Lexical Development in Early Sequential Bilinguals: Evidence from Child Heritage Polish

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DECLARATION

I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of Doctor of Philosophy is entirely my own work, and that I have exercised reasonable care to ensure that the work is original, and does not to the best of my knowledge breach any law of copyright, and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work.

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DAT – Dative
DIM – Diminutive
FEM – Feminine
INF - Infinitive
IPFV – Imperfective
LOC – Locative
MASC – Masculine
NEG – Negative
NOM - Nominative
NVIR – Nonvirile
PFV – Perfective
PL – Plural
PRO – Pronoun
REFL – Reflexive
SING – Singular
VIR – Virile

ABSTRACT

Lexical Development in Early Sequential Bilinguals: Evidence from Child Heritage Polish

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This thesis investigates lexical development in early sequential bilinguals based on cross-linguistic data from thirty-eight Polish-English speaking children and twenty-four age-matched Polish monolinguals. Using a variety of methods, we examine the nature of lexical development, and potential shifts in relative language dominance in child heritage speakers of Polish across the primary school years. The aim of this study is to evaluate early changes in heritage lexical acquisition, their characteristics and the age at which they occur, and to determine whether they form a pattern that precedes and leads to a switch in language dominance in middle childhood. A new test, the Child HALA, is introduced to measure shifts in relative language strength by comparing lexical accuracy and access between two languages. This test has been designed specifically for use with children, and is based on the HALA psycholinguistic tool (O'Grady et al. 2009).

The results show that child heritage speakers of Polish display overall levels of noun acquisition comparable to monolinguals. However, we note that they demonstrate slower language access, and a reduced range of lower-frequency nouns when compared with monolinguals. Their relative language dominance shifts from the initially stronger Polish to the more dominant English between the age of eight and eleven. On the basis of the findings we establish a timeline of changes in heritage lexical acquisition from the onset of continuous exposure to the majority language to the switch in language dominance. We also find that the Child HALA test produces reliable results across age groups and languages when compared with other methods of measuring lexical proficiency, and therefore proves to be a valid method in assessing language strength and maintenance in children.

CHAPTER 1

INTRODUCTION AND THEORETICAL ASSUMPTIONS

1.1 Introduction

This thesis investigates the nature of lexical development in child heritage language. Child heritage speakers display uneven progress in the acquisition of their two languages that leads to a switch in language dominance in middle childhood from the initially stronger minority language to the majority language (e.g. Kohnert, Bates and Hernandez 1999, Jia et al. 2006, Jia, Aaronson and Wu 2002, Oller and Eilers 2002). In comparison with the monolingual pattern of acquisition, the child heritage lexicon develops at a slower rate in both receptive and expressive domains (e.g. Jia et al. 2006, Oller, Pearson and Cobo-Lewis 2007, Bialystok et al. 2010). The differences are not only quantitative, in terms of the size of the lexicons in the two languages, but also qualitative, as studies highlight the impact of restricted sources of input on vocabulary richness in heritage speakers.

The above studies have demonstrated that reduced input in the minority language, and an increasing exposure to the majority language result in slower progress in lexical acquisition in the minority language, and a switch in language dominance in middle childhood. However, there is insufficient evidence documenting the gradual changes in the lexicon of young heritage speakers that occur before the onset of the shift in language dominance. According to Silvina Montrul (2008), research on bilingual children whose exposure to the majority language starts when they begin

primary school, around the age 4 - 6, is still relatively scarce in the fields of bilingual language acquisition and psycholinguistics. On the other hand, there is a relatively substantial body of research on bilingual children who acquired both languages from birth, and on adult language acquisition. Additionally, Montrul claims that there have not been enough studies that document and analyse the interaction of the two languages across the school years.

The aim of this study is to examine the acquisition of the lexicon in child heritage speakers across the primary school years, and to evaluate the characteristics of early changes and the age at which they occur prior to a switch in language dominance.

The following research questions will be addressed in this study:

- What stages of development, stagnation or decrease does the heritage lexical system go through in primary school children?
- Can we identify evidence of early changes in the acquisition of the heritage lexicon that precede and lead to a switch in language dominance?

In order to answer the research questions, we first analyse changes in heritage lexical acquisition as compared with the monolingual pattern of development. Then, we trace parallel lexical acquisition of heritage Polish and the majority language English, in the context of a growing proficiency in English, and of the fluctuations in the relative strength of the languages. Finally, we correlate the outcomes to assess if the earlier documented changes in the acquisition of the heritage lexicon correlate with the pattern of parallel lexical development in both languages, and if they can be identified as early indicators of the switch in language dominance in middle childhood.

The results of this study are based on cross-linguistic data obtained from thirty-eight Polish-English bilingual children and twenty-four age-matched monolingual speakers

of Polish. The heritage speakers acquired Polish from birth in the context of home and family, and their consistent exposure to the majority language English began with the onset of schooling. The children are aged between 4;6 and 13, and are divided into four age groups that span the primary school years. In order to answer the research questions, we employ two methods: narrations of the wordless picture book *'Frog, where are you?'* by Mercer Mayer (1969)[1] and the Child HALA psycholinguistic test. The test is a picture naming task that compares relative lexical accuracy and speed of response time in order to evaluate relative language strength in two languages. It is a new version of the HALA tool (O'Grady et al. 2009) that has been developed specifically for use with child subjects by Bożena Dubiel and Eithne Guilfoyle.

The narrations provide data on lexical development in heritage Polish. The data is analysed for noun accuracy, range, and word frequency. The results are compared with the monolingual pattern of acquisition provided by a monolingual control group. The Child HALA test compares relative levels of noun accuracy and speed of response time in the minority language Polish and the majority language English, to trace lexical development in both languages across age spans, and to evaluate a potential switch in language dominance. The results are compared with those of a Polish monolingual control group to allow for a more thorough picture of first language acquisition in a bilingual context.

Prior to the testing sessions, I conducted interviews with the parents of the Polish-English heritage speakers. The data from the interviews provides evidence for the exposure that the children receive in both languages[2].

[1] I will use the term 'Frog Story' to refer to the book throughout the thesis.
[2] See Appendix B for the script of the interview in Polish and English.

1.2 Theoretical assumptions

The research objectives presented in the previous section are analysed in the view of a direct link between the quantitative and qualitative properties of input, in the form of language use and exposure, and heritage lexical acquisition (Pearson et al. 1997, David and Wei 2008, O'Grady and Lee 2011). Previous studies have shown that language acquisition in bilinguals can be uneven as the development of each system relies on the amount of language exposure and use, which in bilinguals is divided between two languages. Due to sociolinguistic and environmental factors, such as, for example, schooling, motivation and language attitude, the exposure to one language, usually to the majority language, is greater and more varied than to the other, in most cases the heritage language. As a result of this imbalance in input, the acquisition of the heritage language might be hampered (Meisel 2006, Treffers-Daller, Özsoy and van Hout 2007).

The role of input as an important factor in bilingual language acquisition has been generally acknowledged, however, the scale of its influence is still under discussion. For example, according to Gathercole and Thomas (2009), the quantity of input and continued exposure to the minority language are not only directly tied to the level of acquisition in that language in both children and adults, but also stand as the most influential factors in the success or failure of language development and maintenance. On the other hand, Paradis et al. (2011) propose that input cannot be viewed as the sole or most crucial factor in facilitating language acquisition, and argue that properties of the target structure, such as its complexity, should also be considered in the assessment of heritage language acquisition.[3]

While there is less agreement on the impact of input on morphosyntactic

[3] See Dominguez 2009 and Blom 2010 for a more detailed discussion of the impact of input on bilingual language acquisition from different theoretical perspectives.

development, there is a general agreement on the impact of input on lexical acquisition (Hoff and Naigles 2002). It has been widely agreed that lexical acquisition depends to a great extent on continuous input and frequency of language exposure and use, and therefore it has been shown to be affected in bilinguals (Benmamoun, Montrul and Polinsky 2010, Paradis 2010). As word learning generally depends on two factors, i.e. frequent and repeated opportunities to hear words and exposure to a variety of registers (Hart and Risley 1995, Montrul 2010), previous studies have considered the restrictions and limitations of both quantitative and qualitative input on lexical development in bilinguals (e.g. Paradis and Navarro 2003, de Houwer 2007, 2014). The quantity of language exposure plays a crucial role in lexical acquisition, however, the quality of input which is influenced by varied sources of exposure impacts speakers' lexical richness in different registers. According to de Houwer (2007), in a bilingual setting it is not uncommon that a child is exposed to a language from only one or two people (usually parents or carers), and therefore the child's lexical abilities are shaped by the kind of input they receive in this restricted linguistic environment. The input the child is exposed to has been shown to be influenced by the parents' level of education and socio-economic status (Hart and Risley 1995), language strategies used by the parents (the use of the majority and minority languages and the language policy at home) and the number and order of siblings among others (de Houwer 2009). Additionally, in situations where input is obtained from only a few sources of a particular language, the acquisition is strongly dependent on the variety of language to which the child is exposed to (e.g. specific regional dialect) (Paradis and Navarro 2003). Further restrictions in the quantity and quality of input are brought by schooling and socializing in the majority language and using the minority language solely in the

context of home (Polinsky and Kagan 2007, Rothman 2007).

Previous research has also shown that the impact of input and continuous language use should be considered when comparing bilingual and monolingual language development. Studies have demonstrated that as a result of reduced quantity and frequency of exposure to each of the languages, bilingual children lag behind monolingual counterparts in most linguistic domains in each of the languages[4] (Paradis and Genesee 1996), while in the realm of the lexicon, bilinguals are disadvantaged when taking the size and range in both languages into account (e.g. Umbel et al. 1992, Pearson, Fernandez and Oller 1993, Oller, Pearson and Cobo-Lewis 2007). The reduction and limitations in language exposure and use are also responsible for less variability, restricted contexts and registers that bilinguals experience (Paradis 2010), and a slower rate of acquisition in comparison with the monolingual pattern (Gathercole and Thomas 2009).

[4] Silvina Montrul (2008) summarizes the findings of previous research on the effects of early sequential bilingualism on the development of the L1, and shows that depending on the age of the L2 exposure, core aspects of syntax might be the only intact features (e.g. pro-drop, word order, V2 in German, Swedish or clitics in Spanish). Other language domains usually show developmental errors, L2 induced changes, over-regularization and simplified patterns, e.g. case marking and gender agreement in Slavic languages.

1.3 Organization of the thesis and chapter outline

The thesis is organized as follows:

Chapter 2 presents the theoretical background to this study in light of the research objectives. I begin with a brief presentation of the general characteristics of heritage language acquisition, and then I present findings of previous studies that examined lexical development in child heritage speakers of pre- and primary school age. Next, I discuss the phenomenon of language dominance, and the relationship between language use, access and maintenance.

In Chapter 3, I describe the methodology employed in this study. First, I introduce the participants, including the heritage speakers and their families, and the monolingual control group. I present the heritage speakers' biographic data and their sociolinguistic background. I provide details of the children's exposure to the heritage and majority languages from birth to the present time, I discuss their language use, the family's immigration history, and the ways in which they keep ties with the heritage culture and language. Then, I present the methods and analyses used in the study, and the reasons to combine the particular methods for the purpose of answering the research questions.

Chapter 4 documents the production of nouns in Polish across four age spans in the heritage speakers, and these are compared with a monolingual pattern of development. I examine the impact of word frequency on word choice and lexical substitutions in the narrations of the Frog Story, and show evidence of changes in the path of heritage lexical acquisition and the age in which they occur.

Chapter 5 deals with shifts in relative language dominance in the context of parallel lexical acquisition of heritage Polish and the majority English across the primary school years. In this chapter, I introduce a new test, the Child HALA, that measures

relative language strength in two languages by comparing lexical accuracy and response times. Apart from examining lexical accuracy and access in Polish and English in the heritage speakers, I also compare the scores in Polish in the heritage and monolingual speakers in order to obtain a more thorough picture of heritage lexical development in a bilingual context.

In Chapter 6, I compare the results obtained from the Frog Story narrations and the Child HALA test. I establish a timeline of changes in heritage lexical acquisition in early sequential bilinguals across the primary school years.

In Chapter 7, I draw the final conclusions, discuss the results and their contribution to knowledge, and identify areas for further research.

CHAPTER 2

THEORETICAL BACKGROUND TO THE STUDY

2.1 Introduction

In this chapter, we provide the theoretical background to this study, including a review of theoretical assumptions and findings from earlier studies. This will allow us to place the analyses presented in Chapters 4 - 6 in context, and assist us in evaluating the results. Previous studies have shown that once bilingual children begin formal education in the majority language, they experience a change in the quantity and quality of input they receive in both languages. Their exposure to the minority language becomes reduced and limited to the context of home and the minority language community, while the majority language becomes the language of schooling and often socializing. These circumstances lead to a growing disparity between the amount of input the children receive in the minority and majority languages, and this has been shown to affect their lexical development. The initially stronger minority language becomes less dominant within a few years of the onset of schooling, while the majority language becomes the dominant language. Studies examining various language domains have shown that this switch in relative language dominance occurs in middle childhood, usually between 8 and 11 years of age. However, the exact path of lexical acquisition in the minority language, from the onset of the exposure to the majority language until the switch in language dominance, has not been fully investigated. It has been documented that prior to the

switch in dominance, bilingual speakers display differences in vocabulary size and range in comparison to monolingual peers, however, a precise timeline of those changes with specific age spans during which they occur has not been established.

In this chapter, I begin with a presentation of general characteristics of heritage language acquisition. Then, I review the results of studies that investigated lexical development in pre- and primary school bilingual children, and examine how it compares with the monolingual pattern of acquisition. Following that, I discuss the phenomenon of language dominance, and its shifts in child heritage speakers across the primary school years.

The studies reviewed in this chapter form the background of my research, and of the initial assumptions which led to the formulation of the following research questions:

- What stages of development, stagnation or decrease does the heritage lexical system go through in primary school children?
- Can we identify evidence of early changes in the acquisition of the heritage lexicon that precede and lead to a switch in language dominance?

The research questions are answered in Chapters 4 - 6.

2.2 Bilingualism: a note on terminology used in this thesis

The child heritage speakers referred to in this thesis can also be classified as early sequential bilinguals. While the term 'heritage speaker' relates to a specific type of bilingual that bears sociolinguistic, cultural and geographic connotations, the term 'early sequential bilingual' refers to the age and order of language acquisition.

In a broad sense, heritage speakers are a subset of bilinguals who acquire their first language in a naturalistic, home environment, in a country where another language is officially and commonly spoken (Valdes 2001, Rothman 2007). In this context, the

heritage language is then the minority language, while the official language of the country where the speakers reside is the majority language. According to Polinsky (2011), heritage speakers grow up hearing and possibly speaking one language in a home context, they can understand it, and speak it to some degree, but as they get older, due to a limited exposure to the language outside the home context, they switch to another, more dominant language. In the North American context, for example, a heritage language can be Russian while the dominant language is American English. Despite limited proficiency in the language[5], heritage speakers retain familial ties and cultural interest with the language (Carreira and Kagan 2011).

The term 'early sequential bilingualism' has been used in the field of bilingual language acquisition to refer to the order in which young children acquire two or more languages[6]. Bilingual language acquisition in children can proceed simultaneously, when children are exposed to both languages from birth, and the languages develop together as two first languages[7], or it can take place sequentially, when one language is acquired from birth, and the exposure to the other starts between the age of 3 and 6.

In early sequential bilingualism, in contrast to simultaneous bilingualism, the languages are denoted as first language (L1) for the language acquired from birth, and second language (L2) for the language whose acquisition starts after children acquired a basic command of the first language, which occurs after the age of between 3 and 4 in typically developing individuals (Montrul 2008, Paradis 2008)[8]. In this study, we will adopt the terms L1 to denote Polish and L2 to refer to English

[5] See section 2.3 for discussion of general characteristics of heritage language acquisition.
[6] See Appendix A, for a diagram illustrating bilingual language acquisition as distinguished by two factors: 1) age of acquisition and 2) order of acquisition (Montrul 2008).
[7] Simultaneous bilingualism is also referred to as bilingual L1 acquisition (Meisel 2001).
[8] The differences between the acquisition of simultaneous and sequential bilingual children that include maturational and input perspectives (Montrul 2008, Paradis 2008) are not the scope of this thesis.

as used by child heritage speakers.

In the context of this study, the participants satisfy the criteria to be defined as child heritage speakers and early sequential bilinguals. They acquired Polish as their first language in the context of home, and use it with family and members of the Polish community in Ireland. They started learning English as their second language between the age of 3 and 6 with the basics of Polish already in place.

In this thesis, we also use the terms 'language access' and 'response time (RT)' in the analyses and discussions of shifts in relative language strength and a switch in language dominance in bilingual speakers. In the psycholinguistic literature, the terms are used to describe the stages of language processing. Language processing relates to the mechanisms that assist in speech production, and enable a speaker to produce words. Language access is the process of retrieving an item from the mental lexicon for the purpose of speech. The stages of language access are selection from the mental lexicon, activation and production (Levelt 1989, Levelt, Roelofs and Meyer 1999).

The period of time necessary for the process of language access to be completed (from selection to production) is called response time (RT)[9]. The notion of speed is a widely acknowledged psycholinguistic reflex of accessibility - the higher the activation level (the more often language is used), the quicker an item can be accessed, and then produced (O'Grady et al. 2009). In this thesis, we will use the terms 'response time (RT)' to refer to the period of time a speaker needs to produce a lexical item when presented with a visual stimulus. Also, after Kohnert et al.(1999) and Sandoval et al. (2010), we will use the term 'fluency', that is viewed here as 'an ability to rapidly produce words in each language' (Sandoval et al. 2010), and is

[9] The term 'response time' is used in the literature together with 'naming time' or 'reaction time'.

measured by calculating response times in picture naming tasks (Kohnert et al. 1999, Sandoval et al. 2010).

2.3 General characteristics of heritage language acquisition

Heritage languages typically show characteristics that are different from those of monolingual speakers, and recently have been the focus of considerable research, mostly in the North American context (e.g. Polinsky 1995, 1997, 2006, 2007, 2008a, b, 2011; Benmamoun, Montrul and Polinsky 2010; Montrul 2008, 2010; Polinsky and Kagan 2007; Carreira and Kagan 2011). Montrul (2008) characterizes heritage language acquisition as incomplete L1 acquisition in a bilingual environment, and therefore typical features of heritage language acquisition usually combine elements, or lack of them, of child L1 and adult L2 acquisition. The characteristics that distinguish heritage from monolingual language acquisition stem from reduced and limited input, reduced contexts of language use, and from an increasing exposure and proficiency in the L2. These factors cause developmental and L2 transfer errors evident in the most input-dependent language domains, like inflectional morphology, lexicon or language access. Although some heritage speakers may be very advanced and achieve a native-like proficiency in both languages, according to Montrul (2010), for most of them, the home language is the weaker and less dominant language. Depending on sociolinguistic factors and the age of onset of continuous exposure to the majority language, proficiency in the heritage language can range from basic receptive skills to intermediate or even advanced oral and written skills.

Table 2.1 below shows a summary of the characteristics of heritage language acquisition. It can be noted that as for the lexicon, changes in language exposure and use impact lexical accuracy, range and access. The heritage language lexicon is

usually limited as compared with age-matched monolinguals, and is restricted to specific contexts of language exposure and use (e.g. Oller and Pearson 2002, Polinsky and Kagan 2007, Bialystok et al. 2010, Montrul 2010). In child heritage speakers, age-adequate vocabulary size and range does not reach monolingual standards due to incomplete acquisition that is a result of limitations in input (Hulsen 2000), while in adults, word-finding difficulties are caused by a reduced frequency of language use, and possibly incomplete acquisition as children. It has been shown that the size of lexicon and language access are the first areas to be affected by limited language use, and it appears that the lexicon is more vulnerable to attrition than the grammatical system (Schmid 2004, Schmid and Köpke 2009).

Table 2.1 Characteristics of heritage language acquisition (based on Montrul 2008, Benmamoun, Montrul and Polinsky 2010)

Characteristics of heritage language acquisition
Lexical restriction and simplification
Lexical retrieval delays (slow language access)
Problems with basic morphology
Depending on age of consistent the L2 exposure and input, the core of syntax may remain intact
Phonology – from minor changes to foreign accent in the L1
Changes as a result of restricted language use (attrition) and incomplete acquisition

In the realm of grammar, the extent of changes in heritage language acquisition is more varied depending on the area and language. As we can see from table 2.1 above, the core of syntax may remain intact. Benmamoun et al. (2010) refer to this as a predisposition of heritage grammars to retain basic and core elements of language

structure even under reduced input conditions. In contrast, the most affected area of the heritage grammar is morphology, with the nominal domain causing more difficulty than the verbal domain. For example, in a language with rich inflectional morphology, e.g. Russian, Polish or Spanish, heritage speakers tend to have problems with case marking and gender agreement (Laskowski 2009, Polinsky 1997, 2006, 2008, Montrul, Foote and Perpiñán 2008). Within verbal morphology, although it is more resilient to a reduction in input than nominal morphology, research on various languages has shown that heritage speakers may still have difficulty with agreement, aspect and mood (Laskowski 2009, Polinsky 1997, 2006, 2008, Montrul 2002, 2007). Also, heritage speakers tend to show limited proficiency with passives, definiteness and quantification across various languages (Laskowski 2009, Benmamoun et al. 2010). The impact on phonology is strongly correlated with the age at which speakers experience changes in input, therefore some heritage speakers may display foreign accent in their L1, while others who began to consistently learn and use the L2 at a later age can show only minor changes in the L1 accent (Yeni-Komshian, Flege, and Liu 2000, Laskowski 2009, Benmamoun et al. 2010, Montrul 2010).

As summarised by Benmamoun et al. (2010), the general features of heritage language acquisition, which hold for various languages, show a general picture of a linguistic system that has undergone simplification, reduction and over-regularization to different degrees, depending on input and use circumstances. This system, however, maintains the basic properties of the language.

2.4 Lexical development in child heritage speakers

The first question addressed in this thesis concerns the stages of development, stagnation or decrease that the heritage lexical system undergoes in primary school children. Previous studies have shown that bilingual children display differences in vocabulary size and range in comparison to monolingual peers, however, a precise timeline of those changes with specific age spans during which they occur has not been proposed.

The main hypothesis is that the acquisition pattern of the heritage lexicon will show evidence of change due to a reduction in the L1 input. However, more importantly, these indicators of change will become evident at specific age spans. This hypothesis has been inferred by previous findings that point to disparity in the pattern of lexical acquisition between the heritage and monolingual speakers during the primary school years. The studies discussed below reveal that the differences between lexical development of child heritage and monolingual speakers relate to vocabulary size and range. However, we will show that the studies that investigated lexical development in early sequential bilinguals across age spans have produced varied results, with some pointing to a continuous progress in lexical acquisition, and some to stages of stagnation or even regression. The exact path of this acquisition over the primary school years has not been fully investigated, especially the specific characteristics of the changes and the age spans during which they become evident.

To test our hypothesis and evaluate the characteristics and the age of onset of those changes, I analyse the children's production of nouns, as this has been shown to be affected in comparison with monolingual peers, by examining noun accuracy and range from the perspective of word frequency, and then I compare the results with the monolingual pattern of acquisition provided by the control group.

Heritage lexical acquisition in children has been analysed in the context of vocabulary size, range, and as a path of development across age spans. The studies that investigated vocabulary size revealed that bilingual primary school children have a smaller lexicon in both languages relative to age-matched monolinguals (Páez, Tabors and López 2007, Umbel et al. 1992; Pearson, Fernandez and Oller 1993, Oller and Pearson 2002, Bialystok et al. 2010, Cobo-Lewis et al. 2002; Oller, Pearson and Cobo-Lewis 2007, Uccelli and Páez 2007). The differences include both the receptive and expressive lexicon and it has been shown that the discrepancy between monolingual and bilingual vocabulary size continues into adulthood (Portocarrero, Burright and Donovick 2007). Previous studies have shown that the gap between heritage speakers and monolinguals develops quickly, and in very young children, it can be evident after a few months of the onset of change in the input circumstances. Páez, Tabors and Lopez (2007) investigated oral language skills in a substantial sample of 319 English-Spanish bilingual 4-year old children, and compared the results with 144 monolingual Spanish-speaking controls. The participants were tested during two sessions: at the start and the end of pre-kindergarten programmes that were held in English. The methodology included standardized tests of the Woodcock Language Proficiency Battery (Woodcock 1991). The results showed that the vocabulary scores of bilingual children lagged behind the monolingual norms in both languages, and the gap increased between the first and second testing. Slightly older children were the subjects of Uccelli and Páez study (2007) who analysed expressive vocabulary size and narratives in a longitudinal sample of 24 Spanish-English bilingual children between the age of 5 and 6. The results showed that in English the children made gains in both analyses, however, their scores were lower than in the monolingual norms. As for Spanish, the bilingual

children improved only their narrative skills, while their size of vocabulary did not increase over the period of one year. Additionally, the researchers used the count of the total number of different words (TDW) that I use in this study to examine vocabulary range, and they found it to be a sensitive developmental measure that succeeded in capturing changes in vocabulary size between two different age groups. Bialystok et al. (2010) examined differences in receptive vocabulary between bilingual and monolingual children who were of a similar age range as the participants of my research that spanned the primary school years. The analyses included 1,738 children between the ages of 3 and 10. The bilinguals were heritage speakers of various languages who all spoke that language at home, and they were schooled in English, whereas the monolinguals were English speakers. The analyses revealed a consistent gap in English vocabulary size between the bilingual and monolingual cohorts, and highlighted that the difference correlated across languages.

The findings presented above reveal that child heritage speakers have a reduced vocabulary size in both languages as compared with monolingual age-matched speakers. The above changes in lexical development of heritage speakers are of a quantitative nature, and do not provide information on the characteristics of the changes, and in particular on the exact timeline of their occurrence across the duration of primary education, which are of interest in this study. In the following paragraphs, we will look at the impact of restricted contexts of language exposure and use on the development of vocabulary range, and on the stages of lexical development across the primary school years.

Recent research has suggested that the varying size of vocabulary between bilingual and monolingual children in each of the languages may be attributed not only solely to the quantity of input available to the heritage learner, but also to the pattern and

circumstances of exposure. Oller and Pearson (2002) and Oller, Pearson and Cobo-Lewis (2007) refer to it as a 'distributed characteristic' of bilingual knowledge. Bilingual speakers are often exposed to and use certain vocabulary range in certain circumstances and contexts that are often specific to one language only. Therefore, their vocabulary in each language reflects the contexts in which that language is used. Oller et al. (2007) also claim that 'the signature pattern of the distributed characteristic' of bilingual knowledge is that some lexical items are solely encoded in the L1, while other words are used and heard only in the L2 (p. 192). For example, the vocabulary related to family life, the house and relations is often used mainly in the L1, while the L2 is the language in which the speakers acquire the lexicon of schooling and work. The impact of restricted contexts of language exposure and use has also been documented by Polinsky and Kagan (2007) and Rothman (2007) who claim that heritage speakers usually have gaps in the formal register, including specific vocabulary and complex structures that are associated with literacy.

In the study by Bialystok et al. (2010) discussed above, the analysis of the children's L2 English revealed that the gap in the receptive vocabulary score between bilingual speakers of various minority languages and English on the one hand and monolingual English speakers on the other hand was largely restricted to 'home' words that are used with family members. The researchers classified the vocabulary on the basis of their primary context of use: home or school. The criteria for inclusion in the home category were as follows: food and household items, culture-specific items and words that were unlikely to occur in a classroom context. The school category included words that denoted professions, animals or plants, shapes, musical instruments, and words reflecting school experiences that were more associated with school activities (e.g. *writing*). The results have shown that the gap in

vocabulary size between the monolingual and bilingual speakers was limited to the words from the 'home category', however, both cohorts performed comparably in the 'school' vocabulary score in English which is a result of the fact that English was the language of schooling and literacy.

The 'distributed characteristic' of bilingual knowledge may be an explanation for the lexical gap between monolinguals and bilinguals as it shows that the context in which particular languages are acquired determines the size and range of the lexicon. In Chapter 4 of this thesis, I will show that, in addition to this account, word frequency plays a significant part in the discrepancy between the results of monolingual and bilingual children.

In addition to examining the size and range of vocabulary in both languages, previous studies have tried to evaluate the characteristics of lexical development in child heritage speakers, and establish whether, as a result of an increasing exposure to the L2, the acquisition of the L1 lexicon shows evidence of growth, stagnation or regression. The results so far are contradictory, and the divergent outcomes might be explained by various sociolinguistic backgrounds and age differences between the subjects of the various studies. Most of the studies report a trajectory of growth and continuous enlargement of the lexicon (Kohnert et al. 1999, Kohnert and Bates 2002, Jia et al. 2006, Eilers and Oller 2002), however, at a slower pace than in monolinguals peers (Páez, Tabors and López 2007).

Some studies, however, show evidence of stagnation in the vocabulary development in child heritage speakers. Kan and Kohnert (2005) conducted a cross-sectional study of Hmong-English pre-schoolers who were pupils at a bilingual kindergarten. The older group's mean age at the time of testing was 5 years, and the younger group had a mean age of 3;11. The children attended the kindergarten for 16 and 9 months

respectively. The tests that measured expressive and receptive vocabulary in both languages revealed that the older group scored higher than the younger children in English but the results did not differ on the Hmong tasks. This result points to an increase in the children's English lexical abilities, but a stagnation in the acquisiton of the heritage language vocabulary despite continuous exposure to both languages. The results might, however, also support Goldenberg's et al. (2011) finding which shows that lexical growth is robust at the start of language acquisition, which in the case of Kan and Kohnert's study could explain the rapid growth in the English lexicon. The stagnation in Hmong could have been the result of a relatively small age difference between the groups (mean: 1;1 year, and a small difference in the overall time they had attended the kindergarten before the testing, mean: 7 months). More recently, a relative stagnation in lexical development has been reported by Sheng et al. (2011) who tested two groups of Mandarin-English children aged 4;5 and 7;2. The scores showed substantial development in English, however, no improvement in Mandarin vocabulary between the older and younger group. Further insight into this lack of improvement in heritage lexical acquisition in both of the above studies (Kan and Kohnert 2005, Sheng et al. 2011) could have been obtained through comparison with age-matched controls, which could explain whether such outcomes are typical or divergent from the pattern of monolingual acquisition.

The studies that have been discussed above demonstrate that young child heritage speakers have smaller receptive and expressive vocabulary size in both languages, and perform more poorly than age-matched monolinguals in tests measuring lexical accuracy across different age groups. Also, it has been shown that despite evidence of slower but continuous development, some studies report early stagnation in the development of the L1 lexicon. To my knowledge, however, no study so far has

pointed to specific age spans across the whole duration of primary education, during which those changes occur, nor do they point to the characteristics of this path of heritage lexical acquisition. The main goal of the present study is to examine the stages of heritage lexical acquisition during the primary school years, and to point to specific age spans in which any changes take place.

2.5 Language dominance in early sequential bilinguals

2.5.1 Introduction

The second research question addressed in this thesis concerns the phenomenon of language dominance, and whether the earlier documented changes precede a switch from the initially stronger L1 to a more dominant L2 in middle childhood. The hypothesis is that the changes will correlate with the pattern of parallel lexical acquisition in the L1 and L2, and will occur prior to the expected switch in language dominance. The hypothesis is based on previous findings that report trajectories of growth in both languages, however, with greater progression in the L2 than in the heritage language. Previous studies also show that this unbalanced acquisition which is a consequence of uneven input in both languages leads to a switch in language dominance that has been shown to occur between the age of 8 and 11 in early sequential bilinguals (e.g. Kohnert et al. 1999, Kohnert and Bates 2002, Jia et al. 2006, Eilers and Oller 2002). In order to test our hypothesis, we will investigate the development of lexical accuracy and access in the heritage Polish and L2 English of child heritage speakers across the primary school years. Additionally, we will compare the results for heritage Polish with those of monolingual controls. The method chosen for this purpose is the Child HALA test which has been designed specifically for use with young children, and is a version of the HALA task (O'Grady

et al. 2009). It is a picture-naming test that aims at evaluating fluctuations in relative language strength and a switch in language dominance by comparing lexical accuracy and access in both languages in bilinguals.

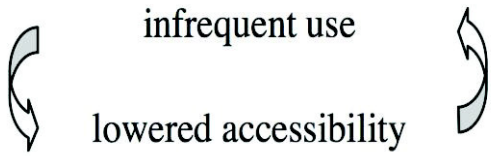
2.5.2 Language dominance in bilinguals

In the field of bilingual acquisition, the phenomenon of language dominance is usually defined as 'a situation where one of a child's languages is more advanced or developing faster than the other' (Yip and Matthews 2006). Most researchers analyse the phenomenon in terms of proficiency, and evaluate relative language strength in bilinguals on the basis of a comparison of proficiency levels between the languages (e.g. Petersen 1988, Genesee, Nicoladis and Paradis 1995).

In this thesis, we believe that in addition to proficiency, language dominance needs to be considered in terms of language use and exposure that underlie and significantly impact language proficiency in bilingual speakers. We view language dominance as a direct link between a psycholinguistic factor of processing proficiency and sociolinguistic factors of language exposure and use. In other words, the language that bilinguals are exposed to and use more frequently becomes their stronger and more dominant language. According to de Bot (2001), the sociolinguistic factor of language exposure determines the amount of language use which in turn affects language processing. Köpke (2007) and O'Grady et al. (2009) support this view, and claim that frequency of language use contributes most directly and significantly to the maintenance of a language and its relative strength. O'Grady outlines this view by further stating that the more often the lexical items and phrases of a particular language are activated, the more accessible they are, and consequently speakers feel more comfortable using them. As shown in Fig. 2.1, this process

becomes a natural cycle, where infrequent use impacts negatively language accessibility, and as a result its speakers become reluctant to use the language, which further decreases its accessibility.

Figure 2.1 Language use and access (O'Grady et al. 2009)



A psycholinguistic approach to language dominance has also been proposed by Lanza (2004) who describes language dominance as a 'psycholinguistic phenomenon closely intermeshed with sociolinguistic parameters' like quantity and quality of input, age of acquisition, continuous language exposure, and language preference (pp. 172-173).

The above assumptions that relate to language dominance in terms of an interface between sociolinguistic and psycholinguistic factors have also been supported by the Weaker Links Hypothesis (Gollan et al. 2008) and the Activation Threshold Hypothesis (Paradis 2004, 2007). In the Weaker Links Hypothesis, Gollan and her colleagues claim that bilingual speakers perform worse than monolinguals in production tasks and in non-dominant versus dominant language comparisons because of an imbalance in frequency of language use. The support for this hypothesis comes from the fact that bilinguals produce fewer low-frequency words than high-frequency words, as compared with monolinguals, and in the dominant versus non-dominant language comparisons. In the Activation Threshold Hypothesis (2004, 2007), Michel Paradis emphasizes the role of inhibition and frequency of use. He claims that the activation of linguistic items depends on their use; frequent use

leads to a lower activation threshold, which in turn results in a quicker and easier access. Consequently, items that are infrequently used have a higher activation threshold which in turn results in difficult access, and thus longer time necessary to produce the items. Paradis also explains that different linguistic domains within the same language system might require different amounts and quality of stimulation in order to be activated, and as the lexicon is highly reliable on continuous input, this is the first domain to be affected by a reduction in language use.

The theoretical assumptions discussed above influence our hypothesis that the early changes in lexical acquisition of child heritage speakers will correlate with the pattern of parallel lexical acquisition in the L1 and L2, and will precede the expected switch in language dominance from the initially stronger L1 to a more dominant L2. We expect fluctuations in lexical accuracy and access in both languages across the primary school years, and the shifts in relative language strength will be considered as a consequence of changes in language exposure and use in both languages and a growing proficiency in the L2.

2.5.3 Timed picture-naming as an assessment of lexical accuracy and access

Past studies that attempted to evaluate language dominance in bilinguals have relied on establishing the speaker's language preference (e.g. Caldas and Caron-Caldas 2000, Petersen 1988, Schlyter 1994), correlations of performance in both languages on standardized vocabulary tests such as the Peabody Picture Vocabulary Test PPVT (Dunn and Dunn 2007) or the Bilingual Verbal Ability Test (Muñoz-Sandoval et al. 2005), evaluating the direction of code-switching (e.g. Lanza 2004, Petersen 1988), or measuring the mean length of utterance (MLU) in both languages (Yip and Matthews 2006). The above approaches are often laborious and may yield results

whose interpretation is not straightforward (O'Grady et al. 2009), and some of them, e.g. evaluating language dominance on the basis of self-reported language preference, may involve subjective reports based on language attitude and motivation instead of observation.

Viewing language dominance in terms of interdependence between language exposure, use and processing proficiency implies the use of online psycholinguistic methods (timed performance) to evaluate language strength and shifts in relative dominance in bilingual speakers. They have been shown to complement the measures that evaluate grammatical knowledge in a way that offers empirical information about how languages function in real time without pre-use of metalinguistic knowledge (Bolger and Zapata 2011). Studies that have aimed at evaluating language dominance, and especially its shifts over time in the domain of the lexicon[10], have primarily used picture-naming tasks to investigate lexical accuracy and access. Picture naming tasks involve an active recall of words on the basis of a graphical presentation of a picture of an object. In picture-naming tasks, RT analyses are restricted only to items that are accurately named in the first place. The advantages of using the response time measure is its sensitivity to minimal differences in accuracy scores (O'Grady et al. 2009), and the fact that it allows for analysis of performance on the basis of the speed of information processing, rather than overall lexical knowledge (Kohnert et al. 1999).

Among the factors that might impact response time scores in online tasks, frequency of use, a variable that has been taken into account in the development of the HALA test, and age of word acquisition have been found to be of greatest significance

[10] I will only focus on the online methodology that is applicable in studies on lexical acquisition due to the nature and objectives of this thesis that concern lexical development.

(Bates et al. 2003, Brysbaert et al. 2011)[11]. Additionally, Bates et al. (2003) report that word frequency correlates cross-linguistically with response time scores of equivalent lexical items in the various languages they tested. Unlike the two above factors, word length and structure have been shown not to produce a reliable effect on the speed with which pictures were named (D'Amico, Devescovi and Bates 2001, Bates et al. 2003, Murray and Forster 2004). Word length that varies significantly across languages has also been shown to be of minor significance in picture naming tasks in monolingual language acquisition studies (Snodgrass and Yuditsky 1996)[12].

2.5.4 Shift in language dominance in early sequential bilinguals

It has been widely acknowledged that bilingual speakers tend to be dominant in one of their languages. However, they can also be dominant in either language depending on the language context and environment, e.g., bilingual speakers might be dominant in one language in the context of their profession or school, and dominant in the other language in casual conversations with family members or friends (Caldas and Caron-Caldas 2000). The non-static characteristic of language dominance is a result of shifts in input circumstances (Lanza 1997, Yip and Matthews 2006, Gathercole and Thomas 2009). This lack of balance in the quantity and quality of input may impact the rate and level of acquisition in both languages, and cause a situation where one language develops faster and shows more complex advancement at any given time. This dominance in one language may, however, shift, and the once

[11] See Section 3.3.3.2 for further discussion relating to the factors of word frequency and word age of acquisition.

[12] Other factors that need to be taken into consideration in picture-naming tasks concern technical aspects of the presentation. These factors include familiarity with the pictures, their codability (the number of different referents that could be used for a particular picture), the categorical distinctiveness of the word, and the degree of image-picture agreement (the extent to which a speaker's mental image matches the picture) (see Snodgrass and Yuditsky 1996 for more details).

stronger language may become weaker depending on the changes in input (Yip and Matthews 2006). These shifts in language dominance over time are characteristic of heritage speakers who might not have fully acquired their first language due to an early exposure to the L2, in most cases in a school environment. According to Polinsky and Kagan (2007), incomplete acquisition makes heritage speakers more prone to variation in linguistic dominance as the system of their L1 has not been fully stabilized before the onset of exposure to another language.

Previous studies that investigated parallel lexical accuracy and access of the L1 and L2 in early sequential bilinguals documented that the two lexicons develop unevenly, with greater progress in the L2 and slower in the L1, leading to a switch in language dominance, from the initially stronger L1 to L2 by middle childhood. One of the most influential studies that investigated language dominance in terms of relative processing speed and accuracy was Mägiste's study (1992) of lexical comprehension and production in primary school pupils in their L1 (German) and L2 (Swedish). The results showed that the children became dominant in the L2 after 4 – 6 years of continuous exposure to the language. Similar results indicating a shift from early dominance in the L1 to a stronger L2 for expressive vocabulary were obtained by Kohnert, Bates and Hernandez (1999). Their study assessed performance in a picture-naming task of Spanish-English early sequential bilinguals who were tested in four age groups that spanned the duration of primary school years. The outcomes revealed that despite balanced accuracy, fluency rates in English expressive vocabulary overtook Spanish by 8 - 10 years of age. As for receptive vocabulary, Kohnert and Bates (2002) obtained similar results in a timed picture-verification task. These two studies examined the parallel L1 and L2 lexical acquisition and the ultimate switch in language dominance for nouns. Jia et al. (2006) replicated the

design of those studies to investigate verb processing in a similar population. Similar to the above studies that investigated noun processing, the results showed overall gains in verb processing in the L1 and L2, indicated by higher accuracy levels and faster response times for older children as compared with the younger participants. However, the trajectory of growth was steeper for English than for Spanish leading to a switch in language dominance between the age of 8 and 10. This trend of fluctuations in the relative language strength that ultimately lead to a switch in language dominance by middle childhood has also been reported in other linguistic domains, like phonology, morphology and syntax for similar age- and type of bilingualism groups of various heritage languages. For example, in the Miami study (Eilers and Oller 2002), early sequential Spanish-English bilinguals scored better on standardized proficiency tests in English than in Spanish by fifth grade. Similar results were obtained by Flege et al. (1999), Yeni-Komshain, Flege and Liu (2000) and Flege et al. (1995) for pronunciation, and by Jia, Aaronson and Wu (2002) for morphosyntactic proficiency.

The above discussed studies that documented the ultimate switch in language dominance in early sequential bilinguals across the primary school years pointed to fluctuations in parallel lexical acquisition in the L1 and L2. However, there are two issues that have not been fully investigated so far. First, there is not enough evidence documenting the characteristics of those fluctuations, especially with respect to the heritage language that has shown slower progression. Additionally, there is also insufficient data that concerns a comparison of the heritage language level of activation at different points throughout the primary school years with that of monolingual pattern, which could offer more explanation for the characteristics of the L1 development in a bilingual environment. Our study will aim at addressing

these two issues in Chapters 5 and 6, and at providing new evidence that could help to better understand the challenges and outcomes of the dual lexical acquisition that early sequential bilinguals face in early and middle childhood.

2.6 Chapter summary and conclusion

In this chapter, I presented the findings of previous research into lexical acquisition and shifts in language dominance in early sequential bilingual children. First, we have seen that heritage speakers have a smaller vocabulary size and range than monolingual speakers in both languages. The analyses of the acquisition pattern across the primary school years have brought contradictory results as some studies report continuous enlargement of the lexicon, while others signal periods of stagnation. Second, the studies that investigated parallel lexical acquisition of the L1 and L2 in early sequential bilinguals documented a varied rate of progression for both languages that leads to a switch in language dominance by middle childhood.

From the review of the literature, the following main findings have emerged:

- **More research is needed into the lexical development of the heritage language in early sequential bilinguals**

It emerges from the studies on lexical acquisition of both languages in early sequential bilinguals that there is not enough evidence that would explain the specific characteristics of heritage lexical development, and in particular, the stages that the acquisition undergoes across the primary school years as compared with the monolingual development.

- **More research is needed to establish early indicators of change in child heritage lexicon, and the age at which they occur**

There is insufficient evidence in the current literature that looks at the period between the onset of the L2 acquisition and the expected switch in language dominance. As the switch has been documented to occur between the ages of 8 and 11 in early sequential bilinguals, we would expect that the changes in heritage lexical acquisition that precede that switch might also occur at specific age(s), and thus signal a weakening of the acquisition process.

CHAPTER 3

METHODOLOGY

3.1 Introduction

In this chapter, I discuss the methodology employed in this study. The chapter is divided into two main sections. In the first section, I present the subjects' biographic data and their sociolinguistic background. I provide details of the children's exposure to the heritage and majority languages from birth to the present time, I discuss their language use, the family's immigration history, and the ways in which they keep ties with the heritage culture and language[13]. I also include data on the Polish monolingual control group.

The second section presents the methods chosen to investigate the research objectives stated in Chapter 1, and the reasons to combine the particular analyses and tests for the purpose of this study.

3.2 The Participants

3.2.1 Introduction

In order to understand and analyse the results presented in Chapters 4 – 6, we need to present the participants' sociolinguistic profile (Gathercole 2007, Poulin-Dubois et

[13] It has to be noted that the information that describes the children's language use with family and friends and their exposure to the L2 outside school is based on the reports obtained from the mothers/parents, and not from direct observation.

al. 2012). An understanding of the sociological background of the participants, sources of input in both languages, and the family's ties to the heritage culture and language will help to accurately interpret the results of the study.

First, I present socio-linguistic information on the heritage speakers, and then relevant data on the Polish monolingual controls. I start with a description of the recruitment process, followed by information about the Polish community in Ireland, its size, immigration history, and geographical and age distribution. Next, I present the sociolinguistic profile of the families that participated in this project. I describe the parents' immigration history, and then I provide information on the children's age at testing, age at first consistent exposure to English, and the length of their English exposure. I then present information on the children's language choice and use with their mothers, siblings and friends, and any additional exposure to English outside school. Finally, I provide data on the four groups of monolingual control speakers.

3.2.2 The Heritage Speakers

3.2.2.1 Selection of participants

The heritage speakers who participated in this project are thirty-eight children divided into four age groups. In order to be included in the study, the children had to meet certain criteria. These are outlined below:

All children:

1) were primary school pupils aged between 4;6 and 13,

2) had both parents of Polish nationality,

3) were exposed to Polish in the home setting where both parents had to speak Polish to the child/children,

4) were born in Ireland or have immigrated to Ireland before the age of 5,

5) met the criteria to be classified as early sequential bilinguals or child L2 speakers, i.e.: their first consistent contact with English could not have occurred before the age of 3; 6 – 4; 6.

Further details about the participants and their exposure to Polish and English are provided in the following sections.

3.2.2.2 The recruitment process

The families participating in this study were recruited through Polish online newspaper advertisements, posters in Polish institutions and associations, and through personal contacts in the Polish communities and organizations in Dublin. The recruitment and testing were carried out in May/June and September/October of 2012. A repetition of the advertising process was needed to gather more participants. Before starting the recruitment process, the research project received approval from the Dublin City University Ethics Committee. The study consisted of two meetings that included an interview with the parent/parents and two testing sessions, one in Polish and one in English. Before accepting to participate in the study, the parents were asked to read and sign a *Plain Language Statement* and an *Informed Consent Form*, which clearly explained the aims and scope of the research. The documents were translated into Polish to facilitate accurate comprehension of the project. In order to protect the subjects' anonymity, each child was given a symbol that denoted the age group they were assigned to, and an individual number within the group, for example: child A1 was the first child in the youngest heritage group[14].

[14] See section 3.2.2.6 for further details on the age group division.

3.2.2.3 General information about the Polish community in Ireland

Most Polish immigrants came to Ireland after 2004 when Poland became a member of the European Union, and Ireland opened its borders to jobseekers from the newly accessed countries. According to the latest census in 2011 (CSO 2011), the new wave of immigrants from Poland reached a peak in 2006, and then increased by another 94 per cent to 122,585 in 2011, marking them the largest immigrant group in Ireland, ahead of the UK nationals with 112,259. Table 3.1 below illustrates the significant change in the size of the Polish population in Ireland over a nine-year period between 2002 and 2011.

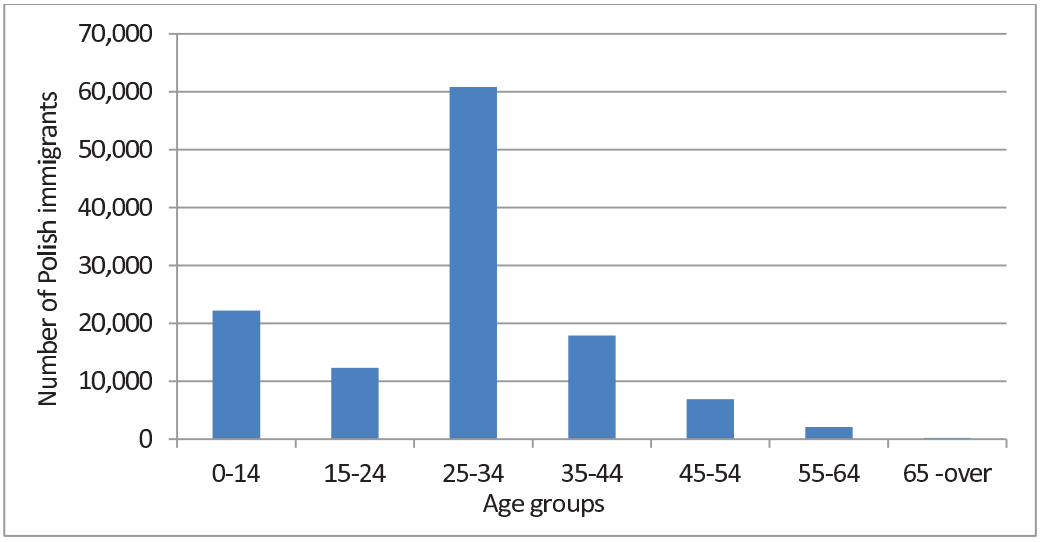
Table 3.1 Population of Polish immigrants in Ireland in 2002, 2006 and 2011. Source: Census 2011

Nationality	**2002**	**2006**	**2011**	**Change 2002-2011**	**% change**
Polish	2.124	63.276	122.585	120.461	5.671.4%

As for the place of residence, 30.581 of the Polish reside in Dublin City and its suburbs, which constitutes approximately one fourth of the whole Polish population in the country.

The division into age groups, presented in figure 3.1 below, demonstrates that most of the immigrants are between 25 and 34 years old, and that this group comprises almost half of the whole Polish population at 60.827 people.

Figure 3.1 Number of Polish immigrants and their children classified by age group. Source: Census 2011



Most Polish immigrants who came to Ireland between 2002 and 2011 were in their twenties and thirties, and in most cases they settled and started families in Ireland. Therefore, it is not surprising that the second biggest group of Polish speakers constitutes children and teenagers aged 0 to 14 years. Census analyses do not break down this number any further to provide more specific information on the number of younger and older children of Polish origin, however, the experience gathered from sourcing participants for this study, and the age group that most of the adult immigrants fall into (24-35), allows me to suggest that the majority of children are between 0 and early primary school age of 4 - 7.

As for the socio-economic status[15], according to census 2011, the majority of Polish immigrants have been classified into the three following categories: 25.2% in the non-manual group[16], 18.2% in the manual skilled category, and 17.8% is characterized by a semi-skilled status. As for the educational background of Polish emigrants to Ireland, the biggest group is formed by adults with technical vocational

[15] The socio-economic category is determined here by occupation and employment status, source: Census 2011.

[16] This group includes occupations such as clerical workers in financial institutions and government, sales assistants and secretaries, source: Census 2011.

qualifications – 28.8%, followed by secondary school graduates – 19.5%, and holders of a bachelor degree – 12% (Census 2011).

3.2.2.4 A sociolinguistic profile of the families and the community

All the families that participated in this study live in Dublin suburbs with a high population of first-generation immigrants from Poland. These are close-knit communities that maintain strong links with Poland and its heritage culture and language. The language of the family and community is Polish. It is used not only at home, but often also at work, with more than 50% of the parents being able to communicate in Polish with their colleagues or customers.

The families often live close to their Polish-speaking neighbours who have become their friends, and they do not feel the need to integrate with the Irish or other English-speaking nationalities. The percentage of parents who have English-speaking friends is below 20%, while the rest claim to have only Polish-speaking friends who are either their neighbours, or whom they have met through participation at events organized by various Polish minority associations in Ireland.

The majority of the families extend their contact with the heritage language and culture outside the immediate place of residence by participating in cultural events and special activities for children organized by many Polish social and cultural associations. Despite the close proximity of local Catholic churches that are most often the patrons of the primary schools the children attend, more than 50% of the families choose to attend masses in the Polish language which are held in a few designated churches in central Dublin. Attendance at these churches requires them to travel some distance in and out of the city centre.

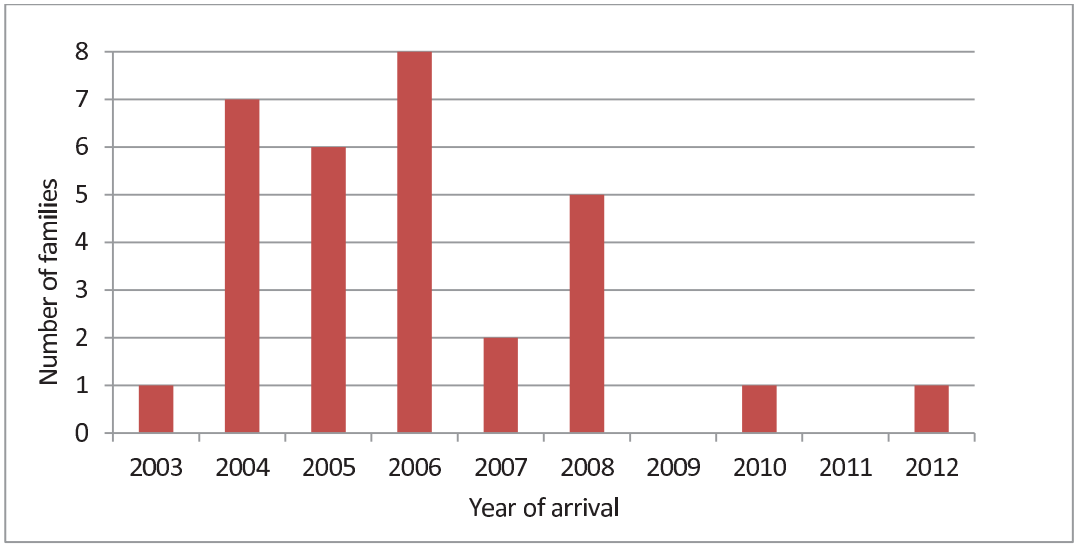
During the interviews, the parents/mothers often blamed the language barrier for

their lack of integration with the Irish culture and society, however, they also felt comfortable within the Polish community of immigrants, and with the strong ties they have maintained with the home country and its culture.

3.2.2.5 Parents' country of origin, year of arrival in Ireland and maternal level of education.

The parents of the children that participated in this study are first generation immigrants from Poland. All of them came to Ireland after Poland's accession to the EU in May 2004, with only one exception, where one family arrived a year earlier in 2003. The breakdown of data on the arrival year for all the parents is shown in figure 3.2 below. In situations where the parents came to Ireland at different times, the mother's time of arrival was considered more relevant for the study, as she often came with the child/children who were born in Poland.

Figure 3.2 Parents'/mother's year of arrival in Ireland



The questions in the interview only considered the mother's level of education as previous studies have shown a positive correlation between maternal level of education and children's language development. Hart and Risley (1995) have pointed

to varied input quantity among mothers with different levels of education, while Pan et al. (2005) have linked the different number of word types used by mothers with various educational backgrounds and literacy levels and the subsequent language development of their children. More recently, Hammer, Farkas and Maczuga (2010) have shown that vocabulary size is positively correlated with the mother's level of education. According to the mothers'/ parents' responses during the interview, 50% of the mothers hold a university degree, while the remaining half graduated from secondary school, with many holding post-leaving certificate diplomas. However, only 22% of the mothers with a third level degree work in professions according to their qualifications, primarily due to limited English skills.

3.2.2.6 Participants' age and exposure to English

3.2.2.6.1 Participants' age at testing

The participants were divided into four groups based solely on their age. All the children were primary school pupils. They were either born in Ireland (16 children) or came to Ireland before the age of 5 (22 children).

Due to the pattern and characteristics of the Polish immigration to Ireland, (see section 3.2.2.3), all attempts to recruit the participants for this study resulted in high numbers of young children aged between 4 and 6, and fewer children at ages of 7 - 13. After the second recruitment process, I gathered twenty-four participants aged between 4;7 and 6;11, and fourteen children aged between 7;3 and 13. I decided to form four age groups that would span all primary school years, and due to the uneven distribution of the participants according to their age, I decided to split the younger children aged between 4;7 and 6;11 into two age groups as we will see below. This division enabled me to observe changes in the acquisition of both languages after

only twelve months of consistent English exposure, and thus observe early signs of a reduction in the L1 input and an increasing exposure and proficiency in the L2.

The first age group, group A, consists of children who were in the first year of primary school, and were tested in October/November after 1-2 months of education in English.

The second age group, group B, comprises children after one full year of primary education. They were tested either in June, the last month of their first year in school, or in the following September.

The following age group, group C, consists of children attending classes 1st, 2nd and 3rd, while the oldest children, pupils of between 4th and 6th classes, formed group D.

Table 3.2 below presents the statistical analysis and division of the participants according to age.

Table 3.2 Age at testing in heritage speakers

Group	Number	Mean age	SD	Age Range
A	10	4;10	0.28	4;7 – 5;3
B	14	5;10	0.52	5;1 – 6;11
C	8	8;0	0.67	7;3 – 8;9
D	6	11;5	1.07	10;4 – 13;0

3.2.2.6.2 Participants' age at first consistent English exposure and length of exposure to English

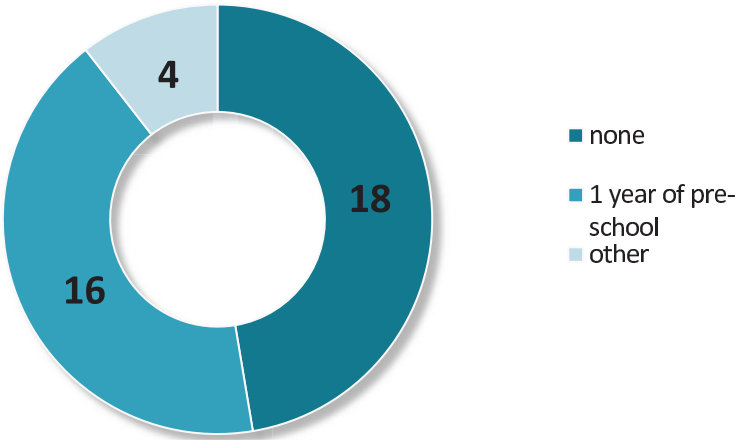
Half of the children in this study began their first consistent exposure to English after the age of three, while the rest started to learn English in the first year of primary

school at around the age of 4;6 – 5. This means that the children in this study can be classified as early sequential bilinguals whose L2 learning began, after the basics of the L1 had already been acquired (Montrul 2008).

Half of the children had attended a free pre-school year at local playschools and Montessori schools one year before the start of primary school. The program offers three hours of pre-school education during school days, excluding the two-month summer holiday period prior to the start of primary school. Most of the children went to English-speaking playschools, and one girl attended a Polish-speaking kindergarten where teachers spoke Polish throughout the day. The other half of the participants, despite the availability of free pre-school places, stayed at home with their parent/parents until the start of primary school at around the age of 4;6 – 5.

As can be seen in figure 3.3 below, the proportion of children who attended playschools one year before the start of primary school, and the children who stayed at home and had no formal contact with English is almost equal. The impact of the playschool turned out to be insignificant probably because of the low number of hours spent in the English speaking environment, and the two-month break in the exposure to English before the start of school. The four children who are marked as 'other' had different patterns of exposure to English before school which consisted of part-time attendance in an English-speaking playschool or crèche between the age of 1 and 3 for between 6 and 12 months and then they stayed at home until the age of around 4;6 – 5.

Figure 3.3 Length of exposure to English prior to the start of primary school (at around the age of 4;6 - 5) per number of children.



The following table 3.3 shows statistical data relating to age at first consistent exposure to English per age group.

Table 3.3 Age at first consistent exposure to English in heritage speakers

Group	Number	Mean age	SD	Age Range
A	10	3;8	0.55	2;6 – 4;6
B	14	3;11	0.54	3;1 – 4;10
C	8	4;6	0.59	3;3 – 5;3
D	6	4;11	0.89	3;3 – 5;7

By analyzing the mean age at first consistent English exposure across the age groups, a shift can be noticed where in the younger groups the children had earlier contact with English than the children from groups C and D. This trend can be explained by the fact that in January 2010 a free pre-school scheme was introduced, and prior to this a significant number of children were not enrolled in any formal education before the start of primary school. The children from groups C and D were already in

primary school when the scheme was launched so their parents did not have an opportunity to send them to a playschool free-of-charge.

The length of exposure to English in all the children in this study, shown in table 3.4, relates linearly to the onset of consistent exposure, as the acquisition of English has not been interrupted in any of the participants.

Table 3.4 Length of exposure to English in heritage speakers

Group	Number	Mean length of exposure to English	SD	Range
A	10	1;2	0.41	0;5 – 2;1
B	14	1;11	0.40	1;2 – 2;9
C	8	3;7	0.59	2;9 – 4;2
D	6	6;6	1.07	4;10 – 7;6

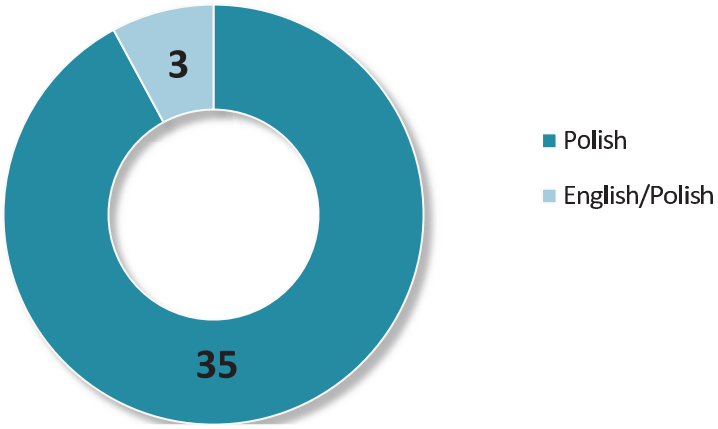
3.2.2.7 Language of communication with the mother, siblings and friends

3.2.2.7.1 Language of communication with the mother

All mothers of the children participating in the study have claimed to use Polish as the sole language of communication with their child/children[17]. As for the children, the majority respond in the language they are spoken to, in this case, Polish, with only three children reported as using a mixture of Polish and English. Figure 3.4 below shows that the overwhelming majority of the children speak in Polish to their mothers.

[17] It needs to be stressed again that all information is based on what the parents have reported, and not on direct observation.

Figure 3.4 Language of communication with the mother per number of children

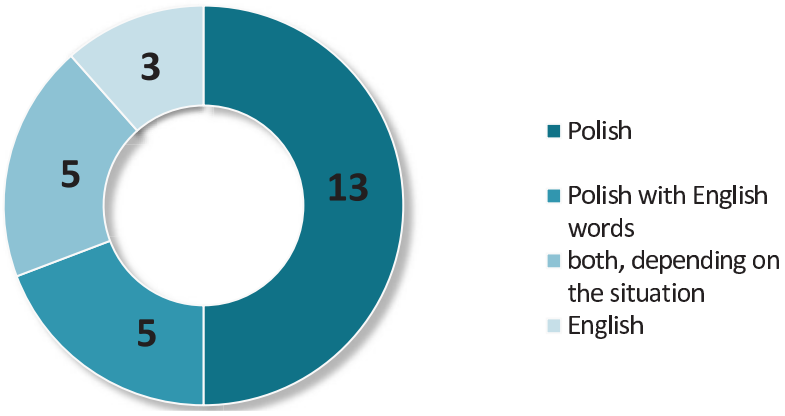


The three children who are reported as mixing the two languages all belong to group B (B3, B11 and B14). What comes as a surprise is the fact that the children from the oldest group D use Polish exclusively and do not mix the languages. It might be a consequence of the mothers' limited skills in the L2, and the children's awareness of the fact; however, unlike most of the younger participants, all the oldest participants were born in Poland and came to Ireland aged between 3 and 5, and also did not obtain any form of pre-school education in English. This outcome might suggest the importance of the fact that the earliest L1 acquisition occurred in a strictly monolingual environment that was undisturbed until the start of primary school.

3.2.2.7.2 Language of communication with siblings and friends

The analysis of the language of communication and play with siblings provides a slightly more varied outcome than the language used with the mothers. Twenty six out of thirty eight participants have older siblings they can communicate with, the rest either have brothers or sisters that are babies or they are the only children. Figure 3.5 below presents the language/s used by the children and their siblings.

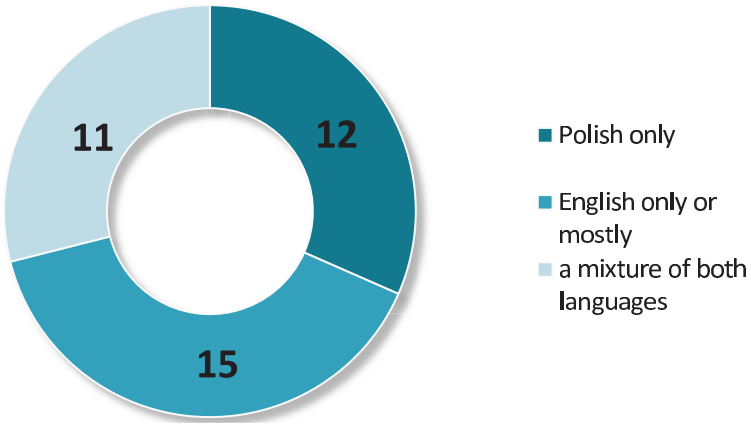
Figure 3.5 Language of communication with siblings per number of children



As can be seen, the majority of the children use the heritage language to communicate and play with their brothers and sisters. The five children who use Polish with English borrowings do so, according to the mothers, in situations when they lack the Polish equivalent during all-Polish conversations. Children who speak mainly English with their siblings are E4, E6 and B11. E6 and B11 are siblings, and B11, is also among the fraction of participants who speak English to their mothers.

The language of communication with friends depends mainly on the area where the families live, and the number of the Polish people living in the neighbourhood. However, despite the fact that most of the families live in areas highly populated with Polish immigrants, the presence of other nationalities in the locality means that the language of play with friends is often English. As we can observe in figure 3.6 below, the distribution of children who use mostly Polish, English or a mixture of both languages is almost equal.

Figure 3.6 Language of communication with friends per number of children

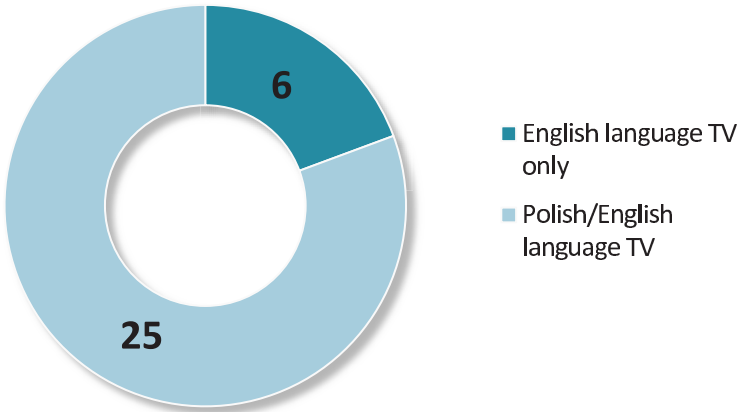


3.2.2.8 The language of television viewing

During the sociolinguistic interview, the parents were asked whether they had Polish television channels at home, and what language channels the children preferred and watched. The wish to have Polish language television at home was viewed as an indicator that the family wished to maintain ties with the heritage language, culture and current affairs. The majority of the families had access to channels in Polish at home, in addition to English language television. Despite the fact that all the families had access to English language television, most of the parents expressed no interest in it, and claimed to never watch television in English. The adults watched Polish channels to obtain information on the current everyday issues in Poland, and never watched Irish news or current affairs programs.

Figure 3.7 below shows the distribution of the families who had only English language television at home, and those who had access to both, Polish and English language channels.

Figure 3.7 Number of families with access to Polish/English or English language television channels



As some of the participants are siblings, the number of children who do not have access to Polish language channels at home is eight. All of these children prefer programmes in English, and even when offered to watch DVDs in Polish, they choose to switch the language to English. In contrast, everybody from the remaining group of thirty children who has Polish television at home prefers to watch it in that language, even when there is a possibility to switch the language. Children from the two oldest groups tend to switch the language to English only when particular programmes use specific vocabulary, e.g. nature documentaries. This is probably motivated by their limited low-frequency lexicon in the heritage language, and the fact that the contents of such programmes are often part of the school curriculum and their language experience[18].

3.2.2.9 Exposure to English outside school

The analysis of the information provided by the parents has revealed that the only two sources of contact with English outside school are English-speaking friends and participation in extracurricular activities. Twenty out of thirty-eight children across all age groups take part in organized activities outside of school, and the time they

[18] The issue of word frequency and language context will be analysed and discussed in detail in Chapter 4.

spend there varies from one to four hours per week. An overwhelming majority of the activities are sport training sessions which can be seen from table 3.5 below.

Table 3.5 Types of extracurricular activities in English per number of children

Type of Activity	Number of Children
Football	12
Swimming	1
Gymnastics	1
Piano/guitar lessons	2
Choir	2
Dancing	2

3.2.3 The Polish monolingual speakers

The twenty-four age-matched subjects were gathered by contacting a primary school in Poland, in a region where the standard dialect is spoken. Prior to the testing, I spoke with the school principal who reported that, as requested during the initial contact, the children are average performers in various school assessments. The children were grouped into four age groups designed to correspond to the heritage groups' pattern. The testing was conducted in March 2012 at the school. The following table 3.6 presents the four age groups and the age of the children at testing.

Table 3.6 Age at testing in Polish monolingual speakers

Group	Number	Mean age	SD	Age Range
V	6	4;10	0.16	4;7 – 5;0
X	6	5;10	0.64	5;3 – 6;10
Y	6	8;0	0.55	7;5 – 8;11
Z	6	12;0	1.03	10;10 – 13;2

In the above sections, I presented the participants of this study with focus on their sociolinguistic background and sources of exposure to Polish and English from birth to the present time. In the following section, I outline the methods and analyses chosen for this study, and the motivation behind this choice of methodology.

3.3 Methods of data collection

3.3.1 Introduction

In order to analyze the children's lexical development in the heritage language, and assess parallel acquisition and relative language strength of the heritage language and the L2, two different methods were chosen that would complement each other and separately validate the outcomes. The first method is narrations of the *'Frog, where are you?'* wordless picture book by Mercer Mayer (1969), and the second method is a picture-naming task - the Child HALA psycholinguistic tool.

The reason for using these two particular tasks was that the methods' characteristics and approach would allow for examining lexical acquisition from different angles.

The Child HALA test was chosen to examine fluctuations in relative language strength across the primary school years that lead to a switch in language dominance. The Frog Story task was chosen to investigate changes in heritage lexical acquisition

that may precede the switch in language dominance. In contrast to the Child HALA task, which is a new development, the Frog Story is an established and widely acknowledged method in child language acquisition research, and therefore it was also chosen for this study to verify the outcomes of the Child HALA test. The reason to investigate the noun category lay in the characteristics of the two methods. The Child HALA is a picture-naming test that uses body part terms to investigate lexical accuracy and access through an on-line, closed conditions task. On the other hand, the Frog Story task is a form of a structured and semi-controlled (pictures) narration, where the choice of vocabulary, apart from some specific items necessitated by the plot, is dependent on the participant, the story angle they have taken, and the lexical repertoire they actually possess. Therefore, in order to verify the Child HALA test and obtain coherent and comparable results, a decision was made to focus on the acquisition of nouns. Bearing all that in mind, the objective was that by comparing the results of the two tasks, we could obtain a more complete picture of the knowledge and production of nouns in child heritage speakers.

In the following two sections, I present the methods and their application in this study. I start with the Frog Story, the description of the method, its use in previous research in child language acquisition, and the analyses that it was used for in this study. Then, I briefly introduce the Child HALA task, before providing a detailed description of the original method - the HALA test (O'Grady et al. 2009), the motivation to develop the Child HALA task, the amendments made to the original method, and a detailed description of the new version for children.

3.3.2 The Frog Story narrative task

3.3.2.1 Description of the task

The *'Frog, where are you?'* is a wordless picture book (Mayer 1969) that has become a well-established research material in the fields of monolingual and bilingual language acquisition.

It is used for investigating the development of narrative skills, complex syntax, and lexicon, and as narrations are not dependent on orthography, it has been employed in cross-cultural investigations and cross-linguistic comparisons. The book was successfully used in the cross-linguistic developmental project tracing child language narrative skills across age spans in the Berman and Slobin study (1994), where the researchers give substantial evidence for the book being applicable, relevant and suited for child subjects. Barbara Z. Pearson (2002) used it to examine morphosyntactic and lexical acquisition of Spanish-English bilingual primary school pupils in Miami, while, more recently, Maria Polinsky (2007) employed the Frog Story to investigate narrative skills in child and adult heritage speakers of Russian. Both researchers also used monolingual control groups in their studies.

The book consists of 24 pictures that tell a story about a boy and his dog who look for their pet frog that has gone missing. They set off on a trip full of adventures that concludes with a happy ending. As proposed by an anthropological linguist, David Wilkins (cited in Berman and Slobin 1994, p. 21), the pictures in the book comply with the drawing standards present in Anglo-Western stories for children and also, the type of story represented in the book is relevant to the culture, experiences and general knowledge of young children. Pre-school and primary school pupils are accustomed to tales with happy endings, tales about nature, about typical behaviour of dogs and inquisitive children, and they also have general pre-existing knowledge

about forests with typical flora and fauna found there. Moreover, as pointed out by Wilkins, it is in the general child frameset that animals can act like people, and that for example, a typical family unit consists of a husband, wife and their children, as portrayed in the book by the family of frogs.

3.3.2.2 Application of the task in this study

The children were asked to tell a story based on the 24 pictures in the book in order to obtain transcripts of semi-controlled narrations. The narrations served multiple analyses of the children's production of nouns in heritage Polish across age spans. The study was conducted only on the heritage language in two cohorts: the heritage speakers and the monolingual age-matched peers.

The analyses include[19]:

1) Total Different Noun assessment (TDN) – the number of different nouns used by each child to tell the story

The TDN analysis was used because this type of method has been found to be a sensitive developmental measure of lexical proficiency in bilingual children of a similar age, and also because it allows for capturing change in vocabulary size between different age groups (Uccelli and Páez 2007).

The decision to look at nouns, and not at a total number of all different words (TDW, as used by the above researchers), was motivated by the fact that the second method used in this study, the Child HALA task, investigates language accuracy and access through the production of nouns. Therefore, this was viewed as a way to verify and complement the results.

2) Total Correct Noun assessment (TCN) – accuracy assessment based on a number

[19] Detailed description of the analyses and the obtained results are provided in Chapter 4.

of different nouns used correctly to refer to an object, person or phenomenon in a narration.

3) Proportion of lower-frequency nouns in narrations

4) Target noun analysis – accuracy assessment of ten particular nouns

5) Analysis of lexical substitutions used in place of the target nouns – assessment of the impact of word frequency on the choice of substitutions in cases of gaps in the lexicon

6) Use of multiple lexical referents for one single term in individual narrations, e. g. using the terms 'bees', 'flies' and 'wasps' to refer to the same image of flying insects in the pictures.

3.3.3 The Child HALA psycholinguistic test

3.3.3.1 Introduction

The Child HALA test has been developed for the purpose of this study by Bożena Dubiel and Eithne Guilfoyle, and is based on the original HALA test (O'Grady et al. 2009). The reason for the design of this version was to develop a test that would be more suitable for young children and that could be applicable cross-culturally[20].

This method investigates noun accuracy and lexical access, as assessed by calculations of response times (RT), in a picture-naming task. The analyses are divided into word frequency strata and overall assessments. The investigations are this time conducted on both of the languages, heritage Polish and the L2 English in order to examine parallel lexical acquisition of the languages across age spans, and any potential shifts in language strength. Following that, a comparison between the results of the heritage speaking children and their Polish monolingual controls is

[20] See section 3.3.3.3 and 3.3.3.4 for information on the amendments made to the original method.

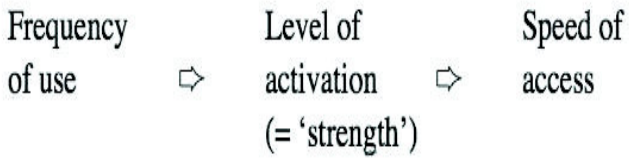
carried out to achieve a more in depth assessment of the nature of heritage language acquisition in a bilingual context.

3.3.3.2 The original HALA test

The Hawai'i Assessment of Language Access, The HALA psycholinguistic tool, was designed by William O'Grady and his team at the University of Hawai'i at Manoã in 2009. The main goal of this development was to establish a compact and straightforward tool for assessments of relative language strength and access in bilingual speakers.

According to O'Grady at al. (2009), the fundamental assumption underlying the method is that language maintenance is dependent on the level of language activation. In order to be used without pauses and hesitations in a variety of contexts, a language system needs to be constantly activated. The factor that conditions the level of activation is in turn the frequency of language use. In other words, the more a lexical item is used, the higher its activation level. Language activation corresponds directly to the speed with which a speaker can access words and phrases for production. When a linguistic item or structure is highly activated, then the speaker can access and produce it quickly. Therefore, as shown in figure 3.8 below, frequency of use translates into higher activation or strength, which in turn facilitates quicker access.

Figure 3.8. Usage, activation, and speed of access (O'Grady et al. 2009).



As a consequence, the language that is used more often in bilinguals becomes their stronger, more dominant language. The same applies to lexical items and phrases within each language: the ones that are used frequently, produce higher accuracy scores and are accessed in a shorter time than the words and phrases that are used less frequently.

The original testing suite includes three tasks - a body part naming task, a nature-image naming task, and a phrase-building task, however, as the latter two tests have not been used in any projects apart from the initial testing, and because this research study employs only the first task, I will focus the description on the body part naming test.

The authors chose to use body part terms because they are universal, have counterparts in all languages, and their basic status may prevent replacement by borrowing. Also, they are acquired by all users of a language at an early age, and therefore, according to O'Grady et al. (2009), low accuracy and RT scores might be interpreted as indicators of language endangerment.

The HALA test includes forty-three lexical items divided into three strata according to word frequency (high, medium, low)[21]. In the design of the test, O'Grady et al. (2009) considered only word frequency as a factor that impacts lexical accuracy and access, and that can be comparable across different pairs of languages. The decision was based on the characteristics of the words that are used in the test. As they are characterized by basic status and an early age of acquisition in the context of a home environment, the words are likely to be of comparable relative relevance in all communities and languages. On this basis, O'Grady et al. claim that there will be positive cross-linguistic correlations between lexical accuracy, access and frequency

[21] The term 'word frequency stratum' is used in this study after O'Grady et al. (2009)

of use. This assumption was also based on Bates et al.'s cross-linguistic study (2003), where the researchers found positive cross-linguistic correlation between frequency of use and response times in the seven languages they examined.

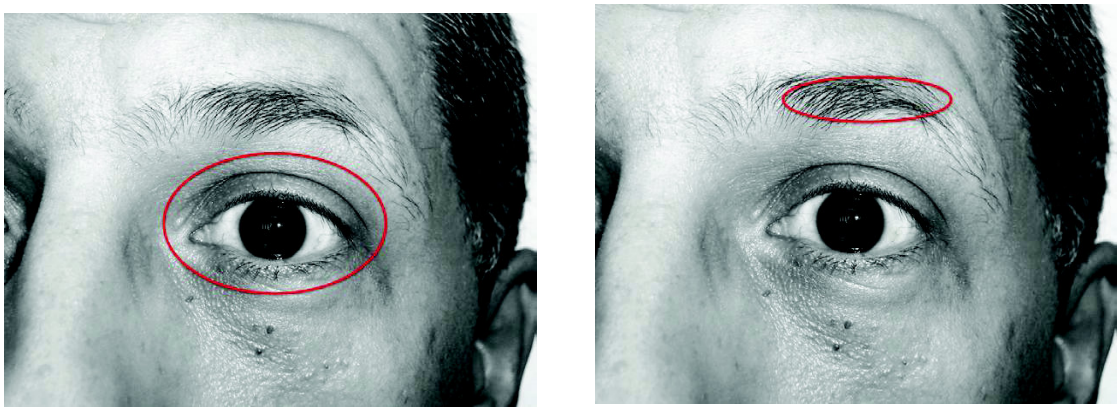
This assumption of the HALA test has recently been questioned by Hamilton, Perla and Robinson (2013) who conducted a study that aimed at assessing the vitality of Adang in an adult population[22]. The researchers suggest that it is impossible to determine baseline norms of word frequency across all languages, and especially in the understudied languages, as in the case of Adang. Hamilton, Perla and Robinson's conclusion seems plausible, taking into consideration that Bates et al. (2003) conducted their test on mainly Indo-European languages from highly civilized cultures, while Adang is a spoken-only language used in agrarian setting by a small number of people. However, in the case of our study, the issue does not concern us as both Polish and English are Indo-European languages, and thus in line with Bates et al and O'Grady et al, we assume that word frequency of equivalent nouns will compare between Polish and English for both, accuracy and response time scores[23].

The administration of the HALA test is simple and quick, it does not rely on orthography, and the investigator does not need to be proficient in the languages tested, making the test feasible with any combination of languages. Subjects are presented with the image of a man, which appears on a computer screen. They have to name the circled body parts, as shown in figure 3.9 below, as they appear with a beep at the onset of the image appearing on the screen. The responses are calculated according to accuracy and response time (RT), measured from the onset of the beep to the onset of the reply.

[22] Adang is an endangered language in eastern Indonesia where Indonesian is the official language.
[23] The same approach was followed by Kang (2011) and Tang (2011) who used the HALA test in the assessments of English and Korean and Mandarin and Truku respectively.

Figure 3.9 Sample images from the HALA body part naming task (O'Grady et al. 2009)

'eye' **'eyebrow'**



Initial tests carried out by the team at the University of Hawai'i used adult subjects who were fluent Korean-English bilinguals. The results, which held for both languages, supported the prediction of a positive correlation between the word frequency of use and accuracy, and even more significant effects for the correlation between frequency and response times. Most importantly, the HALA tool proved to be effective with highly balanced bilingual speakers whose levels of noun accuracy in the two languages could be equaled. The study found that the accuracy levels failed to determine relative language strength between the two languages in the speakers as they produced similar scores in the accuracy analysis. The cross-language effects could, however, be noted when the response time scores were taken into consideration, as the subjects were significantly slower in naming the body parts in Korean than in English. Such results showed that the analysis of response time (RT) is much more precise in assessments of language strength than accuracy, especially in balanced bilinguals. Also, it is more sensitive than the evaluation of lexical accuracy in documenting the onset of a switch in relative language strength between the two languages in bilinguals.

Similar results, with the response time proving to be a more precise measure than accuracy to evaluate relative language strength, were obtained by Tang (2011) who used the HALA tool to investigate language shift among teenagers, young adults and adults speaking Truku and Mandarin. The two youngest groups produced very similar levels of accuracy which, when analysing the results with only the accuracy in mind, might suggest stabilization in language loss. However, the results of the response time measure showed a significant difference between the two groups, with the youngest group requiring longer time to access words in Truku than the older adults, which points to a continuous language decline.

3.3.3.3 Motivation for developing a variation of the HALA test for use with children

The original HALA test was designed to be applicable for studying various linguistic phenomena, including language attrition, heritage language acquisition and language loss and revitalization, with both, children and adults, in different communities and cohorts (O'Grady et al. 2009). The test has been used in studies on adult language (O'Grady et al. 2009, Tang 2011, Hamilton, Perla and Robinson 2013), and because of the authors' assumption that it is applicable to subjects of all ages, Sang-Gu Kang (2011) used it with children to assess their level of English attrition after they had returned to Korea from Hawaii. The child participants fell exactly into the same age range as the subjects of this study, being between 4;11 and 12 years of age during the assessment. The results showed that the children did not display signs of English attrition even after two years back in Korea. The reason might have been the subjects' sociolinguistic environment in Korea, however, as suggested by O'Grady, it might have also originated from the unsuitability of the original HALA test for use

with child participants that I will discuss in the following part of this section (pr. correspondence with O'Grady, Feb. 2012).

Before undertaking the current research, I carried out a small pilot study using the original HALA test. Eight children of primary school age, half of whom were Polish-English bilinguals, and the other half were native speakers of English, were tested. The results of the pre-testing trials lead us to question the suitability of the HALA test for use with young children. First, the children's attention was drawn to irrelevant features of the image, such as moles or hair on arms and legs, which were confusing for the children, and led to their responding to those features rather than to the intended target. They commented on the hair on the man's leg, and the birth mark on his face (see Fig. 3.9), losing milliseconds of the response time, and thus putting the results of the test in question.

Second, there is evidence that a picture of a white man in shorts might be viewed as inappropriate in some cultures. A recent study on adults that used the original HALA method in Indonesia (Hamilton, Perla and Robinson 2013) noted that the participants were confused by the photograph of 'a white man'[24].

Third, the pre-determined speed rate with which the images changed was far too fast for the children in the pre-testing trial, and they often gave an appropriate response after the next item was circled, which was both confusing and too late for it to count.

Next, there are many items that proved too close semantically for the children to distinguish between them, e.g. 'cheek' and 'cheekbone'. The items are clearly marked and are not problematic for adults, however, the children in the trial tests did not even notice that the circles pointed to different body parts.

[24]This might be irrelevant for this study whose subjects are Europeans, however, the aim of the Child HALA test is to be universal and applicable cross-culturally. In some cultures and religions, e.g. Muslim, a photograph of a white man in shorts might not be viewed as appropriate testing material for children.

Finally, as the forty-three items are ordered from high to low frequency of use, some of the younger children became discouraged once they began to have difficulty in naming the body parts accurately. For these children the task turned out to be tiring and discouraging towards the end, with some of the youngest participants refusing to complete the exercise.

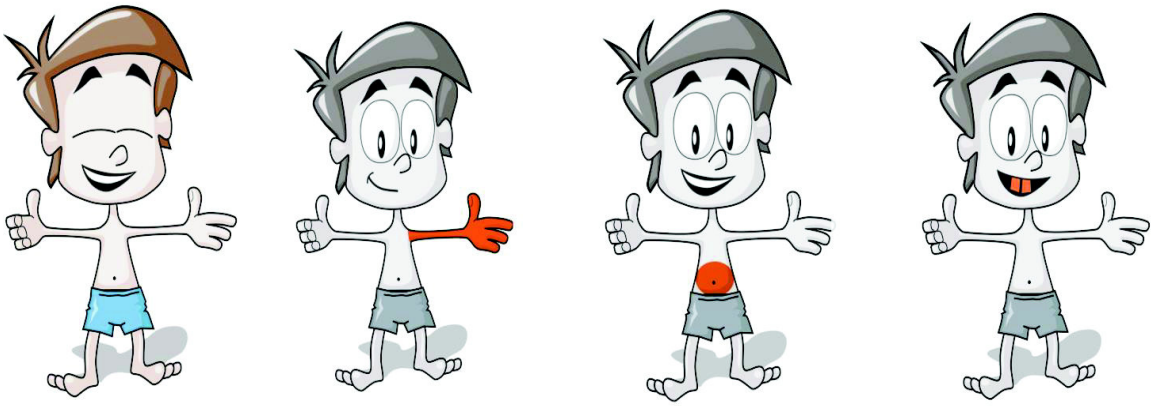
3.3.3.4 Changes made to the original HALA test: the Child HALA development

The results of the pre-testing trial sessions served as an incentive to design and develop a version of the HALA test which meets the needs of primary school children, and like the original HALA test can be a universal method applicable for use with child subjects in investigations of language dominance, maintenance and loss. The final version, called the Child HALA, was approved by the authors of the original task, Professor William O'Grady and Professor Amy J. Schafer (pr. correspondence Feb. 2012). The driving force behind this new development was to make the original test more suitable and appealing to young subjects. However, while the new test includes changes to the presentation and technical sides, the assumptions, key measures and the application of the tool remains the same, as designed and developed by O'Grady and his colleagues.

The first change was to substitute the black and white photographs of a man with an animated cartoon image of a child, as seen in figure 3.10 below.[25] This is more appealing to children, and keeps them engaged throughout the test. More importantly, a cartoon image has no distracting facial and body detail features that would be unnecessary for the study.

[25] The slide show was prepared using Adobe Flash Professional and After Effects programs.

Figure 3.10 Sample material from the Child HALA test.



“start” **“arm”** **“belly”** **“teeth”**

As in the original HALA, the testing starts with a trial session, however, photographs of everyday items were replaced with images of a house, tree, window and a door handle, as shown in Figure 3.11.

Figure 3.11 Sample images from the Child HALA trial session.

‘start’ **‘window’**

As shown in Fig. 3.10 and 3.11, both the trial pictures and the image of the boy are in colour at the start to focus children's attention but turn grey once the testing begins. The image of the boy is slightly animated between questions to keep children engaged and interested throughout the test. However, when a body part is highlighted there is no movement (still image). Another change was to allow the tester to control the speed with which the slides change by clicking the mouse, thereby avoiding changing the image too quickly. Children see the same image throughout the whole testing time. The chosen character and graphics are similar to the type seen in many cartoons, with a disproportionately big head to easily show all the small facial details. Therefore, to prevent distraction, there is no need to zoom in and out on particular body parts and change images. Figure 3.10 also shows that the body parts that are to be named are denoted by highlighting the whole item in red, instead of using circles which might be confusing for some participants, especially young children that are not accustomed to testing[26]. Next, the Child HALA eliminates those body part terms that are easily confused by children, e.g. 'cheek' and 'cheekbone'. Also, words like e.g. 'fingers' and 'thumb' were put one after another to avoid confusion. When a child sees 'fingers' first and then immediately 'thumb', they know they cannot answer 'fingers' again for the image of the 'thumb'. Finally, the images are not shown in order from high to low frequency of use as young children get easily discouraged when an exercise becomes harder and they fail to answer questions one after another. As a result, they might stop participating in the middle of the test as it happened during the pre-testing trial sessions. The final version of the Child HALA test includes twenty-seven nouns, divided into two strata according to

[26] This observation was also made by Hamilton, Perla and Robinson (2013), who noted that their participants who were not accustomed to testing were confused by the use of circles to denote an object to be named.

word frequency (O'Grady et al. 2009)[27].

The table below illustrates how the words were divided.

Table 3.7 Child HALA test items by word frequency stratum

High-frequency nouns	Low-frequency nouns
Ear	Arm
Eye	Cheek
Face	Chin
Fingers	Eyebrow
Foot	Nails
Hair	Forehead
Hand	Neck
Head	Thumb
Knee	Bellybutton
Leg	Elbow
Mouth	Heel
Nose	
Shoulder	
Stomach	
Teeth	
Tongue	

3.4 Chapter summary and conclusion

In this chapter, I presented the participants and the methods employed in this study. The first section provided information on the two cohorts of the subjects: the heritage speakers and the monolingual controls. The details of the heritage speakers' sociolinguistic background include the selection criteria, short outline of the recent

[27] The division of the nouns into word frequency strata follows guidelines set by O'Grady (2009). It was verified for Polish using data from the spoken channel in 'The National Corpus of the Polish Language' (Przepiórkowski et al. 2012), more information about the corpus, see chapter 4.5.2.

history of the Polish immigration to Ireland with geographic and age distribution, the socio-economic status and the educational background of the majority of the population. Next, I provided a profile of the families from the sociolinguistic point of view that includes a description of the links they keep with the home country, the heritage culture and language. Following that, I focused on the children's exposure to English, language use with the mother, siblings and friends, and the sources of the L2 input outside school. The final part of the first section provides information on the Polish monolingual groups.

The biographic and sociolinguistic description of the child subjects and their families provides a picture of a highly homogenous group that maintains extremely strong links with their roots, culture and with their heritage language. The Polish language is not only a language of the family but also of the community, workplace and cultural and religious celebrations. The majority of children are exposed to English only at school, in some cases additional input is provided during extracurricular sport activities, and finally, a few children are exposed to English through television.

In the second section, I presented the methods and analyses employed in this study, and the reason for using these two particular methods. First, I described the Frog Story, its application in previous research on child language acquisition, suitability for this research, and the analyses used in this study.

Then, I presented the second test, the Child HALA task. I began with a description of the original HALA test (O'Grady et al. 2009), and of the results from the studies that have so far used the task. Next, I presented my motivation to develop a version of the test for use with child subjects, the amendments I made to the original HALA test, and a description of the new version.

In the following chapters, I will provide the results obtained from the Frog Story narrations (Chapter 4), the Child HALA test (Chapter 5), and correlations of the results obtained from both methods (Chapter 6). A review of the findings and a discussion of directions for future research are presented in Chapter 7.

CHAPTER 4

NOUN PRODUCTION IN CHILD HERITAGE LANGUAGE

4.1 Introduction

In this chapter, I focus on the nature of lexical acquisition in child heritage language by examining the production of nouns across age spans. The development is investigated by comparing the lexical development of heritage Polish-English speakers with that of age-matched monolingual Polish children.

The goal of this chapter is twofold:

- To document and analyse the stages of development, stagnation or decrease in the heritage lexical system across age spans
- To examine the characteristics of any changes in heritage lexical acquisition, and evaluate the age at which they occur

The main hypothesis is that the acquisition of the heritage lexicon will show evidence of change as a result of a reduction in input and limitations in the contexts of language exposure and use. Once we examine and identify the changes, the next step is to evaluate the age at which they occur. The characteristics and the age of onset of those changes will be investigated by analysing the children's production of nouns in narrations of the Frog Story. I will examine the noun accuracy and range from the perspective of word frequency, and compare the results with the

monolingual pattern of acquisition provided by the monolingual control group across four age groups that span the primary school years.

The chapter is organised as follows:

First, I present the results in terms of the total number of nouns produced by the children and an assessment of noun accuracy. This is followed by an investigation into the effects of word frequency on the noun choice in narrations, and an analysis of the children's use of substitutions and multiple names as a way to compensate for gaps in the lexicon.

The chapter is concluded with a summary and discussion of the findings in the light of the aims of this study.

4.2 Elicitation and transcription techniques

4.2.1 Elicitation method

The elicitation techniques were modelled on the Frog Story design used in the cross-linguistic developmental project by Berman and Slobin (1994). The participants were tested individually in their homes. The instructions were simple and slightly modified depending on the child's age. Each child was asked to look through the 24 pictures prior to telling the story to get accustomed to the type of drawings, and to understand the meaning and sequencing of the pictures[28]. As suggested by Berman and Slobin, the title of the book was covered with a strip of coloured paper to avoid any influence on the interpretation of the drawings in older, literate children.

Throughout the story-telling session the participants were given as little feedback as possible unless it was deemed necessary for individual reasons, like a sudden break in the task caused by, e.g. lack of understanding of what a picture depicted, boredom,

[28] See Appendix C for the pictures used in the *'Frog, where are you?'* book.

etc. Occasionally, in order to motivate a participant, neutral comments or words of encouragement were used, such, that would not suggest any particular structure or word choice, e.g. 'and …', 'Anything else?', 'What happened next?', etc.

4.2.2 Transcription techniques

Each session was audio-recorded on an Olympus VN-8600PC digital voice recorder. The transcription techniques were followed as outlined in detail in Berman and Slobin (1994, pp. 655-664), and the recordings were transcribed using the CHAT format. The basic unit of analysis was a clause, e.g. any unit containing a unified predicate as opposed to an utterance or a sentence. In the above mentioned study, a unified predicate is defined as 'a predicate that expresses a single situation (activity, event, state), including finite and nonfinite verbs as well as predicate adjectives' (p. 657). Each clause was entered on a new textline, and a separate transcription sheet was created for every subject.

The first two transcriptions in every age and language (heritage and monolingual) cohort were verified by an independent Polish-English bilingual linguist. When a situation of doubt arose during the remaining transcriptions, the problem was resolved by discussion with the same independent linguist, and a consensus decision was reached.

4.3 Total different noun assessment (TDN)

In order to examine the overall number of nouns produced by the children in individual narrations, I used the count of total different nouns (TDN)[29]. The decision was motivated by previous research that has shown that it is a sensitive

[29] See Appendix D for all nouns produced by each heritage and monolingual speaker.

developmental measure of vocabulary proficiency in bilingual children of similar age. Additionally, such analysis allows for observing changes in vocabulary size as a function of age (Uccelli and Páez 2007).

The score for TDN produced by each child was calculated by adding all noun forms in the transcript, including synonyms and incorrect terms, e.g. *papuga/*'parrot' for *sowa/* 'owl*', kora/*'tree bark' for *kłoda*/'log', *dziura/*'hole' for *dziupla*/'tree hollow' *or filiżanka/* 'cup' for *słoik/*'jar'.

The incorrect forms were counted in the total score because they are part of the child's noun repertoire, and this assessment aims at evaluating the overall scope.

Furthermore, as Polish nouns are marked for gender, case and number, for typological purposes, all inflected forms of each noun were counted as one type, e.g.:

(1)[30] *pszczoła* *FEM:NOM:SING* – *pszczole* *FEM:DAT:SING* – *pszczoły* *NVIR:NOM:PL*
'bee' 'bee' 'bees'

(2) *but* *MASC:NOM:SING* – *buty* *NVIR:NOM:PL* – *bucie* *MASC: LOC:SING*
'shoe' 'shoes' 'shoe'

Table 4.1 below presents the results of the TDN count in the heritage and monolingual speakers.

[30] Note on the translation: all examples in Polish have been translated into English. However, notes on the grammatical structure are only given where relevant.

Table 4.1 Total different noun count (TDN) in the heritage and monolingual speakers

Group [mean age]	A / V [4;10]		B / X [5;10]		C / Y [8]		D [11;5] / Z[12]	
Heritage Speakers	**14.9**		**17.9**		**25.1**		**25**	
	Range: 8 - 26	SD: 5.3	Range: 10 – 25	SD: 4.8	Range: 19 - 32	SD: 4.7	Range: 20 - 32	SD: 5.2
Monolingual Speakers	**17.8**		**16.2**		**22.8**		**21.8**	
	Range: 7 – 30	SD: 8.0	Range: 8 – 24	SD: 5.9	Range: 14 - 27	SD: 5.1	Range: 15 - 30	SD: 5.7

The analysis reveals that both groups improve across age spans. The trajectory of growth is considerably steeper in the heritage children who begin with a slightly lower score than the monolingual group, however, they outperform their monolingual peers by the oldest age group. In general, the differences between the cohorts are marginal, nonetheless, they show that the heritage speakers perform slightly better than the monolinguals in the quantity of nouns produced in the narrations[31].

4.4 Noun accuracy: Total Correct Noun assessment (TCN)

In section 4.3, we considered the total number of all types of nouns produced by the children in the narrations. We now turn to the assessment of the accuracy of the nouns, as measured by their appropriateness in naming objects, persons, places, animals or ideas present in the book. The aim is to obtain a clearer picture of the

[31] In addition to the TDN analysis, a calculation of Total Different Verbs (TDV) was carried out, based on the same data. The analysis yielded similar results to the TDN count discussed in this section, where the monolingual speakers produced a higher number of verbs than the heritage speakers only at the youngest age level. The three remaining age groups demonstrated similar patterns of development in both cohorts.

children's knowledge of nouns and their use in a semi-controlled task like picture story telling. The structure of the book, through the pictures, necessitates the use of certain nouns, and thus the objective is to examine and compare this accuracy between the child heritage speakers and their monolingual controls.

For this analysis the following items were included in the count:

- synonyms,
- the use of different terms which could reasonably describe an object/animal/place, etc., e.g. *pszczoły*/'bees' and *osy*/'wasps' for the flying insects near a beehive, *kamień*/'stone' and *skała*/'rock', *woda*/'water', *staw*/'pond', *jezioro*/'lake' or *rzeka*/'river' for the water reservoir in the forest, etc.
- age- and experience-related choice of vocabulary, e.g. *chomik*/'hamster', *kret*/'mole', *świstak*/'marmot', etc. for the rodent-type animal.

Terms that were deemed incorrect for this assessment were:

- names that were clearly inappropriate, e.g. *kora*/'tree bark' for *dziupla*/'tree hollow', *kubek*/'mug' for *słoik*/'jar', *muchy*/'flies' for *pszczoły*/'bees' or *osy*/'wasps'[32], *patyk*/'stick' or *stare drzewo*/'old tree' for *kłoda*/'log'.
- overextensions, e.g. *dom pszczół*/'house for bees' for *ul*/'beehive', *dziura*/'hole" for *dziupla*/'tree hollow', etc.

After transcribing the recordings and an initial analysis, it was noted that there was an inconsistent use of diminutive forms; some children used them throughout the narration, some used them occasionally, changing between the forms during the story, e.g. *żaba*/'frog' and *żabka*/'frog'$_{DIM}$, and some children did not use

[32] Some children referred to the image of flying insects as muchy/'flies', however, it was deemed as incorrect for the accuracy assessment because the insects in the picture were visibly accompanied by an image of a beehive.

diminutives at all (this did not correlate with age). In order to obtain consistent results, only one form was used for calculations. The choice was conditioned by the form used by the child, and in case of both forms present in one transcription, the one that was more prevalent was selected.

The outcome of this analysis resembles the previous, TDN count, in that the monolingual group produces more correct nouns than the heritage speakers only at the youngest age. Following that, as shown in table 4.2 below, the two cohorts perform similarly. Despite the fact the oldest groups in both cohorts (heritage group D and monolingual group Z) perform slightly worse than the younger children (groups C and Y respectively), which should be viewed as a result of low number of participants, both the heritage speakers and the monolinguals display an overall trend of improvement and progression as they get older.

Table 4.2 Total different correct noun count (TCN) in the heritage and monolingual speakers

Group [mean age]	A / V [4;10]		B / X [5;10]		C / Y [8]		D [11;5] / Z[12]	
Heritage Speakers	**13.8**		**16**		**24.2**		**23.5**	
	Range: 7 - 24	SD: 5.2	Range: 9 – 23	SD: 4.5	Range: 17 - 32	SD: 5.1	Range: 19 - 30	SD: 5.0
Monolingual Speakers	**16**		**15.8**		**23.2**		**21.2**	
	Range: 7 - 29	SD: 7.8	Range: 8 - 24	SD: 5.6	Range: 14 - 28	SD: 5.4	Range: 15 - 29	SD: 5.2

The results of the total count and the accuracy analysis have not so far signaled any weakening of the lexical acquisition process in the heritage speakers. The results

show that the uneven quantity of input between the monolinguals and the heritage speakers does not affect the bilinguals' overall production of nouns. However, when we consider noun frequency in the following sections, we will see the first signs of divergence in the development between the monolinguals and heritage speakers, with the heritage speakers displaying stages of stagnation in lexical acquisition.

4.5 Proportion of lower-frequency nouns in the narratives

4.5.1 Introduction

In the analyses presented above, I did not consider the lexical characteristics of the nouns produced by the children, instead overall counts were compared. In this section, I examine how word frequency impacts the children's noun production in narrations. This is achieved by calculating the proportion of lower-frequency nouns in the heritage speakers' overall range of nouns, and comparing it with the monolingual score. The motivation behind this task is to obtain a more detailed and accurate description of child heritage lexical acquisition that could shed more light on why the heritage speakers produced a greater number of nouns in their narrations than did their monolingual counterparts, as we saw in sections 4.3 and 4.4.

4.5.2 Criteria for the analysis

All the nouns that were used correctly by the children in the total correct noun count (TDN) were assigned word frequency values[33]. The word frequency values were extracted from *Narodowy Korpus Języka Polskiego,* 'The National Corpus of the

[33] See subchapter 4.4 for the accuracy analysis.

Polish Language' (Przepiórkowski et al. 2012)[34]. For the purpose of the word frequency analysis, this particular corpus was chosen because it is the biggest corpus of modern Polish that contains spoken corpora from speakers of various ages, including children. The word frequency values were taken only from the conversations' category (spoken channel), bearing in mind that the subjects of this study are child heritage speakers who are either illiterate in Polish or have limited reading and writing skills in this language.

The words were divided into two categories: words of higher or lower frequency, with the cut off line at 5000 occurrences per 1 million. In other words, nouns with frequency lower than 5000/1m[35] fell into the lower-frequency category. This decision was made after having analysed all the lexical items from the Frog Story narrations with their corresponding frequencies, which was further verified and agreed on with an independent Polish-English bilingual linguist. The analysis has shown that nouns like *chłopiec*/'boy', *but*/'shoe' and *trawa*/'grass', that were deemed to be of common knowledge and frequent occurrence in everyday conversation, still only have a frequency of under 10.000, with 7.327, 6.764 and 7.327 respectively. All the nouns with a frequency rate lower than 5000 (examples of such nouns are shown in table 4.4) were deemed as not being part of everyday lexicon, but rather story specific and outside of the daily register used at home and with friends. Therefore, it was decided to treat all the nouns with frequencies lower than 5000 as lower-frequency nouns.

The examples of nouns from the lower-frequency category are shown in table 4.3 below.

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[34] The project was a research-development sponsored by the Polish Department of Science and Higher Education. It was initiated and carried out by researchers of the Institute of Computer Science at the Polish Academy of Sciences (coordinator), the Institute of Polish Language at the Polish Academy of Sciences, Polish Scientific Publishers PWN, and the Department of Computational and Corpus Linguistics at the University of Łódź. The corpus structure and volume was designed following the standards set by the British National Corpus (BNC).

[35] The word frequency rates are encoded as number of occurrences per 1 million.

Table 4.3 Examples of lower-frequency nouns in the Frog Story narrations

Noun	Word Frequency
Pszczoły/'bees'	564
Sowa/'owl'	2.255
Staw/'pond'	3.946
Jeleń/'deer'	1.127
Ul/'beehive'	1.691
Wiewiórka/'squirrel'	1.691

One issue that arose during the initial analysis was how to categorize diminutive forms. It emerged that the base forms and their diminutives have different frequency rates that sometimes varied to a great extent, e.g.

(7.a) *pies* - freq. value 124.567 'dog'

(7.b) *piesek* - freq. value 24.801 'dog'$_{DIM}$

(8.a) *drzewo* - freq. value 36.074 'tree'

(8.b) *drzewko* - freq. value 1.127 'tree'$_{DIM}$

The use and, very often, excessive reliance on diminutive forms in heritage language speakers has been documented by Polinsky (2006) in her study on incomplete acquisition in American Russian who examined the language of adult speakers. In Polish diminutives are not used in normal adult-to-adult conversations, apart from when their function is to depict the small size of an object or a positive emotional attitude (Grzegorczykowa and Pużynina 1998 cited in Haman 2003, p. 54). However, in Russian and Polish the forms exist in child-directed speech (CDS), and are a regular feature of adult conversations with very young children (Haman 2003, Zemskaja 1973, 1981 cited in Polinsky 2006, p. 213). Adults usually adapt their CDS to the age of the child, which means that the proportion of diminutives in CDS

decreases with the age of the child (Haman 2003). This situation might however be different for heritage speakers, as shown by Polinsky (2006), due to the fact that heritage speakers usually experience a reduction in their L1 input early in life, and thus diminutives may be the only forms they have acquired.

In the present study the frequent appearance of diminutives was expected, however, for some children, they might have been the only forms they knew, and therefore it was considered appropriate for this analysis to use only the word frequency of the base forms for all diminutives. Otherwise, these forms may lead us to conclude that they had a greater knowledge of lower-frequency nouns than is in fact the case.

4.5.3 The Results

The results of the calculation of the proportion of lower-frequency nouns in the narrations reveal a different pattern of development, especially as a function of language experience, as compared with the outcomes of the previous overall noun count (TDN). In the following two sections, I first present the results of the monolingual Polish speakers, and then of the heritage language children. Finally, I compare the outcomes between the groups as a function of age.

4.5.3.1 The monolingual speakers

The monolingual children in this study use increasingly more nouns of lower frequency as they get older. As we can see in table 4.4 below, the progress is steady with an approximate 4-5% improvement between the age groups, starting from 29% in the youngest group to 45% in the oldest.

Table 4.4 Proportion of lower-frequency nouns in the narrations of the monolingual speakers

Group [mean age]	V [4;10]		X [5;10]		Y [8]		Z [12]	
Percentage of LF nouns	**29.6%**		**35.4%**		**38.6%**		**44.8%**	
	Range: 9.1% - 46.7%	SD: 12%	Range: 25% - 46%	SD: 8%	Range: 30% - 46%	SD: 7%	Range: 32% - 53%	SD: 8%

4.5.3.2 The heritage speakers

The calculation of the proportion of lower-frequency scores for the heritage speakers show different results than those of the monolinguals. These are shown in table 4.5 below.

Table 4.5 Proportion of lower-frequency nouns in the narrations of the heritage speakers

Group [mean age]	A [4;10]		B [5;10]		C [8]		D [11;5]	
Percentage of LF nouns	**29.3%**		**25.2%**		**29%**		**34.2%**	
	Range: 14% - 53%	SD: 12%	Range: 11% - 40%	SD: 9%	Range: 22% - 37%	SD: 5%	Range: 28% - 40%	SD: 5%

As we can see from the scores shown above, the heritage speakers do not improve as they get older until the mean age of 11;5. There is no increase in the proportion of lower-frequency nouns between the ages of 4;10 and 8. The rate fluctuates between stagnation and decrease that continue until the children reach the mean age of 11;5, when the oldest group shows slight signs of increase in the usage of lower-frequency nouns.

4.5.3.3 Comparison between the monolingual and heritage speakers

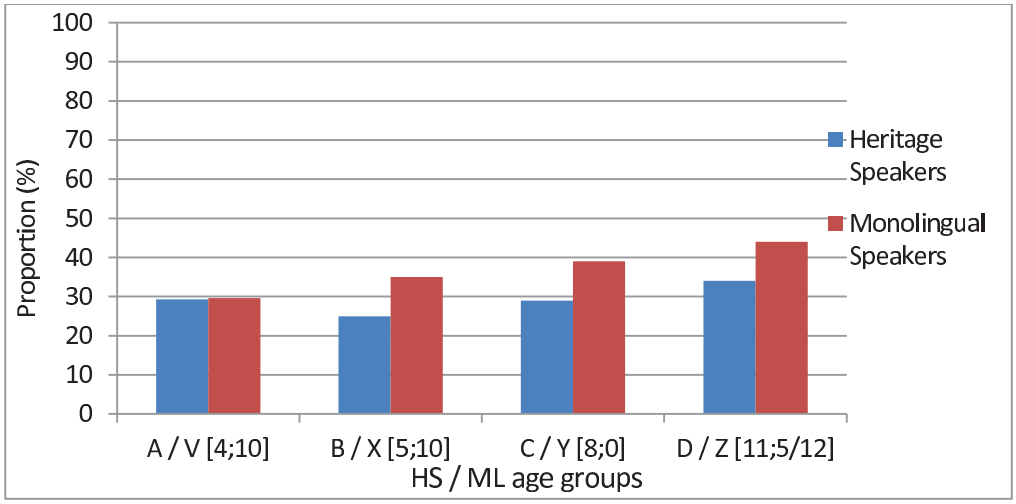
By comparing the results between the two cohorts, as shown in table 4.6 below, we can observe an early emerging disadvantage in the heritage speaking children that is present until the end of primary school years.

Table 4.6 Proportion of lower-frequency nouns in Polish in the monolingual and heritage speakers

Group [mean age]	A / V [4; 10]	B / X [5; 10]	C / Y [8]	D [11;5] / Z[12]
Heritage Speakers	**29.3%**	**25.2%**	**29%**	**34.2%**
Monolinguals	**29.6%**	**35.4%**	**38.6%**	**44.8%**

Contrary to the previous results of TDN and the overall accuracy that show a balanced development between the cohorts, here we can see a strong, 10%, monolingual advantage at the oldest age level. The heritage speakers stagnate in the development of lower-frequency nouns, and do not progress steadily across age spans until the last years of primary school. The monolingual children, on the other hand, show a 15% gain over the years. A possible explanation of this outcome might be the fact that the heritage speakers use the language mainly in the context of home, and lack exposure to Polish in a more variety of contexts. The monolingual children, on the other hand, are exposed to different language registers, especially in the school context, and through growing literacy skills (Oller and Pearson 2002; Bialystok et al. 2010). An overview of the results is illustrated in figure 4.1 that points to the discrepancy between the use of lower-frequency nouns by the monolingual and heritage language children.

Figure 4.1 Overview of the proportion of lower-frequency nouns in the monolingual and heritage speakers[36]



The hypothesis stated at the beginning of this chapter was that the heritage lexicon will show evidence of change due to a reduction in input and limitations of contexts of language exposure and use. The goal was also to document the age at which the changes occur. So far, we can conclude that the first indication of change in the acquisition of the L1 lexicon becomes evident between the mean age of 4;10 and 5;10, and concerns the stagnation in the overall acquisition of lower-frequency nouns. In the following sections, I will focus on more in-depth analyses of the nouns produced by the children in order to investigate further evidence of early changes in the acquisition of the L1 lexicon. We will also seek an explanation for the divergence between the balanced overall TDN and accuracy scores and heritage speakers' poorer results in the lower-frequency analysis. The investigation will look into specific nouns in the narrations, their accuracy, and the strategies used by both cohorts to deal with an inability to produce some of the nouns: the use of lexical substitutions and the role of word frequency in word choice.

[36] In all charts, the groups are denoted by capital letters: A-D for the heritage speakers; V-Z for the monolingual speakers. The numbers in square brackets denote a mean age of the group.

4.6 The target noun analysis

4.6.1 Introduction

In this section, we investigate the children's accuracy[37] in the use of certain nouns, called from now on *target nouns*, the strategies employed by the children to deal with gaps in the lexicon, and the characteristics of the substitutions in terms of their frequency and category.

First, I describe the criteria used in the analysis of the target nouns, and then I present the results that are divided into two categories: the quantitative results of the target noun accuracy assessment and the analysis of the substitutions used to compensate for the lack of knowledge of the required nouns. The types of substitutions produced by the children are examined from two perspectives: their word frequency relative to the frequency of the target nouns and the category of word use.

4.6.2 Criteria for the analysis

As it is not possible to examine and compare all the nouns produced by the subjects during the narrative task, because of avoidance strategies and various narrative angles applied to tell the story, I decided to use a list of 10 target nouns that are essential to the story, and had to be referred to at certain points in the narration. The list is based on a part of the Language Score devised for the purpose of *the Miami study* that was used to investigate narrations of monolingual and bilingual primary school children (Pearson 2002). The study employed the Frog Story for the purpose of examining the subjects' narrative, morphosyntactic, complex syntax and lexical skills. After analysing the transcriptions, a few modifications were made to the list in order to make it more appropriate to the subjects of this study, and the nature of the

[37] The accuracy analysis presented and discussed in section 4.4 deals with all nouns regardless of their word frequency value.

task. The nouns 'cliff' and 'antlers' were replaced with 'burrow' and 'tree hollow' as they are less prone to be avoided in the course of narration. Table 4.7 below presents the list of the target nouns used for the analyses described in this section.

Table 4.7 List of target nouns in the Frog Story

Target nouns	Word frequency according to NCPL[38]
Żaba / 'Frog'	7.327
Słoik / 'Jar'	14.655
Pszczoły/ 'Bees' Osy/'Wasps'	0.564 7.891
Ul / 'Beehive'	1.691
Rodent type animal, e.g.: mysz/'mouse' kret//'mole', etc.	Frequency depending on the term chosen
Dziupla / 'Tree hollow'	0.564
Nora / 'Burrow'	0.564
Sowa / 'Owl'	2.255
Animal with antlers, e.g.: jeleń/'deer' sarna/'doe', etc.	Frequency depending on the term chosen
Kłoda /'Log'[39] Pień/ 'tree trunk'	0.564 0.0

4.6.3 Quantitative results of the target noun analysis

In this section, I examine accuracy in the production of the target nouns by both the heritage and monolingual speakers. The outcomes are analysed by age level in the two cohorts to examine whether the heritage speaking children display any sign of

[38] National Corpus of the Polish Language, for more details, see subchapter 4.5.2
[39] As the image of the log may be confusing for young children, the noun 'tree trunk' was also accepted as a correct target description.

disadvantage as compared with their monolingual peers, in which case we will establish at which age the change occurs.

In the previous section on overall accuracy (section 4.4), I compared the number of all correctly used nouns to obtain the score for the overall noun production in the narratives. However, in this section we consider only the nouns that are the appropriate names for ten objects in the Frog Story. The usage of substitutions and the issue of their word frequencies as relative to the target nouns are discussed later in the next section.

In the following parts of this section, from a) to d), I present the quantitative analysis that is discussed at four age levels, from the youngest to the oldest, as a comparison between the heritage and the monolingual children at each age level. I analyse only the target nouns that produced different scores in both cohorts at one age level. Target nouns that produced similar scores are not included in the analyses[40].

a) heritage group A and monolingual group V
mean age: 4;10

As we can observe from the scores in table 4.8 below[41], the heritage speakers are more accurate with four nouns: *słoik*/'jar', *pszczoły*/'bees', the rodent type animal, and *dziupla*/'tree hollow'; whereas their monolingual counterparts are better at correctly naming three nouns: *ul*/'beehive', *nora*/'burrow', and the animal with antlers.

[40] See Appendix E for lists of target nouns produced by each child.
[41] The scores marked in red denote which cohort (monolingual or heritage speakers) has been more accurate with the specific target nouns.

Table 4.8 Target noun accuracy in heritage group A and monolingual group V

	Słoik/ Jar	Pszczoły/ Bees	Ul/ Beehive	Rodent	Dziupla/ Tree hollow	Nora/ Burrow	Sowa/ Owl	Animal with antlers	Kłoda/ Log
HS A	50%	80%	30%	70%	20%	0	60%	50%	30%
ML V	16%	66%	66%	50%	0	33%	66%	66%	33%

At the youngest age level, despite different accuracy scores in respect to different nouns in both cohorts, neither the heritage speakers nor the monolinguals show any signs of advantage.

b) heritage group B and monolingual group X
mean age: 5;10

The following two age groups, again, perform similarly, however, this time with a slight advantage on the heritage speakers' part. The following table 4.9 shows results for all nine target words that produced varied results. The tenth noun *żaba*/'frog' was produced correctly by all the children, and therefore is not included in the analysis.

Table 4.9 Target noun accuracy in heritage group B and monolingual group X

	Słoik/ jar	Pszczoły/ Bees	Ul/ beehive	Rodent	Dziupla/ Tree hollow	Nora/ Burrow	Sowa/ Owl	Animal with antlers	Kłoda/ Log
HS B	29%	64%	50%	64%	7%	36%	86%	29%	35%
ML X	50%	66%	100%	50%	0%	50%	50%	83%	0

The monolingual children are more accurate at naming four images: *słoik*/'jar', *ul*/'beehive', *nora*/'burrow' and the animal with antlers; whereas the heritage speakers perform better with three objects: the rodent type animal, *sowa*/'owl' and *kłoda*/'log'. Both of the groups perform similarly with the other nouns.

The analyses of the first two age levels illustrate that the children from both cohorts produce comparable results, with the heritage speakers performing better with some nouns, and the monolinguals with others. No significant difference can be observed, apart from an initial sign that both of the two youngest heritage groups have particular problems with the words *nora*/'burrow', *ul*/'beehive' and the animal with antlers. This finding will be discussed later in the light of register and literacy skills.

The following two analyses of the performance of the older children will show that the balance in the performance between the children who reside in Ireland and the monolinguals who grow up in Poland changes dramatically around the age of 8. From then on, we will see a pattern of monolingual advantage, with most of the terms named effortlessly by 100% of the control group members, while some being continuously problematic for the heritage speakers.

c) heritage group C and monolingual group Y mean age: 8

The scores for the second oldest age level are shown in table 4.10 below.

Table 4.10 Target noun accuracy in heritage group C and monolingual group Y

	Słoik/ Jar	Ul/Beehive	Dziupla/Tree hollow	Nora/Burrow	Animal with antlers	Kłoda/log
HS C	62%	50%	12.5%	12.5%	50%	37.5%
ML Y	100%	100%	66%	66%	100%	66%

As we can observe, the heritage speakers have most difficulty identifying and correctly naming the nouns: *słoik*/'jar', *ul*/'beehive', *dziupla*/'tree hollow', *nora*/'burrow', the animal with antlers, and *kłoda*/'log', with the latter two being named by only one child each. In contrast, all the monolingual children produce

accurate terms for almost all the target images, the only exception being *dziupla*/'tree hollow', *nora*/'burrow' and *kłoda*/'log' that are referred to correctly by four out of six children each.

d) heritage group D and monolingual group Z
mean age: 11;5 and 12

The results of the previous age level are replicated by the oldest age groups, D and Z, in terms of the monolingual advantage in correctly naming all the target nouns.

Table 4.11 Target noun accuracy in heritage group D and monolingual group Z

	Ul/beehive	Dziupla/tree hollow	Nora/burrow	Kłoda/log
HS D	50%	0	16%	16%
ML Z	100%	66%	100%	83%

As we can see in table 4.11 above, the oldest children from the monolingual group perform best of all the groups. The only words that are still slightly problematic are *dziupla*/'tree hollow' that is substituted by two children, and *kłoda*/'log' that is replaced with an overextension by one subject. The heritage speakers, on the other hand, still have most difficulty using the same target nouns as the younger children: the word *ul*/'beehive' is referred to by only half of the subjects, *nora*/'burrow' and *kłoda*/'log' – by one child each, and finally *dziupla*/'tree hollow' is substituted by all the heritage speakers. In case of the last two nouns, we can observe that the oldest heritage speakers produce poorer results that their younger counterparts from group C.

To sum up, we can conclude that the heritage speakers' and monolinguals' production of the target nouns is at a comparable level at the younger age, however, a change starts to occur between the age of 5;10 and 8. The monolingual children

continue to expand their lexical repertoire with words of lower-frequency, while the heritage speakers remain at the same level as the youngest children from their cohort, or even show slight signs of decrease at the oldest age level. The nouns they have failed to acquire all belong to the lower-frequency stratum, and are mostly acquired within a school setting, through reading in the target language, or in oral input outside the everyday home context. The situation is most visible with specific nouns like *nora*/'burrow', *ul*/'beehive', *kłoda*/'log' and *dziupla*/'tree hollow', where the heritage speakers have difficulty throughout all age spans, and the monolinguals acquire them as they get older. This may be a consequence of the fact that although some of the heritage speakers could read and write in Polish, none of them practised those skills on a daily basis. When asked during the interviews, all the parents said that the children always read for pleasure or information in English. These limitations in input and reduced contexts of language exposure and use in the heritage language might be viewed as the main cause why the early sequential bilinguals have not acquired the above mentioned target nouns.

Relating to the hypothesis in which we claimed to show evidence of change in lexical development in the L1 of the heritage speakers in comparison to their monolingual counterparts, we can conclude that the heritage language lexicon indicates further signs of stagnation. This time, it is evidenced in the acquisition of nouns that are of lower-frequency and are commonly acquired through schooling and literacy. These changes start to manifest at around mid-primary school years, between the age of 5;10 and 8. In the following section, we will look into the issue of lexical substitutions used by the children when they do not know the target nouns, and these will be analysed considering the impact of word frequency.

4.6.4 Types of substitutions for the target nouns and the impact of word frequency

The target nouns investigated in the previous section are the most precise and widely used terms for the particular objects in the story, and thus most expected in the Frog Story narrations. Nonetheless, the use of substitutions in cases of either gaps in the lexicon or other nouns being more easily available due to their higher-frequency was anticipated. This prediction was based on the fact that younger monolingual children often overextend high-frequency terms to refer to lower-frequency items; a common phenomenon that stems from insufficient exposure to lower-frequency words or lack of language experience (Bedore and Pena 2008). In the case of bilingualism, we can expect that this use of substitutions lasts longer than in the monolingual acquisition due to limitations of input.

The previous two sections have shown that the heritage speakers fail to achieve similar levels of lower-frequency nouns, and demonstrate most difficulty with words that are outside of the informal register that they are exposed to in the home and community context. In this section, we will look at the substitutions the children produce in place of the expected target nouns, and whether they are lexical over-extensions of higher-frequency.

First, I present the analyses of the six target nouns that belong to the lower-frequency stratum in order to examine whether the substitutions produced are of much higher-frequency, and whether there is a difference between the monolinguals' and the heritage speakers' choice of nouns. Then, I focus on the noun *słoik*/'jar' that is of higher-frequency than the rest, and the lexical terms used to refer to the picture of the animal with antlers, and the rodent type animal to investigate whether the type of terms used by the two cohorts are of any significant difference. The target noun

żaba/'frog' will not be analysed as it was correctly named by all the children.

a) The target noun: pszczoły (osy) / 'bees' ('wasps')[42], word freq.: 0.564 (7.891)

As can be seen from table 4.12 below, the image of the flying insects is always referred to as *pszczoły*/'bees' by the monolingual group, and it is applied by all the subjects, including the youngest. There is one case of substitution with the noun *muchy*/'flies' in the youngest group V, however, from then on, all the children use the lower-frequency target noun.

The heritage speakers across age groups, in addition to *pszczoły*/'bees', produce nouns of higher-frequency: *osy*/'wasps', *muchy*/'flies' or *muszki*/'flies'$_{DIM}$

Table 4.12 Types of lexical substitutions for the target noun *pszczoły*/'bees' in the monolingual and heritage speakers

Pszczoły (osy)/'Bees' ('wasps') word freq.:0.564 (7.891)					
Monolinguals		Word Freq.	Heritage Speakers		Word Freq.
V	Muchy/'Flies'	20.855	A	Muchy/'Flies' Osy/'wasps'	20.855 7.891
X	-		B	Muchy/'Flies' Muszki/'flies'$_{DIM}$.	20.855 0.564
Y	-		C	Osy/'wasps'	7.891
Z	-		D	Osy/'wasps'	7.891

[42] In case of this target noun, both of the nouns 'bee' and 'wasp' were accepted in the accuracy analysis as many children may not distinguish between the terms. As for the analysis of lexical substitutions, the aim is to show the variety of the nouns used by both cohorts at the same age level.

b) The target noun: ul/'beehive', word freq.: 1.691

The data in table 4.13 shows that the lower-frequency target noun *ul*/'beehive', again, is never replaced with any other equivalent by the monolingual children, and is produced by all the subjects from the second youngest age group onwards[43]. The early sequential bilinguals, on the other hand, along with the word *ul*/'beehive', use overextensions of much higher-frequency: *gniazdo*/'nest', *dom*/'house', and *domek*/'house'$_{DIM}$. This strategy of substitution occurs at all age groups, with only about half of the heritage language children using the target noun.

Table 4.13 Types of lexical substitutions for the target noun *ul*/'beehive' in the monolingual and heritage speakers across age groups

Ul/'beehive' word freq.: 1.691					
Monolinguals		Word Freq.	Heritage Speakers		Word Freq.
V	-		A	Gniazdo/'nest' Dom/'house'	7.327 118.370
X	-		B	Gniazdo/'nest' Dom/'house'	7.327 118.370
Y	-		C	Domek/'house'$_{DIM.}$	29.310
Z	-		D	Gniazdo/'nest'	7.327

[43] See section 4.6.3 for the quantitative analyses.

c) The target noun: dziupla/'tree hollow'[44], word freq.: 0.564

The target noun *dziupla*/'tree hollow' proves to be another tricky noun for the heritage speakers as it is never used by the children from the two older groups, and is substituted with higher-frequency categorical overextensions of *dziura*/'hole', *dziurka*/'hole'$_{DIM}$, or analogical overextensions *kora*/'tree bark' and *kłoda*/'log'. The target noun is as difficult for the younger subjects as for the older ones, as they score similarly, adding two more items to the range of replacements: *nora*/'burrow' and *drzewo*/'tree'.

As for the monolinguals, they struggle with the target word at the younger age (groups V and X), but contrary to the heritage speakers, use it confidently from the mean age of eight, which is also shown in the target noun accuracy assessment in the previous section. The substitutions, presented in table 4.14 below, that were produced by the monolinguals are individual cases, and do not form a trend as in the heritage speakers.

[44] Some of the target nouns might be sensitive to cross-linguistic differences in lexical expression (Slobin 2004). For example, the nouns 'tree hollow' and 'burrow' are commonly referred to as 'hole' in English, whereas in Polish, it is lexically inappropriate to use the noun 'hole' to denote a 'tree hollow' and 'burrow'.

Table 4.14 Types of lexical substitutions for the target noun *dziupla*/'tree hollow' in the monolingual and heritage speakers

dziupla/'tree hollow' word freq.: 0.564					
Monolinguals		Word Freq.	Heritage Speakers		Word Freq.
V	Dziura/'hole' Pień/'trunk' Drzewo/'tree'	27.691 0 36.074	A	Dziura/'hole' Dziurka/'hole'$_{DIM.}$ Drzewo/'tree'	27.691 3.946 36.074
X	Dziurka/'hole'$_{DIM}$ Nora/'burrow'	3.946 0.564	B	Dziura/'hole' Nora/'burrow' Pień/'trunk' drzewo/'tree'	27.691 0.564 0 36.074
Y	Pień/'trunk' Gniazdo/'nest'	0 7.327	C	Dziura/'hole' Dziurka/'hole'$_{DIM.}$ Pień/'trunk'	27.691 3.946 0
Z	Dziura/'hole' Kora/'tree bark'	27.691 4.509	D	Dziura/'hole' Kora/'tree bark'	27.691 4.509

d) The target noun: nora/'burrow', word freq.: 0.564

As shown in the quantitative analysis (section 4.6.3), the heritage speakers have most difficulty with this target noun, substituting it, as presented in table 4.15 below, with a variety of nouns of much higher-frequency. The Polish monolinguals, on the other hand, master this lower-frequency noun as they get older, and the last group names it correctly 100% of the time. In group Y, the second oldest, only two subjects replace it: one with the word *dziupla*/'tree hollow', and the other - with the high-frequency overextension *dziura*/'hole'. In the two youngest monolingual groups, along with the target noun, the children produce the nouns *dziura*/'hole' or *dziurka*/'hole'$_{DIM}$.

Table 4.15 Types of lexical substitutions for the target noun *nora*/'burrow' in the monolingual and heritage speakers

Nora/'burrow' word freq.: 0.564					
Monolinguals		Word Freq.	Heritage Speakers		Word Freq.
V	Dziura/'hole'	27.691	A	Dziura/'hole' Dziurka/'hole'$_{DIM.}$ Rura/'pipe'	27.691 3.946 8.455
X	Dziurka/'hole'$_{DIM}$	3.946	B	Dziura/'hole'	27.691
Y	Dziura/'hole' Dziupla/'tree hollow'	27.691 0.564	C	Dziura/'hole' Dziurka/'hole'$_{DIM}$	27.691 3.946
Z			D	Dziura/'hole' Dziurka/'hole'$_{DIM}$ Dziupla/'tree hollow' Ziemia/'ground'	27.691 3.946 0.564 18.601

e) The target noun: sowa/'owl', word freq.: 2.255

Table 4.16 shows that the target noun *sowa*/'owl', is never replaced with any other word by the monolingual group, however, the children from the youngest heritage groups A and B, produce overextensions: *ptaszek*/'bird'$_{DIM}$, and even *oczy*/'eyes' and *papuga*/'parrot'.

Table 4.16 Types of lexical substitutions for the target noun *sowa*/'owl' in the monolingual and heritage speakers

Sowa/'Owl' word freq.: 2.255					
Monolinguals		Word Freq.	Heritage Speakers		Word Freq.
V	-		A	Ptaszek/'bird'$_{DIM.}$	2.255
X	-		B	Oczy/'eyes' Papuga/'parrot'	87.366 1.127
Y	-		C	-	
Z	-		D	-	

f) The target noun kłoda (pień)/'log' ('tree trunk'), word freq.: 0.564 (0)

The quantitative analysis discussed in section 4.6.3 showed that the image of 'log' (similarly to 'tree hollow' and 'burrow') proved to be problematic for the heritage speakers, resulting, as we will see in table 4.17, in a high number of lexical substitutions. The data in table 4.17 shows that the monolinguals master this low-frequency word as they get older, substituting it on a few occasions with the higher-frequency categorical overextension of *drzewo*/'tree', or by one child with the noun *kora*/'tree bark', which is slightly more frequent than the target noun but classifies as an analogical overextension. On the other hand, the heritage speakers rely mainly on substitutions in the two oldest age groups, producing items like *drzewo*/'tree', *kora*/'tree bark' or *patyk*/'stick'. The two younger age groups in both cohorts behave comparably, producing similar substitutions, and rarely using the lower-frequency target noun.

Table 4.17 Types of lexical substitutions for the target noun *kłoda*/'log' in the monolingual and heritage speakers

Kłoda (pień)/'log' ('tree trunk') word freq.: 0.564 (0)					
Monolinguals		Word Freq.	Heritage Speakers		Word Freq.
V	Deska/'plank' Drzewo/'tree'	4.509 36.074	A	Drewno/'wood' Gałąź/'branch' Takie od drzewa/ 'something off the tree'	12.400 1.127 36.074
X	Drzewo/'tree' Dziupla/'tree hollow'	36.074 0.564	B	Drzewo/'tree' Drewno połamane/ 'broken wood' Takie od drzewa/ 'something off the tree' Odcinane drzewo/'cut off tree'	36.074 12.400 36.074 36.074
Y	Drzewo/'tree'	36.074	C	Drzewo/'tree' Utnięte drzewo/'cut off tree'	36.074 36.074
Z	Kora/'tree bark'	4.509	D	Kora/'tree bark' Drzewo/'tree' Stare drzewo/'old tree' Opadnięte drzewo/'fallen tree' Patyk/'stick'	4.509 36.074 36.074 36.074 2.255

The outcomes obtained from the above analyses support the results from the target noun accuracy assessment discussed in the previous section, in that certain lower-frequency items that are not part of the informal home register are not acquired by the heritage speakers, but do become part of the monolinguals' lexicon. The youngest children in both cohorts behave similarly, and start to follow different paths of lexical development only around the age of 8. The evidence from this section points to an over-reliance on a variety of higher-frequency nouns or on analogical overextensions to compensate for gaps in the lower-frequency range.

In the following part of this section, I present the types of substitutions and words used by the children to refer to the target noun *słoik*/'jar' which is of higher-frequency than the rest of the target nouns described above, and the terms used by the children to name the rodent type animal and the animal with antlers. The purpose of this is to examine whether there is a difference between the two cohorts in the scope and range of lexical terms used in cases of the target nouns of higher-frequency ('jar'), or when no single noun is required (the animal with antlers and the rodent type animal).

g) The target noun słoik/'jar', word freq.: 14.655

As can be seen in table 4.18, the target noun *słoik*/'jar' caused confusion only for the youngest participants. Even though this particular word belongs to the group of nouns with relatively higher-frequency rate, it is still replaced with a variety of nouns by the heritage speakers. In comparison, the subjects of the monolingual group name it correctly most of the time.

Table 4.18 Types of lexical substitutions for the target noun *słoik*/'jar' in the monolingual and heritage speakers

Słoik/'Jar' word freq.:14.655					
Monolinguals		Word Freq.	Heritage Speakers		Word Freq.
V	Butelka/'bottle'	12.400	A	Kubek/'mug' Wazon/'vase'	19.164 2.818
X	Akwarium/'aquarium'	9.018	B	Butelka/'bottle' Puszka/'tin' Szklanka/'glass' Pojemnik/'container' Pojemniczek/'container'$_{DIM}$	12.400 10.709 6.764 5.637 1.127
Y	-		C	Szklanka/'glass' Butelka/'bottle' Kubek/'mug'	6.764 12.400 19.164
Z	-		D	Szkło/'glass'	10.146

h) The target noun: the rodent type animal

The two following images of the rodent type animal and the animal with antlers attracted a wide range of lexical terms. As it was difficult to distinguish the exact species from the pictures, no specific target nouns were set, and the analysis is limited to the range of words produced by the children.

As for the rodent type animal, the monolingual speakers mostly recognised the animal to be either a *kret*/'mole', *krecik*/'mole'$_{DIM}$ or a *wiewiórka*/'squirrel'. There are also two individual cases of children using very low-frequency nouns like *nornica*/'vole' and *świstak*/'marmot'. As we can see from table 4.19 below, the heritage speakers offer a much wider variety of terms to refer to the picture of the rodent.

Table 4.19 Types of lexical substitutions for 'the rodent type' animal target noun in the monolingual and heritage speakers

The rodent type animal					
Monolinguals		Word Freq.	Heritage Speakers		Word Freq.
V	Wiewiórka/'squirrel' Kret/'mole'	1.691 0	A	Wiewiórka/'squirrel' Kret/'mole' Myszoskoczek/'gerbil' Myszka/'mouse'$_{DIM.}$ Chomik/'hamster'	1.691 0 0 13.528 1.127
X	Krecik/'mole'$_{DIM.}$ Wiewiórka/'squirrel' Zwierzątko/'animal'$_{DIM}$	0 1.691 1.127	B	Wiewiórka/'squirrel' Zwierzątko/'animal'$_{DIM}$ Bóbr/'beaver' Chomik/'hamster' Mrówki/'ants' Kret/'mole' Szczur/'rat' Mysz/'mouse'	1.691 1.127 0 1.127 1.691 0 6.764 3.382
Y	Wiewiórka/'squirrel' Kret/'mole' Zwierzątko/'animal'$_{DIM}$ Świstak/'marmot'	1.691 0 1.127 0	C	Wiewiórka/'squirrel' Kret/'mole' Skunks/'skunk'	1.691 0 0
Z	Wiewiórka/'squirrel' Kret/'mole' Zwierzątko/'animal'$_{DIM}$ Nornica/'vole'	1.691 0 1.127 0	D	Kret/'mole' Borsuk/'badger' Chomik/'hamster' Mysz/'mouse' Surykatka/'meerkat'	0 0 1.127 3.382 0

i) The target word: the animal with antlers

The image of the animal with antlers provoked a wide range of names in both, the heritage speakers and monolinguals, as shown in table 4.20 below. The variety is quite abundant in both cohorts across age spans with an interesting occurrence in the heritage speakers' output, who often describe the animal as *renifer*/'reindeer', a term not produced by any monolingual child. This can be definitely linked to cultural influences of the English speaking country where the children live and grow up,

where reindeers are associated with Christmas and Santa Clause, and are known by children from a very young age.

Table 4.20 Types of lexical substitutions for 'the animal with antlers' target noun in the monolingual and heritage speakers

The animal with antlers					
Monolinguals		Word Freq.	Heritage Speakers		Word Freq.
V	Jeleń/'deer' Jelonek/'fawn' Sarenka/'doe'	1.127 1.127	A	Jelonek/'fawn' Renifer/'reindeer' Jeleń/'deer'	1.127 1.127 1.127
X	Jeleń/'deer' Sarenka/'doe' łoś/'moose'	1.127 0.564 0.564	B	Jelonek/'fawn' Renifer/'reindeer' Osiołek/'donkey'$_{DIM}$ Zwierzątko/'animal'$_{DIM}$ łoś/'moose'	1.127 1.127 1.127 1.127 0.564
Y	Jeleń/'deer' łoś/'moose' Antylopa/'antelope'	1.127 0.564 0	C	Renifer/'reindeer' Jeleń/'deer' Zwierzę/"animal"	2.818 1.127 5.073
Z	Jeleń/'deer' Sarna/'doe' łoś/'moose'	1.127 2.818 0.564	D	Jeleń/'deer' Sarenka/'doe' łoś/'moose' Renifer/'reindeer'	1.127 0.564 0.564 2.818

To conclude, it can be observed that from an early age child heritage speakers rely on a wide variety of higher-frequency substitutions for specific target nouns. Although this phenomenon applies also to the youngest monolingual child speakers of Polish, its extent is not as wide, as the controls use fewer replacements. This situation continues up to the mean age of 8, after which the monolinguals tend to master the lower-frequency nouns, and the heritage speakers still rely heavily, and sometimes exclusively, on substitutions, due to gaps in the lower-frequency nouns that were

documented in the previous sections (4.5 and 4.6.3).

In the following section, I show that in order to compensate for the missing nouns, the heritage speakers, apart from using a wide variety of higher-frequency replacements, also turn to the use of multiple names and synonyms in one narration. This fact might be an explanation for the initial balance in the overall noun production (TDN, TCN), and even slight gain over their monolingual peers shown in sections 4.3 and 4.4.

4.7 The use of multiple names and synonyms

The analysis of the substitutions discussed in the previous section revealed one more aspect of the noun production that shed light on the characteristics of the heritage lexicon. It has emerged that the heritage speakers produce a wider variety of nouns to describe particular images than the children from the monolingual group. The aim of this follow-up investigation is to establish whether individual children produce multiple names or synonyms to describe a particular object in their narrations, and whether it can be treated as an explanation for the overall higher number of nouns in the heritage speakers' narratives.

In this section, I present analyses of cases of multiple name or synonym use for one object in the story in individual narrations. The results are compared between age groups, starting from the youngest to the oldest, across both cohorts.

a) heritage group A and monolingual group V
mean age: 4;10

The youngest early sequential bilinguals produce a total of four instances of multiple names in single narrations for two images: the target noun 'jar' and 'bees'. To give an example, the A1 child describes the image of a glass container once as

butelka/'bottle', and then as *słoik*/'jar' in one narration:

(9.)

A1: *żaba im wpadła do butli*[45]
frog them fell into bottle
'the frog fell into a bottle'
(...)
a potem nie widzieli
and (they$_{\text{PRO DROP}}$) then saw$_{\text{NEG}}$
'and then they didn't see'

że żaba jest w słoiku
that frog is in jar
'that the frog is in the jar'

Additionally, two children, A4 and A10, use two terms to describe the image of the flying insects: the first one mixes the two names *pszczoły* and *muchy* ('bees'/'flies'), while the other alternates between *pszczoły* and *osy* ('bees'/'wasps'):

(10.)

A4: *I pszczoły wyleciały z ulu*
And bees flew out of beehive
'and bees flew out of the beehive'
(...)
I muchy goniły pieska
And flies were chasing dog$_{\text{DIM.}}$
'And flies were chasing the dog'

In contrast, no monolingual child uses multiple nouns to describe a single object.

b) heritage group B and monolingual group X
mean age: 5;10

In the overall output of group B, the use of multiple name terms occurs nine times. Some of the mixing refers to the image of the insects:

[45] Multiple nouns for one image are shown in red.

(11.)

B14: *To* *muchy*
This flies
'These are flies'
(...)
Bo *osy* *chciały go ukłuć*
Because wasps wanted him sting
'Because wasps wanted to sting him'

The situation also applies to mixing 'bees' with 'wasps' in individual narrations produced by B7 and B11.

Additionally, two children produce two different names for the rodent type animal. One child calls it *chomik,* and then changes to *wiewiórka* ('hamster'/'squirrel'), while the other participant alternates between *kret* and *wiewiórka* ('mole'/'squirrel'):

(12.)

B8: *potem* *kret* *wyszedł*
then mole got out
'then a mole got out'
(...)
I *patrzył* *do* *norki* *wiewiórki*
And (it$_{\text{PRO DROP}}$) was looking into burrow$_{\text{DIM}}$ squirrel
And (it$_{\text{PRO DROP}}$) was looking into a squirrel's burrow'

In the same way, the children from heritage group B use multiple names to refer to the image of antlers, calling them both *patyki* and *gałęzie* ('sticks'/'branches') (B7), water type – *kałuża* and *błoto* ('puddle'/'mud') (B7), log – *beczka* and *kłoda* ('barrel'/'log') (B7), and to describe the target word 'jar' by using the referents *puszka* and *butelka* ('box' and 'bottle') one right after another (B10).

On the other hand, the Polish monolinguals in the same age range produce only two instances of multiple names for one image: *sarenka/łoś* ('doe'/'moose') (X2) for the target noun of animal with antlers, and *skała/kamień* ('rock'/'stone') (X6) to refer to the image of the stone.

c) heritage group C and monolingual group Y
mean age: 8

The following group of heritage speakers, group C, uses multiple names while referring to the same single images seven times. The target word *pszczoły*/'bees' is most often accompanied by *osy*/'wasps' (C6, C3 and C5), the image of the rodent is described by both *wiewiórka*/'squirrel' and *skunks*/'skunk'(C8), and the type of water reservoir receives two terms: *woda*/'water' and *staw*/'pond' in one narration (C3). Furthermore, the target noun 'jar' proves confusing to two children, who refer to it as a *słoik*/'jar' and *butelka*/'bottle' (C7), and as a *szklanka*/'glass' and *filiżanka*/'cup' (C6):

(13.)

C6: *Piesek i chłopczyk znalazł żabę*
Dog$_{DIM.}$ and boy$_{DIM}$ found frog
'the dog and the boy found a frog'

I zamknęli ją w szklance.
And (they $_{DIM}$)locked her in glass
'and (they $_{DIM}$) put her in a glass'
(...)
Potem piesek próbował znaleźć je w filiżance
Then dog$_{DIM.}$ was trying find them in cup
'then the dog was trying to find her in a cup'
(...)
A potem pieska głowa weszła do tej filiżanki.
And then dog$_{DIM}$ head went into this cup
And then the dog's $_{DIM}$ head got stuck in this cup'

The age-matched monolinguals use multiple names for certain images four times applying them to describe the target word 'beehive' – *dom/ul/gniazdo* ('house'/'beehive'/'nest') (Y6), the rodent – *kret/wiewiórka* ('mole'/'squirrel') (Y2), the image of the 'burrow' – *dziurka/norka* ('hole $_{DIM}$'/'burrow $_{DIM}$') (Y3), and the 'tree hollow' by referring to it using the target noun and the word *nora*/'burrow' in the same narration (Y4):

(14.)

Y4: *A chłopczyk poszedł szukać w dziupli na drzewie tej żabki*
And boy$_{DIM.}$ went search in tree hollow on tree this frog$_{DIM}$
'And the boy$_{DIM.}$ went to search for the frog $_{DIM.}$ in the tree hollow'
(...)
A z nory nie wyleciała żabka
And out of burrow flew out$_{NEG.}$ frog$_{DIM.}$
'And it was not the frog who flew out of the burrow'

Tylko sowa
Only owl
'But an owl'

d) heritage group D and monolingual group Z
mean age: 11;5 and 12

The oldest heritage speakers also mix different lexical terms for single objects with instances of calling the rodent both *chomik*/'hamster' and *kret*/'mole' in one narration (D6), and using a variety of names for the target noun 'log'. The latter noun already proved problematic for this group due to its low frequency and rare occurrence in everyday register, and the use of multiple names of *opadnięte drzewo/kłoda* ('fallen tree'/'log') (D6) and *patyk/drzewo* ('stick'/'tree') (D4) to refer to this noun in single narrations confirm the earlier finding.

(15.)

D4: *Bo myślał że*
Because (he $_{PRO\ DROP}$)thought that

Za tym patykiem jest żaba
Behind this stick is frog
'That the frog is behind this stick'
(...)
I zaskoczyli żabę i ... za drzewem.
And (they $_{PRO\ DROP}$) surprised frog and … behind tree
'And (they $_{PRO\ DROP}$) surprised the frog behind the tree'

In the monolingual age-matched control group only one participant produces one set

of multiple names by hesitating over the proper lexical term for the rodent, calling it once *skunks*/'skunk' and once *nornica*/'vole' (Z4).

From the analyses above, we see that the child heritage speakers produce substantially more instances of multiple nouns for one image than the monolinguals, and this pattern is constant across age spans, applying to every single age level. This might explain the slightly higher number of nouns produced by the heritage speakers in the previously described overall counts (TDN and TCN), and signal a phenomenon of using multiple lexical items when the speaker is unsure of the correct term, or when they simply do not know the name and use this strategy as a form of compensation. Nonetheless, due to the fact that the number of cases of multiple name use in single narrations is relatively low, a further investigation would be necessary to validate these outcomes, and to check whether this trend correlated in a study with a higher number of participants and using other types of methodology.

4.8 Chapter summary and conclusions

The aim of this chapter was to trace the heritage speakers' lexical development across the primary school years, and to evaluate to what extent this path of L1 acquisition in a bilingual environment follows the pattern displayed by the monolingual age-matched speakers. The hypothesis presented in the introduction predicted that heritage lexical acquisition will be marked with changes, and we aimed at estimating at what age they occur.

The results showed that the heritage speakers' lexicon improves as a function of age, however, the acquisition of lower-frequency nouns stagnates. The changes are evident between the mean age of 4;10 and 5;10 for the overall proportion of lower-frequency nouns in narratives, and then between the mean age of 5;10 and 8 for the

acquisition of nouns belonging to a register commonly associated with schooling and literacy.

The multiple analyses conducted on the production of nouns that were described in this chapter brought interesting, and in some cases unexpected results. In this section, I first summarize the results, and then I discuss them in light of the objectives and the hypothesis presented in the introduction.

First, the initial outcomes of the total noun count reveal that the heritage speakers produce equal or even slightly higher number of lexical items than their monolingual counterparts. The monolingual children outperform the heritage speakers only at the youngest age level, however, from then on, the two cohorts are either at the same level, or the early sequential bilinguals produce slightly more TDN in the three remaining age categories. Such a result is surprising, as it shows that despite reduced input, the heritage lexicon develops comparably to the monolingual pattern in the overall noun production.

Second, in spite of a continuous growth of the lexicon, the heritage speakers start to show evidence of stagnation in attaining lower-frequency nouns that begins between the mean age of 4;10 and 5;10. The monolingual children improve as a function of age, acquiring less common nouns as they get older, whereas the proportion of lower-frequency nouns in the heritage speakers' narrations remains at the same level as in the youngest children in both cohorts.

Third, further evidence that supports the results of stagnation in the area of lower-frequency nouns has been found in the analysis of the target nouns. The heritage speakers' difficulty with the acquisition of lower-frequency nouns that belong to the academic register became evident between the mean age of 5;10 and 8.

Finally, the analyses of the use of lexical substitutions and multiple names show that

the heritage speakers are able to narrate the story using a wide range of nouns, substituting specific low-frequency items with a spectrum of higher-frequency synonyms and overextensions. The results also show that the need to become understood and convey a message often requires the use of multiple names for unknown items.

The interesting conclusion that comes from the analyses summarised above is that, in the heritage speakers, the range of produced nouns grows parallel to a decreasing knowledge of the target nouns, lack of advancement in the lower-frequency range and an overuse of synonyms and over-extensions. By the time the early sequential bilinguals reach the mean age of 8, and outperform monolinguals in the general production of nouns, their knowledge of specific vocabulary has already started to lag behind the monolingual norms. It might be suggested that the advancement in the overall score is in fact a consequence and a way to deal with the weakening of the lower-frequency range of nouns. The monolingual children, on the other hand, increase the number of lower- frequency nouns in their vocabulary as they get older and more proficient in the language, which enables them to precisely name images, and thus tell the story employing fewer descriptive techniques that would entail the use of multiple names.

We can conclude that the lexicon of the early sequential bilinguals whose first contact with the L2 occurs at school grows steadily and comparably to the monolingual pattern across primary school years, with the exception of the lower-frequency nouns. The lower-frequency vocabulary that belongs to the academic register normally encountered outside the home and the L1 community context does not show signs of development beyond the age of 8, with early symptoms of stagnation already occurring as early as after one year of a continuous L2 exposure at

the age of 5;10. These signs of stagnation are discussed further in the two following chapters which aim to evaluate parallel acquisition in the L1 and L2, and show that this stagnation in the acquisition of lower-frequency lexicon might be an early indication of a later shift in language dominance.

CHAPTER 5

LEXICAL ACCURACY AND ACCESS – THE CHILD HALA STUDY

5.1 Introduction

In the previous chapter, I compared heritage children's lexical development with that of their monolingual peers. The investigation showed that the heritage speakers perform similarly or even slightly better than the monolinguals in the overall quantity of nouns produced in narrations, however, their lexical development stagnates in the area of lower-frequency nouns. The changes become evident between the age of 4;10 and 5;10 for the proportion of lower-frequency nouns in narrations, and between the age of 5;10 and 8 for the acquisition of lower-frequency vocabulary commonly associated with literacy and schooling.

In this chapter, we document parallel acquisition of the L1 and L2 lexicon across the primary school years by examining the changing relative strength of the languages. The main goal is to investigate the heritage speakers' response times and accuracy with respect to a specific set of nouns divided into two frequency strata. In order to examine the dynamic lexical development in both languages, we propose a new version of the HALA psycholinguistic tool (O'Grady et al. 2009) called the Child HALA, which measures lexical accuracy and access to evaluate language dominance in children.

The main hypothesis is that both languages will improve, however, with a greater

progress in the L2 lexical accuracy and fluency, tending for a shift in language dominance in late primary school years (as documented by e.g. Kohnert at al. 1999, Kohnert and Bates 2002, Jia et al. 2006). The heritage language will develop more slowly than English, and in comparison with the monolingual group (e.g. Bialystok et al. 2010; Oller, Pearson & Cobo-Lewis 2007; Uccelli and Paez 2007). This study will add to the existing knowledge by comparing the heritage speakers' lexical accuracy and access with that of their monolingual peers to obtain a more thorough picture of the nature of the L1 acquisition in the context of sequential bilingualism. Also, we predict that the results will support the finding documented by O'Grady et al. (2009) and Tang (2011) who used the original HALA test that showed that the response times (RT) analysis is a more reliable and sensitive diagnostic tool than accuracy to document relative language strength and a switch in language dominance.

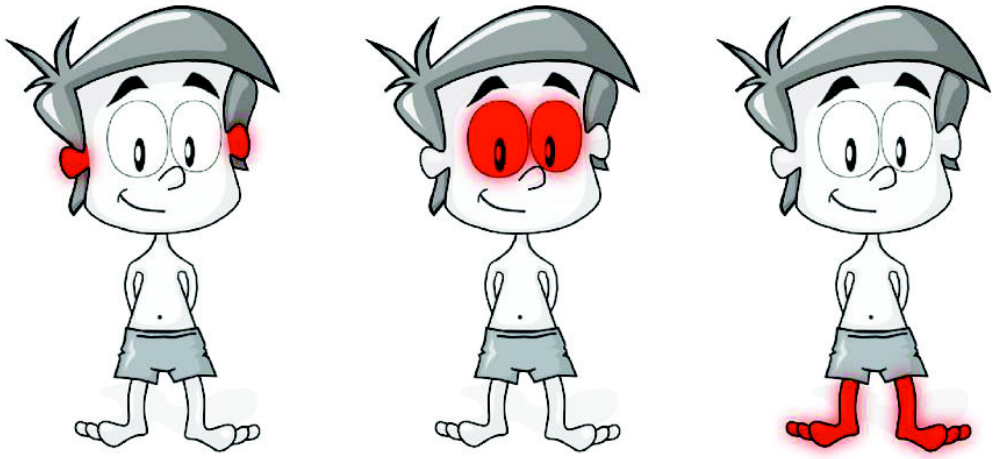
This chapter is organized as follows:

I start with a description of the testing procedure and coding techniques. Then, I present the results of the Child HALA test which are split into two categories. First, I discuss the analysis of parallel lexical acquisition in the two languages in the heritage group, the L1 Polish and the L2 English. Then, I compare the results from Polish between the heritage speakers and the monolingual controls to obtain a clearer picture of L1 lexical development in a bilingual context. The chapter is concluded with a summary and discussion of the findings in the context of the provided hypotheses and aims of the study.

5.2 Testing procedure

The Child HALA test is a picture-naming task that compares levels of lexical accuracy and access (as calculated by response time) in one language relative to a speaker's other language(s) in order to evaluate the relative strength of the languages. It consists of twenty-seven body part terms that are divided into two strata: high- and low-frequency words. The implementation is simple. Speakers need to name body parts of a cartoon-image of a boy that are highlighted one after another (see Figure 5.1).

Figure 5.1 Sample images from the Child HALA test.



'ears' **'eyes'** **'legs'**

First, the responses are assessed for accuracy, and then the response times of the accurately named nouns are calculated in milliseconds from the onset of the body part being highlighted to the onset of the response. Afterwards, these scores are compared for the two languages of interest[46].

The participants of this study were tested during two sessions with a week's interval between them: once in Polish and once in English. In order to balance the testing

[46] See sections 3.3.3.2-4 for more detailed information on the HALA and Child HALA tests.

order between the participants, half were tested first in Polish and half were tested first in English. There are two versions of the Child HALA test, one version was used for Polish and the other for English. The order of the items was re-shuffled in the second version to reduce the level of predictability, and to limit the likelihood of the participants being affected by any memory of the first session.

The testing took place at the children's homes. The subjects were seated in front of a Toshiba 14 inch laptop with an embedded microphone. The recordings were made using an Olympus VN-8600PC digital voice recorder which was placed in front of the participant and next to the laptop. Each testing began with a practice session, when the child saw the trial images in the same manner as the main testing images, so that they could get accustomed to the nature of the task.

During the test, an animated cartoon image of a boy was displayed in the centre of the laptop monitor. The body part terms to be named were highlighted in red, one after another; the image animation (eye blinks) was only active in between the highlights in order to regain attention, especially in the younger subjects. The onset of the body part term being highlighted was synchronised with a beep to allow precise transcription, and to attract the subject's attention.

The tester controlled the speed rate with which the images were highlighted, and the decision to move to another image was made when the participant either named the body part term, asked/gave a sign to move on, or indicated that they did not know the term. Following that, the particular body part remained highlighted for around 2000ms so that the child could complete the response and prepare for the next image.

5.3 Coding techniques

The output was analysed with respect to accuracy and response time (RT) using the Excel statistical suite. The level of accuracy was established based on the number of correct responses given by each child. The following types of responses that were produced in the target language were counted as correct:

- responses that corresponded to either the dominant name of the highlighted image or were an appropriate synonym/dialectal variation of the item (e.g. in Polish, 'buzia' and 'twarz' were both correct responses for the target 'face'; in English 'tummy' and 'belly' were accepted for 'stomach')
- diminutive forms
- plurals
- correct lexical forms with wrong inflection (e.g. *uchy* – 'ears').

Some type of responses were scored as accurate and used to establish the level of accuracy, however, they were counted as incorrect for the response time (RT) analysis. They included: repetition of the first syllable (e.g. 'sho-shoulder') or audible hesitations (e.g. 'eeeebelly'). Accurate responses that were excluded from the RT analysis were 3.8% of the total in the heritage group, and 3.4% in the monolingual control group.

Items eliminated from further study of the RT analysis included:

- lack of response
- responses not in the target language
- guesses (e.g. 'I don't know…forehead?')
- two or more responses (e.g. 'foot … no… heel')
- responses interrupted by sneezing or coughing
- responses which failed to trigger the timing device due to background noise,

e.g. car engine, siblings playing in the other room, etc.

The response time analysis was conducted only for those test items that fulfilled the above criteria. In the psycholinguistic literature, response times of more than 2000ms are discarded from the analysis for monolingual speakers (Jescheniak and Levelt 1994). However, as the participants of this study are bilingual children with an assumed reduced proficiency in both languages, a decision was made not to follow this procedure[47].

All the responses that were taken into consideration in the RT measure were entered into spread sheets, and to eliminate the extreme values, it was decided to narrow the analysis to a 4000ms response-window, following criteria used by Kohnert, Bates and Hernandez (1999), Kohnert and Bates (2002), Bates et al. (2003) and Jia et al. (2006) in their timed-picture naming studies. Also, as is common in psycholinguistic research, a further screening was applied to eliminate any response times for each participant that were more than 2 standard deviations from the overall mean response time for accurate responses from that participant.

I decided not to apply any threshold of accuracy in order to include the results in the RT analysis[48]. This decision was based on the children's presumed low level of proficiency in English, especially in the youngest group. It was one of the aims of this study to track the subjects' lexical development in both languages and their mutual interaction, with the assumption that the progress in English would be observed from the onset of acquisition. Nonetheless, despite low accuracy levels in English in the youngest group, their RT scores did not deviate from the RT scores of the subjects with medium or high accuracy levels.

[47] See also Hulsen (2000) and Kang (2011) who adopted the same approach in their studies on bilingual adults and children.

[48] See Kang (2011) who used the same approach in her study on young bilingual children.

5.4 The Results

5.4.1 Introduction

In this section, I present the results of the accuracy and RT analyses. First, I show the outcomes of both languages in the heritage speakers to examine parallel lexical acquisition across the primary school years. Second, in order to shed light onto the rate and characteristics of heritage lexical development in a non-monolingual environment, I compare the results obtained from the heritage speakers and the monolingual control peers in terms of the Polish language only. All the analyses are divided into two categories: word frequency effects and overall cumulative results that provide information when the scores in the word frequency divisions are not sufficient for statistical comparisons.

5.4.2 Language dominance in child heritage speakers

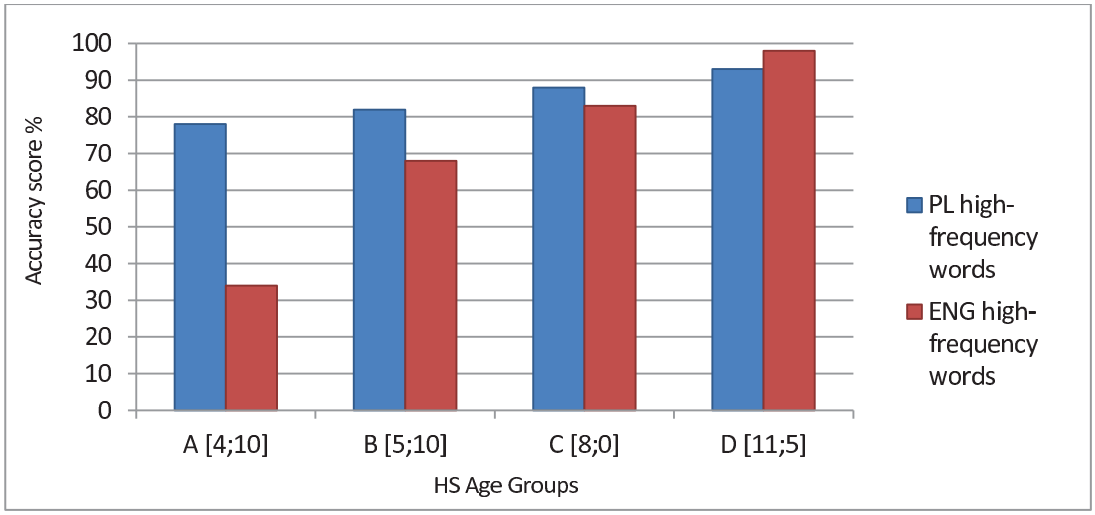
5.4.2.1 Accuracy scores according to word frequency

As we can observe from the results shown in fig. 5.2 and 5.3[49], accuracy gains have been made at both frequency levels across all age groups in both languages, with a stable improvement in Polish, and considerable shifts in English, especially for the low-frequency words.

The results of the high-frequency words analysis in English, presented in figure 5.2, show that the participants double their score after only 9-12 months of English exposure, and manage to equal the score with the Polish equivalent by the end of primary school.

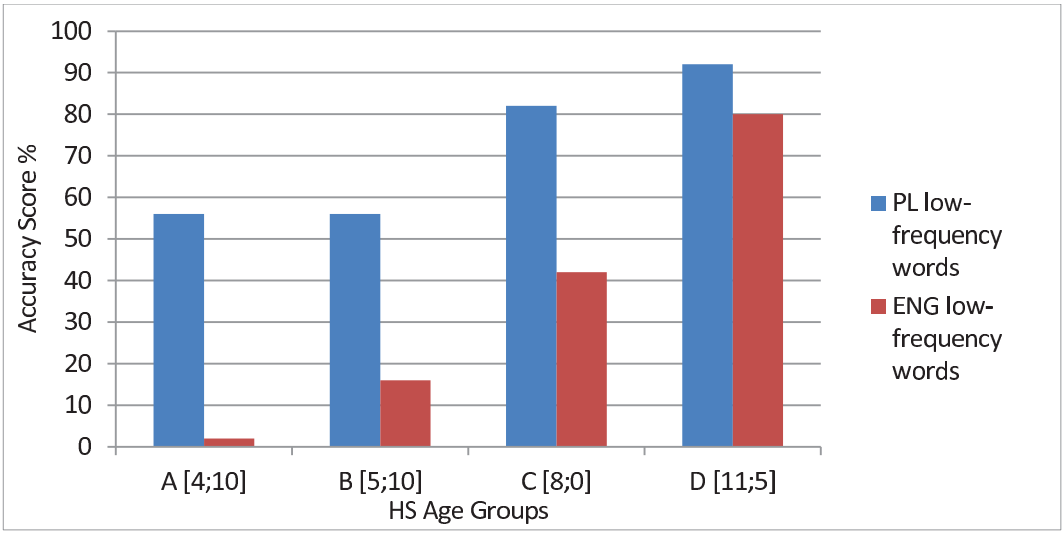
[49] Data from all analyses is provided in the form of graphs for clarity purposes. Numerical data for all groups with scores of standard deviation and range is provided in Appendix F.

Figure 5.2 Accuracy scores in Polish and English for the high-frequency words in the heritage speakers



The knowledge of low-frequency words in English is limited in the youngest group, however, we can observe in Figure 5.3 that they improve significantly across the age groups. The children make 800% progress after their first year at school, following by a 263% gain, and then again with a 190 % gain between the last two age groups. Despite this significant improvement in English, the participants do not achieve the same level of accuracy in the low-frequency measure as in the Polish language.

Figure 5.3 Accuracy scores in Polish and English for the low-frequency words in the heritage speakers



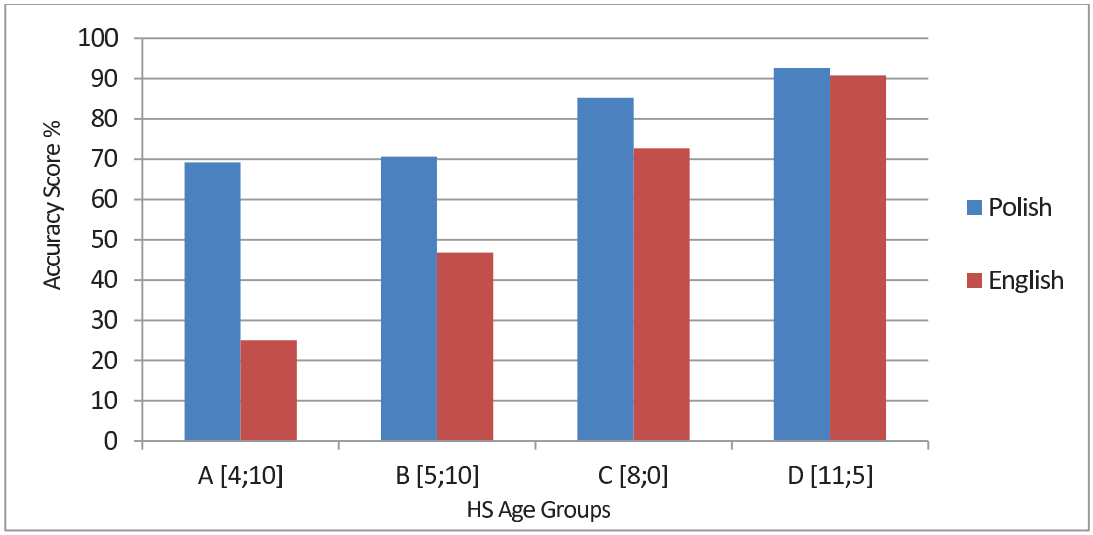
The above results also support the correlation between accuracy scores and word frequency, as it can be observed that the high-frequency words produce higher accuracy scores than the low-frequency words.

5.4.2.2 Overall accuracy scores

The overall accuracy scores support the separate word frequency results, and show that they improve across age spans in both languages, with a steady improvement in Polish and a steep growth trajectory in English. In figure 5.4, we can see that the across-age group comparisons in Polish show a stable growth, starting with the same 70% score in the two youngest groups, improving to 85% after a mean 2;6 years, and reaching over 90% at the mean 11;5 years of age. On the other hand, the gains made between the age groups in English are much greater, beginning at a mere 25% in the youngest group, then they almost double at the mean age of 5;10, improving to 73% in the third group, and finally reaching over 90% in the oldest group. The above results, shown in figure 5.4, reveal that the divergence in accuracy between the languages is substantial in the youngest age groups, however, it becomes balanced

(reaching the 90% score in both languages) after mean 6;8 years of education in primary school.

Figure 5.4 Overall accuracy scores in Polish and English in the heritage speakers



The above results provide support for the prediction of a slower development in Polish than in English in the accuracy analysis, however, a more explanatory picture of heritage lexical acquisition will be available when we compare the results with the monolingual speakers[50].

Figure 5.4 illustrates the initial divergence between the scores, the steep improvement in the L2, and the final balance between the languages. It also illustrates that the measure of accuracy does not point to any switch in language dominance. The children are initially dominant in the Polish lexicon and gradually achieve relative balance in both languages. In the next section, we turn to the analyses of language access measured by calculations of response times (RT).

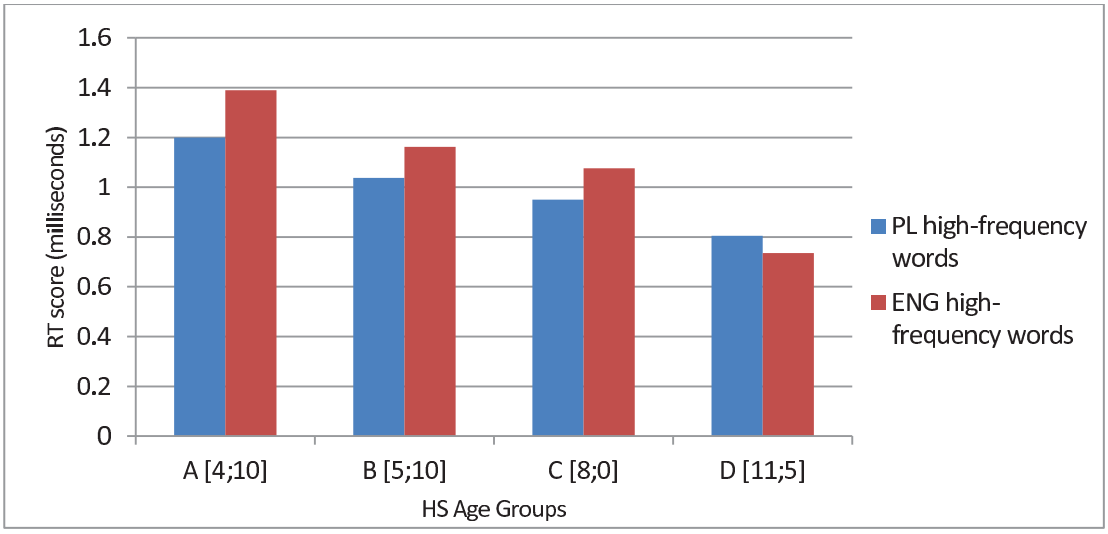
[50] See section 5.4.3

5.4.2.3 RT scores according to word frequency

The analyses of the accuracy measure results, described in the above sections, showed no signs of a shifting dominance between the two languages, pointing rather to a state of a relative balance in the oldest age group. In this section, we will present the outcomes of the RT analyses, and we will show that it is more sensitive and precise than accuracy in investigations of relative language dominance and strength in bilinguals.

The results of the RT analysis present evidence of fluctuations in bilingual lexical development across age, range, and as a function of language exposure. The scores reveal that, again, gains have been made across both, high- and low-frequency words in both languages, however, the improvement has been more dynamic in the L2. Figure 5.5 shows that the overall increase in the RT for high-frequency words in Polish is 0.395 ms, while in English, it is 0.655, almost double that of Polish.

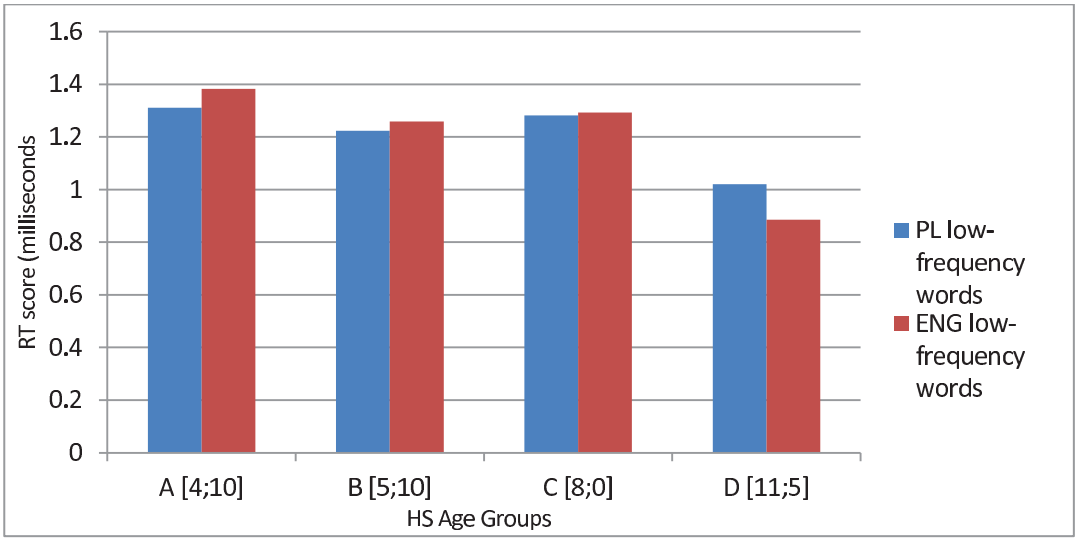
Figure 5.5 RT scores in Polish and English for the high-frequency words in the heritage speakers



The analysis of the low-frequency words, shown in figure 5.6 below, has revealed the overall gain, from the youngest to the oldest age group in Polish, to be 0.291 ms;

there is a slight advantage of the younger B group over the C group, however, it is not statistically valid. As for English, due to the fact that the accuracy levels have been so low in the two youngest groups, I decided not to evaluate the total gain[51].

Figure 5.6 RT scores in Polish and English for the low-frequency words in the heritage speakers



Despite that, as can be seen in figure 5.6, the children display substantial progress in the English response times as a function of age, in other words, the older children name the body part terms much faster than the younger children. Also, the children's English RT scores are lower than Polish by 0.135 ms. Comparisons of the RT scores across both languages, shown in fig. 5.5 and 5.6, have revealed that despite quicker responses in Polish in the youngest group, the dynamic process of the acquisition in the L2 results in quicker responses in English by the mean age of 11;5.

[51] See section 5.4.2.1for the accuracy results for the low-frequency words in English.

5.4.2.4 Overall RT scores

The cumulative scores support the results from the word frequency division discussed above. The RT gains have been made across age groups in both languages, with a greater improvement achieved in English. The overall mean gain in Polish is 0.316 ms (from the youngest to the oldest group), whereas in English the mean gain is 0.605 ms.

Following O'Grady et al. (2009), I calculated the size of response time differentials by dividing the mean response time in the heritage language by the mean response time in the L2. This yields the results shown in table 5.1.

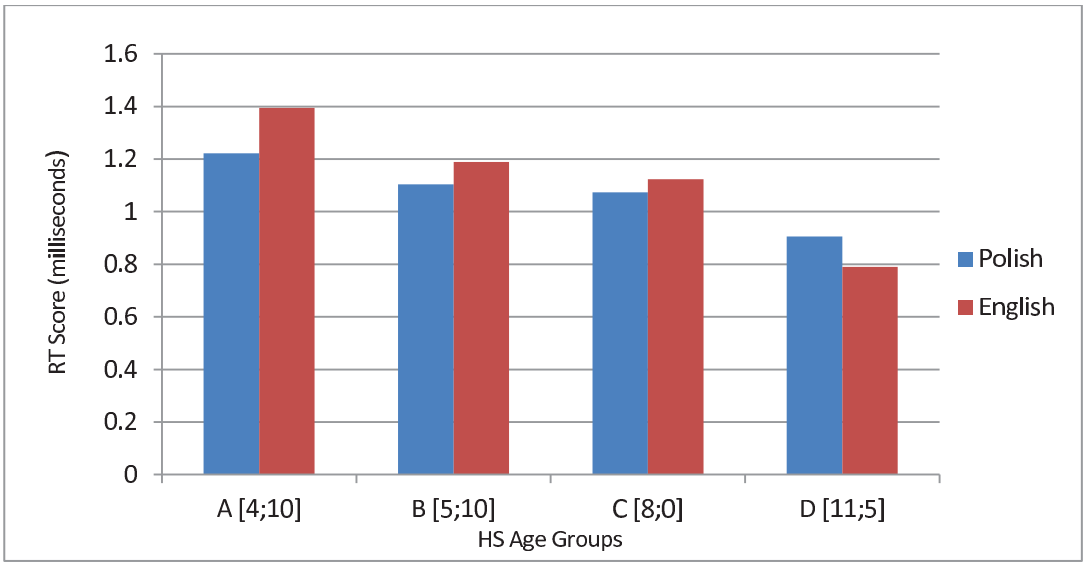
Table 5.1 Overall RT scores in Polish and English and differentials in the heritage speakers (milliseconds)

Group and mean age	Polish	English	Differential
A – 4;10	1.222	1.395	**0.87**
B – 5;10	1.104	1.189	**0.93**
C – 8;0	1.074	1.124	**0.95**
D – 11;5	0.906	0.790	**1.15**

According to O'Grady (2009), differentials can be indicators of language dominance measured by response time calculation. The scores nearest 1.00 denote balance in the strength of the speaker's two languages. As we can see in table 5.1 above, the youngest group A is clearly dominant in Polish, while the two middle groups – B and C are closer to a state of balance in the lexical access in the two languages. Assuming

after O'Grady, that differentials above 1.00 indicate a shift in language strength, we can conclude that at the oldest age level, the children become dominant in English. Figure 5.7 below illustrates the overview of the RT scores for both languages, and highlights a switch in language dominance occurring between the mean age of 8 and 11;5.

Figure 5.7 Overall RT scores in Polish and English in the heritage speakers



The analyses discussed in this section have shown that, in line with the first hypothesis of a continuous but uneven improvement in both languages, the heritage speakers display steeper progression in the L2 than in the L1, despite initially worse scores in the L2 accuracy and access. The results also support the earlier finding by O'Grady et al. (2009) and Tang (2011) of the response time measure being more sensitive and precise in the assessment of language strength than lexical accuracy. Although the accuracy scores show an overall balance between the lexicons at the oldest age level, the results of the RT analysis indicate that a switch in linguistic dominance is about to occur.

5.4.3 Comparison of lexical accuracy and access between the heritage and monolingual speakers

5.4.3.1 Introduction

The main aim of the Child HALA and HALA tests is to evaluate language strength and shifts in dominance by comparing relative levels of accuracy and RT in two languages, which in case of this study is in Polish and English in Polish child heritage speakers. Nonetheless, I decided to add a Polish monolingual control group in order to compare the development of heritage Polish with the monolingual pattern. The monolingual group employed for this study consists of children that reside in Poland and attend kindergarten, in the case of the two youngest groups, and primary school. The four monolingual groups have been formed to closely correspond to the mean age of the heritage speakers' groups[52].

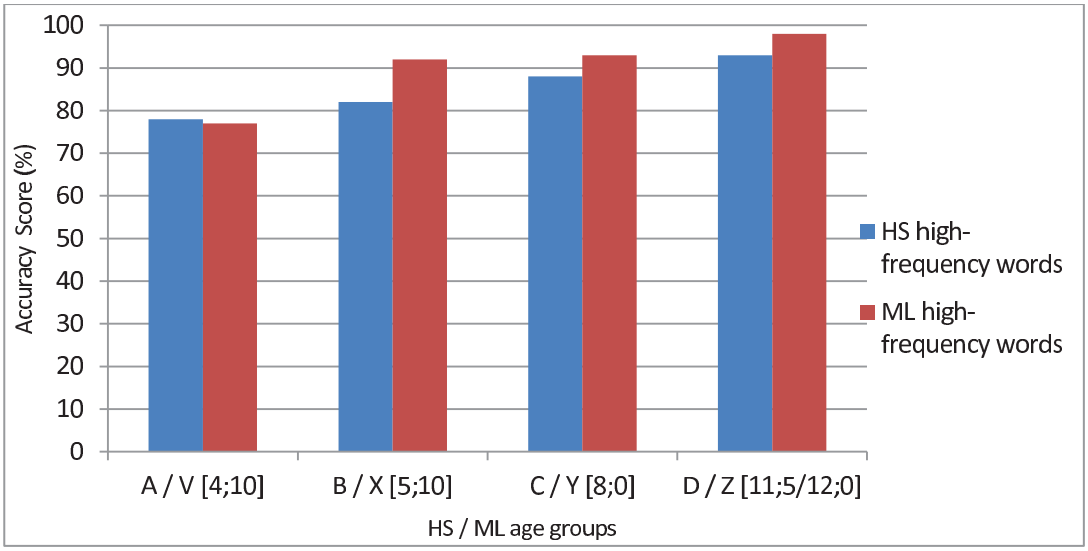
5.4.3.2 Accuracy scores according to word frequency

The comparison between the heritage speakers and the Polish monolingual controls reveals that there is little difference between the groups with regard to the high-frequency words. As for the low-frequency words, despite significant early divergence, the heritage speakers catch up with the monolinguals.

As we can see in figure 5.8, the scores show similarities in the knowledge of the high-frequency words between the two groups in the youngest cohorts (78% and 77% respectively), that then diverge slightly, ending with the monolingual group's slight advantage in the oldest groups (93% HS and 98% ML).

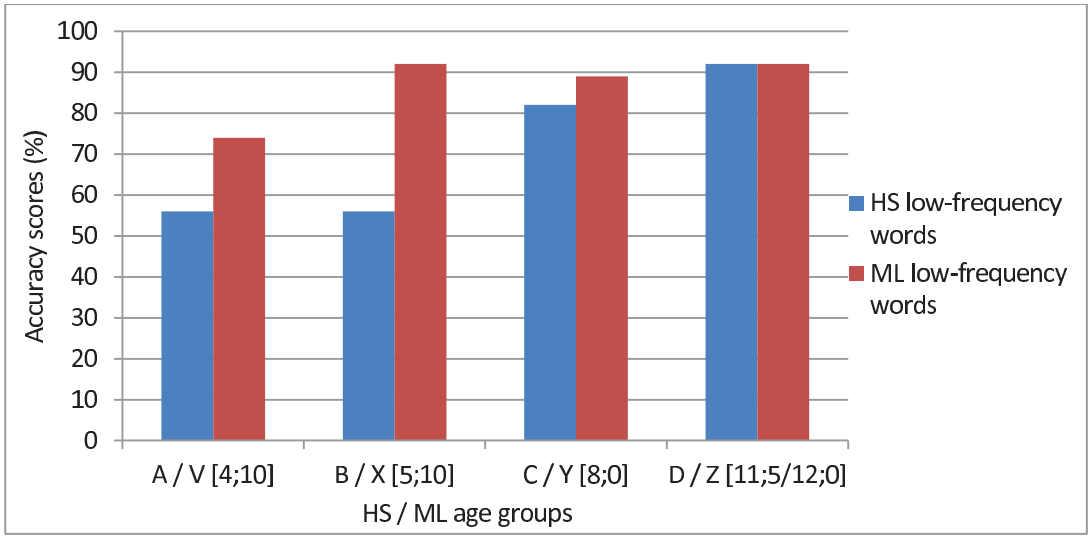
[52] See Chapter 3 for more information about the monolingual controls.

Figure 5.8 Accuracy scores in Polish for the high- frequency words in the heritage and monolingual speakers



As for the low-frequency words, the comparison of the results presented in figure 5.9 below shows that the accuracy scores between the cohorts already diverge from those of youngest age level, with 18% difference between the heritage speakers and the higher scoring monolingual group. The gap widens to 36% between them at the next age level of mean age 5;10, but is followed by immense progress of 146% made by the heritage speakers. The same 92% result is achieved by the oldest heritage and monolingual age groups.

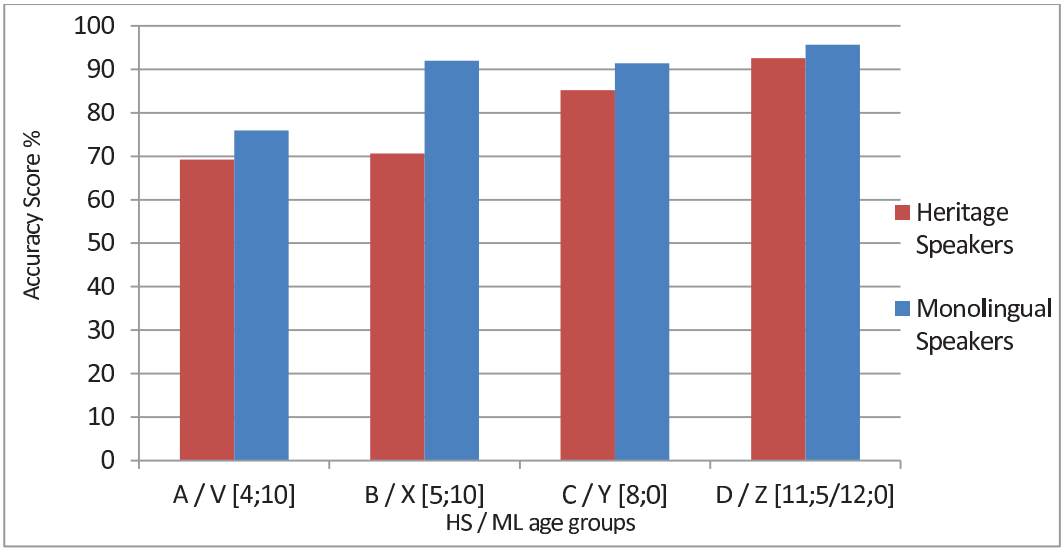
Figure 5.9 Accuracy scores in Polish for the low-frequency words in the heritage and monolingual speakers



5.4.3.3 Overall accuracy scores

The results in figure 5.10 show that heritage lexical development progresses at a slower pace, however, equals with the monolingual scores at the oldest age level. We can observe that the children in both cohorts start off at a very similar level with 69% and 76% respectively, however, at the mean age of 5;10, the divergence becomes significant as the heritage speakers remain at the same level, whereas the monolingual group shows great improvement reaching the 90% score. Most interestingly, the second youngest group in the monolingual cohort shows almost the same level of accuracy (91.4%) as the oldest participants in the heritage group (92.6%).

Figure 5.10 Overall accuracy scores in Polish in the heritage and monolingual speakers



The above comparison highlights the slower rate of lexical acquisition in the heritage speakers by comparison with their monolingual peers. Taking into consideration the monolingual rate of development and the rapid growth in the heritage speakers' English lexical acquisition[53], we can conclude that due to a reduced input quantity and quality in Polish and an increasing exposure to English, the heritage speakers manage to achieve a similar level of lexical knowledge, however, require longer time to catch up with the scores produced by their monolingual peers. The impact of a sudden reduction in input due to the start of schooling in English is particularly visible in the second age group. The heritage speakers do not improve between the age of 4;10 and 5;10, while the monolingual speakers progress substantially, displaying the same accuracy level as the oldest group.

5.4.3.4 RT scores according to word frequency

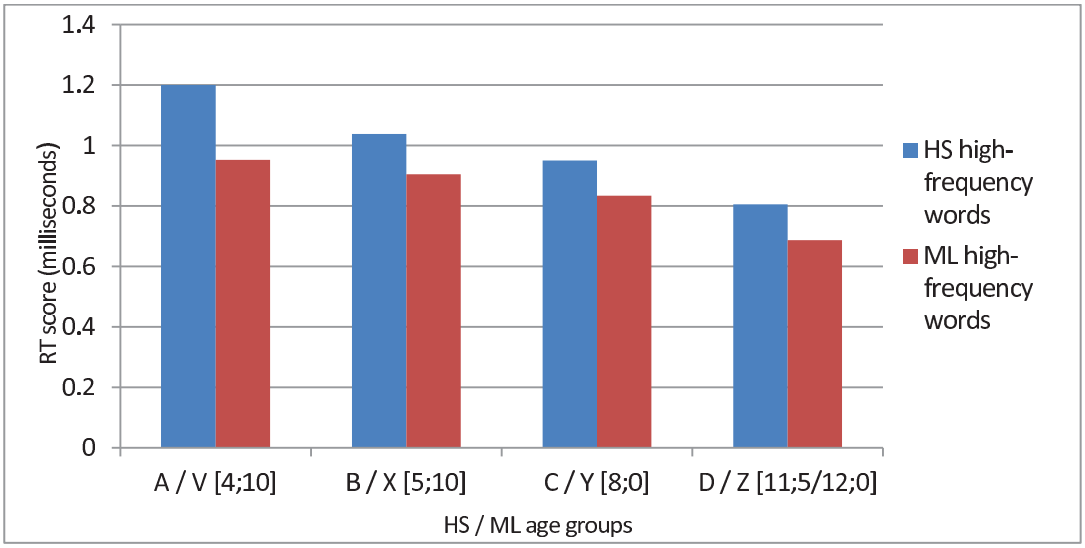
In contrast to the accuracy scores, that showed that despite slower progress, the heritage speakers produce similar results at the oldest age level, the RT analyses

[53] See section 5.4.2 that discusses the subjects' progress in English.

report that they perform considerably worse than the monolinguals at all ages in both frequency strata.

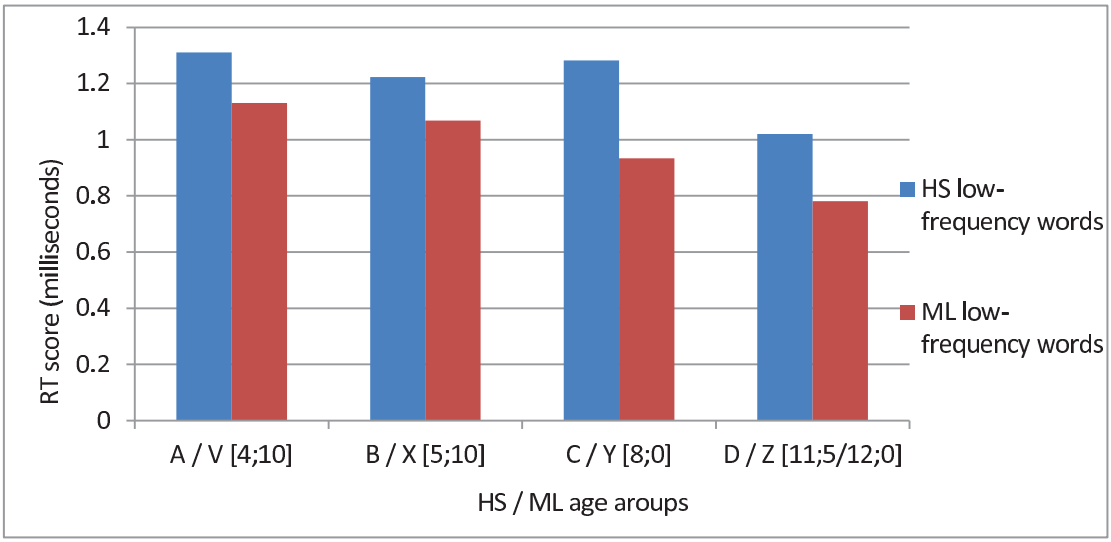
As for the results of the high-frequency words analysis shown in figure 5.11, the monolingual youngest group begins with a 0.248 advantage over the age-matched heritage group, achieving the same result as the heritage speakers from group C. Following that, the oldest group produces a mean of 0.118 ms quicker response time than the heritage group, reaching a total mean of 0.687ms.

Figure 5.11 RT scores in Polish for the high-frequency words in the heritage and monolingual speakers



The continuous divergence between the cohorts is also visibly present in the low-frequency word stratum, where the monolingual group has an advantage of between 0.348-0.155 ms across all age groups over the heritage speakers. The comparison is illustrated in figure 5.12 below.

Figure 5.12 RT scores in Polish for the low-frequency words in the heritage and monolingual speakers

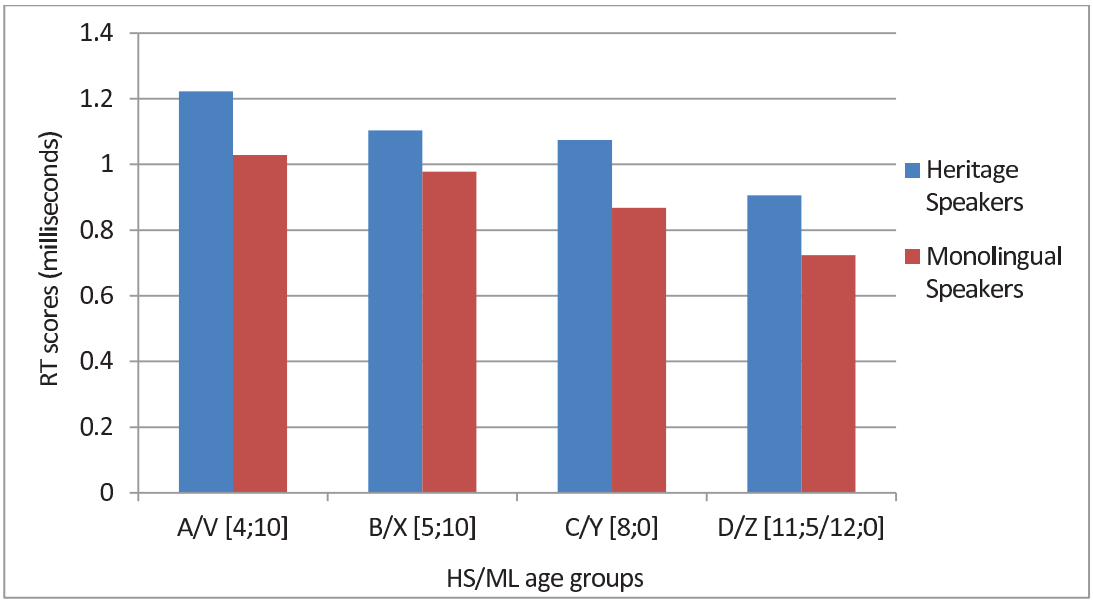


5.4.3.5 Overall RT scores

The comparison of the overall Polish RT scores between the two cohorts, presented in figure 5.13, shows the monolinguals' advantage across all ages, supporting the results of the word frequency division discussed above.

The differences between the groups, starting with the youngest children are 0.193 ms, 0.126 ms, 0.206 ms, and 0.182 ms for the oldest participants, documenting a constant imbalance in the lexical accessibility between the heritage speakers and the monolinguals. In accordance with the accuracy results, the 11-year old heritage language speaking children demonstrate similar level of language fluency as their 6-year old monolingual peers.

Figure 5.13 Overall RT scores in Polish in the heritage and monolingual speakers



In accordance with the analyses of relative language strength discussed in section 5.4.2, the results, shown in figure 5.13, again point to the superiority of the RT measure over accuracy in the assessment of language strength and maintenance. The outcomes of the RT analyses signal that, despite the fact that the heritage speakers show similar levels of accuracy in Polish as the monolinguals at the oldest level, it takes them longer to access words for production.

5.5 Chapter summary and conclusions

In this chapter, we documented lexical acquisition in the children's L1 and L2 by analysing the relative strength of the languages at different ages during the primary school years. The objective was to investigate the heritage speakers' lexical accuracy and access with respect to a specific set of nouns divided into two frequency strata. The main hypothesis stated in the introduction concerned varied rates of growth in both languages, and as compared with the monolingual pattern of acquisition, tending for a switch in language dominance from the L1 to L2 towards the end of the

primary school years. The analyses were conducted using a new test, the Child HALA, which we used to measure the children's lexical accuracy and access as a function of age.

The results presented in this chapter show varied progression for the L1 and L2, and that despite initially better accuracy and RT scores in Polish, the heritage speakers achieve equal accuracy levels and a higher fluency rate in English by the end of primary school. The reduction in the Polish input and an increase in English language exposure and use lead to a switch in language dominance from the L1 to L2 between the age of 8 and 11;5.

In the following part of this section, I summarize the results, and discuss them in light of the objectives and the main hypothesis presented in the introduction.

First, the results show varied rates of progression in both languages that applies to both accuracy and response time scores. The children show a steady rate of development in Polish, with the older children always outperforming the younger participants. However, the growth trajectory in English is much more dynamic and steep, starting from a minimal or non-existent range of vocabulary, to reaching the same or even higher accuracy and fluency scores than in Polish.

Second, the results show that the youngest children are more accurate and display shorter response time in Polish than in English which points to Polish being their more dominant language. After 6;8 years of continuous exposure to the L2, the oldest heritage speakers balance the accuracy scores between the languages, which could suggest a state of relative balance between the languages. However, the results also clearly show that the oldest children have quicker access (shorter RT) to their lexicon in English than in Polish at all stages of the evaluation (overall, low- and high-

frequency words). This outcome is consistent with a switch in language dominance from the initially stronger Polish to English.

Third, the results also demonstrate that heritage lexical acquisition and fluency develop more slowly than in age-matched monolinguals. The heritage speakers achieve similar rates of accuracy as their monolingual peers by the oldest age group, however, they display continuous fluency disadvantage, as measured by response time calculations, in their L1 across all age spans. More importantly, the bilingual 11 year-old children's final scores in both measures match the level achieved by the monolingual 6 year-old participants. A significant reduction in the heritage language input caused by schooling in English is the reason for the longer time needed by the heritage speakers to acquire a set of basic vocabulary, and for the slower lexical access at all ages.

Finally, the analyses of the heritage Polish and L2 English support the earlier finding by O'Grady et al. (2009) and Tang (2011) that the RT measure is more accurate and sensitive for diagnostics of relative language strength than accuracy. The higher sensitivity of the RT measure is also evident in the comparison between the results of the heritage speakers and the monolingual children. As already mentioned above, at the oldest age level, despite equal accuracy scores, the heritage speakers produce much longer RTs than their monolingual peers.

In Chapter 4, we showed that the development of the heritage lexicon shows signs of stagnation in the acquisition of lower-frequency nouns, and that the changes are evident during two age spans between the mean age of 4;10 and 8. The analyses in this chapter showed that the changes are in line with an increasing proficiency in the L2. As a consequence of changes in language exposure and use in both languages, the heritage speakers switch their language dominance from Polish to English

between the mean age of 8 and 11;5. In the following chapter, we will examine whether these signs of stagnation correlate with the path of parallel lexical acquisition in heritage speakers, and thus can be viewed as evidence of early changes that precede and lead to a switch in language dominance

CHAPTER 6

TIMELINE OF CHANGES IN HERITAGE LEXICAL ACQUISITION ACROSS THE PRIMARY SCHOOL YEARS

6.1 Introduction

The goal of this chapter is to compare the results obtained from the two tasks employed in this study, the Frog Story narratives and the Child HALA test, in order to establish a timeline of changes in lexical development of early sequential bilinguals across the primary school years. We identified the signs of early change in the acquisition of nouns in the L1 as compared with the monolingual pattern of acquisition, and then we documented parallel lexical acquisition of the L1 to L2 that leads to a switch in language dominance. It is now important that we compare these findings, and establish more links between the effects of a reduced input in the heritage language and a growing proficiency in the L2.

The main hypothesis is that the correlation of the outcomes from both tasks will produce a timeline with specific age spans in child heritage lexical development that indicates gradual changes leading to a switch in language dominance. The hypothesis is based on the findings of previous research into lexical development in bilingual children of a similar age to the children in this study, which showed differences in vocabulary size and range in both languages as compared with the monolingual pattern of acquisition in each language (e.g. Cobo-Lewis et al. 2002, Páez, Tabors

and López 2007, Bialystok et al. 2010, Oller, Pearson and Cobo-Lewis 2007, Uccelli and Páez 2007). Previous studies also demonstrated that the reduced input in the L1, and an increasing exposure to the L2 play a significant part in the slower rate of lexical development in the L1, and in an increasing knowledge and fluency in the L2, leading to a switch in language dominance in middle childhood (e.g. Kohnert et al. 1999, Kohnert and Bates 2002, Jia et al. 2006). To my knowledge, however, there is insufficient evidence documenting the exact timeline of changes in the L1 lexical acquisition, and estimating earlier sensitive age spans with regard to word frequency between the onset of exposure to the L2 and the later switch in language dominance.

The results will show that there are three age spans in the path of heritage lexical acquisition across the primary school years during which significant changes occur. The first change occurs after twelve months of consistent exposure to the L2 between the mean age of 4;10 and 5;10, and concerns stagnation in the acquisition of overall lower-frequency nouns. The second change concerns the lower-frequency nouns that are commonly associated with literacy and schooling, and it takes place between the mean age of 5;10 and 8. The two age spans indicate early changes in the acquisition of the heritage lexicon, and they precede the last change – a switch in language dominance, which is viewed as a consequence of a growing L2 proficiency and a reduction and limitations in the L1 input.

The chapter is divided into two main sections. In the first section, I present evidence of early changes in the development of the heritage language lexicon. In the second section, I discuss the later signs of a switch in language dominance.

The chapter is concluded with a summary and discussion of the correlations in light of the main hypothesis stated in the introduction.

6.2 Evidence of early changes in the L1 lexical acquisition

In this section, I discuss two different age spans during which changes in the heritage speakers' L1 occur as evidenced by the two tasks, and how the changes and their time of occurrence impact one another.

6.2.1 Indicators at age 4;10 - 5;10

Despite comparable accuracy results (TDN and TCN) between the heritage and monolingual speakers, the analysis of the proportion of lower-frequency nouns in the Frog Story narrations suggests that the heritage speakers' lexicon shows the first signs of change. As we can see from table 6.1 below, the monolingual children steadily develop their range of nouns, enriching it with lower-frequency items, while the lexicon of the early sequential bilinguals does not add those lower-frequency words at the same rate, only showing slight gain in the last age group.

Table 6.1 Comparison of proportion of lower-frequency nouns between the monolingual and heritage speakers

Group [mean age]	A / V [4; 10]	B / X [5; 10]	C / Y [8]	D [11;5] / Z[12]
Heritage Speakers	**29.3%**	**25.2%**	**29%**	**34.2%**
Monolinguals	**29.6%**	**35.4%**	**38.6%**	**44.8%**

The above results are supported by the analysis of the Child HALA accuracy test, shown in table 6.2 below. During the same age span, the heritage speakers make minimal progress in the acquisition of high-frequency words as compared with their monolingual peers, however, their acquisition of low-frequency nouns stagnates. The monolinguals, on the other hand, make significant improvement reaching the same accuracy levels as the oldest children in their cohort.

Table 6.2 Comparison of the Child HALA accuracy scores in Polish between heritage groups A and B and monolingual groups V and X

Accuracy scores	Heritage Speakers		Monolingual Speakers	
	A mean age: 4;10	B mean age: 5;10	V mean age: 4;10	X mean age: 5;10
High freq. nouns	78.1%	81.7%	77.1%	91.7%
Low freq. nouns	56.4%	55.8%	74.2%	92.4%
Overall	69.3%	70.6%	75.9%	92%

The above comparisons show that the first signs of change in the pattern of lexical development in the heritage language occur as early as between 4;10 and 5;10 years of age, after only twelve months of consistent exposure to English, and concern the overall acquisition of low-frequency nouns. The two cohorts start at similar level but diverge soon after, with the monolinguals improving significantly, and the heritage speakers displaying stagnation in the acquisition of the low-frequency nouns.

6.2.2 Indicators at age 5;10 – 8

So far, we have observed that the signs of early changes are already evident in the youngest children, between the age of 4;10 and 5;10.

The next indicator also becomes evident by comparing it to the monolingual pattern of development. The accuracy scores in the lower-frequency target noun analysis show that between the age 5;10 and 8, the lexicon of the early sequential bilinguals starts to lack the lower-frequency nouns that are associated with schooling and literacy skills. As discussed in section 4.6.3, the two youngest age groups in both cohorts perform similarly in the quantitative analysis of the target nouns. As the divergence starts to show in the third and fourth age groups (groups C/Y and D/Z),

we concluded that the change occurs between the mean age of 5;10 (groups B/X) and 8 (groups C/Y). The following two tables, 6.3 and 6.4 illustrate the acquisition of four lower-frequency nouns from the Frog Story, and compare the results between the heritage speakers and their monolingual peers at two age levels: the mean age of 8 and the mean age of 11;5 for the heritage children, and 12 for the monolinguals. The aim of this comparison is to show that, in contrast to the monolingual children, the heritage speakers do not progress between those two age periods.

Table 6.3 shows the accuracy scores at age 8, and illustrates that the heritage speakers achieve much lower accuracy scores than the monolingual children at that age.

Table 6.3 Comparison of accuracy scores for the target nouns 'beehive', 'tree hollow', 'burrow' and 'log' between heritage group C and monolingual group Y

	Ul/'Beehive'	*Dziupla*/'Tree hollow'	*Nora*/'Burrow'	*Kłoda*/'log'
HS Group C [mean age: 8]	50%	12.5%	12.5%	37.5%
ML Group Y [mean age: 8]	100%	66%	66%	66%

Table 6.4 below presents the accuracy scores for the same four nouns at the next age level of 11;5 / 12. As can be seen, the monolingual speakers have made progress in their acquisition, and most of the children have acquired the nouns by the mean age of 12. The heritage speakers, on the other hand, have made minimal improvement in the production of the noun 'burrow', however, have stagnated and even decreased their accuracy scores with the three remaining nouns.

Table 6.4 Comparison of accuracy scores for the target nouns 'beehive', 'tree hollow', 'burrow' and 'log' between heritage group D and monolingual group Z

	Ul/'Beehive'	*Dziupla*/'Tree hollow'	*Nora*/'burrow'	*Kłoda*/'log'
HS Group D [mean age: 11;5]	50%	0%	16%	16%
ML Group Z [mean age: 12]	100%	66%	100%	83%

The above analysis demonstrates that changes in heritage lexical acquisition occur early, with some taking place already after only twelve months of schooling in the majority language. The first indicator concerns the overall proportion of lower-frequency nouns in narrations, and the second indicator relates to the lower-frequency nouns commonly associated with schooling and literacy skills. The early changes in lexical development of child heritage speakers can be considered in light of incomplete acquisition as the children failed to acquire the lower-frequency nouns, and thus stagnated in the acquisition process. According to Montrul (2010), the main reason behind this incomplete acquisition is that during the age of primary linguistic development[54], the children experience restricted daily access to the language, in terms of frequency of exposure and use that also occurs in limited contexts.

These conclusions have been mainly drawn on the basis of a comparison between the heritage speakers and monolinguals. The following section discusses one possible cause and effect of those early changes by an analysis of the heritage speakers growing proficiency in the L2, and its impact on the lexical accuracy and fluency in the L1.

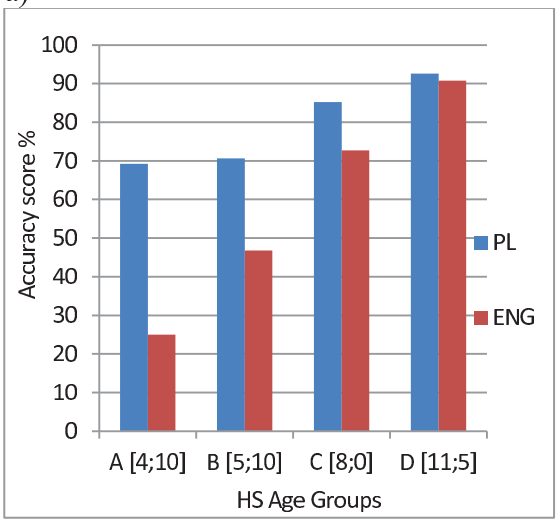
[54] The primary linguistic development relates to the age span from birth to puberty, and should be considered in line with the critical period hypothesis (Montrul 2008).

6.3 Switch in language dominance at age 8 - 11;5

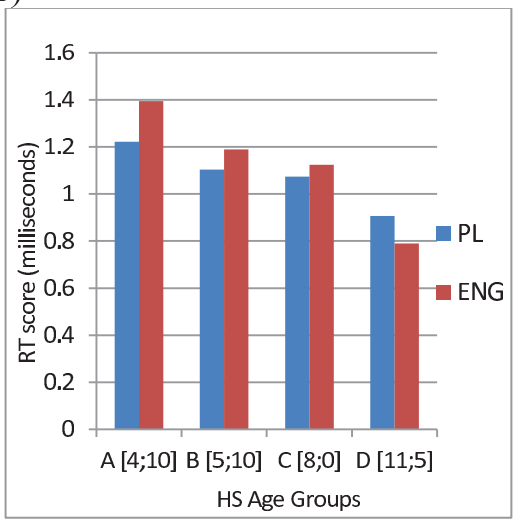
The results of the Child HALA test reveal that at the start, the younger children are more accurate and have faster response time in Polish than in English. By the time they are 11;5, they are as accurate in Polish as in English, however, they become faster in the response time analysis in English. This shift in language access is an evidence of a switch in relative language strength, and occurs between the mean age of 8 and 11;5. Figure 6.1 a) and b) below illustrate the comparison of the accuracy and RT scores across the age groups in both languages. We can observe the significant improvement in English accuracy and fluency, and the slower progress in Polish as a function of age that eventually lead to a gradual switch in language dominance.

Figure 6.1 Comparison of overall a) accuracy and b) RT scores between Polish and English in the heritage speakers

a)



b)



This comparison demonstrates that although the children are fluent users of the heritage language, their linguistic dominance shifts towards English by the end of primary school, after approximately 6;8 years of exposure to the L2.

The two sections present the child heritage language acquisition to be a dynamic process marked with gains, plateaus and losses. They also show that the impact of continuous exposure and use of English, and the lack of schooling in the heritage language can be evident at different stages of the development. The earliest changes are visible as early as twelve months after starting school, and then in the middle of primary education. Both of them lead to a switch in language dominance in the final years of primary school.

6.4 Chapter summary and conclusions

In this chapter, I compared the results from both of the tasks employed in this study, the Frog Story narrations and the Child HALA test, that point to specific age spans during which changes occur in heritage lexical acquisition. The comparisons included the outcomes from both languages, heritage Polish and the L2 English, and from both cohorts: the heritage speakers and the monolingual counterparts.

In the first section, I presented results that indicate that the L1 lexical acquisition stagnates as compared with the monolingual pattern of development, and that point to two age spans during which the changes occur. The second section showed that as a result of a growing proficiency in the L2, the child heritage speakers experience a later switch in language dominance from the L1 to L2.

The correlations allow us to propose a timeline of heritage lexical acquisition in early sequential bilinguals during the primary school years (fig. 6.2 below), with three age spans during which changes occur. They also provide information on the nature of those changes that concern:

- the proportion of overall lower-frequency nouns in oral production between the mean age of 4; 10 and 5;10,
- the attainment of lower-frequency nouns that are associated with literacy and schooling between the mean age of 5;10 and 8,
- a switch in language dominance from the L1 to L2 between the mean age of 8 and 11;5.

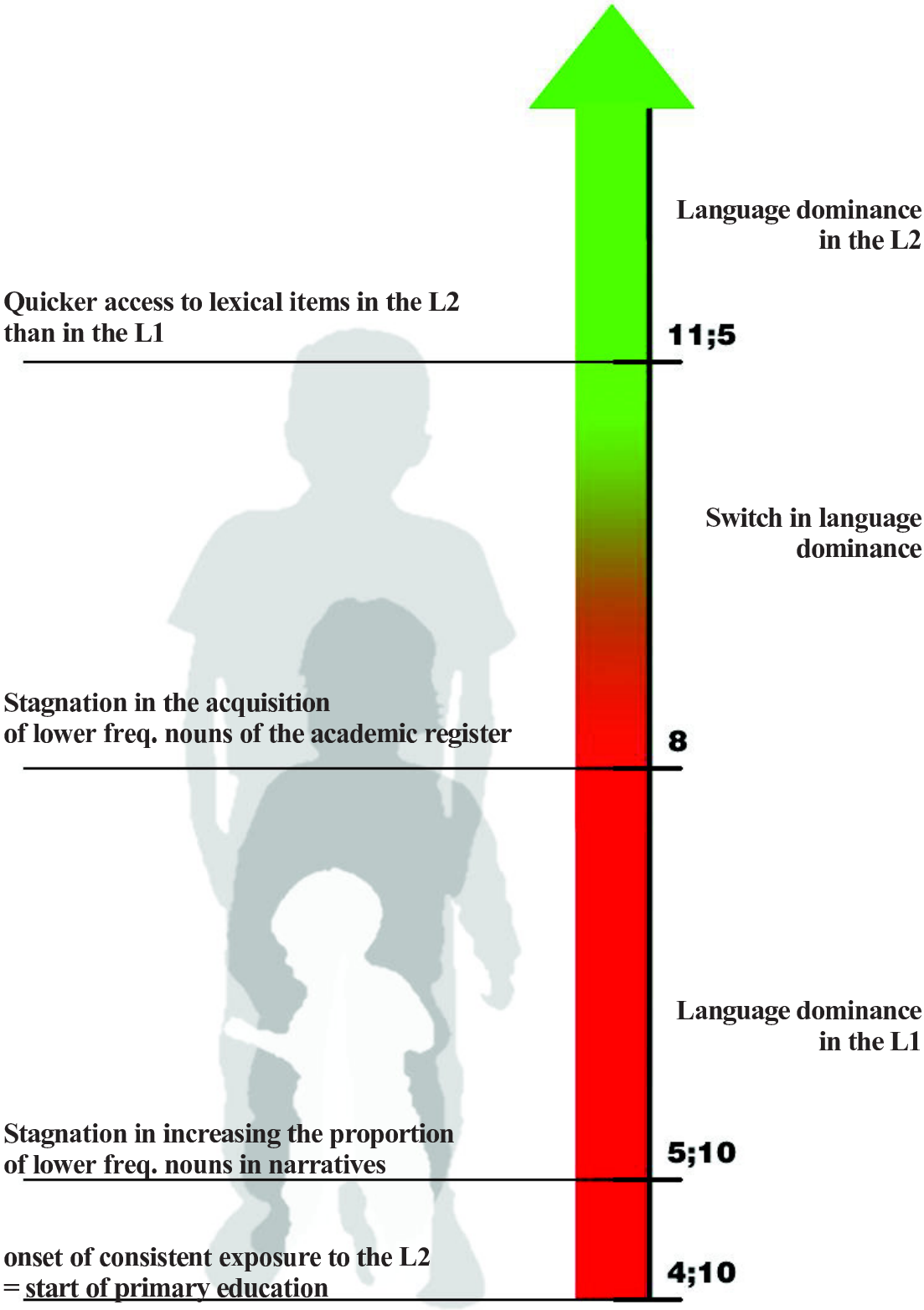


Fig. 6.2 Timeline of changes in heritage lexical acquisition in early sequential bilinguals across the primary school years.

The main conclusion arising from the comparisons presented in this chapter is that changes induced by a sudden reduction of input and limitations in contexts of use in the L1, and by a growing proficiency and exposure to the L2 occur much earlier than the widely documented switch in language dominance. The signs of stagnation in the acquisition of lower-frequency nouns can be considered indicators of early language weakening preceding the switch in language dominance as they correlate with the path of parallel lexical development of the L1 and L2. Along with the children's growing proficiency in the L2 from the onset of the exposure at the mean age of 4;10 to the end of primary school, the heritage speakers experience a quantitative and qualitative reduction in the L1 input and output. The timeline of changes that we propose reflects these fluctuations in language exposure and use by showing gradual changes in lexical accuracy, range and access.

The two assessments that have been used in this study to examine the noun category and the effects of word frequency on the lexical acquisition in child heritage language complemented each other, producing consistent results. The employment of the monolingual group for the Child HALA analyses proved useful and effective. It supported the results from the narrations that investigated the attainment of the Polish lexicon by heritage speakers as a comparison with monolingual development, and allowed us to shed light onto heritage lexical acquisition under reduced input circumstances and a growing exposure to the L2.

CHAPTER 7

DISCUSSION AND CONCLUSIONS

7.1 Introduction

In this final chapter, I discuss the findings of the thesis and provide an overview of the methodological and theoretical implications of this research. Following that, I evaluate the contribution of this study to existing knowledge and make recommendations for future research.

7.2 Discussion and conclusions

This thesis provides new insight into the field of bilingual language acquisition. The starting assumption underlying this study was that there is a direct link between the properties of input, in the form of language use and exposure, and heritage lexical acquisition and maintenance. In addition to the quantity and quality of input, the frequency of use of lexical items impacts the speaker's processing abilities that point to their relative language strength at a certain point in the acquisition, and its shifts across age spans. Throughout this study, the changing amount and character of input and language use in both languages reflected on the subjects' results. A reduction in the L1 input and an increase in the L2 exposure and use were evident in the children's narrations in the L1, where they needed to resort to substitution strategies to cope with deficiencies in the lower-frequency vocabulary, then in the dynamic shifts in the lexical accuracy levels in both languages as documented by the Child

HALA test, and finally in the changing levels of linguistic activation which has been shown to be a direct representation of language strength.

The main research question addressed in this thesis concerns the stages that the heritage lexicon goes through across the primary school years. Based on previous findings, I assumed that the lexicon continues to develop, however, the rate of the improvement will be slower than in monolingual speakers. Numerous studies also suggest that early sequential bilinguals switch their language dominance from the initially stronger L1 to the dominant L2 between the age of 8 and 11. However, there is insufficient evidence in the current literature that documents the acquisition of the heritage lexicon throughout the primary school education, from the onset of the exposure to the L2, to this switch in language dominance in middle childhood. The results of this study relate to this time span, and allow us to establish a timeline of changes in heritage lexical acquisition that precede the ultimate switch in language dominance. The results show that there are two sensitive periods during the course of heritage lexical acquisition: the first occurs between the mean age of 4;10 and 5;10, and the second between the mean age of 5;10 and 8.

The results of this study should be viewed in the light of the phenomenon of incomplete, partial, or interrupted acquisition that according to Montrul (2008) is characteristic of the heritage speakers' linguistic system when it does not display equal levels of proficiency in comparison with those of monolingual speakers of the same age, cognitive development, and social group. Also, as stated by Benmamoun et al. (2010), incomplete acquisition usually occurs in childhood and is a direct result of deficiencies in input. For the heritage speakers in this study, the change in the amount and quality of input brought about by schooling in the majority language English only has lead to an incomplete command of nouns that are outside of the

naturalistic source of language exposure that occurs in the home setting. Montrul (2010) argues that specialized vocabulary which in the case of primary school children is that of academic register acquired through literacy is generally not a part of the heritage speakers' lexicon, or remains imperfectly acquired, depending on the qualitative and quantitative characterisctics of their input.

Assuming that lexical development correlates positively with the bilinguals' knowledge of grammar, which has been documented for adult speakers (Polinsky 1995, 2006), the next step could be to evaluate whether these indicators of early changes that were documented in this study correlate with the pattern of the children's grammatical development. Such evidence of early signs of the heritage language weakening could be informative to the emerging field of heritage language pedagogy in terms of the exact areas of the language acquisition that require additional support. Therefore, the question may be asked as to whether early preventative pedagogical intervention could assist in delaying the onset of this lexical weakening in the heritage language. Also, if however, diagnosed, could we prevent further changes in the lexical system or lessen their scope? And finally, could these early interventions and pedagogical support delay the ultimate switch in language dominance? These questions open the door for further research into the dual language development in child heritage speakers.

7.2.1 Contribution to existing knowledge

The main contributions relate to the theory of bilingual language acquisition, and the methodology applicable in the studies with child subjects. Overall, this thesis presents three major findings, which can be summarised as follows:

- The results of this study established a timeline of heritage lexical

development in early sequential bilinguals, pointing to the characteristics of the changes and the age spans at which they occur. The lexical development of child heritage speakers displays indicators of early changes that occur before the switch in language dominance from the L1 to the L2. The first indicator becomes evident between the mean age of 4;10 and 5;10, and relates to the stagnation in the acquisition of lower-frequency nouns. The second indicator occurs between the mean age of 5;10 and 8, and concerns the lower-frequency nouns that are commonly associated with literacy and schooling.

- Word frequency has been found to significantly impact lexical acquisition in child heritage speakers, and its development across the primary school years. In the assessments of noun production and knowledge, word frequency has been shown to be sensitive to changes in the heritage language quantity and quality of input. In addition to being influenced by the lack of or reduced literacy skills and limited exposure to a variety of registers, changes in the input and output properties affect the general proportion of lower-frequency nouns in the children's speech as early as after twelve months of the onset of consistent exposure to the L2.
- The Child HALA test has been validated as a new method for use with bilingual children in the assessments of relative language strength and shifts in language dominance. The method has been shown to be sensitive and precise in detecting minimal shifts in lexical fluency which, according to previous studies, is an indicator of language use. There are three aspects in this study that validate the test. First, the ultimate evidence of the Child HALA's feasibility, suitability, reliability and applicability for use with child subjects are the results that are coherent, parallel, and consistent as totals, and

relevant in between-group and strata divisions. The test produced reliable, transparent and decisive results that are not only applicable to one group or one measure, but reflect a clear pattern of credible outcomes over several age groups, cohorts (monolingual and heritage speakers) and measures (frequency strata and overall). The trial tests using the original HALA tool signaled some drawbacks that disqualified the method to be used with child participants. The results of this study validate the amendments as appropriate and successful, but also support the main assumptions of the original HALA tool. Second, the final outcomes of the Child HALA test are in line with the findings of previous studies that examined relative language strength through assessments of lexical accuracy and access, and thus validate the method's applicability, suitability and reliability for use in research on lexical acquisition in bilingual children. The results that point to slight fluctuations and shifts in lexical accuracy and access that are evident as early as after twelve months of the L2 exposure highlight the Child HALA's sensitivity in the assessments of language weakening and early endangerment. Third, further support for the validation of the Child HALA test comes from positive correlations between the results produced by the test and the results from the Frog Story narratives. The latter method has been independently validated in numerous studies that used it in research on child language acquisition, and thus we may conclude that obtaining comparable outcomes from the two methods confirms and verifies the Child HALA's application.

On this basis, the Child HALA test can be treated as a new tool applicable in studies investigating language dominance, acquisition and loss in bilingual children.

Overall, this study contributes to knowledge in different fields of bilingual language acquisition, namely lexical development of early sequential bilinguals, language maintenance and incomplete acquisition, and the phenomenon of language dominance. The hypotheses and results presented in this thesis constitute a starting point for more in-depth research in these areas.

7.2.2 Limitations of this study and directions for future research

The areas of bilingual language acquisition explored in this study require further thorough analyses using different types of methodology and subjects. First, the study needs to be replicated with larger groups due to the fact that the numbers of participants in the groups are relatively low and uneven, especially at the two oldest age levels. Second, as we only investigated the children's narrations for the production of nouns and the impact of word frequency in their heritage language, it would be important to conduct similar analyses on the children's L2. This would allow for a more complete analysis of parallel lexical development across the primary school years, and would enable us to observe a relationship between a growing proficiency in the L2 and the emergence of the early indicators of change in heritage lexical acquisition.

Third, the analysis of the use of multiple lexical terms for single items in the narrations presented in section 4.7 requires further examination. The results showed an emerging trend of an overreliance on higher-frequency nouns, and an excessive use of multiple referents in the cases of gaps in the lexicon or uncertainty of the correct forms. This analysis was limited to a relatively low number of cases of multiple name use in single narrations, and therefore a further investigation would be

necessary to support this trend in a study with a higher number of participants and using other types of methodology.

The final limitation concerns the Child HALA test and its validation as a new method for use with bilingual children. The method needs further validation in studies with different language pairs to assess the correlations between the frequency values, lexical accuracy and RT scores. Additionally, it would require to be used in projects with larger samples of subjects, of different age and type of bilingualism in order to confirm the findings of this study.

There are important issues emerging from this study that would require further investigation and should be addressed in future research. The first issue concerns the subjects of this study. There is still little data in the literature on early sequential bilingualism. In this thesis, we attempted to shed light onto the parallel lexical development of the L1 and L2 in early sequential bilinguals, and we have shown that during this period the acquisition of the lexicon is extremely susceptible to the dynamic and changing pattern of language exposure, use and proficiency. As it is a transitional stage between a relative dominance in the heritage language and the L2, more research is necessary to examine how the acquisition patterns of the two languages interact across the primary school years. Second, as in this study we only examined lexical development, an interesting question remains as to what extent the pattern of lexical acquisition mirrors syntactic and phonological development. We can tentatively expect that such correlations could be positive on the basis of earlier work by Kagan and Friedman (2004) and Maria Polinsky (2008b) who pointed to the issue of speech rate (words/minute) as a valid diagnostics in evaluating language maintenance in heritage speakers. While Kagan and Friedman showed that heritage speakers display great variability in their speech rate, Maria Polinsky found that

speech rate correlates with grammatical proficiency. In her study on heritage Russian, she showed that speakers who retained the three-gender system had a higher speech rate than speakers who maintained a two-gender system. The issue of further correlations was already suggested by O'Grady et al. (2009) who stated that more work would be necessary to compare the results obtained from the original HALA method and from other methodologies used to examine language proficiency, e.g. MLU. This issue could have implications for the usefulness of the Child HALA as an assessment tool. The Child HALA and HALA tests share the same theoretical assumptions, and therefore if such correlations bring positive outcomes, both tests could become universal and compact tools applicable in projects aiming at quick and straightforward diagnostics of language proficiency in any language.

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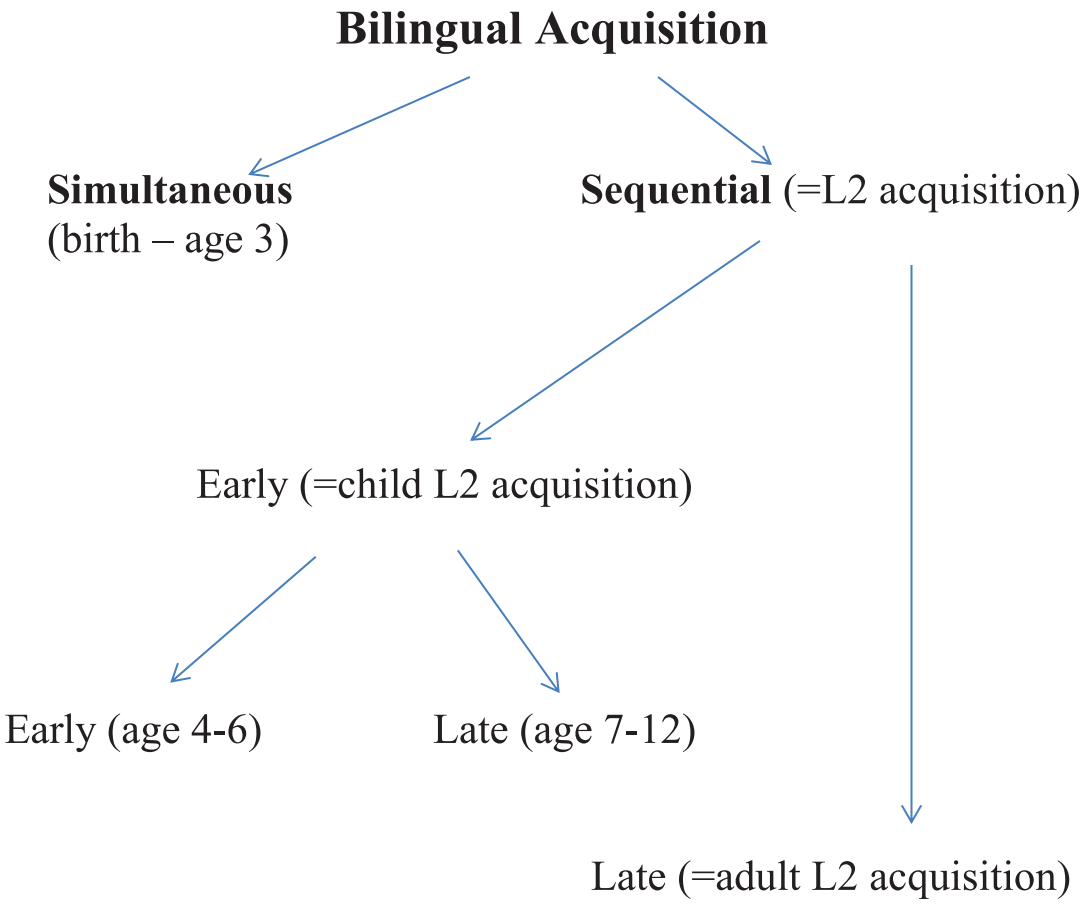
APPENDIX A

Bilingual language acquisition as distinguished by age and order of acquisition *(Montrul 2008)*



APPENDIX B

Scenariusz rozmowy z rodzicem/ rodzicami

Podczas tej rozmowy chciałabym się dowiedzieć podstawowych informacji na temat Waszej rodziny, Waszego przyjazdu i pobytu w Irlandii, w jaki sposób i jak często używają Państwo języka polskiego i angielskiego w ciągu dnia, a także jaki kontakt z każdym z jezyków ma Państwa dziecko/dzieci. Chciałabym się także dowiedzieć w jaki sposób Wasza rodzina utrzymuje kontakt z Polską i polską kulturą i przyzwyczajeniami. Zadam Państwu 31 pytań. Byłbym wdzięczna gdyby odpowiedzieli Państwo na wszystkie z nich, jednak jesli nie chcą Państwo odpowiadać na którekolwiek, to prosze mi to powiedzieć.

1. Kiedy przyjechali Państwo do Irlandii?
2. Jak długo już tu Państwo mieszkają?
3. Jakie ma Pani (matka dziecka) wykształcenie?
4. Czym zajmowała się Pani (matka dziecka) w Polsce?
5. Czym zajmuje się Pani w Irlandii?
6. Kiedy i gdzie urodziło się dziecko?
7. Jak długo już tu mieszka?
8. W której obecnie klasie jest dziecko?
9. Czy dziecko ma/miało zdiagnozowaną wadę słuchu lub mowy?
10. W jakim wieku dziecko zaczęło mieć stały kontakt z językiem angielskim (przedszkole, szkoła)?
11. Czy dziecko chodziło do przedszkola? Czy dzieckiem zajmował się ktoś inny oprócz rodziców?Jeśli tak, to ile miało lat jak zaczęło naukę w przedszkolu/ opieka innej osoby?
12. Czy było to przedszkole polskie czy irlandzkie? W jakim języku mówiła opiekunka?
13. Ile dni w tygodniu i godzin dziennie było dziecko pod opieką przedszkola lub opiekunki?

14. Kto się zajmuje dzieckiem po powrocie ze szkoły? W jakim języku mówi ta osoba?

15. W jakim języku zwraca się Pani/matka do dziecka?

16.W jakim języku zwraca się dziecko do Pani/matki?

17. Czy dziecko ma rodzeństwo? Jeśli tak, to w jakim wieku?

18.W jakim języku rozmawia dziecko ze swoim rodzeństwem?

19. W jakim języku rozmawia z kolegami/koleżankami, z którymi bawi sie po szkole?

20. Jak często dziecko wyjeżdża do Polski?

21. Ile czasu spędza dziecko w Polsce w ciągu roku?

22. Czy dziecko uczestniczy w zorganizowanych zajęciach po szkole?

23. Jeśli tak, ile czasu tam spędza i w jakim języku prowadzone są zajęcia?

24. Czy maja Państwo polską telewizję w domu?

25. W jakim języku dziecko głównie ogląda telewizję?

26. Gdzie Państwo głównie robią zakupy? W supermarketach typu: Dunnes Stores, Tesco, czy w sklepach z polską żywnością?

27.W momencie rozpoczęcia (i w trakcie) edukacji w szkole podstawowej w Irlandii czy martwili sie Państwo o :

a) jego/jej poziom języka angielskiego?

b) rozwój jezyka polskiego?

28. Jeśli chodzą Państwo do kościoła, to na msze w jakim języku?

29. Gdzie jeszcze, oprócz domu, używają Państwo języka polskiego (praca, znajomi...)?

30. Czy mają Państwo polskojęzycznych znajomych?

31. Czy mają Państwo angielskojęzycznych znajomych?

'Script of the interview with the parent(s)'

In this interview, we would like to learn some basic information about your family, your arrival and stay in Ireland, about your use of the Polish and English languages in your day to day life, and your child's exposure to each language. We are also interested in finding out about how you and your family maintain ties with Poland and your Polish heritage. There are 31 questions in this interview. We would be grateful if you answered all of them, however, if you feel that some of them do not apply to you, or you are uncomfortable answering any of them, please do not hesitate to say that.

1. When did you arrive in Ireland?

2. How long have you been living in Ireland?

3. What is your (the child's mother) highest educational qualification?

4. What did you (the child's mother) do in Poland?

5. What do you (the child's mother) do in Ireland?

6. When and where was your child born?

7. How long has your child been living in Ireland?

8. In which class is the child currently enrolled?

9. Has the child been diagnosed with a hearing or speech difficulty?

10. How old was your child when he/she started to have a continuous exposure to English (pre-school or school)?

11. Did the child attend pre-school? Has the child ever been looked after by somebody else than the parents? If yes, how old was the child when he/she started pre-school/ was looked after a child minder?

12. Was the pre-school Irish or Polish? What was the language of instruction? What language did the child minder use to communicate with the child?

13. How many days per week and hours per day did your child spend in pre-school / was looked after by a child minder?

14. Who looks after the child when he/she comes back from school? What language do they speak?

15. What language do you (the child's mother) use when speaking to your child?

16. What language does your child use when speaking to you?

17. Does the child have siblings? If yes, how old are they?

18. What language does your child speak with their siblings?

19. What language does your child speak with their friends that he/she usually plays with?

20. How often does your child go to Poland?

21. How much time does your child spend in Poland per year?

22. Does your child attend any extracurricular activities after school?

23. If yes, how much time per week does your child spend there? and what is the language of instruction?

24. Do you have Polish television at home?

25. In what language does your child mostly watch television?

26. Where do you mostly do your grocery shopping (shops with Polish/Eastern European food, supermarkets like Tesco, Dunnes Stores, etc. or both?)

27. When your child started school, were you concerned about ...

a) his/her little proficiency in English?

b) the development of their Polish?

28. If you go to church, in what language is the service?

29. Where else, apart from home, do you use the Polish language (friends, work, etc.)?

30. Do you have Polish speaking friends in Ireland?

31. Do you have English speaking friends in Ireland?

APPENDIX C

'Frog, where are you?'[55]

[55] The pictures have been downloaded from http://childes.psy.cmu.edu/manuals/frog.pdf.

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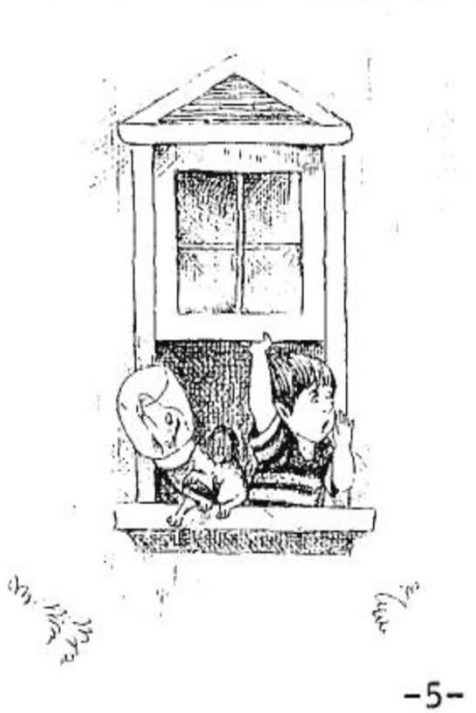

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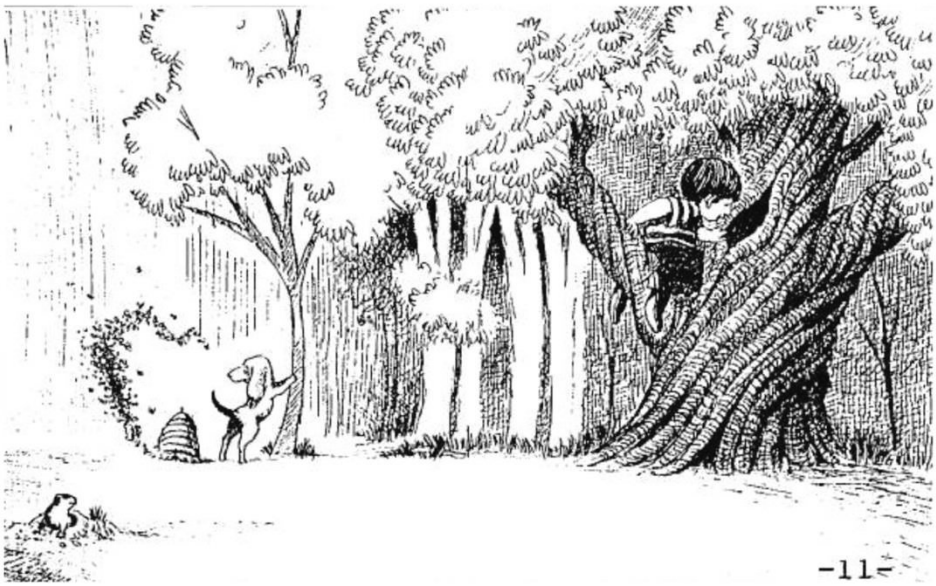

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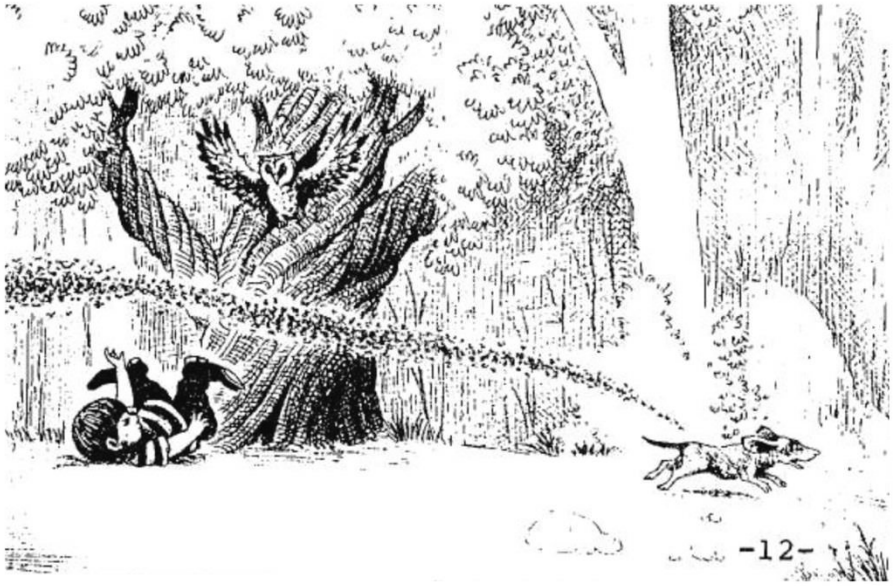

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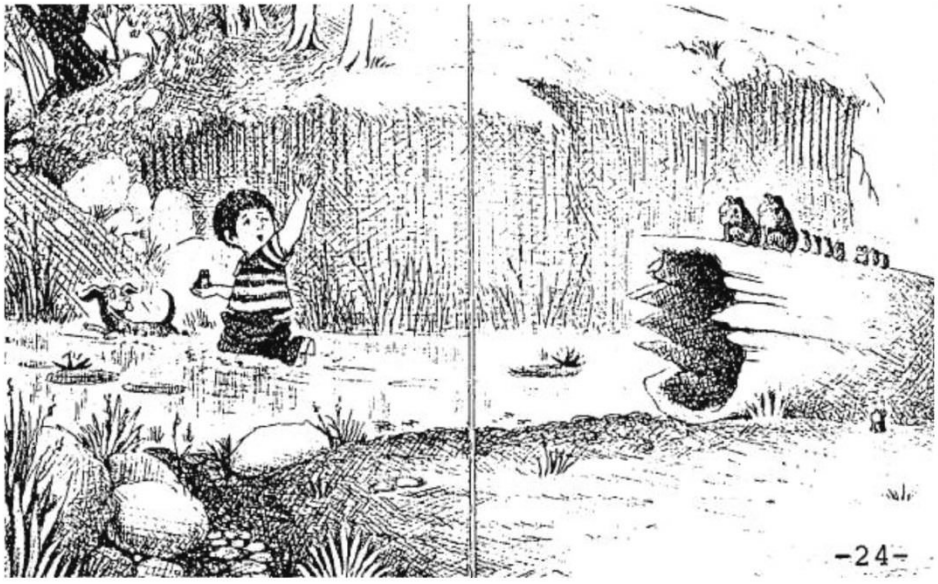
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APPENDIX D

Production of nouns in the Frog Story narratives in the heritage and monolingual speakers

HERITAGE SPEAKERS

GROUP A MEAN AGE: 4;10

Table D.1 Production of nouns in the Frog Story narratives in heritage group A

A1	A2	A3	A4
Żaba	Księżyc	Żaba	Chłopczyk
Butla	Żabka	chłopczyk	piesek
Słoik	Chłopczyk	Okno	Wazon
piesek	Piesek	Piesek	Głowa
Okno	Słoik	Dziurka	Okno
Pszczoły	But	wiewiórka	Mama
Ul	Głowa	Drzewo	Ul
Chłopiec	Pszczółki	Głowa	Środek
Dziura	Wiewiórka	Osy	Myszoskoczek
Kret	Miód	pszczółki	Drzewo
Dziupla	Kamień	Woda	Pszczoły
Drzewo	Renifer		Sowa
Sowa	Przepaść		Grzbiet
Jelonek	Woda		Ziemia
Rzeka	Kłoda		Woda
Głowa			Dom
Kłoda			Żabka
			Muchy

A5	A6	A7	A8
Żabka	Żabka	Żaba	Piesek
Piesek	Słoiczek	chłopiec	Chłopczyk
Ubranie	Piesek	Piesek	Żabka
Czapka	Chłopczyk	podwórko	Noc
Miodek	Okno	gniazdo	Księżyc
Myszka	Pszczoły	Drzewo	Łóżko
Renifer	Ul	Sowa	Koszulka
Muchy	Dziupla	Woda	Papier
	Drzewo	Muchy	kubełek
	Sowa		Buty
	Renifer		Kapcie

	Drewno		Stolik
	Woda		Podłoga
	Tył		Okno
	Rodzina		Las
	Dom		Dziura
			Osy
			Chomik
			Drzewo
			Sowa
			Kamień
			Jeleń
			Woda
			Dom
			Gałąź
			Kubek

A9	A10
chłopiec	Chłopiec
Żabka	Żabka
Słój	Słoik
Piesek	Głowa
Dwór	Dwór
Dom	Rączki
Drzewo	Las
pszczółki	Pszczoły
Sowa	Wiewiórka
Kamień	Drzewo
dziewczynka	Ptaszek
Woda	Rzeka
Głowa	Kłoda
	Mama
	Dom
	Osy
	Rura

GROUP B MEAN AGE: 5;10

Table D.2 Production of nouns in the Frog Story narratives in heritage group B

B1	B2	B3	B4
Żaba	Żabka	Chłopczyk	Piesek
Chłopiec	Chłopiec	Piesek	Żabka
Kapelusz	Piesek	Żabka	Chłopiec
But	Bluzka	pojemniczek	Butelka
Pojemnik	Skarpetki	Pszczoły	Koszulka
Głowa	Księżyc	Park	Okno
Okno	Okno	Dziura	Las
Pies	Łóżko	Ul	Dziura

Las	Lampka	zwierzątko	wiewiórka
Nora	But	Drzewo	Drzewo
Miód	Butelka	Sowa	Sowa
Bóbr	Dom	Jelonek	Kamień
Drzewo	Las	Woda	Woda
Pszczoły	Buzia	Dom	Osiołek
Sowa	Nora		Góra
Kamień	Drzewo		Drewno
Gałęzie	Sowa		
Woda	Kamień		
Pień	Patyk		
Ręka	Renifer		
	Przepaść		
	Woda		
	Rodzina		
	Muszki		
	Dziura		

B5	B6	B7	B8
Chłopiec	Chłopiec	Żaba	Żabka
Piesek	Piesek	Noc	chłopczyk
Żabka	Żabka	Buty	Piesek
Środek	Pokój	Okno	Słoik
Noc	Las	Pies	Głowa
Buzia	Drzewo	Głowa	Stado
Głowa	Pszczoły	Dziura	Osy
Okno	Sowa	Osy	Ul
Las	Skała	Chomik	Kret
Drzewo	Woda	Wiewiórka	Nosek
Ul	Głowa	Sowa	Drzewo
Sowa	Błoto	Kamień	Sowa
Ręka	Dół	Gałązki	Dziupla
Woda	Rodzina	Patyki	Kamień
Szklanka	Gniazdo	Przepaść	zwierzątko
Mrówki	Dziura	Kałuża	Renifer
Muchy		Błoto	przepaśc
Dziura		Kłoda	Woda
Kamyk		Dzieciaki	Ogonek
Czas		Rodzina	Kłoda
		Puszka	Norka
		Beczka	Wiewiórka
			Czas

B9	B10	B11	B12
Księżyc	Żabka	Żaba	Żaba
Żaba	Butelka	Pies	Pies
Ubrania	Chłopczyk	Słoik	chłopiec
Łóżko	Piesek	Dół	butelka

But	Buty	Dziura	Drzwi
Okno	Las	Drzewo	Nora
Dziura	Nora	Sowa	Szczur
Ul	Kret	Woda	Drzewo
Woda	Nos	Dom	Osy
Muchy	Sowa	Muchy	Łoś
Chomik	Drzewo		Kałuża
Oczy	Skała		Dom
	Dół		Gniazdo
	Woda		Papuga
	Plecy		
	Pień		
	Mama		
	Tata		
	rodzina		
	pudełko		
	Muchy		
	gniazdo		

B13	B14
Żabka	Piesek
Słoik	Słoik
Pies	Żabka
Krzesełko	chłopiec
Okno	Głowa
Chłopiec	Ziemia
Pszczoły	drzewo
Nora	Dziura
Myszka	Osy
Ul	Sowa
Sowa	Krzaki
Woda	Rogi
Głowa	Woda
Pomoc	Kłoda
	Dzieci
	Ręka
	Krzesło
	Góra
	Nogi
	Czas
	Muchy
	Dom
	zwierzątko

GROUP C MEAN AGE: 8;0

Table D.3 Production of nouns in the Frog Story narratives in heritage group C

C1	C2	C3	C4
Chłopiec	Chłopczyk	Chłopiec	chłopczyk
Pies	Stolik	Żaba	Żaba
Żaba	Piesek	Pies	Piesek
Noc	Żaba	Dzień	Łóżko
Słój	Bluzka	Buty	Słoik
Poranek	Noc	Stołek	Okno
Głowa	Lampka	Słoik	Osy
Słoik	Łóżko	Noc	Norka
Okno	Kapcie	Okno	Góra
Dom	But	Dom	Nos
Dziura	Okno	Pszczoły	wiewiórka
Ul	Pole	Ul	drzewo
Pszczoły	Las	Osy	Sowa
Wiewiórka	Dziurka	Kret	Ziemia
Drzewo	Pszczoły	Dziura	Krzaki
Dół	Głowa	Drzewo	Jeleń
Sowa	Środek	Nos	jeziorko
Ziemia	Wiewiórka	Sowa	Woda
Kamień	Nos	Kamień	Mama
Gałązka	Drzewo	Rogi	Tata
Zwierzę	Sowa	Krzaki	
Przepaść	Ręka	Jeleń	
Woda	Patyki	Głowa	
Pień	Renifer	Staw	
Rodzina	Woda	Woda	
	Górka	Pień	
	Dźwięk	Rów	
	Dom		
	Kropeczki		
	Kubek		
	Kamyk		

C5	C6	C7	C8
Chłopczyk	Piesek	Chłopiec	chłopczyk
Żaba	Chłopczyk	Żabka	podłoga
Pies	Żabka	Piesek	Żabka
Wieczór	But	Środek	lampka
Słoik	Okno	Noc	księżyc
Dwór	Las	Światło	Pole
Okno	Pszczółki	Łóżko	ubrania
Las	Ul	Okno	Buty
Pszczoły	Dziura	Buty	buteleczka
Drzewo	Drzewo	Słoik	Dom
Dziura	Kret	Głowa	Okno

Dziupla	Ziemia	Krok	Głowa
Osy	Sowa	Przód	Pszczoły
Ul	Osy	Butla	Ul
Sowa	Głaz	Policzek	Środek
Kamień	Woda	Miód	Dziura
Krzaki	Głowa	pszczółki	Wiewiórka
Głowa	Szklanka	Czas	Skunks
Woda	Filiżanka	Dziurka	Sowa
Plecy		Drzewo	Woda
Kłoda		Kret	Śnieg
Dzieci		Nos	Zwierzątko
Dom		Sowa	Dzidziuś
Powrót		Kamień	
		Jeleń	
		Koniec	
		Ziemia	
		Rzeczka	
		Domek	
		Strona	
		Mama	
		Tata	

GROUP D MEAN AGE: 11;5

Table D.4 Production of nouns in the Frog Story narratives in heritage group D

D1	D2	D3	D4
Noc	Chłopiec	Chłopczyk	Chłopczyk
Chłopczyk	Żaba	Pies	Pies
Piesek	Pies	Żaba	Żaba
Żaba	Pokój	Słoik	Noc
Piżama	Noc	Sypialnia	Pokój
Słoik	Dom	Noc	But
Ranek	Okno	Okno	Okno
Pokój	Słoik	Głowa	Pszczoły
Buty	Głowa	Łąka	Ul
Okno	Las	Osy	Dziura
Las	Dziurka	Mysz	Surykatka
Osy	Ul	Drzewo	Nos
Nora	Chomik	Sowa	Drzewo
Nos	Nos	Kamienie	Sowa
Drzewo	Pszczoły	Gałęzie	Głaz
Ul	Sowa	Sarenka	Jeleń
Sowa	Skała	Górka	Głowa
Ziemia	Renifer	Woda	Rogi
Kamień	Głowa	Dom	Staw
Kijek	Dół	Dziupla	Dom

rogi	Drzewo		szkło
Jeleń	Górka		patyk
Strona	Woda		
Jeziorko	Dzieci		
Głos			
Dzieci			
Reszta			
Przypadek			
Borsuk			
Dziura			
Kora			

D5	D6
Chłopczyk	Chłopiec
Pies	Pies
Żabka	Żaba
Noc	Noc
Słój	Słoik
Okno	Okno
Las	Pokój
Pszczoły	Głowa
Dół	Parapet
Kret	Dziura
Nos	Dom
Sowa	Las
Kamień	Pszczoły
Łoś	Kret
Głowa	Chomik
Woda	Nos
Kłoda	Łapka
Krzaki	Drzewo
Młode (dzieci)	Kamień
Gniazdo	Sowa
Kora	Gałęź
	Rogi
	Jeleń
	Górka
	Koniec
	Dół
	Strumyk
	Woda
	Pień
	Czas
	Szczęście

MONOLINGUAL SPEAKERS

GROUP V MEAN AGE: 4;10

Table D.5 Production of nouns in the Frog Story narratives in monolingual group V

V1	V2	V3	V4
Żabka	Żabka	Piesek	Piesek
Chłopczyk	Pies	Chłopczyk	Żaba
Rodzina	Słoik	Żabka	Chłopczyk
But	Chłopczyk	Domek	Głowa
Piesek	But	Okno	Butelka
Pszczoły	Okno	Buzia	Miód
Wiewiórka	Pszczółki	Ziemia	Nos
Ul	Ul	Nogi	Drzewo
Pień	Dziura	Pszczoły	Kamień
Sowa	Wiewiórka	Norka	Rzeka
Sówki	Drzewo	Kret	Woda
Skała	Sowa	Miód	Deska
Jeleń	Ziemia	Nos	Muchy
Głowa	Kamień	Łapki	
Strona	Dzidzuś	Drzewo	
Mąż	Jelonek	Ul	
Dom	Woda	Sowa	
Czas	Maleństwo	Kamień	
	Mama	Sarenka	
	Dzieci	Trawa	
	Góra	Woda	
	Sikorka	Oczy	
	Nogi	Nogi	
		Ręka	
		Piety	
		Paluszki	
		Stopy	
		Kłoda	
		Strona	
		Góra	

V5	V6
Chłopczyk	Chłopczyk
Piesek	Środek
Żabka	Pies
Las	Żabka
Ul	Nora
Kamień	nos
Rzeka	Dziura
	Pszczoły
	Sowa
	Sarenka

	Woda
	Rodzina
	Mama
	Tata
	Dół
	Góra

GROUP X MEAN AGE: 5;10

Table D.6 Production of nouns in the Frog Story narratives in monolingual group X

X1	X2	X3	X4
Żabka	Chłopczyk	Chłopiec	chłopczyk
Chłopczyk	Żabka	Pokój	Piesek
Piesek	Okno	Piesek	Żabka
Głowa	Piesek	Żabka	Okno
Ul	Pszczoły	Bałagan	Dwór
Drzewo	Krecik	Słoik	słoiczek
Jeleń	Miodek	Ul	drzewo
Woda	Ul	Ziemia	dziurka
	Drzewo	Drzewo	miodek
	Skała	Nora	Ul
	Sarenka	Pszczoły	Sowa
	Łoś	Rzeka	Rogi
	Woda	Głowa	Jeleń
		Dom	Staw
			rodzina
			Dom

X5	X6
Chłopiec	Chłopczyk
Piesek	Żabka
Żabka	Piesek
Okno	Słoik
Las	But
Nora	Okno
Ul	Głowa
zwierzątko	Buty
Drzewo	Pszczoły
Pszczółki	Ul
Sowa	Nora
Kamień	Nos
Gałąź	Drzewo
Łapka	Wiewiórka
Rogi	Sowa
Głowa	Kamień
Rzeczka	Głaz
Dzieci	Rogi

Przypadek	Jeleń
Akwarium	Staw
Łosoś	Mama
Kumkanie	Rodzina
	Przykład
	Kumkanie

GROUP Y MEAN AGE: 8;0

Table D.7 Production of nouns in the Frog Story narratives in monolingual group Y

Y1	Y2	Y3	Y4
Chłopczyk	Noc	Chłopczyk	Chłopczyk
Piesek	Żabka	Dom	Żabka
Słoik	Słoik	Piesek	Piesek
Żaba	Chłopczyk	Pokój	Kapelusz
Buty	Ranek	Słoik	Okno
Okno	but	Buty	Słoik
Las	Okno	Okno	Głowa
Dziura	Las	Głowa	Ręce
Ul	Nora	Ul	Dom
Wiewiórka	Ul	Pszczoły	Pszczoły
Ziemia	Pszczoły	Dziurka	Nora
Pszczoły	Kret	Norka	Ul
Sowa	Wiewiórka	zwierzątko	Świstak
Kamień	Gałąź	Nos	Nos
Dół	Dół	Drzewo	Dziupla
Łoś	Sowa	Dziupla	Drzewo
Woda	Gniazdo	Sowa	Pszczoły
Głowa	Kamienie	Kamienie	Sowa
Pień	Skała	Jeleń	Kamień
Dzieci	Rogi	Rogi	Antylopa
	Jeleń	Góra	Rogi
	Góra	Koniec	Staw
	Woda	Droga	Kłoda
	Nogi	Woda	Pan
	Tata	Cisza	Dzieci
	Mama	Kłoda	Rodzice
			Koniec

Y5	Y6
Żabka	Żabka
Słoik	Chłopiec
Chłopczyk	Pies
Piesek	Słoik
Dom	Głowa
Okno	Dziupla
Ul	Pszczoły

Nora	Ul
Pszczoły	Zwierzątko
Drzewo	Nos
Kamień	Drzewo
Patyki	Dziupla
Jeleń	Sowa
Woda	Krzaki
	Jeleń
	Kamyki
	Rogi
	niespodzianki
	Pień
	Dzieci
	Woda
	Dom
	Gniazdo

GROUP Z MEAN AGE: 12;0

Table D.8 Production of nouns in the Frog Story narratives in monolingual group Z

Z1	Z2	Z3	Z4
Chłopiec	Chłopczyk	Chłopczyk	Chłopiec
Piesek	Żaba	Żabka	Żaba
Żabka	Dom	Słoik	Słoik
Słoik	Okno	Piesek	Pies
Okno	Las	Ubrania	Głowa
Pszczoły	Nora	Głowa	Buty
Nora	Wiewiórka	Okno	Parapet
Ul	Ul	Las	Ul
Kret	Dziupla	Nora	Pszczoły
Drzewo	Pszczoły	Ul	Drzewo
Dziupla	Sowa	Zwierzątko	Nora
Sowa	Drzewo	Nos	Nornica
Saran	Skała	Drzewo	Skunks
Woda	Jeleń	Pszczoły	Nos
Kłoda	Woda	Sowa	ziemia
	Kłoda	Skała	dziupla
	Pies	Łoś	Sowa
		Górka	Górka
		Woda	Kamień
		Dzieci	Jeleń
		Kora	Rogi
		Przypadek	Staw
		Czas	Kłoda
			strona
			Mama

			Tata
			Dzieci
			Pień
			Woda
			Dzień

Z5	Z6
Chłopiec	Chłopiec
Pies	Żaba
Żabka	Słoik
Słoik	Noc
Głowa	Księżyc
Okno	Ubrania
Pszczoły	Pokój
Nora	Dom
Ul	Podwórze
zwierzątko	Nora
Dziupla	Pszczoły
Sowa	Ziemia
Drzewo	Sowa
Kamień	Ul
Jeleń	Miejsce
Woda	Gałąź
Brzeg	Jeleń
Kłoda	Przepaść
Dzieci	Bagno
	Dźwięk
	Pień
	Mąż
	Żona
	Dzieci
	Kora
	Dziura

APPENDIX E

Production of the target nouns in the Frog Story narratives in the heritage and monolingual speakers

THE HERITAGE SPEAKERS

Table E.1 Production of the target nouns in the Frog Story narratives in heritage group A

Target Nouns	**Żaba 'frog'**	**Słoik 'jar'**	**Pszczoły/osy 'bees'/'wasps'**	**Ul 'beehive'**	**Rodent type animal**	**Dziupla 'tree hollow'**	**Nora 'burrow'**	**Sowa 'owl'**	**Animal with antlers**	**Kłoda/pień 'log'/tree trunk**
A1	Żaba 'frog'	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	Kret 'mole'	Dziupla 'tree hollow'	-	Sowa 'owl'	Jelonek 'fawn'	Kłoda 'log'
A2	Żabka 'frog'$_{DIM.}$	Słoik 'jar'	Pszczółki 'bees'$_{DIM.}$	-	Wiewiórka 'squirrel'	-	-	-	Renifer 'reindeer'	Kłoda 'log'
A3	Żaba 'frog'	-	Pszczółki 'bees'$_{DIM.}$	-	Wiewiórka 'squirrel'	-	-	-	-	-
A4	Żabka 'frog'$_{DIM.}$	-	Pszczoły 'bees'	Ul 'beehive'	Myszoskoczek 'gerbil'	-	-	Sowa 'owl'	-	-
A5	Żabka 'frog'$_{DIM.}$	-	-	-	Myszka 'mouse'$_{DIM.}$	-	-	-	Renifer 'reindeer'	-
A6	Żabka 'frog'$_{DIM.}$	Słoiczek 'jar'$_{DIM.}$	Pszczoły 'bees'	Ul 'beehive'	-	Dziupla 'tree hollow'	-	Sowa 'owl'	Renifer 'reindeer'	-
A7	Żaba 'frog'	-	-	-	-	-	-	Sowa 'owl'	Jeleń 'deer'	-
A8	Żabka	-	Osy	-	Chomik	-	-	Sowa	-	-

	‘frog’$_{DIM.}$		‘wasps’		‘hamster’			‘owl’		
A9	Żabka ‘frog’$_{DIM.}$	Słoik ‘jar’	Pszczółki ‘bees’$_{DIM.}$	-	-	-	-	Sowa ‘owl’	-	-
A10	Żabka ‘frog’$_{DIM.}$	Słoik ‘jar’	Pszczoły ‘bees’	-	Wiewiórka ‘squirrel’	-	-	-	-	Kłoda ‘log’

Table E.2 Production of the target nouns in the Frog Story narratives in heritage group B

Target Nouns	**Żaba ’frog’**	**Słoik ‘jar’**	**Pszczoły/osy ‘bees’/’wasps’**	**Ul ‘beehive’**	**Rodent type animal**	**Dziupla ‘tree hollow’**	**Nora ‘burrow’**	**Sowa ‘owl’**	**Animal with antlers**	**Kłoda/pień ‘log’/ ‘trunk’**
B1	Żaba ‘frog’	-	Pszczoły ‘bees’	Ul ‘beehive’	Bóbr ‘beaver’	-	Nora ‘burrow’	Sowa ‘owl’	-	Pień ‘tree trunk’
B2	Żaba ‘frog’	-	-	-	-	-	Nora ‘burrow’	Sowa ‘owl’	Renifer ‘reindeer’	-
B3	Żaba ‘frog’	-	Pszczoły ‘bees’	Ul ‘beehive’	Zwierzątko ‘Animal’$_{DIM.}$	-	-	Sówka ‘owl’$_{DIM.}$	Jelonek ‘fawn’	-
B4	Żaba ‘frog’	-	Pszczoły ‘bees’	-	Wiewiórka ‘squirrel’	-	-	Sowa ‘owl’	-	-
B5	Żabka ‘frog’$_{DIM.}$	-	-	Ul ‘beehive’	-	-	-	Sowa ‘owl’	-	-
B6	Żaba ‘frog’	-	Pszczoły ‘bees’	-	-	-	-	Sowa ‘owl’	-	-
B7	Żaba ‘frog’	-	Osy ‘wasps’	Ul ‘beehive-	Chomik ‘hamster’	-	-	Sowa ‘owl’	-	Kłoda ‘log’
B8	Żaba ‘frog’	Słoik ‘jar’	Osy ‘wasps’	Ul ‘beehive’	Kret ‘mole’	Dziupla ‘tree hollow’	-	Sowa ‘owl’	Renifer ‘reindeer’	Kłoda ‘log’
B9	Żaba	-	-	Ul	Chomik	-	-	-	-	-

	‘frog’			‘beehive’	‘hamster’					
B10	Żabka ‘frog’$_{DIM.}$	-	-	-	Kret ‘mole’	-	Nora ‘burrow’	Sowa ‘owl’	-	Pień ‘tree trunk’
B11	Żaba ‘frog’	Słoik ‘jar’	-	-	-	-	-	Sowa ‘owl’		-
B12	Żabka ‘frog’$_{DIM.}$	-	Pszczoły ‘bees’	-	Szczur ‘rat’	-	Nora ‘burrow’	-	Łoś ‘moose’	-
B13	Żaba ‘frog’	Słoik ‘jar’	Pszczoły ‘bees’	Ul ‘beehive’	Mysz ‘mouse’	-	Nora ‘burrow’	Sowa ‘owl’	-	-
B14	Żabka ‘frog’$_{DIM.}$	Słoik ‘jar’	Osy ‘wasps’	-	-	-	-	Sowa ‘owl’	-	Kłoda ‘log’

Table E.3 Production of the target nouns in the Frog Story narratives in heritage group C

Target Nouns	**Żaba ’frog’**	**Słoik ‘jar’**	**Pszczoły/osy ‘bees’/’wasps’**	**Ul ‘beehive’**	**Rodent type animal**	**Dziupla ‘tree hollow’**	**Nora ‘burrow’**	**Sowa ‘owl’**	**Animal with antlers**	**Kłoda/pień ‘log’/ ‘tree trunk’**
C1	Żaba ‘frog’	Słój ‘jar’	Pszczoły ‘bees’	Ul ‘beehive’	Wiewiórka ‘squirrel’	-	-	Sowa ‘owl’		Pień ‘tree trunk’
C2	Żaba ‘frog’	-	Pszczółki ‘bees’$_{DIM.}$	-	Wiewiórka ‘squirrel’	-	-	Sowa ‘owl’	Renifer ‘reindeer’	-
C3	Żaba ‘frog’	Słoik ‘jar’	Pszczółki ‘bees’$_{DIM.}$	Ul ‘beehive’	Kret ‘mole’	-	-	Sowa ‘owl’	Jeleń ‘deer’	Pień ‘tree trunk’
C4	Żaba ‘frog’	Słoik ‘jar’	Osy ‘wasps’	-	Wiewiórka ‘squirrel’	-	Norka ‘Burrow’ $_{DIM.}$	Sowa ‘owl’	Jeleń ‘deer’	-
C5	Żaba	Słoik	Pszczoły	-	-	Dziupla	-	Sowa	-	Kłoda

	‘frog’	‘jar’	‘bees’			‘tree hollow’		‘owl’		‘log’
C6	Żaba ‘frog’	-	Pszczoły ‘bees’	Ul ‘beehive’	Kret ‘mole’	-	-	Sowa ‘owl’	-	-
C7	Żaba ‘frog’	Słoik ‘jar’	Pszczoły ‘bees’	-	Kret ‘mole’	-	-	Sowa ‘owl’	Jeleń ‘deer’	-
C8	Żaba ‘frog’	-	Pszczoły ‘bees’	Ul ‘beehive’	Skunks ‘skunk’	-	-	Sowa ‘owl’	-	-

Table E.4 Production of the target nouns in the Frog Story narratives in heritage group D

Target Nouns	**Żaba ’frog’**	**Słoik ‘jar’**	**Pszczoły/osy ‘bees’/’wasps’**	**Ul ‘beehive’**	**Rodent type animal**	**Dziupla ‘tree hollow’**	**Nora ‘burrow’**	**Sowa ‘owl’**	**Animal with antlers**	**Kłoda/pień ‘log’/’tree trunk’**
D1	Żaba ‘frog’	Słoik ‘jar’	Osy ‘wasps	Ul ‘beehive’	Borsuk ‘badger’	-	Nora ‘burrow’	Sowa ‘owl’	Jeleń ‘deer’	-
D2	Żaba ‘frog’	Słoik ‘jar’	Pszczoły ‘bees’	Ul ‘beehive’	Chomik ‘hamster’	-	-	Sowa ‘owl’	Renifer ‘reindeer’	-
D3	Żaba ‘frog’	Słoik ‘jar’	Osy ‘wasps	-	Mysz ‘mouse’	-	-	Sowa ‘owl’	Sarenka ‘doe’	-
D4	Żaba ‘frog’	-	Pszczoły ‘bees’	Ul ‘beehive’	Surykatka ‘meerkat’	-	-	Sowa ‘owl’	Jeleń ‘deer’	-
D5	Żaba ‘frog’	Słój ‘jar’	Pszczoły ‘bees’	-	Kret ‘mole’	-	-	Sowa ‘owl’	Łoś ‘moose’	Kłoda ‘log’
D6	Żaba ‘frog’	Słoik ‘jar’	Pszczoły ‘bees’	-	Kret ‘mole’	-	-	Sowa ‘owl’	Jeleń ‘deer’	-

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Table E.5 Production of the target nouns in the Frog Story narratives in monolingual group V

Target Nouns	**Żaba 'frog'**	**Słoik 'jar'**	**Pszczoły/osy 'bees'/'wasps'**	**Ul 'beehive'**	**Rodent type animal**	**Dziupla 'tree hollow'**	**Nora 'burrow'**	**Sowa 'owl'**	**Animal with antlers**	**Kłoda/pień 'log'/'tree trunk'**
V1	Żabka 'frog'$_{DIM.}$	-	Pszczoły 'bees'	Ul 'beehive'	Wiewiórka 'squirrel'	-	-	Sowa 'owl'	Jeleń 'deer'	Pień 'tree trunk'
V2	Żabka 'frog'$_{DIM.}$	Słoik 'jar'	Pszczółki 'bees'$_{DIM.}$	Ul 'beehive'	Wiewiórka 'squirrel'	-	-	Sowa 'owl'	Jelonek 'fawn'	-
V3	Żabka 'frog'$_{DIM.}$	-	Pszczoły 'bees'	Ul 'beehive'	Kret 'mole'	-	Nora 'burrow'	Sowa 'owl'	Sarenka 'doe'	Kłoda 'log'
V4	Żaba 'frog'	-	-	-	-	-	-	-	-	-
V5	Żabka 'frog'$_{DIM.}$	-	-	Ul 'beehive'	-	-	-	-	-	-
V6	Żabka 'frog'$_{DIM.}$	-	Pszczoły 'bees'	-	-	-	Nora 'burrow'	Sowa 'owl'	Sarenka 'Doe'	-

Table E.6 Production of the target nouns in the Frog Story narratives in monolingual group X

Target Nouns	**Żaba 'frog'**	**Słoik 'jar'**	**Pszczoły/osy 'bees'/'wasps'**	**Ul 'beehive'**	**Rodent type animal**	**Dziupla 'tree hollow'**	**Nora 'burrow'**	**Sowa 'owl'**	**Animal with antlers**	**Kłoda/pień 'log'/'tree trunk'**
X1	Żabka 'frog'$_{DIM.}$	-	-	Ul 'beehive'	-	-	-	-	Jeleń 'deer'	-
X2	Żabka 'frog'$_{DIM.}$	-	Pszczoły 'bees'	Ul 'beehive'	Krecik 'mole'$_{DIM.}$	-	-	-	łoś 'moose'	-
X3	Żabka 'frog'$_{DIM.}$	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	-	-	Nora 'burrow'	-	-	-
X4	Żaba 'frog'	Słoiczek 'jar'$_{DIM.}$	-	Ul 'beehive'	-	-	-	Sowa 'owl'	Jeleń 'deer'	-
X5	Żaba 'frog'	-	Pszczoły 'bees'	Ul 'beehive'	Zwierzątko 'animal'$_{DIM.}$	-	Nora 'burrow'	Sowa 'owl'	-	-
X6	Żaba 'frog'.	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	Wiewiórka 'squirrel'	-	Nora 'burrow'	Sowa 'owl'	Jeleń 'deer'	-

Table E.7 Production of the target nouns in the Frog Story narratives in monolingual group Y

Target Nouns	**Żaba 'frog'**	**Słoik 'jar'**	**Pszczoły/osy 'bees'/'wasps'**	**Ul 'beehive'**	**Rodent type animal**	**Dziupla 'tree hollow'**	**Nora 'burrow'**	**Sowa 'owl'**	**Animal with antlers**	**Kłoda/pień 'log'/'tree trunk'**
Y1	Żaba 'frog'	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	Wiewiórka 'squirrel'	-	-	Sowa 'owl'	Łoś 'moose'	Pień 'tree trunk'
Y2	Żaba 'frog'	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	Kret 'mole'	Gniazdo 'nest'	Nora 'burrow'	Sowa 'owl'	Jeleń 'deer'	-
Y3	Żaba 'frog'	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	Zwierzątko 'animal'$_{DIM.}$	Dziupla 'tree hollow'	Nora 'burrow'	Sowa 'owl'	Jeleń 'deer'	Kłoda 'log'
Y4	Żaba 'frog'	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	Świstak 'marmot'	Dziupla 'tree hollow'	Nora 'burrow'	Sowa 'owl'	Antylopa 'antelope'	Kłoda 'log'
Y5	Żaba 'frog'	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	-	-	Nora 'burrow'	-	Jeleń 'deer'	-
Y6	Żaba 'frog'	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	Zwierzątko 'animal'$_{DIM.}$	Dziupla 'tree hollow'	-	Sowa 'owl'	Jeleń 'deer'	Pień 'tree trunk'

Table E.8 Production of the target nouns in the Frog Story narratives in monolingual group Z

Target Nouns	**Żaba 'frog'**	**Słoik 'jar'**	**Pszczoły/osy 'bees'/'wasps'**	**Ul 'beehive'**	**Rodent type animal**	**Dziupla 'tree hollow'**	**Nora 'burrow'**	**Sowa 'owl'**	**Animal with antlers**	**Kłoda/pień 'log'/'tree trunk'**
Z1	Żaba 'frog'	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	Kret 'mole'	Dziupla 'tree hollow'	Nora 'burrow'	Sowa 'owl'	Sarna 'doe'	Kłoda 'log'
Z2	Żaba 'frog'	-	Pszczoły 'bees'	Ul 'beehive'	Wiewiórka 'squirrel'	Dziupla 'tree hollow'	Nora 'burrow'	Sowa 'owl'	Jeleń 'deer'	Kłoda 'log'
Z3	Żabka 'frog'$_{DIM.}$	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	Zwierzątko 'animal'$_{DIM.}$	-	Nora 'burrow'	Sowa 'owl'	Łoś 'moose'	-
Z4	Żaba 'frog'	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	Nornica 'vole'	Dziupla 'tree hollow'	Nora 'burrow'	Sowa 'owl'	Jeleń 'deer'	Kłoda 'log'
Z5	Żabka 'frog'$_{DIM.}$	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	Zwierzątko 'animal'$_{DIM.}$	Dziupla 'tree hollow'	Nora 'burrow'	Sowa 'owl'	Jeleń 'deer'	Kłoda 'log'
Z6	Żaba 'frog'	Słoik 'jar'	Pszczoły 'bees'	Ul 'beehive'	-	-	Nora 'burrow'	Sowa 'owl'	Jeleń 'deer'	Pień 'tree trunk'

APPENDIX F

The accuracy and RT scores from the Child HALA test

Table F.1 Accuracy scores in Polish and English according to word frequency in the heritage speakers

Word freq.	A Mean Age: 4;10				B Mean age: 5;10				C Mean age: 8				D Mean age: 11;5			
	PL		ENG		PL		ENG		PL		ENG		PL		ENG	
High	**78.1%**		**33.8%**		**81.7%**		**68.3%**		**87.5%**		**83.1%**		**92.7%**		**97.9%**	
	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD
	69% - 87%	8%	0% - 69%	20%	69% - 94%	7%	37% - 94%	15%	75% - 100%	9%	62% - 100%	13%	75% - 100%	9%	94% - 100%	3%
Low	**56.4%**		**1.8%**		**55.8%**		**15.6%**		**81.8%**		**41.8%**		**92.4%**		**80.3%**	
	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD
	27% - 73%	19%	0% - 9%	4%	27% - 73%	11%	0% - 63%	18%	45% - 100%	19%	0% - 73%	25%	73% - 100%	11%	64% - 91%	12%

Table F.2 Overall accuracy scores in Polish and English in the heritage speakers

Group – Mean Age	**Polish**		**English**	
A – 4;10	**69.3%**		**25%**	
	Range: 52% - 89%	SD 10.9%	Range: 15% - 41%	SD 9.2%
B – 5;10	**70.6%**		**46.8%**	
	Range: 56% - 85%	SD 7.5%	Range: 22% - 74%	SD 14.2%
C – 8	**85.2%**		**72.7%**	
	Range: 70% - 96%	SD 9.3%	Range: 56% - 85%	SD 9.1%
D – 11;5	**92.6%**		**90.7%**	
	Range: 85% - 100%	SD 6.6%	Range: 81% - 96%	SD 5.6%

Table F.3 RT scores in Polish and English according to word frequency in the heritage speakers (milliseconds)

Word freq.	A Mean Age: 4;10				B Mean age: 5;10				C Mean age: 8				D Mean age: 11;5			
	PL		ENG		PL		ENG		PL		ENG		PL		ENG	
High	**1.200**		**1.390**		**1.038**		**1.162**		**0.950**		**1.076**		**0.805**		**0.735**	
	range	SD	range	SD	range	SD	Range	SD	range	SD	range	SD	range	SD	range	SD
	0.800 - 1.846	0.329	1.037 - 1.779	0.232	0.777 - 1.782	0.246	0.940 - 1.564	0.199	0.751 - 1.095	0.097	0.801 - 1.380	0.170	0.693 - 1.000	0.114	0.570 - 0.995	0.164
Low	**1.311**		**1.383**		**1.223**		**1.258**		**1.282**		**1.293**		**1.020**		**0.885**	
	range	SD	range	SD	range	SD	Rang e	SD	range	SD	range	SD	range	SD	range	SD
	0.672 - 1.920	0.465	1.240 - 1.526	0.202	0.788 - 1.987	0.332	0.761 - 1.720	0.347	0.942 - 1.924	0.296	0.790 - 1.728	0.325	0.722 - 1.270	0.216	0.706 - 1.139	0.186

Table F.4 Overall RT scores in Polish and English in the heritage speakers (milliseconds)

Group – Mean Age	**Polish**		**English**	
A – 4;10	**1.222**		**1.395**	
	Range: 0.752 – 1.856	SD 0.356	Range: 1.037 – 1.779	SD 0.230
B – 5;10	**1.104**		**1.189**	
	Range: 0.811 – 1.845	SD 0.260	Range: 0.940 – 1.512	SD 0.172
C – 8	**1.074**		**1.124**	
	Range: 0.928 – 1.337	SD 0.127	Range: 0.919 – 1.288	SD 0.151
D – 11;5	**0.906**		**0.790**	
	Range: 0.728 – 1.044	SD 0.144	Range: 0.627 – 1.041	SD 0.163

Table F.5 Accuracy scores in Polish according to word frequency in the heritage and monolingual speakers

Word freq.	A V Mean Age: 4;10				B X Mean age: 5;10				C Y Mean age: 8;0				D Z Mean age:11;5 / 12;0			
	HS		ML		HS		ML		HS		ML		HS		ML	
High	**78.1%**		**77.1%**		**81.7%**		**91.7%**		**87.5%**		**92.7%**		**92.7%**		**97.9%**	
	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD
	69% - 87%	8%	68% - 87%	9%	69% - 94%	7%	87% – 100%	5%	75% - 100%	9%	81% – 100%	8%	75% - 100%	9%	87% – 100%	5%
Low	**56.4%**		**74.2%**		**55.8%**		**92.4%**		**81.8%**		**89.4%**		**92.4%**		**92.4%**	
	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD
	27% - 73%	19%	64% – 82%	9%	27% - 73%	11%	82% – 100%	7%	45% - 100%	19%	82% – 100%	7%	73% - 100%	11%	91% - 100%	4%

Table F.6 Overall accuracy scores in Polish in the heritage and monolingual speakers

Group [Mean Age]	**Heritage Speakers**		**Monolingual Speakers**	
A / V [4;10]	**69.3%**		**75.9%**	
	Range: 52% - 89%	SD 10.9%	Range: 67% - 85%	SD 8.4%
B / X [5;10]	**70.6%**		**92%**	
	Range: 56% - 85%	SD 7.5%	Range: 89% - 96%	SD 2.8%
C / Y [8]	**85.2%**		**91.4%**	
	Range: 70% - 96%	SD 9.3%	Range: 81% - 100%	SD 7.3%
D / Z [11;5 / 12]	**92.6%**		**95.7%**	
	Range: 85% - 100%	SD 6.6%	Range: 89% - 100%	SD 3.6%

Table F.7 RT scores in Polish according to word frequency in the heritage and monolingual speakers (milliseconds)

Word freq.	A V Mean Age: 4;10				B X Mean age: 5;10				C Y Mean age: 8				D Z Mean age: 11;5 / 12			
	HS		ML		HS		ML		HS		ML		HS		ML	
High	**1.200**		**0.952**		**1.038**		**0.905**		**0.950**		**0.834**		**0.805**		**0.687**	
	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD
	0.800 - 1.846	0.329	0.822 – 1.037	0.073	0.777 - 1.782	0.246	0.617 - 1.065	0.153	0.751 - 1.095	0.097	0.648 – 1.180	0.213	0.693 - 1.000	0.114	0.590 – 0.773	0.071
Low	**1.311**		**1.131**		**1.223**		**1.068**		**1.282**		**0.934**		**1.020**		**0.781**	
	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD	range	SD
	0.672 - 1.920	0.465	0.970 – 1.523	0.215	0.788 - 1.987	0.332	0.693 – 1.432	0.271	0.942 - 1.924	0.296	0.711 – 1.114	0.139	0.722 - 1.270	0.216	0.618 – 0.943	0.120

Table F.8 Overall RT scores in Polish in the heritage and monolingual speakers (milliseconds)

Group [Mean Age]	**Heritage Speakers**		**Monolingual Speakers**	
A / V [4;10]	**1.222**		**1.029**	
	Range: 0.752 – 1.856	SD 0.356	Range: 0.914 – 1.254	SD 0.119
B / X [5;10]	**1.104**		**0.978**	
	Range: 0.811 – 1.845	SD 0.260	Range: 0.646 – 1.239	SD 0.202
C / Y [8]	**1.074**		**0.868**	
	Range: 0.928 – 1.337	SD 0.127	Range: 0.702 – 1.135	SD 0.175
D / Z [11;5 / 12]	**0.906**		**0.724**	
	Range: 0.728 – 1.044	SD 0.144	Range: 0.602 – 0.811	SD 0.072