

Filozofická fakulta Univerzity Palackého
Katedra anglistiky a amerikanistiky

**Multiple Languages in One Brain – Interpreter's
Perspective**

(Bilingvismus z pohledu tlumočnicka)

Author: Bc. Eva Prokopová (Angličtina se zaměřením na tlumočení a překlad)

Supervisor: Mgr. Václav Jonáš Podlipský, PhD

Olomouc 2013

Prohlašuji, že jsem tuto diplomovou práci vypracovala samostatně a uvedla úplný seznam použité a citované literatury.

V Olomouci dne 23. dubna 2013

.....

Děkuji Mgr. Václavu Jonáši Podlipskému, PhD za odborné vedení při zpracování mé diplomové práce a za užitečné rady, které mi v průběhu psaní práce poskytl.

Table of Contents

1	INTRODUCTION	5
2	DEFINITION OF BILINGUALISM	7
2.1	Definition	7
2.2	A Variety of Bilingualism.....	10
3	MONOLINGUALS VERSUS BILINGUALS	13
3.1	Differences and Similarities of Bilinguals and Monolinguals	13
3.2	Early versus Late Bilinguals	28
4	BILINGUAL BRAIN	30
4.1	Language and the Brain	30
4.2	The Bilingual Brain and Multiple Languages	32
4.3	Bilingual Brain and its Role in Interpreting	36
5	BILINGUALISM, PHONETICS AND INTERPRETING	44
5.1	Bilingualism and Phonetics – Introduction	44
5.2	Research in Phonology and Interpreting	51
6	CHALLENGES	58
7	CONCLUSION	60
	SUMMARY	61
	BIBLIOGRAPHY	65
	Works cited:	65
	Works Consulted:	69
	ANNOTATION	70

1 Introduction

This thesis is concerned with bilingualism and interpreting. It explores the effects bilingualism has on interpreting. The paper will be divided into five major parts. The first part of the paper will review literature that deals with bilingualism in general. What does bilingualism mean and where did it originate. There are different types of bilingualism and various publications use different names. Generally unified terminology will be used in regards to the different types of bilingualism.

Furthermore this thesis is going to describe the differences between late and early bilinguals. Their advantages and disadvantages, presented by researchers in various bilingualism readers.

Another section is dedicated to bilingualism and the brain, where it will try to briefly map out the relationship between neuroscience and our ability to speak more than one language. It will briefly outline the processes happening in our brain when we speak different languages. The next section is going to outline bilingualism and phonetics. The changing fluctuation of accents and possible outcomes it has on interpreting.

The last part of the paper deals with implications that bilingualism has on interpreting. It will present future challenges in research and this thesis is trying to provide a complex and unified work where students of interpreting can find inspiration and sources for their future work.

There are a few works that have already dealt with interpreting research and various experiments conducted in this field. As was stated above it is important to tie bilingualism with interpreting more closely and to bridge the invisible gap between these two fields. Bilingualism itself is an important part of interpreting because this process always occurs in two or more languages (apart from sign language interpreting). This makes interpreters very likely candidates for research and experiments. This work would like to introduce some of it here and create a general overview in the aforementioned sections (brain, phonetics).

This paper will outline bilingualism and various fields that are interconnected with it. In subsequent sections I will introduce various papers that deal with bilingualism and interpreting, trying to focus on different perspectives and branches of research. The primary goal of this thesis is to present an overview

of literature that describes bilingualism in general terms as well as in the fields of neuroscience and phonetics. The secondary focus is on interpreting and how bilingualism and interpreting influence each other and what can be learnt from this area of linguistics and how to possibly apply its research on interpreter training and practice.

2 Definition of Bilingualism

This section describes and summarizes the definition of bilingualism. What is the term and what does it mean. Who is considered bilingual and what are the criteria with which to determine someone's bilingualism?

2.1 Definition

Many researchers argue about how to define bilingualism as was presented in Wei (2000, 3). It does not seem that there is a unified definition of bilingualism in their ranks. According to Li Wei many people live in a world where monolingualism is being promoted and therefore many people feel that bilingualism must be something 'special' (Wei 2000, 3). He then continues and says that the world population is more bilingual or multilingual than monolingual and people use languages in various settings, be it at work, with their family or in their free time – therefore it can be considered that monolinguals are a minority, compared to the rest of the world (Wei 2000, 3).

Elsewhere, William F. Mackey claims that “bilingualism is not a phenomenon of language; it is a characteristic of its use. It does not belong to the domain of ‘langue’ but of ‘parole’” (Mackey 2000, 22). John Edwards (2006, 7) shares Wei's view, that most people are bilingual. He further ponders the question to which degree is someone bilingual and claims it is one of the few matters that seems to be undecided in the world of academia (Edwards 2006, 7).

It is very difficult to define a bilingual person therefore Baker and Prys Jones (as cited in Wei 2000, 4) suggested that in order to identify a bilingual person it is important to ask these questions:

- Should bilingualism be measured by how fluent people are in two languages?
- Should bilinguals be only those people who have equal competence in both languages?
- Is language proficiency the only criterion for assessing bilingualism, or should the use of two languages also be considered?

- Most people would define a bilingual as a person who can *speak* two languages. What about a person who can understand a second language perfectly but cannot speak it? What about a person who can speak a language but is not literate in it? What about an individual who cannot speak or understand speech in a second language but can read and write in it?
- Should self-perception and self-categorization be considered in defining who is bilingual?

(Wei 2000, 4)

Wei's definition of bilingualism states that it has to be a person with the possession of two languages. Although many people have different levels of proficiency and use two, three even four languages. Africa and Asia being one of the two areas that use this system. Multilingualism is also a possession of individuals who do not live in a multilingual speech community. One of the primary examples can be families living in a trilingual setting. It is also very important to define what a language is because this question is integral to the definition of bilingualism (Wei 2000, 6).

Mackey (2000, 23) agrees that bilingualism is the use of two or more languages by an individual. He then considers what factors have to be present. He names degree, function, alternation and interference as the main ones (Mackey 2000, 23). According to Mackey, degree means how well the person knows their language. Function signifies what the language is being used for. Alternation describes how an individual can change and switch from one language to the other and under what circumstances. Interference means how well the individual can keep their languages apart (Mackey 2000, 23).

There are many other tests created to determine the depth of one's bilingualism. Test such as rating scales and fluency or dominance and flexibility. Researchers conducted interviews and various measures of language use. These interviews and measures usually failed because individuals could not self-report accurately. Other factors that could not be properly measured and had to be incorporated into the tests were sex, attitude, intelligence, memory and linguistic difference between the two languages (Edwards 2006, 9).

These tests are not the only problem. Even if there was a way to accurately measure bilingualism there is still the question of labeling. It is very unlikely that each individual undertaking any of the tests would fall into just one category. Most of the individuals fall into one or more categories of ability, or a degree of bilingualism. There is some confusion among scholars about terminology and labels of individual degrees of bilingualism (Edwards 2006, 9). This topic will be explored and examined in the following sections.

2.2 A Variety of Bilingualism

There are many possible tables, graphs and charts about the variety of bilingualism presented in many publications on the topic. This paper will present one such table that hints at the plethora of types and kinds of bilinguals and the possible variations that many researchers divide them into. For the purpose of this work and because of its extensive listing, Li Wei's (2000, 4-5) table of variety of bilingualism has been chosen. It illustrates the division and many types of bilingualism that can be found among its speakers:

Additive bilingual – someone whose two languages combine in a complementary and enriching fashion.

Ascendant bilingual – someone whose ability to function in a second language is developing due to increased use.

Balanced bilingual – someone whose mastery of two languages is roughly equivalent.

Compound bilingual – someone whose two languages are learnt at the same time, often in the same context.

Co-ordinate bilingual – someone whose two languages are learnt in distinctively separate contexts.

Covert bilingual – someone who conceals his or her knowledge of a given language due to an attitudinal disposition.

Diagonal bilingual – someone who is bilingual in a non-standard language or a dialect and an unrelated standard language.

Dominant bilingual – someone with greater proficiency in one of his or her languages and uses it significantly more than the other languages.

Dormant bilingual – someone who has emigrated to a foreign country for a considerable period of time and has little opportunity to keep the first language actively in use.

Early bilingual – someone who has acquired two languages early in childhood.

Functional bilingual – someone who can operate in two languages with or without full fluency for the task in hand.

Horizontal bilingual – someone who is bilingual in two distinct languages which have a similar or equal status.

Incipient bilingual – someone at the early stages of bilingualism where one language is not fully developed.

Late bilingual – someone who has become a bilingual later than childhood.

Maximal bilingual – someone with near native control of two or more languages.

Minimal bilingual – someone with only a few words and phrases in a second language.

Natural bilingual – someone who has not undergone any specific training and who is often not in a position to translate or interpret with facility between two languages.

Productive bilingual – someone who not only understands but also speaks and possibly writes in two or more languages.

Receptive bilingual – someone who understands a second language, in either its spoken or written form, or both, but does not necessarily speak or write it.

Recessive bilingual – someone who begins to feel some difficulty in either understanding or expressing him or herself with ease, due to lack of use.

Semilingual – someone with insufficient knowledge of either language.

Simultaneous bilingual – someone whose two languages are present from the onset of speech.

Subordinate bilingual – someone who exhibits interference in his or her language usage by reducing the patterns of the second language to those of the first.

Successive bilingual – someone whose second language is added at some stage after the first has begun to develop.

Vertical bilingual – someone who is bilingual in a standard language and a distinct but related language or dialect.

(Wei 2000, 4-5)

This one of the more extensive and exhaustive lists of various bilinguals. There are two types that are highlighted in bold text. The first one is the early bilingual and the other one is the late bilingual. These two were chosen for an easier and clearer division and to make sure that the terminology throughout this paper is unified. I will look more closely at both of these types of bilinguals in the following section and highlight some of their similarities and differences. In Section 3 of this paper there is

a more extensive look into monolinguals and bilinguals as well as early and late bilinguals, following the distinction I made above.

3 Monolinguals versus Bilinguals

The following section will outline the similarities and differences among bilinguals and monolinguals and the plethora of research that has been published comparing both of these groups. Later in this chapter some of the research papers that were selected are going to look at and explore the differences between early and late bilinguals. I have already supplied a list of various types of bilingualism in section 2.2. I am now following this list and will use the supplied terminology so that there is no confusion in the subsequent sections.

3.1 Differences and Similarities of Bilinguals and Monolinguals

As was mentioned in section 2 bilingualism has not always been a sought after ability or a desired condition. Many believed that people cannot be bilingual but merely semi-lingual and that they cannot speak any of the languages properly. This attitude was also held by some of the bilinguals themselves. Romaine (as cited in Wei 2000, 17-18) during one of her experiments heard the following statement from a Panjabi-English speaker claiming that he himself is guilty of using a word or an expression or two in his mother tongue. So even among some bilinguals this was an undesirable behavior (Wei 2000, 17-18).

Some of the earlier research and studies claimed that bilinguals had a smaller IQ than monolinguals. This was stated by Saer in 1923 (as cited in Wei 2000, 16), one of the earliest studies on this topic. It was conducted in rural and urban areas of the UK. It was later disputed and questioned. It was said that the IQ in the rural areas was lower for bilinguals but almost the same as monolinguals in urban areas. As for the results in rural areas, most of the results were distorted because children in that area were not exposed to English as often as their urban counterparts (Wei 2000, 16).

As late as 1981 researchers claimed that bilinguals had large deficiencies in the following categories: size of vocabulary, subconscious language processing, language construction, level of proficiency of said language, meaning and images in one's brain, proper speech in language. These categories were stated by

Hansegard in 1975 and Skutnabb-Kangas in 1981 according to Wei (2000, 17-19). These categories as well as the creation of the term semi-lingual were an indirect result of a study that was conducted on ethnic minorities. This term perpetuated the stereotype of second language learning in facilities for minorities and immigrants. Most of the studies conducted had vast problems and discrepancies as well as methodological inaccuracy. This has led to a series of laws against language discrimination around the world, mainly in the US where there are various language laws at the local and federal level. These language initiatives are supported by such organizations as the UN, the European Union and UNESCO. The European Union proposed and passed a directive (77/486/EEC) to state that member states should promote their mother tongue and subsequent education of it (Wei 2000, 17-19).

One of the studies underlying and focusing on bilinguals and monolinguals and their differences is Bialystok and Craik study from 2010 that is looking at cognitive processes in the mind of a bilingual and compares them against monolinguals. It has been generally concluded that bilingualism has its advantages and disadvantages. Bialystok and Craik (2010, 19) argue (and this study is focusing on it as well) that bilinguals are believed to have decreased language proficiency and language mastery. One of the areas in which the proficiency is lower is the area of vocabulary and lower access to lexical terms (Bialystok and Craik 2010, 19).

On the other hand bilinguals display a remarkable executive control in the non-verbal area during tasks of conflict resolution. The test used here was the so called Stroop and Simon task. Lambert, in 1962, (as cited in Bialystok and Craik 2010, 20) proclaimed the then very radical point of view that bilingual children might not be as disadvantaged as the previous research stated. He conducted a couple tests and concluded that bilinguals actually do better than monolinguals in certain areas. This of course ushered in a modern era of bilingual testing and research. In Bialystok's earlier research, it was founded that bilingual and monolingual children can detect grammatical errors on the same level unless the sentences were different semantically. In that case bilingual children fared much better and were more accurate than their monolingual counterparts (Bialystok and Craik 2010, 20).

The sentences seemed incorrect in meaning but were grammatically correct and monolinguals only focused on the grammatical part wherein bilinguals benefited from a process that looked and operated behind the mere linguistic level. So it was concluded that bilinguals have an advantage in “selectivity and inhibition” (Bialystok and Craik 2010, 20).

Due to extensive evidence gathered over the decades of research it is said that bilinguals have better results in executive control processes. In one test conducted by Bialystok in 1999 (as cited in Bialystok and Craik 2010, 20) where the subjects (small children) were given cards to sort out first according to color then according to shape. Bilingual children were better at switching to the other task and were to quickly adapt to the new task. It was also said according to Kovács and Mehler in 2004 (as cited in Bialystok and Craik 2010, 20) that even very small children (seven month old children) were better able to adapt to responses after a change than monolinguals which further supports Bialystok’s and other scientist’s assumption about executive control in bilinguals and monolinguals (Bialystok and Craik 2010, 20).

This of course extends to adults as well. In similar studies using different tasks such as Stroop and flanker, Bialystok, Craik and Luk (2008a) (as cited in Bialystok and Craik 2010, 20) and Costa, Hernández and Sebastián-Gallés (2008) (as cited in Bialystok and Craik 2010, 20) concluded that bilinguals are less distressed by disruptions in patterns than monolinguals. When presented with stimuli that ignored some of the previous patterns and confusing some of the monolingual subjects. It is also said that in senior and older age bilinguals tend to have a slower mental decline than found in monolingual individuals. This particular hypothesis was tested with the so called Simon Effect where older subjects that were monolingual manifested slower reaction times. This supports the notion that in older age, bilinguals may protect themselves from age related cognitive decline (Bialystok and Craik 2010, 20).

On the other hand there are some negative aspects of bilingualism that manifest themselves. One of the more talked about negative aspects is decreased vocabulary and poorer performances on test scores that were vocabulary related. Bialystok, Luk, Peets and Yang (as cited in Bialystok and Craik 2010, 20-21) have documented over 1,700 children, monolingual and bilingual, on their

vocabulary in English. Monolingual children fared better on the tests than bilinguals, even though bilinguals were completely fluent in English and were speaking the language on daily basis. The other disadvantages found in another study conducted by Micheal and Gollan (2005) (as cited in Bialystok and Craik 2010, 20-21) stated that bilinguals have slight problems in other areas such as lexical decision making. It was found that picture naming was not successful even when it was conducted in their main language. Many bilinguals also scored very badly on verbal-fluency (Bialystok and Craik 2010, 20-21).

It is not relevant in regular conversations with bilinguals but in the test environment, these results keep reappearing which might mean that two language systems might have a negative impact on linguistic performance. Even though the abilities of executive control and language processing seem to be acting independently there are some tasks where both of these functions work together. (Bialystok and Craik 2010, 21)

One such occasion was recreated in a test where subjects had to recall things from lists of words that belonged to the same semantic unit. When adding a new list in a row creates a decline in performance a different list with different semantic categories is added and that restores the success rate. It resulted in the fact that bilinguals were able to retrieve more than monolinguals even though it was also vocabulary related (Bialystok and Craik 2010, 21).

This means that when both of these abilities work simultaneously, bilinguals score higher and do better. One of the reasons that bilinguals outperform monolinguals in executive control tasks is that fact that bilinguals that are switching between language use and practice this very part that is domain controlled by executive control. They are consistently better at it compared to monolinguals because they are using this part the most and therefore it is subsequently much better than the one that monolinguals have and use (Bialystok and Craik 2010, 22).

The effects of bilingualism on the onset of symptoms of dementia were found in a study produced by Bialystok, Craik and Freedman in 2007 (as cited in Bialystok and Craik 2010, 22). There were about 91 older monolinguals and 93 bilinguals who had been diagnosed with dementia that were tested. The tests concluded that the onset time for the symptoms was delayed by 4 years which

means that the symptoms would appear 4 years later than in the case of monolinguals. This is a remarkable phenomenon that makes a big difference in a person's life and the delay is longer than any drugs could provide right now (Bialystok and Craik 2010, 22).

The results show that speaking more than one language has its advantages and disadvantages – it increases your executive control and other cognitive processes but has a negative impact on vocabulary and smaller access to lexical items. Fortunately the advantages outweigh the disadvantages and after further studies are conducted it might even prolong chances for a healthy life (Bialystok and Craik 2010, 22-23).

The following study by Tuncer (2009) is going to look at learning strategies implemented by monolinguals and bilinguals. Such research has been done all over the world, mainly in the US. It shows an interesting insight into the way monolinguals and bilinguals learn languages. It looks into the differences of language acquisition strategies in both groups and how they use and apply them. The study further examined the differences in language learning within each gender of bilinguals and monolinguals as well as the effect of proficiency on acquiring new languages (Tuncer 2009, 853).

According to literature that was reviewed in this study, it was claimed that bilinguals might have an advantage in learning languages than their monolingual counterparts. This notion is popular mostly because once an individual masters two languages it is assumed to be easier to acquire another one. Green and Oxford in 1995 conducted a study where they concluded that females use slightly more language learning strategies and rely on social strategies more than males (Tuncer 2009, 853).

Tuncer's study used total of 245 students that had English as foreign language. The premise of the study was to find out if bilinguals do use and rely more on their language learning strategies when learning a new language as opposed to monolinguals. Thanks to various tests used in this study it was concluded that bilinguals use learning strategies more than monolinguals. It appeared that bilinguals are also more confident and adventurous in their strategies because they are already motivated by their previous language success (Tuncer 2009, 854).

In addition to the first question Tuncer's study also answered two more. One of them was whether females differ in the usage of their learning technique compared to males. The results showed that females do differ from males in terms of learning strategies but the biggest and most notable difference is in the so called affective strategies. There is a wide spread idea that females are better at learning languages than men. Coleman (as cited in Tuncer 2009, 854) said that females are better at acquiring new languages because they are more willing to take risk and adopt a positive attitude towards new strategies. This particular study does not support this notion because the differences were not as significant as to claim the same idea as Coleman did in 1997 (Tuncer 2009, 854).

The last question posed by Tuncer was the difference in any proficiency levels and whether there is some among bilinguals and monolinguals. It was founded that in most cases both groups used the same strategies regardless of proficiency levels. Most notably there were no differences in the affective and metacognitive strategies. There were difference on the level of memory, compensation and social strategies. It is possible that more proficient learners more strategies and also special ones that they already acquired during their previous studies. Therefore there are differences between bilinguals and monolinguals where bilinguals use more of them, especially some of the strategies (Tuncer 2009, 854).

To conclude, this study showed that bilinguals do use more strategies than monolinguals when learning new languages, which makes it easier to acquire a new language. This is a result of the confidence that bilinguals possess because they have already acquired one language. Even though women should be better than men in learning a language as is the case in most of the studies done on this topic, this study did not prove this phenomenon and men fared the same as women in this area. Lastly Tuncer found that more proficient learners tend to use more strategies when acquiring a new language. This information not only highlights some differences between monolinguals and bilinguals but also gives an idea about how to form and create lessons for future ESL students (Tuncer 2009, 856).

A study by Tamminen et.al (2012) looks at the differences among bilinguals and monolinguals in their phonological processes. It shows whether

bilinguals and monolinguals perceive speech sounds differently or similarly and whether bilinguals that have two phonological systems in their brain tend to be affected by one of their languages that further affect the other language. In the previous following sections we will look at phonetics and bilinguals and so far it has been established that there are two different phonological systems where one is interconnected with the one representing the other language (mostly present in early bilinguals) and two systems that are independent of each other (Tamminen et al. 2012, 8).

This leads to the fact that learning background of each type of bilingual affects pronunciation and phonemic systems. The other criterion is age of acquisition: whether they are early or late bilinguals – more on this in the next sub section of this paper. The goal of this presented study is to establish whether phonological speech processing might show any differences within the groups of bilinguals and monolinguals. The aim of the study was to look at whether two phonological systems interact differently and have different perception than only one system used by monolinguals. All this was tested on the background of “pre-attentive memory traces retrieval” (Tamminen et al. 2012, 8-9).

Methods used in this study related to the so called MMN (mismatch negativity component) of ERP (this particular phenomenon was also part of some studies in the fourth section dealing with the bilingual brain). Therefore the hypothesis of this study was that bilinguals will have different perceptual and speech processing capabilities than monolinguals due to the fact that they operate with more language, and therefore phonological systems, and as a result their phonological categories are more extensive. Subjects were right-handed Swedish-Finnish bilinguals and Finnish monolinguals. The Swedish-Finnish bilinguals were early bilinguals (Tamminen et al. 2012, 9).

The bilinguals reported a high proficiency in both languages and they used both languages every day. Therefore if bilinguals were able to switch off one of their languages then their results would be identical to the results of monolingual, the MMN response that is. If they could not switch them off it would result in one of the languages not used at the moment overlapping and affecting the one being used. The results of the study showed that there was a difference between MMN latency. In the non-verbal part of the test bilinguals fared the same as

monolinguals. On the other hand as was previously stated there is a difference between the perception of speech sounds of bilinguals and monolinguals (Tamminen et al. 2012, 11-12).

It was observed that the more phonological categories there are to choose from then the more MMN increases, due to more languages present in the individual's brain. This leads to the conclusion that bilinguals, unlike monolinguals, have more varieties to choose from and phonological systems are more interconnected especially when both languages are active all the time. This phenomenon results in slower lexical access something that was also debated in the studies mentioned earlier in this section. Due to the language interference of bilingual subjects some of the vowels lost their native like sounds mostly because both phonological systems work at the same time, even when the subjects used one language only. This was not the case for monolinguals that only possess one language and the phonological system therefore could not face any interference from non-native sounds (Tamminen et al. 2012, 12).

A further study examines bilingualism and monolingualism from the children's point of view. It deals with coordination of executive function in both of these groups and it was done by Ellen Bialystok (2011). It has been established that the most important part on childhood is the development of cognitive achievements. This study goes a bit further and looks at these components from the point of view of bi- and monolingual children. It is very difficult to measure these components mostly because it is difficult to recreate the real life situations normally presented to children in their development. Bilingualism is one experience that affects these cognitive processes and that differs from that of monolingual children (Bialystok 2011, 461-462).

It has been stated in other studies that bilinguals develop their executive control earlier than monolinguals, such studies done by Bialystok herself and Carlson and Meltzoff in 2008, Adi-Japha, Berberich-Artzi and Libnawi in 2010 (as cited in Bialystok 2011, 462) and of course many others. Thus it seems bilingualism cannot be attributed to one component only but it is part of more of them. Of course one of the main components is inhibition which is definitely influenced by bilingualism as was stated in a study done by Blumenfeld and Marian in 2011 (as cited in Bialystok 2011, 462). The question is why

bilingualism would affect that. One of the answers was found in a study done by Marian, Spivey and Hirsh in 2003 which was an eye movement study (Bialystok 2011, 462).

Individuals were watching pictures with English words on them and it was disrupted by Russian whenever the word seemed phonologically similar. Therefore bilinguals are always in a state of '*dual tasking*' which puts a lot of strain on executive control. This was tested in a study done by Bialystok, Craik and Ruocco (2006) (as cited in Bialystok 2011, 463). Participants were bilinguals and monolinguals who had to correctly guess semantic stimuli. The results showed that bilinguals were better at identifying the categories than monolinguals due to the fact that it was a dual task that was more established in bilinguals than monolinguals and therefore bilinguals had an advantage in that department. This study therefore focused on all the components at once and all conditions were presented simultaneously to see how bilingual and monolingual children fared (Bialystok 2011, 463).

Participants of this study were 63 8 year-old monolingual and bilingual children. The children looked at 25 pictures of animals and musical instruments and then listened to 25 sounds of animals and musical instruments. In case of the visuals task, each participant had to press a key and in the case of auditory files, participants gave verbal responses, either M for music or A for animal (Bialystok 2011, 464).

Results of Bialystok's study concluded that bilingual children were better than monolingual children in the visual task of the experiment. Even though the efficiency in both tasks decreased due to the complicated nature of the experiment where all the tasks were presented simultaneously. Bilinguals were also more accurate in establishing which picture was which using their developed dual-task skills. The experiment included all three components of executive control – working memory, inhibition and shifting. If the researchers looked at the data independently than bilingual children had similar results as monolingual children did but the difference and advantage came from the usage of coordination and applying their dual-task experience. In this case bilinguals were more accurate than monolinguals (Bialystok 2011, 466).

It means that the bilingual speaker has to ignore interference from the language that is being targeted and switch accordingly to the task's demands. The biggest advantage was therefore found mainly in the visual tasks not the auditory one. One of the reasons for this is the fact that the auditory task required naming the category and that involves lexical access which is slower in bilinguals than in monolinguals. These results were also confirmed in a similar study done by Morris, Gick and Craik in 1988 (as cited in Bialystok 2011) (2011, 466).

Therefore the results presented in this study show how to understand bilingualism and how it affects executive control in young children. The experiment was very complex because it encompassed all the levels of executive control and its system. None of the components stood out during the tests which led to the interpretation that bilingualism is more prominent in general areas of executive control than just one particular area with the exception of maybe inhibition that was researched by Bialystok and Martin in 2004 and shifting written about by Meuter and Allport in 1999 (as cited in Bialystok 2011, 466). This helps in addressing more serious and difficult tasks. It is therefore believed that bilingualism might play a significant role in child's cognitive and executive thinking and performance (Bialystok 2011, 466).

The following paper written by Yeganeh (2012) examines language learning and age constraint in monolinguals and bilinguals and what differences there are between them. One of the main influences on language learning is age. The time in life in which any individual starts learning a new language is crucial to acquiring it and to how fast and how proficient they can become. This idea is supported by many studies and one of the names for this phenomenon is the Critical Thinking Period which was also mentioned in previous sections of this paper. Some of the proponents of this idea are Bialystok, Lenneberg (who coined the term), Birdsong, Flege, Murphy and many other researchers (Yeganeh 2012, 1794-1795).

According to this theory once a child reaches this critical period it is believed that the individual cannot reach the native-like standards of the language and the age of acquisition does not apply as well. On the other hand there are numerous scientists and researchers (e.g. Ellis 1990, Gregg 1984, Mitchell and Miles 1998, and McLaughlin 1987) (as cited in Yeganeh 2012, 1795) who claim

that there is a possibility that this phenomenon is not applicable to every situation and every individual. They conducted a series of tests on age acquisition and its importance. This study will try to find answers to the following questions: Are there any differences between language levels of pre-pubescent monolinguals and bilinguals and are there any difference between post-puberty monolinguals and bilinguals (Yeganeh 2012, 1795)?

There were 75 students who were tested. Monolinguals who studied English before puberty and the ones that took the courses after their pubescent period. The same criteria were applied with bilinguals who spoke other languages but took up English in either pre-or post puberty. They were given TOEFL tests to fill out and performed other grammatical judgment tasks. One of the first results stated that monolinguals within their own group performed better if they took English courses before puberty – this agrees with the age of acquisition hypothesis (Yeganeh 2012, 1796-1797).

When comparing monolinguals and bilinguals that studied English before puberty the results were the same, which means that bilingualism does not pose any advantage in this case. Both groups did similarly. This is surprising considering some of the data from other research papers. The biggest difference occurred with bilinguals and monolingual who took English after puberty. Bilinguals performed much better at English tests than their monolinguals colleagues which mean that in this case being a bilingual is an advantage. The results showed that age and the ability to speak other foreign languages does pose a certain advantage, especially after reaching a certain age. This hypothesis goes hand in hand with critical thinking period. It is an interesting fact because it might be beneficial to conduct more studies on bilingualism and its beneficial effects on language learning (Yeganeh 2012, 1798).

The next research paper done by Lehtonen et al. (2011) asks the question of word recognition among bilinguals and monolinguals and their subsequent differences. Evidence was found on the basis of ERP studies also used in some of the studies in section 2 and behavioral evidence. It is interesting to look at early bilinguals and whether their ability and high proficiency in both languages can create differences in lexical processes with monolinguals. Previous studies have already showcased differences in executive control among bilinguals and

monolinguals. And even though bilinguals tend to have a lot of advantages as opposed to monolinguals there have been numerous studies that showed areas where bilinguals are not so dominant (Lehtonen et al. 2011, 1362-1363).

Such studies proved that bilinguals are slower in the language that they claim is more dominant than monolinguals. As was stated before, bilinguals also have difficulty in naming pictures and dealing with low frequency words. Due to the constant usage of both languages bilinguals have more difficulties with lexicon than monolinguals that use one language exclusively. This might create weaker links between phonological and semantic systems and they will access words from the lexicon less frequently and with more difficulty. It is known that word frequency is slower in bilinguals and there is a possibility that this might also be the case with word recognition and its potential delay (Lehtonen et al. 2011, 1363).

Lower word production may be also the result of control issues. Bilinguals have to constantly choose between one and the other language and that this might affect word creation. Costa (2005) (as cited in Lehtonen et al. 2011, 1363) claims that during word production both lexical presences gets activated which results in the fact translations compete for selection. This particular study focuses on visual word recognition in early bilinguals and monolinguals. Early bilinguals were chosen because they were proficient in both languages on a very high level and have been using both languages for most of their lives at the same level and with the same frequency (Lehtonen et al. 2011, 1363).

The main focus was on three important psycholinguistic aspects - morphology, word recognition and lexical level. All the aspects were observed from the behavioral point of view as well as even-related potentials (ERPs). The word recognition tests might be interesting from the point of view of the lack of vocabulary that might make it difficult to recognize words from pseudo-words within the bilingual group (Lehtonen et al. 2011, 1363).

The participants that were tested were university students. The groups were divided into monolinguals and bilinguals. Languages presented were Finnish and Swedish. Bilinguals spoke both languages from an early age and still spoke both languages in their household. Monolinguals spoke Finnish only. Participants had to undergo a lexical decision task where frequency (high versus low) and

morphology (*inflected versus monomorphemic words*) was tempered with. The whole test was done in Finnish, even the instruction were given in Finnish. Subjects had to identify whether the word appearing on the screen was an actual word or just a pseudo-word (Lehtonen et al. 2011, 1364-1365).

The results from the behavioral point of view showed that they were very high even though the group that was studied was early bilinguals as opposed to monolinguals. The ERPs were also much slower within bilinguals compared to monolinguals. In terms of frequency bilinguals tended to lean towards high frequency words than low frequency ones, from a morphological point of view bilinguals used less inflected words than monomorphemic ones. It was therefore found that bilinguals are more prone to basic stimulus manipulations and manifestations in word recognition and that might result in less exposure to word forms than monolinguals have. This is a natural result of the fact that bilinguals have numerous lower frequency words and it does take a while to identify the correct one among them (Lehtonen et al. 2011, 1369).

The difference in morphology can be explained by having to find a lexical item among two representations rather than one. Another possible explanation might speculate that bilinguals have not developed their “automatized language processing mechanism” (Lehtonen et al. 2011, 1370) as much as monolinguals have. Morphological decomposition and its differences among monolinguals and bilinguals might also be the result of the differences among Swedish and Finnish. Swedish is much more limited in this area and that leads to a lesser need to morphologically decompose it. This study has also found that exposure might be connected with word frequency and that might indirectly affect brain stimuli. This is the result of the fact that bilinguals had to divide input between two languages rather than just one. Bilinguals were exposed less to Finnish words. To summarize bilinguals represented bigger effects of frequency, morphology and lexicality than monolinguals did (Lehtonen et al. 2011, 1370).

The last study presented in this section done by Makarec and Persinger (1993) compares bilingual and monolingual men and women in their verbal memory. Women that were either bilingual or monolingual did not have problems when it came to verbal fluency and memory tasks and therefore did not differ from their male counterparts. Monolingual men on the other hand were much

more successful in the tests than bilingual men. And bilingual men were the least successful group out of the three (Makarec and Persinger 1993, 531).

According to the above mentioned results some hypothesis was established. Kimura (1987) (as cited by Makarec and Persinger 1993, 531) claims that there is a different representation of areas that deals with language and its subsequent processing within the male and female population. Kimura explained that male left hemisphere is located in a different area than that of female left hemisphere. Male left hemisphere is in a rearward position opposed to the female brain areas. One of the other ideas comes from Norman Geschwind and he suggested that due to the male hormone testosterone some parts of the language processing part of the brain (left hemisphere in this case) are developing later and with a certain delay (Geschwind and Galaburda 1985).

And the last hypothesis claims that due to a better communication and coherence between hemispheres of the female brain, many women have an easier communication between each hemispheres rendering language processing more efficient that way (Corsi-Cabrera, Herrera and Malvido 1989). All these ideas and opinions were reflected during the following test and experiment that determined differences among bilingual and monolingual men within the display of verbal memory (Makarec and Persinger 1993, 531).

The subjects of this study were 58 men and 67 women. Among them were monolinguals who spoke English only and others spoke French and other languages. The main results concluded that bilingual men performed poorly as opposed to monolingual men and mono- and bilingual women in the verbal memory tasks, especially narratives. The biggest difference occurred when recalling the second story which was more difficult. Bilingual men recalled fewer units than monolingual men or women that were either bilingual or monolingual. These findings supported the above mentioned hypothesis stated by Geschwind and Galaburda (1985) (Makarec and Persinger 1993, 534-535).

These results were presented in accordance with the opinion that genders have different expressive skills. The poorer performance during the verbal memory tasks might be more representative of a general lack of language processing in the male brain and the interference caused by multiple languages. These factors might be one of the reasons why bilingual males had worse

performance than monolingual males and then bilingual and monolingual women (Makarec and Persinger 1993, 535).

3.2 Early versus Late Bilinguals

This section focuses mainly on experiments and studies done about the differences among early and late bilinguals. One of the first studies presented here will be dealing with articulation of both of these groups. Another study will be dealing with the efficiency of attention networks among early and late bilinguals. All of these studies will show whether there are any differences among them or whether both of these groups are more similar than researchers thought.

One of the first studies presented here is about articulation among early and late bilinguals and their respective languages. The evidence was extracted from functional magnetic resonance imaging (Frenck-Mestre et al. 2005, 761).

According to this experiment, areas that are used and activated by articulation are identical in late and early bilinguals. Due to these results all the researchers that were part of this experiment challenge the idea that age of acquisition of a new language results in the creation of different areas of articulation in early and late bilinguals. The only slight variation was found in the so called left putamen of late bilinguals. This is a result of bigger and more demanding usage of articulation in their late acquired second language (Frenck-Mestre et al. 2005, 761).

This particular study tested the phenomenon of slight left putamen deviation for late bilinguals and was tested with the articulation of individual words and whole sentences. Furthermore, this study set out to decide whether the same or different articulation centers are activated. There were about twenty-four participants that were English-French bilinguals. The early bilinguals spoke both languages from birth and late bilinguals spoke French from the age of 12 and lived in a French speaking country for extended periods of time (Frenck-Mestre et al. 2005, 762).

Neural activity of all participants was monitored while they were producing 225 words in English and French, plus consonants strings were added. Results in various categories led to the conclusion that both early and late bilinguals activate motor cortex, temporal gyri and cerebellum respectively. In the category of words late bilinguals showed an important activation of their left putamen. During the sentences task none of the areas were activated differently or were significantly different in any way (Frenck-Mestre et al. 2005, 763).

The results of the experiment confirmed both hypotheses and the idea of Kleine et al. (as cited in Frenck-Mestre et al. 2005, 764) where the left putamen will be used more by late bilinguals due to different and more difficult usage of articulation centers in a second language that was acquired later in life. Another conclusion was that the centers activated during articulation in both groups of late and early bilinguals are quite similar and do not differ in almost any aspect, therefore the age of acquisition does not play a major role in articulation centers (Frenck-Mestre et al. 2005, 764).

Another study done by Lily Tao et al. in 2011 focused on executive attention among early and late bilinguals. They compared both of these groups with monolinguals. As was stated in section 3.1, bilinguals have better executive control. This was confirmed in Tao's study and further explored on the level of early and late bilingualism. Tao and colleagues found that late bilinguals seemed to be more proficient and better at conflict solution. Early bilinguals on the other hand showed better and increased monitoring processes (Tao et al. 2011, 1).

According to this study it appears that bilingualism is a dominant factor and one of the reasons for better executive control, regardless of the closeness of languages. Furthermore this study looked at lateralization for both groups of late and early bilinguals and the results suggested that early bilinguals might have reduced lateralization. But Tao et al. stated that the results were not finished and there needs to be further research done in this field (Tao et al. 2011, 1).

Both of the studies presented in this section reflect upon the next two sections focused on phonetics and bilingual brain and interpreting. That's why both of the studies were chosen to represent phonetics and bilingual brain from the point of view of early and late bilinguals.

4 Bilingual Brain

One of the most fascinating organs in the human body is the brain. It is the center that controls all movements and holds secrets to our emotions, ideas, opinions and creativity. That is why the particular section is dedicated to the phenomena of brain with special emphasis on the bilingual brain. How it works and what centers control and run our linguistic ability and the ability to learn, maintain and develop new languages. The first part of this section is dedicated to the speech centers of the brain and where it is located accompanied with some historical insight. Other sections will closely examine the brain of the bilinguals.

4.1 Language and the Brain

Language and speech is a phenomenon that is very specific to humans. It is said that speech itself involves over 100 muscles and normal speech rate is at about 14 sounds per second which means that humans require around “140,000 neuromuscular events per second” (Dingwall 1998, 54).

Throughout history, ideas about brain had developed from the mere idea that it is just a “cooling system, a radiator” (Dingwall 1998, 43) to more complex explanations of its many intricate functions. Most knowledge about speech and language acquisition was formed on the basis of research done on brain injuries (Dingwall 1998, 43). The Hippocratic scholars were one of the first to claim that speech disturbances occurred commonly in the left-side of the brain but were unable to develop a further theory based on that fact (Dingwall 1998, 43).

Finally in the nineteenth century, scientist of that era made a concentrated attempt to explore how language was organized in the brain. They did so by studying patients with aphasia. It was the French surgeon Pierre Paul Broca (1824-1880) who localized speech in the brain (Dingwall 1998, 44). He even has part of the brain named after him – Broca’s Area – which is the left third frontal convolution (Dingwall 1998, 44). Because of him it is established that our speech is located in the left hemisphere. He also made it clear that we are left-lateralized for articulate language and stated the idea of the so called plasticity of the brain, that states that brains of children are remarkably flexible and can recover from

brain damage or injury that affects their brain without any major damage to their speech ability (Dingwall 1998, 46-47). This led to a creation of the so called “critical period for language acquisition” coined by Lenneberg (as cited in Dingwall 1998, 47). This term states that within a certain age language acquisition is very flexible and brain damage does not produce any lasting speech disorder (ibid. 1998, 47).

The evolution of our communicative ability has not developed from one single genetic mutation but rather occurred and developed gradually over time. Toulmin claimed that certain behavior used for nonlinguistic purposes developed into further language function (Dingwall 1998, 57).

It could be said that most individuals have their language skills represented by the left hemisphere, though some skills such as humorous language and interpretation of discourse is controlled by the right hemisphere (Dingwall 1998, 82).

4.2 The Bilingual Brain and Multiple Languages

This part of the paper deals with the function and processes of the bilingual brain, what happens inside of the brain and how code-switching affects language acquisition and speech in another language, what hemispheres control which language and how this affects the speech of the individual.

It is said that the majority of right-handed adults process their language in the left hemisphere and vice versa. On the other hand during acquisition of the second language the right hemisphere takes over and plays a major part in learning but as the individual gets more proficient the prominence of this hemisphere decreases again and the left takes over (Wei 2000, 12). It is believed that bilinguals do not vary from monolinguals in this part and that the left hemisphere dominates in many cases (Wei 2000, 13).

When it comes to the storage of languages and vocabulary of L1 and L2 there are at least two possibilities. It is stored either separately or it has shared storage of both languages in the brain. This might lead to the conclusion that a bilingual's brain has a separate storage for both languages and a more general one as well (Wei 2000, 13). This creates a so called '*interconnection*' between the two languages and it creates a system of association and translation where the general storage acts as a '*mediator*'. It is also believed that speakers with varying language proficiency possess different strengths and directness of their interconnections. The highly proficient individuals go straight from the concept to the target language wherein less proficient individuals use their L1 as mediator (Wei 2000, 13).

Weinreich (as cited in Romaine 1995, 78-79) claims that there are three types of bilingualism concerning the position and encoding in their brain. He stated that late bilinguals keep their words from both languages separated and each has its meaning. One of the examples he shows is a native speaker of English that learns French later in school and he believed that different systems were developed to maintain the two languages (Romaine 1995, 78-79). On the other hand early bilinguals learn both languages simultaneously so the systems develop together and are fused into each other. So a child growing up in a bilingual household would have one common meaning for both terms for book in English or Czech (Romaine 1995, 78-79).

So to sum up, according to Weinreich (as cited in Romaine 1995, 78-79) early bilinguals would have “one set of meanings and two linguistic systems tied to them” (Romaine, 78-79). The late bilinguals have one set of meanings created through their L1 and another language system attached to it. The languages of early bilinguals are interdependent and the languages of late bilinguals are independent according to Weinreich’s theory (Romaine 1995, 78-79).

In recent studies the focus of research has shifted from neural basis of bilingualism and how two or more languages are represented in various parts of the brain but on the notion of acquiring these languages and its processes. Such processes are working memory, attention and cognitive control – some of the research papers will be presented in the following section. One of such studies devoted to areas of memory, somatosensory processing and emotion was done by Hernandez in 2009 (as cited in Abutalebi et al. 2009, 1). The result of which was an increase in the activity in the area of memory, processing and emotion in regards to two and more languages but not when the subject only communicated in a single language. He then further states that processing in bilinguals might not be controlled by the typical neural systems dedicated to language but parts that are not typically involved in such processes (Abutalebi, Tettamanti and Perani 2009, 1).

This leads to other assumptions. One of them is that the L2 that is considered as a “weak” language in that individual’s case might be controlled and processed in different areas than those that are involved in L1 processing. Those differences are found in the more “anterior parts of the left prefrontal cortex and the anterior cingulate cortex”, as was stated in the study of Abutalebi and Green from 2007 (Abutalebi, Tettamanti and Perani 2009, 1).

This disagreed with the above mentioned Hernandez study but the prefrontal activity might cognitively process L2 more than L1 which should do so automatically. Another thought goes to the fact that more attention and cognition control goes into the process of a weaker L2 and therefore the subject needs more attention and cognitive mechanisms. This affects regional “neural engagement that reflects auxiliary cognitive processing” more than the actual language representation (Abutalebi, Tettamanti and Perani 2009, 2).

Most of the evidence is pointing out to the fact that L2 is acquired in the same way and through the same neural structures as L1. This is also true for grammar acquisition in late L2 learners as was stated by Abutalebi in his 2008 study. In another research paper dedicated to this idea, Kotz (as cited in Abutalebi et al. 2009, 2) claimed that syntactic processing (the so called critical thinking hypothesis) is not as significant as was initially thought. It is assumed that L2 proficiency might be the real reason and influence of the extent of brain activity concerning neuroimaging studies. According to Kotz this is true for the so called ERP (event-related potential) studies (Abutalebi, Tettamanti and Perani 2009, 2).

L2 acquisition is considered a dynamic process that requires other neural resources indexed especially by “prefrontal, subcortical, and cingulated activity” (Abutalebi and Green 2007) (as cited in Abutalebi et al. 2009, 2). These studies are also responsible for deciding on language recovery in any cases of bilingual aphasia. This clinical case study and research is not only focused on aphasia but other language disorders (Abutalebi, Tettamanti and Perani 2009, 2).

In the 1994 study done by Kroll and Stewart (as cited in Abutalebi et al. 2009, 2) it is expected that once the subject gains a sufficient L2 proficiency, then the additional auxiliary brain activity becomes unnecessary and the processes return toward the processes used for L1. In this therefore suggested that once an L2 is processed in the same way as L1, the neural structure and response should also be the same as L1. Chee in her 2009 (as cited in Abutalebi et al. 2009, 2) study suggests that we should use so called adaptation paradigms in L2 acquisition (pair of identical stimuli creates a smaller neural response than dissimilar stimuli) (ibid. 2009, 2).

Research in psycholinguistics suggests that early engagement and cognitive control enable bilinguals to solve conflicts in nonverbal tasks. Such similar research was conducted by Bialystok and Feng in 2009 (as cited in Abutalebi et al. 2009, 3) and deals with the pros and cons of bilinguals and monolinguals. A further section is going to take a closer look at these matters. Other studies look into bimodal bilinguals, i.e. people that are fluent in a spoken and a signed language (ibid. 2009, 3).

The understanding of the bilingual brain is made possible by all the technological advances in the field of neuroimaging and neurophysiology. It is

crucial in our understanding of the bilingual brain as a “special kind of brain” and creates new possibilities not just in understanding language processing but also helps in treatment of various language impairments. All the above mentioned studies were made possible by another very important aspect of interdisciplinary, multidisciplinary and integrated approach, from its humble beginning of Pitres’ observations of bilingual aphasia to the future of possible research areas and topics (ibid. 2009, 3).

Research on the bilingual brain has still a long way to go in terms of possible research areas and questions that still remain unanswered. One such research area is the relative exposure toward a language and cross-linguistic studies – comparing linguistically distinct languages such as Indo-European ones and Ural-Altaic languages (Abutalebi, Tettamanti and Perani 2009, 3).

The following section will look into interpreting and bilingual brain – how bilingualism is portrayed and influences the work of the interpreter and what is happening inside of the interpreter’s brain while he/she performs.

4.3 Bilingual Brain and its Role in Interpreting

There are various papers and articles concerning the topic of bilingual brain and its effects on interpreting. This section will provide an inside view into a couple of studies that deal with this particular field of research and their various outcomes and discoveries. This paper is going to focus heavily on memory and hemispheric preferences which are considered to be very important for interpreters.

Hamers, Lemieux and Lambert (2002) wrote an article that relates to hemispheric preferences in simultaneous interpretation due to early bilingual acquisition. They stated that number of studies proved that bilinguals tend to have a different lateralization than monolinguals and these patterns differ in late and early bilinguals as well (Hamers, Lemieux, and Lambert 2002, 587). Furthermore they claim that language lateralization is influenced by language learning where formal learning proves to have a more of a left-hemispheric involvement, whereas informal learning proved to be right-hemisphere oriented. These data were concluded in a study done by Vaid (as cited in Hamers et al. 2002, 587). Although this particular study has been challenged and proven to be inconclusive (Hamers et al. 2002, 587).

This led to a more task-specific approach and that became more relevant to interpreting – in this case simultaneous interpreting, where the person has to decode and then re-encode the messages heard in their source language into their target language at almost the same time. This poses a special and very unusual linguistic task (Hamers et al. 2002, 587).

According to the claims of Paradis (as cited in Hamers et al. 2002, 587) there are at least three neurofunctional systems that are activated while interpreting – one that activates for the source language, another for the target language and the last one that connects them both. Of course there is a slight difference depending on which language the person is interpreting into, whether it is from L1 to L2 or vice versa. So it seems that interpretation appears as an autonomous linguistic function and has very little to do with subjects or individual's bilingual competence. Recent research and studies indicate that both hemispheres appear to be active during interpreting but its intensity varies according to the acquired experience (Hamers et al. 2002, 587).

There were several studies that have showed that professional interpreters have different hemispheric preferences than student interpreters – one of the studies was done by Gran and Fabbro (as cited in Hamers et al. 2002, 588). Professionals were better at determining semantic errors in their mother tongue L1 using their right-ear and using their left-ear to determine semantic errors in their second language L2. On the other hand student interpreters paid more attention to syntactic features of their source language. So Gran and Fabbro determined that simultaneous interpreting modifies hemispheric specialization though these studies failed to show that professionals acquire a change in hemispheric preference due to the fact that they interpreted from L1 to L2 or vice versa (Hamers, et al. 2002, 588).

In another study that used the so called interference paradigm to compare monolinguals, bilinguals and interpreters that were doing two tasks – shadowing, paraphrasing (this task was specific to monolinguals) and interpreting. Monolinguals demonstrated a left hemispheric preference, whereas bilinguals and interpreters used both hemispheres for each task respectively. This seems to be the proof of the usage of both hemispheres in simultaneous interpreting (Hamers et al. 2002, 588).

On the other hand this above mentioned experiment done by Green, Schweda-Nicholson, Vaid, White and Steiner (as cited in Hamers et al. 2002, 588) was not reported while observing interpreters in their work environment. Lambert (as cited in Hamers et al. 2002, 588) stated that interpreters usually use only one earphone when listening to the speech instead of both. It seems to be so that they can track their own output. In many cases the output was better if student and professional interpreters used only one earphone and their left-ear condition tended to be better than their right-ear condition (Hamers et al. 2002, 588).

Green and Fabbro's findings (as cited in Hamers et al. 2002, 589) claimed that both hemispheres are involved during the act of interpreting. The left one focuses on morpho-syntactic aspects of L1 and the right one focuses on the more pragmatic aspects, for example global coherence and construing situational model. So in this case both hemispheres come together and create a coherent sentence and thought structures in order to render the message correctly (Hamers et al. 2002, 589).

Lemieux (as cited in Hamers et al. 2002, 589) established that the right ear condition is more prominent in the beginning of the interpreting process and left ear is superior during the end of it. She then went on and proposed the following model: if the interpreter starts interpreting an argumentative text, s/he relies on being literal and therefore using sequential information which is the main domain of the left hemisphere. After this initial process the interpreter turns his/her attention on a more meaning-oriented approach that involves a global information process. This is where the right hemisphere takes over. This means that her theory of right ear preference in the beginning and left ear preference at the end has proven to be true (Hamers et al. 2002, 589).

The study of Hamers, Lemieux and Lambert is concerned with the role of age and experience in the interpreting process and hemispheric control. They tried to prove whether the interpreters really have different hemispheric control over their output than bilinguals that have not been trained in interpreting. Another question they are raising is whether age might be a factor that can influence hemispheres in interpreting (Hamers et al. 2002, 590).

To collect data on this experiment, twenty-three subjects were used – one of the groups was professional interpreters and the other were students of interpreting. Both groups received a text to be interpreted into their L1 from L2 and they used two texts. Each of the subjects will receive these texts either in the left, right or both ears (Hamers et al. 2002, 591).

The result of this study proved that the right hemispheric condition did not prove superior to the other condition and there were no significant results among the monoaural or binaural condition either. Subjects did appear to have one differentiating condition. When they receive input in the beginning in their right ear they seemed to perform better than when they received it in their left ear. This similar phenomenon appeared when subjects received the final section in their left ear they performed better then when they received it in their right one. Lemieux then proposed that the optimal measure for interpreting would be to receive source language in the right ear at the beginning and then switch to the left one towards the end (Hamers et al. 2002, 591-592).

In conclusion to their experiments they did not find any evidence that age of bilingual acquisition might affect hemispheric preferences in regards to

interpreting. Of course experience does influence interpreter's skills and quality and the more experience the better the interpreting process (Hamer et al. 2002, 594).

One of the other aspects of the brain is memory and the way it is distributed in the bilingual brain during interpreting. This particular question was raised by a study done by Christoffels, de Groot and Kroll (2005). In addition to this they are trying to ascertain the role that expertise and language proficiency play in the memorization and language skills in simultaneous interpreting. The basic premise of the study was to measure performance on basic language and working memory that supposedly engage cognitive skills that are important for simultaneous interpreting. The participants in this case were Dutch speakers with English as their L2. They compared the performances of professional interpreters, bilingual students and English teachers (Christoffels, de Groot and Kroll 2005, 1).

Simultaneous interpreting is an interesting discipline in regards to memory and language proficiency. The individual has to be highly proficient in two languages and he has to control his/her input and output but both languages have to be active and there is no language switch allowed. It has been suggested by recent studies that word forms in both languages are active in bilinguals brain even when they are processing in only one of them (Christoffels et al. 2005, 2).

This of course poses a problem for the interpreter whose job it is to have no interference and switching into his/her non target language. One of the solutions to this problem seems to be the so called inhibitory control model proposed by Green (as cited in Christoffels et al. 2005, 2). This hypothesis requires an inhibition of the individual during their language selection in the non target language (Christoffels, de Groot and Kroll 2005, 2).

A number of studies then propose that interpreters outperform other individuals or groups on memory tasks and some language tasks. Researches proved that interpreters were responding faster on atypical examples of categories in semantic categorization and were faster with non-words in lexical decision. Another area where interpreters proved to be superior to people with no formal interpreting training was on digit and reading span tasks in the native language (Christoffels, de Groot and Kroll 2005, 3).

That is why the goal of the study was to understand the basic components of language processing and how it may differ from an individual who is a professional interpreter and someone who is not and how it might affect memory capacity. The individuals that were assessed were Dutch speaking interpreters, students and teachers with a various degree of proficiency in English as their L2 and different level of professional training in interpreting. The claim was that if interpreting was a specific skill that does not subsequently affect any basic components of language then all participants should have the same results in these language processes on their L1 and L2 (Christoffels, de Groot and Kroll 2005, 4).

The comparisons were done in two experiments where they put interpreters and students and interpreters and teachers in the same testing group and afterwards intercepted data from both tests to show an overall result for all three groups. Overall the results for the interpreters versus student group resulted in the fact that interpreters outperformed students in memory related tasks, even when the students were presented with tasks in their own L1. This means that memory skills appear to be important for simultaneous interpreting. It appears then the differences between language and memory skills were not just a matter of better language proficiency (Christoffels, de Groot and Kroll 2005, 3, 11, 12).

The other experiment took place among teachers and interpreters. Teachers were very proficient in their L2 (English) but they had no formal training in interpreting. The question was that the teachers should do similarly to interpreters and if that would not be the case it means that interpreter training has played some role in the performance of interpreters (Christoffels, de Groot and Kroll 2005, 12).

The results showed that teachers performed on the same level as interpreters in regards to lexical retrieval task. Therefore the control tasks and language processing was more or less on the same level. In comparison the memory task showed a stark difference between the two groups. Interpreters outperformed teachers on all memory tasks. This does show a significant relation to interpreter training because both groups had similar level of proficiency in their L2 (Christoffels, de Groot and Kroll 2005, 15).

So the overall results after comparing all three groups together led to the fact that interpreters and teachers were similar in regards to lexical retrieval which might have been cause by their similarities in language proficiency. The groups

that was lacking behind both of the aforementioned ones were the students. Significant change came in their memory capacities where interpreters outperformed both groups. It was concluded that better memory capacity is associated with interpreting training (Christoffels, de Groot and Kroll 2005, 15-16).

One of the most interesting studies was done at the Institute of Translation and Interpretation of the University of Vienna. Ingrid Kurz (1992) worked on a project that mapped brain mechanisms involved in simultaneous interpreting. She worked with the Institute of Neurophysiology and used the method of EEG that was to provide a deep insight to any verbal processes in the brains of interpreters. One of the main issues she and her colleagues wanted to solve and clarify was: whether there were any differences between simultaneous interpreting and other cognitive tasks, interindividual processing in simultaneous interpreting, which areas and places in the brain are the most active during interpreting, which hemispheric areas are connected and create relationships and lateralization of any speech dominance (Kurz 1992, 1-6).

The testing was done on native speakers of German who interpreted to various languages, mostly English and French. In addition to interpreting the subjects were then subjected to non-verbal tasks. They listened to Mozart and did mental arithmetic. It needs to be pointed out that the simultaneous interpreting was only done mentally. This was not a standard interpreting process but it was done to make sure that the EEG was not tempered with by “speech musculature artifacts” (Kurz 1992, 7).

During language tasks any coherence increases in the so called beta bands, these are particularly important in information processing. It means that the left temporal region has an increased activity during this task. There were also differences in regards to what language was the interpreter (in this case Kurz herself) processing into. The number of increases in beta bands was higher when the subject was interpreting into her B language (in this case English) and there was no increase when she was interpreting into her mother tongue (in this case German). This data might suggest that interpreters and individuals have to expand more mental effort when interpreting into their foreign language (B language or L2) (Kurz 1992, 8).

This leads to a conclusion that there is a bigger involvement of the “homologous right hemispheric area” (Kurz 1992, 9) in the interpreting process into a foreign language. Similar data and conclusion was found in the study conducted by Sussman et al. in 1982 and Gran and Fabbro in 1988 (as cited in Kurz 1992, 9). They used finger tapping and dichotic listening to conclude that there is a greater right hemispheric involvement for second languages. In Kurzs’ mental shadowing any coherence decreased as opposed to the above mentioned increase in mental interpreting. Language tasks recorded a decrease in coherence of beta bands in the right hemisphere (Kurz 1992, 9).

The other research subject that was tested differed from Kurz in her handedness. She was left-handed as opposed to Kurz who was right-handed. This resulted in one major difference in the results. She showed “maximum coherence increase in the beta bands of the right temporal region” (Kurz 1991, 10).

The results from these experiments are similar to those found in Petsche et al. in 1993 (as cited in Kurz 1992, 13). It resulted in stark differences in interindividual relationships between increases and decreases of coherence. EEG results vary increasingly among mental interpreting and non-verbal tasks. Any information on verbal thinking can be obtained from EEG and especially from differences in coherence. Temporal regions are among the more significant areas of brain that are operating during tasks such as interpreting. The areas that had the highest coherence were, for the most part, located in the language-dominant hemisphere. And lastly interpreting into L2 or B language results in bigger coherence increase in “temporal regions of the non-dominant hemisphere” (Kurz 1992, 13).

The last study presented here is regarding language switching of simultaneous interpreters done by Proverbio et al. (2004). It was done as an ERP study. ERP stands for Event-Related Potential. These ERP studies along with other neuroimaging studies claim that bilinguals inhibit the process of non-target language during speaking or reading in another language. The main goal of this study was to talk about and explain some of the neurofunctional bases of these mechanisms (Proverbio, Leoni and Zani 2004, 1).

The main subjects of this study were simultaneous interpreters and monolinguals – both of whom were native Italians. Interpreters spoke several

languages and were highly proficient in English (L2). Researchers presented 400 sentences either in Italian or English; another set of sentences that were began in English and ended in Italian and vice versa. Data showed that lesser influence of hemispheric lateralization for linguistic processes in L2 than in L1 in interpreters (Proverbio, Leoni and Zani 2004, 1).

The general idea was that bilinguals use their L1 lexical knowledge to make lexical decisions in L2. This also seems to be true at orthographic and phonological levels as regarded by Li in 1996 (as cited in Proverbio et al. 2004, 2). In addition to this there have been several studied that looked into which parts of the brain are involved in code switching – namely by Green and Price. They found that “the left inferior frontal region” and “bilateral supramarginal gyri” (Price, Green and von Studnitz 1999, 2231) are responsible for switching between L1 and L2 (Proverbio, Leoni and Zani 2004, 2).

This particular effect has to be separated from the fact that we have to take into consideration the age of acquisition and the proficiency in L2. One of the other goals of the study was whether different languages overlap each other within their brain representation or if they differed significantly. Researchers predicted that any difference in either of the groups would be partially due to the professional skills of interpreters and their excellent knowledge of multiple languages. Any difference would be ascribed to the age of acquisition of L1 and L2. Reaction times showed a pattern for interpreters to be slower than monolinguals in the response to regular sentences in their native tongue. They concluded that code switching does pose a significant cost for linguistic performance (Proverbio, Leoni and Zani 2004).

This last section was dealing with scientific papers and research concerning interpreting and how it is represented in the bilingual brain and additional studies measure brain activity during interpreting. The next section will move from brain activity and will focus on phonetics and bilingualism.

5 Bilingualism, Phonetics and Interpreting

Last section dealt with the brain and bilingualism with emphasis on research done in interpreting and various ways the brain works during interpreting. This section contemplates phonetics in bilinguals and what relationship is there between these two fields. Consequently I will present numerous studies and research conducted about interpreters and phonetics – pronunciation and how it might be affected during the process, especially considering that interpreters are a special kind of bilinguals and their job is to convey the message as clearly as possible.

5.1 Bilingualism and Phonetics – Introduction

There has been much debate about foreign accents. Native speakers tend to recognize when there is a divergence from their native tongue and phonetic norms that build it and detect a foreign accent in a non-native speaker. This might result in a variety of undesirable consequences for the non-native speaker. Speakers of English as a L2 language might be misunderstood and create awkward or uncomfortable situations (Flege 1995, 233-234).

Professionals that are affected the most by this phenomenon are interpreters. They are a special kind of bilinguals and need to be understood under all circumstances due to the nature of their profession. Another subsection is going to look closely at this phenomenon and a couple of studies and empirical research will be presented.

There are various explanations as to why bilinguals have accents. Some of them are neurological claiming reduced neurological plasticity as stated by Penfield in 1965 and Lenneberg in 1967 (as cited in Flege 1995, 234). Flege claimed that it is about inaccurate perception of sounds in L2. Others propose that it is the wrong phonetic input in L2, insufficient motivation or psychological problems of maintaining ones foreignness. This topic is therefore very diverse and there are many ways one can look at this problem (Flege 1995, 234).

The previous section talked about brain and therefore the first hypothesis should be about the neurological explanations of foreign accents, in this particular case, scientists have mentioned neural maturation as the main cause. Many

believe that languages cannot be perfectly taught after a certain age. They call this the critical period. Unfortunately this hypothesis does not actually say and explains what causes foreign accent in L2. It was also disputed by Flege (1995) himself that critical period does not really apply to pronunciation because it never showed a sharp decline in pronunciation right after puberty. The age of acquisition did play a part because late bilinguals when evaluated by native speakers were more prone to have a foreign accent (Flege 1995, 234).

Flege then went on and proposed his hypothesis. He claimed that children after acquiring sensorimotor abilities lose the ability to learn consonants and vowels of another language L2. After examining a language there was a consensus that if the word in L2 is identical in sound to that of L1, the individual automatically replaces the L2 sound with L1 sound and that causes his/her foreign accent. Different sound of L2 will not be reproduced if it does not occur in L1. If there a different contrast in L1 it might be reproduced in L2 regardless if it is there or not. Of course little thought was given to the age of acquisition and the experience in L2 and of course who was the teacher (Flege 1995, 234-235).

There was an interesting hypothesis leading to the fact that adults might be able to reproduce foreign sounds without any particular knowledge of them or even when they had foreign accents themselves. In study done by Neufeld (1979) (as cited in Flege 1995, 236), he made his adult subject listen carefully before they spoke. They were able to reproduce sounds in a foreign sounding language without any accent. This of course leads to the idea that no foreign accent is inevitable and even adults can change their foreign accents (Flege 1995, 236).

Similar study was done by Snow and Hoefnagel-Höhle (1979) (as cited in Flege 1995, 236), where they examined native English adult and children speakers and how they can acquire and imitate Dutch sounds. At first the adults were in the lead considering they had more experience but after a year of training both groups, i.e. children and adults, were on the same level of proficiency in reproducing Dutch sounds (Flege 1995, 236).

These two studies proved that adults are able to decrease their foreign accents but somehow adults in reality cannot use their motoric abilities to their full potential. Flege did research concerning foreign accents in 2007. He conducted this research on native Korean subjects who lived in the USA. His

findings were that age of arrival (AOA) played a big part in the way the individuals produced sounds. This also goes hand in hand with the fact that the later the person arrives into the country the more foreign his/her English will sound. Children that came later in life around the 8 years of age had detectible foreign accent than children who came earlier. This also depends who the subjects talk to upon their arrival and whether they surround themselves with locals and stay within their own community (Flege 2007, 360-362).

In his 2007 study he also found that phonetic interference is bi-directional. This means that not only the first language influences the second language phonetically but it also works the other way around, where L2 phonetically influences L1. One of the other findings was the fact that late bilinguals have phonetic and language interference of L1 to L2 and early bilinguals have phonetic interference of L2 to L1, respectively (Flege 2007, 364, 366).

The interference that is happening to late bilinguals is due to how L1 and L2 phonetic subsystems react, interact and influence each other. Flege goes on to say that these subsystems have a so called “common phonological space” that forces those two subsystems to interact with each other. The paper then proposes two methods that explain how L1 and L2 interact and influence each other – one is called ‘*phonetic category assimilation*’ and the other is called ‘*phonetic category dissimilation*’ (Flege 2007, 367). These methods affect the production of vowels and consonants in L1 and L2. In theory this means that individuals that are learning L2 are able to create new categories for L2 sounds. This of course is not completely possible in reality. Flege mentions that native English speakers do not create new categories for Danish voiceless stops /p t k/ mostly because they have only slightly longer VOT than their English counterparts (Flege 2007, 367).

The ability to create new category for L2 really depends on the development of L1 sounds. It is said that the further away the L2 sound is from the L1 sound, the more likely it is to create a new category for it. This does not depend on the age of the speaker. In this case the phonetic category assimilation prevents the development of L2 categories and sounds because it is too similar to L1 sounds (Flege 2007, 367).

Flege tried this hypothesis in one of his experiments from 1987 where he took a group of French speaking women who lived in the US and English

speakers living in France. First he measured VOT of /t/ sounds for monolinguals of English and French and afterwards measured if bilinguals would sound more like monolinguals or not. The test turned out to show that bilinguals come close to the monolingual pronunciation but not quite. None of the groups achieved the VOT norm set for the pronunciation of /t/ (Flege 2007, 368-369).

The other interesting discovery that Flege made was the fact that native speakers of both English and French were influenced in their L1 pronunciation. Their L2 learning subsequently influenced their L1 production. The French natives living in the US had longer VOT than French monolinguals and English natives living in France had shorter VOT than their monolingual counterparts. This represents the phonetic category assimilation because no new category was established, just an already existing set of L1 sounds that morphed and created a two language sources of input. The group studied in this experiment was late bilinguals (Flege 2007, 369).

MacKay et al. (as cited in Flege 2007, 369-370) was able to extract data about this phonetic assimilation for late and early bilinguals. This experiment focused in native Italian speakers – late and early bilinguals- living in Canada. The focused was put on English production of /b/ /d/ /g/. Both groups were unable to create new phonetic categories even though early bilinguals lived in Canada most of their life but were not born there. These English sounds are produced with short-lag VOT but Italian ones are realized with pre-voicing. The result was that Italian language was still influencing their L2 production. It became apparent that early bilinguals sounded more English like and their pronunciation was closer to the English production than the other group. On the other hand their L1 (Italian) production was influenced as well and some of the /b/ /d/ /g/ sounds. This led to the same results stated above by Flege (Flege 2007, 369-370).

The other phenomenon mentioned above was phonetic category dissimilation which works differently than the one described above. It means that bilinguals establish a new phonetic category for their L2 sounds that differ from their L1 sounds. This new category creates itself either from an already existing L1 one or it needs to be created to stop and prevent any confusion in L1 and L2 categories in bilingual's speech production. This is expected to create a difference between monolingual and bilingual production (Flege 2007, 370-371).

Flege and Eefting (1988) (as cited in Flege 2007, 372) were able to observe and measure phonetic dissimilation in one of their experiments. Their subjects were Spanish speakers who learnt English when they were children and adults, in both cases they were looking at early bilinguals. The main focus was on /p/ /t/ /k/ production in Spanish. The /p/ /t/ /k/ sounds were produced with a longer VOT values in English than in Spanish. There was no language versus age interaction therefore bilinguals produced different English-Spanish VOT differences and therefore categories. It was then concluded that early bilinguals produced and created new phonetic categories for English /p/ /t/ /k/ sounds. Their Spanish categories dissimilated in order to create a contrast with their English counterparts. This resulted in shortening of VOT for the Spanish /p/ /t/ /k/ sounds (Flege 2007, 372).

Similar study that was conducted by Flege, Shirru and MacKay in 2003 (as cited in Flege 2007, 372-374) was able to capture acoustic evidence of phonetic category dissimilation. They examined the production of English sound /e'/ as opposed to the Italian /e/ sound. Italians with little English knowledge tend to mistake this sound for it Italian /e/. The researchers concluded that early bilinguals that did not use Italian so frequently were able to discriminate between these two sounds. This led to the conclusion that early Italian-English bilinguals were able to create new phonetic categories better than their counterparts that used their L1 (Italian) more often (Flege 2007, 372-374).

This was also true in regards to late bilinguals; they were unable to distinguish between the sounds and therefore could not create a new category. Acoustically early bilinguals, that did not use their L1 (Italian) so frequently, differentiated between the sounds of Italian /e/ and English /e'/ by an exaggerated tongue movement. This corresponds with another study done in 2004 by Flege and MacKay (Flege 2007, 372-374).

Flege (1995) and his colleagues have come up with the so called “speech learning model” (SLM) that looks at the limits related to age that put restriction on L2 production of vowels and consonants. It focuses mainly on achieving a native-like L2 pronunciation and correct L2 sound production. SLM helps and creates prediction concerning anything production related to L2 vowels. Common idea is that adults tend to recognize phonetic differences in vowels in L1 and L2,

provided L1 has fewer vowels than the L2. This affects L2 learning because the production of L2 vowels might be affected depending if a new category was or was not created (Flege 1995, 243).

According to SLM some of the sounds produced in L2 might be linked to the allophones of L2 but with more experience and gained proficiency in the L2, learners will eventually distinguish between the sounds of L1 and L2 with more accuracy. So the L1 sounds individuals create and the categories they store them in can gradually transform into L2 sounds and new categories. The question remains that if L2 sounds change, it is crucial to know how and when they change (Flege 1995, 267-268).

Some of the results that were presented here led to interesting conclusions. One of them was the fact that neurological development was not the only factor influencing speech production and in L2. The studies also concluded that cross-language phonetic interference is a phenomenon of both language systems L1 and L2 and they significantly influence L2 speech production (Flege 1995, 373-374).

These articles were also able to describe and explain the two theories of how L1 and L2 influence each other through phonetic category assimilation and dissimilation. It is also important to state that input of L2 speech learning is crucial even though this theory has been refuted in the past; DeKeyser (as cited by Flege 2007, 373-374) has said so in his 2000 study. It has been shown now that input in L2 production as has been stated by Flege, Munro and MacKay in 1995 (Flege 2007, 373-374).

Of course all of these theories need more proof and studies to be done in order to make sure they are irrefutable in the future. There are other questions that can be researched and studied. One of them is a question of more new categories that might emerge and be created if a subject has a larger L2 lexicon that might contain more pairs that are confusing and interchangeable than someone whose lexicon in L2 is minimal or very restricted? Or if the size of any L1 to L2 phonetic differences somehow depends on the frequency in which bilinguals code switch during their conversations (Flege 2007, 376)?

The following two paragraphs deal with research methods done in the field of phonology and bilingualism. Most of the studies use a variety of methodologies to search for data in the area of code switching. Some of the researchers used

introspection as one of the possible measuring methods. This method is positive from one point of view and that is the fact that any researcher has the answer at his fingertips mostly because he/she is the subject. Unfortunately there is a downside to this particular method because the subject is influenced by his or her study questions and subconsciously makes sure not to make any mistakes. This of course compromises any data and the research might be jeopardized (Muyesken 2006, 164).

On the other we have a research that is very wide spread and very common. It involves recording spontaneous speech. Bilinguals are very sensitive to contextual levels, this method play a very valuable part and big amounts of data are gathered because of it. Lastly researchers use semi-structured tasks in order to trigger any reaction from bilinguals. This particular method has been used only in handful of experiments with interesting results that might be a bit vague in the end (Muyesken 2006, 164).

This subsection dealt with an introduction into bilingualism and phonetics as well as an interesting research that was conducted in this area and what kind of impact it might have on pronunciation in L2 acquisition and how to create a native like accent. This section also proposed a couple of research questions that could be possibly done in the area of bilingualism and phonology. The next section is going to look closely at phonetic research in interpreting and during interpretation processes.

5.2 Research in Phonology and Interpreting

This section focuses on research done in the area of phonology and interpreting. It introduces various studies done during the interpreting process. Some of the studies presented here might be interconnected with the previous section mostly because there are a lot of studies relating to verbal memory and phonetics. This area of research is very interesting and important for interpreters as well as having important implications for the process of interpreting itself. The job of an interpreter is to render one message from L1 into another message to L2 and the pronunciation is incredibly important, especially in instances of production into L2 (not the mother tongue), where there should not be any misunderstandings.

The first study presented here (Takahashi and Ooigawa 2009) compares interpreting students with professionals in identification of English consonants. The study focused on the English consonants /l/ /r/ /s/ /θ/. Each group was made to listen to words containing these consonants. This experiment was founded on a remark of one of the interpreting students in a previous study done by Takahashi in 2009 (as cited in Takahashi and Ooigawa 2009, 55). It talks about the relationship between perception and the result of interpreting (Takahashi and Ooigawa 2009, 55).

The above mentioned previous study of Takahashi's, done in 2009, that was a predecessor to this one dealt with interpreting performance and asked questions about the final product to interpreting students. The results found that omissions during the performance were a common difficulty. In the questionnaire after the performance some of the students claimed that poor speech perception resulted in omissions of parts of the text. One of the participants said that they were unable to phonetically detect some words and therefore could not interpret it. Others mixed '*within cell*' with '*with itself*'. Based on these statements the present test was conducted (Takahashi and Ooigawa 2009, 56).

As far as the authors claim there is very little research done on speech perception among professionals or interpreting students. Gile (as cited in Takahashi and Ooigawa 2009, 56) claimed in 1994 that the way interpreters understand text surpasses the identification of individual words. This was also seconded by Flowerdew and Miller in 2005 (as cited in Takahashi and Ooigawa 2009, 56) who claimed that when receiver gets a message and decodes it he/she

relies not only on acoustic signal but also on contextual knowledge. It was said prior that there is very little research about this topic. Though is certain that phoneme identification is crucial and incredibly important to interpreting and rendering the correct message as was also stated by Pöchhacker in 2007 (as cited in Takahashi and Ooigawa 2009, 56), so one of the main questions of this research was “whether poor identification is attributable to omissions in interpreting” (Takahashi and Ooigawa 2009, 57).

The experiment was whether students and professionals can distinguish between English consonants /l/ /r/ /s/ /θ/. One of the important aspects of each participant was whether they spent some time abroad. Out of the 7 students that were part of this experiment only two were not educated or otherwise occupied outside of Japan. Only one professional had never been abroad. Each group had to listen to word with any of the four consonants present and then they had to press either ‘*easy*’ or ‘*difficult*’, depending whether they could hear the consonants without problems. The results showed that there was a little bit of a difference among the professionals and students in the rate of identification of each consonant. The professionals had a slightly higher accuracy than students (Takahashi and Ooigawa 2009, 59-61).

The study did not only compare professionals and students it also compared each group individually and how participants fared against each other. Within the professional group, participants that did not spend any amount of time abroad or the one participant that went to university later fared worse than their other counterparts. The differences among students were quite similar. Students that spent no time abroad fared worse than others and one student who did spend time in an English speaking country did not fare well either because said student spent that time in a Japanese school instead of going to a local school (Takahashi and Ooigawa 2009, 62-63).

Upon closely inspecting the results of the study on interpreting performance itself, it was concluded there was little relationship between the experiment and the interpreting performance. Furthermore the study focused on differences among those two groups and found that there is a slight tendency to be more accurate at identification in the professional group as was stated above. It was also stated that this does not contribute significantly to the interpreting

process itself, due to the variety of professionals taking part of the experiment. The authors suggest it would be better to have a bigger sample of professional subjects to make any assumptions (Takahashi and Ooigawa 2009, 65-66).

Thanks to the previous study done by Takahashi where some of the students claimed that if they cannot hear the sounds they are not able to interpret and have to omit the words, this new study proved some of that, especially among two of the subjects. However it is necessary to point out that the individuals only listened to four consonants and it would be advisable to try identification of other vowels and consonants and it might also be taken into consideration that this might distort any results hindering interpreting performance (Takahashi and Ooigawa 2009, 66).

It is also said that during actual interpreting, individuals do not interpret single words but try to comprehend the whole meaning of a sentence and perceive the whole text. It is still possible that the subjects that ranked lowest on the identification experiment might also do poorly during an actual interpreting (Takahashi and Ooigawa 2009, 66).

The researchers suggest that it might be helpful to increase the number of participants and to examine students with the highest rate of omissions separately to get new and more accurate data. It was therefore found that due to the small sample of individuals there is no correlation between speech perception and interpreting. Takahashi and Ooigawa outlined a couple of educational implications their findings might have. One of them is the possibility of teachers quizzing their students on speech perception based on the experiment conducted in this study. Teachers should try to examine whether student are capable of identifying consonants at a word level (Takahashi and Ooigawa 2009, 67-68).

The problem of poor reception might not only lie in identification but it might also have different implications and origins. One of such problems as stated by Takahashi and Ooigawa might be an “ignorance of intonation rule, English prosody, reductions or allophones” (ibid. 2009, 68). That is why it is better is teachers of interpreting examine this phenomenon from a wider perspective in order to find and present the best solution to their students (Takahashi and Ooigawa 2009, 67-68).

In the last part of the study both researchers suggested other possibilities on how to improve this experiment: using more subjects and subjects that have similar backgrounds and experiences overseas. The other suggestions were using a wider range of consonants and possibly vowel as well. It would also be a good idea to make listeners identify consonants in a word within a whole sentence. That way the experiment can simulate what is really happening during actual interpreting, not only within a single word (Takahashi and Ooigawa 2009, 68).

The following two research papers outline the relationship between phonological interference, articulatory suppression and working memory in simultaneous interpreting. The first study presented here is by Darò and Fabbro and dates back to 1994 and a similar study will be presented further on by Christoffels (2006) who builds on some of the results that Darò and Fabbro came to. It was suggested by Isham in 1994 (as cited in Darò and Fabbro 1994, 369) that spoken simultaneous interpretation leads to worse recall than sign language interpreting due to phonological interference. This interference is caused by simultaneous listening and speaking. Therefore it was suggested that recalling a message from L1 into L2 requires different articulatory components and it interferes with “subvocal rehearsal system” that lies within the articulatory loop (Darò and Fabbro 1994, 369).

So the following study and experiment done by Darò and Fabbro (1994) tried to determine whether simultaneous interpreting depends on the decreased volume of memory thanks to the phonological interference. The study was conducted on twenty-four students of interpreting. They had to listen to two short stories, one in Italian and one in English. The first part made the subjects recall the story immediately after listening and then recalling the same story with a delay. The second part focused on interpreting and the subjects had to recall the story after the interpreting task. Here the students were divided into two groups. One interpreted into L1 (Italian), the other into L2 (English), both with delayed and immediate recall. The last test involved the so called digit-span memory, where subjects had to recall a series of digits (Darò and Fabbro 1994, 369-371).

The results showed that Group A performed slightly better, it was the recollection in L1, than Group B. In case of just recalling the story without any delay both groups fared better than when they had to interpret them. These results

are consistent with the fact that interpreters tend to forget the text right after the process itself as was recorded in other research done by Lambert in 1989 (as cited in Darò and Fabbro 1994, 373-374). Of course the situation is a little different in the real life situation of interpreting. The texts and speeches are longer and more condense. The other factor is that most interpreters are not trained nor have a particular motivation to remember texts heard at a conference. This poor recall is the result of the extra effort put into these simultaneous tasks happening during the interpreting process (Darò and Fabbro 1994, 373-374).

It also needs to be stated that professional interpreters treat their profession as a second nature due to the extensive experience they have in it. Therefore students might increase their recall time with experience and practices. According to Darò (1994) this might happen after one year of training, though it also depends on the individuals themselves. The bad results in the digit-span test are attributed to or are partial to phonological interference that was caused by spoken or verbal production in the target language. There was no difference between languages during the digit-span test. This is a result of high proficiency in both languages and another result might occur if researchers were dealing with beginners. After closer examination interpreters into L2 had better recall by a slight margin because it takes longer to pronounce digits in Italian (L1) than in English (Darò and Fabbro 1994, 374-375).

Another research paper presented by Ingrid Christoffels (2006) focused on listening while talking – or the effects of articulatory suppression in simultaneous interpreting. This ties-in with other papers presented in the previous section on the Bilingual Brain and Interpreting where some of its focus was on verbal memory and memory tasks in the bilingual brain. This paper is developing that idea further and is using articulatory suppression and phonological loop as the main focus of its study that is why it was included in this section (Christoffels 2006, 206).

The study is divided into two experiments where the first one entails the retention of a short story and the second experiment deals with the process on simultaneous interpreting and the articulatory suppression. This so called articulatory suppression means that an individual speaker is repeating sounds or words in order to distract him/herself from the story or coherent text that is being recited. As Baddeley and colleagues in 1984, 1999 (as cited in Christoffels 2006,

206-207) assumed working memory has one significant component and that is phonological loop. This loop has, according to Baddeley, two important components. One of them is '*passive phonological store*' and '*active subvocal rehearsal system*' (Christoffels 2006, 206-207).

Both of these components are helping each other to refresh speech-based decoding. Furthermore Baddeley (as cited in Christoffels 2006, 206-207) is assuming that phonological loop has four components. One of them is the so called phonological similarity that claims that similarly sounding words are harder to remember than items that are not similar. The other component is irrelevant speech that is also making it harder to remember other items. The third component is word length. It means that the longer the word the fewer the words are remembered. The last component is articulatory suppression. This particular phenomenon makes it harder for the individuals to focus on the main story or words because they are distracted by these irrelevant sounds (Christoffels 2006, 207).

It was found by Darò and Fabbro in 1994 (previous study mentioned in this paper) and later by Christoffels herself that remembering a text after simultaneous interpreting is much worse and more difficult than after just listening to the same text. This might be the result of having to focus on interpreting the text and not on the qualities of the story. It is therefore possible that a situation similar to articulatory suppression arises. This led to the first experiment conducted by Christoffels. She established whether articulatory suppression stretches not only to single words but also to whole sentences within a story. The other experiment was then tried to prove whether articulatory suppression has a further negative effect on retention of text and what is the relationship between articulatory suppression and simultaneous interpreting (Christoffels 2006, 208).

The first experiment focused on Dutch students who had to retain a coherent text with articulatory suppression and without it and for extra measure an extended articulatory suppression was added. The same was applied to an incoherent text. The hypothesis in this experiment was correct. Students were impaired by the suppression and it decreased their ability to remember the text. Recall was better for coherent text than for incoherent one. If articulatory

suppression was added the retention decreased and if the suppression was extended or complex it further incapacitated the ability to recall the story. The reason for that might be that the attention was taken away and the focus shifted on the articulatory suppression (Christoffels 2006, 211-213).

The other experiment conducted in this study explored the relationship between the retention of a story with articulatory suppression and how well they will do on their interpreting performance. Students from the first part were asked to interpret an English text into Dutch (L2 to L1). The results from the first experiment were correlated with the data from the second one. It was between simultaneous interpreting on one hand and recall with articulatory suppression on the other. The result was that retention correlates positively with the interpreting performance. This results in the fact that differences in retention of information under articulatory suppression are associated with differences in interpreting performance (Christoffels 2006, 214-215).

It is therefore possible for professional simultaneous interpreters that they might excel in the quickness on any transfer of information and those other individuals who are as fast as these professionals might have an advantage if or when they try their hand in simultaneous interpreting (Christoffels 2006, 217-218).

This section focused on phonetics and bilingual research as well as research done in phonetics and interpreting. It outlined research in the area of L2 pronunciation and bilingual acquisition. Furthermore it looked deeper into the issue of phonetics and interpreting research. All the studies in that section focused on memory as a link to the previous sections and moved onto and explored phonetics and phonological interference and the importance of further research in similar disciplines. One of the most interesting studies looked at problems of omission during interpreting when the subjects did not understand some of the consonants. Further investigation and similar studies would help teachers and students improve their interpreting performance and eliminate as many mistakes as possible.

6 Challenges

The main goal of this thesis was to show the plethora of research done in the area of bilingualism and most importantly interpreting. This paper focused on two main areas that are interesting and growing in terms of research and that is phonetics and neurology, mostly represented by research focused on the brain and memory. Section 3 compared early and late bilinguals. This has a lot of significance for interpreting. Interpreters tend to be either early bilinguals or late bilinguals (learn a second language in school). By comparing both of these groups, it is easier to see some of the areas that either of the two have to work on and try to balance.

Section 4, called the Bilingual Brain looked into verbal memory, and hemispheric lateralization of bilinguals. Research in the area of memory was chosen because it has significant importance for interpreters, especially conference and consecutive interpreters who rely heavily on their memory.

Ingrid Kurz is one of the researchers that are very prominent and who cooperate with doctors and neurologist in order to conduct experiments on interpreters. Due to MRI's and other brain mapping technology it is increasingly easier to do research in this area. Even though there are many studies showing hemispheric lateralization of bilinguals, not many of them choose interpreters or their brains as the main subjects. Interpreters represent a unique group of bilinguals that use their language skills and their bilingualism in unusual situations (they also use different hemispheres as was stated in section 4.3).

This leads to a question of research done on simultaneous interpreters and monitoring their brain activities while performing actual tasks. This will not only lead to a better understanding of the so called "black box" which is the interpreting process and more specifically the interpreter's brain. Another area of research that is being neglected is consecutive interpreting, due to the specific nature of simultaneous interpreting, consecutive interpreting is being overlooked, even though it poses many of the same challenges and the additional task of listening and writing and recall. Simultaneous interpreting is a popular phenomenon to research because interpreters in this category use their brain in a different way than regular speakers. They listen in one language and have to

reproduce said speech in a different language. As part of my research efforts I have not found many papers dealing with this phenomenon as the backdrop of bilingual research.

In understanding the brain of the interpreter many levels of opportunity open up. It not only answers some of the questions of what is happening inside the black box but also how to improve working memory in student interpreters. In understanding the brain of a simultaneous and consecutive interpreter, we can create and transform the way interpreting is taught on the university level. It would be easier to match students and their abilities and to create courses that take full advantage of their brain activity and their potential.

Section 5 focused on phonetics and interpreting where the research is extensive but rarely focuses on interpreting itself. Articulation and the way interpreters speak are crucial to their everyday work and can influence not only their performance and the basic understanding of the speech but can also jeopardize individual's career. Bilingualism and phonetics is a theme that has been and still is explored from many points of view. One of the research papers (Takahashi and Ooigawa, 2009) presented here in section 5.2 focused solely on articulation of consonants among student interpreters and professionals.

It is to be proposed to focus research on student articulation and pronunciation mostly because these two areas are significant to interpreter's performance. After conducting a research on pronunciation and understanding of various speech patterns it might result in the creation of special university courses and programs that only focus on speech interpretation and proper pronunciation which can create programs that enable better results during interpreting.

The last thing to mention in this discussion is the sample size and languages represented in this paper. Unfortunately I was not able to find any relevant studies on Czech-English bilinguals and most importantly on Czech-English interpreters within the area of bilingualism. So any studies with sizable samples of subjects among this group would certainly help establish how Czech interpreters work and what problems need to be addressed in the future.

7 Conclusion

This paper tried to put into perspective various research papers found on bilinguals in general and bilingualism and interpreting in particular. The structure of this work went from the definition of bilingualism and the history of some of the ideas that researchers had during the beginning of such research to various areas and specific fields of study. After defining the term I went on to show the similarities and differences of monolinguals and bilinguals and further subgroups. After that it focused on the brain of bilinguals and how it works as well as what centers are activated when speaking multiple languages.

The last section dealt with phonetics, bilingualism and interpreting. This chapter is very important from the point of view of interpreters that make their living by emulating another speech and trying to sound as authentic as possible. Another aim of this paper was to put together studies and research papers that were related to the field of interpreting for future reference to students and people interested in pursuing this field further. In the Challenges section I raised some of the questions as to what research should be done and what areas to focus on that would be beneficial to interpreting studies and further research.

This paper brought together relevant and recent studies in the area of interpreting and attempts to be a helpful tool in future research, reference and finding topics and ideas to write about on the topic of bilingualism and interpreting.

Summary

Tato diplomová práce pojednává o bilingvalismu a návaznosti na profesi tlumočení. Práce je rozdělena do tří velkých celků pojednávacích o bilingvním mozku, fonetice a rozdílech mezi monolingválními a bilingválními či multilingválními lidmi. Práce je takto rozdělena, protože jsou tyto tři celky považovány za důležité, nejenom v oblasti bilingválních studií, ale zejména v oblasti tlumočení, na kterou se v této práci klade důraz. Cílem je vytvořit teoretický rámec pro další výzkum a přehled pro studenty.

Každá z těchto kapitol obsahuje velké množství zahraničních článků, které se zabývají výzkumem v této oblasti a v každé kapitole se objevuje i výzkum příslušného tématu v návaznosti na tlumočení. Práce slouží jako sborník tematických článků, které souvisí s tlumočením a bilingvalismem, vznikla jako pomocná průprava pro studenty, kteří hledají články a výzkum pojednávající o těchto dvou celcích a zároveň jako inspirace pro studenty k budoucímu výzkumu.

Témata jednotlivých kapitol byla vybrána dle návaznosti a důležitosti pro obor tlumočení. Kapitola pojednávající o výhodách a nevýhodách mnohojazyčnosti, jejichž dopad je znát i v procesu tlumočení. Poukazuje na výhody bilingvalismu a jeho nevýhody v různých oblastech a směrech. V sekci 3.2 se rozlišuje mezi bilingvními jedinci, kteří mluví dvěma a více jazyky od svého raného věku a jedinci, kteří se další jazyk naučili až v pozdním věku nebo ve školním věku.

Pojednání o bilingvním mozku a výzkumu v oblasti tlumočení, bylo vybráno kvůli neustálému bádání v oblasti tlumočnického procesu, a výzkumech procesů probíhajících v mozku tlumočnicků, popřípadě jaké hemisféry se nejvíce aktivují. Poslední kapitola se soustředila na fonetiku a artikulaci, která je při práci tlumočnicka velmi důležitá a v některých případech i pomíjena. Hlavní částí byl souhrn výzkumu o tlumočení v této oblasti.

Tlumočníci jsou pro výzkum v oboru mnohojazyčnosti jedni z nejlepších kandidátů. Jejich výhodou je to, že většina z nich jsou buď bilingvní od narození

nebo se druhý či další jazyk naučili v průběhu života. Zároveň jsou i výjimečnou skupinou bilingvních lidí, jelikož využívají oba jazyky stejně a velmi intenzivně. Používají je v různých podmínkách a musí obsáhnout a využít velké množství terminologie z různých oborů. Jejich jazyková výbava je tedy na velmi vysoké úrovni. Všechny tyto faktory z nich dělají výborné subjekty na výzkum. Díky mimořádnému vypětí a zatížení mozku jsou zároveň výbornými subjekty na výzkum v oblasti neurolingvistiky. Tlumočníci používají nejenom hemisféry vyhrazené k mluvě a přepínání jazyků, ale i další části, které zaručují a udržují dlouhodobou a krátkodobou paměť.

Právě v této práci, se některé výzkumné práce vybrané pro kapitolu Bilingual Brain, zabírají otázkou tlumočnického procesu. Například Ingrid Kurzová se již dlouhá léta zabývá výzkumem tlumočnického mozku a procesů dějících se během práce tlumočnicka. I přes mnohaleté snahy vědců tento proces a další procesy mozku tlumočnicka odhalit, i nadále zůstávají utajeny, i přesto, že některé výzkumy na tomto poli napomohly tento jev objasnit. Velkým pomocníkem při výzkumech tohoto typu jsou tzv. počítačová tomografie a hlavně magnetická resonance, která umožňuje podrobnější nahlédnutí a monitorování mozkové aktivity.

Kapitola zabývající se fonetikou se zaměřila na artikulaci, která je v práci tlumočnicků nesmírně důležitá a zdali samotná schopnost mluvit více jazyky ji neovlivňuje. Některé výzkumy v kapitole 3 a 5 jasně stanovily, že doba a věk osvojení druhého jazyka je zásadní a může posléze ovlivnit artikulaci jedince v dospělosti. Dobré porozumění projevu je dalším důležitým bodem, který je zásadní nejenom ve všedním životě, ale obzvláště u profese tlumočnicka. Špatné porozumění může vést ke špatné replikaci projevu.

V následujících odstavcích uvedu dvě studie, každá součástí dvou hlavních kapitol této práce, na ukázkou některých výzkumů, které jsou součástí této diplomové práce.

Jednou z takovýchto studií byla studie od Takahashiho a Ooigawy z roku 2009 (viz bibliografie). Tato studie je zajímavá tím, že porovnává studenty tlumočení s profesionály. Hlavním tématem byla identifikace anglických souhlásek. Tento výzkum navazoval na ten předchozí a snažil se vyřešit otázku špatného tlumočení v důsledku neporozumění projevu. Studenti si Takahashimu stěžovali na to, že nedokázali přetlumočit některé části kvůli tomu, že neporozuměli artikulaci mluvčího. Výsledkem této studie bylo, že profesionální tlumočníci lépe identifikovali souhlásky nežli studenti. Takahashi proto radí, aby vyučující zkoušeli studenty z náslechlů a zjistili, zdali je opravdu problém ve špatné identifikaci slov.

Další ukázková studie, tentokrát z oblasti neurolingvistiky, která se objevuje v této práci je experiment Ingrid Kurzové (viz bibliografie). Kurzová se zabývala změnami v EEG měření v mozku tlumočnicka při simultánním tlumočení. Samotná Kurzová byla předmětem této studie. Subjekty měly tlumočit z jejich jazyka A do jazyka B a naopak (to reprezentovalo jejich verbální dovednost) a poté podstoupily neverbální úkoly (poslech Mozarta a matematické počty). Všechny tyto úkony byly sledovány a monitorovány pomocí EEG.

Výsledky zjistily, že pokud tlumočnick tlumočí do cizího jazyka (jazyka B), pak se nejvíce aktivuje pravá hemisféra mozku. Ostatní části svou aktivitu snižují. Pokud subjekt překládal z cizího jazyka (jazyka B) do mateřského jazyka (jazyka A), pak došlo ke zvýšené aktivitě levé hemisféry. Co se týče neverbálních úkolů, které jednotlivé subjekty podstoupily, žádná z oblastí, které aktivují jazyková centra, těmito úkony nebyla aktivována. To nahrává teorii, že jsou centra oddělena, a že pokud se nějaká část mozku pro určitý úkon nepoužívá, pak se její účast snižuje.

To byly studie, které se vyskytují v této práci a které reprezentují dvě hlavní oblasti, o kterých se v této práci pojednává. Obě studie už jsou vázané na tlumočnický výzkum v oblastech neurolingvistiky a fonetiky. Jak už bylo řečeno výše, tyto dvě oblasti jsou pro tlumočení velmi důležité a potřebné. Určitě by bylo možné v těchto oblastech zkusit pokračovat a zkoumat je z jiných hledisek.

Cílem této práce tedy bylo představit souhrn literatury dostupné pro další výzkum v oblasti tlumočení a bilingvalismu a zároveň vznést a položit si otázky pro budoucí výzkum a oblasti, ve kterých by se mohlo zkoumat. Jednou z takových oblastí je konsekutivní tlumočení.

Většina vědeckých článků prezentovaných v této práci spíše dává přednost simultánnímu tlumočení. Toto tlumočení je výhodné z hlediska neurolingvistiky, jelikož se jedná o zvláštní případ, kdy jedinci přepínají z jednoho jazyka do druhého a musí vnímat v jednom jazyce a produkovat řeč v tom druhém. Konsekutivní tlumočení není v tomto ohledu až tak populární, ale určitě stojí za to zkoumat jej z hlediska bilingvalismu. U konsekutivního tlumočení se neobjevují jenom verbální projevy, ale i neverbální úkony (tlumočnický zápis, neverbální komunikace). Výzkum vedený v oblasti artikulace a fonetiky je vhodnou pomůckou pro vyučující na vysokých školách. Výsledky z výzkumu mohou pomoci vyvářet lepší kurzy, které se zaměří na artikulaci a porozumění projevu, což může značně zlepšit výkon tlumočnicka.

Tyto a další otázky jsou předmětem této práce. Díky přehledu literatury v těchto dvou oblastech je možno získat nové informace a ucelený přehled literatury ohledně bilingvalismu a tlumočení a zároveň získat potřebné materiály pro budoucí výzkum v této oblasti.

Bibliography

Works cited:

Abutalebi, Jubin, Tettamanti, Marco, and Petani, Daniela. 2009. "The Bilingual Brain: Linguistic and non-linguistic skills." *Brain and Language* 109 (2-3): 51-54. <http://dx.doi.org/10.1016/j.bandl.2009.04.001>.

Bhatia, Tej K., and Ritchie, William C., edit. 2004. *The Handbook of Bilingualism*. United Kingdom: Blackwell Publishing.

Byalistok, Ellen, and Craick, Fergus I.M. 2010. "Cognitive and Linguistic Processing in the Bilingual Mind." *Current Directions in Psychological Science* 19:19. Accessed October 25, 2012. doi: 10.1177/0963721409358571.

Byalistok, Ellen. 2011. "Coordination of executive functions in monolingual and bilingual children." *Journal of Experimental Child Psychology* 110 (2011) 461-468. doi:10.1016/j.jecp.2011.05.005.

Corsi-Cabrera, M., Herrera, P., and Malvido, M. 1989. „Correlation between EEG and cognitive abilities: sex differences.“ *International Journal of Neurosciences* 45: 133-141.

Darò, Valeria, and Fabbro, Franco. 1994. "Verbal Memory during Simultaneous Interpretation: Effects of Phonological Interference." *Applied Linguistics* 15 (4): 365-378.

Dingwall, William O. 1998. "The Biological Bases of Human Communicative Behavior." In *Psycholinguistics*, edited by Gleason, Berko, Jean, and Ratner, Bernstein, Nan, 51-105. Fort Worth: Harcourt Brace College Publishers.

Christoffels, Ingrid K., de Groot, Annette, M.B., Kroll, Judith F. 2005. "Memory and language skills in simultaneous interpreters: The role of expertise and language proficiency." *Journal of Memory and Language* 54 (3): 324-345. doi: <http://dx.doi.org/10.1016/j.jml.2005.12.004>.

Christoffels, Ingrid K. 2006. "Listening while talking: The retention of prose under articulatory suppression in relation to simultaneous interpreting." *European Journal of Cognitive Psychology* 18 (2), 206-220. doi: 10.1080/09541440500162073.

Edwards, John. 2004. "Foundations of Bilingualism." In *The Handbook of Bilingualism*, edited by Tej K. Bhatia, and William C. Ritchie, 8-31. United Kingdom: Blackwell Publishing.

Flege, Emil, James. 1995. "Second Language Speech Learning: Theory, Findings, and Problems." In *Speech Perception and Linguistic Experience: Issues in Cross-Language Research*, edited by Winifred Strange, 233-277. Timonium, MD: York Press.

Flege, Emil, James. 2007. Language contact in bilingualism: Phonetic system interactions. In *Laboratory Phonology 9*, edited by Jennifer Cole, and José Ignacio Hualde, 353-383. Berlin, New York: Mouton de Gruyter.

Frenck-Mestre, Cheryl, Anton, Jean, Luc, Roth, Muriel, Vaid, Jyotsna, and Viallet, François. 2005. "Articulation in early and late bilinguals' two languages: evidence from functional magnetic resonance imagining." *NeuroReport* 16(7): 761-5. PMID: 15858421.

Geschwind, Norman, and Galaburda, A.M. 1985. "Cerebral Lateralization: biological mechanisms, associations and pathology: Parts I-III." *Archives of Neurology* 42: 428-459, 521-552, 634-654.

Hamers, Josiane F., Lemieux, Sylvie, Lambert Sylvie. 2002. "Does Early Bilingual Acquisition Affect Hemispheric Preferences during Simultaneous Interpretation?" *Translator's Journal* 47 (4), 586-595. doi: 10.7202/008038ar.

Kurz, Ingrid. 1995. "Watching the Brain at Work – an Exploratory Study of EEG Changes during Simultaneous Interpreting (SI)." *The Interpreter's Newsletter* 6 (1995): 3-16. URI: <http://hdl.handle.net/10077/4781>.

Lehtonen, Minna, Hultén, Annika, Rodríguez-Fornells, Antoni, Cunillera, Toni, Tuomainen, Jyrki, Laine, Matti. 2011. "Differences in word recognition between early bilinguals and monolinguals: Behavioral and ERP evidence." *Neuropsychologia* 50 (2012) 1362-1371. doi:10.1016/j.neuropsychologia.2012.02.021.

Mackey, William F. 2000. "The Description of Bilingualism." In *Bilingualism Reader*, edited by Li Wei, 22-51. New York and London: Routledge.

Makarec, Katherine, and Persinger, M.A. 1993. "Bilingual men but not women display verbal memory weaknesses but not figural memory differences compared to monolinguals." *Personality and Individual Differences* 15:5 (1993) 531-536. doi: 10.1016/0191-8869(93)90336-2.

Muysken, Pieter. 2006. "Two Linguistic Systems in Contact: Grammar, Phonology, and Lexicon." In *The Handbook of Bilingualism*, edited by Tej K. Bhatia, and William C. Ritchie, 147-168. United Kingdom: Blackwell Publishing.

Price, Cathy J., Green, David W., and von Studnitz, Roswitha. 1999. "A functional imaging study of translation and language switching." *Brain* 122:2221-2235. URL: <http://brain.oxfordjournals.org/content/122/12/2221.full.pdf>.

Proverbio, Mado, Alice, Leoni, Giuliana, and Zani, Alberto. 2004. "Language switching mechanisms in simultaneous interpreters: an ERP study."

Neuropsychologia 42 (12) 1636-1656. doi:
<http://dx.doi.org/10.1016/j.neuropsychologia.2004.04.013>.

Tamminen, Henna, Peltola, Maija S., Toivonen, Heidi, Kujala, Teija, Näätänen, Risto. 2012. "Phonological processing differences in monolinguals and bilinguals." *International Journal of Psychophysiology* 87 (2013) 8-12.
<http://dx.doi.org/10.1016/j.ijpsycho.2012.10.003>.

Romaine, Suzanne. 1995. *Bilingualism, Second Edition*. Oxford: Blackwell Publishers.

Takahashi, Kinuko, and Ooigawa, Tomohiko. 2009. "Identification of English Consonants by Interpreting Students and Professional Interpreters." *Interpreting and Translation Studies* (9) 55-69. URL:
http://jaits.jpn.org/home/kaishi2009/pdf/04-Takahashi_Ooigawa.pdf.

Tao, Lily, Marzecová, Anna, Taft, Marcus, Asanowicz, Dariusz, and Wodniecka, Zofia. 2011. "The efficiency of attentional networks in early and late bilinguals: the role of age acquisition." *Frontiers in Psychology* 2: 123. doi:
10.3389/fpsyg.2011.00123.

Tuncer, Ufuk. 2009. "How do monolingual and bilingual language learners differ in use of learning strategies while learning a foreign language? Evidences from Mersin University." *Procedia Social and Behavioral Sciences* 1 (2009) 82-856, 1877-0428. doi:10.1016/j.sbspro.2009.01.153.

Wei, Li, edit. 2000. *The Bilingualism Reader*. New York and London: Routledge.

Yeganeh, Tafaraji, Maryam. 2012. "Age constraint on foreign language learning in monolingual versus bilingual learners." *Procedia Social and Behavioral Sciences* 70 (2013) 1794-1799. doi: 10.1016/j.sbspro.2013.01.255.

Works Consulted:

Hamers, Josiane F., and Blanc, Michel H.A. 2000. *Bilinguality and Bilingualism*. United Kingdom: Cambridge University Press.

Landry, Rodrigue, and Allard, Réal, and Deveau, Kenneth. 2009. "Self-determination and bilingualism." *Theory and Research in Education* 7:203. Accessed October 30, 2012. doi: 10.1177/1477878509104325.

Pennington, Martha C., edit. 2007. *Phonology in Context*. New York: Palgrave MacMillan.

Valdés, Guadalupe, and Angelelli, Claudia. 2003. "Interpreters, Interpreting and the Study of Bilingualism." *Annual Review of Applied Linguistics* 23: 58-78. doi: 10.1017/S0267190503000199.

Wu, Jing, Yan, and Thierry, Guillaume. 2012. "How Reading in a Second Language Protects Your Heart." *The Journal of Neuroscience* 32(19): 6485 – 6489. doi: 10.1523/JNEUROSCI.6119-11.2012.

Annotation

Author:	Bc. Eva Prokopová
Department:	Katedra anglistiky a amerikanistiky
Title in English:	Multiple Languages in One Brain: Interpreter's Perspective
Title in Czech:	Bilingvismus z pohledu tlumočnicka
Supervisor:	Mgr. Václav Jonáš Podlipský, PhD.
Number of Pages:	71
Number of Characters:	136 711
Literature Used:	34
Key Words in English:	bilingualism, interpreting, lateralization, articulation, monolingualism, left hemisphere, review
Key Words in Czech:	bilingvalismus, tlumočení, lateralizace, výslovnost, monolingvalismus, levá hemisféra, vyhodnocení
Annotation in English:	This thesis is concerned with bilingualism and interpreting. It explores the effects bilingualism has on interpreting. It is presenting an overview of the literature about bilingualism and how it ties in with interpreting research. Its main goal is to provide a comprehensive work for future research in these two fields and to help students by creating an overview

of the most relevant work regarding both of these two fields.

Annotation in Czech:

Tato práce slouží jako přehled a soubor literatury a vědeckých článků, které byly vydány v rámci odvětví bilingvalismu a tlumočení. Zároveň slouží jako možná inspirace pro další výzkum v obou oblastech, jelikož nabízí ucelený přehled zahraniční literatury, obzvláště v oblastech fonetiky a neurolingvistiky, která je pro tlumočení důležitá z hlediska tlumočnického procesu.