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Effect of Time of Exposure to L2 on the Comprehension of Relative Clauses in Primary
School Children

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Prohlášení autora

Prohlašuji, že jsem tuto diplomovou práci vypracovala samostatně, že jsem řádně citovala všechny použité prameny a literaturu, a že práce nebyla využita v rámci jiného vysokoškolského studia či k získání jiného nebo stejného titulu.

Author declaration

Hereby I declare, that I created this master diploma thesis on my own, that I correctly cited all relevant literature and that this thesis was not used for the purpose of any other university study program in order to receive a degree.

Abstract

This study investigates the impact of second language age of onset on the development of syntactic competence in bilinguals. Forty-five bilingual children were tested using a picture-matching task with relative clauses. In this paradigm, children are aurally presented with relative clauses of various kinds and are asked to match what they hear with the appropriate picture (out of four choices) on the screen. More specifically, our experiment compared the comprehension of subject- vs. object-extracted center-embedded relative clauses and contained sentences with noun phrases (NPs) that did or did not match in number (both NPs singular or plural = match, one NP singular, one NP plural = mismatch). We compared the performance of a group of Simultaneous bilinguals (two languages since birth), Early sequential bilinguals (first exposure to L2 - English between the ages of 1 to 4) and Late sequential bilinguals (first exposure to L2 -English after the age of 4 but latest at the age of 6 – primary school). The mean age of the participants at the time of testing was approx. 10 years of age. The results show that there is a varied pattern in the comprehension strategies used among the three bilingual groups. The group of Simultaneous bilinguals showed more reliance on the syntactic information contained in the relative clause (large effect of Subject relative vs. Object relative). The other two groups, those of Late and Early Sequential bilinguals, showed more sensitivity to number dissimilarities (morphological feature of Match vs. Mismatch). The time of onset of each group was confirmed to be a relevant factor in motivating changes in the linguistic behavior of bilingual children. These findings are interpreted in the light of current relevant research outcomes in the field, psycholinguistic models of sentence comprehension, works on bilingual language functioning and acquisition and, overall, provide further insight into the linguistic nature of bilingualism.

Keywords:

bilingualism, bilingual acquisition, childhood bilingualism, language acquisition, language comprehension, bilingual brain, simultaneous bilingual, sequential bilingual, time of exposure, age of onset, relative clauses, markedness, Subject relative, Object relative, number dissimilarity, syntax, morphology

Abstrakt

Tato práce zkoumá vliv doby působení druhého jazyka na schopnost porozumět danému jazyku a na vývoj syntakticko-morfologických kompetencí u bilingvních jedinců. 45 bilingvních žáků základních škol bylo testováno na úloze zkoumající porozumění vztažným větám. Během testování děti poslouchaly namluvené vztažné věty různých typů a jejich úkolem bylo přiřazovat je k vhodným obrázkům (jednomu ze čtyř) na obrazovce. Náš experiment konkrétně porovnával porozumění vztažným větám podmětným a předmětným. Tyto věty zároveň obsahovaly jmenné fráze, které se buď shodovaly, nebo neshodovaly v kategorii čísla (obě fráze v jednotném nebo množném čísle = shoda; jedna fráze v jednotném, druhá v množném čísle = neshoda). Porovnávali jsme výsledky skupin "simultánně bilingvních" dětí (dva jazyky od narození), "raně sekvenčně bilingvních" dětí (angličtina od 1- 4 roku) a "pozdně sekvenčně bilingvních" dětí (angličtina od 4 let, nejpozději však od 6 roku – základní školy). Průměrný věk účastníků výzkumu byl v době testování přibližně 10 let. Výsledky odkryly rozdílné vzorce ve strategiích pro porozumění jazyku (v našem případě angličtiny), které tyto tři bilingvní skupiny používaly. Skupina "simultánně bilingvních" dětí se více spoléhala na syntaktickou informaci, jež byla obsažena v typu vztažné věty (velký vliv na porozumění měla syntaktická vodítka vztažné věty podmětné a předmětné). Ostatní dvě skupiny "sekvenčně bilingvních" dětí byly citlivější na morfologické tvary shody a neshody v čísle jmenných frází. Doba působení druhého jazyka tak byla potvrzena jako relevantní faktor při změnách v jazykovém chování bilingvních dětí. Tyto výsledky jsou zde interpretovány ve světle relevantních výzkumů v dané oblasti a na základě psycholingvistických modelů větného porozumění. Celkově práce přináší vhled do lingvistické povahy bilingvismu.

Klíčová slova:

bilingvismus, dvojjazyčnost, bilingvní osvojování řeči, dětský bilingvismus, simultánní bilingvismus, sekvenční bilingvismus, doba působení druhého jazyka, osvojování řeči, porozumění jazyku, vztažné věty, příznakovost, jmenná fráze, tvarová shoda/neshoda v čísle, syntax, morfologie

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List of Abbreviations

NP – Noun Phrase

DP – Determiner Phrase

RC – Relative clause

SR – Subject relative clause

OR – Object relative clause

M – Match of the markedness features of number

MM – Mismatch of the markedness features of number

L1 – First language, mother tongue

L2 – Second language

EL2 – Early second language

2L1 – Simultaneous bilinguals (two mother tongues)

SLI – Specific Language Impairment

CNRep – Children's test of non-word repetition

Sg. – Singular

Pl. – Plural

ANOVA – Analysis of variance

SE – Standard Error

SD – Standard Deviation

F-ratio – Result value of the ANOVA test that indicates if the two variables are significantly different

p-value – Cut-off statistical value for rejection of null-hypothesis

DF – Degree of Freedom

r – Correlation coefficient

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Introduction

Multilingualism is an old and widespread phenomenon, yet, in today's mobile society we encounter multilingual environments and individuals more and more often. Nowadays, it is rather common to encounter children that have been exposed to their second language immediately or shortly after birth, or even started their age of onset several years after birth. All of these individuals are considered bilingual. Despite a large body of research on bilingualism, many questions are still open regarding how two language systems function in the brain, as well as how linguistic behaviour and the language perception of such bilingual children work. In short, the developmental patterns of bilingual language acquisition are yet to be completely understood.

In the Theoretical Background of the present thesis, a general account of the features of bilingualism can be found, as well as an overview of the crucial literature on bilingual language acquisition and other issues in the field. This part of the scientific field lends itself to many questions, especially whether bilinguals fully differentiate their two language systems in adulthood, and whether they can ever achieve standard monolingual language competence in both their languages.

From the research available, it appears that bilingual language functioning differs in a given child in accordance with the age of onset and the amount of L2 (second language) input. Kovelman et. al. (2008), for example, have shown that age of exposure to the L2 may have an important impact on the development of reading abilities in children. The authors measured the effect of the age of first exposure to L2 on reading and phonological awareness; on the basis of the mapping of the general linguistic competence of their subjects, they aimed to discern whether a young bilingual is normally developing (i.e. when compared to monolinguals) or whether he or she is more likely to present with a reading problem or a possible learning disability. As a result of their research, we can assume that bilingual children exposed to two languages from birth follow the language developmental timetable of monolinguals for each of their languages (Kovelman et. al, 2008), while different patterns emerge for later ages of onset.

The present study is also based on the available work of Tsimpli (2014) who examines the role of age of onset and input and aligns it with the application of linguistic phenomena. Of particular importance for our study is her reference to relative clauses, the main focus of our experiment. In her work, the author describes relatives as complex structures with irregular timing of acquisition, i.e. a late phenomenon (Tsimpli, 2014). The designated age of testing in our study (above 8 years of age) was set on the basis of Tsimpli's findings, as it is the earliest period in which children are already comfortable with both the comprehension and production of relatives. There is a lively ongoing debate in the field as to whether there are specific milestones or certain boundaries to the optimal age of acquisition of particular linguistic information, referred to as the "sensitive period". For our purposes, we based the division of our groups on the work of Meisel (2009) who proposed in his work an important benchmark of morpho-syntactic development - a cut-off point of four years of age. According to Meisel, only children presented with the second language before the age of 4 will "successfully develop grammatical properties by mere exposure to the primary linguistic data" (2009, p. 7).

Mainly on the basis of the aforementioned literature, the results of 45 bilingual children recruited from three international schools in Prague were divided into three groups according to their age of onset. A test based on Relative clause comprehension was recently created by Adani et al. (2014) for the purpose of investigating language comprehension in children with language impairment. The test of Adani et al. (2014) is also used in the present study. The test unfolds in this way: children hear a spoken sentence (specifically, either a Subject or an Object relative clause) from a laptop and are asked to choose among four pictures (either with correct or inverted theta roles) the one that better represents the spoken sentence. A morphological manipulation is also made in the test. Some sentences have Noun phrases with matching morphological features of number (Match) and some have Noun phrases with mismatching numbers (Mismatch). The exact execution of the testing, together with all pre-testing procedures, is described in the Methods chapter.

On the basis of the results of Adani's (2014) control group of monolingual children we could make predictions on the behaviour of our group of Simultaneous bilinguals, who were exposed to both languages from birth. Specifically, we expected that the

experimental morphological manipulation - Match and Mismatch of the markedness features of number – would show an effect with this group. Moreover, Adani's study implied that our Simultaneous bilingual group will probably also perceive centre-embedded Object Relative clauses as more challenging than right-branching Subject Relative clauses, since this is what she found in monolingual, typically-developing children. Yet, in her work, there is no implication for our two other groups of Early and Late Sequential bilinguals and a prediction on the effect of syntactic complexity and on the effect of morphological complexity on their language comprehension cannot be made due to the lack of research on this specific problem. In the Theoretical part, there is a further general description of relative clauses in relation to the present topic as well as their place as a complex syntactic structure in language acquisition.

To sum up, the present study addresses some of the essential questions from the field of bilingual child's language functioning: Is there an effect of time of first exposure to L2 on the language comprehension of young bilinguals? Do syntactic and morphological processing mirror monolingual acquisition in bilinguals or not? As researches look for a so-called "sensitive period" (in which the child would learn most optimally particular grammatical word types, syntactic knowledge, vocabulary etc.), many questions remain open for bilinguals. This thesis attempts to make a contribution in answering these questions. As hinted above, an important impact of the age of exposure to L2 on the development of phonology and reading abilities in bilingual children was already observed (Kovelman et. al., 2008). However, little is known about the effect of time of onset on verbal comprehension in bilingual children exposed to their L2 for distinct periods of time. The present research aims at filling this gap.

Theoretical background

In the following section, the general difficulties regarding the study of bilingualism and bilingualism in children will be presented. Additionally, the topic of child language acquisition will be summarized with a focus on the developmental stages relevant to bilinguals. The theoretical findings will be supported by the current research ground in the field.

1. Bilingualism

This section introduces bilingualism as a specific language phenomenon and presents its basic definition, pros and cons and contemporary research issues of bilingual language functioning. In the last part, the issue of child language acquisition is presented and developmental stages relevant to bilinguals are brought into focus. Finally, the theoretical terms of individual variability, amount of language input and first time of exposure/age of onset are specified as regards the topic of language acquisition.

1.1 Definition

Multilingualism is a phenomenon that extends as far as the history of mankind; members of communities grow up and live their everyday lives in multilingual environments. A confirmation of this is the fact that around 5,000 languages coexist nowadays in fewer than 200 countries, which brings on an enormous amount of language contact (Crystal, 2015). In an individual speaker, the phenomenon of mastering two languages is defined as bilingualism. “Bilingualism is not the exception, but the norm,” states Guasti (2017, p. 541), and it is clear that humans possess the ability of mastering multiple languages. In the western world, we find that 56% of the European population is bilingual, with the highest rate of bilingualism in Luxembourg (99%). In North America, we find a lower rate (23%), but there are some exceptions (i.e. Los Angeles, Toronto etc.). The list of places with high rates of bilingualism can continue almost indefinitely around the world; we can count 4 official languages in

Singapore, the 11 of South Africa, the 22 languages in India, with 234 dialects spoken natively by at least 10,000 people, the 60+ languages spoken in Pakistan, the 68 indigenous languages of Mexico, the 182 living languages of the Philippines, or the 706 or so of Indonesia (Paradowski, 2016). It is confirmed over and over again that our brains are predisposed to handle more than one language. Yet, no matter the extent of the spread of multilingualism, there is not that much we know about how two language systems operate in one's brain and what influence this language coexistence has on an individual's language development.

To start with, there is no proper way to define and identify bilingualism. Stating that a bilingual is someone who knows two languages will not suffice. We need to take into account speakers who make irregular use of one of their languages, speakers that haven't used the language for many years (so called "dormant bilinguals"), or speakers that developed skills in the comprehension but not the production of a certain language. The use of the term bilingualism is often not very well defined in the literature. Grosjean (2008, p. 22), for example, refers to bilinguals as to "those who use two or more languages (or dialects) in their everyday lives" and thus leaves us with a broad notion of bilingualism. Nevertheless, in his writing he presents the important fact that there are different degrees of bilingualism and, therefore, stresses the impact of frequency of language use (Grosjean, 2010).

Following this train of thought, most complex issues are raised by the notion of specific language proficiency that would make a cut-off point for defining a bilingual individual. The level of such proficiency defining bilingualism is, however, not clearly stated anywhere. Although some cut-off points have been defined, scholars currently tend to think of bilingual ability as a continuum. "As only a minority of bilingual people reaches the theoretical ideal of perfect control of both languages being close to native-like fluency, the vast majority of bilinguals will find themselves at different points of this continuum with unequal command of their two languages," (Crystal 2015, p. 374). Generally, one language is used more fluently than the other, and the roles can switch in relation to the language environment of the individual.

For this reason, bilinguals are also characterised by the appearance of a phenomenon referred to as "language-mixing", "language-switching" or "code switching". As

Bialystok (2012, p. 3) states, “a logical possibility for the organization of a bilingual mind is that it consists of two independently-represented language systems that are uniquely accessed in response to the context,”. Neuroimaging studies show that specific brain areas are involved in bilinguals’ rapid switching from one language to another (Kovelman et al., 2008). Switching can occur within a long narrative, or sentences may alternate or begin in one language and end in another, resulting in phrases from both languages succeeding each other in apparently random order. Reasons for this vary; the speaker may want to express solidarity with a social group, or show certain attitude towards the listener, such as friendliness, irritation, distance, or irony. Monolinguals usually communicate these effects by means of the level of formality in their utterance; bilinguals can use language switching instead. Code switching can also be a result of the speaker’s inability to express themselves adequately in one of their languages. For instance, Italian could be used to express emotions or feelings, and English for more general or detached sentences (Crystal, 2015). This bilingual verbal strategy is therefore closely connected with the phenomenon of language and psychological identity.

As we will examine more closely in a following section, a bilingual is not a sum of two monolinguals dwelling in one head. “Fluent bilinguals show some measure of activation of both languages and some interaction between them at all times, even in contexts that are entirely driven by only one of the languages,” states Bialystok (2012, p. 3). The languages can influence one another, interfere with one another, or impose an accent on one another. This is clearly demonstrated in an experiment with 2-3-year-old English – Italian children living in England, where the cross linguistic influence can be seen at the interface between syntax and pragmatics, a hypothesis proposed by Mueller and Hulk (2011). Serratrice, Sorace and Paoli (2004) showed in their experiment that Italian children growing up in England are using overt subjects in Italian too often (40-60%), and that they happen to use null subjects when speaking English (max. 12%) in the early stages of acquisition. In Italian, it is grammatically possible for a clause to lack a subject, since person, number and gender of the referent are expressed with marking on the verb (*Non vuole dormire.* - [(S)he] does not want to sleep.). Independent clauses are then considered to have a so-called null subject, which, however, when transferred to English, results in the production of ungrammatical sentences ([Subject] *Not wants [to-] sleep*). Conversely, an extensive use of an overt subject in Italian, as observed by Serratrice et al. (2004), appears odd. It is clear from this kind of example

that we can identify certain patterns of cross-linguistic influence in bilinguals, even though they vary, appear, and disappear according to the individual's stage of language development as well as his or her linguistic environment and individual variability.

Furthermore, it is necessary to recognize the exact purpose of bilingualism within the speech community. Bilingualism is an intense experience that has the impact of modifying one's mind even more than, for example, playing video games or building a career in architecture. Compared to these examples, bilingualism is not an ability typically pre-selected based on talent or interest. A bilingual individual is required to learn more than one language as a result of family circumstances, place of birth or immigration history (Bialystock, 2012), and thus has to cope with the bilingual benefits and consequences, no matter his predispositions for language acquisition. If we move away from the individual, there is the more general question of the purpose of using more than one language in a society. As the basic purpose of language is communication, the purpose of using two languages is mostly to communicate with people of different language backgrounds (Crystal, 2015). However, this obvious description of a single purpose will not suffice. Bilingualism presents itself in individuals and equips them with additional multilingual communication ability and a remarkable range of linguistic behaviour. For example, a bilingual has the power to choose one language in communication, knowing that the listener would prefer the other, simply in order to take an antagonistic stand. An example could be the choice of Corsican over French in order to embarrass the authorities with their lack of knowledge in the separatist upheavals. As we showed through some statistics at the beginning of this chapter, bilingualism is an omnipresent phenomenon in our multilingual world and there are innumerable occasions of language contact interspersed throughout our history. Bilinguals have always played an important role within their societies, not only as mediators and translators, but also as individuals who have access to two cultures of which their languages are an essential core.

1.2 Bilingualism: Disadvantages, Myths, Advantages

Bilingual Disadvantage

It is important to state that, besides its numerous advantages, bilingualism might possibly bring along certain costs. First of all, a large body of evidence shows that bilingual individuals have generally weaker lexical skills in each of the languages compared to their monolingual peers. Receptive vocabulary tests show that they control a smaller vocabulary, with a level of difference compared to respective monolingual counterparts of about 10% (Bialystock et al. 2012). Also, on picture-naming tasks, bilinguals tend to be slower in both comprehension and production of words (Ransdell and Fischler, 1987) and while trying to recall vocabulary, they more often experience the “tip of the tongue“ phenomenon. Even when they respond in their dominant language, bilingual participants appear to be less accurate (Gollan, 2007).

Moreover, bilinguals show some systematic deficits while performing verbal fluency tasks, particularly in semantic fluency and thus, as Bialystok (2012, p. 2) puts it, we can conclude that “the simple act of retrieving a common word is more effortful for bilinguals.” Overall, these phenomena might be a natural consequence of the relatively lower input in each of the languages and omnipresent necessity to suppress the influence of the parallel language.

This phenomenon is referred to as "joint activation", and it causes another challenge for bilinguals. As they are constantly processing selection constraints in areas of register, collocation and synonymy, they are also choosing between the competing forms, and so an attention struggle can appear (Bialystok, 2012). Again, a given need to select the appropriate language system makes simple language processing a task which requires greater effort than that of monolinguals. Nevertheless, Bialystok (2012, p.3) concludes that, despite the risk of language errors due to language interference, “[the errors] rarely occur, indicating that the selection of the target language occurs with great accuracy.”

Depending on a given language combination, bilinguals could be delayed in developing certain syntactic structures (Nicoladis, 2006), relevant to the similarity or difference of the specific types of languages involved. Generally, syntactic development

poses more difficulty for a bilingual when his two languages use two significantly distinct syntactic patterns, for example with one language being analytic with fixed word order (English) and the other flecional with more flexible word order (Spanish). Switching fast enough between the emerging structures might constitute a difficulty at some stage of a bilingual's life.

However, bi/multilinguals do catch up with their monolingual peers after some time, and such deficits cannot be spotted in their everyday language functioning anymore (Paradowski, 2016). On the other hand, the combined lexical resources and broad linguistic repertoire of people who speak more than one language are considerably larger compared to monolingual speakers (Pearson, Fernández and Oller, 1993).

Bilingualism – Myths

It is important to realize that the phenomenon of bilingualism is lingering in the midst of many myths that have been formed over centuries and have subsequently been clarified scientifically in contemporary studies. To discuss these myths, it is relevant to understand their triggers.

Already in the 18th and 19th centuries, with the formation of nation states, identifying a majority or official language was central to the creation of a national identity in each country. Such language took on a privileged status, as the aim of the powerful was the linguistic unification of the citizens (Mesthrie, 2010). These endeavours were strengthened by the growth of colonialism, and people thus developed a strong monolingual bias (Paradowski, 2016).

A consecutive misconception is the striving for native-like qualities in each of the bi/multilingual's languages. Based on Saussure and Chomsky's theories, the linguistic tradition of centralising an idealised monolingual native speaker, it is sometimes wrongly demanded that a bilingual have a perfect and equal command of all his or her languages (Grosjean, 2008). Code-switching and the presence of a foreign accent are thus considered a form of language contamination or linguistic sloppiness (Jarvis and Pavlenko, 2007). However, "people who have perfect fluency in two languages ... are the exception, not the rule," as Crystal (1986, p. 362) points out.

There have also existed negative myths regarding the education of bilingual pupils. Such beliefs, namely, that bilingualism is detrimental to linguistic and cognitive development, were the result of studies from the 1890s to the 1950s (Hakuta and Diaz, 1985). These studies focused on immigrants or subjects from underdeveloped regions and the tests were phrased in the participants' less fluent second language while using a monolingual standard (Baker, 1988). Children obviously performed poorly on these tasks, and bilingualism was sentenced to constitute a handicap and a cause of linguistic confusion (Bialystok, 2012). Prejudice against bilingualism affecting intellectual development and academic performance, and hampering the child's literacy were strengthened, but this bundle of data was misleading because it did not take into account the effects of socio-economic status (SES).

Views based on the fear of inevitable confusion as a result of exposure to two languages represent a historical anecdote rather than a strong scientific position these days. In an article in the *Journal of Experimental Psychology* of 1926, F. Goodenough claims that: "[...] the use of a foreign language in the home is one of the chief factors in producing mental retardation as measured by intelligence tests." On the contrary, the current scientific evidence and neurological findings support the promise of "mental flexibility" in bilingual individuals (Bialystok, 2012).

Bilingual Advantage

Despite the prejudices and some actual difficulties encountered by bilinguals, there is a large body of evidence showing that speaking two or more languages is beneficial.

In 1962, Peal and Lambert conducted a large study on bilingual children with a large battery of tests, and showed that bilinguals were superior to monolinguals on most tests performed, especially symbol manipulation, reorganization and conflict tasks, and showed an advantage in solving linguistic problems as well as in the ability to ignore misleading information (Peal & Lambert, 1962).

Even though certain advantages of a bilingual upbringing have been already mentioned here, it is appropriate to pay attention to further advantages that accompany a bilingual life. Furthermore, we must take into account that the phenomenon of

bilingualism is the subject of broad research, and that many questions still hang in the air, awaiting clarification.

Generally, bilingualism proves to be beneficial in the area of non-linguistic processing; Peal and Lambert (1962) found bilingual children superior in most tests performed in their study, particularly those requiring reorganization and symbol manipulation, as previously mentioned. As a result, more questions regarding the positive influence of bilingualism on general cognitive system and executive functions arose. Later on, it was found that growing up with two languages equips children with different metalinguistic awareness and allows them to understand concepts such as realizing the difference between form and meaning (Galambos and Goldin-Meadow, 1990). More recently, Bialystok and Majumder (1998) discovered that bilingual children outperform monolingual children in nonverbal conflict tasks and the results had thus shown that bilinguals better handle distracting perceptual information. Therefore, the fact that bilinguals need to resolve competition between the two languages has a positive effect on general conflict resolution skills in nonverbal tasks and, as a result, a positive effect on direct attention as well. To be more specific, the inhibition of misleading information and constant, necessary selection between two language systems might give bilinguals better executive control. In bilingual individuals, there is an expected improvement of standard components of executive control – inhibition, shifting, switching and sustaining attention, as well as an above-average working memory (Byalistok, 2012).

Overall, children raised in a multilingual environment and especially those who actively use more than one language show an advantage compared with their monolingual peers in some cognitive skills. Furthermore, despite the fact that bilingualism brings certain difficulties at some points of language development, the overall effect is certainly rewarding. Although the process can be demanding for both parents and children, it is worth making the effort, especially when considering its positive effects (Paradowski, 2016).

1.3 Brain impact of bilingualism

Over the centuries, it has been proven that human minds are capable of hosting more than one language. The modern research technologies used in neuroscience help us understand how the phenomenon of bilingualism might actually alter an individual's brain and have an impact on the way he or she processes language.

The simple fact that any bilingual has to juggle at least two language systems present in the brain forces the individual to constantly resolve competitions between them. Thus, bilinguals gain lifelong experience in managing attention, which is considerably harder to keep given the constant co-existence of more language systems in the brain. For this reason, bilingual individuals demonstrate improved general cognitive systems. Considering this fact, it is expected that bilinguals use different mechanisms in linguistic processing and that specific brain networks are reorganized toward a more effective basis for so called executive control (Bialystok, 2012).

To look into the physical impact of bilingualism on the brain, research has proven - through modern brain imaging techniques such as fMRI, TMS, EEG – that the bilingual experience modifies brain structure and equips the individual with better neuroplasticity (Bialystok, 2012).

Research also shows that bilingual development has a crucial impact on a possible decline of cognitive abilities (Bialystok, 2012) as it causes an increased amount of white matter (tissue consisting of myelinated axons¹ and coordinating the communication between various brain regions and influencing learning and brain functions (Purves et al., 2008)). Such increase might result in reduced symptoms of dementia and even, to some extent, the prevention of brain atrophy in Alzheimer disease development (Schweizer, 2012).

Furthermore, structural imaging has proven an increase in grey matter - a substance that contains neuronal cell bodies and houses neurons responsible for muscle control, sensory perceptions: seeing, hearing, as well as speech, memory, self-control and

¹ Fiber leading from neuron/nerve cell that transports electrical impulses and is covered in myelin sheath that increases the speed of transmission (Cambridge Brain Sciences, 2018).

decision making (Miller et al., 1980). The increase of grey matter in the bilinguals' brain is particularly evident in the left inferior lobe of the brain, which is responsible for language processing (Mechelli et al., 2004).

Interestingly, these changes are observed on a spectrum; they are most significant in high-proficiency bilinguals, and lowest in low-proficiency bilinguals (Kovelman et al., 2008).

We will now move our discussion to studies of brain activation, rather than focusing on studies describing the brain anatomy of bilinguals.

Despite very advanced brain imaging techniques, like the functional MRI that shows brain activity by measuring changes of blood flow, there are still pressing questions hanging above the phenomenon of bilingualism as well as blank spots regarding the specific method of language processing of a bilingual individual.

Firstly, it is unknown whether the manner of language acquisition is the same for bilinguals and monolinguals and whether we all use exactly the same classic language areas in the same manner. Contemporary researchers like Kovelman, Baker and Petitto are looking into the matter by searching for a specific “neural signature” of bilingualism, designing research with the aim of “provid[ing] a fascinating window into the language processing potential not recruited in monolingual brains and reveal[ing] the biological extent of the neural architecture underlying all human language” (2008, p.1).

They also address a second important question, asking whether bilinguals have one general, or “fused,” language representational system, or whether they have two distinct, “differentiated, systems, meaning a unique system for each of their languages. This question about the degree of separation of bilinguals' dual language representation is actually decades old. Earlier, the belief was that young bilinguals have their two languages “fused” into one general language system, which become differentiated into two at about the age of 4 to 5 years (see e.g. Vihman, 1985; Volterra & Taeschner, 1978). In contrast, Kovelman et al. showed in their neuroimaging data support for the view “that bilinguals have differentiated neural representation of their two languages” (2008, p. 13). Their results indicated that, when processing English, bilingual

participants' brains have the same neural profile as their English monolingual peers. However, the authors showed that the use of English as a second language caused a significant increase in blood flow to the area responsible for syntax in comparison to the use of the same area by monolingual speakers. In other words, while both groups used the same parts of the brain to process language, bilinguals were diverting more resources to the task, in comparison to monolinguals (Kovelman et al., 2008b). This new, fascinating window into the architecture and capabilities of the human brain and language processing is still being further opened.

Given the numerous studies aimed at clarifying these ongoing questions, we can conclude that the debate over the impact of bilingualism on a human's brain is still very active, and goes hand-in-hand with the common questions as to whether bilinguals do fully differentiate their two language systems in adulthood, and whether they can ever achieve standard, monolingual language competence in both their languages. As such, we can see that bilingualism in its most physical form is certainly a fascinating and very lively topic.

1.4 Child language acquisition

If we want to tackle the issue of bilingualism properly, it is essential to linger for a while at the point where it all starts, child language acquisition. Therefore, this chapter focuses on the developmental stages relevant to bilinguals.

Pre-natal phase and critical period

When we examine chronological development relevant to human speech, language input has already begun in the pre-natal phase, when the fetus perceives the different rhythms of the various languages spoken by or in the vicinity of the mother (Guasti, 2017). It has been proven by the High Amplitude Sucking procedure² that newborns are able to note the change between two languages of distinct rhythmic classes already shortly after birth. In the test with one- to five- -day-old monolingual and bilingual

² An experimental method based on a non-nutritive sucking reflex that follows a sound stimulus. Usually used for testing infants up to 4 months (Byers-Heilein et al., 2010).

babies, it was found that bilinguals not only discriminate between syllable-timed and stressed-timed languages, but, in contrast to monolinguals, have no preference for either of the two language types (Byers-Heilein et al., 2010). A different study shows that four-month-old bilinguals are capable of recognising a familiar language as they track prosodic properties, and they respond according to which language is spoken to them. In the experiment of Bosch & Sebastián-Gallés (1997), children were presented with stimuli of natural examples of words read by native speakers of either Spanish or Catalan. The point of the experiment was to assess young infants' perceptual discrimination of the two languages with different phonetic natures. It was confirmed that bilingual infants possess the ability to discriminate between the languages on the basis of audio information at an extremely early stage of their development.

Due to a phenomenon called perceptual narrowing, monolinguals gradually lose their vast sensitivity to non-familiar linguistic stimuli during the first year of their lives. Bilinguals, on the other hand, “maintain attentional abilities to detect the cues relevant for language discrimination” (2017, p. 611) for a longer time. This phenomenon is related to the broader notion of the so-called critical or sensitive period, which is supposed to last for approximately the first 6 months of life for phonological development, in which the brain is maximally plastic and prepared to narrow to the phonology of L1. According to the research, the fact that bilingual children maintain the ability to discriminate non-native phonemes longer than monolinguals indicates that the brain remains plastic longer and the critical period is thus prolonged. With this benefit caused by increased discrimination practice comes enhanced learning ability as well as selective attentional abilities (Werker & Hensch, 2015).

Pre-verbal babbling phase

Following the development of phonological categories, children undergo a period of so called pre-verbal babbling. Babbling is a stage in child language acquisition in which infants experiment with sound articulation, yet do not produce proper words (Oller, 2000). In the pre-verbal babbling phase, bilinguals show differences depending on the languages they are exposed to in a given specific moment (Paradowski, 2016). By the age of two, bilingual children already possess sufficient communicative proficiency as

to be able to switch between their two languages according to the situation or addressee (Baker, 2011).

Two to three years of age and language separation

In the further development of the bilingual child's language abilities, there are still numerous unanswered questions. The myth of being confused in their language performance at certain stages of their childhood has been negated in the previous chapters (although delays can occur). Two-to three-year-old bilinguals do distinguish between their own two grammatical systems. However, influence of one language on the other does occur.

At this point, we come across a crucial question, which is whether there is an initial stage of "fusion" of the two given languages in a bilingual mind, or, rather, whether children develop two separate linguistic systems that interact with each other from the beginning. Presently, the researchers agree on the latter hypothesis and support the idea that the two languages are separated but constantly active, as influences, borrowings, and even intrusions can be observed. Guasti illustrates this in the study of Italian – English bilinguals, where she concludes that "bilingual children use more overt pronouns than monolinguals, that is, they use overt pronouns in discourse contexts that require a null pronoun," (2017, p. 613.). The tested bilingual children's use of pronominal subjects in Italian differed from the use found in monolinguals. Even though they operate with distinct grammars for Italian and English we can observe a certain level of cross-linguistic influence and so we cannot consider a bilingual simply a "sum of two monolinguals", as Guasti points out (2017, p. 624).

Individual differences are particularly large in bilinguals. Three factors seem to play a crucial role in this variation: individual endowment, age of onset, and degree of input.

Individual variety

The least investigated among the three is the complex concept of personal endowment for language, such as, for example, individual intelligence, specific aptitude or processing ability in perceiving linguistic sound (Guasti, 2017). Despite its

importance, this factor is rarely investigated. More research in this area is desired, yet the vast spectrum of individual variety limits the imaginable methods of study.

Amount of input

Equally important in bilingual performance is the amount of input. An interesting thought pointed out by Tsimpli (2014, p. 286) is that “bilingual children develop and attain competence in two languages, sometimes even without an attested delay compared to monolingual children, despite the fact they are likely to be exposed to almost 50% less of language input in each language.” Monolingual children are, in comparison, considered to receive 100% of input in only one language, the mother tongue. This implies that even half of the input that we receive would suffice to fully acquire a language, and a curious question arises as to what the smallest sufficient amount of language input would be. The most crucial sources of input appear to be parental language and a natural bilingual environment. Receiving L2 input outside of the child’s home alone might not be sufficient in order to reach balanced bilingual performance (Paradowski, 2016).

Age of onset

For our purposes, the term “age of onset” in bilinguals will be used interchangeably with the terms “age/time of first L2 exposure” or bilingual “age of acquisition” to denote the age when a bilingual was first exposed to two languages and started receiving intensive, systematic and maintained exposure to two languages. The age of first exposure to/time of onset of a language has a definitively significant impact on a speaker’s production (Kovelman et al., 2008a).

This discussion also presents terminological implications. For example, Guasti uses the term “bilingual” for individuals who acquired two languages from birth and the term “Early second language” (EL2) or “sequential/successive bilinguals” for those who were exposed to the second language shortly after birth (2017, p. 633). Kovelman et al. (2008a) use the terms “Birth bilinguals” for children exposed to two languages before the age of 3, “Early bilinguals” for children exposed to the L2 between ages 3-4 and “Late bilinguals” for children exposed to the L2 between ages 5-6.

With regard to phonological performance, the first signs of a non-native accent were already detected in bilinguals exposed to a second language at around 4 years of age (Flege, Munro & MacKay, 1995), which is also the cut-off point for morpho-syntactic development as proposed by Meisel (2009). Tsimpli distinguishes among three groups: “simultaneous bilinguals” (2L1), “early successive bilinguals” (exposure up to age 4), and “late bilinguals” (age of onset after 4 years of age) (2014, p. 284). The division of age groups used in this thesis is based on this outline and further described in the methods chapter.

2. Relative clauses

In this chapter, the syntactic phenomenon of relative clauses will be addressed, as it constitutes the examination tool used in our experiment. As this thesis focuses on (bilingual) language development and relative clauses belong to complex syntax, the theoretical framework of the acquisition of complex language structures will be also described.

2.1 Syntactic definition of Relative Clauses

From the syntactic point of view, relative clauses belong to the category of subordinate clauses. They are further divided into Nominal relative clauses (*I eat what I like.*) and Adjectival relative clauses (*The lion that the dolphin washes sits on the ground.*), either non-restrictive or restrictive (Quirk et al., 1985, Dušková, 2012). This project focuses on Adjectival relative clauses. Depending on the animacy of the antecedent, relative clauses are introduced by the relative pronoun *who* (animate) or *which* (inanimate). The optional relativizer *that* (Huddleston & Pullum, 2005) does not primarily indicate either an animate or inanimate antecedent, as it carries no morphological marking. Additionally, the relative pronoun *whom* is marked for the objective case of the pronoun *who*. Not to confuse or unnecessarily mislead the bilingual children that were tested in the present study, only the complementizer *that* had been used in the given sample sentences. The objective case version of the relative pronoun - *whom* - would be contemplated as a distinction of case, which was not a tested feature in our task.

Restrictive relative clauses are subordinated to the main clause and function as a restrictive modifier to the main clause in the clausal structure (Hamburger & Crain, 1982). This type of relative clause is restrictive, since the subordinate clause contains information that restricts the number of possible referents for the noun in the main clause to a specific entity. This type of clause is sometimes called an essential clause, since it cannot be optionally omitted. They can appear in two distinct types of structure, either subject relative or object relative clause.

Subject relative clauses

The subject relative clause is the most common form of restrictive relative construction (Friedmann et al., 2008). The relative pronoun acts here as the subject of the clause. The structure of such a construction is e.g.

¹The deer ²who is splashing the dog ¹is sitting on the ground.

Main clause pattern¹:

S (*the deer*) – V_{partic} (*is sitting*) – Adv_{place} (*on the ground*)

Subordinate clause pattern²:

S (*who = the deer*) – V (*is splashing*) – O_d (*the dog*)

Who refers to the deer and is the subject of the auxiliary verb *is* in the relative clause.

Object relative clauses

In comparison, object relative clauses are deemed a more complex structure. An example of the usual pattern would be e.g.

¹The cat ²whom the rabbit is combing ¹has entered the box.

Main clause pattern¹:

S (*the cat*) – V_{pres.perfect} (*has entered*) – Adv_{place} (*the box*)

Subordinate clause pattern²:

S (*the rabbit*) – V (*is combing*) – O_d (*whom = the cat*)

Whom refers to the cat and is the object of the verb *is combing* in the relative clause.

If the antecedent is plural, the relative pronoun used will be *who*. Nevertheless, all presented relative pronouns could be substituted by the relativizer *that* under the condition that they are not preceded by or bound to a preposition (Carter et.al, 2017).

Object relative clauses can be characterized as most often having inanimate heads, according to research by Fox and Thompson (1990). Also, the subject within the relative clause is actually most often a discourse-old referent in relation to the linguistic context, e.g. a pronoun. An example would be *The car that she borrowed had a low tyre*

(Kidd et. al., 2007). These distributional properties are likely related to the fact that subjects are the animate entities most often referred to by means of a pronoun, while objects are usually inanimate.

2.2 Language acquisition of grammar/syntax

Various linguistic theories approach the issue of acquisition of grammar in notably different ways. Chomsky's generativist approach based its theory of universal grammar on the hypothesis that the human brain possesses an innate set of structural rules. Unlike other species, he claims, humans are equipped with what he refers to as a Language Acquisition Device, a hypothetical module that gives us the predisposition for language learning from birth and makes the acquisition of grammatical language possible (Chomsky, 1965). In other words, he believes that a child already possesses some extent of language-specific skills at birth. On the other hand, usage-based approaches contend that language skills are acquired gradually after birth in a bottom-up manner by use of the language in our everyday lives (McCrum, 2012). Tomasello (2008, p. 238) admits that "many aspects of human linguistic competence have indeed evolved biologically, [however], specific grammatical principles and constructions have not,". He claims that our linguistic knowledge is not innate but, rather, shaped during the language acquisition period of each individual's life.

In this thesis we will not take a specific stand on this issue, since we are focusing on late phenomena that are supposedly acquired from the environment in both approaches.

According to Tsimpli (2014), we can divide the timing of monolingual acquisition into early, late and very late phenomena. Tsimpli argues that this division is what "reflects differences in the role of narrow syntax: early phenomena are core, parametric and narrowly syntactic, in contrast to late and very late phenomena, which involve syntax-external or even language-external resources," (2014, p. 283). More specifically, at about 2 years of age some morpho-syntactic properties, like directionality³ in Germanic languages, are mastered. In the following years, from 2 to 3, determiners,

³ Parameter for classification according to whether the head of the phrase precedes (head-initial) or follows its complements (head-final). In Germanic languages both head-final and head-initial phrases occur (Dopke, 1998).

interrogatives and relatives begin to develop, but some phenomena (e.g. passives) develop as late as the age of 5. As Tsimpli sums up, “by their early school years (age 5–6), children have usually acquired the morpho-syntactic properties of local and non-local dependencies, transitivity alternations, the semantics of quantification and operator-variable structures as well as syntactically-encoded properties of information structure,” (2014, p. 286). Thus, we can conclude that, by the beginning of obligatory school attendance, children have usually mastered all formal aspects of the native language. Metalinguistic aspects of language as discourse connectives, ambiguity resolution or pragmatic cues develop in late childhood or early adolescence (Tsimpli, 2014).

Further on, I will try to outline a timeframe of grammatical language acquisition based on the article of Tsimpli (2014). It is important to notice that some linguistic phenomena need more time of exposure to input than others. In addition, it is also possible that the timing of the same phenomenon differs cross-linguistically, so that, for example, passives in Sesotho are acquired earlier than passives in English (Tsimpli, 2014).

2.3 Acquisition of complex structures

From the language acquisition point of view, relative clauses are classified as syntactically complex and challenging structures together with passives (e.g. complex assignment of thematic role) and pronominal reference (use of pronouns) (Krashen, 1998). Passives are first learned without the *by*-phrase, and pronouns are initially treated as anaphors. Relative clauses are acquired in various phases as timing can vary between types of the same structure within a language, which will be described in detail later in this section.

The acquisition of relative clauses was first tested using the act out methodology (e.g. Tavakolian, 1981), where children used toy props to act out tested sentences, like *The dog [that chased the cat] jumped over the cow*. The authors concluded that children under the age of 5 have ‘little knowledge of the recursive properties of language’ (Kidd et. al., 2007). Recursion is the core property of syntax, i.e. the ability to combine words

to form sentences (Chomsky et. al., 2002). The results of the mentioned studies were not very systematic, as there was no supporting discourse context that would help them establish the relative clause as a restrictive modifier. Furthermore, they unnecessarily complicated the child's task, as the children had to perform sentences they rarely heard (Diessel & Tomasello, 2005).

In later experimental studies by Diessel and Tomasello (2005), it was revealed that children indeed acquire the grammar of relative clauses by building upon initially restricted syntactic knowledge, from the already existing knowledge of presentational constructions (e.g. *This is an X*) and noun modification (Kidd et. al., 2007). The authors also proved that relative and interrogative clauses emerge quite early, around the age of 3. The results had shown that little children use their first relatives in presentational constructions, such as *This is the sugar that goes in there*, which consist of a copular main clause where the main predicate nominal is modified by the RC. These sentences are generally very simple and express only one idea even though they contain two clauses and the relative clause brings new information instead of developing an old one (Diessel & Tomasello, 2005).

At this point, it is important to note that, in English, subject relatives are mastered sooner than object relatives. The children's preference for this easier type of relative construction is very probably due to the fact that they expect the noun to have the thematic role of agent, which should be relativized. At the same time, they expect the first noun of the relative clause to encode the agent (Kidd & Bavin, 2002). It is also interesting that the comprehension and production of relative clauses follows a rather unusual pattern. It appears that, unlike with other syntactic structures, comprehension of relatives in children develop later than production (Tsimpli, 2014).

Nevertheless, as children grow older they start to produce more complex relative clauses and by the age of 4 they start to produce even object relatives. Other research shows that despite the fact that children have increasing knowledge of relative clauses, they don't possess full competence of the 'easy' type of the structure until 5 years of age (Correa, 1982). Moreover, the more problematic type of object relative shows more gradual development even as late as the age of 8 (Tsimpli, 2014).

Intervention

The difficulties with relative clauses are explained with formal syntactic analysis. In these proposals, the delay in the acquisition of object relatives may be caused by their computational complexity. The confusion is caused by the presence of what falls into the definition of an intervening element. According to these proposals, a so-called ‘copy’ or ‘trace’, which is the subject or the object of the dependent clause, is in co-referential relation with the first Noun Phrase. Now, the other Noun Phrase, appearing in the dependent clause, intervenes in this relation in the Object Relatives, but not in the Subject Relatives. We can demonstrate this in the following examples:

- a) *Show me the lion that <t> washes the elephant.*
- b) *Show me the lion that the elephant washes <t>.*

In a) we have a subject relative clause with the trace in the vicinity of the antecedent of the relative clause. On the other hand, in b) the trace is placed far from the antecedent and an intervening embedded subject Determiner Phrase [the elephant] is inserted between the Determiner Phrase head and its copy (Adani et. al. 2014, Cilibrasi, 2014). Based on this approach the asymmetries between these types of the same structure can be explained by a universal constraint on computations, the so-called Relativized Minimality (Rizzi, 1990). In the human brain, the presence of intervention increases the language processing load, and possibly creates confusion as the non-canonical word order in object relatives makes semantic strategies less likely to be successful.

The afore-described intervention is graded by morphological properties such as case or gender, which are argued to alleviate Relativized Minimality (Adani et. al, 2014). When there is no number dissimilarity between the subject of the main clause and subject of the subordinate clause to give a morpho-syntactic cue, it takes longer to assign the following verb to the correct phrase (Tsimpli, 2014). Adani et. al. (2014) give four examples of possible case manipulation in which the problem can be observed:

- a) *The goat that <goat>is washing the cat has climbed onto the stool.*
- b) *The goat that <goat>is washing the cats has climbed onto the stool.*

- c) *The goat that the cat is washing <goat>has climbed onto the stool.*
 d) *The goat that the cats are washing <goat>has climbed onto the stool.*

In all four sentences, the position of the head noun, whether it is subject or object of the embedded Verb, is indicated within angled brackets '< >'. In the first two subject relative sentences (a, b), the RC head [the goat] is the subject of the main clause as well as of the relative clause. In the object relative sentences c) and d), the head of the relative clause is the subject of the main clause and, at the same time, object of the relative clause. Significant is the presence of mismatching number that, through its features on the Determiner Phrase and related verbs, helps to predict the correct interpretation of the relative clause. This is helpful especially with the more challenging type, the object relative clauses. Adani et al. (2010) executed a study with Italian-speaking, typically-developing children aged 5 – 9 years who were presented with subject and object relative clauses. The related DPs had either the same or different number properties (singular, plural), and the same and different gender (masculine, feminine). In the overall results, children performed significantly more accurately in the mismatched conditions. Therefore, the authors presented the idea that independent functional heads as the match in the number feature trigger a strong facilitation effect.

Nature of the head noun

Another feature that is supposedly crucial for the comprehension of relative clauses is the nature of the head nouns in determiner phrases. The difficulty related to the complexity of the structure presents even in adults, and is most prominent when the head noun is inanimate (Weckerly & Kutas, 1999). On the other hand, the comprehension of a sentence containing a relative clause is easier when the RC subject is a discourse referent, e.g. a pronoun, which is a kind of anchor for the head noun. From the psycholinguistic point of view, discourse referents of this kind aid comprehension as they are said to be more accessible and, thus, the speaker does not need to activate as many processing resources as with both lexical NPs. Therefore, he or she is left with more space for syntactic processing (Kidd et. al., 2007). This is confirmed even in the results of tests where adults were presented with sentences like: *The barber that the lawyer/you/Joe/everyone admired <the barber> climbed the mountain.* The subjects were significantly faster and more accurate in Relative Clauses

where the embedded Determiner Phrase was a pronoun [you], a proper name (Joe), or a quantifier (everyone), rather than when it was a definite description [the lawyer] (Adani et al., 2014). The trick obviously lies in the fact that it is helpful when the relative head and the intervening subject have a set of disjoint features. In the nouns *barber* and *lawyer*, a lexically-restricting feature is present, which leads to more difficulty when interpreting the sentence. On the other hand, the lexical noun *lawyer* and the pronoun *you* do not share the same lexical restrictions, and so the embedded subject is less prone to misinterpretation as a member of the relation between the relative clause head and the copy.

To sum up, relative clauses are considered a complex syntactic structure that is acquired in late stages of child language development as a so-called late linguistic phenomenon. The complexity of subject- and object-extracted center-embedded relative clauses is caused by the presence of syntactically distant elements and intervention. In a study relevant to the present one, Kovelman et al. summarize the reason for choosing Relative clauses as an optimal structure for testing by saying "the two different relative-clause sentence types (Subject and Object relative) exploit the differences between particular types of linguistic constructions in a language (as well as their typical frequency in a particular language), and thus, lay bare the nature of an individual's processing in that language " (2008b, p. 6). Comprehension can be further complicated by sentences containing match or mismatch of number feature in the NPs. Relative clauses are thus used in the present study as an ideal linguistic phenomenon for testing comprehension of complex structures containing both syntactic and morphological manipulations.

3. Hypothesis

On the basis of the above presented literature, the present study addresses the question of whether or not there is an effect of time of first exposure to L2 on language comprehension in bilingual children. Experimentally-manipulated relative clause sentences with all possible combinations of Subject vs. Object relative clauses and morphological feature of Match and Mismatch were used for testing.

A few predictions were made on the basis of previous research in the field. Adani et al. (2014) introduced a control group of monolingual children that may correspond to our group of Simultaneous bilinguals, who were exposed to both languages from birth. Her findings suggest that our Simultaneous bilingual group will probably also perceive centre-embedded Object Relative clauses as harder than right-branching Subject Relative clauses.

Furthermore, in accordance with Adani's findings, we can expect that the experimental morphological manipulation - Match and Mismatch of the markedness features of number – will show an effect within this group, with children showing an overall facilitation for sentences with Mismatch.

Moreover, as plural is a marked form in English, it can be hypothetically assumed that the morphological effect of number Match or Mismatch would be larger in children with less experience in L2. More specifically, we expected the facilitation effect of Mismatch to be more important in Late sequential bilinguals in comparison to simultaneous bilinguals. This feature is supposed to help them with faster assignment of the main verb to its head complement rather than would the syntactic features of Subject and Object Relative sentence types in children with poorer syntactic structures.

Nevertheless, there is no clear implication in Adani's work for our two other groups of Early and Late Sequential bilinguals and a prediction on the effect of syntactic complexity and on the effect of morphological complexity on their language comprehension cannot be made due to the lack of research on this specific problem.

Methods

In this chapter, the methods of the research testing procedures will be described in detail. We present the specifics of participants, tests used for pre-testing and the design of the main syntactic test and other used materials. The testing procedure is also described as well as the method of response coding.

1. Participants

Three private international schools in Prague agreed to take part in the study: Parklane International School, The Prague British School, and the International School of Prague. All students were admitted into the study after parental consent for their participation was obtained, and all children willingly took part in this study. Students were selected with the initial requirement of having had early and maintained dual-language exposure. The project was approved by the Charles University Ethics Committee.

The time of onset/input criteria for child selection among given school pupils were initially as follows:

Group 1) Early sequential bilinguals:

- both Czech parents
- born in the Czech Republic, growing up in the Czech Republic OR an English-speaking country
- receiving education in the English language, from the beginning at the given school

Group 2) Simultaneous bilinguals:

- both English native parents OR one English native/one Czech native parent
- growing up in the Czech Republic OR an English-speaking country
- receiving education in the English language, NOT necessarily from the beginning at the given school

The children had to be between 9 and 11 years of age at the time of the study ($M = 10.2$; $SD = 0.94$), and in the 5th or 6th grade. They could not have been exposed to a third language for a long time period. 45 participants fell under such criteria. The reason for this timeframe was the fact that relative clauses are considered complex structures with irregular timing of acquisition (viz. section 2.2.3.). They are considered as a rather late phenomenon, with object relatives being developed even as late as the age of 8 (Tsimpli, 2014). Thus, the designated age period is the earliest one in which the children are already comfortable with both comprehension and production of relatives. In this way, the results should not be affected by developmental issues.

Following the assessment of the parent's and child's questionnaires, the participants were divided into three groups according to the age of onset with assumed input effects. The first group was labelled "Simultaneous bilinguals" and contained children who were exposed to both English and Czech from birth. The results of children who first encountered English between the age of one to four years were analysed within the group labelled "Early sequential bilinguals". The cut-off point of four years of age was made on the basis of the work by Meisel (2009), who proposed it as a benchmark of morpho-syntactic development. The second group, "Late sequential bilinguals", consisted of the results of children who had started to be exposed to English after the age of 4 or even as late as the time of their initial enrollment in primary school.

2. Additional testing

None of the children who took part in this study were diagnosed with Specific Language Impairment (SLI), Grammatical-SLI, dyslexia, or any other language and learning impairments. To ensure that the differences in results were only of linguistic origin, additional pre-testing was performed with each child.

Raven's Coloured Progressive Matrices

First, three sets (A, A_b, B) of Raven's Coloured Progressive Matrices (Raven, 2008) were used to map each child's abstract reasoning and non-verbal intelligence. The test consisted of 36 items – patterns with a missing element to be identified - listed in order of difficulty. Broadly speaking, the test is designed to measure the participants' reasoning ability and general intelligence (Domino & Marla, 2006).

Digit span

A Digit span test was used for measuring verbal short-term memory. Short-term memory is a component of memory that allows for temporary information storage and is essential for everyday tasks, e.g. understanding longer and difficult sentences (Purves et al., 2008). The test is based on remembering gradually longer sequences of numbers that appear on the screen one at a time and then disappear. The tested subject is supposed to provide the number sequence in the same order immediately after the presentation of the sequence. "The number of digits increases with correct answers and performance is indicated by the average number of digits correctly remembered" (Cambridge Brain Sciences, 2018). For our participants, the average length of remembered numbers was five digits. These values conclude that all children had more than sufficient verbal ability to participate in the main test.

The Children's Test of Nonword Repetition

The Children's Test of Non-word Repetition (CNRep) was administered despite the fact that the test is designed for younger children between the ages of 4 to 8, or children with language-related learning difficulties. The reason was to rule out possible language learning difficulties in our tested subjects. CNRep functions as a reliable indicator of short-term memory, like the Digit Span test. However, unlike the Digit Span, this kind of testing is more closely linked to abilities like vocabulary knowledge, spoken

language understanding and reading achievement. The children are asked to repeat unfamiliar, spoken, nonsensical words that are not part of the English language. The words are then scored according to their number of syllables. For our purpose, it is important to stress that the test does not disadvantage children with less rich environmental experience of language or shorter time of exposure to L2 (Gathercole & Baddeley, 1996).

3. Design

The exact design of the main test by Adani et al. (2014) on relative clause comprehension (originally used on children with Grammatical Specific Language Impairment) was used in this study. Two factors are manipulated in this test; sentence type – Subject (SR) vs. Object relative (OR) and number match - Match (M) or Mismatch (MM) (examples viz. table 1). The relative clause head varied in either singular or plural for each sentence type. Therefore, the plurality of the head noun was balanced in the final count of the test.

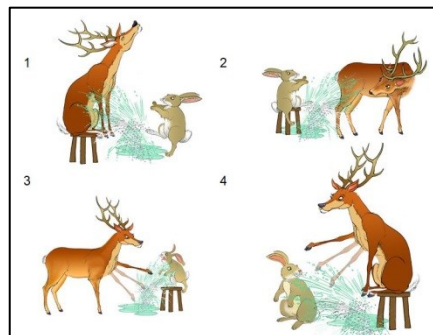
TABLE no. 1 - Examples of test sentence types - Subject (SR) vs. Object relative (OR) and number match (DP) - Match (M) or Mismatch (MM) combinations

Sentence type	DP match	Head Noun number	Test sentence example
SR	M	Both sg.	The penguin that is pulling the fish is slipping on the stones.
	MM	sg.	The turkey that is waving to the squirrels has slipped in the puddle.
	MM	pl.	The crocodiles that are combing the lion have slipped on a banana.
OR	M	Both pl.	The pigs that are washing the penguins have slipped in the puddle.
	M	Both sg.	The peacock that the parrot is pushing has fallen down.
	MM	sg.	The bear that the lions are pulling has fallen down.
	MM	pl.	The dolphins that the penguin is waving to have fallen onto the leaves.
	M	Both pl.	The leopards that the horses are washing have fallen into the pond.

Twelve trials were performed for each of these four conditions – six with singular and six with plural head noun). In total there were 48 spoken sentences with relevant picture sets. Each trial was visually paired with four pictures, which represented all possible combination between the two actions (main and embedded verb) and the actors (subject and object determiner phrases), with correct or inverted theta roles (viz. picture no. 1). Only one of the pictures matched the played sentence in meaning. Eight verbs were used as main verbs (*fall, sit, climb, jump, fly, enter, lie, slip*). Those were paired

with eight other transitive verbs that occurred in the embedded clause (*pull, splash, wash, stroke, wave, push, comb, touch*). All the verbs and some of the pictures were used in previous work (Fonteneau & van der Lely, 2008). The same pair of verbs never occurred again with the same pair of nouns. All nouns were names of animals. In the original test, all sentences were “pre-recorded by a female native speaker of British English” (Adani et al., 2014, p. 283).

PICTURE no. 1 - Example of the four pictures in the trial of the syntactic test



The test had versions A and B, with the difference of reversed noun order (S and O determiner phrases). Such cross-over design allows the control of possible confounding effects such as the possibility of a more suitable subject (object) for a particular noun. In each of the three groups of tested children, half were presented with version B in the present study.

As it is known that bilingual children may have certain difficulties with reading (Kovelman et al., 2008a), it was desired to avoid any possible confound. Therefore, a comprehension assessment test was chosen rather than a written verbal test. The aim was to avoid the reading skills of individual tested subjects to play a role. Thus, the test focused exclusively on oral sentence processing.

4. Materials

The trial - voice and picture presentation - was presented with the use of full screen Microsoft Power Point Presentation on an ASUS UX305C laptop. In each testing, the trial order was randomized by the installed support TM Randomize Slideshow version 4. Standardized answer sheets were created by the researcher to mark the answers.

5. Procedure

Each child was taken out of a regular class for one hour and a quiet room was provided by the school for the purpose of testing. First, the participating children went quickly through the Child’s questionnaire (Tsimpli & Andreou, 2014) and all the pre-tests. The last 35 minutes were left for the previously described syntactic test by Adani. The children were asked to look at four pictures on the screen, listen carefully to the spoken sentence and then choose the appropriate picture according to their interpretation. Four practice trials preceded the presentation of the testing trials. During training, the researcher emphasized looking carefully at all four pictures and preferring accuracy to speed. The pictures were numbered from one to four. The researcher marked the final response on a standardized answer sheet of paper to optimize the testing time. To maximize each child’s attention, the researcher controlled the presentation of the next item by clicking the mouse after the response was marked. Afterwards, the answers were typed into an Excel table.

6. Response coding

Responses were re-typed into another results sheet and sorted according to the sentence type/condition. As described before, there were eight different sentence types/conditions (SR, OR, M, MM, sg., pl.), and six trials were performed for each. The results were evaluated according to the principle correct/incorrect answer. What was recorded in the table was the number of correct answers per each condition (viz. Table no. 2). Thus, it was clear from the results which children were most successful. All results were analysed with the use of the response Excel table and with the use of Excel statistics tools.

TABLE no. 2 - Example of response coding

Participant	AGE - months	AGE - years	SR both sg.	SR NP1 sg. NP2 pl.	SR NP1 pl. NP2 sg.	SR both pl.	OR both sg.	OR NP1 sg. NP2 pl.	OR NP1 pl. NP2 sg.	OR both pl.
X	116	9	6	5	4	6	4	5	5	2
Y	126	10	5	5	6	4	4	3	3	4
Z	140	11	6	6	6	5	6	5	5	5

Analysis

As described in detail in section 3.1. Methods, the decision was to divide the sample of children into three groups in accordance with their age of first exposure to L2. The division of analysed results was the same as the division of participants during testing:

1. Simultaneous bilinguals – first exposed to English before the age of 1.
2. Early sequential bilinguals – first exposed to English at age 1 - 4.
3. Late sequential – exposed to English from 4 years of age or since 1st grade of primary school.

Below, a descriptive statistics table (viz. Table no. 3) shows the mean age of the participants with Standard Deviation and the mean score of the children in all tasks, with Standard Deviation.

TABLE no.3 - A descriptive statistics table

	Mean score	SD Age
Age in years	10.17	0.77
Age in months	127.86	9.58
Adani's Syntax test	39.13	5.89
CNRep	8.23	1.49
Raven's matrices	10.08	1.59
Digit span	4.46	1.01

Sums of correct responses were divided into three separate sheets with tables of values according to the bilingual groups. Within each group a categorical factor of morpho-syntactic features was generated into a new table. Thus, we had a separate table for the sum of the results of only Subject Relative sentences with Match and Mismatch of number and Object Relative sentences with Match and Mismatch of number (viz. Table no. 4).

TABLE no. 4 - Table for the sum of results divided according to morphological and syntactic variables

Participant	SR Match	SR Mismatch	OR match	OR mismatch
X	12	11	8	12
Y	11	10	10	11
Z	7	9	5	7
..	11	11	6	10
..	8	12	4	9
..	11	12	7	11
..	6	5	5	3
..	11	10	6	8
..	9	11	11	11
..	10	9	5	6
..	10	10	11	11
..	10	10	8	10
..	12	11	8	11
..	11	12	11	12
..	11	10	9	7
..	9	9	9	12

The impact of Match and Mismatch of number in each group was compared together with variables of Subject and Object Relative sentence type. To analyze the differences, an Analysis of variance (ANOVA) test was applied to the above described sets of results. This method is useful for testing three or more groups of data or variables for statistical significance. Our experiment consisted of 2 binary variables (type: Subject Relative vs. Object Relative) and Match (Match vs. Mismatch) leading to 4 cross-conditions.

The aim was to observe the variation within the specific dataset of each group of bilinguals and find out whether any of the two variables would lead to significant differences. In each of the four parameters, the significance of the results was determined by the probability value, the so called "p-value" (standard cut-off value of 0.05) which is generally used in statistical hypothesis testing.

1. Simultaneous bilinguals' data group results

The group of children that fell under the category of simultaneous bilinguals were exposed to English for the longest time period (2L1). Therefore, they were hypothetically assumed to perform in the same way as monolinguals. The comparison can be made to the results of Adani's (et al., 2014) control monolingual group tested with the same battery of sentences. In that study, an effect of Match was found on monolinguals as well as an effect of Type. On the basis of these results, it was expected that simultaneous bilinguals would show some sensitivity to morphological number Match/Mismatch. Moreover, we also expected an effect of the type of relative sentence. It was assumed that Object Relatives and Subject Relatives would be processed differently by participating children. More specifically, we expected that the participants of this group would be more accurate with Subject relatives than with Object relatives.

After applying the ANOVA test to the above described set of data (Table no. 5), there was a highly significant **main effect of type of sentence**, $F(12,3) = 7.61$, $p = 0.007$ and **marginal effect of Match** of the markedness feature, $F(12,3) = 3.31$, $p = 0.073$. The interaction was not significant, $F(12,3) = 2.15$, $p = 0.14$. When we compared the sentence types, there was a higher level of accuracy with Subject Relatives = 10.03, in comparison to Object relatives = 8.56. When the markedness feature of number matched in both sentences, children were less accurate (Match = 8.81) than when the markedness feature of number was different (Mismatch = 9.78)

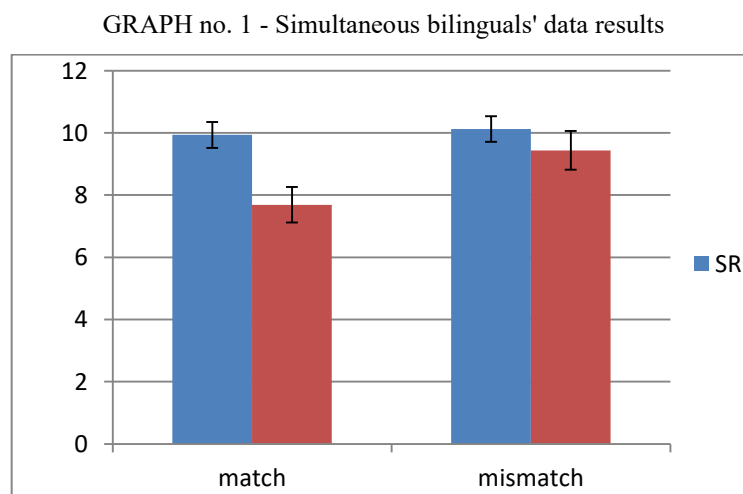
TABLE no. 5 - ANOVA test: Simultaneous bilinguals' data group results

	F-ratio	P - value
Type	7.61	0.007
Match/Mismatch	3.31	0.073
Interaction	2.15	0.147

As the p-value of the Object and Subject relative clause results was significant (lower than 0.05), we rejected the null hypothesis that there is no difference between the two types of sentences and our expectations could be considered confirmed.

Simultaneous bilingual children can thus be considered sensitive to the syntactic factor of Subject and Object relative sentence type. The morphological feature of Match was only marginally significant within this group. In conclusion, both effects showed to play a role for this group, with a leading effect of type.

Below (Graph no. 1) the set of data is illustrated graphically. We can observe that children were more accurate with Subject relatives in both Match and Mismatch of number conditions. In the meantime, they were more accurate in sentences with number Mismatch in both types of sentences. The error bars show consistency within the group, and were created on the basis of the Standard Error that equals the Standard Deviation divided by the square root of the sample size ($\sqrt{16}$).



To sum up, simultaneous bilingual children confirmed the hypothesis made regarding their group. As the p-value was smaller than 0.05 for the sentence type condition, they have shown sensitivity to syntactic features of Subject and Object relatives. Specifically, they show more accuracy with Subject relative compared to Object relative, as reported in the literature on monolinguals (Adani et al. 2014). On the other hand, sensitivity to morphological markedness (number Match vs. Mismatch) was only marginally significant.

2. Early sequential bilinguals' data group results

Data for the children who had been exposed to English (L2) first between 1 to 3 years of age fell under the group “Early sequential bilinguals”. There were no specific expectations regarding the results of this group, as there has not been enough relevant research made with similar set of participants.

The results of the ANOVA test (Table no. 5) show a **highly significant main effect of Match** of the markedness feature, $F(11,3) = 10.36, p = 0.002$ and a **marginally significant effect of sentence type**, $F(11,3) = 3.5, p = 0.066$. The results showed a non-significant interaction, $F(11,3) = 0.94, p = 0.334$. When we compare the sentence types, there was a higher level of accuracy for Subject relatives = 10.33, in comparison to object relatives = 9.5. When we compared the number Match results, there was a higher level of accuracy with sentences containing number Mismatch (= 10.63) compared to the accuracy in sentences with Match of the Noun Phrases number (= 9.2).

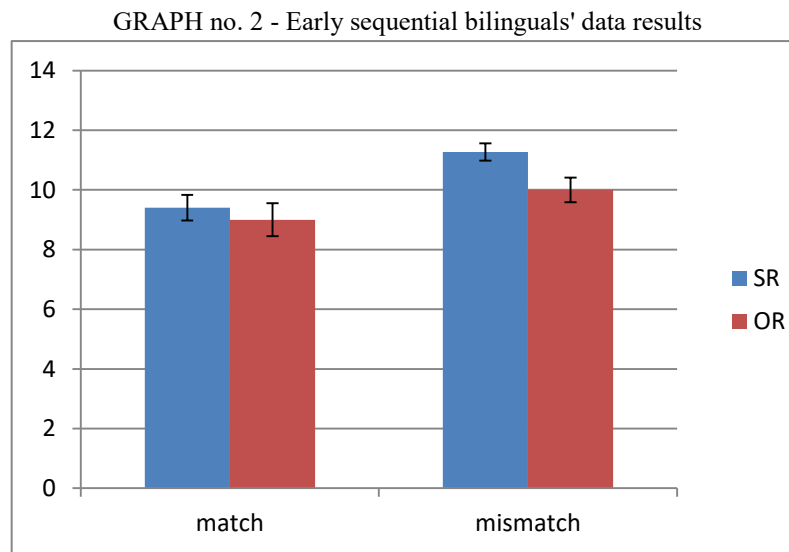
TABLE no. 6 - ANOVA test: Early sequential bilinguals' data group results

	F-ratio	P - value
Type	3.50	0.066
Match	30.81	0.002
Interaction	0.94	0.334

The p-value relevant to number Match and Mismatch showed highly significant (lower than 0.05) and we rejected the null hypothesis that Match in number does not play a role. Thus, we concluded that our group of Early bilingual children already used different mechanisms for language comprehension compared to simultaneous bilinguals. Early sequential bilinguals rely more on the morphological markedness feature of number, since accuracy was higher with sentences containing number Mismatch between two Noun Phrases, while the effect of sentence type showed to be only marginally significant within this group.

In the following Graph no. 2, we can observe the leading significance of the Mismatch condition as we can clearly see that children were more successful with sentences of both types containing Mismatch of number. The error bars show

consistency within the group. Error bars were created on the basis of Standard Error that equals the Standard Deviation divided by the square root of the sample size ($\sqrt{15}$).



Overall, the group of children between 1-3 years of age showed a change in performance compared to the previous group of simultaneous bilinguals. They showed much higher sensitivity to number Match of the markedness feature, and only marginal sensitivity to the syntactic features of sentence type.

3. Late sequential bilinguals' data group results

"Late sequential bilinguals" were first exposed to English (L2) as late as after the age of 4. As plural is a marked form in English, it was hypothetically assumed that the morphological effect of number Match or Mismatch would be larger in children with less experience in the L2. More specifically, we expected the facilitation effect of Mismatch to be more important in late sequential bilinguals as compared to simultaneous bilinguals. This feature is supposed to help them with faster assignment of the main verb to its head complement rather than would the syntactic features of Subject and Object relative sentence types.

In the ANOVA test results (Table no. 6), there was a **significant main effect of morphological feature of number Match**, $F(10,3) = 4.29$, $p = 0.043$ and a **non-significant effect of the syntactic aspect of a sentence type**, $F(10,3) = 0.71$, $p = 0.402$. There was also a non-significant interaction, $F(10,3) = 0.005$, $p = 0.939$. When we compare the sentence types, Subject relatives = 10.39 did not differ from Object relatives = 10. In comparison, the number Match condition accuracy was 9.71 and there was a higher level of accuracy with sentences containing number Mismatch = 10.67.

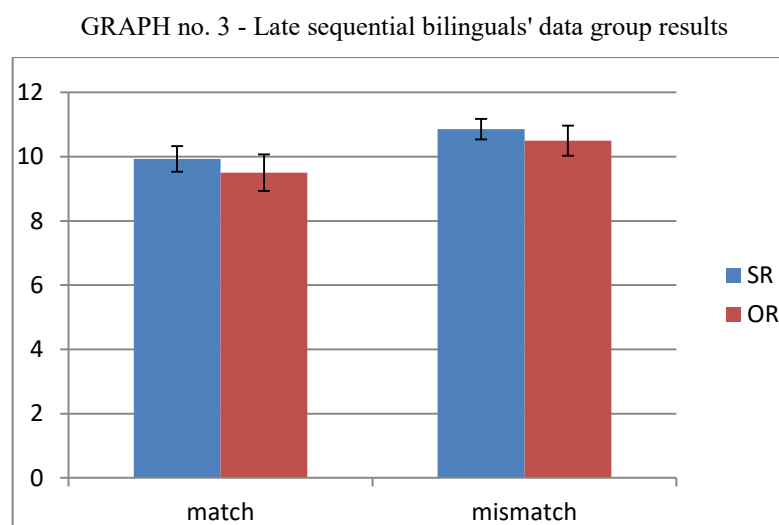
TABLE no. 7 - ANOVA test: Late sequential bilinguals' data group results

	F-ratio	P - value
Type	0.71	0.402
Match	4.29	0.043
Interaction	0.005	0.939

As the p-value of the Match and Mismatch is smaller than 0.05, we managed to reject the null hypothesis that there is no difference between number Match and Mismatch. Thus we can assume that Late sequential bilinguals are more sensitive to Match and Mismatch of number rather than to sentence type of Subject and Object relatives.

There was a strong effect of Mismatch, which confirms the previous research by Adani (2014, p. 816) who concluded that "overall, children were significantly more accurate in Mismatch-feature-value conditions, but it was also shown that the size of this effect was larger in the number condition."

In Graph no. 3 seen below, we can observe the main effect of Match when columns of the same color are compared. As the two columns representing Match and Mismatch Subject relatives have significantly different heights and the same counts for the Object relative columns, we can see that number Mismatch conditions are more accurate than number Match conditions. The error bars show consistency within the group, and were created on the basis of Standard Error that equals the Standard Deviation divided by the square root of the sample size ($\sqrt{14}$).



In conclusion, Late sequential bilinguals, who were exposed to L2 for the shortest amount of time, showed once again a slight change in performance compared to the previous group of Early sequential bilinguals and a more noticeable change compared to the first group of simultaneous bilinguals. They showed high sensitivity to number Match of the markedness feature but, in contrast to the other two groups, there was no significance in the effects of sentence type.

4. Overall performance

Despite this important variation among the pattern of performance among the groups, it is interesting to note that, at the time of testing, there was no significant difference in overall accuracy among the groups.

5. Additional correlations

Using the data from the additional psychological testing, we found correlations in the background variables.

We did not find any significant correlation between nonverbal working memory (Digit Span) and fluid intelligence (Raven matrices), $r(43) = 0.15, p > .05$.

Furthermore, there was no significant correlation between verbal working memory (CNRep) data and fluid intelligence (Raven's matrices), $r(43) = 0.16, p > .05$.

We assumed there would be a correlation between the nonverbal (Digit Span) and verbal working memory (CNRep) as these data both represent verbal memory; however, we did not find any significant correlation, $r(43) = 0.16, p > .05$.

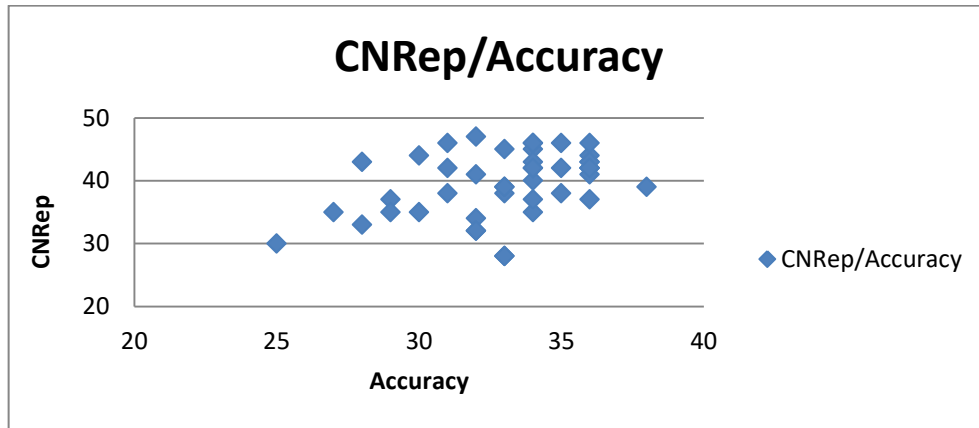
On the contrary, a rather interesting correlation showed when we put into the query the results of the verbal memory test with the accuracy achieved in the main syntactic test. We assumed there would be a correlation between nonverbal working memory (Digit Span), verbal working memory (CNRep) and accuracy, and that assumption was confirmed. With Digit Span and accuracy, the two variables were marginally correlated, $r(43) = 0.22, p = 0.073$ (Table no. 10). However, with CNRep and accuracy, the two variables were strongly correlated, $r(43) = 0.36, p = 0.012$. Therefore, we can assume that there is a correlation between verbal, non-verbal working memory and accuracy in this type of syntactic testing.

TABLE no. 8 - Correlation between Digit Span, CNRep and accuracy

	DF	r	p
Digit span/accuracy	43	0.22	0.07
CNRep/accuracy	43	0.36	0.01

The graph below (no. 4.) shows a positive correlation between verbal working memory (CNRep) and accuracy, which increase in tandem in the recorded results.

GRAPH no. 4 - Correlation of verbal working memory (CNRep) and accuracy



Discussion

The comprehension of Subject Relative and Object Relative clauses with matching and mismatching number features on subject and object Determiner Phrases was assessed in three groups of bilingual children divided on the basis of their L2 age of onset. The goal of the present study was to investigate how the age of onset (which in this study correlates with the input of L2) might impact the nature of child language development and language comprehension.

Our main finding is that the number Match is of greater importance for the subjects with later L2 onset and that type of sentence is of decreasing importance as the age of onset increases. That is, for simultaneous bilinguals, sentence type plays a more important role when they try to interpret the given relative sentences correctly. For early sequential bilinguals, the sentence type still matters, but they already find the number Match important. On the rightmost side of the tested bilingual age of onset related spectrum, the late sequential bilinguals rely mostly on the number Match feature when trying to interpret relative sentences. Therefore, the earlier age of onset/ more input of L2 (English), the more the bilinguals assess Relative clauses by sentence type. Put another way, the later the age of onset/ less input of L2, the more bilinguals rely on the use of other morphological cues – e.g. the markedness feature of number on the two Noun Phrases - to facilitate the comprehension of Relative clauses.

Overall, there was higher accuracy across the groups where one Determiner Phrase was singular and the other was plural, meaning in sentences with number Mismatch. In conditions where both Determiner Phrases had identical morphological number marking, the accuracy was lower in all groups of children. As was expected from previous research (Adani et. al., 2014), overall, most bilingual children performed less accurately on Object relative sentences, which they perceived as harder compared to Subject relative sentences.

Below, I will discuss the above-mentioned findings in light of the existing psycholinguistic approaches to the comprehension of relative clauses and the language development of bilingual children.

Age of onset/first exposure and Relative Clauses comprehension

First, it is important to map the impact of the age of onset on the basis of which our groups of participants were divided. As explained in the Theoretical Background (2.2.3.), there is a lively ongoing debate in the field as to whether there is a so-called "sensitive period" in language development that would give certain boundaries to the optimal age of acquisition of particular linguistic information. In other words, researchers look for important age milestones in which the child would most optimally learn particular grammatical word types, syntactic knowledge, vocabulary, etc. It is usually assumed that bilingual children exposed to two languages from birth follow the language developmental timetable of monolinguals for each of their languages (Kovelman et. al, 2008a). However, in today's mobile society we often encounter children with varying ages of first bilingual exposure, ranging from a few days to several years after birth (Kovelman et. al, 2008a). The nature of such bilingual development has, however, received very little scientific attention and our thesis attempts to contribute to this gap in the research.

Among the studies that would consider the age of first bilingual exposure as a factor in dual-language development in bilingual children, the study of Kovelman, Baker & Petitto (2008) stands out. The authors observed the impact of age of onset with the use of reading-related tests on Spanish-English bilingual children that were first exposed to the L2 between the ages of 0 – 6. Their goal was to find out if the age of first bilingual exposure contributes to whether a young bilingual is normally developing or whether he or she has a reading problem or a possible learning disability. Their group of Early bilinguals (corresponding to our group of Simultaneous bilinguals) performed the same way as native speakers of Spanish and English on the standardized Language Competence/Expressive Proficiency assessment. Moreover, they showed language development equal to monolingual speakers their age. Late sequential bilinguals, instead, showed atypical patterns. Yet, what Kovelman et al. measured was the optimal performance and best language competence as they searched for the positive effect on reading and phonological awareness in both languages on the basis of overall performance of their subjects. In comparison, our present study, which observes the

character of language behaviour in bilingual children, did not focus on reading and phonology, but rather on complex syntax.

In some studies' designs, a question arises as to whether it is the age of first bilingual exposure or the intensity of exposure/input or even the amount of years of exposure that matters most in bilingual performance, development and behaviour. Kovelman et al. (2008a) conclude that what makes the difference is the age of exposure, as there has been found a significant distinction between subjects exposed to L2 before 3 years of age and subjects exposed to L2 after this milestone, and no difference between simultaneous bilinguals and monolinguals. An important amount of language competence acquisition happens by the age of 3 (or 4, as suggested on the basis of morpho-syntactic development by Meisel, 2009). The results of the present study are consistent with this claim, as only the simultaneous bilinguals demonstrate a native-like performance, and the other two groups show a gradual shift in the patterns of language comprehension based on the field of syntax and morphology.

Tsimpli (2014) tried to disentangle the effects of age of onset from those of amount of input in the L2. In her review paper, the author concludes that macroparameters and microparametric properties (i.e. core syntactic phenomena) of the given languages are more sensitive to age of onset, whereas late phenomena (i.e. phenomena that rely on language external resources, such as working memory) are more subject to input. Unsworth et al. (2014) explored the development of gender acquisition in Dutch and Greek bilinguals with the aim of disentangling the effects of varying amounts of input from the age of onset in the linguistic development of child bilinguals. Their final analysis suggested that: "a complex interplay between the factors of input quantity and age of onset play a role" (2014, p. 15). Interestingly, the cross-linguistic influence between the two given languages is also sensitive to both these variables (Tsimpli 2014). Nevertheless, the role of these variables is still a question, which I will try to address below.

In our case, the information regarding the amount of input of our subjects has been extracted from parental questionnaires and the age of onset correlates with the amount of input/ length of exposure to L2 (English) in the tested sample of children. Therefore, the age of onset in our case is directly related to the number of years of exposure. In

other words, amount of input was smaller for Late sequentials compared to Early sequentials, and smaller for Early sequentials as compared to simultaneous, in our sample.

When we observe the linguistic behaviour among the groups involved in our study, Simultaneous bilinguals showed significant effects of both syntactic sentence type and match of the marked feature of plurality, yet the latter was only marginally significant. On the contrary, Early sequential bilinguals (1-3 years) showed a significant effect of these two language phenomena with reversed significance – match in the markedness feature being highly significant and sentence type only marginally significant. The last group of Late sequential bilinguals differed even more and showed a significant effect of the feature of match of morphological markedness only and not a sentence type effect anymore. Therefore, we can clearly see that language comprehension patterns shift gradually across our bilingual groups and they clearly depend on the age of first exposure together with the correlating amount of input.

Interestingly, there was no significant difference found in the overall accuracy in relative clause comprehension in our sample of children at the time of testing.

In the paragraphs below, I will further discuss the reasons of such linguistic behaviour in bilinguals based on the available literature and research.

Markedness feature of number effects in Relative Clauses comprehension

As Adani et al. point out in the discussion of their study:

“A number of recent psycholinguistic studies investigating on-line processing, production, or comprehension abilities in adults and Typically Developing children have shown that relative clauses difficulty can be modulated in experimental contexts [and] these effects can be traced back to the nature of linguistic constituents that appear in the sentence. It is now established that Object Relative clauses with two full Determiner Phrases are harder to interpret than Object Relatives where one argument is a full Determiner Phrase and the other is a pronoun, a proper name, a quantified expression, or another nominal constituent of a different structural type and that feature dissimilarity also plays a role (2010, p. 833).”

According to the predictions of Adani et al. (2014), mismatch in the number of the NPs involved in a relative clause should be one of the features that cause facilitation in comprehension. Later in her research, she confirms this prediction on a control group of Typically Developing children and on a group of children with specific language impairment (SLI). These results were also confirmed by all our tested children in the same experimentally modified linguistic context. Considering that centre-embedded Object relative clauses are deemed to be, even for adults, harder than right-branching Subject relative clauses, Match and Mismatch of the markedness features of number were included in the design to investigate whether they would significantly impact comprehension (Adani et. al., 2014). Tsimpli & Dimitrakopoulou (2006, p.1) base their study of Greek – English bilinguals on recent second language acquisition theories that account for dissociation between syntactic knowledge and morpho-phonological, and argue that some linguistic features are less accessible to the learner for their setting in the L1 grammar and have constraints on their learnability. “Uninterpretable formal features, such as (subject, object) agreement, cause learnability problems even at advanced stages of acquisition,” they conclude (2010, p. 237). In line with this analysis, our results seem to suggest that such features as the Subject/Object relative type of sentence may be harder to acquire as a feature of syntactic complexity compared to the more straightforward morphological features of match in number markedness.

As mentioned above, our results show that the later the age of onset/ less input, the more probable the reliance of a bilingual on the morphological features is. Also, across all of our groups, accuracy was higher in sentences containing mismatch in the markedness feature of number. This suggests that morphological feature dissimilarities are prominent and make the relations between a verb and its arguments more explicit, which in turn leads to easier sentence comprehension (Adani et al., 2014).

Another possible explanation for our results could be the fact that the markedness feature of number has a double nature, representing not only the morphological aspect, but the semantic aspect as well. When formal markedness is concerned, the plural is morphologically marked, and the singular remains unmarked in the typologically frequent pattern. De Swart & Farkas (2010) add the notion of markedness in terms of semantic complexity. In their analysis, they propose that the plural morpheme is

semantically relevant whereas “the singular form is not contributing any number restriction on its own, but acquiring one when in competition with the plural form” (2010, p. 1.).

With regard to the present study, we can assume that the semantic nature of number plays a role for Late bilingual children. Due to their later age of onset and shorter time of exposure/input, they have less access to developed syntax than their simultaneous bilingual peers. Therefore, they subconsciously use the aid of the morphological cues that, however, also carry a semantic value. In our test, it was the morphological manipulation of Match only that showed to be of more importance for children who were first exposed to two languages later than at 1 year of age. Yet, because morphologically marked forms are considered also semantically marked in the above-mentioned analysis (De Swart & Farkas, 2010), we can conclude that the semantically marked information of the markedness feature of number is contributing to the late bilingual children’s ability to comprehend the sentences. This all leads us to the realisation that morphological markers carrying appropriate semantic features *do* help to identify grammatical relations between sentential constituents and improve the comprehensibility of relative clauses.

Subject vs. Object Relative sentence types in Relative Clauses comprehension

When we look at the other effect observed in the experimentally modified context of the present test, the sentence type effect of Subject vs. Object relative, we can clearly see that this manipulation is purely syntactic. The expectation that the two types will be processed differently by bilingual children was confirmed only for the simultaneous bilinguals in our sample. Adani's results, as well as ours for the simultaneous group, confirmed that it is harder to comprehend Object relatives than Subject relatives. In their paper, Adani et al. account for this by saying “both structures are derived by syntactic movement but the presence of non-canonical word order in Object relatives makes any semantic strategy less likely to lead to success” (2014, p. 813). The monolingual children in their study showed the same linguistic behaviour as Simultaneous bilinguals in our study. One possible explanation could be that these children are not as open to non-canonical word orders, which leads to the fact that

Object relatives pose greater difficulty for them. Late sequential bilinguals, on the other hand, could be more open to non-canonical word orders, as their second language is slightly more dominant for them and could possibly influence their linguistic behaviour (i.e. Czech word order is more flexible than English).

Late sequential bilinguals and even Early sequential bilinguals did not show highly significant effects based on type of sentence. We can try to look for a possible explanation of such linguistic behaviour, as Tsimpli (2014) suggests, in the cross-linguistic influence that could, among other things, affect the perception of word-order in some languages. In her study of Italian-Sardinian bilinguals, Garaffa provides an overview of several authors that also support the results of the present study:

"Dopke (1998) and Yip and Matthews (2007) reported cross-linguistic effects of one language on the other at the syntactic level, from the dominant language, or the language of the environment, to the weaker language. The effects of dominance and of the amount of input in the weaker language are solidly attested. Bernardini and Schlyter (2004) found syntactic effects of Swedish on Italian and French in Swedish-dominant bilinguals." (2015, p. 2)

She herself found an atypical pattern. In fact, her results showed that Sardinian - Italian bilingual children are slightly better at comprehending object relatives than monolingual children (Garaffa, 2015). Müller & Hulk (2001) present an argument that states that morpho-syntactic and discourse structures are vulnerable to cross-linguistic influence in a bilingual child's language development. In relation to the cross-linguistic influence of morphological features, Unsworth et al. (2014) demonstrated in their sample of English-Greek/Dutch bilinguals and Greek/Dutch monolinguals that the differences between the morphological cues for gender marking in the languages involved are important and play a role. They observed a significant cross-linguistic impact of Dutch, which offers limited input cues for gender, and of Greek, which offers a consistent morphological pattern of gender. Thus, the English-Dutch bilinguals did show an influence on the grammatical gender in their English, whereas the English-Greek bilinguals did not.

Most relevant to our results would be the analysis of Kovelman et al. (2008b), in which processing of Subject and Object relatives is observed on English – Spanish bilingual children with similar ages of onset as in the present study. They also address

the role of sentence type in their investigation of bilinguals and claim that comprehension of these structures also depends on whether the bilingual is more influenced by word order constraints in English or prominent morphological markings in Spanish. Relevant to the present thesis, they explain that English belongs to the analytic/syntax base class of world languages and so relies mostly on strict word order. In English, changes in word order can result in changes in meaning, e.g. in sentences “*Becky kicked Jim*” and “*Jim kicked Becky*”. the position of the constituents in the sentence is crucial for meaning comprehension (i.e. who did what to whom) and is used rather than adding subject-object morphological markings on individual words of the sentence. Compared to other types of languages, English thus relies much less on morphological markings. On the other hand, languages with synthetic (fusional/inflected) features like Spanish or Czech rely often on morphology and, in comparison with English, are less strict with word order. Consequently, in Kovelman's results, monolingual speakers together with Simultaneous bilinguals found word order information more salient than the marked morphological features. Nevertheless, it is important to note that they did not ignore the morphology completely. Our results also completely support the finding that bilingual children exposed longer and earlier to a more synthetic language, such as Spanish, pay greater attention to morphological information rather than to syntactic cues (Kovelman et. al., 2008b).

In light of the present study's results, Spanish could be substituted by Czech which is an even more heavily inflected language with heavy reliance on morphological markings. The cross-linguistic influence of Czech can be seen already in Early sequential bilinguals who showed significant effect of Match and Mismatch of the markedness feature of number, but even more obviously in Late sequentials. This could be a possible explanation for the fact that our group of Simultaneous bilinguals found the syntactic cues of sentence type most salient, whereas the other two groups of Sequential bilinguals showed a higher impact based on morphological information. Thus, the group of simultaneous bilinguals who were exposed to English earliest (age of onset) and for the largest amount of time (input) had a strong sensitivity to the syntactic manipulation which is very relevant in English and not as influential in Czech. On the other hand, the children who were first exposed to Czech after birth and subsequently to English at some point of their early linguistic development already took the prominent

morphological patterns of Czech language and transferred their use as an easier cue for faster comprehension in the L2, English.

We would like to conclude this section with a remark regarding the possible future outcomes and uses of the presented results and their implications. It has been shown that bilingual linguistic behaviour and language perception differ in relation to the given child's age of onset and amount of input. One important implication of our findings is, thus, the fact that it is crucial to consider the child's first exposure to the given language when evaluating whether a bilingual shows normal language development. We do expect some atypical development in children that are exposed to their second language after a certain time threshold. Moreover, the results have revealed that different comprehension strategies are used by various age-of-onset-related bilingual groups. Early L2-exposed children rely more on syntactic information, whereas children exposed later to the L2 are guided by morphological and semantic information. The reliance can be caused by the different structural types of the involved languages, in our case English and Czech. As Garraffa et al. hinted, comprehension data seem to suggest that bilingual children adopt potential alternative strategies when processing syntactically complex structures, and we should bear this in mind when addressing bilingual development.

Conclusion

The present study focuses on syntactic and morphological processing in bilingual children, and aims to partially fill a gap in the research of the effect of time of exposure to an L2 in primary-school-aged bilingual children. Comprehension was tested with syntactically-complex items - relative clause sentences - that contained both morphological and syntactic manipulations. A key part of this research was to provide an insight into bilingual behavior across various ages of first bilingual exposure.

Scientific background regarding the present topic has been presented in detail in the Theoretical part. Previous research has shown that age of exposure to L2 may have an important impact in the development of reading abilities in children (Kovelman et al., 2008a). However, there were limitations to the knowledge of the causes of the effect of L2 age of onset, and little was known about verbal (spoken) comprehension differences among children with various L2 times of onset. In particular, during the testing and the analysis sections of this thesis, Adani's et al.'s (2014) study of relative clauses comprehension in children with G-SLI was an important source of information. Her control monolingual group results were taken into account several times for the purpose of this thesis, and we showed that our group of simultaneous bilinguals in some ways corresponds to Adani's group of monolinguals.

Our results revealed that different comprehension strategies are used by various bilingual groups with different ages of onset. Our group of Simultaneous bilinguals showed more reliance on syntactic information contained in the relative clause (Subject relative/Object relative). The other two groups of Late and Early Sequential bilinguals showed more sensitivity to number manipulations. This sensitivity was related to the age of onset of each group; in other words, the later the children were exposed to the L2 (i.e. English) for the first time, the more sensitive to morphological manipulations they were. Thus, we can observe that bilingual linguistic behavior and language perception differ in relation to the given child's age of onset and amount of input. Also, different comprehension strategies are used in accordance with these variables.

In the Discussion part we presented some possible reasons for such outcomes, mainly the cross-linguistic influence of the bilingual's two languages, especially when there are different structural types of languages involved. An important implication came to light in our findings that it is normal to expect some extent of atypical development in bilingual children that are exposed to a second language after a certain time threshold, since they adopt potential alternative strategies when processing syntactically complex structures.

It is thus also necessary to consider the child's first exposure to the given language when evaluating whether a bilingual shows normal language development. In other words, children with a late age of onset may show patterns of performance that appear atypical on the surface, but that are instead completely normal given their specific background and experiences.

The alternative strategies in the comprehension of syntactically complex sentences revealed and described in this study, i.e. the impact of morphological and/or syntactic information as cues, allow for further implementation in practical language teaching strategies or in therapies for children with language impairments. Nevertheless, because we used a behavioral method with certain intrinsic limitations and intra-individual variability within the three groups of children, it would be convenient to further investigate the issue. As the study addressed only one linguistic phenomenon (i.e. Relative clauses), it would be possible to execute consequent investigation in this manner, yet on other linguistic phenomena (e.g. passives, pronouns, etc.) in order to further map the linguistic behavior and language perception of bilingual children in relation to their age of first exposure to their L2.

Resumé - Shrnutí

Tato práce je zaměřena na fenomén bilingvismu, který je v dnešním světě běžným prvkem každodenního života. Je běžné setkávat se s dětmi, které vyrůstají ve vícejazyčném prostředí již od narození, či začnou přicházet do styku s druhým jazykem v prvních několika letech života. Všechny tyto jedince pak považujeme za bilingvní. Přestože existují rozsáhlé výzkumy na téma bilingvního jazykového vývoje, vyvstává dodnes mnoho nezodpovězených otázek ohledně fungování dvou jazykových systémů v lidském mozku i ohledně jazykového chování bilingvních jedinců a jejich vnímání jazyka jako takového. Ani vývojové vzorce rozvíjející se během doby, kdy bilingvními děti osvojují řeč, nebyly ještě zcela pochopeny a detailně prozkoumány. Proto se tato studie věnuje některým základním otázkám z oblasti bilingvního vývoje dětí. Především se zde zabýváme těmito otázkami: má doba působení druhého jazyka vliv na schopnost porozumět jazyku u mladých bilingvních jedinců? Zpracovávají dvojjazyčné děti syntaktické a morfologické prvky jazyka stejným způsobem jako děti jednojazyčné? Tato práce tak mapuje syntaktické a morfologické fungování jazyka u bilingvních jedinců a jejím cílem je doplnit chybějící části výzkumu, který se týká vlivu doby působení druhého jazyka na dvojjazyčné žáky základních škol. Dobou působení druhého jazyka rozumíme věk, od kterého začalo být dítě poprvé vystavováno druhému jazyku v každodenním životě. Testovacím prvkem bylo porozumění syntakticky komplexním vztažným větám, které obsahovaly jak syntaktickou, tak morfologickou experimentální manipulaci. Hlavním bodem tohoto výzkumu bylo přinést vhled do jazykového chování bilingvních jedinců napříč různými dobami působení druhého jazyka.

Teoretický úvod

Tato práce vznikla na základě odborné literatury na téma bilingvismu, psycholingvistických modelů větného porozumění a výsledky této studie jsou interpretovány ve světle relevantních výzkumů v dané oblasti. Teoretická část práce se zabývá obecnými rysy a charakteristikami bilingvismu, shrnuje základní poznatky a výzkumy na toto téma a poskytuje přehled jazykového vývoje zaměřeného na dvojjazyčné děti.

Předchozí vědecký výzkum Kovelmanové a kol. (2008) týkající se tohoto tématu ukázal, že doba působení druhého jazyka může mít u dětí významný vliv na schopnost čtení. Autoři měřili vliv doby působení druhého jazyka na čtení a fonologickou vnímavost. Na základě mapování obecné jazykové kompetence testovaných dětí se snažili rozlišit, zda se z jazykového hlediska bilingvní dítě vyvíjí normálně, nebo zda vykazuje známky možného vývojového problému v oblasti řeči. Jejich výsledky ukázaly, že děti vystavené působení dvou jazyků od narození se vyvíjejí v obou daných jazycích stejně jako jejich jednojazyční vrstevníci, zatímco děti, na které začal druhý jazyk působit v pozdějších fázích raného dětství, vykazovaly jiné vzorce jazykového chování. V této zmiňované studii (Kovelman et al., 2008) však narážíme na jisté limity, co se týče objasnění důvodu daného vlivu doby působení druhého jazyka. Dosud byl velmi málo probádán i vývoj schopnosti porozumět jazyku u dětí s různou dobou působení druhého jazyka. Tato práce se zabývá právě tímto tématem a přináší nové poznatky o vlivu doby působení angličtiny u dvojjazyčných dětí.

Na teoretické rovině jsme se opírali i o dostupnou studii Tsimpli (2012), která zkoumá roli doby a intenzity působení druhého jazyka a dává tyto faktory do jazykovědné perspektivy. Pro naši studii je zde zásadní její pojednání o vztažných větách, které jsou hlavním prostředkem pro testování v našem experimentu. Autorka popisuje vztažné věty jako komplexní strukturu, která je u každého typu jazyka osvojována v jiném věku. Zařazuje tak vztažné věty mezi tzv. "pozdně osvojované jazykové prvky". Právě aktuální věk testovaných dětí v našem výzkumu byl stanoven na základě poznatků Tsimpli, která zmiňuje hranici 8 let věku dítěte v angličtině jako dobu, kdy mají děti již zažitě porozumění a produkci vztažných vět. V tomto smyslu probíhá stále živá debata vědecké obce, zda existují optimální vývojová období, ve kterých si dítě osvojuje jednotlivé jazykové struktury a prvky. Teoreticky si v tzv. "senzitivním období" dítě jazykovou strukturu, prvek nebo slovní zásobu optimálně osvojí a mimo něj již plné osvojení není možné, nebo je neúplné. Pro účely naší studie jsme se opřeli o práci Meisela (2009), který ve své práci stanovuje hranici pro morfo-syntaktický vývoj okolo 4 let věku dítěte. Podle jeho poznatků plnohodnotně rozvinou gramatické náležitosti jazyka pouze děti, které byly vystaveny lingvistickým vjemům daného jazyka před dosažením věku čtyř let. Tento věk představoval hranici mezi našimi skupinami "raně bilingvních" a "pozdně bilingvních dětí." Pro bilingvní děti je však

stanovení hranice senzitivních období stále velkou otázkou a proto se touto prací snažíme přinést nové poznatky na toto téma.

Především během testování a analýzy byla dále důležitým zdrojem studie Adani a kol. (2014), která se zaměřovala na porozumění vztažných vět u dětí se specifickými jazykovými poruchami. Pro účely jejich studie vytvořili test obsahující experimentálně manipulované vztažné věty se všemi možnými kombinacemi typů věty podmětne a předmětne, a zároveň s morfologickými prvky shody a neshody v čísle jmenných frází. Tento test byl použit i v našem výzkumu. Jejich kontrolní skupina jednojazyčných dětí určitým způsobem korespondovala s naší skupinou "simultánně bilingvních" dětí. Proto jsme ze studie Adani a kol. mohli předem vyvodit, že "simultánně bilingvní" děti budou pravděpodobně vnímat předmětne věty vztažné jako obtížnější než podmětne věty vztažné, které mají jasnější syntaktickou strukturu. Mohli jsme také předpokládat, že faktor shody a neshody v čísle jmenných frází bude mít u této skupiny vliv na porozumění vztažným větám. Dále jsme mohli hypoteticky očekávat, že shoda a neshoda v čísle jmenné fráze bude mít větší vliv u dětí s menší zkušeností s druhým jazykem, jelikož je plurál považován za příznakový jazykový prvek v kontrastu s nepříznakovým singulárem. Proto jsme u skupin "raně a pozdně sekvenčně bilingvních" dětí očekávali větší vliv faktoru neshody v čísle jmenných frází v porovnání s výsledky skupiny "simultánně bilingvních dětí". Tento morfologický prvek by měl dětem s menší zkušeností s angličtinou napomáhat rychleji přiřazovat sloveso k dané jmenné frázi spíše než syntaktická struktura a slovosled podmětne a předmětne věty, jež napomáhá jednojazyčným a "simultánně bilingvním" dětem.

Obecně ale z výzkumu Adani a kol. ani z jiných výzkumů nevyplývají žádné další předpoklady pro naše dvě skupiny "raně a pozdně sekvenčně bilingvních" dětí. Kvůli nedostatku výzkumu v této oblasti tak není možné přesněji předvídat, jaký význam budou mít faktory syntaktické a morfologické komplexity na vnímání jazyka u tohoto typu bilingvních jedinců.

Metoda

Testováno bylo 45 bilingvních dětí ze tří mezinárodních škol v Praze, Parklane International School, The Prague British School a International School of Prague, které se společně s rodiči rozhodly pro spolupráci na této studii. Testované subjekty byly

následně rozděleny do třech skupin podle doby působení druhého jazyka (angličtiny), což bylo zjištěno z vyplněných dotazníků rodičů. Skupiny byly následující: "simultánně bilingvní" děti (dva jazyky již od narození), "raně sekvenčně bilingvní" děti (intenzivní styk s angličtinou od 1 - 4 roku) a "pozdně sekvenčně bilingvní" děti (angličtina od 4 let, nejpozději však od 6 roku – začátek základní mezinárodní školy). Průměrný věk účastníků výzkumu byl v době testování přibližně 10 let.

Jak již bylo naznačeno, děti byly testovány na úloze zkoumající porozumění vztažným větám, již vytvořila Adani a kol. (2014). Během testování děti poslouchaly vztažné věty různých typů, namluvené rodilým mluvčím, a jejich úkolem bylo přiřazovat je k příslušným obrázkům (jednomu ze čtyř) na obrazovce počítače. Na obrázcích byla vždy vyobrazena zvířata, u tří pak byly chybně zobrazeny tematické (theta) role aktérů děje. Tři ze čtyř obrázků tak nebyly syntakticky relevantní k namluvené větě na základě informací "kdo, kde a co dělá". Mezi větami experimentu byly obsaženy vztažné věty podmíněné a předmětné. Tyto věty zároveň obsahovaly jmenné fráze, které se buď shodovaly, nebo neshodovaly v kategorii čísla. Tedy buď byly obě fráze v jednotném, nebo množném čísle = shoda; nebo jedna fráze v jednotném, druhá v množném čísle = neshoda. Kombinace všech zmíněných morfologických a syntaktických prvků (podm. a předm. věta vztažná, shoda a neshoda v čísle – sg., pl.- jm. fráze) činila dohromady 48 namluvených vět v testovací baterii. V hlavních větách bylo použito 8 sloves, ve vztažných větách vedlejších dalších 8 tranzitivních sloves a stejný pár sloves se nikdy neopakoval se stejným párem podstatných jmen.

Výsledky

Výsledky této studie odkryly rozdílné vzorce a strategie jazykového porozumění, které tyto tři bilingvní skupiny používaly. Skupina "simultánně bilingvních" dětí se více spoléhala na syntaktickou informaci, jež byla obsažena v typu vztažné věty (velký vliv na porozumění měla syntaktická vodítka vztažné věty podmíněné a předmětné). Ostatní dvě skupiny "sekvenčně bilingvních" dětí byly citlivější na morfologické manipulace, konkrétně tvary shody a neshody v čísle jmenných frází. Tyto změny chování byly ve spojitosti s dobou působení druhého jazyka u každé ze tří skupin. Jinými slovy, čím později byly děti poprvé intenzivně vystaveny druhému jazyku (angličtině), tím citlivější byly na morfologické prvky v namluvených větách, tedy shodu či neshodu v

čísle jmenné fráze. Naopak čím dříve byly děti v kontaktu s oběma jazyky, tím více se spoléhaly na syntaktickou stavbu věty, tedy konstrukci věty vztažné podmíněné či předmětné. Doba působení druhého jazyka tak byla potvrzena jako relevantní faktor při změnách v jazykovém chování bilingvních dětí. Můžeme tedy konstatovat, že jazykové chování a vnímání jazyka se různí v závislosti na tom, jak dlouhá je doba působení druhého jazyka v životě bilingvního jedince. Ten pak v závislosti na těchto faktorech volí různé strategie pro jazykové porozumění.

Diskuse

V kapitole Diskuse prezentujeme možné důvody těchto výsledků. Jedním z hlavních důvodů pro rozličné jazykové chování dvojjazyčných dětí může být vliv jednoho jazyka na druhý, především ve chvíli, kdy dítě funguje ve dvou typově a strukturně odlišných jazycích. Jelikož je čeština flektivním jazykem, můžeme s tímto faktem spojovat výsledek, že sekvenčně bilingvní děti spoléhaly více na morfologická vodítka daných vět (shodu a neshodu v čísle jmenných frází). Použití této jazykové strategie potvrzuje právě skupina "pozdně sekvenčně bilingvních" dětí, u které bylo toto jazykové chování nejmarkantnější. Na druhé straně angličtina jako analytický jazyk spoléhá spíše na syntaktické prvky a slovosled, což potvrzuje naše skupina "simultánně bilingvních" dětí s nejdelsí dobou působení angličtiny. Ty se v porozumění spoléhaly na typ vztažné věty podmíněné nebo předmětné.

Všechny ostatní hypotézy týkající se skupiny "simultánně bilingvních" dětí, které odpovídaly jazykovým chováním jednojazyčným dětem, byly v naší studii potvrzeny. Potvrdil se i předpoklad, že tyto děti budou pravděpodobně vnímat předmětné věty vztažné jako obtížnější než podmíněné věty vztažné, a to u všech třech skupin. S předchozími studiemi se také shodujeme na vlivu faktoru shody a neshody v čísle jmenných frází při porozumění vztažným větám.

Důležitým poznatkem, který plyne z této studie, je to, že u bilingvních dětí je normální očekávat do jisté míry atypický jazykový vývoj závislý na určité časové hranici. Bilingvní děti uplatňují rozličné strategie při zpracování syntakticky komplexních větných struktur v závislosti na době působení druhého jazyka. Tento faktor je také vhodné zvážit, pokud vyhodnocujeme, zda dvojjazyčné dítě vykazuje

znaky normálního jazykového vývoje. Jinými slovy, děti s pozdější dobou působení druhého jazyka mohou vykazovat zdánlivě atypické znaky jazykového vývoje, tento fakt však může být naprosto normální vzhledem k jejich atypické dvojjazyčné zkušenosti.

V souhrnu tato práce přináší vhled do lingvistické povahy bilingvismu a blíže mapuje jazykové chování bilingvních jedinců, především vývoj řeči u bilingvních dětí. Jsou zde odkryty alternativní strategie pro porozumění syntakticky komplexním větám, konkrétně strategie, jež využívají syntaktické a/nebo morfologické jazykové prvky jako vodítka v porozumění. Tyto strategie mohou být prakticky využity a zahrnuty například do výuky a terapie dětí s jazykovými obtížemi či poruchami. Je však potřeba mít na paměti, že v této studii byla použita behaviorální metoda, která v sobě nese určité limity, týkající se možností individuální variability testovaných dětí v rámci daných třech skupin. Bylo by proto vhodné dále testovat získané výsledky na dalších subjektech. Studie byla také provedena pouze na jediné jazykové struktuře, vztažných větách, a bylo by proto vhodné ověřit dané výsledky podobným způsobem na jiném komplexním jazykovém jevu (např. pasivech, zájmenech), a dále tak mapovat jazykové chování a vnímání jazyka u bilingvních dětí ve vztahu k době působení druhého jazyka.

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