Laura Kanto

TWO LANGUAGES, TWO MODALITIES. A SPECIAL TYPE OF EARLY BILINGUAL LANGUAGE ACQUISITION IN HEARING CHILDREN OF DEAF PARENTS
LAURA KANTO

TWO LANGUAGES, TWO MODALITIES. A SPECIAL TYPE OF EARLY BILINGUAL LANGUAGE ACQUISITION IN HEARING CHILDREN OF DEAF PARENTS

Academic dissertation to be presented with the assent of the Doctoral Training Committee of Human Sciences of the University of Oulu for public defence in Keckmaninsali (HU106), Linnanmaa, on 27 May 2016, at 12 noon

UNIVERSITY OF OULU, OULU 2016
Abstract

In this study, early bilingual language acquisition was explored from the age of 12 to 36 months in 10 hearing children of Deaf parents, KODAs (Kids of Deaf Adults). KODA children’s language acquisition is bimodal; they acquire simultaneously sign language in visual-gestural and spoken language in auditory-vocal modality. This study aimed to describe the developmental paths of early bilingual language acquisition and their interrelationships with language input. Additionally, the characteristics of children’s language use and their associations with the features of the linguistic environment, child’s language competence and contextual variables were examined.

Information about the children’s linguistic environment was collected with parental interviews. Children’s linguistic development (productive vocabulary) was measured with the MacArthur Communicative Development Inventory (MCDI) in both Finnish Sign Language (FinSL) and the Finnish language between the ages of 12 to 30 months. Children’s development in the Finnish language was tested at the age of 36 months by using the Reynell Developmental Language Scales III. Additionally, the children’s interaction was video recorded twice a year between the ages of 12 to 36 months during three different play sessions: with their Deaf parent, with the Deaf parent and a hearing adult and with the hearing adult alone.

A large variation was uncovered in both the amount and type of language input and the children’s bilingual developmental paths. According to the results of the MCDI, KODA children’s (N = 8) mean size of productive vocabulary in both languages separately was smaller when compared to the monolingual norms. However, in all but three children, their total vocabulary, which includes both productive vocabulary of FinSL and Finnish, was comparable with age peers. According to the Reynell test in Finnish, three children scored at age level, three within –1 SD and two children within –2 SD.

Contextual variables clearly influenced the KODA children’s language use. KODA children, as young as 12 months old, accommodated their use of language and communication modes according to the language(s) of their interlocutor(s). Children preferred to code-mix when communicating with their Deaf parent by producing simultaneous, mainly semantically congruent signs and words.

Keywords: bimodal bilingualism, CODA, code-mixing, KODA, language differentiation, simultaneous bilingualism
Kanto, Laura, Kaksi kieltä, kaksi modaliteettia. Kuurojen vanhempien kuulevien lasten erityyslaatua ja laajaa kaksikielisyys.

Oulun yliopiston tutkimuskeskus, Oulun yliopiston Humanistinen tiedekunta, Logopediayksikkö


Asiasanat: kaksikielisyys, kielen erityyslaatu, kielten yhdistyminen, kodinvaihto, simultaattinen kaksikielisyys
To my Deaf parents
Acknowledgements

The saying “It is not the destination that is important, but the journey there.” holds important words of wisdom that were actualized during this research work many times.

Before the research can be started, there is an important question that the researcher needs to have answered. My question literally hit me when I was a freshman in Oulu University sitting in a lecture room that dealt with bilingualism. Inside that room I started to wonder, how on earth I had acquired my bilingualism that was really unique and that had clearly garnered little attention, and was not always even considered to be a type of bilingualism at all. Looking back at all of the experiences, from that lecture room where my journey began to this moment, I feel an enormous gratitude.

I have been more than fortunate to have the best co-drivers and navigators during my journey, my supervisors, Professor Kerttu Huttunen and Professor Marja-Leena Laakso, to whom I want to express my deepest gratitude. With their endless support, they guided my way, helping me to choose the right paths and showing the right way, when I felt lost. They have had the most significant influence on my journey towards finishing this dissertation and pushed me to continuously improve the work. My collaboration with Kerttu Huttunen began during my freshman year, when I determinedly wanted to start collecting data on KODA children’s language acquisition for my Master’s Thesis. This work has now functioned as a pilot study for this dissertation. I am really grateful for her supporting me at the start of my journey, back then, as a freshman, walking beside me during the whole journey, especially when times were difficult and felt like an uphill battle. I thank her for her wisdom, endless patience and advice. Professor Marja-Leena Laakso joined this journey soon after I started work on this dissertation. Her amazing ability to build up whole concepts when I had been struggling with small details, made this dissertation more coherent in a way that I could not have done by myself. I am grateful for her amazing kindness and highly important comments. It has been more than a joy to collaborate with her.

In addition, I wish to thank the official reviewers, Professor Emerita Pirjo Korpilahti and Professor Deborah Chen Pichler. With their highly constructive comments I was able to finalize the work and deepen the theoretical viewpoints.

During my journey there have been many people who supported this work. Their guidance and help has had an important influence on me and this work. I acknowledge my gratitude to the department of Logopedics in supporting my work.
throughout the journey. I also wish to thank Docent Tommi Jantunen for his constructive comments relating to the structure of Finnish Sign Language and the whole Department of Language in Jyväskylä University. My studies in Finnish Sign Language there supported this dissertation in many ways. I am also deeply grateful to Dr. Lea Nieminen for her crucial help when I was finalizing my third article.

I have had the privilege of participating in many different national and international conferences, seminars and a research visit where I have been able to represent my work, but most importantly, I have been able to get a feel for the atmosphere of the whole scientific field of researchers from different countries. As this research topic is rather unique, the discussions with many other researchers who share similar interests have had a crucial impact on my journey and this dissertation. Professor Beppie Van den Bogaerde, Professor Diane Lillo-Martin and Professor Karen Emmorey are warmly thanked for their comments and thoughts on KODA children’s code-mixing. Additionally, I am grateful for having been able to co-author a conference abstract with Ms. Kirstin Hofmann. It was so rewarding to find a person with common interests and our conversations during both of the times we spent in Amsterdam were memorable.

I want to also warmly thank the Deaf clubs throughout Finland. They warmly welcomed me to their meetings when I spoke at the Deaf society of my ongoing study and recurring participatory families. Ten amazing families participated in this study. They let me inside their homes, and shared their daily lives and many memorable moments with me. I am deeply indebted to these families. All of the families who took part in this study stayed through to the end of the two-year data collection period. All of the parents carefully reported the language development of their child and did their best to ensure that the child was enthusiastic throughout the whole video recording sessions.

This journey would have not been possible without my family. Their support provided me with the circumstances where I was able to make this journey. My Deaf parents provided me the valuable bilingualism and the viewpoint of two cultures. I thank them for many conversations where I insisted they recall details of my bilingual language acquisition. I owe my deep gratitude to the support and patience of my husband Antti Kanto. He has been my comfort and mainstay during the whole journey. He was also my private car-driver during my data collection tours and drove almost 1,000 kilometres in two days just to enable the data collection for this study. He took my share of the work on our farm, while I needed to work on my dissertation or was on a conference trip. Our cows played an important and special role in this dissertation. Their peaceful appearance enabled
me to solve many issues and problems that I faced during my journey. The best ideas were gained while I was working with my cows, either milking or taking care of them. Finally, I have achieved the end, where I finish this dissertation, but I hope that this is not the end, and that I will be able to continue my journey forward.

This research was supported by the Ministry of Education and Culture, the Southern Ostrobothnia Hospital District (grant number EVO198), Emil Aaltonen Foundation and Child Language Research Centre of the University of Oulu. This support is gratefully acknowledged.

15.3.2016 Laura Kanto
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASL</td>
<td>American Sign Language</td>
</tr>
<tr>
<td>CODA</td>
<td>Children of Deaf Adults</td>
</tr>
<tr>
<td>FinSL</td>
<td>Finnish Sign Language</td>
</tr>
<tr>
<td>KODA</td>
<td>Kids of Deaf Adults</td>
</tr>
<tr>
<td>MCDI</td>
<td>MacArthur Communicative Development Inventory</td>
</tr>
<tr>
<td>MLU</td>
<td>Mean Length of Utterance</td>
</tr>
<tr>
<td>MLU10</td>
<td>Mean Length of the Ten Longest Utterances</td>
</tr>
</tbody>
</table>
List of original publications

This thesis is based on the following publications, which are referred throughout the text by their Roman numerals:

## Contents

Abstract  
Tiivistelmä  
Acknowledgements  
Abbreviations  
List of original publications  
Contents  

1 Introduction  
2 Review of the literature  
  2.1 Bilingual developmental paths .......................................................... 23  
  2.2 Dominant language of bilingual children and assessment of their language competence .......................................................... 25  
  2.3 Linguistic environment and its association with bilingual language development .......................................................... 27  
  2.4 Language use and code-mixing in unimodal bilingual children and KODA children .................................................. 30  
    2.4.1 Pragmatic differentiation across utterances .................................. 31  
    2.4.2 Factors affecting language choice and code-mixing ..................... 34  
    2.4.3 Code-mixing within an utterance ................................................. 35  
3 Aims of the study .......................................................... 39  
4 Methods .......................................................... 43  
  4.1 Participants ...................................................................................... 43  
  4.2 Procedure .......................................................................................... 44  
    4.2.1 Parental interviews ..................................................................... 45  
    4.2.2 Parental questionnaires ............................................................. 49  
    4.2.3 Reynell Developmental Language Scales .................................. 50  
    4.2.4 Video recorded play sessions .................................................... 50  
  4.3 Coding .............................................................................................. 51  
    4.3.1 Coding of the communication mode .......................................... 52  
    4.3.2 Coding of gestures and different expression-type combinations .......................................................... 53  
    4.3.3 Coding of language ................................................................... 54  
    4.3.4 Coding of MLU ......................................................................... 55  
    4.3.5 Coding of code-mixing ............................................................. 56  
    4.3.6 Statistical analyses ..................................................................... 59
5 Results

5.1 KODA children’s language development and its association with their linguistic environment (Studies I, and III) ........................................... 61
  5.1.1 Linguistic environment of KODA children .................................. 61
  5.1.2 Development of Finnish Sign Language and spoken Finnish ......................................................... 63
  5.1.3 Summary ........................................................................... 70

5.2 Features in the use of communication modes and languages by KODA children and their relationships with language competence and contextual variables (Studies I, II and III) ............... 71
  5.2.1 Pragmatic differentiation .................................................... 71
  5.2.2 Code-mixing in KODA children .......................................... 75
  5.2.3 Summary ........................................................................... 86

6 Discussion

6.1 Developmental paths of KODA children’s bilingual language acquisition ............................................................................................... 89
  6.2 Differentiated use of languages and code-mixing ........................... 94
  6.3 Clinical implications .................................................................. 99
  6.4 Methodological challenges and limitations .................................... 102
  6.5 Conclusions and the need for further studies ............................... 105

References 107

Appendices 117

Original publications 121
1 Introduction

It has been estimated that half of the world’s population is bilingual and there are as many bilingual children as there are monolingual children (Paradis, Genesee & Crago, 2011). During the past few decades, intensive efforts have been made in research to increase our understanding of childhood bilingualism. One very important and specific group of bilinguals is hearing children of Deaf1 parents, also known as KODAs (Kids of Deaf Adults). KODA children simultaneously acquire, sign language and spoken language, which qualifies their bilingualism as bimodal. Recently, the research on KODA children has been increasing (e.g. Van den Bogaerde, 2000; Donati & Branchini, 2013; Hofmann & Chilla, 2015; Lillo-Martin, de Quadros, Chen Pichler & Fieldsteel, 2014; Petitto et al., 2001). These recent studies have provided relevant information on this specific group of children and have a great potential to increase our understanding of bilingual development, in a more general sense. However, more knowledge is still urgently needed especially in the developmental path of bimodal bilingualism in KODA children and the patterns of their language use.

Children are born with an innate potential to acquire the language(s) around them, regardless of which modalities or which language(s) they will be exposed to. When a child is exposed to two languages, rich input from both languages is important for the bilingual child’s linguistic development. Linguistic environment (that is the amount and quality of linguistic exposure, the characteristics of the surrounding language community, among others) and the languages the child is acquiring, as well as the child’s inner factors (e.g. temperament and heritance) have a significant effect on the features and paths of the development towards bilingualism (Hoff et al., 2012; Pearson, 2007). The particular challenge in studying childhood bilingualism is the considerable heterogeneity that exists among bilingual children. The languages an individual child is acquiring and the environment where the development takes place, along with many other features, make bilingual children highly heterogenic as a group. For this reason, it is difficult to find a large group of bilingual children that is homogenous enough to enable comparison for scientific research. The question of what is typical in bilingual development, is therefore, not yet completely solved (see e.g., De Houwer, Bornstein & Putnick, 2013 and Hoff et al., 2012).

1 Deaf written with an upper case letter refers to a person who identifies himself or herself culturally and linguistically with the Deaf community.
There are several clinical and theoretical viewpoints from which the issue of typical features in bilingual language acquisition can be addressed. Especially for professionals working with bilingual children, what is typical in bilingual development, is an important clinical matter. This knowledge is crucial for separating deviant features from typical ones in bilingual language acquisition and hence preventing professionals from under or over diagnosing bilingual children who express difficulties in language development.

Despite previous studies on childhood bilingualism, the bilingualism of KODAs is generally unknown and unrecognized. Therefore, broader knowledge and understanding is still missing on the bilingual language acquisition of KODA children. The unique features of their language development, and especially the acquisition of spoken language, compared to their monolingual hearing age peers, are often the reasons that raise concerns on the language development of KODA children. For this reason, the children, even within the typical bilingual development, are at risk of being diagnosed with a language disorder or delay (see e.g. Chen Pichler, Lee & Lillo-Martin, 2014). In previous studies, different views on the language acquisition of KODA children have been presented varying from delayed and disordered development to effortless acquisition of two languages (for different opinions see, e.g., Brackenbury, Ryan & Messenheimer, 2006; Chen Pichler et al. 2014; Hofmann & Chilla, 2015; Petitto et al., 2001; Prinz & Prinz, 1979; Schiff & Ventry, 1976).

The status of the acquired languages also affects children’s bilingual development. KODA children simultaneously acquire languages, one of which has the clear majority status in the surrounding community, while the other represents the language of a small minority group. On the basis of studies on unimodal bilingual children (Gathercole & Thomas, 2009; De Houwer, 1998; 2007; Pearson, 2007; Wong Fillmore, 2000), the different status in the surrounding community of acquired languages may affect the language development of KODA children as well. Hence, the question of in which cases the language development of KODA children should be regarded as typical for bimodal bilingual children and in which cases the detected differences reflect a true language delay or disorder, calls for more research.

In addition to the clinical perspective, the early language development of KODA children is also motivated on the basis of theoretical issues in conducting studies. Their simultaneous bilingual language acquisition across the two modalities, sign language in visual-gestural modality, and spoken language in auditory-vocal modality, provides a unique setting for studying the language
differentiation and language use among young bilingual children. Research on this topic focuses, for example, on the process of language production and code-mixing (where bilingual children mix different linguistic units).

In previous research, two opposing hypotheses, which are introduced later in Section 2.4, have been presented on language differentiation among bilingual children (Genesee, 1989; De Houwer, 1990; Meisel, 1994; Volterra & Taeschner, 1978). These hypotheses are based on the features of bilingual language acquisition and they attempt to explain how linguistic systems are represented in the mind of a bilingual child. From the perspective of language production, which is clinically an important issue, these hypotheses have focused on the characteristics in language choice and code-mixing by bilingual children. However, these previous studies have almost exclusively researched unimodal bilingual children, who are regarded in this study as children acquiring two spoken languages. Due to the restricted and unintelligible vocal production of children before the age of two years, the essential challenge in the previous bilingual studies has been the difficulty to detect the language a bilingual child is producing at each moment (Deuchar & Quay, 2000; Montanari, 2009; Petitto, et.al., 2001). The two different modalities of expression make it much easier to study the language differentiation even in young KODA children because, compared to other bilingual children, it is easier to detect the language the KODA child is producing at each moment (Petitto et al., 2001). When studying young KODA children’s ability to accommodate their language use according to the language of their interlocutor (called pragmatic differentiation), one can also study language differentiation at a younger age than has been possible with unimodal bilingual children. For this reason, more research on young bilingual children is clearly needed and the area is worth examining.

In addition to the question of language differentiation, there are other features in bimodal bilingual language acquisition, which make it a highly interesting target for research. In previous studies, bimodal bilingual children and adults have been observed to use high amounts of simultaneous production of signs and speech, a phenomenon known as code-blending (Emmorey, Borinstein, Thompson & Gollan 2008). This is a unique way of code-mixing that cannot be found among unimodal bilinguals and may, in fact, provide new viewpoints for studies on code-mixing among bilingual children. However, due to a lack of knowledge, this type of code-mixing has confused professionals working with KODA children and possibly produced unnecessary concerns about their language development, which justifies additional research.
The general purpose of this dissertation was to deepen the understanding of the features of childhood bilingualism and describe the early simultaneous acquisition of Finnish Sign Language (FinSL) and spoken Finnish in KODA children for which very little previous research exist. On the basis of the theoretical frameworks presented in previous studies on bilingualism, two main aims were set: 1) to describe different features and developmental paths of simultaneous sign language and spoken language acquisition and 2) to explore how KODA children use their two languages that are represented in two different modalities. Longitudinal data on KODA children was collected between the ages of 12 and 36 months by using both video recordings of natural communication and structured assessment methods. The work is based on three empirical studies that describe the language acquisition of KODA children and its associations with the features of the linguistic environment (Studies I and III). Differentiation and interaction of the languages acquired were explored by describing the characteristics of KODA children’s language use and code-mixing (Studies II and III).
2 Review of the literature

Bimodal bilingualism is not a very widely known phenomenon and different views have existed among researchers on the language development of KODA children. Some of the earliest studies of these children have focused on the development of spoken language only and the deviations that have been found in it (see e.g., Schiff & Ventry, 1976). The general lack of knowledge on the bilingual language development of KODA children, different attitudes towards sign languages, together with the early studies observing only the spoken language, have caused concerns and a cautious atmosphere around the language acquisition of these children. However, the language acquisition of KODA children should be seen from the bilingual point of view. Namely, many factors and features that have been observed in previous studies on language acquisition of unimodal bilingual children might take place in bilingual language acquisition of KODA children as well. These features and similarities are worth examining as they can help us to understand the individual paths and characteristics of typical bilingual development in general, and the language development of KODA children, in particular.

It has been underscored that the development of bilingual children is not the sum of two monolinguals (Grosjean, 2010). However, the majority of language development assessment tools have been developed and designed for monolinguals, but these same tools are used for testing language development of bilingual children as well. There are still special aspects in bilingual language development that a speech and language therapist should be aware of. Accordingly, when evaluating bilingual children’s language development, the importance of assessing the competence in both languages the bilingual children are acquiring has been stressed by Pearson, Fernández, Lewendag, and Oller (1995) and other researchers (Hoff et al. 2012; Mancilla-Martinez, Pan & Vagh, 2011). Typically, children’s competence in one language is better than that in the other language (see e.g., Hoff, et al., 2012). For this reason, researchers point out that one needs to take into account the relative proficiency (i.e., language dominance) in each language, as well as evaluate the linguistic environment of bilingual children.

2.1 Bilingual developmental paths

Language development is strongly guided by a child’s individual features that are related to language processing; for example, attentional, perceptual, memory and auditory processing skills (Bates, 2004; Bates, Dale & Thal, 1995). In children who
acquire two or more languages these mechanisms pave the paths of bilingual development, particularly during the child’s early years. It has been reported in studies on unimodal bilingual children that their vocabulary size and grammatical abilities might be similar or lower in one or both languages compared with the results of monolingual age peers (Core, Hoff, Rumiche & Señor, 2013; Hoff et al., 2012; De Houwer et al., 2013; Paradis & Genesee, 1996; Pearson et al., 1997). However, after counting the total size of the vocabularies and taking into account the grammatical abilities in both languages of the children, the bilingual children were no longer significantly different from the monolinguals (Core et al., 2013; Hoff et al., 2012).

The recent case studies on KODA children have focused on exploring the development of both sign language and spoken languages. These studies have found that children reach early linguistic milestones (e.g., produce first word/sign, two- and multi-word/sign utterances) in both sign language and spoken language, and produce different signs and words within the pace that falls within the norms of monolingual children (Petitto et al., 2001; Brackenbury et al., 2006). However, Van den Bogaerde (2000, p. 132) found that two out of the three KODA children she studied had a smaller cumulative vocabulary in sign language compared with three deaf children of Deaf parents. In grammatical development of KODA children, Van den Bogaerde (2000, p. 173–174) found that MLU (the Mean Length of Utterance) in spoken language showed a clear upward trend, but that the same trend was not found in sign language. On the other hand, Hofmann and Chilla (2014) noted that the six KODA children they studied (age range 3;10–6;3) clearly reached lower scores in multiple areas of spoken language, than did their monolingual age peers, as measured by standardized tests. However, in the bilingual screening tool, HAVAS 5, that is designed to examine language competence of bilingual children, KODA children reached the age appropriate development, to a certain degree. On the basis of this finding Hofmann and Chilla suggested that the children they studied were acquiring spoken language at the same pace as age-matched bilingual children. These previous studies clearly show the variability in language development of these children. The results are also influenced by the methods used in the different studies.

The developing vocabulary of bilingual children is formed by words from two acquired languages and children need to acquire the words that have the same referential meaning in both languages. These words are called translation equivalents. According to several studies, monolingual children hardly ever acquire synonyms but instead, acquire new words that refer to new referents in the early
phases of their language development (see, e.g., Principle of Contrast proposed by Clark, 1988; Markman, Wasow & Hansen, 2003). Based on these findings on monolinguals, it was argued in the earliest studies that bilingual children do not acquire translation equivalents in their early vocabulary (see, e.g., Volterra & Taeschner, 1978). However, in later studies, the emergence and amount of translation equivalents in the vocabularies of bilingual children has been a central argument in the matter of language differentiation and especially children’s ability to use the appropriate language of his or her interlocutor’s language. Recent studies have frequently shown that bilingual children indeed acquire translation equivalents, but that the amount of these words may vary between individual children (Holowka, Brosseau-Lapré & Petitto, 2002; Nicoladis & Genesee, 1996; Pearson, et al., 1995; Quay, 1995). Pearson and others (1995) found in their study of 27 English-Spanish bilinguals that between the ages of 0;8 to 2;6 approximately 30% of the children’s vocabularies consisted of translation equivalents. In regard to code-mixing, it has been found that children tend to produce mixed utterances by code-switching to the other language when the translation equivalent is missing from the target language (Genesee, Nicoladis & Paradis, 1995; Nicoladis & Secco, 2000).

2.2 Dominant language of bilingual children and assessment of their language competence

When assessing both languages that the bilingual child is acquiring, an important question that arises is the relative proficiency i.e. dominance between these languages. Equal competence (i.e., balanced bilingualism) between the two acquired languages is rather unusual (e.g., Baker, 2006; Grosjean, 2010; De Houwer, 1995; Yip & Matthews, 2007). Typically, one of the languages a bilingual child is acquiring is the dominant language (i.e. has more vocabulary, greater grammatical proficiency or fluency than the other language) and the other language is the non-dominant language (Paradis, Genesee & Crago, 2011, p. 80). In previous studies on KODA children, the question of language dominance has mainly been disregarded. On the contrary, in unimodal bilingual children, language dominance has been studied and linked to the amount of exposure, features in language production, code-mixing, and cross-linguistic influence between the languages (Genesee, et al., 1995; Hoff, et al., 2012; Nicoladis & Secco, 2000; Place & Hoff, 2011). In these studies, it has been observed, for example, that the dominant language may affect the structures of the non-dominant one; children tend to use
more code-mixing when using their non-dominant language and produce more different word types and longer utterances when using the dominant language. Additionally, language dominance has been found to affect children’s pragmatic differentiation, that is, the abilities to use the appropriate language according to their interlocutor. This phenomenon refers to the influence the languages have on each other, especially when children produce code-mixed utterances (Yip & Mathews, 2000). Based on these findings, information about the language dominance of a bilingual child can reveal important knowledge on his or her general language competence and explain different features in language development. This is also clinically important information.

The specific nature of the language development of bimodal bilingual children also has highly important and relevant clinical implications. When a speech and language therapist meets a bilingual child, the assessment of language development brings forth many challenges, for example, the lack of assessment tools designed to evaluate bilingual language development in both languages, the difficulty to compare a child’s achievements to the monolingual norms and the lack of knowledge on the language and culture acquired by the child.

Although it is well demonstrated that it is not recommended to compare the linguistic development of bilingual children with the development of monolinguals or that if this is done, great caution should be used, it does not match clinical conventions. Professional tests and other evaluation tools for language acquisition and development are mainly designed for, and normed with monolinguals. Due to the lack of evaluation tools the practitioner is often only able to conduct **single-language assessment**, which refers to the evaluation where only one language of a bilingual child is tested and the results are compared with monolingual norms for that particular language. Although this way of testing is not recommended, practitioners often have no other way of evaluating the language development of the bilingual child. This is problematic since previous studies have shown that bilingual children are highly variable in their bilingual language development and that their language scores are also lower than those of monolingual norms, when only one of their languages is assessed (Bedore, Peña, García & Cortez, 2005; Bialystok & Feng, 2011; Core, Hoff, Ruminche, & Señor 2013; Hoff et al., 2012; Junker & Stockman, 2002; Pearson, Fernández & Oller, 1993; Thordardottir, Rothenberg, Rivard & Naves, 2006). It has been observed that when testing bilingual children in their dominant language, as is sometimes recommended, they may score within the normal variation of monolingual norms, but that they may also score significantly below the norms, when only one of the languages is
assessed (see, e.g., Core et al., 2013; Hoff et al., 2012; De Houwer, 2013). This 
assessment practice underestimates children’s language competence as it does not 
take into account their competence in the other language, and may easily lead to 
over-identification of developmental language difficulties (Bedore et al., 2005).

2.3 Linguistic environment and its association with bilingual language 
development

Since the language input of bilingual children is divided between the two languages 
acquired, it has been argued that the relative amount of input affects the rate of their 
language development (Cote & Bornstein, 2014). That is why it has been stated 
that bilingual children may need more time than monolinguals to gain from the 
language input in learning sufficient vocabulary and specific structures in both 
languages. Recent studies have highlighted the role of linguistic environment in 
language dominance and in the rate of unimodal bilingual language acquisition. It 
has been stated that the relative amount of exposure to each language strongly 
influences the language dominance and language development of bilingual children 
(Hoff et al., 2012; Pearson, 2007), but not much is yet known about the linguistic 
environment of KODA children. More specifically, information is needed on the 
association between the language input and KODA children’s language 
development (Van den Bogaerde & Baker, 2008; Mather, Rodriguez, Andrews & 
Rodriguez, 2006; Wilhelm, 2008). The issues related to both the Deaf community 
and the surrounding hearing community may have a strong impact on the linguistic 
environment of KODA children in many ways, which, again, may produce great 
variability in their bilingual language experiences and, eventually, in their language 
development (Jones & Dumas, 1996; Mather & Andrews, 2008; Mather et al., 2006; 
Wilhelm, 2008). Knowledge of the features of linguistic environment provides 
important understanding of the developmental paths of bilingual language 
acquisition of KODA children.

In research on unimodal bilingualism, many quantitative and qualitative 
properties of language input in both languages have proven to affect bilingual 
language development. Parents’ education, their economic resources, language 
learning beliefs, communication strategies and child-rearing practices have also 
been shown to be important factors in monolingual children’s language learning, in 
general. Furthermore, the number of children in the family and child’s birth order 
have been found to have an effect on the language development of all children (e.g., 
Gathercole & Thomas, 2009; Hammer, Miccio & Rodriguez, 2004; Lanza, 1997;
Pearson, 2007; Place & Hoff, 2011; Unsworth, 2013). The feature in the linguistic environment that is more specific to bilingual than to monolingual children is the status of the languages acquired in the surrounding community. In studies on unimodal bilingualism, the minority status of the language and the possible experiences of disrespect towards it shown by the surrounding community have been identified as factors affecting children’s rate of acquisition of a minority language (Gathercole & Thomas, 2009; De Houwer, 2007; Pearson, et al., 1997). It has been found that families need to put a lot of effort into adopting specific strategies and providing necessary exposure and adequate opportunities for using the minority language with their children, in order to secure the sufficient development of the minority language (see also Grosjean, 2010, pp. 172–174), whereas the acquisition of the majority language of surrounding community takes place more effortlessly (Unsworth, 2013). The language learning experiences among bilingual children are, therefore, known to vary to a significant extent.

As the Deaf community is a small minority group, KODA children are mostly exposed to sign language in their home. Thus, sign language is the family language in Deaf-parented families, although different choices in language use by family members have been reported (Van den Bogaerde, 2000; Pizer, 2008; Wilhelm, 2008). At the same time, children acquire the majority language spoken by the larger community. Since sign language always has the minority status, KODA children can be regarded as heritage signers and that they are acquiring sign language within their family as a heritage language (Compton, 2014; Montrul, 2008; Palmer, 2015; Reynolds, 2015; Rothman, 2009). Consistent with previous studies on heritage speakers (see e.g. Pires & Rothman, 2009; Rothman, 2007), language exposure of KODA children is affected, at least to some degree, by language contacts with sign language and spoken language as code-mixing by Deaf parents and other sign language users, is a well-known phenomenon (Van den Bogaerde, 2000; Lillo-Martin et al. 2014; Petitto et al., 2001; Pizer, 2008; Wilhelm, 2008). Deaf parents often master the spoken majority language, at least in its written form, and identify themselves as bilingual persons. Thus, in the field of childhood bilingualism, KODA children, as heritage signers, can be regarded as a special case of childhood bilingualism. All of these factors might contribute to KODA children’s language exposure and their possibilities to actively use the languages, and hence development towards bilingualism (Koskiniemi, 1993; Preston, 1994 p. 128; Singleton & Tittle, 2000; Wilhelm, 2008).

In her study, Van den Bogaerde (2000) compared language development in sign language and spoken language with each other and found that the developmental
paths in languages seemed to be associated with the features of KODA children’s linguistic environment. She (Van den Bogaerde, 2000, pp. 132, 173–174) studied three KODA children and observed that in sign language, the minority language, hardly any development was seen (measured with cumulative vocabulary and MLU) while the development in the spoken language, the majority language, showed a clear upward trend. On the contrary, the sign language development of the three deaf children she studied illustrated a clear developmental path. According to Van den Bogaerde, this finding was related to the linguistic environment of KODA children. She reasoned that Deaf parents’ frequent use of language mixing and minor use of multi-sign utterances was connected to the slow development in the size of their hearing children’s expressive vocabulary and syntactic complexity in sign language. Concordant with these findings by Van den Bogaerde, studies on unimodal bilingual children have proposed that the amount of exposure to the majority and to the minority language needs to be different from each other for the child to learn the languages at an age-equivalent pace (Gathercole & Thomas, 2009; De Houwer, 2007). Indeed, it has been observed that the minority language may need more exposure than the majority language, to have its sufficient development secured (Gathercole & Thomas, 2009; De Houwer, 2007; Unsworth, 2013). Furthermore, a combination of language mixing in input and a strong imbalance between the exposure to the two languages may also endanger the favourable development of the minority languages (Pearson et al. 1997; Unsworth, 2013).

Brackenbury and his colleagues (2006) described the development of expressive vocabulary in both American Sign Language and spoken English in one KODA child who they followed for four months from the age of 16 months. This child’s vocabulary progressed at the normal pace in both of her languages, and was comparable with the development of both monolingual signers and speakers. This happened despite that this child received only 20% of her language input in her daily environment in spoken English, the majority language of the surrounding community.

An important phenomenon that is often not brought forth, is that despite bilingual linguistic environment and exposure, some of the children develop as active bilinguals who have the necessary linguistic skills to interact similarly in both of their languages. Some children raised in a bilingual environment are able to understand both languages, but produce only one (i.e., they are passive bilinguals) (Gathercole & Thomas, 2009; De Houwer, 1998; 2007; Pearson, 2007; Wong Fillmore, 2000). Incomplete acquisition in many linguistic areas of a heritage
language has been described in many previous studies (see a review by Montrul, 2010).

Children socialize into their language or languages not only by acquiring linguistic structures, but also by adopting the cultural inheritance related to the language(s). For KODA children, sign language offers the identity, cultural knowledge (values, customs and information) and the social bonding between the members of the Deaf community (Mindess, 2006, p. 77; Padden & Humphries, 2005). It has the key role of securing the relationship and mutual language between the members of Deaf-parented families and also provides the link between the KODA children and the Deaf community (Preston, 1994 p. 128; Singleton & Tittle, 2000; Wilhelm, 2008). The situation where the family members do not share a sufficient level of mutual language will have damaging consequences on the communication and relationship between the family members, socio-emotional development of the children and on family dynamics (Portes & Hao, 1998; Tseng & Fuligni, 2000, Wilhelm, 2000; Wong Fillmore, 2000). Thus, the importance of KODA children acquiring sufficient competence in sign language cannot be over emphasized.

2.4 Language use and code-mixing in unimodal bilingual children and KODA children

There has been strong interest in exploring the processes and reasons behind the bilingual children’s production, selection and mixing of their two languages. Often questions that have emerged in previous studies have been: how and when children are able to accommodate their language use according to the language of their interlocutor, why do children choose one language over the other and why is the mixing between the languages such a prevalent phenomenon among bilingual children. All these questions also relate to the debate on language differentiation. Discussion on the language differentiation of bilingual children was started after the researchers had revealed interesting features in their language use and code-mixing. Language differentiation has been the focus of research on bilingualism for a long time and it offers information about the representations of the developing languages in children’s minds. Opposing views on the language differentiation of bilingual children have been presented. The Unitary Language System Hypothesis was formulated by Volterra and Taeschner (1978). According to this hypothesis, a lack of translation equivalents and the frequent mixing of phonological, lexical and morphosyntactic elements in the same utterance or stretch of conversation speaks
for the idea that children are unable to differentiate their languages. Thus, this hypothesis proposes that children first have a unitary vocabulary and grammar until the two linguistic systems are finally differentiated, at around the age of three years. At that age, the amount of translation equivalents increases and language mixing decreases. The opposing Dual Language System Hypothesis posits that children who acquire two languages from birth, establish two separate linguistic systems from the very beginning (De Houwer, 1990; Genesee, 1989; Meisel, 1994). The researchers supporting this hypothesis have found that translation equivalents, indeed, emerge in the early vocabulary of bilingual children. Additionally, researchers argue that code-mixing does not indicate confusion of linguistic representation, but rather that it is rule governed and synchronized in nature. This Dual Language System hypothesis has been supported by research showing bilingual children’s language differentiation in phonology, lexicon, syntax and pragmatics (see, e.g., Comeau, Genesee & Lapaquette, 2003; Deuchar & Quay, 2000; Meisel, 2001; Montanari, 2009; Paradis & Genesee, 1996; Pearson et al., 1995). However, it has been difficult, in previous studies, to provide evidence of language differentiation before the age of two, due to the unintelligible vocal production of young children. For this reason, the newer studies have aimed to provide evidence that children are not using their two languages in an unsystematic way. However, the evidence on language differentiation during the early phases of language development is still limited. In bilingual children, the interaction between the acquired languages is both likely and usual (De Houwer, 1990; Döpke, 2000; Emmorey et al., 2008; Paradis & Genesee, 1996). Despite previous findings on the rule governed and synchronized structure of code-mixing, more research is needed on children who acquire different language pairs in order to deepen our understanding of childhood bilingualism and the typical features of code-mixing (MacSwan, 2000; Meisel, 1994; Paradis, Nicoladis & Genesee, 2000). This knowledge is also useful for speech and language therapists to be able to detect the deviant features from the typical ones, in bilingual children. As KODA children are producing their languages in two different modalities, we are able to address the questions on pragmatic differentiation and code-mixing from a unique viewpoint.

2.4.1 Pragmatic differentiation across utterances

Bilingual children’s ability to accommodate their languages according to the language of the interlocutor and differentiate their languages pragmatically has
been regarded as a sign of separate linguistic systems and support for the Dual Language Hypothesis (Comeau, Genesee, & Lapaquette, 2003; Montanari 2009). Studies on pragmatic differentiation in bilingual children can reveal how sophisticated abilities young children have for monitoring their language choices according to their interlocutors, and explore their potential for language development, in general. For clinicians, the knowledge of pragmatic differentiation of bilingual children provides explanations on bilingual-specific features in language production, information on, e.g., how early one should expect bilingual children to show appropriate language use according to the interlocutors, and how different factors influence the language choices of these children.

It has been revealed that children are able to use their languages differentially and appropriately, according to the language of their interlocutor, around the age of two years (Comeau et al., 2003; Deuchar & Quay, 2000; Genesee, Boivin, & Nicoladis, 1996; Genesee et al., 1995; Nicoladis & Genesee, 1996). At that age, children growing up bilingual tend to have enough vocabulary and grammatical competence in both of their languages to be able to demonstrate appropriate language choices, according to the language of the interlocutor (see, e.g., Montanari, 2009; Nicoladis & Secco, 2000). Language dominance and lexical gaps, however, have been reported to be the reasons for children not choosing the language of their interlocutor.

Thus, the challenge in these studies has been to detect the language used by unimodal bilingual children under two years of age, and thereby, the difficulty of really showing pragmatic differentiation (Deuchar & Quay, 2000; Montanari, 2009; Nicoladis & Secco, 2000; Petitto et al., 2001). For these reasons there are only a few case studies on young unimodal bilingual children where researchers have been able to find any evidence of distinct features in babbling, according to different language contexts (Andruski, Casielles & Nathan, 2014; Maneva & Genesee, 2002).

When one takes into account the challenges that studies on language differentiation have faced with unimodal bilinguals, the bimodal bilingualism of KODA children offers fruitful material for examining this topic. Due to bimodality, it is easier, compared to unimodal bilinguals, to identify the communication mode(s) (manual, mixed or vocal) a KODA child is using and the language(s) he/she is producing in each utterance. This provides, from an early age, the possibility to explore the pragmatic differentiation of the languages the children are using. KODA children’s ability to differentiate their languages has previously been studied, for example, by Petitto et al. (2001) and Lillo-Martin et al. (2014). Their results are consistent with the studies on pragmatic differentiation in unimodal
bilingual children suggesting that children are able to use their languages differentially and appropriately according to the language of their interlocutor (Comeau et al., 2003; Deuchar & Quay, 2000; Genesee et al., 1995, 1996; Nicoladis & Genesee, 1996). In comparison with publications on unimodal bilingual children, Petitto et al. (2001) reported in their study that a KODA child they studied showed appropriate language use according to his interlocutor by the age of 11 months, which is clearly earlier than researchers have been able to show in studies on bilingual children acquiring two spoken languages. Petitto and others (2001) were only following the language production of the children studied. However, around the age of 12 months, the first signs and words are just about to emerge, that is, children are moving from the pre-lexical towards the lexical phase. Thus, a more fruitful approach is to also observe the use of gestures, which is an essential part of communication at this developmental phase. Gestures are essential in all children, but among KODA children, gestures raise issues that may provide a new viewpoint for exploring pragmatic differentiation in the pre-lexical phase.

Children begin to use gestures before they produce their first lexical items around the age of nine months and onwards. Gestures are considered to be an important predictor of children’s early intentional communication and language development (see, e.g., Capirci, Iverson, Montanari & Volterra, 2002; Goldin-Meadow, 2003; Volterra, Iverson & Castrataro, 2005). Children express their thoughts and desires by three different types of gestures; deictic (requesting, showing, giving objects, pointing to objects and people), iconic (e.g., flapping arms to represent a bird flying), and conventional gestures (e.g., nodding and waving bye-bye) (Guidetti & Nicoladis, 2008; Goldin-Meadow, 2003). These gestures may represent a larger proportion of children’s communicative acts than the words do, before the age of 20 months. After that age, children typically shift to using a more vocal modality (Capirci et al., 2002; Volterra et al. 2005). The use of gestures also precedes children’s syntactic development before the two-word/two-sign stage regardless of the modality of the language they are acquiring. This is shown in the number of gesture-word/gesture-sign combinations before children produce two-word/two-sign combinations (Capirci et al., 2002; Iverson & Goldin-Meadow, 2005; Morgenstern, Caët, & Collombel-Leroy, 2010). However, no consensus currently exists on how culture, input and bilingualism may affect children’s use of gestures (Capirci, Contaldo, Caselli & Volterra 2005; Iverson, Capirci, Volterra & Goldin-Meadow, 2008; Pettenati, Sekine, Congestri & Volterra, 2012).

Although gestures play a significant role in conveying messages for all children during the pre-linguistic period, for KODA children, their role and significance is
regarded to be even more important and, evidently, language specific. Although co-speech gestures are prevalent in spoken languages, they are not built within the language structure. In sign languages, the situation is different; gestures are fully integrated into their linguistic structures and gesturality is often part of the many signs (Puuponen, Waisio, Burger & Jantunen, 2015). It has been proposed that the production of pronouns, agreement verbs, and so-called classifier constructions coclude both linguistic and gestural components. For example, the *handshape* of an agreement verb (where, e.g., verb’s agreement is indicated by the sign’s orientation and initial and final position in signing space) and a pronoun (e.g., a personal pronoun) is linguistically specified, but a sign’s *direction* toward persons or objects and its *location* in signing space are regarded as representational gestural components (Emmorey & Herzig, 2003; Liddell, 2003).

There is some research evidence suggesting that because of sign language exposure and acquisition, KODA children use gestures differently and in more diverse ways, compared to children who learn spoken languages (Capirci *et al.* 2002; Morgenstern *et al.*, 2010). Both Capirci *et al.* (2002) and Morgenstern *et al.* (2010) used a longitudinal design in their case studies. The former follow-up was conducted from the age of 11 to 29 months and in the latter from the age of 10 months to 32 months. In both studies, the KODA child studied made greater and more varied communicative use of the manual modality than did the monolingual age peers who had no sign language exposure. These studies were not exactly aimed at exploring the pragmatic differentiation. The findings, however, indicated the different and language-specific use of gestures by KODA children, suggesting the possibility of being able to detect KODA children’s pragmatic differentiation by the pre-linguistic phase.

**2.4.2 Factors affecting language choice and code-mixing**

When exploiting all their linguistic competence in both of their languages, bilingual children mix, from time to time, their languages across and within the utterances. The factors that affect language choice and code-mixing are multiple and vary in different children and in different situations, by both a child’s inner factors and environmental causes. Generally, in order to be able to choose the appropriate language according to the language of the interlocutor and to code-mix within the utterances, children need to have enough language competence in both of their languages (Baker & Van den Bogaerde, 2008; Montanari, 2009; Pearson *et al.*, 1997; Nicoladis & Secco, 2000). The overall language competence has been found
to have a significant role in language choice and code-mixing in bilingual children (Genesee et al., 1996; Montanari, 2009; Nicoladis & Secco, 2000; Pearson et al., 1997). If children have not yet learned a word in the target language, they need to borrow it from their other, stronger language. As the Gap-Filling Hypothesis proposes, the lexical gaps in one of the languages being acquired are, indeed, often found to be the reason for unimodal bilingual children’s inappropriate language choice and intra-utterance code-mixing (Deuchar & Quay, 2000; Montanari, 2009; Nicoladis & Genesee, 1996). Children’s dominant language also affects the language choice and code-mixing: children have been found, for instance, to frequently shift to use their dominant rather than their non-dominant language and use more code-mixing in their non-dominant language (Genesee et al., 1995; Nicoladis & Secco, 2000).

Code-mixing has been reported to be very common among sign language users (see e.g. Van den Bogaerde & Baker, 2008; Emmorey et al., 2008; Lillo-Martin et al., 2014). Consequently, KODA children are raised in a community where they are socialized into the norms, types and amount of code-mixing through everyday interaction; they learn when, where, how often and what kind of mixing is appropriate (see, e.g., Donati & Branchini, 2013; Emmorey et al., 2008; Lillo-Martin et al., 2014). These kinds of specific norms of the community and individual families shape the use of code-mixing of all bilingual children. Modeling hypothesis suggests that the high frequency of code-mixing in the language exposure of the bilingual child or in the interaction context increases his or her use of code-mixing (Comeau et al. 2003; Genesee et al., 1995; Deuchar & Quay, 2000; Nicoladis & Genesee, 1998). Consistent with these findings, Petitto et al. (2001) and Baker and Van den Bogaerde (2008) argued that the Deaf parents’ code-mixing frequency increased their hearing children’s use of code-mixing as well. The minority or majority status and societal prestige of languages in the surrounding community may also have an influence on the frequency of children’s code-mixing. For example, bilingual children have been observed to be more likely to use the majority language of the surrounding community when using the minority language, than to switch to the minority language when using the majority language (Greene, Peña & Bedore, 2013; Paradis & Nicoladis, 2007).

### 2.4.3 Code-mixing within an utterance

Since bimodal bilinguals are able to produce their languages in two different modalities, a unique form of language mixing called code-blending (simultaneous
The use of signs and words by both children and adults who are bimodal has been reported in many studies (Van den Bogaerde & Baker, 2008; Emmorey et al., 2008; Mallory, Zingle, & Schein, 1993; Petitto et al., 2001; Preston, 1994 p. 128; Wilhelm, 2008). Emmorey and others (2008) found in their study that 11 bimodal bilingual adults produced code-blends in 36% of their utterances. Correspondingly, Petitto and others (2001) found that the three KODA children (between the ages 0:10 and 4:6) they studied changed their code-mixing rate depending on with whom they were communicating. The child followed by the research group, from the age of 2:6 until the age of 3:6 mixed 33% of her utterances produced when interacting with her Deaf mother. Her Deaf mother mixed her utterances rather frequently, with 91% of all produced utterances being mixed when interacting with the KODA child. However, with a hearing person, the same child produced mixed utterances only 9% of the time.

Code-blended utterances among bimodal bilingual children and adults have been shown to be highly synchronized with congruent syntactic structures that contain simultaneously produced semantically equivalent signs and spoken words (Van den Bogaerde & Baker, 2005; Donati & Branchini, 2013; Emmorey et al., 2008; Petitto et al., 2001). Additionally, according to the studies, both children and adults tend to clearly favor code-blending instead of code-switching (successive production of signs and words within the same utterance) with the latter being commonly used by unimodal bilinguals. Still, further studies are urgently needed, especially with different language pairs acquired by KODA children.

Children who acquire two spoken languages are typically around two years old when they start to use two or multiword utterances, organize their languages according to the grammatical principles of each language and to use intra-utterance code-mixing (De Houwer, 1990; Döpke, 2000; Meisel, 2001; Yip & Mathews, 2000). Researchers have observed that children prefer to code-mix those structures that match each other in the two languages and avoid violating the grammatical rules of either language. In that way, children obey the grammatical constraints of both languages that guide what elements and from which part of one language can be mixed into a sentence of another language (Döpke, 2000; De Houwer, 1990; Meisel, 2001; Myers-Scotton, 1997, 2002; Paradis et al., 2000; Poplack, 1980; Yip & Mathews, 2000). Paradis et al. (2000 p. 225) found that French-English bilingual children (N = 15) between the ages of 1:9 and 3:8 code-mixed the languages in many ways, for example, by mixing words or parts of phrases. They, for instance, produced utterances like “petit bird” (free translation: little bird), “il fait dodo there” (free translation: he is sleeping there).
In the studies on code-mixing among unimodal bilinguals, a commonly used concept is the *Matrix Language*. The Matrix Language model refers to a case where one language is leading over the other in code-mixed utterances. It is hypothesized in the model (see, e.g., Myers-Scotton, 1997, 2002) that the language that possesses the dominant role serves as the syntactic frame and supplies more words and morphemes into the sentence in code-mixed utterances, in other words, it acts as the Matrix Language. According to this model, the other language in a code-mixed utterance is the *Embedded language*, the elements of which (e.g., words, phrases) are added into the sentence of the Matrix Language. Paradis *et al.* (2000) used the Matrix Language Frame model (Myers-Scotton, 1993, 1997) in studying how grammatical constraints emerged into the structures of code-mixed utterances among French-English bilingual children. The vast majority of the code-mixed utterances obeyed the grammatical constraints of both the languages, and only 18% of all of the mixed utterances violated them. Additionally, their results spoke against the idea of developmental shift, where code-mixing is expected to violate grammatical constraints in the early stage and change to be more constrained during development. This finding by Paradis *et al.* suggests that, from early on, children are able to control language-specific morphosyntactic properties in their code-mixed utterances and operate their separate grammars in tandem.

In their study on code-mixing by KODA children, Van den Bogaerde and Baker (2005) used the concept of a *leading language*, but, instead of the grammatical structures of the utterance, they based their analysis on the semantic contents of lexical items produced in one utterance. They regarded, as the leading language, the language that is used to produce the full proposition of the utterance. Van den Bogaerde and Baker termed it as the base language and, on these grounds, classified the children’s code-blend utterances into four different types. As an example of a Dutch base utterance, they presented (Van den Bogaerde & Baker, 2008, p. 15) a case where a three-year-old child said “*is been auto maar een trein*” (Engl. *is not car but a train*) and simultaneously signed “*AUTO TREIN*” (Engl. AUTO TRAIN) (free translation: *[This] is not a car, but a train*.). Despite the fact that there were clear individual differences in the use of different types of code-blends, KODA children mostly used *Dutch base* code-blends or such code-blends where they simultaneously produced semantically congruent signs and words (called *Full code-blends* by the researchers). During the data collection period, between the ages of 1;0 and 6;0 years, Van den Bogaerde and Baker (2008) found that children tended to use a higher amount of code-blends and at the same time the MLU of code-blended utterances increased. The researchers noted that with increasing age
the children tended to produce more words than signs in their code-blended utterances. Petitto et al. (2001) detected only a few code-blended utterances where simultaneously produced signed and spoken parts were following the grammar of each language separately. Researchers regarded these kinds of utterances as a sign of children having two distinct grammars, which the children were employing at the same time. Of the code-blended utterances detected 89% were semantically congruent.

Despite the fact that KODA children have mainly been found to produce semantically and grammatically congruent code-blend utterances, they have also been discovered to produce a few grammatically non-adult-like structures in their utterances. In their study on adults, Emmorey with her colleagues (2008) observed that American Sign Language (ASL), as the Matrix Language, influenced the syntax of the English parts of the code-blend utterances. This phenomenon may often be considered as deviant or disordered. This is especially the case if the commonly held perception is that code-mixing, in general, is an ungrammatical form of language use. Use of non-adult-like structures in spoken English by KODA children has been reported in some studies (i.e., Lillo-Martin, Müller de Quadros, Kouididobrova & Chen Pichler, 2012; Chen Pichler et al., 2014). In these studies, examples have been presented where word order is incorrect in English (preverbal object, doubled verb, post-verbal subject, and WH-question word in the final position) but acceptable in ASL. Chen Pichler and others (2014, p. 243) presented an example where a two-year-old KODA child produced a code-blend utterance with a preverbal object (Object-Verb structure) when saying “chocolate eat” while simultaneously signing “HOT CHOCOLATE EAT” (free translation: He’s eating hot chocolate.) This structure is, again, ungrammatical in English but grammatical in ASL. This kind of influence between the sign language and the spoken language is regarded as a bidirectional influence by the Synthesis model (Lillo-Martin et al. 2014). However, in previous research literature, these structures have easily been regarded as a sign of delayed or deviant language development by some researchers (e.g., Johnson, Watkins & Rice, 1992; Murphy & Slorach, 1983). In two recent studies, Donati and Branchini (2013) and Lillo-Martin et al. (2014) have proposed the theoretical models to describe features in code-blending and code-switching by KODA children.

In this chapter, language development and its unique characteristics among KODA children were described. It is essential to increase the knowledge about language acquisition of KODA children. This then, is the objective of this study, which focuses on aims that are described next.
3 Aims of the study

Purpose of this study was to increase the understanding of a specific form of childhood bilingualism by exploring the early bimodal bilingualism of KODA children. Since not all children become successfully bilingual (Garhercole & Thomas, 2009; Wong Fillmore, 2000), it is important to know in what kinds of situations bilingual development may fail and which factors in the environment are preventing or supporting the bilingual language acquisition process, and helping the children to reach active bilingualism. For this reason, the first principal aim was to 1) describe KODA children’s simultaneous acquisition of sign language and spoken language and its association with environmental factors. Additionally, due to their bimodal bilingualism, there are unique features in KODA children’s language production, which are both clinically and theoretically important issues. For these reasons, it is necessary to study the patterns of their language use. Thus, the second aim was to 2) explore how KODA children use their two languages that are represented in two different modalities and how the patterns in their language use associate with the features in their linguistic environment, language competence and contextual variables (related to the interlocutor(s) the child is communicating with). The areas studied and their mutual interrelationships are illustrated in Figure 1 and Table 1.

Knowledge about simultaneous language learning and patterns of language use is especially needed by the professionals working with KODA children, as only limited earlier research exists on the language development of KODA children in Finland. Due to the lack of previous research on KODA children, it is still highly challenging for speech and language therapists and other professionals to be able to distinguish between bimodal bilingual development that is simply divergent from monolingual development, and that which is delayed or disordered, thus warranting clinical intervention. The central factors contributing to the active bilingualism in KODA children are not yet thoroughly understood. When exploring these issues, the linguistic environment and the language exposure are inseparable aspects of children’s language use and language development, and hence crucial targets of the present study.
The two aims of the study were dealt with within the three empirical studies (Studies I, II, and III) conducted (Table 1). The specific connections between the purpose, aims and research questions are shown in Table 1.

Fig. 1. Areas studied and their interrelationships.
Table 1. Connections between the principal purpose, aims and research questions of the study.

<table>
<thead>
<tr>
<th>Principal purpose</th>
<th>Aims</th>
<th>Research questions</th>
<th>The specific research questions of Studies I, II and III:</th>
</tr>
</thead>
</table>
|                   | Description of the pace and different developmental paths of simultaneous sign language and spoken language acquisition and its association with environmental factors. | 1) How do sign language and spoken language develop simultaneously in KODA children and how is this development associated with the features of their linguistic environment? | Study I  
1. What variation is there in the linguistic environments of the hearing children of Deaf parents?  
2. What variation is there in the rate of development of these children's early spoken language and sign language and in the dominance between these two languages?  
3. How is the variance in linguistic environments related to these children's language development and language dominance? |
|                   | Exploration of how KODA children use their two languages that represent two different modalities and how the patterns in their language use is associated with the features in their linguistic environment, language competence and contextual variables. | 2) What kinds of features can be seen in KODA children's use of communication mode, language and code-mixing and how are these features associated with children's language competence and some contextual variables in the language learning environment? | Study II  
1. What is the association between the size of KODA children's sign language and spoken language vocabularies and the language children use with their interlocutor(s)?  
2. What is the KODA children's ability to accommodate their expressions as a function of the language used by their interlocutor(s) in selecting communication mode(s), in using gestures (number of different gesture types) and in using gestures jointly with vocal communication and sign language? |
|                   | Description of early simultaneous acquisition of Finnish Sign Language (FinSL) and spoken Finnish in KODA children |                                                                                     | Study III  
1. What are the quantitative and qualitative characteristics of code-mixing among young KODA children?  
2. Is KODA children's use of code-blends affected by child-specific factors and contextual variables? |
4 Methods

4.1 Participants

Families were recruited for this study by informing the Finnish Deaf community. The hearing children included in the study had to have at least one Deaf parent who was either a native user of Finnish Sign Language (FinSL) or had started to use FinSL as a child and currently used FinSL when communicating with other people. Altogether, ten Deaf-parented families volunteered to take part in the present study. All of the parents had completed a secondary level of education (either upper secondary school or vocational school). The children who participated in this study are described in Table 2.

Both parents were deaf in five families (those of Paula, Lauri, Onni, Matti and Kati), and in five families one parent was hearing and the other was deaf (those of Heidi, Miisa, Miina, Ari and Riina). The names of the children with two parents Deaf are boldfaced from here on, and all of the names of the children have been changed to protect anonymity. The researcher visited the children’s home every six months between the ages of 12 to 36 months. However, two children (Matti and Kati) were followed up only during the pilot phase of the project. For this reason, only the results of their parents’ interviews are analysed in this study. Additionally, data collection for Onni started at the age of 18 months. That is the reason why part of the data is missing for these children.

All of the Deaf parents, except Kati’s, Matti’s and Miina’s mothers, reported that they exclusively used sign language when communicating with their hearing child. However, during the video recorded play sessions, the Deaf parents of Ari and Onni mainly used simultaneous production of signs and spoken words. Only one hearing parent (Riina’s mother) out of the total of five was a fluent user of FinSL. All the children had regular and consistent exposure to both spoken Finnish and FinSL from birth and were acquiring them simultaneously either at home (five children had one hearing parent), in a day care centre (spending six to eight hours per day there, from three to five days per week), or by regularly meeting hearing and Deaf close relatives. During the data collection period, a total of five children started in full-time day care, Lauri and Kati at the age of 12 months, Paula and Heidi after they had turned 18 months, and Onni at the age of 24 months. Three children—Lauri, Paula, and Onni—had weekly contacts with other Deaf people.
Heidi, Miina, Miisa, Ari, and Riina met other Deaf people once every two weeks or more rarely.

Table 2. Hearing status of the parents and other close relatives and language exposure of the hearing children.

<table>
<thead>
<tr>
<th>Child</th>
<th>Hearing status of parents</th>
<th>Hearing status of other close relatives</th>
<th>Age upon starting in day care</th>
<th>Contacts with other Deaf people</th>
<th>Language(s) the deaf parents reported using when communicating with their hearing children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lauri</td>
<td>Both parents deaf</td>
<td>Both hearing and deaf</td>
<td>12 months</td>
<td>Weekly</td>
<td>Sign language</td>
</tr>
<tr>
<td>Kati</td>
<td>Both parents deaf</td>
<td>Hearing</td>
<td>12 months</td>
<td>Rarely</td>
<td>Sign/spoken language</td>
</tr>
<tr>
<td>Onni</td>
<td>Both parents deaf</td>
<td>Hearing</td>
<td>24 months</td>
<td>Weekly</td>
<td>Sign language*</td>
</tr>
<tr>
<td>Paula</td>
<td>Both parents deaf</td>
<td>Both hearing and deaf</td>
<td>18 months</td>
<td>Weekly</td>
<td>Sign language*</td>
</tr>
<tr>
<td>Matti</td>
<td>Both parents deaf</td>
<td>Hearing</td>
<td>12 (up to the age of 18 months)</td>
<td>Weekly</td>
<td>Sign/spoken language</td>
</tr>
<tr>
<td>Miisa</td>
<td>Mother deaf; Father hearing</td>
<td>Hearing</td>
<td>N/A</td>
<td>Every two weeks</td>
<td>Sign language</td>
</tr>
<tr>
<td>Miina</td>
<td>Mother deaf; Father hearing</td>
<td>Both hearing and deaf</td>
<td>N/A</td>
<td>Rarely</td>
<td>Sign/spoken language</td>
</tr>
<tr>
<td>Heidi</td>
<td>Mother deaf; Father hearing</td>
<td>Hearing</td>
<td>18 months</td>
<td>Every two weeks</td>
<td>Sign language</td>
</tr>
<tr>
<td>Ari</td>
<td>Mother deaf; Father hearing</td>
<td>Both hearing and deaf</td>
<td>N/A</td>
<td>Rarely</td>
<td>Sign language*</td>
</tr>
<tr>
<td>Riina</td>
<td>Mother hearing; Father deaf</td>
<td>Both hearing and deaf</td>
<td>N/A</td>
<td>Rarely</td>
<td>Sign language</td>
</tr>
</tbody>
</table>

Note. The names of the children with both parents deaf are boldfaced

N/A = Not applicable; the child did not attend day care during the follow up

* In the parental interview the parents reported using sign language when communicating with their hearing child. However, during the video recorded play sessions the parents of these two children were observed to use simultaneous production of signs and spoken words.

4.2 Procedure

The children were observed longitudinally. The same researcher visited each family every six months from the time the hearing child was 12 months old, until the age of 36 months. Data collecting methods and data points used can be seen in Figure
2. They include: *Parental interviews* (Study I), *MCDI questionnaires* (Studies I, II and III), *Video recorded interaction sessions* (Studies II and III) and testing of the children’s competence in Finnish language by using *The Reynell Developmental Language Scales* test (Kortesmaa, Heimonen, Merikoski, Warma & Varpela, 2001) at the age of 36 months (Study III). Each of these data sources is described in detail below. As mentioned earlier, two children (Matti and Kati) were followed up only during the pilot phase of the project, and therefore, only their parents’ interviews are analysed in this study. For this reason, the number of children varied from eight to 10 during the data collection described in the Figure 2.

![Fig. 2. The data collection methods used in the study.](image)

### 4.2.1 Parental interviews

During the first home visit, one parent in three families and both of the parents in seven of the families of each child were interviewed in order to obtain information about the child’s linguistic environment and language competence in both
languages. The video recorded interviews contained semi-structured questions, which covered a total of eight themes, e.g., the hearing status of the parents and their closest relatives and the linguistic goals of the parents in child rearing (Study I) that are presented in the Table 3. These themes were selected based on the previous research on unimodal bilingual children, on studies that suggest factors in linguistic environment and which associate with the language development of bilingual children (Gathercole & Thomas, 2009; Hammer et al., 2004; De Houwer, 2007; Pearson, et al., 1997). During later visits, the researcher took notes on the parents’ comments about the child’s comprehension and production ability in each language (smaller scale parental interview), information on possible changes in the linguistic environment and other important issues related to language learning.

Table 3. The themes of the interview exploring the linguistic environment (four themes) and linguistic development (four themes) of the KODA children.

<table>
<thead>
<tr>
<th>Environment</th>
<th>Child’s linguistic development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing status of the parents and the closest relatives</td>
<td>Age at which the child produced his/her first spoken word and sign</td>
</tr>
<tr>
<td>Linguistic goals of the parents</td>
<td>Language(s) the child uses in communication with different interlocutors</td>
</tr>
<tr>
<td>Language exposure to sign language and spoken language present in the child’s immediate environment (e.g. parents’ language choice; frequency of contacts with Deaf and hearing people and day care attendance)</td>
<td>Language competence of the child in each language</td>
</tr>
<tr>
<td>Language(s) the child and siblings use when communicating with each other</td>
<td>Parental concerns related to the child’s development</td>
</tr>
</tbody>
</table>

All the interviews were transcribed with ELAN software (see, e.g., Lausberg & Sloetjes, 2009) and transferred into a word processing file. The parent’s answers to each theme were entered into a transcript file and their responses were further analysed using data-based inductive content analysis (see, e.g., Carley, 1990; Krippendorff, 1980).

In determining the number of language contacts of the family, a scoring system was conceived that is exemplified in Table 4. The scoring system was based on parents’ reports of their child’s frequency of contacts with Deaf and hearing people.
As presented in the Table 4, zero to two points were credited for either sign language or spoken language for a total of five different categories in every feature of language exposure, e.g. parents’ communication mode and hearing status, child being in day care outside the home and how often other Deaf and hearing people were met. The maximum score was 10 points for spoken and 10 points for sign language. The scores of each individual child are presented in the Results section on a continuum illustrating the dominance in the children’s linguistic environment between FinSL and Finnish.
**Table 4. Hypothetical* examples of scoring of language contacts of KODA children.**

<table>
<thead>
<tr>
<th>Hearing status and communication mode of the parents (maximum 4 points)</th>
<th>Hearing status of siblings (maximum 2 points)</th>
<th>Day care setting (maximum 2 points)</th>
<th>Hearing status of close relatives (1 point)</th>
<th>Contacts with the Deaf community (e.g. attending clubs) or the hearing society (1 point)</th>
<th>Summary (maximum 10 points for spoken and 10 points for sign language)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Child 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother: deaf, uses sign language (2 p for sign language)</td>
<td>Father: deaf, uses sign language (2 p for sign language)</td>
<td>One hearing and one deaf sibling (1 p for sign language and 1 p for spoken language)</td>
<td>At home with a Deaf mother (2 p for sign language)</td>
<td>Both hearing and deaf (0.5 p for spoken language and 0.5 p for sign language)</td>
<td>Spoken language: 1.5, Sign language: 8.5, Preference for sign language: 7</td>
</tr>
<tr>
<td><strong>Child 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother: deaf uses sign language (2 p for sign language)</td>
<td>Father: hearing, uses spoken language (2 p for spoken language)</td>
<td>Two hearing siblings (2 p for sign language)</td>
<td>At home with a Deaf mother (2 p for sign language)</td>
<td>All hearing (1 p for spoken language)</td>
<td>Spoken language: 5, Sign language: 5, Languages in balance: 0</td>
</tr>
</tbody>
</table>

* to ensure the anonymity of the children studied
4.2.2 Parental questionnaires

Information on the eight children’s productive vocabulary, separately in signs and in spoken words, was collected by using the Finnish adaptation (Lyytinen, 1999) of the MacArthur Communicative Development Inventory (MCDI, Fenson et al., 1991). Two children (Kati and Matti), as previously mentioned, were followed up only during the pilot phase of the project when the MCDI was not yet used. Therefore, their vocabulary results are lacking. The MCDI forms were sent to the parents two weeks before the researcher’s visit and the parents returned the filled-in forms during the home visit. In case of any obscurity, it was possible to clarify the task and discuss the form with the parents. If both parents of the child were deaf, the child’s closest hearing adult (e.g. a grandparent or a person at the child’s day care centre) filled in the part of the MCDI form concerning spoken language.

The Infant version of the MCDI (designed for ages 8 to 16 months) was used at the age of 12 months and the Toddler version (designed for ages 16 to 30 months) at the ages of 18 and 30 months. The MCDI is an internationally widely used, reliable and valid method for assessing children’s early vocabularies (Fenson et al., 1994). It has also been used to measure development in sign language (Anderson & Reilly, 2002; Woolfe, Herman, Roy & Woll, 2010). However, the MCDI has not yet been adapted for FinSL, thus the same form was used to collect the data on both Finnish and FinSL. In order to gather information on the FinSL development of the children studied, these modifications were done to the MCDI form: six signs related to the Deaf culture were added together with some question words in FinSL, the guidelines written in the MCDI form were given in FinSL, as well. When filling in the MCDI form, the adult marked a P, when the lexical item included the child’s Finnish productive vocabulary, V, when the lexical item included the child’s FinSL productive vocabulary and PV, when the lexical item included the child’s productive vocabulary in both languages. These modifications were partly based on the changes that Anderson and Reilly (2002) and Woolfe et al., (2010) made when adapting the English version of the MCDI for American Sign Language and British Sign Language. Still, making the noun-verbal distinction was a difficult task. The features of some FinSL signs are, in certain cases, similar to two items included in the MCDI, and the structure of these morphologic forms in FinSL is not known in detail. For this reason, it was important to discuss with the parent the production of these signs by their child. Based on the discussion with the parent these signs were usually considered to have two occurrences (e.g., both pen and write), but if
the parent reported that the child used the sign only for either nominal or verbal, the lexical item was counted only once.

### 4.2.3 Reynell Developmental Language Scales

When the children were 36 months, their Finnish language proficiency was tested by using the Finnish version of the Reynell Developmental Language Scales test (Kortesmaa et al., 2001) administered in Finnish. The results of the Reynell test were used to check if the eight children’s development was age-appropriate, and to explore the associations between the children’s language competence and use of code-blending (Study III).

### 4.2.4 Video recorded play sessions

At each data collection point, eight children were video recorded with six-month intervals at their home by a hearing researcher who was a CODA (Child of Deaf Adults) and fluent in both Finnish and FinSL (Table 5). During the home visit the researcher only used FinSL when communicating with the Deaf parent(s) and only Finnish when interacting with the child. During the play sessions, the parents were asked to play with their child as they normally would. A standard set of books and toys suitable for the child’s age was provided, but the adults and the children were not restricted to playing with them.

Altogether, eight children’s communication modes and patterns of language use were examined in three different situations, at each data collection point. Namely, the home visit always contained three different sets of video recorded play sessions. During the first play session, the KODA child communicated with his or her Deaf parent. In the second condition, the hearing researcher joined in playing with the child and the deaf parent. During this play session, the hearing researcher used only Finnish. The aim was to observe the language use and communication of the child in a situation where two adults (one deaf and one hearing) were simultaneously present. Special focus was set on the child’s ability to differentiate spoken Finnish and FinSL from each other and to switch between these languages rapidly without prior thought. Finally, the child interacted alone with a hearing adult, most often the hearing researcher, who communicated with the child by solely using spoken Finnish (naturally accompanied by some gestures). The goal of this third condition was to capture the child’s patterns of language use with a hearing interlocutor.
Altogether, 108 play sessions were video recorded and the size of the video recorded data is presented in Table 5. Of the 69 sessions where a hearing person was present, the hearing researcher was replaced by the hearing parent of the child in five occasions (two by a hearing father and three by a hearing mother). This was done because the child did not cooperate with the hearing researcher. At each home visit, 45 minutes of video recorded data (three play sessions each lasting for 15 minutes) were collected, and the most active five minutes during which the child produced the highest number of expressions and longest utterances with each different interlocutor were selected from each play session for the analysis. Thus, nine hours (540 minutes) of video recorded data were analysed.

Table 5. The number of analysed five-minute play sessions and the total duration of analysed data per time point (children’s age).

<table>
<thead>
<tr>
<th>Play session</th>
<th>12 months</th>
<th>18 months</th>
<th>24 months</th>
<th>30 months</th>
<th>36 months</th>
<th>Total number of play sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. With the Deaf parent</td>
<td>7 sessions</td>
<td>8 sessions</td>
<td>8 sessions</td>
<td>8 sessions</td>
<td>8 sessions</td>
<td>39 play sessions</td>
</tr>
<tr>
<td>2. With the Deaf parent and a hearing adult</td>
<td>6 sessions</td>
<td>6 sessions</td>
<td>7 sessions</td>
<td>6 sessions</td>
<td>8 sessions</td>
<td>33 play sessions</td>
</tr>
<tr>
<td>3. With a hearing adult</td>
<td>7 sessions</td>
<td>8 sessions</td>
<td>8 sessions</td>
<td>7 sessions</td>
<td>6 sessions</td>
<td>36 play sessions</td>
</tr>
<tr>
<td>Total length of the analysed data</td>
<td>100*</td>
<td>110**</td>
<td>115**</td>
<td>105**</td>
<td>110**</td>
<td>540 minutes</td>
</tr>
</tbody>
</table>

*Data collection for Onni started at the age of 18 months.
**Missing data were due to children's tiredness or a general unwillingness to cooperate.

4.3 Coding

Each video recorded session was transcribed, speech orthographically and signed communication by using glosses (sign-word correspondence written in capital letters). Then they were coded and analysed using the ELAN software (see, e.g., Crasborn, 2015; Lausberg & Sloetjes, 2009).

All children’s output was analysed based on utterances, which were defined, as in many previous studies, as any sequence of speech, vocalizations, signs and/or gestures that are preceded and followed by a pause, a change in an intonation pattern or a conversational turn (Van den Bogaerde & Baker, 2008; Chen Pichler,
Hochgesang, Lillo-Martin & de Quadros, 2010; Petitto et al., 2001). The sequence also had to be intentionally communicated. In intentional communication the child directs his/her manual and/or vocal act toward the interlocutor(s) by using eye gaze, body orientation, or physical contact and awaits a response from the adult, as evidenced by looking at the adult hesitantly or persisting in the communicative act (Sarimski, 2002, p. 489).

4.3.1 Coding of the communication mode

In Study II, all utterances were grouped into three categories of communication mode. When an utterance consisted of only gestures or signs, it was regarded as a manual utterance. Further, if an utterance contained only vocalization and/or spoken words, it was counted as a vocal utterance. When gestures/signs and vocalization/words both occurred either simultaneously or sequentially within the same utterance, the utterance was classified as a mixed one. The pre-linguistic and lexical constituents of communication modes of the young children studied are presented in Figure 3.

Fig. 3. Pre-linguistic and lexical constituents of different communication modes used in the analyses.

Two recordings from the play sessions with the Deaf parent and the child, one representing the age of 12 months and one the age of 18 months, were randomly selected for reliability analysis of the identification of the utterances and classification of the communication mode(s). Inter-rater reliability of segmentation, as a percentage agreement, between the two coders (LK, who was CODA and fluent in both Finnish and FinSL and KH, who was native in Finnish and considerable practical studies in FinSL and several years’ experience with working among
signing children) working independently from each other was 87%. The communication mode analyses were in almost perfect agreement with each other; when the child was 12 and 18 months old, the inter-rater agreement was 94% and 96% for the child’s productions, respectively. Inter-observer agreement exceeding 80% is generally considered sufficient (Thompson, 2014).

4.3.2 Coding of gestures and different expression-type combinations

Gestures can be produced not only with the hands and arms, but also with the head (such as nodding), the legs (such as kicking), or the whole body (change of posture, such as moving away). Two criteria were used to ensure that a gesture was functioning as a communicative symbol (see discussion on this matter in Butcher, Mylander & Goldin-Meadow, 1991; Goldin-Meadow & Mylander, 1984). First, when a hand movement was produced, it could not be a direct manipulation of some relevant person or object (i.e., it had to be empty-handed; Petitto, 1988). No acts performed on objects were included, except when a child was showing (holding up an object to bring it to another person’s attention) or giving objects, because these two acts serve the same communicative function as pointing. Secondly, a gesture was not marked if it was a ritual act (e.g., a game or blowing a kiss to someone) (Iverson & Goldin-Meadow, 2005).

In Study II, all manual gestures produced by the children were counted. When a child extended a finger, multiple fingers, or a palm toward a referent, the act was considered as a point. Because pointing gestures are fully integrated into the linguistic system of sign language, categorizing pointing into a non-linguistic or linguistic item is challenging (see Hoiting & Slobin, 2007). In the present study, the aim was mainly to observe the role of pointing in the interpersonal communication of bimodal bilingual children, so there was no need to classify pointing as being either linguistic or gestural. To be able to compare the children’s gesture use with different interlocutors, a point was classified as a gesture, although points produced by 24-month-old children may already function as a pronominal sign (see, e.g., Hatzopoulou, 2008; Hoiting & Slobin, 2007; Petitto, 1994).

After separating pointing gestures to form a category of their own, gestures were then classified into three categories (see Capirci et al., 2005; Iverson et al., 2008). Other deictic gestures refer to movements that indicate referents in the immediate environment. This category included showing, giving, and requesting. A gesture was regarded as showing when a child held up an object in an adult’s line of sight, as giving when a child gave an object to an adult, and as requesting when
a child extended his or her arm toward an object and expressed with an eye-gaze, body movement, repeated palm opening and closing, or vocalization that he or she wished an adult to give the object.

The second category of gestures—*iconic gestures*—included all gestures that conveyed symbolic meanings by directly referring to their semantic contents in terms of the gesture’s hand shape, type of movement, and place of articulation (e.g., flapping arms to represent a bird flying) (Capirci et al., 2005; Iverson et al., 2008). The third category included *conventional gestures*, the meanings of which are often culture-specific (like nodding or lifting a thumb).

Study II was also analysed for how the children combined gestures, vocal communication, and signs together within the same utterance. All utterances were categorized where the children combined a) two gestures, b) a gesture or gestures with words/vocalization and/or signs, and c) signs and words/vocalization. This classification is presented and exemplified in Table 6. Altogether, seven different categories were found. A sequence was marked to represent a gesture+gesture combination if a child produced two different gesture types, e.g., pointing and an iconic gesture within the same utterance. This was also marked if a child produced the same gesture, e.g., two pointing gestures, which had two different referents.

Table 6. Classification of gesture, word, and sign combinations in Study II.

<table>
<thead>
<tr>
<th>Gesture combinations</th>
<th>Gesture</th>
<th>Gesture</th>
<th>Sign</th>
<th>Word/vocalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Gesture+sign</td>
<td>Pointing_book</td>
<td></td>
<td>FISH</td>
<td></td>
</tr>
<tr>
<td></td>
<td>gesture_nod</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Gesture+word/vocalization</td>
<td>Pointing_mother</td>
<td></td>
<td>pa-a</td>
<td></td>
</tr>
<tr>
<td>5. Gesture+gesture+word/vocalization</td>
<td>Pointing_book</td>
<td>Pointing_mother</td>
<td>pa-a</td>
<td></td>
</tr>
<tr>
<td>6. Sign+word/vocalization</td>
<td></td>
<td></td>
<td>DOG</td>
<td>a-a</td>
</tr>
<tr>
<td>7. Gesture+sign+word/vocalization</td>
<td>Pointing_book</td>
<td></td>
<td>COW</td>
<td>buu</td>
</tr>
</tbody>
</table>

### 4.3.3 Coding of language

Criteria were also needed to define the language(s) the children used in each segment of their utterances. In Studies II and III for attribution of lexical status, the criteria were based on the principles proposed by Petitto *et al.* (2001) and Vihman.
and McCune (1994). The children’s productions were coded to contain a sign or a word if the verbal production or manual act 1) was used across appropriate contexts in strong relation to a referent, 2) had at least one phonetic unit that resembled the adult form of that sign in FinSL (e.g., place, orientation or handshape) or word in Finnish and 3) if the form had to be invariant. If the nature of the motor act was not clear, it was defined as a sign if it occurred in the parents’ motherese variant of FinSL. A manual act that resembled a sign in all its linguistic features (e.g., handshape, location, direction and movement of a hand) but which was not understood by the parents or the hearing researcher was defined as manual babbling (see, e.g., Petitto & Marentette, 1991). Communicative speech was coded as vocalization if it did not contain any intelligible words but was nonetheless produced for the purpose of intentional communication.

4.3.4 Coding of MLU

When evaluating the development of syntactic complexity during the data collection in Studies I and III, the mean length of the ten longest utterances (MLU10) of each child was analysed for both the number of whole signs and spoken words, and not morphemes. Data from the video recorded play sessions were used for this purpose. To calculate the MLU, the same procedure and criterion were used as Van den Bogaerde (2000, p. 168) has used. Thus, if the semantic content of the points, signs and/or words within the same utterance are the same, the combination is counted as one element. In any other case, signs and/or words are counted as separate elements of the utterance. The MLU10 provides information on the longest structures a child is able to express. Because the MLU10 calculation is based on whole words and signs, not morphemes, it can be used to obtain comparable measures of the level of language development in both sign language and spoken language and to determine the dominant language. The MLU10 has been used by, e.g. Van den Bogaerde (2000, p. 168) and Klatter-Folmer, van Hout, Kolen and Verhoeven (2006) in studying KODA children and deaf children of deaf and hearing parents. In Studies I and III, the results of MLU10 and MCDI were used together to determine the dominant language of the children studied.

In Study III, the mean length of the utterances (MLU) was also used to measure the length of code-blended utterances in order to evaluate the qualitative characteristics of code-mixing. The MLU of the code-blended utterances produced by the children was first calculated for the total number of code-blended utterances
and then for both the number of signs (MLU in signs) and the number of spoken words (MLU in words) separately.

### 4.3.5 Coding of code-mixing

In Study III, criteria were first conceived for separating code-switches from code-blends, and, second, for identifying different types of code-blends. Utterances that consisted of simultaneous production of sign(s) and phonated or whispered word(s) were classified as *code-blended*, whereas utterances that consisted of sequential production of sign(s) and word(s) were regarded as *code-switched*. In this study, we used criteria similar to those of, e.g., Petitto *et al.* (2001), Emmorey *et al.* (2008) and Lillo-Martin *et al.* (2014), who regarded an utterance as code-blended if the sign was accompanied by speech that was phonated or whispered. This decision was made because we did not consider transcriptions of the children’s productions that were only mouthed, with no phonation, to reliably constitute spoken Finnish.

To identify different types of code-blended utterances, the concept of *Base Language* was adopted, as the otherwise more commonly used concept of Matrix Language (Myers-Scotton, 1993, 1997, 2002) has been found to be somewhat problematic among bimodal bilinguals (Emmorey *et al.*, 2008; Van den Bogaerde & Baker, 2005). Base language is the language that expresses the full proposition of utterances and provides more linguistic units in that particular language compared with another language used in a code-mixed utterance. The Matrix Language model utilises information on the syntactic frame (Myers-Scotton, 1997, 2002) of the utterance, whereas in our study semantic content was used to classify utterances. Previous studies on KODA children have also commonly utilised the semantic content of children’s code-mixed utterances (e.g., Van den Bogaerde & Baker, 2005; Petitto *et al.*, 2001).

The code-blended utterances were further subcategorised similarly to Van den Bogaerde and Baker (2005, 2008); they were allocated into four different categories that are presented in Table 7. Code-blended utterances with (1) *Finnish as the base language* refer, therefore, to utterances that were expressed fully in spoken words and were accompanied by some semantically congruent FinSL sign(s), which did not bring any additional meaning into the utterance, whereas code-blended utterances with (2) *FinSL as the base language* refers to utterances that were produced fully in signs and were accompanied by some semantically congruent spoken words that did not carry any additional meaning. Utterances that were fully expressed in both signs and spoken words in which signs and words had equivalent
semantic content were called (3) *Equally strong* (Finnish = FinSL). Finally, utterances where both signs and words were necessary for building up the full meaning of the utterance were referred to as (4) *Combined* (Finnish + FinSL). It is more difficult to determine if a point is a gesture or a sign when it accompanies only a spoken word, than when it is produced with a sign/other signs. For this reason, it was decided that the combinations of speech, and point and speech, and interjections expressed in signs (e.g., speech with only a head nod or a point) would be excluded from our analyses. This decision was also made by Lillo-Martin *et al.* (2014) in their recent study.

Five recordings from the different play sessions, one from each data collection point, were randomly selected for the reliability analysis of the code-blended utterances. Cohen’s kappa was used to explore the degree of agreement between the two coders (LK and KH) working independently from each other. The coders’ agreement was perfect (with the kappa value of 1) when deciding on whether a child’s utterance contained a code-blend or not. A kappa value of 0.656 was obtained for the inter-rater agreement in categorization of the code-blended utterances into different code-blend types. According to Landis and Koch (1977), the strength of agreement is considered substantial when it is over 0.61.
Table 7. Subcategories with some examples of code-blended utterances used in the analyses. Productions in sign language are transcribed using glosses written in capital letters.

<table>
<thead>
<tr>
<th>Code-blend type: Finnish base* produced by Onni at the age of 30 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Utterance Spoken Piitä-ø muumi-ø talo-n</td>
</tr>
<tr>
<td>Signed TALO</td>
</tr>
<tr>
<td>Glossing Spoken draw-3pl Moomin-gen.sg house-acc.sg</td>
</tr>
<tr>
<td>Signed HOUSE</td>
</tr>
<tr>
<td>Translation ‘Draws a Moomin’s house.’</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code-blend type: FinSL base produced by Lauri at the age of 24 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Utterance Spoken Haukku-huu pupu-ø hauhhu-u</td>
</tr>
<tr>
<td>Signed KOIRA PUPU HAUKKUJA KOIRA PUPU</td>
</tr>
<tr>
<td>Glossing Spoken bark-3sg bunny-nom.sg bark-3sg</td>
</tr>
<tr>
<td>Signed DOG BUNNY BARK DOG</td>
</tr>
<tr>
<td>Translation ‘The dog is barking at the bunny (and) the dog is chasing the running bunny.’</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code-blend type: Equally strong produced by Miisa at the age of 36 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Utterance Spoken Mä-ki syö-n aina pulla-a</td>
</tr>
<tr>
<td>Signed SYÖÄ osoitus-MINÄ AINA SYÖÄ-PULLAA</td>
</tr>
<tr>
<td>Glossing Spoken I-too eat-1sg always bun-part.sg</td>
</tr>
<tr>
<td>Signed EAT point-I ALWAYS TO-EAT-BUN</td>
</tr>
<tr>
<td>Translation ‘I’m always eating buns, too.’</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code-blend type: Combined (Finnish + FinSL) produced by Paula at the age of 36 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Utterance Spoken Se-ø yrittää-kävellä</td>
</tr>
<tr>
<td>Signed YRITTÄÄ KÄVELLÄ</td>
</tr>
<tr>
<td>Glossing Spoken it-nom.sg try-3sg</td>
</tr>
<tr>
<td>Signed TRY WALK</td>
</tr>
<tr>
<td>Translation ‘It’s trying to walk.’</td>
</tr>
</tbody>
</table>

*Used as the Base Language in this category (by supplying more words than signs to express the full proposition of an utterance).

**In the transcription, a hyphen between two signs is used to illustrate that the child produced only one sign but in the written transcription two or more words need to be used.
The summary and description of the methodological tools used in this study are presented in the Table 8.

Table 8. Summary of the methods used in the study.

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental interview (Study I)</td>
<td>Linguistic environment of the children</td>
</tr>
<tr>
<td>Parental questionnaire (MCDI) (Studies I, II and III)</td>
<td>Productive vocabulary in FinSL and spoken Finnish, also used together with the MLU10 to determine the language dominance of each child</td>
</tr>
<tr>
<td>Reynell Developmental Language Scales (Study III)</td>
<td>Proficiency in spoken Finnish at the age of 36 months</td>
</tr>
<tr>
<td>Video recordings (Study II)</td>
<td>Coding</td>
</tr>
<tr>
<td>Communication mode (Study II)</td>
<td>Manual communication mode (signs and/or gestures)</td>
</tr>
<tr>
<td></td>
<td>Mixed communication mode (signs/gesture and words/vocalization)</td>
</tr>
<tr>
<td></td>
<td>Vocal communication mode (word(s) and/or vocalization)</td>
</tr>
<tr>
<td>Gestures (Study II)</td>
<td>Points</td>
</tr>
<tr>
<td></td>
<td>Other deictic gestures (showing, giving and requesting)</td>
</tr>
<tr>
<td></td>
<td>Iconic gestures</td>
</tr>
<tr>
<td></td>
<td>Conventional gestures</td>
</tr>
<tr>
<td></td>
<td>Various gesture, word, and sign combinations</td>
</tr>
<tr>
<td>Language (Studies I, II and III)</td>
<td>Signs and words produced</td>
</tr>
<tr>
<td>MLU (Studies I and III)</td>
<td>MLU10 for syntactic complexity of the utterances and together with the MCDI to determine the language dominance of each child MLU of code-blended utterances</td>
</tr>
<tr>
<td>Code-mixing (Study III)</td>
<td>Code-switching</td>
</tr>
</tbody>
</table>

4.3.6 Statistical analyses

Statistical testing was done with SPSS Statistics for Windows software, version 21.0. The standard alpha level (p < 0.05) was adopted. In Study I, Spearman’s rank correlation coefficients were calculated between the MCDI results and the
children’s production of signs and words and the results of MLU10 during the video recorded play sessions.

In Study II, differences by the individual interlocutor in the children’s use of spoken and sign language, communication mode(s) (manual, mixed, or vocal), different forms of manual modality, and gesture use, together with gesture-sign-word/vocalization combinations were tested with the Related-Samples Friedman’s Two-Way Analysis of Variance by Ranks. The standard alpha level (p < 0.05) was adopted. Multiple comparisons were performed with the Related-Samples Wilcoxon Signed Rank Test, and the familywise type I error rate was controlled with Bonferroni correction as a post hoc test (resulting in a significance level of p < 0.017 with three comparisons). All the data collection points (at the child’s ages of 12, 18, and 24 months) were generally combined. Statistical testing was done with SPSS Statistics for Windows software, version 21.0.

In Study III, in order to compare the number of code-blended utterances (total and different types) produced by each child at different ages, the Related-Samples Friedman’s Two-Way Analysis of Variance by Ranks and Related-Samples Wilcoxon Signed Rank Test with a Holm-Bonferroni adjusted significance level were used. The child’s age, language dominance, score on the Reynell test, interlocutor(s) and the frequency of using code-blends by the Deaf parent were used as the independent variables, and the total number and the number of different code-blend types served as the within-subject dependent factors. Additionally, Spearman’s Correlation Coefficients, and a Mann-Whitney Test were used in the analyses.
5 Results

5.1 KODA children’s language development and its association with their linguistic environment (Studies I, and III)

The aim of the first research question was to explore how sign language and spoken language are simultaneously developing in KODA children and how this development is associated with the features in their linguistic environment. In order to gain knowledge on the linguistic environment of the children, the scoring system based on parental interviews was conceived in the Study I. This methodological tool was developed to describe the amount of language exposure. Eight children’s development of productive vocabulary was evaluated by MCDI, and syntactic complexity by calculating the mean length of the 10 longest utterances (MLU10) in FinSL and in Finnish. The results of the MCDI and the MLU10 were used to determine the children’s dominant language. Additionally, language competence in spoken Finnish language was evaluated using the Reynell Developmental Language Scales (Kortesmaa et. al., 2001) at the age of 36 months.

5.1.1 Linguistic environment of KODA children

In order to gain knowledge on the linguistic environment of KODA children (Study I), semi-structured parental interviews that covered a total of eight themes, were conducted during the first meeting with the families. Five of those themes: hearing status of the parents and other close relatives, attendance at day care, language choice of the Deaf parents and the contacts with other Deaf and hearing people, are reported in a detailed manner in Study I. The aim was to describe which factors affect the language exposure and language development of KODA children. Results of 10 children are reported.

Children’s everyday linguistic environment at the age of 12 months was described on a continuum between sign language and spoken language (Figure 4). An arrow refers to the direction towards which dominance appeared to be moving during the follow-up. A clear change in linguistic environment favouring spoken language usually happened when the child started full-time day care.
Children’s linguistic environments varied widely. The frequency of children’s regular contacts with both hearing and Deaf people naturally influenced the balance between the languages in the child’s language exposure. The five children whose both parents were Deaf received more sign language than spoken language input from their linguistic environment. Their parents, for example, reported more frequent contacts of the children with other Deaf people than did parents of other children (see Table 2). For this reason, these children were placed on the continuum towards the end that represents sign language dominance in exposure. Because of regular contacts with other Deaf people and their parents’ mutual sign language use when communicating with each other, these children had more opportunities to see and use sign language themselves. The children who had only one deaf parent were placed close to the neutral pole of the axis or towards the end representing spoken language. In these families, children met other Deaf people less often than weekly. Due to the lack of sign language competence of four hearing parents and rather infrequent contacts with other Deaf people, the Deaf parent was often the only person who communicated with the hearing child in sign language. According to the parents, all KODA children met hearing people daily or almost daily. However,
parents often reported difficulties in finding other Deaf people who the children could meet and communicate with.

In seven families out of the ten studied, parents reported their own worry or concerns expressed by others on their child's development. Concerns on spoken language development of their child were reported by the parents of Kati, Matti and Onni. Parents even changed their day care arrangements for Matti so that he would receive more spoken language exposure. The parents of Paula and Lauri were worried about the sign language development of their child, especially after the children started in full time day care, where they received only spoken language exposure. Five families (those of Lauri, Onni, Kati, Heidi and Riina) reported that either health or day care personnel had expressed concern over their child’s language development. Language development of four children was evaluated by a speech therapist and they also received an intervention period. However, only Onni was diagnosed with disordered language development (SLI).

Bilingualism of the Deaf parents was reflected in their language choices. This came up in both the parental interviews and parents’ language choices during the video recorded play sessions. According to these data sources, the Deaf parent(s) in five families (those of Kati, Matti, Onni, Miina and Ari) used simultaneous production of signs and words (with vocalization) in at least 50% of all utterances they produced when communicating with their hearing children. Additionally, the mother of Paula whispered spoken words when producing signs in 41% of all of her utterances during the video recorded play sessions. On the contrary, the parents of Lauri, Miisa, Heidi and Riina almost exclusively used sign language during the video recorded play sessions. Deaf parents hardly ever used only spoken words in their utterances.

5.1.2 Development of Finnish Sign Language and spoken Finnish

**Productive vocabularies.** The productive vocabularies in both FinSL and Finnish were measured by the MCDI in eight children. Great individual variation was detected in the size of children’s FinSL and Finnish vocabularies when measured with the MCDI (Studies I, II and III). The size of productive vocabularies in FinSL and Finnish, on average, was close to each other at the group level, but great individual variation was, nonetheless, evident (see Figure 5). Individual results on the MCDI are presented in Appendix 1. These results on children’s productive vocabularies showed, however, that at the age of 18 to 24 months and older, the mean number of produced spoken words and signs were clearly lower in KODA
children than the mean size of the productive vocabulary of Finnish monolingual children reported by Lyytinen (1999). In contrast, the mean size of the total productive vocabulary of the whole group of KODA children, in which both signs and words were included, was equal to the mean size of productive vocabulary of monolingual age peers. However, one should note, the large dispersion within this group of children. Therefore, the group mean results are vulnerable, so that a more detailed examination of the individual results follows.

At the age of 30 months, the cut-off for age-appropriate development in the Finnish version of the MCDI is 380 words (Lyytinen, 1999). Using this limit at that age, only three out of eight of the KODA children had an age-appropriate total vocabulary (see Figure 6). Of those three children, only one, Paula, produced more signs (N = 557) than the monolingual age-equivalent mean. She also produced 374 words. With this result in vocabulary for Finnish, she, however, slightly lagged behind the monolingual mean of the norm sample, but her total vocabulary was
clearly larger than that of her monolingual age peers. Also Riina’s and Lauri’s total vocabulary exceeded the monolingual normative mean at 30 months of age. On the other hand, the total vocabulary of five children (Onni, Miina, Miisa, Heidi and Ari) belonged to the lowest quartile of the monolingual norm sample reported by Lyytinen (1999). Of these children, three (Onni, Heidi and Ari) were in the 10th percentile. The total productive vocabulary of these children’s growing bilingualism was, therefore, clearly developing more slowly than that of their monolingual age peers. In her report, Lyytinen (1999) suggests a careful follow-up of children whose results belong to the 10th percentile of the MCDI.

The children who had the lowest results in total vocabulary according to the MCDI, also represented variable linguistic environments; Onni had a strong sign language exposure (but also SLI), Ari had a strong spoken language exposure and in Heidi’s linguistic environment languages were rather equally represented (see Figure 6). On the other hand, Lauri and Paula had strong sign language exposure and they reached age-appropriate level in their total vocabulary.

![Fig. 6. Relationship between the dominance in language input* and the child's total vocabulary in MCDI at the age of 30 months.](image)

*Children with strong sign language exposure (as reported by the parents) are marked with grey, children with rather balanced input with grey and white, and children who received strong spoken language exposure are marked with white background colour.

According to the MCDI, approximately 43% of children’s productive vocabularies consisted of translation equivalents. All but one (Heidi at the 18 month session) of the children produced translation equivalents at every data collection point, but the
share of translation equivalents from total vocabulary varied. The proportion of translation equivalents increased by age. At the age of 12 months, on average, 26% of the children’s vocabularies included translation equivalents and at the age of 30 months, the proportion of translation equivalents had risen to 54%.

**Syntactic complexity.** The mean length of the 10 longest utterances (MLU10) in FinSL and Finnish was analysed in Studies I and III, in order to gain knowledge on the syntactic complexity of the children’s utterances. The results of the mean MLU10 in FinSL and Finnish are presented in Figure 7 and the individual results in the Appendix 2. The results showed that at the age of 12 months, children produced single signs in their utterances more often than single words. However, the MLU10 in FinSL did not show a clear upward trend after the age of 18 months. On the other hand, after the age of 18 months, the increase in the MLU10 of spoken language utterances was clear and continued until the age of 36 months.

![Fig. 7. Mean length of the 10 longest utterances (MLU10) in FinSL and Finnish in video recorded play sessions during the data collection period.](image-url)
Statistical analysis based on the results of eight children (Study I) showed that the MLU10 in sign language and productive vocabulary in sign language (measured with the MCDI) correlated significantly with each other (Spearman’s correlation coefficient was .703, \( p = .000 \)). The MLU10 in spoken Finnish and productive vocabulary in Finnish (measured with the MCDI), also correlated significantly with each other (Spearman’s correlation coefficient was .911, \( p = .000 \)). More specifically, e.g., at the age of 30 months these correlations were .802 (\( p = .017 \)) and .905 (\( p = .002 \)), respectively.

Bilingual developmental paths and dominant language. In Study I, the results of the MCDI and the MLU10 were used to determine the children’s dominant language. Based on these results, the eight children studied were divided into two groups according to the development of productive vocabulary and syntactic complexity. According to the results in the MCDI, four of the children (Onni, Miina, Miisa and Riina) showed an upward trend in their productive Finnish vocabularies, but the development of productive FinSL vocabularies tended to be slower than that of spoken Finnish, and three children even showed a declining trend in FinSL vocabulary over time. Concordant with this finding, the MLU10 in FinSL remained rather short. Only two of these four children reached the value of 1.8 at the highest, and the scores of the other children were even lower than that. Thus, a data-based criterion was used in determining the language dominance of the children. The MLU10 in FinSL was found to divide the children into two groups. Thus, spoken language was judged to be the dominant language of Onni, Miina, Miisa and Riina.

The other four children studied (Lauri, Paula, Heidi and Ari), used longer sign language utterances (compared with the children who had a stronger spoken language development). Their MLU10 in sign language was higher than 2.1 on at least one data point. According to the results of the MLU10, children who had sign language as their dominant language outperformed the spoken language dominant children in the MLU10 of signed utterances at the age of 30 months (\( U = -2.323, p = .029 \)). However, no other significant differences were found in the MLU10 as a function of the children’s language dominance. These children’s MCDI results also showed that, during the data collection period, their FinSL vocabulary developed at a faster rate than their Finnish vocabulary. Sign language was, therefore, judged to be their dominant language. Due to large individual variations and the small number of children studied, a Mann-Whitney test showed that the total vocabulary did not vary by language dominance. Additionally, although FinSL dominant children had a mean of 124 signs more than words in their vocabulary, this difference was not significant. Comparably, spoken language dominant children’s
number of words produced outnumbered the number of signs in their productive vocabulary by, on average, 129 items. Again, this difference between the number of signs and the words in the vocabulary was not significant.

When looking more closely at the relationship between the linguistic environment and the child’s dominant language, dominance in linguistic environment was not associated with the child’s dominant language. Two children (Miina and Riina) who received strong spoken language input according to the parental interviews, were found to have spoken language as their dominant language (see Figure 8). Miisa’s language input was rather balanced between the two languages, and she used Finnish as her dominant language. Whereas, despite Onni having had rather strong exposure to sign language, his dominant language was spoken language. All of these four children had either (a) Deaf parent(s) who used simultaneous production of both signs and words (with vocalization) and/or contacts with other sign language users only rarely (see Table 2). On the other hand, two children (Paula and Lauri) who received strong sign language exposure were found to have FinSL as their dominant language. Additionally, Heidi, whose linguistic input was found to be balanced between FinSL and Finnish, used sign language as her dominant language. All three of these children had Deaf parents who mostly used sign language when communicating with their child and regular contacts with other sign language users. However, despite that Ari had strong Finnish exposure in his linguistic environment, according to the parental interviews, FinSL seemed to be his dominant language according to the MCDI and the MLU10. However, his language development was, overall, rather slow when compared to the other children.
In Study III, the spoken language competence of the KODA children was evaluated with the Reynell Developmental Language Scales at the age of 36 months. According to the Reynell test in Finnish, three children scored at the age level, three within –1 SD and two children within –2 SD (see Figure 9). The mean standard receptive, expressive and total scores of the KODA children studied were 92, 94 and 93, respectively. Individual scores are presented in Appendix 3.

It should be pointed out that the Reynell test measured only one language of the bilingual children. For instance, Lauri’s dominant language was FinSL according to the MCDI and MLU10. Thus, the Reynell test measured his non-dominant language, which was found to be clearly below age level. After the data collection period, the parents of Onni were informed by hospital personnel that he was diagnosed with SLI (Specific Language Impairment) which probably explains his low scores on the Reynell test and slow development of productive vocabularies according to the MCDI (see Figure 6).
Fig. 9. Relationship between the dominance in language input* and the child’s development in spoken language as measured by the total language score in the Reynell Developmental Language Scales.

*Children with strong sign language exposure (as reported by the parents) are marked with grey, children with rather balanced input with grey and white, and children who received strong spoken language exposure are marked with a white background colour.

5.1.3 Summary

The aim of the first research question was to explore the KODA children’s simultaneous development of sign language and spoken language and how the development was associated with the features in the children’s linguistic environment. The KODA children that were studied were found to have great variance in their linguistic environment. The sign language use by the Deaf parent(s) and regular contacts with other sign language users seemed to increase the sign language exposure of the children.

According to the results of the MCDI and the MLU10, sign language was found to be the dominant language of four children (Paula, Lauri, Heidi and Ari). During the data collection period, they produced more signs than words in the MCDI and they also produced longer utterances in sign language (MLU10) than the other four children. On the other hand, spoken language was the dominant language of four children (Onni, Miisa, Miina and Riina). They started to produce more words than signs, as shown by the MCDI while their MLU10 in sign language, showed hardly any increase.

When compared with the normative data of monolingual Finnish children in the Reynell Developmental Language Scales test, all of the children scored within -2 SD. One child (Onni) with low scores in the test was, after the data collection
period of the present study, diagnosed with SLI. However, only three children (Paula, Lauri and Riina) reached age-appropriate total vocabulary in the MCDI at 30 months of age, when compared with the norm values of monolingual Finnish children reported by Lyytinen (1999).

5.2 Features in the use of communication modes and languages by KODA children and their relationships with language competence and contextual variables (Studies I, II and III)

The aim of the second research question was to explore the features in the use of communication mode, language and code-mixing by KODA children, and to study how these factors were associated with contextual variables and language competence. Study II focused on the differentiated use of the languages (sign language and spoken language) and communication modes (manual, mixed and vocal) as a function of the language used by the children’s interlocutor(s). These results provide the view for the pragmatic differentiation in the KODA children. A more specific phenomenon of language use will be presented in the form of the KODA children’s use of code-mixing. Patterns of language use are presented in Study III.

5.2.1 Pragmatic differentiation

Differentiated use of languages. Children’s production of words and signs was analysed during three different play sessions (Figure 10) at the ages of 12, 18 and 24 months (Study II). Children were found to use their languages according to the language of their interlocutors. Statistically significant differences were found in the use of signs in the language used by the interlocutor (F = 25.794, df = 2, p = 0.000). When all the ages covered in Study II (12, 18, and 24 months) were combined, the KODA children used signs significantly more with their Deaf parent (mean 17.6 signs) than in the play session with the Deaf parent and the hearing adult together (mean 6.2 signs; Z = -3.043, p = .002), or with the hearing adult alone (mean 0.7 signs; Z = -3.922, p = .000). Use of spoken language words followed an opposite trend; the KODA children produced a mean of nine words when interacting with their Deaf parent, a mean of 31 words with the Deaf and the hearing adult together, and a mean of 30 words, when only the hearing adult was present. The number of words the 12- to 24-month-old KODA children produced when interacting with the hearing adult was significantly higher than the number of words
produced when playing with the Deaf parent ($Z = 2.573, p = .010$). In spite of the fact that the children modified their language use according to the interlocutor(s) they used more spoken words with the Deaf parent than signs with the hearing adult.

**Fig. 10.** Mean number of Finnish words and FinSL signs the KODA children produced when playing with different interlocutors at the ages of 12, 18, and 24 months of age.

**Differentiated use of communication modes.** The children studied were video recorded during three different play sessions and interacted with different interlocutor(s). The results of Study II clearly showed that the children used communication modes significantly differently as a function of their interlocutor(s). Thus, children were already able to show pragmatic differentiation in their pre-lexical expressions (see Figure 11). Children preferred to use manual modality (gestures and signs) when they interacted with their Deaf parent compared with the frequency of using a manual modality during other play sessions ($F = 21.895, \text{df} = 2, p = .000$). After the hearing adult joined the play session, the children increased their use of a vocal modality (spoken words and vocalization, $Z = 2.839, p = .005$) and decreased their use of the manual modality ($Z = -3.463, p = .000$). When
children interacted with the hearing adult alone, they continued to increase the use of the vocal modality (vocalization and spoken words) even more; the difference in the use of the vocal modality compared with the session with the Deaf parent was statistically significant ($Z = 3.564, p = .000$). Thus, by the age of 12 months, children preferred to use a manual mode (gestures and signs) when communicating with the Deaf parent and a vocal mode (phonated words and vocalization) when communicating with the hearing adult. On the other hand, the children used a mixed mode of communication and combined gestures or signs and vocalization or spoken words quite constantly during all three play sessions, at all data collection points. There were no statistically significant differences in these communication modes as a function of different interlocutors.

![Fig. 11. Use of different communication modes by KODA children during the three different play sessions at the ages of 12, 18 and 24 months.](image)

In addition to the differentiated use of communication modes, the results of Study II showed that children were also using manual modality (gestures, signs and gesture-sign combinations) differentially according to their interlocutors. The
analyses revealed that when the KODA children were playing with their Deaf parent, they clearly used a greater number of gestures (Z = -3.130, p = .002) and signs (Z = -2.387, p = .017) compared with other play sessions. Additionally, the number and type of gestures used by the children differed significantly according to the children's interlocutor(s) (F = 7.190, df = 2, p = .027). In essence, children clearly produced more and varied types of gestures when communicating with their Deaf adult compared to when communicating with the hearing adult. The difference in the point rate was also significant (Z = 2.400, p = .016). Depending on with whom the KODA child was communicating with, differences were detected in the number of other types of gestures, too. Conventional (F = 9.294, df = 2, p = .010), iconic (F = 6.200, df = 2, p = .045), and point gestures (F = 7.763, df = 2, p = .021) differed according to the interlocutor type, when all the data collection points were combined. Children were also found to combine gestures, signs and words in ways which differed according to the interlocutor(s) they were communicating with. The KODA children used a richer spectrum of different combinations of gestures, signs, and word(s)/vocalization when interacting with their Deaf parent than in other play sessions (see Figure 12). The most prevalent combination the children used in all the three play sessions was gesture+word/vocalization, and the children also used it in a significantly different quantity, with different interlocutors (F = 6.636, df = 2, p = .036). Sign-word/vocalization (F = 7.659, df = 2, p = .022), gesture+sign (F = 19.955, df = 2, p = 0.000), and gesture+gesture expressions (F = 12.061, df = 2, p = .002) were also combinations that were used differently as a function of different interlocutor(s) - mostly at a higher rate when communicating with the Deaf parent alone.
Fig. 12. Different combinations of gestures, signs, and words/vocalization produced by the KODA children during the three video recorded play sessions. The figures represent mean numbers during each 5-minute session averaged over the video recordings made at 12, 18, and 24 months of age.

These results showed that the KODA children were sensitive to the language of their interlocutors, even within the manual modality. Depending on the interlocutor, the children used the manual modality differently, not only in quantity, but also qualitatively. Despite all the communicative capacity they had within the manual modality, they avoided using signs, in particular, when communicating with the hearing adult.

5.2.2 Code-mixing in KODA children

Although the KODA children studied were found to use their communication modes and languages differently, according to the interlocutor(s), they were nonetheless found to mix their languages and communication modes (see Figure 11). A more detailed analysis on their use of code-mixing is reported in Study III.
The aim was to explore how the child’s language competence and contextual variables (that is, the interlocutor(s) the child is communicating with) affected the use of code-mix utterances by KODA children. In addition, the interest was also to describe the characteristics of code-mix utterances.

The results indicated that the KODA children clearly preferred to use code-blend utterances (simultaneous production of signs and spoken words within an utterance) over code-switch utterances (sequential production of signs and spoken words within the utterance). Of a total of 4,509 utterances produced by the children, 393 (9%) utterances contained code-blends, while code-switches were only used five times (0.1%). For this reason, the more thorough analysis focused on code-blend utterances.

The code-blend utterances were classified into four different categories: Finnish base code-blends, where Finnish was the leading language, FinSL base code-blends, where the FinSL was functioning as the base language, Equally strong, where both languages conveyed the same meaning and, Combined, where the languages carried different semantic content. Children clearly preferred to produce semantically equivalent words and signs. For this reason, the Combined type of code-blends, where the signed and the spoken part conveyed semantically different meanings was used less often (see Figure 13).
When analysing how language competence was associated with the use of code-blend utterances (Study III), it was found that along with a growing linguistic competence (indicated by the results of the MCDI and the MLU10), children increased their use of code-blended utterances at the age of 24 months (see Figure 13). At the age of 24 months, the size of the total productive vocabulary of the KODA children studied contained, on average, 330 items and the mean MLU10 in sign language and in spoken language was between 1.6 and 2.7. Before the age of 24 months, there were only a few code-blends produced by the children. This result refers to the fact that the child has to have enough language competence in order to be able to produce code-blend structures. Despite the fact that the code-blend occurrences increased by age ($F = 16.451$, $df = 4$, $p = .002$) with the highest numbers found at the age of 36 months, pairwise post-hoc testing did not show any age effects in the number of code-blends produced.
The child’s language dominance and the amount of code-blended utterances were not interrelated; both children with FinSL and children with Finnish as their dominant language produced code-blends. Although no statistically significant associations existed between language dominance and the use of code-blends, some interesting trends were seen. The KODA children whose dominant language was sign language used code-blend structures in 11% (N = 248) of their utterances (N = 2 252), whereas the children who had spoken language as their dominant language produced code-blends, on average, in only 7% (N = 156) of all of their utterances (N = 2 257). Additionally, the sign language dominant group produced FinSL-based code-blend utterances in 29% (N = 72) of their code-blend utterances, whereas the other group used this type of code-blend in only 8% (N = 12) of their code-blend utterances. The *Equally strong* code-blend structure was the most prevalent type of code-blend in both groups.

According to the scores obtained on the Reynell Developmental Language Scales, the children were divided into two groups, the one with children who had scores within -1 SD on the test (which included Paula, Heidi, Miina, Miisa and Riina) and the one with children who scored within -2 SD either in the receptive, expressive or total score of the test (which included Lauri, Onni and Ari) (Study III). The children with age-appropriate scores on the test used code-blended utterances, on average, in 10% (mean N of utterances produced by each child = 63) of their utterances (mean N per child = 601). The children who had lower than -1 SD in the test produced code-blended utterances, on average, in 5% (mean N = 26) of their utterances (mean N per child = 501). However, according to Spearman’s correlation coefficient, no statistically significant correlation existed in the number of code-blends produced and the results of the Reynell test.

*The association between contextual variables and the use of code-blends.* Results of Study III showed that the KODA children used code-blended utterances differently according to their interlocutor(s) (F = 16.000, df = 2, p = .000). The children produced 68% of all of their code-blend utterances when they were interacting alone with their Deaf parent and only 7% when playing alone with the hearing adult. This means that 16% (N = 267) of all the 1 662 utterances produced when playing with the Deaf parent were code-blended, whereas with the hearing adult only 2% (N = 26) out of a total of 1 478 utterances produced were code-blended. This is shown in Figure 14. During the session where both the Deaf and the hearing adult were present, 7% (N = 100) of the children’s utterances were code-blended. The number of code-blends produced when communicating with the Deaf parent and the hearing adult differed significantly from the number of code-blends...
produced with the Deaf parent ($Z = 2.524, p = .012$) and the number of code-blends produced when communicating with the hearing adult ($Z = 2.524, p = .012$).

![Chart](chart.png)

**Fig. 14.** Mean proportion of code-blended utterances by the children when communicating with different interlocutors. The total number of all utterances produced by the children in each play session is mentioned under the bars.

Children used Equally Strong code-blends during all of the play sessions (see Figure 15). However, when the children were interacting with their Deaf parent, they preferred to use the FinSL base code-blends, a code-blend type that was hardly ever used when communicating with the hearing adult. Furthermore, Finnish base and Combined code-blends were the two less used code-blend types with the Deaf parent. However, when the children were communicating with the hearing adult, the Finnish base code-blends were the second most used code-blend type.
Fig. 15. Mean proportion of different types of code-blends of all the code-blended utterances produced when communicating with different interlocutors. The total number of code-blend utterances produced in each play session is mentioned under the bars.

In the video recorded play sessions, it was observed that four of the Deaf parents (those of Paula, Onni, Miisa and Ari) produced code-blends in at least 43% (with a mean of 54%) of their utterances, whereas the other four Deaf parents (those of Lauri, Heidi, Miina and Riina) clearly preferred to use only FinSL in their utterances. Three of these parents did not use code-blends at all, and one parent (that of Heidi) used code-blended utterances in only 16% of the utterances she produced. For this reason, the Deaf parents and their children were divided into two groups depending on the number of code-blended utterances used by the parents (see Figure 16). However, there was no association between the Deaf parent’s and their child’s use of code-blends. The children in the two groups used approximately the same number of code-blends regardless of the number of code-blended utterances produced by their parents.
Fig. 16. Mean proportion of code-blended utterances produced by the Deaf parents and their KODA children. The total number of utterances produced by the children and their parents is presented below each bar.

**Characteristics of the code-blended utterances.** The base language in code-blended utterances provided the syntactic structure and more words or signs into the code-blend utterances than did the embedded language (see code-blend Examples 1 and 2 below). The MLU was naturally higher in the base language than in the embedded language (see Table 9). In particular, the Finnish base and FinSL base utterances in the base language were mostly accompanied with single words or signs from the embedded language. This was also shown in the MLU results for the code-blends.

The mean length of all code-blend utterances was 2.3. When analysing the spoken and signed parts separately, it was found that the mean MLU in words was 1.9 and in signs, 1.7. This means that the spoken parts of the code-blend utterances contained slightly more words than the signed parts contained signs, which can partly be explained by the different morphosyntactic structure of these languages.
The most used code-blend type, Equally strong, had the shortest MLU and was mainly used for naming objects or events. On the other hand, Combined code-blend utterances were used less (see Figure 14) by the children, but utterances belonging to this category had the longest MLU compared with other code-blend types. In the transcription, a hyphen between two signs is used to illustrate that the child produced only one sign, but to present it in the written transcription form, two or more words are needed.
Table 9. MLUs in the code-blended utterances (N = 393) produced by the KODA children between the ages of 12 and 36 months.

<table>
<thead>
<tr>
<th>Code-blend type</th>
<th>MLU of the whole utterance</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>MLU calculated separately for words</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>MLU calculated separately for signs</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finnish base</td>
<td>2.8</td>
<td>1.4</td>
<td>1</td>
<td>8</td>
<td>2.8</td>
<td>1.4</td>
<td>1</td>
<td>8</td>
<td>1.2</td>
<td>0.5</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>FinSL base</td>
<td>1.9</td>
<td>1.1</td>
<td>1</td>
<td>7</td>
<td>1.3</td>
<td>0.6</td>
<td>1</td>
<td>4</td>
<td>1.9</td>
<td>1.1</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Equally strong</td>
<td>1.3</td>
<td>0.7</td>
<td>1</td>
<td>5</td>
<td>1.3</td>
<td>0.7</td>
<td>1</td>
<td>5</td>
<td>1.2</td>
<td>0.6</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Combined</td>
<td>3.3</td>
<td>1.5</td>
<td>1</td>
<td>8</td>
<td>2.3</td>
<td>1.4</td>
<td>1</td>
<td>7</td>
<td>1.8</td>
<td>1.0</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Mean</td>
<td>2.3</td>
<td>1.1</td>
<td>1</td>
<td>8</td>
<td>1.9</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>1.5</td>
<td>0.8</td>
<td>1</td>
<td>7</td>
</tr>
</tbody>
</table>
Some examples are presented here to describe the data.

1) A Finnish base code-blend utterance within its translations (signs produced are written in capital letters) produced by Riina, at 30 months of age

Finnish: Pupu vaihtaa toiset vaatteet.
Translation: The bunny is changing other clothes.
FinSL: PUPU TOINEN VAATTEET-PÄÄLLE
Translation: BUNNY OTHER PUT-CLOTHES-ON
Free translation: "Bunny is changing clothes."

2) A FinSL base utterance with its translations produced by Ari, at 36 months of age

Finnish: omena
Translation: apple
FinSL: osoituskirja OMENA MISSÄ
Translation: pointbook APPLE WHERE
Free translation: "Where is the apple?"

3) An Equally strong code-blended utterance produced by Miisa, at 20 months of age

Finnish: niin pupun nenä
Translation: yes bunny’s nose
FinSL: nyökkäys PUPU NENÄ
Translation: nod BUNNY NOSE
Free translation: "Yes, (that is) bunny’s nose."

4) Combined code-blend utterance produced by Paula, at 30 months of age

Finnish: oho pumpu auto pumps
Translation: oops (onomatopoetic) car (onomatopoetic)
FinSL: TÖRMÄTÄ osoituskirja TÖRMÄTÄ
Translation: CRASH pointbook CRASH
Free translation: "Oops, the cars are crashing, ‘bumps’.”

Use of deviant structures in spoken language is a clinically important topic. For this reason, a more detailed analysis was performed to find out whether non-adult like structures can be found in Finnish code-blended utterances and if they exist, to
identify the characteristics of these structures. It was found, however, that most of the
time children managed to build the utterances in a way that did not violate the
structures of Finnish language. Only 25 (6%) utterances of all of the code-blended
utterances produced (393) contained a non-adult like structure in Finnish. The usual
non-adult like structures were: deviant word order (see Example 5a below; Object-
Verb order), missing syntactic structure (see Example 5b below; missing copula) and
missing inflections (see Example 5c below; missing suffix). Thus, the
utterances usually followed the morphosyntactic structure of the base language or
were produced in a way that followed the grammar of both languages. The code-
blend utterances were, therefore, found to be highly systematic and synchronized
in nature. However, due to the early phase of language development, code-blended
utterances were rather short, as can be seen in Figure 13 and Table 9, which partly
explains the low number of non-adult-like structures in Finnish.

5) Examples of non-adult like word order, missing inflection and missing copula in
Finnish and their translations.
a) Object-Verb order produced by Heidi, at 36 months of age
Finnish: TV kattoo (correct form: katsoo TV:tä)
Translation: TV watch
FinSL: KATSELLA
Translation: WATCHING
Free translation: "(He) is watching TV."

b) Missing copula produced by Lauri, at 24 months of age
Finnish: perhonen se perhonen
Translation: butterfly that butterfly
FinSL: YKSI-KAPPALE PERHONEN
Translation: ONE BUTTERLY
Free translation: "One butterfly"

c) Missing suffix produced by Miina, at 24 months of age
Finnish: tyttö nukkua (correct form: tyttö nukkua)
Translation: girl sleep
FinSL: osoituskirja NUKKUA
Translation: pointbook SLEEP
Free translation: "Girl is sleeping."
5.2.3 Summary

Taken together, these results revealed that the KODA children were able to accommodate their pre-lexical expressions according to their interlocutor(s) at an early age. Children preferred to use a manual communication mode when interacting with the Deaf parent and vocal communication when interacting with the hearing adult. With the Deaf parent, the children used a higher number and more varied types of gestures and signs, while with a hearing adult they used a smaller number and less varied types of gestures and hardly any signs at all. Thus, the ability for pragmatic differentiation was already detected in their pre-lexical expressions.

The results of code-mixing showed that KODA children clearly preferred to use code-blends over code-switch structures in their code-mixing. The most commonly used type of code-blend was Equally strong where the children simultaneously produced semantically equivalent Finnish words and FinSL signs. In order to be able to code-mix, children need to have enough language competence in their languages. The KODA children mainly used code-blend structures when communicating with their Deaf parent, which indicates both pragmatic differentiation of languages and acquisition of social patterns of code-mixing from the environment. Additionally, code-blend utterances were semantically congruent and obeyed the syntactic structure of both languages.
Table 10. The research questions and summary of the results.

<table>
<thead>
<tr>
<th>Research question</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>How are sign language and spoken language simultaneously developing in KODA children and how is this development associated with the features in their linguistic environment?</td>
<td>The development of productive vocabularies of sign language and spoken language was clearly slower than the development of productive vocabulary of Finnish monolingual age peers. However, in three children, the total vocabulary of the KODA children were developing at approximately the same rate as the productive vocabulary of their age peers. Children were able to produce longer utterances in spoken language than in sign language. Sign language was the dominant language of five children and spoken language was the dominant language of five children. Sign language, as a minority language, was more at risk of not developing alongside the spoken language.</td>
</tr>
<tr>
<td>What kinds of features do KODA children have in their use of communication mode, language and code-mixing and how are they associated with contextual variables and language competence?</td>
<td>KODA children showed pragmatic differentiation by 12 months of age by using their languages and communication modes according to their interlocutors. Children preferred to use code-blends, not code-switches, in their code-mix utterances and code-mixing did not usually violate the grammar of either acquired language. Children needed to have enough language competence in both of their languages in order to be able to use code-blend structures. Children clearly used more code-blend utterances when communicating with their Deaf parent than with a hearing adult. Thus, contextual variables affected their use of code-blends.</td>
</tr>
</tbody>
</table>
6 Discussion

Since KODA children are acquiring two languages with clearly different structural properties, information on their language development can broaden the understanding of the children’s capability to acquire and use languages in general. Accordingly, two aims were established in the present study. The first aim was 1) to describe the developmental paths of simultaneous sign language and spoken language acquisition, and to investigate how that development is associated with the linguistic environment of the children studied. The second aim was 2) to explore how the KODA children use their two languages that are represented in two different modalities and how the patterns in their language use are associated with the features in their linguistic environment, language competence and contextual variables. In the following, the main results that were obtained will be discussed reflecting these two aims from both a practical and theoretical perspective.

6.1 Developmental paths of KODA children’s bilingual language acquisition

Development of vocabulary. The first aim of this study was to describe the developmental paths of simultaneous sign language and spoken language acquisition. Previous studies suggest that bilingual children acquire the basic milestones of language development on par with their monolingual age peers (De Houwer, 1990, De Houwer et al., 2013; Paradis & Genesee, 1996; Petitto et al., 2001). Different arguments on the pace of bilingual development have, however, been presented. Some researchers have stated that the development of bilingual children has been found to be comparable with monolinguals in both of their languages (see, e.g., De Houwer et al., 2013; Petitto et al., 2001) while others have argued that the languages of bilingual children are developing slower than in monolingual development, but when one takes into account their language competence in both language (e.g., their total vocabulary) the development is comparable with their monolingual age peers (see, e.g., Core, et al., 2013 and Hoff et al., 2012). The heritage language might show incomplete development and the differences e.g. in vocabulary and grammatical areas between a heritage language and the primary language of monolinguals have been shown in many studies (see a review by Montrul, 2010). The results of the present study supported the later view by showing that the KODA children’s development of productive vocabulary in FinSL and Finnish measured with the MCDI between the ages 12 and 30 months.
was, on average, slower compared to the expected development of age peers acquiring Finnish. In addition, the individual paths demonstrated the great variability in language development: only one child had development in productive vocabulary in both languages that was on par with the vocabulary age norms in Finnish, and the rest of the children had distinctively individual developmental paths. Moreover, five children’s development in total vocabulary, assessed with the MCDI, was somewhat slower than that of their monolingual age peers. This may, however, be partly related to the methodological challenges discussed later in this chapter.

Differences in vocabulary development between bilingual and monolingual children have often been discussed in previous research. A slower developmental rate in one language of bilingual children when compared with monolinguals has been explained as being related to the relative amount of input from two languages, the children’s overall cognitive capacities in language acquisition and the rate of acquisition of new lexical items, which in bilingual children are divided between two languages instead of one (see, e.g., Gathercole & Thomas, 2009; Genesee, 2006; Hoff et al., 2012; Pearson et al., 1993, 1997). The acquisition rate of new lexical items has been found to be similar between bilinguals and monolinguals when the total vocabulary of bilingual children has been studied. Among bilinguals, however, lexical items are divided between two languages, and for this reason, the vocabulary of a single language is naturally smaller compared to the vocabulary of monolinguals (Core et al., 2013; Hoff et al., 2012; Pearson et al., 1993). Bilingual children’s language exposure and context for language learning are also divided between two languages. It has, therefore, been suggested that due to the divided input between two languages, it takes more time for a bilingual child to acquire sufficient vocabulary and specific structural features in both languages compared to monolinguals, who receive the total language exposure and learning context from one language only (see, e.g., Cote & Bornstein, 2014). Concordant with this background, in six of the eight KODA children explored in the present study, the vocabulary size in both FinSL and Finnish was smaller than the vocabulary in Finnish of their monolingual peers, although the total vocabulary in three of the children was equal to that of the monolingual children. However, this does not exclude the possibility that a bilingual child is capable of acquiring both languages at the same rate as monolinguals, as could be seen in this study with one child, Paula.

Based on the results of the MCDI and the MLU10 for both FinSL and Finnish in this study, five of the KODA children were judged to have FinSL and five of the
children Finnish as their dominant language. According to the MCDI, those children whose dominant language was Finnish, not only produced more spoken words than signs but also the length of their signed utterances was shorter compared with those of the other children studied. On the other hand, children who were dominant in FinSL not only produced more signs and fewer words, according to the MCDI, but also longer sign language utterances compared with the other children studied. It has been found in monolinguals that vocabulary growth precedes morphosyntactic abilities. Similar developmental patterns have also been found in bilingual children. However, previous studies suggest that morphosyntactic development can be language specific in bilingual children and especially tied to lexical development in a particular language. This means that the vocabulary growth in one language precedes the morphosyntactic abilities in the same language, but no effects are found across the two languages (Conboy & Thal, 2006; Marchman, Martinez-Sussmann & Dale, 2004; Paradis, Nicoladis, Crago, & Genesee, 2011; Parra, Hoff & Core, 2011). This kind of developmental trend was also found in the KODA children of the present study as the results of the MCDI and the MLU10 showed significant correlation with each other, in both languages. However, because the data were collected at six-month intervals, it was not possible to determine if there were any language spurts at some phase of development.

In spite of different language dominance and clear individual variation in the developmental paths among the children studied, spoken language development did not clearly lag behind the sign language development in any of the children, according to the results of the MCDI. On the contrary, the opposite was true; there were children whose sign language development clearly lagged behind their spoken language development or even slowed down during the data collection period. Additionally, the mean MLU10 in sign language showed that, on average, the children’s utterances in sign language were rather short with no clear developmentally upward trend. These results tentatively suggest that it is actually the sign language that may be more at risk of not developing well alongside the spoken language rather than the opposite (which professionals usually find concerning). Thus, it was found that sign language, in particular, seemed to contribute to the favourable development of bilingualism in the KODA children. This finding is in accordance with previous studies, which have shown that, compared to the majority language, bilingual children’s minority language may need more support and special efforts to secure its development (Gathercole & Thomas, 2009; De Houwer, 2007; Pearson, et al., 1997; Unsworth, 2013). Proficiency in a heritage language has been found to vary considerably, but most
often it has been reported to be the non-dominant language of the heritage speakers. Recent studies on heritage language have suggested that heritage speakers are a unique group with special features in their language learning and are different from monolinguals and second language learning (Montrul 2010; Piers & Rothman, 2009; Rothman, 2007, 2009). Based on previous research, Montrul (2010) proposes, in her review, that the special characteristics of a heritage language can be considered to be caused by language contact situations, the emergence of new linguistic varieties and diachronic language change.

*Linguistic environment and its association with bilingual language development.* The great variation in the linguistic environments of the KODA children that was found in this study underlines the importance of examining the whole linguistic environment in which the bilingual language development takes place. Together with the child’s individual capacity to acquire languages (e.g., attentional, perceptual, auditory processing and memory skills), linguistic environment has an important role in the bilingual language development and linguistic identity of bilingual children (Garnercole & Thomas, 2009; Hoff, Welsh, Place & Ribot, 2014; De Houwer, 1998; 2007; Pearson, 2007; Wong Fillmore, 2000). However, due to the small community of the sign language users, parents had greater difficulties finding sign language exposure for their children compared to the spoken language exposure that the KODA children received from their daily environment. Additionally, bilingualism of Deaf parents was shown in six families where the Deaf parent(s) mostly used simultaneous production of signs and spoken words in their utterances when communicating with their hearing child.

It has been shown that mixed language use is a common feature among sign language users (Van den Bogaerde, 2000; Pizer, 2008; Preston, 1994; Wilhelm, 2008) and this pattern in parents’ language use may decrease the amount of sign language exposure received by KODA children (Van den Bogaerde, 2000; Singleton & Tittle, 2000). Van den Bogaerde (2000) suggested in her study that frequent use of language mixing by Deaf parents was connected with the slow development in the size of KODA children’s (N = 3) expressive vocabulary and syntactic complexity in sign language. In unimodal bilingual children, the negative influence of mixed language exposure on bilingual language development has been reported, for example, by Byers-Heinlein (2013). Similarly, Pearson (2007) argued that one parent who speaks the minority language, or parents who are bilingual, may possibly not secure enough input in the minority language for that language to develop in their children. On the other hand, a bilingual child, whose both parents speak the minority language, have been found to be more exposed to the minority
language, and this has had a positive influence on the development of the child’s minority language (De Houwer, 2007; Place & Hoff, 2011). For this reason, these researchers highlighted the importance of contacts with other minority language users, which has been found to support the child’s development in the minority language. Due to the small number of children studied in this research, it was not possible to investigate the association between the mixed language exposure and language development in KODA children, but, this topic definitely needs to be researched in further studies. However, according to the parental interviews, children, whose both parents were Deaf, seemed to receive more sign language than spoken language exposure.

When the association of linguistic environment and bilingual language acquisition has been studied, the relative amount of input from each language has been found to influence the language dominance of a bilingual child (see, e.g., Gathercole & Thomas, 2009; Hoff et al., 2012; Paradis, 2011; Place & Hoff, 2011; Thordardottir, 2011). It has been suggested that the language with stronger exposure will become a child’s dominant language, and in cases where there is a more balanced exposure between the languages, input will also lead to a more balanced competence in these languages (Hoff et al., 2012; Pearson, 2007). In this study, the results did not suggest a clear association between the relative amount of input and the language dominance of the KODA children. The relationship between the exposure and the developmental path of bilingualism in these children, therefore, turned out to be more complicated than the concept of relative amount of input originally suggests.

In this study, sign language did not always develop favourably among the children who did not receive sign language exposure regularly and/or whose Deaf parent used simultaneous production of signs and speech when communicating with their KODA child. It is possible that the children who do not receive a strong enough exposure in sign language and are struggling in the development of sign language may even be heading toward passive bilingualism, that is, they are able to understand sign language but are not competent enough for production (De Houwer, 1998; 2007; Pearson, 2007; Wong Fillmore, 2000). On the other hand, two children, Paula and Lauri, in the present study, with the strongest sign language exposure at home and outside the home were found to be dominant in FinSL. Moreover, the results showed a great individual variation between the linguistic environment and the bilingual language development in the KODA children. For this reason, the association between specific aspects in the KODA children’s linguistic environment and their language development in this study, should be
made with great caution. Different methodological decisions, e.g., more careful and repetitive evaluation of linguistic environment of KODA children, should be taken into account in further studies. Again, the concept of a relative amount of input may not be that straightforward in explaining the different phenomena in language production, especially in the case of a heritage language, when there is a clear difference in the status of the acquired languages. Additionally, there may be other factors that influence the language development and dominance of a bilingual child. These factors can be related to, for example characteristics of the child (e.g., difficulties in language development), heritage language (e.g. status of the minority language), as well as environmental factors (the quality of language exposure).

According to some studies, the minority language may need more exposure and effort from the environment than the majority language in order to develop sufficiently, whereas the development in the majority language has proven to be quite unproblematic (De Houwer, 2007; Gathercole & Thomas, 2009; Unsworth, 2013). In order to secure the development of both of the languages of KODA children, there seems to be a need for at least a balanced or, more preferably, a stronger exposure to sign language than to the spoken language. Place and Hoff (2012) found that the number of different conversation partners and sources of language exposure and higher proportion of language exposure from native speakers positively predicted the language development, in the particular language, of a bilingual child. These findings also support the general theories on language acquisition of monolinguals; both the amount and the quality of the input predict the language development of monolingual children (see, e.g., Tomasello, 2003). Bilingual children’s experiences from each language shape the bilingual development and the development of a particular language (Gathercole & Thomas, 2009; Hoff et al., 2012; Place & Hoff, 2012; Pearson et al., 1997).

6.2 Differentiated use of languages and code-mixing

The second aim that was addressed in this study was to describe the features of the language use and code-mixing in the studied KODA children. Due to the bimodal bilingualism of these children, there are some unique features in their language production. When it comes to language differentiation, it is easier to detect the language that the young KODA child is using compared with unimodal bilingual children as the languages are produced in two different modalities. This makes KODA children a particularly interesting target for research, as language differentiation can be explored with them at a young age. Moreover, these children
are able to produce their languages simultaneously, which is the type of code-mixing not found in unimodal bilingual children. Pragmatic differentiation was studied in the KODA children of this study between the ages of 12 and 24 months, and code-mixing from the age of 12 months through the age of 36 months.

The question of pragmatic differentiation provides knowledge about young bilingual children’s ability to use and process their languages differentially, and thus communicate effectively in a bilingual context. In addition to production of linguistic structures, KODA children growing in a bilingual environment also need to learn to make appropriate choices in their language use depending on their interlocutor. Thus far, the studies on unimodal bilingual children have been able to show pragmatic differentiation mostly when the children studied have had enough lexical resources and language competence to really demonstrate the ability to accommodate their language use according to the language of their interlocutor (see e.g., Comeau et al., 2003; Deuchar & Quay, 2000; Genesee et al., 1995; Montanari, 2009; Nicoladis & Genesee, 1996; Nicoladis & Secco, 2000). Two-year-old children have usually been found to show pragmatic differentiation of their languages and only a few studies have been able to report children’s pragmatic differentiation before that age (Andruski et al., 2014; Maneva & Genesee, 2002). The results of this study showed that the KODA children were clearly able to modify their language use before the age reported in previous studies on unimodal bilingual children. Despite their limited vocabulary, the KODA children studied already preferred to use sign language with their Deaf parent and spoken language with the hearing adult at the age of 12 months; the age when the data collection began.

In addition to the differentiated language use, pragmatic differentiation was also looked at by exploring the way the KODA children used different communication modes and gestures. Regardless of the language(s) they are exposed to, all children use gestures during the early phases of their language development (see, e.g., Nicoladis, Pika & Marentette, 2009; Nicoladis, Mayberry & Genesee, 1999; Sherman & Nicoladis, 2004). As gestures, however, have a different role in sign language compared to spoken language, pragmatic differentiation in the KODA children could also be seen in their use of communication modes and especially in their use of gestures with different interlocutors. With the Deaf parents, the KODA children that were studied used the manual modality more often (shown by the number of gestures and signs used) and in a more diverse way (shown by the number of different types of gestures and gesture, sign, and word combinations) compared to the use of communication
modes and gestures with the hearing adult. Sign language exposure has been found to affect the amount and quality of gesture use among children and adults (see, e.g., Capirci et al., 2002; Casey & Emmorey, 2009; Morgenstern et al., 2010). KODA children’s differentiated use of gestures with different interlocutors as found in this study, may possibly indicate that these children are already conventionalizing gestures to become a part of the sign language’s linguistic structure (see also Hoiting & Slobin, 2007; Petitto, 1988). It remains undetermined whether the ability to show pragmatic differentiation already takes place before the age of 12 months, the start point of the present study. All in all, these results show even very young children’s sensitivity in communicating with others and their high competence in modifying their communication during interaction with different interlocutors.

The use of mixed modality (which includes both signs, gestures and words, and vocalization) by the studied KODA children was essentially equal for the different interlocutors and across the data collection points between the ages of 12 and 24 months (Study II). However, the use of code-blend utterances, where both sign(s) and word(s) were produced simultaneously in the same utterance, became more common in children’s utterances at the age of 24 months and onwards. Many different factors affecting the code-mixing of bilingual children have been proposed in the research literature. Consistent with earlier studies (e.g., Van den Bogaerde & Baker, 2008; Genesee et al., 1995, Paradis et al., 2000), this study showed that at the age of 24 months, code-blend utterances become more common. According to the MCDI results, at the age of 24 months seven out of eight children had passed the first 50-word milestone in both of their languages. At this stage the children commonly started producing two-word utterances. This implies that in order to be able to produce code-mix utterances, a bilingual child needs to have enough language competence in both acquired languages and the ability to combine two lexical units in one utterance (Baker & Van den Bogaerde, 2008; Montanari, 2009; Pearson et al., 1997; Nicoladis & Secco, 2000). Due to the small number of children and heterogeneity of the results in this study, statistically significant relationships were not found, either between the age and use of code-blends by the KODA children, in their language dominance or in the results of the Reynell Developmental Language Scales. However, this topic warrants further research with a larger data set. The Gap-Filling Hypothesis introduced in the studies on unimodal bilinguals (e.g., Genesee & Nicoladis, 2007; Nicoladis & Secco, 2000) was not supported by our results. The KODA children studied clearly preferred to produce Equally Strong code-blends, where semantically congruent signs and words were produced simultaneously. Furthermore, the Combined code-blends,
that included semantically distinct information in signed and spoken parts of the utterance, were clearly the less used code-blend type. Thus, the main reason for code-mixing may not be to fill in vocabulary shortcomings, as suggested by the Gap-Filling Hypothesis (e.g., Genesee & Nicoladis, 2007; Nicoladis & Secco, 2000).

Statistically significant associations were found between some contextual factors and the children’s use of code-blends. This finding was in line with previous studies (Greene et al., 2013; Lillo-Martin et al., 2014; Paradis & Nicoladis, 2007). The KODA children were more likely to code-blend when they were communicating with their Deaf parent than with a hearing adult. Similar findings have been reported by Lillo-Martin et al. (2014) in their research. In agreement with this finding, unimodal bilingual children have also been observed to use code-mixing more often when using the minority language than the majority language of the community (see, e.g., Paradis & Nicoladis, 2007). Additionally, the frequent use of code-blending by the KODA children may be related to the general discovery that bilingualism and the prevalent use of code-blends are also common features among adult sign language users. One can hypothesize that these normative patterns of code-blending that the KODA children seem to have acquired from their environment, were already guiding their use of code-blends with different interlocutors during the early phases of their language development. Use of code-blends seemed to be more natural with the Deaf parent than was its use with a hearing person. During the video recorded play sessions, code-blend used by the Deaf parent did not, however, influence use of code-blends by their hearing child.

The results of the present study on pragmatic differentiation and use of code-blended utterances support the findings of previous studies, which propose that both languages of bilingual persons are activated at all times and bilinguals borrow different constructions, for example, phonological, morphologic, syntactic ones from one language to another (Casey & Emmorey, 2009; Emmorey et al., 2008; Kroll, Bobb & Wodniecka, 2006; Nicoladis & Genesee, 1996; Shook & Marian, 2012). Since KODA children clearly preferred to use code-blended utterances rather than code-switched, this finding in the present study supports the view that both languages of a bilingual person are activated. Thus, it is easier to produce both languages simultaneously than to suppress one language when using the other. Based on previous studies the language production process does not require early language selection. Thus the selection of two linguistic representations can be made simultaneously without causing an extra burden, unlike that which complete inhibition of the unselected language causes (Casey & Emmorey, 2009; Emmorey
et al., 2008; Kroll, Bobb & Wodniecka, 2006; Lillo-Martin et al., 2014; Petitto et al., 2001; Shook & Marian, 2012).

However, as the KODA children clearly used more code-blended utterances with the Deaf parent than with a hearing adult, this result supports the hypothesis of Asymmetric Inhibition (see, e.g., Costa & Santesteban, 2004; Green, 1998; Lillo-Martin et al., 2014; Meuter & Allport, 1999), which in this study was dependent on the context where the communication took place. Lillo-Martin and her research group (2014) had similar findings and they suggested that the difference in the use of code-blends according to the interlocutor could be caused by the processing cost in the inhibition of the unselected language, as well as the constraints on the use of code-blended utterances that was driven by the linguistic environment. Thus, in this study, the results showed that the KODA children clearly avoided using code-blended utterances when communicating with the hearing adult by inhibiting sign language more than they did spoken language, when interacting with the Deaf parent. For this reason, it seemed that it is more acceptable to code-blend with the Deaf parent than with a hearing adult. This possibly indicates that children are acquiring the model and normative patterns for language use and code-blending from their linguistic environment and that the community around them rather than solely from their home. Hearing people hardly ever have knowledge of sign language, whereas the common use of code-blends among sign language users has been widely reported (Van den Bogaerde, 2000; Petitto et al., 2001; Prinz, 2008). Furthermore, in the same way as Prinz (2008) found in his study on English and ASL, the KODA children, in this study, leaned towards Finnish by using more code-blending when communicating with the Deaf parent rather than using only FinSL and decreased the use of FinSL during the two other play sessions, where a hearing person was present.

The semantic content and structure of the code-blended utterances was also of interest in this study. It was found that the KODA children used semantically congruent signs and words and that the structure of the utterances in four different code-blend types was synchronised and systematic in nature, as was noted in previous research as well (Van den Bogaerde, 2000; Van den Bogaerde & Baker, 2008; Emmorey et al., 2008 Petitto et al., 2001). Additionally, the number of non-adult-like structures was rather low. These findings provide important knowledge about the KODA children’s ability to acquire, process and use two languages in two different modalities. Namely, in order to produce code-blended utterances, the KODA children needed to have access to the grammars of the participating
languages simultaneously and enough knowledge and competence to synchronize both languages during the production process.

The results showing that children were already able to pragmatically differentiate their languages at the age of 12 months and that they produced code-blend utterances in a structured and synchronised way supports the Dual Language System Hypothesis. These findings suggest that with the simultaneous acquisition of two languages, KODA children are also acquiring the abilities to modify their expressions according to the requirements of the communication in the bilingual contexts, early on. The children studied demonstrated highly sophisticated skills in the modification of their language use and level of code-blending, according to the language of the communication partner. These findings suggest that the potential young children have in their language acquisition may be even higher than we can conclude on the basis of previous studies.

6.3 Clinical implications

Language testing. In this study, the interviewed parents expressed their concerns about the language development of their children. They were also sensitive to this kind of concerns expressed by people around them. Four out of ten of the children studied had had contact with a speech and language therapist during the data collection period. In productive vocabulary of Finnish (measured by the MCDI) three, and in the Reynell test, two to three of the children showed a delay in their linguistic development in Finnish. Still, only tentative implications with respect to the development of the KODA children can be made due to the small amount of data in this study. In addition, there are only a limited number of previous studies on this subject, and they mostly comprise case studies or only small groups of children. Furthermore, as was noted in this study, KODA children, just like other bilingual children, form a highly heterogeneous group, both by their language development and by their linguistic environment. This makes it extremely difficult or even impossible to identify normative patterns of bilingual language development.

Due to their heterogeneity, language development of the bilingual children should be evaluated by multiple tools in both languages in order to gain a complete knowledge of the language competence in each language, as also proposed by Chen Pichler et al. (2014). Furthermore, it is important to assess the language context in which the development takes place. Only in this way, can understanding be achieved as to their bilingual linguistic competence. The clinicians working with
bilingual children, however, are faced with many challenges. Despite the fact that the development of bilingual children should not be compared with the development of monolinguals, clinical conventions are contradictory to this need. Professional tests and other evaluation tools for language acquisition and development are mainly designed for and normed on monolinguals. In the cases where a speech and language therapist is able to test both of the languages of a bilingual child, there are no guidelines on how to describe the findings of individual tests from individual languages. This is a challenge that especially arises in situations where the child scores somewhat below the monolingual norms in both languages (Thordardottir et al., 2006). Additionally, testing the two languages separately does not naturally tell about the relationship between the languages. This situation is complex for professionals and requires that they be acquainted with the theoretical knowledge of childhood bilingualism. From time to time, the clinicians are also faced with the situation in which they meet a bilingual child who is acquiring a language pair that has not been previously studied at all or that the existing previous research is very limited. Moreover, the clinician may not be familiar with one of the languages the child is acquiring or the cultural background of the family. This is often the case with KODA children. In spite of that, the speech and language therapist should be able to recognize the typical and deviant characteristics of bilingual language development. It is clear, that due to a lack of information and assessment tools for language acquisition of KODA children, a distinction between typical and deviant development is highly challenging to make.

Assessment of vocabulary is rather easy to use and is a good evaluation tool, during the early phases of language development. The size of the vocabulary has been found to strongly indicate later language development in monolinguals and it gives information about the language dominance of bilingual children (see, e.g., Bates, Bretherton, & Snyder, 1988; Dale, Dionne, Eley & Plomin, 2000). With respect to the assessment of vocabulary development in bilingual children, the findings of both this study and previous studies (see, e.g., Core et al., 2013) support the use of total vocabulary instead of a sole comparison between the monolingual norms and the vocabularies of individual languages of the bilingual children. Still, as was the case in this research, there are no norms available for FinSL in the MCDI or any other test to measure the development in FinSL. Thus, for the speech and language therapist, the only possibility is to assess the two languages separately and interpret the results according to the recent theoretical knowledge on bilingualism. This is the only way to go, even though this assessment practice takes into account only part of the language competence of bilingual children, who often
score lower compared to monolinguals. Research also suggests only assessing the dominant language of a bilingual child but again, this assessment practice will underestimate the real language competence when the other language of the bilingual child is left out of the evaluation. This phenomenon was shown in this study, in the results of the MCDI for Finnish productive vocabulary; in almost all of the children studied, it was clearly lower than for monolingual Finnish age peers, as reported by Lyytinen (1999). In the Reynell Developmental Language Scales, which measured only the Finnish language, the scores of three of the KODA children were within the normal range and three within -1 SD. However, two of the children scored lower than that: within -2 SD. Thus, comparison of the KODA children’s scores and the monolingual age norms should be done with caution, especially when only one language is evaluated. This challenge was actualized in the results of Lauri in the MCDI and Reynell test. The MCDI showed that the total vocabulary of Lauri was at age level, but his scores on the Reynell test were below age level (within -2 SD). However, Reynell measured only the Finnish language, which was found to be the non-dominant language of Lauri, according to the results of both the MCDI and the MLU10.

Supporting the bilingual family. Pearson (2007 p. 400-401) describes how a bilingual child’s usage of heritage language results in more input, which again leads to a greater proficiency and more use of the child’s heritage language. However, the progression may take an opposite direction, as in the cases where the children do not use the heritage language, but rather, a different language instead. This situation leads to the fact that parents use the heritage language less and, therefore, the child develops less proficiency in it, which again leads to less use of it. This is in line with a comment by Miina’s mother, when she explained the reasons for her language choices: “If I use just sign language, the children won’t understand me. Thus, I use both spoken words and signs.” (Study I). Concordant with Pearson, recent studies have found that children’s output is a significant predictor of the level of the children’s bilingualism (Bohman et al., 2010; Hammer et al. 2012; Paradis, 2011). Moreover, as Bohman et al. (2010) has highlighted, the quantity of the input is a significant predictor of the initial language learning and increases the children’s language usage. Still, language attrition, that is, the loss of the heritage language has been found to be a common phenomenon among immigrants, regardless the parents’ hopes for sufficient development of the heritage language by their children (Eilers, Pearson & Cobo Lewis, 2006; Wong Fillmore, 2000). Deaf-parented families struggle with these same issues (Prinz, 2008; Preston, 1994; Wilhelm, 2008).
Sign language is the key for mutual interaction between the Deaf parent(s) and the KODA children. Despite that, only two families, of the ten interviewed in the present study, expressed concern about the sign language development of their KODA child, and five families expressed their concern about their child’s spoken language development. It seems, that in addition to the fact that Deaf parents fret over the child’s spoken language development, there is a basis for concern about their development in sign language, as was shown on the MCDI and the MLU10 results in sign language. Naturally, Deaf parents often place a high value on the sufficient development of sign language in their hearing children. Still, at the same time, they should also secure the age appropriate development in spoken language, a task where they may experience pressure and monitoring from the hearing people around the family. Part of the families in the present study had indeed experienced critique of their sign language use from the society around them. They are, therefore, not necessarily receiving positive support for their decisions to use sign language. These kinds of experiences related to the status of a minority language, such as possible disapproval from the surrounding community that may be shown towards sign language, and the pressure to provide hearing children with sufficient input in the majority language (Koskiniemi, 1993), may affect Deaf parents’ language choices and the amount and quality of language exposure of their hearing child (Singleton & Tittle, 2000; Wilhelm, 2008). As Grosjean (2010, pp. 172–174) has stated, families may need to adopt different ways to ensure that the minority language will not be lost. Deaf-parented families need support in providing sign language exposure for their children rather than an extra careful monitoring of sufficient spoken language development. Sign language offers the identity, cultural knowledge (values, customs and information) and the social bonding between members of Deaf community (Mindess, 2006, p. 77; Padden & Humphries, 2005). It plays the key role in securing the relationship and mutual language between the members of the Deaf-parented families and also provides the link between the KODA children and the Deaf community (Preston, 1994 p. 128; Singleton & Tittle, 2000; Wilhelm, 2008). The importance of acquiring sufficient competence in sign language cannot therefore be over emphasized.

6.4 Methodological challenges and limitations

The methodological decisions of this study were made on the basis of the methods used in previous studies, within this field. In all studies, the researcher is dependent on the participants that he or she is able to recruit, and when one is studying a
phenomenon with a small basic population, the research process may be very challenging. Also, having a longitudinal design increases the demand of finding subjects who are willing to make a long-term participatory commitment. All the families who participated in this study were highly motivated and followed the instructions of the data collection during the whole two-year data collection period. No families dropped out of the study. The aim of this study was to describe the typical language acquisition of the KODA children. After the data collection period, the development of one child turned out to be deviant, as he was diagnosed with SLI after the data collection period. However, this child was kept in the research group as various kinds of language difficulties are normal parts of the follow-ups of language development. Reminders of his diagnosed SLI were added to the text on the results when reporting on the language development of the children studied. Due to the small group of participating children, the results of this study only enable tentative interpretations and suggestions about the bimodal and bilingual language acquisition of KODA children. More research with larger sample sizes needs to be conducted in order to draw more definitive conclusions in this field.

Both the data collection intervals and the detailed planning of the data collection affect the results obtained. The data collection schedule of every six months clearly created over long intervals between the measurement points, and so precluded the following of the early phases of language development in a more detailed manner. Thus, more frequent data collection intervals should be used in further research to gain a more profound picture of the process of early language development.

The design of the play sessions was only partly structured. The children were provided with age-appropriate books and toys to elicit interaction and language production, but the adults and the children were not restricted to playing with them. For this reason, however, the researcher is hardly able to control the sample that he or she is able to obtain from the play sessions. On the other hand, video recording of the natural interaction offered a possibility for new findings that were not anticipated. Still, the success of the video recordings is highly dependent on the co-operation and occasional mood of a child. Several elements were used to maintain the children’s interest during the play and test sessions. The new books and toys usually inspired the children to play and to interact. In spite of that, co-operation problems caused some missing data (8% of the video recordings). This particular challenge was specifically due to the young age of the children participating in this study.
When it comes to language assessment tools used, no assessment tools exist for evaluating the development of FinSL. Therefore, the MCDI was used in this study although it was not originally designed for evaluating FinSL. For this reason, adaptations needed to be made to the MCDI questionnaire (on the basis of, e.g., Anderson & Reilly, 2002; Woolfe et al., 2010) so that the same questionnaire could be used to explore the vocabulary development in both the Finnish language and in FinSL. However, comparisons of the results on the productive vocabularies of FinSL with Finnish monolingual age peers should be made with caution.

Adaptation of the MCDI for FinSL is needed in the future for both clinical work and for research purposes. Even though the parental reports have been found to be valid measures of early language development (see e.g., Fenson et al., 1994), they still have limitations that need to be discussed. The accuracy of parental reports as methodological tools is highly dependent on the knowledge and carefulness of the parents or other persons who fill out the report. In this study, the arrangements that were made for filling out the MCDI were found to be beneficial. The Deaf parent filled out the sign language part and a hearing adult filled out the spoken language part of the form. The MCDI questionnaire was sent to families two weeks before the researcher’s home visit. During the home visits, the discussions with the parents on the MCDI were especially related to the definition of a proper sign produced by the child. This has probably improved the quality of the data collected. Additionally, one challenge in the MCDI for sign languages is the existence of the more descriptive signs like classifiers that do not have the status as a lexicalized sign, but which nevertheless, are a part of the sign language. There is, therefore, the possibility of an underestimation of the size of the productive vocabulary in FinSL.

In five cases, spoken language vocabulary was assessed by a hearing person other than the child’s parent. This may have negatively influenced the assessment, as parents are often those who know their child best. However, the validity of the MCDI was supported by the data from video recordings where the results of the MCDI and the MLU10 in both languages correlated significantly with each other.

In exploring children’s morphosyntactic development, the MLU10 was used instead of counting the MLU. It is often recommended to count at least 50 or 100 utterances for the MLU (see, e.g., Miller, 1981; Eisenberg, Fersko, & Lundgren, 2001) but for the clinicians working with small children, it is often challenging to get this amount of intelligible utterances. According to Casby (2011), the MLU can, however, be reliably and effectively used for assessing the utterance length in small samples compared with the larger samples, which are typically recommended for calculating the MLU. Furthermore, it is more time consuming to analyse the MLU
from all the utterances in the sample, than to identify a child’s 10 longest utterances for calculating the MLU10. However, for sign language assessment, MLU needs to be further developed as a methodological tool. The reason for different results in the MLU10 in sign language compared with the results of the MLU10 in spoken language may partly be methodological, since sign language expressions are often compact; it is, e.g., possible to express action with a single sign, but one may well need two or more words to express the same content in spoken language. Although there are no studies on the MLU in children acquiring FinSL, based on the general knowledge of children’s development in sign language, the KODA children that were studied, were expected to produce longer sign language utterances than those obtained in the present study. Thus, the lower result in the MLU10 in sign language cannot be explained by methodological issues only.

One limitation of this study was the issue that the quality of language exposure was not evaluated in a more detailed manner. This is a clear weakness and, in further studies, a proper measure for capturing different aspects of language exposure needs to be constructed. For example, the role of older siblings in language exposure was not fully taken account. The older siblings of bilingual children have been reported to shape the language exposure towards the majority language, and bilingual children with older siblings have been found to be more advanced in the majority language compared with bilingual children with no older siblings (Bridges & Hoff, 2014; Pearson, 2007). However, there were only two children in this data set who did not have older siblings, so comparison between the children with and without older siblings would not have produced valuable information on this important aspect.

6.5 Conclusions and the need for further studies

In summary, the previous studies on childhood bilingualism and this study on the KODA children’s bilingual language development provide some suggestions that can be made from the practical point of view. (1) The language development of the KODA children should be regarded as bilingual. (2) The development of single language is often slower compared with the monolingual norms. For this reason, both of the languages a KODA child is acquiring, as well as his or her linguistic environment, need to be taken account when assessing the language development of these children. Additionally, comparisons with monolingual norms should be done with great caution. (3) KODA children are able to acquire both spoken language and sign language simultaneously, however, the development of sign
language as a minority language may need substantially more support to develop alongside the spoken language. Considerable variation may be found in bilingual development in individual children. (4) Professionals working with Deaf-parented families should provide support for the Deaf parents’ language choices and inform them about the relationship between the linguistic environment and bilingual language development. (5) KODA children are not confused in their language acquisition, but are able to use the languages acquired in differentiated ways, according to the language of their interlocutor. (6) Code-mixing can be found in KODA children’s language production but it should be regarded as a natural feature of bilingual children’s language development that is influenced by both the child’s inner factors and environmental factors.

It has been noted in previous research that variability in the form of different paths of bilingual language development is partly caused by the relative amount of input (Gathercole & Thomas, 2009; Hoff et al., 2012; Pearson et al., 1997; Parra et al., 2010; Place & Hoff, 2011). Still, as noticed in this study, the relationship between the relative amount of input and the relative rate of development is not straightforward and there is a large variance in the rates of bilingual language development. The question that still remains unanswered is, what are the individual factors that are associated in each case with the bilingual language development. This study addressed only a few factors (parental language choice, contacts with other native language users, minority and majority status of the languages acquired) (for other factors see, e.g., Palace & Hoff, 2011). As the research on heritage language has found a high level of variability in heritage bilingual speakers and also specific features in their language that is distinct from monolinguals and non-heritage bilinguals, this research field on heritage language might provide a fruitful viewpoint for further studies in identifying what is typical in the bimodal bilingual language acquisition of KODA children. A very clear finding was that the KODA children studied demonstrated highly developed and sensitive abilities in their communication and language development and use at a very young age, and that further research on the different aspects of communication with a larger data sample and an earlier age start (prior to 12 months of age) is warranted.

The findings of this dissertation discuss the flexibility and amazing potential young children have in their language acquisition. The bilingual language acquisition process is a highly complex one and far from completely understood.
References


### Appendices

#### Appendix 1

Table 11. KODA children’s productive vocabularies in Finnish Sign Language and spoken Finnish, measured with the MCDI. Total vocabulary includes translation equivalents.

<table>
<thead>
<tr>
<th></th>
<th>Lauri</th>
<th>Onni</th>
<th>Paula</th>
<th>Miisa</th>
<th>Miina</th>
<th>Heidi</th>
<th>Ari</th>
<th>Riina</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>12 months</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signs</td>
<td>17</td>
<td>-</td>
<td>81</td>
<td>25</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Words</td>
<td>9</td>
<td>-</td>
<td>7</td>
<td>2</td>
<td>8</td>
<td>3</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Total vocabulary</td>
<td>26</td>
<td>-</td>
<td>88</td>
<td>27</td>
<td>16</td>
<td>8</td>
<td>7</td>
<td>30</td>
</tr>
<tr>
<td><strong>18 months</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signs</td>
<td>77</td>
<td>138</td>
<td>265</td>
<td>104</td>
<td>87</td>
<td>25</td>
<td>5</td>
<td>42</td>
</tr>
<tr>
<td>Words</td>
<td>21</td>
<td>31</td>
<td>53</td>
<td>53</td>
<td>78</td>
<td>5</td>
<td>16</td>
<td>207</td>
</tr>
<tr>
<td>Total vocabulary</td>
<td>98</td>
<td>169</td>
<td>318</td>
<td>157</td>
<td>165</td>
<td>30</td>
<td>21</td>
<td>249</td>
</tr>
<tr>
<td><strong>24 months</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signs</td>
<td>171</td>
<td>163</td>
<td>401</td>
<td>156</td>
<td>100</td>
<td>104</td>
<td>29</td>
<td>135</td>
</tr>
<tr>
<td>Words</td>
<td>109</td>
<td>101</td>
<td>361</td>
<td>148</td>
<td>170</td>
<td>52</td>
<td>26</td>
<td>414</td>
</tr>
<tr>
<td>Total vocabulary</td>
<td>280</td>
<td>264</td>
<td>762</td>
<td>304</td>
<td>270</td>
<td>156</td>
<td>55</td>
<td>549</td>
</tr>
<tr>
<td><strong>30 months</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signs</td>
<td>292</td>
<td>114</td>
<td>557</td>
<td>80</td>
<td>78</td>
<td>206</td>
<td>135</td>
<td>225</td>
</tr>
<tr>
<td>Words</td>
<td>160</td>
<td>126</td>
<td>374</td>
<td>216</td>
<td>252</td>
<td>105</td>
<td>55</td>
<td>417</td>
</tr>
<tr>
<td>Total vocabulary</td>
<td>452</td>
<td>240</td>
<td>931</td>
<td>296</td>
<td>330</td>
<td>311</td>
<td>190</td>
<td>642</td>
</tr>
</tbody>
</table>

- “-” = the child was not yet followed up (no MCDI form filled out)
**Appendix 2**

Table 12. MLU10 (mean length of the 10 longest utterances) in sign language and spoken language utterances in the video recorded play sessions.

<table>
<thead>
<tr>
<th></th>
<th>Sign language utterances</th>
<th>Spoken language utterances</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Lauri</td>
<td>*</td>
<td>1</td>
</tr>
<tr>
<td>Onni</td>
<td>–</td>
<td>*</td>
</tr>
<tr>
<td>Paula</td>
<td>1.8</td>
<td>(1.2)</td>
</tr>
<tr>
<td>Nilsa</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Miina</td>
<td>1.2</td>
<td>1</td>
</tr>
<tr>
<td>Heidi</td>
<td>*</td>
<td>1</td>
</tr>
<tr>
<td>Ari</td>
<td>1.2</td>
<td>*</td>
</tr>
<tr>
<td>Riina</td>
<td>1</td>
<td>1.6</td>
</tr>
</tbody>
</table>

* Child produced fewer than 10 utterances during the analysed 5-minute session, so the MLU10 could not be calculated.

( ) Parentheses indicate that the value is calculated from signed or spoken parts with simultaneous use of these languages, if the value was higher in simultaneous production than in solely signed or spoken utterances.

- No recording obtained
Appendix 3

Table 13. KODA children’s standard scores on the Reynell Developmental Language Scales.

<table>
<thead>
<tr>
<th></th>
<th>Paula</th>
<th>Lauri</th>
<th>Onni</th>
<th>Heidi</th>
<th>Miina</th>
<th>Misa</th>
<th>Ari</th>
<th>Riina</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receptive</td>
<td>111</td>
<td>79</td>
<td>67</td>
<td>86</td>
<td>116</td>
<td>86</td>
<td>82</td>
<td>110</td>
<td>92</td>
<td>18</td>
</tr>
<tr>
<td>Expressive</td>
<td>99</td>
<td>77</td>
<td>85</td>
<td>97</td>
<td>85</td>
<td>97</td>
<td>95</td>
<td>119</td>
<td>94</td>
<td>13</td>
</tr>
<tr>
<td>Total score</td>
<td>108</td>
<td>77</td>
<td>73</td>
<td>90</td>
<td>103</td>
<td>90</td>
<td>87</td>
<td>115</td>
<td>93</td>
<td>15</td>
</tr>
</tbody>
</table>

A standard score of 100 with a SD of 15 is the average for a child with typical linguistic development on the Reynell Developmental Language Scales. Standard scores between 85 and 115 are, therefore, considered to be within the broad normal range for a typically developing child.
Original publications


Reprinted with permission from Oxford University Press (I) and Cambridge University Press (II, III). Original publications are not included in the electronic version of the dissertation.
125. Anttila, Tero (2014) The power of antiquity: the Hyperborean research tradition in early modern Swedish research on national antiquity
126. Ylipulli, Johanna (2015) Smart futures meet northern realities: anthropological perspectives on the design and adoption of urban computing
139. Sitonen, Pauliina (2016) Ehdotukseen vastaaminen perheen vuorovaikutustestiissä: Keskielokuulan analytiikkaan näkökulma vuorovaikutukseen ja sen arviointiin
140. Mustamo, Aila (2016) ” Yö, metsä, aika ennen kristinuskusta”: Kotimaa ja kansakunnan repreensenästa black metallista ja folk metalista Suomessa ja Norjassa
Laura Kanto

TWO LANGUAGES, TWO MODALITIES. A SPECIAL TYPE OF EARLY BILINGUAL LANGUAGE ACQUISITION IN HEARING CHILDREN OF DEAF PARENTS