the quality of English vowel /u/, I will comment on the difference in the quality of /u/ in English and in Czech and on the typical Czech-accented pronunciation of this vowel.

The second part of this study describes an experiment that was carried out to test the effect of language mode (monolingual or bilingual) on the phonetic production of English high back vowel /u/ by Czech-English bilinguals. The experiment consisted of two recording sessions. In the first one, the conditions were manipulated to encourage code-switching and activation of both English and Czech. Opposite to this, the second recording session was designed to encourage English monolingual mode and minimize the participants' activation of Czech. The recorded data were then used to compare the quality of vowel /u/ when pronounced in two different situations of the speaker – either closer to the monolingual side of language mode continuum or towards the bilingual one.

If the vowel quality is closer to the typical Czech-accented pronunciation in bilingual session than in monolingual, it will provide an evidence of short-term interference in the vowel production of Czech-English bilinguals.

In the last part of this work, I will compare and comment on the results of the experiment and its relevance with respect to the findings in this study field.

2 Literature Review

2.1 Language interference

Language interference in bilingualism has been defined by many (Flege 1987, Grosjean 2011, Antoniou 2011) as the influence of one language on another (and vice-versa) within a bilingual (or multilingual) speaker. There are different types of bilinguals – those who learned both of their languages simultaneously in early childhood, those who acquired their languages one after another in childhood and are highly proficient in both of them, those who only learned their second language (L2) later in life and whose level of language proficiency can vary. There are also cases, when bilinguals feel more confident and dominant in L2 than in their first language (L1).

The research on language interference (and the way that languages interact in the mind and in production of bilingual speakers) reflects similar variability as we see in the types of bilinguals. There are studies (Magloire and Green 1999 and Yeni-Komshian et al. 2000, Antoniou 2010, 2012) that provide evidence for monolingual-like abilities of bilingual language users and there are also studies that show clear influence of L1 on L2, or even L2 on L1 in different levels of linguistic knowledge (Caramazza et al 1973, Yeni-Komshian et al. 2000, Fowler et al. 2008, Flege and Eefting 1987, Escudero and Boersma 2002, Flege 1987, Guion 2003, Berk-Seligson 1986, Sankoff and Poplack 1981, Pfaff 1979, Kolers 1966, Poplack et al. 1988). These findings imply different perspectives and theories about separate vs. joined speech systems in bilinguals' minds.

Bilinguals' performance has been studied across linguistic disciplines – syntax, morphology, lexicology, phonetics, etc. (Berk-Seligson 1986, Sankoff and Poplack 1981, Pfaff 1979, Kolers 1966, Li 1996, Poplack et al. 1988, Flege, Yeni-Komshian and Liu 1999). These studies investigated code-switching patterns or compared bilingual production and perception to monolingual, examining what can influence the amount of language interference of bilinguals (age of speakers, age of second language acquisition, proficiency, education, etc.) For example, Flege, Yeni-Komshian and Liu (1999) studied the language skills of Koreans who learned English as L2. Their ability to use the correct English grammar (judged by native speakers) was influenced by the amount of education received in the US, their lexical knowledge depended on how much they interacted in English

in everyday life and the foreign accent they performed in pronunciation was stronger with growing age in which the participants acquired their L2 (English).

2.1.1 Interference in phonetics

2.1.1.1 Long-term interference

Research in phonetic interference, both in perception and production, focuses in great number of studies on measuring the voice onset time (VOT) – the time lag between the release of a stop and the start of periodical tone of a following consonant (Magloire and Green 1999, Antoniou et al. 2010, 2011 and 2012, Fowler et al. 2008, Caramazza et al. 1973, Sundara et al. 2006, Flege Eefting 1987, Williams 1997, Flege 1987). Other studies measured vowel quality (Escudero Boersma 2002, Flege 1987, Flege et al. 1999, Guion 2003) or rated the “foreign accent” of participants by native speakers’ assessments (Yeni-Komshian et al. 2000).

Magloire and Green (1999) and Yeni-Komshian et al. (2000) report almost identical production of (early) bilinguals compared to monolinguals. Antoniou 2010, 2012 gives evidence of no interference in perception and only a slight influence of a specific feature (nasalization) from L1 on L2 in production for L2 dominant Greek-English bilinguals. Sundara et al. report similar, but not identical production of French and English voiced and voiceless coronal stops by Canadian bilinguals. Similarly, Guion (2003) shows native-like production of Spanish high front and high back vowels by Quicha-Spanish early bilinguals, but a slightly accented (L1 influenced) production of Spanish low vowel /a/.

Fowler et al. (2008) reports an interesting pattern of VOT production by different groups of English / French speakers: the English VOT of bilinguals with French as their L1 was lower (closer to French) than the VOT of bilinguals who learned English and French simultaneously in early childhood. But the VOT produced by simultaneous bilinguals was still lower in comparison with monolingual English speakers. These results suggest that the age of second language acquisition (SLA) is an important factor in phonetic interference. Yeni-Komshian et al. (2000), Flege, Yeni-Komshian and Liu (1999), Flege, MacKay and Meador (1999), Guion (2003), support this finding.

Concerning the vowel production, Escudero and Boersma (2002) and Flege (1987) studied how L2 learners manage to create new phonological categories for vowels absent in L1. They found that speakers, who were more experienced in L2, showed more ability to categorize and produce L2 vowels correctly. Flege (1987) also tested the difference between segments that are “similar” (exist in L2 as well as L1, but with slightly different category boundaries) or “new” (exist only in L2 with no counterpart in L1). The results show that the non-native speakers of L2 in his study adopted categories for “new” segments quite easily, while they showed considerable interference in the production of “similar” phonemes.

2.1.1.2 Short-term interference

Language mode framework

Bilinguals have different patterns of using their languages in everyday life. They are able to switch between the languages according to the situation, they can use both languages in a conversation with another bilingual or they can exclude one language if their interlocutor is monolingual. In his research of bilingualism, Francois Grosjean (Grosjean 2001, 2004) introduces the term “language mode” for different levels of activation of languages in bilingual’s mind. He distinguishes between monolingual mode (using and activating only one language) and bilingual mode (using both languages at the same time). However, these two modes are only endpoints of a wide scale of language behavior dependent on situation.

Sancier and Fowler (1997) provide an example of interference dependent on the amount of language usage in longer period of time. They measured the VOT of an English-Portugal bilingual and found a significant difference between her production after several months spent in the US (higher VOT – closer to English) compared to her production after several months spent in Brazil (lower VOT – closer to Portugal). Grosjean suggests that language modes can have similar influence on bilingual speakers in shorter periods of time and that the performance of speakers can vary from situation to situation according to the language modes of a speaker. Based on this suggestion, he differentiates between static and dynamic interference. (Grosjean 2011) Static interference (or transfer) is

linked to the competence of speaker and does not depend on the linguistic context or situation. Dynamic interference is a result of the influence of language mode on bilingual speaker. Simonet (2014) uses slightly different terminology, differentiating between **short-term** and **long-term** interference. These names are employed in the present work as well.

Grosjean (2001, 2004) argues that most studies did not take into account the impact of language modes on participants, when creating the experimental conditions. He suggests that in order to study the short-term interference, language modes and setting of the experimental sessions need to be carefully manipulated in a way that allows comparison between monolingual and bilingual performance. As I will show in the next section, several studies HAVE addressed this question lately with varying results.

VOT

Like most studies in bilingual phonetic production, the investigation of short-term phonetic interference was mostly carried out by measuring and comparing the VOT of stop consonants. That is also the case of all studies reported in this section. Grosjean and Miller (1994) studied the effect of code-switching on the production of speakers in bilingual and monolingual language modes. His findings did not show any interference in neither monolingual nor bilingual mode. Contrary to this, Antoniou (2011) reports a clear difference between monolingual and bilingual language mode. Greek-English L2 dominant speakers showed minimal interference in monolingual session, while the influence of L1 (Greek) on L2 (English) in bilingual session was evident. Similarly, Olson (2013) shows difference between language modes, although none of his experimental conditions was strictly monolingual. In contrast with Antoniou (2011), Olson reports the influence of L2 on L1 and not L1 on L2. Thus, in both studies, the production of dominant language was modified.

Bullock et al. (2006) bring results that are different from any of the previously mentioned studies. The participants in this experiment were Spanish-English bilinguals divided into two groups according to their dominant language. Both groups consisted of late learners of either English or Spanish. The study shows influence of language mode in specific positions of consonant with respect to the moment of code-switch, but the only

language influenced this way is English in both groups of participants, regardless of their language dominance.

López (2012) in her study of native English learners of Spanish, found bi-directional influence of L1 on L2 and vice-versa. This influence differed with respect to language mode as well as with respect to the position of the consonant before, at or after the code-switch. An interesting finding of this study is the fact, that the place of articulation of voiceless stop consonant (bilabial, alveolar or velar) had a significant effect on the patterns of phonetic interference.

Vowels

Simonet (2014) measured the first formant (F1) frequencies of Catalan-specific contrasting vowels /o/ and /ɔ/ produced by highly proficient Catalan-Spanish bilinguals. Spanish, unlike Catalan, recognizes only one of these vowels – /o/. Simonet found that both Catalan vowels had higher F1 frequency (closer to Spanish /o/) in bilingual session than in monolingual. Thus, he gave evidence for short-term interference in the quality of vowels produced by bilingual speakers. His results can be compared to the present study, which deals with vowel production of bilingual speakers in different language modes as well.

2.1.2 Research Question

As the previous research shows, conflicting results were obtained in attempts to investigate the impact of language mode on the phonetic production of bilingual speakers. However, most studies report some difference between the production in different language modes, though the nature, scale and conditions of this influence require further research. Does short-term interference occur only in production, or does it include perception as well? Is it same across languages and their combinations? How does it depend on the type of bilinguals and their language proficiency or age of SLA? If the interference has different patterns for specific segments (for example voiceless stops with different place of articulation), what factors determine the extent of interference for each segment?

Most research until now was based on measuring the VOT in languages with different realizations of voiced and voiceless stop consonants (mostly English and

Romance languages). This makes the results easier to compare, but examining greater variety of phonological segments in greater number of different languages might provide deeper insight into this phenomenon.

The present study examines short-term interference in the vowel production of Czech-English bilinguals with English as their second language. Based on previous research, the participants in this experiment, being relatively late learners of English, are expected to manifest, to some extent, long-term competence-related influence of L1 on L2 (foreign accent). The vowel measured in this study is English high back /u/, which, in Flege's terminology, would be marked as "similar" to Czech high back vowel. This supports the hypotheses that the production of participants' /u/ in English will be modified by Czech vowel, which is lower in second formant (F2) frequency. However, it is less predictable whether this vowel modification will be stronger in bilingual mode than in monolingual, i.e. whether short-term interference will be found under the conditions of this study or not.

Thus, the research question for the present study is following:

Does the language mode (monolingual or bilingual) influence the extent of L1 to L2 interference in the vowel production of bilingual speakers of Czech (L1) and English (L2)?

If the quality of English vowel proves to be different in the two language modes, especially if the bilingual mode triggers more Czech-like production, the results of this study will support the existence of short-term interference and provide an evidence and example of its impact on phonetic production under specific conditions.

2.2 Czech and English vowel systems in comparison

Skaličková (1979, 14-28) compares Czech and English vowel systems and points out the main differences, such as different role of vowel quality and quantity, the influence of voiced or voiceless stops on the vowel length in English (and no such phenomenon in Czech) and different articulatory patterns and acoustic qualities of the vowels.

There are 12 monophthong vowels in English and 10 in Czech. Each of the English vowels is defined by its vowel quality, which is different for every vowel. On the other side, the phonemes in Czech vowel system form pairs with very similar quality but different length. However, even though the quality of the paired short and long vowels is the same (or very close), each of them is an independent phoneme. Thus, the length of the vowels can distinguish meaning, as it is clear in minimal pairs *víl – vil*, *peče – péče*, *dal – dál*, *tonu – tónu*, *nuž – nůž*.

The articulatory patterns in English differ especially in the movement of jaw (it is much more dynamic in Czech) and the position of the tip of the tongue (in Czech it tends to bend downwards behind the lower teeth, in English it stretches out freely in the oral cavity).

Furthermore, the Czech and English vowel systems not only differ one from another, but each of them also evolves in time, as I will show later in section 2.2.3. Because of this complexity, working with data from both languages requires careful consideration of various influences that can take place in this study.

2.2.1 Vowel properties

There are numerous ways to characterize vowels with respect to their articulation, perception, auditory and acoustic properties, distribution, spelling, etc. In this study, it was important to work with the properties that can be measured precisely and compared across the different languages. This is difficult to do with articulatory properties – there are too many articulatory organs, targets and manners of articulation to be able to provide precise cross-language comparison which takes into consideration all the nuances in the articulation of the speakers. On the other hand, the acoustic properties are clearly measurable and comparable even across the languages.

This study focused on formant frequency, especially the second formant F2, which is a characteristic acoustic property of vowels and other periodic sounds. It corresponds roughly to the movement of tongue in vertical direction (Ladefoged 2014). It is measured in Hertz, but it can be converted to scales such as ERB (equivalent rectangular bandwidth) or Bark, which were designed to reflect more precisely the listener's perception (Zwicker 1961, Moore and Glasberg 1983). In ideal case, the vowel comparison would take

into consideration the whole course of the vowel and its dynamics, as well as its length. In this limited study, only static measurement of F2 is provided, since F2 is the main distinguishing property for English and Czech vowel /u/.

2.2.2 High back vowels in Czech and in English

Both English and Czech have two high back vowels. In Czech they are differentiated primarily by their length, but as recent research shows, there is considerable difference in quality as well (Skarnitzl and Volín 2012). The English high back vowels differ in quality in the first place, but if they are found in the same environment (preceding and following segments, stress, etc.), /u/ is always longer than /ʊ/. This study is concerned with the pronunciation of the longer English high back vowel /u/ by Czechs, who learned English as a foreign language. Because there is the longer and shorter high back vowel in both languages, it is expected that the Czech bilingual students will tend to have a shifted pronunciation of English /u/ based on the mental representation of Czech long /u/. However, the Czech shorter version and its quality needs to be taken into consideration as well, as a sound similar to English /u/ that can be easily and naturally produced by Czechs.

Skaličková (1979, 47-48) compares the longer /u/ in the two languages and makes remarks on its articulation, distribution, spelling and auditory properties. The articulation of Czech /u/ places the tongue further back in the oral cavity than the English articulation. There is considerable lip rounding in both English and Czech version. The distribution of English /u/ allows central or final position in a syllable, while the Czech /u/ can stand in syllable-central, final or initial position as well. The spelling in English varies and includes graphic representations such as oo, o, u, ou, oe, ue, ui, ew. In Czech spelling, the phoneme is represented by letters ú and ů.

The major distinction between English and Czech /u/ is their F2 frequency. The English one is clearly fronted compared to very back Czech /u/. In the next section, I will look closer at this difference.

2.2.3 Formant frequencies

2.2.3.1 English

British

The systematic research on acoustic properties of English vowels started in the sixties with Wells (1962). Together with Deterding (1997), who followed him later, they established basic reference data in this field, providing formant frequencies of all English vowels in RP or near-RP pronunciation.

Later, Hawkins and Midgley (2001) tested the results of these studies and provided evidence for a shift in several English vowels including /u/, which was much more fronted in younger speakers compared to the older. They recorded 20 male RP speakers from four different age groups and measured the formant frequencies of 11 vowels for each speaker individually. Concerning the vowel /u/, the oldest speakers born before 1935 pronounced the vowel with average F2 frequency 994 Hz. The pronunciation of the age group born between 1961 – 1966, a so-called „break group“, according to Hawkins and Midgley, showed much wider span of F2 frequency ranging from 1036 Hz to 1817 Hz. The youngest age group (born 1975 and later) pronounced /u/ which was considerably fronted compared to the older participants. The average F2 in the youngest group was 1616 Hz. The vowel frequencies of the youngest and the oldest group compared to the frequencies of Czech /u/ are summarized in Table (1) below.

The findings of Hawkins and Midgley were later confirmed by Harrington (2011), de Jong et al. (2007) and Fabricius (2007), who compared English high back vowels using the method of measuring angles between F1 and F2 frequency in the vowel quadrilateral. Torgersen and Kerswill (2004) showed the fronting of /u/ in other than RP accents of British English.

American

Detailed surveys of American English, such as Thomas (2001, 33), Grieve and Spielman (2012, based on the acoustic data from the Atlas of North American English Labov, Ash and Boberg 2006) confirm fronting of /u/ across American dialects. Recent studies of specific dialects prove the fronting as well (Fridland 2008, Fridland and Barlett 2006, Grieve Spielman 2012). Nevertheless, because the frequencies for /u/ are usually

stated for each dialect separately (and slightly different for each dialect), the comparison with Czech frequencies made here is based on British Received Pronunciation.

2.2.3.2 Czech

The acoustic properties of Czech vowel system were thoroughly studied by Hála already in the first half of 20th century (Hála 1941, 1962). He measured the formant frequencies of first three formants for 10 Czech vowels. Skarnitzl and Volín (2012) recently carried out a similar study in order to provide up-to-date reference data and, in comparison with Hála, document the development of Czech vowels. Similarly as in English, his results show a shift in vowel quality and quantity for long high vowels /i/ and /u/. The F2 frequency of both short and long /u/ in this study is much higher than in Hála (1962, 180-181). This could suggest fronting of /u/ - a similar process as in English. However, the F2 frequency of Czech /u/ is still much lower compared to English, even after fronting. The F1 and F2 frequencies for both short and long /u/, as well as English /u/, are listed in Table (1). Another consequence of this shift is that the contrast between short and long high back Czech vowel becomes evident not only in quantity, but also in quality. The long /u/ has lower F1 as well as F2 frequencies compared to the short high back vowel. Contrary to this, the contrast between these two vowels in quality became less dominant. While Palková (1994, 179) states that long Czech vowels are approximately twice as long as the short ones, the results of Skarnitzl and Volín (2012) show that the long /u/ is in average 60% longer than the short /u/. If this tendency continues, Skarnitzl and Volín suggest, it might lead to similar situation as in English, where the quality is crucial in distinguishing the vowels and the length is only a secondary category.

As I mentioned above, the most significant acoustic difference between English and Czech /u/ is their second formant (F2) frequency. That is why, in this experiment, measuring and comparing F2 frequency will serve to determine the degree of language interference. Lower frequency indicates more influence of Czech /u/, while higher frequency signals more native-like production.

	Hawkins-Midgley (older)	Hawkins-Midgley (younger)	Hála	Skarnitzl-Volín
English /u/	F1 301, F2 994	F1 289, F2 1616		
Czech long /u/			F1 350, F2 680	F1 304, F2 769
Czech short /u/			F1 385, F2 758	F1 359, F2 937

Table (1) : Formant frequencies of English and Czech high back vowels in Hz, measured for male speakers, according to Hála (1962), Skarnitzl and Volín (2012) and Hawkins and Midgley (2005) – age groups represent older speakers born between 1928 and 1936, younger speakers born between 1976 and 1981.

2.3 Methodology

As explained above, this study seeks to explore the patterns of phonetic interference in different language modes. This is done by measuring and comparing the F2 of high back English vowel /u/. The question asked in this section is how to best approach this task, using adequate methods and materials. It deals with the choice of participants, stimuli and the procedures employed to ensure that participants are in either bilingual or monolingual language mode.

2.3.1 Language modes

Grosjean (2001, 2004) introduces several questions that address the factors that influence bilingual speakers with respect to their language mode.

Firstly, he asks about the participants. What level of language competence do they have in their languages? Are they fluent enough in both languages to be able to remain in the monolingual mode? Do they mix their languages in everyday life or do they usually stay in the monolingual mode? Do they belong to any bilingual community of speakers? Did they know that the experiment is concerned with bilingualism?

Secondly, the role of experimenters is crucial in creating the monolingual vs. bilingual conditions. If any of the persons speaking to the participant (or present in the room) is bilingual, there is a risk that the participant becomes aware of it even if it is not explicitly said and the other language is not spoken. Knowing that the person he interacts with is bilingual inevitably moves the participant towards the bilingual language mode. Moreover, Poplack (1981) and Treffers-Daller (1998) prove in their studies that

the formality of situation also has impact on the language mode of the participant and show that the more personal the situation is, the more language mixing takes place.

Thirdly, he raises questions about the task. Does it require using both languages? Does it permit using both languages? Does it include both perception and production? in which form – spoken or written? What is the content of the task? What kind of vocabulary is used?

In this study, the participants were all native speakers of Czech who acquired English as a foreign language. The fact that they were all university students of *English translation and interpreting* should ensure their sufficient fluency. The nature of their study program encourages code-switching habits.

The experiment was carried out in two recording sessions “monolingual” and “bilingual”. The task in the bilingual session required using both English and Czech in perception (listening and reading) and oral production. The experimenters were bilingual. The task in the monolingual session excluded the usage of Czech. Only English was activated in both perception and production. There were two experimenters – one monolingual and one bilingual. However, unlike the researchers in bilingual session, who were fellow students of the participants and thus could easily encourage an informal atmosphere open to language switching, the bilingual experimenter in the monolingual session was a university teacher. The students were therefore more likely to respond in the same language in which the teacher addressed them.

2.3.2 Design of stimuli

Harrington (2010, 17-20) names several variables that need to be controlled for in the process of creating a corpus and designing the material, such as speed of speech, stress, lexical frequency and participants. Since the vowel length and vowel quality are important categories for this study, the material needed to be designed in a way that prevented differences in prosody of the words. To achieve this, the target words were incorporated in short sentences of similar length.

Because the participants were not native speakers of English and a parallel experiment required them to interpret the short sentences, the target words that were used

had relatively high lexical frequency to ensure that the participants know them and translate them correctly.

To summarize, this experiment aims to manipulate the conditions of two recording sessions to achieve that the participants move, as much as possible, towards either monolingual or bilingual end of language mode continuum. Comparison of the data obtained in both sessions should serve as an answer and evidence for the research question:

Does the language mode (monolingual or bilingual) influence the extent of L1 to L2 interference in the vowel production of bilingual speakers of Czech (L1) and English (L2)?

3 Methods

3.1 Stimuli

The stimuli consisted of 88 short sentences for each task. In each task, 10 sentences included a target word and 78 were fillers. Six monosyllabic target words with the high back English vowel /u/ preceded and followed by a consonant – /CuC/ were inserted at the beginning or at the end of 14 short sentences.

In order to control for the speed of speech and prosody, the words were all monosyllabic and the sentences were of similar length. The words were put at the beginning and at the end of the sentences to create similar stress patterns throughout the material. Different consonants with variable places and manners of articulation appeared before and after the vowel /u/. Table (2) below lists all the target words and short sentences used in both recording sessions. The target words are all open class words and

Target word	Lexical frequency (lemmas per 1 million)	Monolingual session		Bilingual session	
		<i>Sentence-initial</i>	<i>Sentence-final</i>	<i>Sentence-initial</i>	<i>Sentence-final</i>
Choose	179	Choose your friends well.	Somebody must choose.	Choose your friends well.	Somebody must choose.
Lose	339	Lose some weight.	Nothing to lose.	Lose some weight.	Nothing to lose.
Soup	20	Soup is not enough.	We don't serve soup.	Soup for the poor.	They only ordered soup.
Shoot	74	Shooting is wrong.	The police will shoot.	Shooting is wrong.	The police will shoot.
Goose	10	Goose liver is fatty.	I shot a goose.	Goose meat is excellent.	We had a goose.

Table (2) : List of short sentences used in the experiment, organized according to the target words and recording session in which they were used.

their lexical frequency ranges from 10 to 339 per 1 million according to the Celex database (Baayen et al. 1995).

5 native speakers (2 women and 3 men) read and recorded the short sentences. The native speakers also recorded 2 prompt questions “What should you say?” and “What did you hear?” One Czech prompt question “Co jsi slyšel?” (What did you hear?) was also recorded as they were read by three native Czech speakers. All three of them were women.

However, since the questions were repeated 88 times in each of the three tasks, the Czech questions were played randomly in 3 different voices and the English questions and short sentences in 5 voices. This prevented the participants from imitating the particular speaker-specific pronunciation patterns and helped to avoid the monotony.

3.2 Participants

The experiment was carried out with the students at Palacký University in Olomouc, Czech Republic. Participants were all native speakers of Czech who acquired English as a foreign language.

There were 20 participants – all were women aged 19-27. At the beginning of the experiment, 37 students responded to the invitation to participate, out of which 2 were other than first or third year students of the previously mentioned study program and 9 were men. These were sorted out because of the difference in vowel frequency between male and female speakers (Harrington 2010, 129) and the remaining 26 students were invited to the recording. 6 did not come, so the recordings were obtained from 20 students.

These were students of the bachelor study program *English for Community Interpreting and Translating* at Palacký University. The entrance examination for the program requires at least level B2 of Common European Framework of Reference for Languages in English. Both English and Czech are used in classes, which are usually taught by non-native speakers of English. The students tend to speak Czech to each other. Code-switching is very frequent both in classes and in the informal communication among the students.

According to a questionnaire prepared and collected by an author of the parallel study (see Table (7) in Appendix), all the participants started learning English at the average age of 8. They reported to feel comfortable using English from the average age of 17 (range 13

to 21). Half of the participants stated that, outside the university, they interact with a native speaker 1-2 times a month or more. Most of them (15) stated that they are daily exposed to English-speaking media.

The participants were told that they were taking part in a phonetic experiment. The focus of the experiment on bilingualism was not mentioned, even though the participants who did the bilingual recording first could have guessed it from the character of the task.

3.3 Recording

The experiment was carried out in two recording sessions. In each session, the students repeated 88 short sentences, out of which 10 included the target word and the rest was recorded for the purpose of another study. The monolingual session, designed to encourage monolingual language mode of the participants, included one task and lasted approximately 15 minutes. The bilingual session, in which the experimenters and the task encouraged the usage of both English and Czech, lasted approximately 35 minutes and included 2 tasks. Each participant had a gap of at least 24 hours between the two sessions. Nine participants did the monolingual session first and then continued with the bilingual. The other eleven students started with the bilingual session and then did the monolingual one. All recordings were done in a sound-treated recording studio.

3.3.1 Monolingual session

The monolingual session was led by a monolingual English native speaker or by a bilingual university teacher. The only language spoken during the whole session was English, but the students knew that the teacher was bilingual. Nevertheless, it was supposed they would not consider it appropriate to code-switch once the teacher started the conversation in English.

The experimenter introduced a participant to the recording studio and explained the instructions for the first task in approximately 5 minutes.

The participant heard from headphones a sentence with a target word and a prompt question “What should you say?” She responded with the answer “I should say...” and repeated the short sentence. This way she heard and repeated all 88 sentences. She was

asked to say the phrase “I should say...” before each short sentence. I add an example (3) of the recording process:

(3) *Headphones: “Somebody must choose. What should you say?”*

Participant: “I should say: Somebody must choose.”

At the beginning of the task, the participant was asked to repeat one or two training sentences to make sure that she understood the task properly. The short sentences and the prompt questions after each sentence were played in random order using Praat (Boersma and Weenink 2001). The experimenter controlled the speed of the task by clicking “play” on the computer for each short sentence after the participant repeated the previous one successfully. This way, the short sentences followed one after another in regular rhythm. If the participant mispronounced the sentence or forgot to repeat the phrase “I should say,” the experimenter replayed the short sentence and asked the student to repeat it again.

If the participant didn’t hear the sentence correctly or forgot it, she could also ask the experimenter to replay it by a simple hand gesture or by saying “again”. The task took approximately 10 minutes to complete.

3.3.2 Bilingual session

The bilingual session was led by bilingual experimenters who were students at the same department as the participants. The instructions were given in Czech using occasional English code-switches and the tasks required using both languages.

The bilingual session had two tasks, one for the purpose of this research and one for the purpose of the other study. The introduction and the instruction took about 5 minutes. The participant was given a short, 2 minute priming exercise which required reading and labeling parts of speech of the target words. The two tasks followed, each lasting about 10 minutes. After the first one, the participant watched a short relaxing movie without words that lasted about 5 minutes. The instructions were explained separately before each of the tasks.

Task 1 was aimed at code-switching. The instructions were similar as in the monolingual session, but the prompt questions were in Czech.

Again, the participant heard a sentence with a target word in English and a prompt question in Czech “Co jsi slyšel?” She answered the prompt in Czech (“Slyšela jsem...”) and repeated the short sentence in English. Again, I add an example (4) of the recording process:

- (4) *Headphones: “Somebody must choose. Co jsi slyšel?”*
Participant: “Slyšela jsem: Somebody must choose.”

If the participant didn't hear the sentence correctly or forgot it, she could ask the experimenter to replay it by a simple hand gesture or by saying “again” in English or “znova” in Czech. If she mispronounced the sentence or forgot to repeat the answer “Slyšela jsem,” the experimenter replayed the short sentence and asked the student to repeat it again. At the beginning of the task, the participant was asked to repeat one or two training sentences.

Task 2 was included in the session only as part of the parallel study and was aimed at interpreting. The participant heard the short sentences and the prompt questions in Czech and was asked to repeat the prompt and then translate the short sentence and say it in English.

Half (nine) of the participants started the session with task 1 and then continued with task 2, the other half did the two tasks in reversed order. The whole session took approximately 30-35 minutes.

3.4 Data analysis

The data were saved as wav files and processed using the Praat software. They were converted to mono audio files. The target words and the vowels /u/ were annotated manually. The boundaries between the segments were marked as follows:

The beginnings of target words starting with stops were marked at the release of the stop. Target words starting with fricatives were marked at the starting point of the noise or, in case of the words “serve soup” following after each other, at the change

of the spectrogram structure of the noise. Target words starting with nasals or liquids were marked either at the start of the periodical tone, or at the change in spectrogram formant structure, when preceded by a nasal or a vowel.

The ends of the sentence-initial target words were marked at the start of periodical tone of the following segment before vowels, nasals and laterals, or at the start of the noise of the following fricative. If two identical fricatives followed one after another, the end of the word was marked approximately in the middle of the noise.

The ends of sentence final target words were marked at the end of the noise if they ended with fricatives or at the end of burst noise if the last segment was a stop.

The starting / ending points of the vowel /u/ were marked at the start / end of the periodical tone or its change (before / after nasals or laterals), or at the beginning or the end of the noise (before / after fricatives).

The F2 frequencies of /u/ were extracted automatically using Praat. The values were then converted from Hertz to Bark and mean values for sentence-initial and sentence-final target words for each speaker in monolingual and in bilingual session were calculated.

4 Results

The mean F2 values in Bark were submitted to two-way repeated measures (RM) ANOVA with two within-subject factors: language mode (monolingual or bilingual) and position of target word at the beginning or at the end of sentence. The analysis found a significant effect of language mode ($F(1, 19) = 5.405, p = .031$) with higher F2 in monolingual mode (Figure (5)). The effect of position was near-significant ($F(1, 19) = 3.493, p = .077$). Mean F2 in sentence-initial position of target word was higher (11,495 Barks) than sentence-final (11,308 Barks). No significant interaction between language mode and position was found.

Table (6) in Appendix shows mean F2 (Bark) for each speaker and session in sentence-initial and sentence-final positions. The F2 values for native speakers who recorded the stimuli were also measured. They are listed in the table as well.

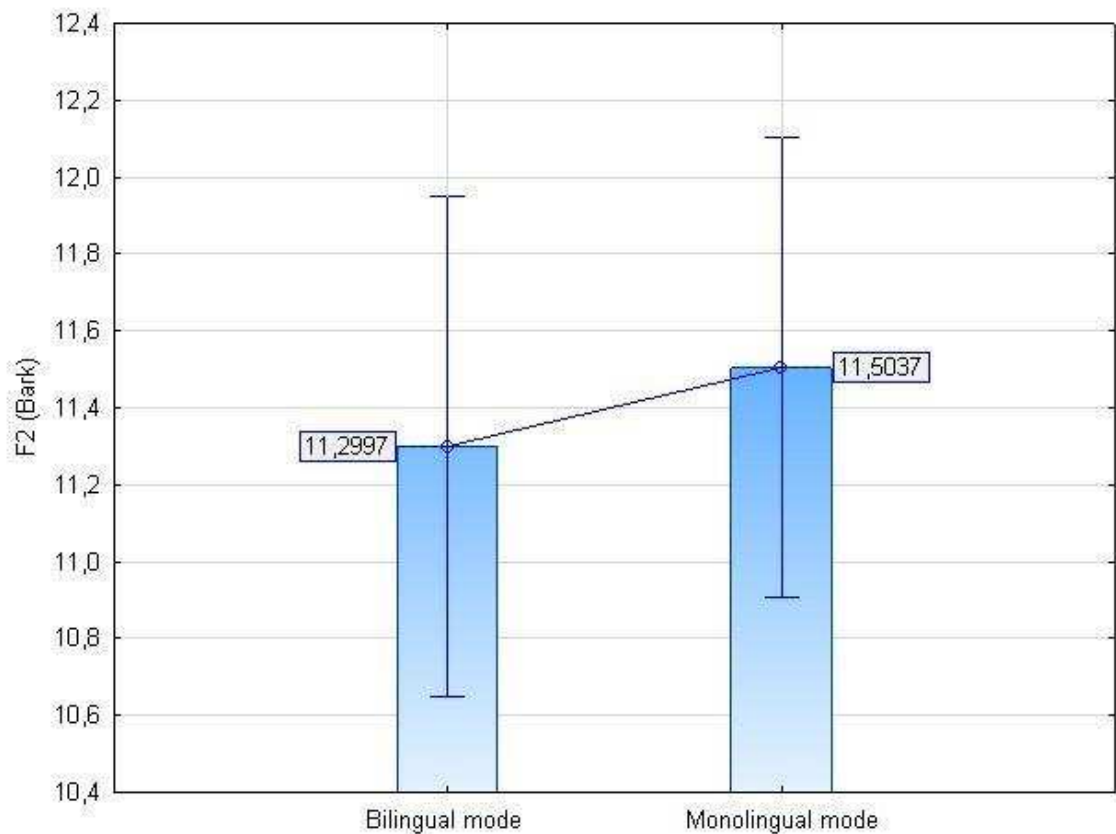


Figure (5): Least squares (LS) means for F2 in Barks in bilingual and monolingual session. Error bars represent 0.95 confidence intervals.

5 Discussion

The results of this experiment provide an evidence for the existence of short-term language interference in the phonetic production of bilinguals. The analysis showed that language mode had a significant effect on the F2 values of English high back vowel /u/. However, while evaluating the results of this study, it is important to bear in mind its specific conditions, the choice of languages (English and Czech), phonetic segment (vowel /u/), type of bilinguals (relatively late learners of English), direction of language interference (the influence of L1 on L2) and the way in which language modes were manipulated.

Nevertheless, the research in this field (short-term phonetic interference) is still in its beginnings, providing some evidence for the influence of language modes on language interference, but lacking sufficient body of research to draw conclusions about the nature and conditions of this interference. In this context, the present study provides an example of interference under specific conditions. However, short-term interference remains to be a phenomenon that requires a lot of systematic research.

5.1 In the light of previous research

The results are in accordance with Simonet (2014), who carried out a similar study to the present one. In both experiments, the vowel quality was influenced by language mode, with values closer to the interfering language in bilingual mode. The difference is that Simonet measured the production of simultaneous bilinguals or early second language learners (of both Spanish and Catalan), while this experiment focused on much later learners. Yet, the agreement of these results reflects the existence of short-term interference in vowel production across different languages and types of bilinguals.

Concerning the production of consonants, López (2012) and Antoniou (2011) also found the short-term influence of L1 on L2. On the other hand, Olson (2013) only reports interference in opposite direction (i.e. L2 on L1) and Grosjean and Miller (1994) provide an example of consonant production that was NOT influenced by language mode. These varying results trigger questions about their causes.

One of the possible reasons is the variability of experimental conditions. For example Olson (2013), in his “monolingual” sessions, used material that contained 95% of tokens

in one language and 5% in the other. This way the participants were encouraged, though in small amount, to activate the other language as well and inevitably move towards the bilingual mode. Similarly, the monolingual and bilingual sessions in López (2012) followed immediately one after another, which contrasts with most studies in this field, which leave at least 24 hour gap between the different language mode sessions.

Another possible reason is the difference between participants studied in each work. Their proficiency, age of SLA, their language switching patterns in everyday life and other aspects could cause different results in their phonetic production as well. The third possible explanation for variability across the studies in short-term interference is the difference between languages and their specific phonetic segments and pronunciation patterns. Further research might show that short-term phonetic interference applies to some segments in particular language combinations and is absent in others. Nevertheless, three of the above-mentioned studies (Olson 2013, Bullock et al. 2006, López 2012) measured the same property (VOT) of the same consonants (voiceless stops) in the same combination of languages (English and Spanish) with different results.

Finally, and most probably, the variability in the results is caused by combination of some of the above-mentioned reasons or other aspects that still need to be explored.

5.2 The present study challenged

The experiment did not include comparison between groups of monolingual and bilingual speakers with different proficiency and age of SLA (that can be important factors in phonetic production, see Flege 1987, Escudero and Boersma 2002, Fowler et al. 2008). The vowels produced by native speakers who recorded the stimuli tend to have slightly higher F2 than participants, but it is not very appropriate to compare these two groups, since there were only 5 native speakers of both sexes and different age as opposed to quite homogenous group of participants. Neither did this study investigate the influence of L2 on L1 or the effects of coarticulation on the vowel quality and on the interference.

The effect of language mode on the vowel quality could have been higher if the conditions of monolingual session were modulated more precisely. Monolingual experimenters or other monolingual participants would probably encourage the monolingual mode in participants. Having all the participants come to the monolingual

session first would ensure smaller probability that they deduce the aim of the experiment from the character of the task. Also, target words with more similar places and manners of articulation of preceding and following consonants could have been used. However, this was difficult to do, since the parallel interpretation task required well-known target words that the participants could translate easily.

The results of this experiment also showed a trend of participants to pronounce /u/ with higher F2 frequency in sentence-initial target words than in sentence-final. Though this tendency did not reach significance, it might demonstrate different prosodic patterns of participants at the beginning and at the end of English declarative sentences.

5.3 A challenge for the future

The present study answers Grosjean's (2001, 2004) objection that it is essential to differentiate between language modes in experimental conditions of interference studies. The results provided here support his view, showing that the values obtained from monolingual session differed significantly from those obtained in bilingual session. Since the time Grosjean introduced the language mode framework, several studies, including this one, gave evidence for short-term interference of some kind, but it seems that these results triggered more questions than in provided answers. Further research is needed to answer these questions and determine the patterns and conditions of short-term interference on phonetic level.

6 Conclusion

This study investigated the influence of language mode on cross-linguistic phonetic interference of English and Czech. Literature review introduced the topic of bilingual interference and its effects on phonetic level. It explained how bilingual speakers change their language mode depending on the situation and introduced Grosjean's hypothesis that language mode can influence speakers' performance. Then, the studies testing this hypothesis were summarized. A lack of consistency in their results indicated the need of further research in this study field.

The study continued with comparison of Czech and English vowel /u/, especially its acoustic quality. It was explained that lower F2 frequency in the production of English vowel is a sign of Czech-accented pronunciation.

The main focus of this study was an experiment, which was carried out to test the effects of language mode on the production of English high back vowel /u/ by Czech-English bilinguals. The results showed that participants produced the vowel /u/ with much higher (native-like) F2 frequency in monolingual (English-only) session than in bilingual. This provides an evidence for the existence of short-term (dynamic) phonetic interference in the vowel production of advanced L2 learners of English. These results were then compared to similar studies in the field and evaluated in the light of previous research. The discussion presented hypotheses about the causes of inconsistent results in this study field and questions that require further research.

7 Resumé

U bilingvních mluvčích často dochází k vzájemnému ovlivňování jazyků, které se nazývá *mezijazyková interference*. Ta zasahuje do všech jazykových rovin, včetně fonetické.

Jazyková interference je určena mnohými faktory, například věkem nebo jazykovou úrovní mluvčího. Výzkum v této oblasti mnohá léta nebral v potaz jazykovou situaci, v níž se mluvčí nachází a která je určena mírou užívání jednoho nebo obou jazyků. V poslední době začali někteří autoři rozlišovat interferenci krátkodobou (dynamickou) a dlouhodobou (statickou) (Grosjean and Miller 1994, Bulock et al. 2006, López 2012, Simonet 2014, Antoniou 2011, Olson 2013).

Krátkodobá se může lišit v závislosti na jazykové situaci. Dlouhodobá interference je permanentní vlastnost nacházející se v projevu bilingvního mluvčího vlivem druhého jazyka, která se nemění s jazykovou situací (Grosjean 2001, 2004, 2011).

Přecházení z jednoho jazyka do druhého a jeho vliv na výslovnost je předmětem studií teprve krátce. Výsledky těchto studií se různí. Jak uvádí Simonet (2014,28), charakter tohoto vlivu je nejasný a je třeba dalšího výzkumu k hlubšímu pochopení krátkodobé interference na fonetické úrovni.

Tato práce se věnuje vlivu češtiny na angličtinu ve výslovnosti vokálu /u/. V úvodu představuji pojem jazykové interference a popisuji rozdíl mezi dlouhodobou (statickou) a krátkodobou (dynamickou) interferencí. Dále se zabývám monolingvní a bilingvní jazykovou situací, mezi nimiž se nachází široká škála mezistupňů. Na příkladě nedávných výzkumů v tomto oboru ilustruji vliv jazykové situace na bilingvní řečový projev, zejména na jeho fonetickou složku. Také porovnávám anglickou a českou výslovnost krátkého a dlouhého vokálu /u/ a vysvětluji, v čem spočívá typicky český přízvuk.

Praktická část této práce popisuje experiment, který zkoumal účinek jazykové situace na výslovnost /u/ v projevu dvaceti bilingvních mluvčích. Experiment sestával ze dvou nahrávání. Při prvním se mluvilo výhradně anglicky. Při druhém se od mluvčích vyžadovalo soustavné přecházení z jednoho jazyka do druhého. Získaná data byla použita pro srovnání kvality vokálu /u/ použitého v monolingvní a bilingvní jazykové situaci.

Výsledky ukazují, že frekvence druhého formantu vokálu /u/ ve výslovnosti účastníků experimentu byla vyšší (bližší angličtině) v monolingvním než v bilingvním nahrávání. To dokazuje existenci krátkodobé fonetické interference ve výslovnosti bilingvních mluvčích.

V závěru konfrontuji výsledky experimentu s výsledky výzkumů současných studií v této oblasti.

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9 Appendix

Speaker	Monolingual session		Bilingual session	
	Sentence-initial	Sentence-final	Sentence-initial	Sentence-final
1	12,03359	12,28378	11,94269	11,78039
2	12,70741	12,87204	11,93918	12,61597
3	10,60467	10,70562	10,1864	9,670979
4	11,53765	11,35086	11,48867	11,72456
5	11,83138	11,13305	11,55208	11,43725
6	13,57632	13,77703	14,15924	13,6276
7	11,33903	10,97856	12,12117	11,17928
8	12,64658	11,95298	11,29669	11,44863
9	11,47598	11,11678	10,70918	10,52656
10	12,40585	12,12465	11,71349	11,95548
11	11,23166	10,37496	11,00058	10,36308
12	10,95379	9,550685	10,39625	9,458516
13	11,36442	11,76983	10,83621	11,29337
14	11,51419	11,75378	11,73729	11,45616
15	11,24348	11,83241	10,82873	11,64061
16	11,87865	12,10769	11,72895	11,66634
17	9,774113	9,528348	9,810441	9,307813
18	11,75412	10,63472	11,4459	11,03831
19	11,49301	11,68654	12,26065	12,12248
20	10,79403	10,4521	10,4821	10,0391

Native speakers

1	12,04313	12,21584
2	12,46352	12,3538
3	12,52067	12,32157
4	12,1573	11,98012
5	11,17019	11,47656

Table (6) : Mean F2 in Bark in monolingual and bilingual session, with target words in sentence-initial and sentence-final position, for each participant as well as for each native speaker who recorded the stimuli.

	Question 1	Q 2	Question 3	Q 4	Question 5	Question 6
1	4th gr., 10	No		18	on a daily basis	several hours per week
2	3 gr., 8	Yes	4	15	1-2 times a year	more than 2 hours per day
3	5th gr., 11	No		18	several times a year	more than 2 hours per day
4	6th gr., 11	No		17	1-2 times a year	1-2 hours nearly every day
5	4th gr., 9	Yes	7	17	1-2 times a month	more than 2 hours per day
6	3rd gr., 8/9	Yes	kindergarten	16	1-2 times a week	daily – 1 to 2 hours
7	4th gr., 9	Yes	5	16	none	daily – 1 to 2 hours
8	3rd	No	8	16	1-2 times a year	daily – 1 to 2 hours
9	4th gr., 11?	Yes	6	13	several times a year	more than 2 hours per day
10	4th gr., 9	No		21	1-2 times a month	daily – 1 to 2 hours
11	3rd gr., 9	Yes	5	16	several times a year	several hours per month
12	5 yrs old	No		15	1-2 times a week	daily – 1 to 2 hours
13	3rd gr., 9	Yes	6	15	1-2 times a month	daily – 1 to 2 hours
14	2nd gr., 7	No		16	several times a year	daily – up to 1 hour
15	3rd gr., 8	No		13	1-2 times a month	more than 2 hours per day
16	3rd gr., 9/10	No		15	1-2 times a week	daily – 1 to 2 hours
17	4th gr., 12?	No		21	on a daily basis	more than 2 hours per day
18	around 10	No		20	several times a year	1-2 hours per week
19	4th grade	No		14-15	none	daily – 1 to 2 hours
20	1st gr., 6	Yes	5	18	none	more than 2 hours per day

Table (7) : Answers of participants in a questionnaire collected by research colleague. The questions are following: 1. At which grade did you start learning English at school? How old were you? 2. Did you learn any English before that? 3. If yes, how old were you when you started? 4. At what age did you start to feel comfortable using English? 5. How much time apart from school do you spend interacting with native English speakers? 6. How often are you currently exposed to the English speaking media? (films/music/news/radio/others)