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Use of pointing in parent-child interactions by hearing children of deaf and hearing parents: A follow-up from 1- to 3-years of age

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Abstract

Pointing plays a significant role in communication and language development. However, in spoken languages pointing has been viewed as a non-verbal gesture, whereas in sign languages, pointing is regarded to represent a linguistic unit of language. This study compared the use of pointing between seven bilingual hearing children of deaf parents (Kids of Deaf Adults [KODAs]) interacting with their deaf parents and five hearing children interacting with their hearing parents. Data were collected in 6-month intervals from the age of 1;0 to 3;0. Pointing frequency among the deaf parents and KODAs was significantly higher than among the hearing parents and their children. In signing dyads pointing frequency remained stable, whereas in spoken dyads it decreased during the follow-up. These findings suggested that pointing is a fundamental element of parent-child interaction, regardless of the language, but is guided by the modality, gestural and linguistic features of the language in question.

Introduction

Pointing action as a part of human communication, language use, and language development has gained much attention among researchers representing different theoretical perspectives. During child development, the use of pointing actions has been found to be an important part of social communication and language development, as pointing often initiates and maintains joint and sustained attention between the participants (Tomasello, Carpenter & Liszkowski, 2007). The use of pointing also predicts different outcomes during language development, from the first words to various elements of narrative structure, and changes alongside developing language (Colonna et al., 2010; Goodwyn & Acredolo, 1998; Iverson Capirci, Longobardi & Caselli, 1999; Morgenstern, 2014; Özçaliskan & Goldin-Meadow, 2009). In studies on spoken language and spoken language acquisition, pointing has mainly been studied and viewed as a gesture, a pre-linguistic and discrete unit of language, and an important building block of communication and later language development (Kita, 2003; Rowe & Goldin-Meadow, 2009).

In sign languages, pointing action has been argued to represent a linguistic unit of language and function as a pronominal pointing sign (see Fenlon, Cooperrider, Keane, Brentari & Goldin-Meadow, [2019] and a review by Meier and Lillo-Martin [2013]). Thus, despite their similar forms, pointing used in sign language has been argued to be distinct from the pointing action produced by non-signers (Fenlon et al., 2019). However, an increasing number of studies with a cognitive-functional linguistic framework, particularly those on sign language, have challenged the common conception of pointing by regarding pointing actions as both containing gestural elements and being an inseparable gradient property of language use that every language has (Jantunen, 2017; Johnston, 2013a, 2013b; Kendon, 2008). Clearly, contradictory perspectives have been presented in recent literature on the functions of pointing and its relationship with spoken and sign languages and language development. These perspectives are now actualised in the research on language acquisition, especially sign language development.

This study deals with the different theoretical approaches and contradictory perspectives of recent studies on pointing (Cormier, Schembri & Woll, 2013; Ferrara, 2020; Johnston, 2013a, 2013b; Morgenstern, Caët, Collombel-Leroy, Limousin & Blondel, 2010; Özçaliskan & Goldin-Meadow, 2009) in a novel way by studying pointing not only from an interactional perspective in a parent-child context but also from the perspective of language acquisition in two modalities, visual and auditory. The aim of the present research was to describe parents' and children's use of pointing and, more

specifically, how frequently parents and children use pointing in two types of parent-child dyads during the early phases of children's language development. First, the use of pointing was studied in hearing children and their deaf parents (referred to as *Kids of Deaf Adults*, [KODAs]). KODAs acquired spoken Finnish and Finnish Sign Language (FinSL) simultaneously and used FinSL in mutual interactions with their deaf parents. Second, KODAs and their deaf parents use of pointing was then compared with the pointing actions of hearing children and their hearing parents, who used spoken Finnish when communicating with each other.

The role of pointing in early interactions and language development

Pointing is part of a child's social activity from the very beginning. It is considered to originate from a need to connect and share things with other people (Bruner, 1983; Liszkowski & Tomasello, 2011; Meyer & Baldwin, 2013). Pointing is linked to other pre-linguistic, socio-cognitive modes such as joint attention; together, these skills form the basis for language development (Tomasello et al., 2007). By pointing, children refer to various targets such as objects in their environment, accompanying it with vocalisation, and the caregivers respond to children's gestures by naming (e.g., Laakso, Helasvuo & Savinainen-Makkonen, 2010). Thus, the use of pointing has also been found to be an important part of parent-child interactions. Moreover, to establish sustained and joint attention between the child and the parent, in general, parents have been found to modify their use of gestures according to the developmental stage of their children (Yoshida, Cirino, Mire, Burling & Lee, 2020). Furthermore, parental gestural scaffolding has been found to have a positive effect on children's language development (Dimitrova & Moro, 2013; Goldin-Meadow, Goodrich, Sauer & Iverson, 2007; Goodwyn & Acredolo, 1998; Iverson et al., 1999).

The use of pointing is considered one of the first signs of a child's symbolic function and thus reflects the beginning of language acquisition. From a socio-pragmatic perspective, pointing is assumed to be related to language development from an early age, and a child uses pointing for communicative purposes from at least the age of 12 months (Liszkowski & Tomasello, 2011). Previous studies have shown that in spoken language acquisition, the use of pointing is most frequent at around one and a half years of age, after which the frequency starts to decrease (Lüke, Grimminger, Rohlfing, Liszkowski & Ritterfeld, 2017). An increase in the use of pointing precedes the development of a child's productive vocabulary. By the age of three to four years, children's use of pointing alongside speech begins to be comparable with adults' use of pointing during speech (Nicoladis, Mayberry & Genesee, 1999). Furthermore, pointing-word combinations precede the development from single-

word utterances to longer utterances. Research on the role of pointing in language development has shown that children not only point to objects before they start producing lexical labels for them but also, for instance, combine pointing with words and signs to convey more complex sentence-like units (Kanto, Huttunen & Laakso, 2015; Özçaliskan & Goldin-Meadow, 2009). In a study by Rowe and Goldin-Meadow (2009), the use of pointing at 18 months predicted lexical and syntactic skills at the age of 42 months, and the pointing-speech combinations produced at the age of 18 months predicted sentence complexity at 42 months.

A few previous studies on pointing by children acquiring sign language have posited that, at first, children's pointing was gestural, but during language development, pointing gestures developed into pronoun signs (Hatzopolou, 2008; Petitto, 1994). Morgernstern et al. (2010) found that the KODA they followed up from the age of 0;10 to 2;8 started to produce pointing at an earlier age and continued to use it more frequently than a monolingual child acquiring spoken language. Additionally, they found that the pointing frequency of this KODA child increased during the follow-up along with the child's age and language development. Instead, the number of pointings produced by a monolingual child acquiring spoken language decreased along with the child's age and language development. Concordantly, Kanto et al. (2015) found that the eight KODAs they followed up who were between the ages of 1;0 and 3;0, used pointing more frequently when interacting with their deaf parent than with a hearing person. Furthermore, Fieldsteel, Bottoms and Lieberman (2020) found that deaf mothers ($N = 7$) communicating using American Sign Language pointed at themselves and at a child, incorporating pointing into longer sentences and using pointing as an attention-getting strategy in parent-child interactions. KODAs often acquire sign language and spoken language simultaneously (Kanto, et al., 2015; Lillo-Martin, Quadros, Chen Pichler & Fieldsteel, 2014). For this reason, the discussion on the features and functions of pointing actualises when language acquisition and the use of pointing among KODAs are studied.

The role of pointing in spoken and sign languages

Pointing is used throughout one's lifetime and across cultures and contexts (Cooperrider, Fenlon, Keane, Brentari & Goldin-Meadow, 2021; Kita, 2003). Both signers and speakers frequently use pointing to direct and regulate their interactions and attention and to refer to themselves, others, locations, and visible and invisible referents (Cooperrider et al., 2021; Ferrara, 2020; Johnston, 2013a; Kendon, 2004; Liddell, 2003). Researchers on sign language linguistics and gestures have discussed gestural and linguistic features and the components of pointing. However, no clear consensus has

been reached on when pointing should be regarded as a sign or gesture or on whether this kind of clear-cut distinction could even be made (Cooperrider et al., 2021; Cormier et al., 2013; Fenlon et al., 2019; Johnston 2013a, 2013b; Koulidobrova & Lillo-Martin, 2016).

The difference of pointing in spoken and signed languages is that in sign languages pointing is a seamless part of the signing stream sharing the same modality with it, whereas, in spoken languages, pointing is produced on a different modality than speech and is seen as a multi-modal part of spoken language discourse. Partly for this reason, pointing in spoken language studies is often regarded as a non-verbal gesture, not a linguistic unit (see, e.g., Cooperrider et al., 2021; Kita, 2003; Yoshida et al., 2020). Despite the rather similar forms and functions of pointing between sign and spoken languages, previous studies have argued that pointing in sign languages is more conventionalised than pointing in spoken languages (see, e.g., Fenlon et al., 2019). Previous studies have suggested that pointing has many functions in sign languages that partly match the functions of pronouns, locatives, and demonstratives in spoken languages. Moreover, pointing also appears to hold some word-like meanings and is included in sign language dictionaries (see, e.g., Cormier et al., 2013; Fenlon et al., 2019; Meier & Lillo-Martin, 2013). However, an increasing number of recent studies, particularly those on sign languages, have challenged the definition of pointing as either a gesture or a pronoun by suggesting that pointing is an inseparable and gradient property of all languages, and contains both linguistic and gestural properties that are not completely distinguishable from each other and (Cormier et al., 2013; Johnston, 2013a, 2013b; Kendon, 2016).

Johnston (2013a, 2013b) argued that both signers and speakers use pointing in similar way, but the frequency of pointing differ by language. Only a few previous studies have investigated pointing used with spoken Finnish and FinSL. Previous studies on spoken and sign languages, including FinSL, have observed that pointing is used in both languages to refer to present and non-present referents. In spoken and sign languages, pointing towards persons and objects and to (signing) space is used for indicating different spatial locations and representing the referents in the signing space that have previously been mentioned in the discourse (see, e.g., Cormier et al., 2013; Jantunen, 2017; Johnston, 2013a, 2013b; Norlund, 2019). Pointing has been found to be the most frequent sign in many sign languages, but the frequency of pointing can vary between different discourse types and contexts (Johnston, 2013a).

Most studies on adult signers' use of pointing have focused on exploring the referential and gestural functions of pointing. Only a few studies have investigated the interactional function of pointing in

sign language conversations, with most studies comparing adult signers with each other, not parent-child dyads. Data on adult signers have shown that in sign language interactions, pointing has functions related to turn-taking and conversational feedback (Ferrara, 2020; van Herreweghe, 2002). A recent study by Ferrara (2020) discovered that in addition to its referential and gestural functions, pointing also holds multiple important interactional functions in signing conversations between adult signers and is used to deliver information, cite previous contributions, seek responses, manage turns, and give feedback. These functions resemble those found in studies on spoken-language conversations. More research on deaf parents' use of pointing is clearly needed to deepen understanding of the different features of sign language interaction between deaf parents and their young children and to show how deaf parents modify their use of pointing according to their children's development.

The present study

Previous studies have presented contradictory perspectives on pointing as a part of language acquisition, interaction, sign language and spoken language. This study particularly focused on the frequency of pointing in early parent-child interaction in relation to the modality of language used, and the children's age and stage of language development. In this study, parents' and children's use of pointing during the early phases of children's language development were longitudinally observed (every six months from the child's age of 1;0 until the age of 3;0). The frequency of pointing was first studied between KODAs and their deaf parents, who used FinSL in their mutual communication, and then compared with pointing frequency of hearing children and their hearing parents, who used spoken Finnish in their mutual communication. The findings on the use of pointing in two different parents-child dyads in this study will be then discussed in relation to the different perspectives on pointing presented in previous studies.

As mentioned, KODAs simultaneously acquire both sign and spoken languages. Previous studies have found that from a very early age, KODAs can accommodate their language use according to their interlocutor. Already at the age of 1;0, KODAs prefer to use sign language and manual modality when communicating with their deaf parents and spoken language and vocal modality when communicating with hearing adults (Kanto et al., 2015; Lillo-Martin et al., 2014). Hence, as a target group, KODAs are highly interesting and can enrich the discussion on the role and function of pointing in language development, parent-child interactions, and spoken and sign language. The use

of pointing among KODAs is informative, as KODAs use pointing actions when communicating with different interlocutors representing the two different languages they are acquiring.

On this ground, this study focused on examining the use of pointing in spoken and sign language interactions between children and their parents to determine how frequently children and their parents use pointing, the relationship between the child's and their parent's use of pointing, and how pointing is shaped by the modality of language. Two research questions were set:

1. How frequently do KODAs and their deaf parents, using sign language in interactions, and hearing children and their hearing parents, using spoken language in interactions, use pointing during video-recorded play sessions from the children's age of 1;0 to the age of 3;0?
2. What are the differences in the frequency of pointing between these two types of parent-child dyads as a function of different languages used and a function of children's age and developing language?

Methods

Participants

Seven KODAs with their deaf parents and five hearing children with their hearing parents participated in this study and are described in Table 1. Deaf-parented families, in which one or both parents were deaf, were recruited for the study by informing the Finnish Deaf community. Families interested in the research project then contacted the first author. In deaf-parented families, one parent was hearing and the other was deaf in four families, whereas both parents were deaf in three families. All parents had completed at least a secondary education, either at an upper secondary school or a vocational school. The deaf parents were either native signers of FinSL or had started to use it as a child. All deaf parents reported mainly using FinSL when communicating with their children. In the four families with one deaf and one hearing parent, only one hearing parent was a fluent user of FinSL. As a result, the families with one deaf parent and one hearing parent mainly reported using different variations and combinations of signs, gestures, spoken language, and speech reading when parents were communicating with each other. All hearing parents of the KODAs reported mainly using spoken Finnish when communicating with their child.

Table 1.*Demographic Information about the Participants*

| | <i>n</i> | Children | | Parent's hearing status |
|-------------------------------------|----------|----------|------|--|
| | | Girls | Boys | |
| KODAs | 7 | 5 | 2 | Four had one deaf parent and one hearing parent Three had both parents deaf |
| Hearing children of hearing parents | 5 | 3 | 2 | All five had both parents hearing |
| Total | 12 | 8 | 4 | |

All children in the deaf-parented families were acquiring their two languages simultaneously and had regular and consistent exposures to both FinSL and spoken Finnish either at home, in day care, or by regularly meeting hearing and deaf close relatives and friends. To describe the development of the KODAs in the two languages they were acquiring, a Finnish adaptation of the MacArthur-Bates Communicative Developmental Inventories (MCDI) form (Lyytinen, 1999) was used, as a FinSL MCDI adaptation or other tests to measure children's FinSL development were not yet available at the time of data collection. The parents of KODAs reported the size of their child's productive vocabulary separately in Finnish words and FinSL signs from the ages of 1;0 to 2;6. Thus, all the words that the child produced in Finnish and FinSL signs were marked in the form. If the form did not contain the word or sign produced by the child, the word or sign was added in a space reserved at the end of the MCDI form. If both parents were deaf, a hearing adult knowing the KODA well (e.g., close relative or an early childhood educator) filled out the forms concerning Finnish (see anonymised). The infant version of the MCDI (for ages 8 to 16 months) was used for children aged 12 months, and the toddler version (for ages 16 to 30 months) was used for children aged 18 to 30 months.

Between the ages of 1;0 and 2;6, the expressive vocabularies of spoken words and FinSL signs of the KODAs were found to increase in parallel with each other (Figure 1). A Wilcoxon Signed Ranks Test revealed that their size did not significantly differ from each other at any of the data points in which the MCDI forms were filled out at 6-month intervals. The mean size of the total productive vocabulary, including both signs and words, of the KODAs during follow-up was found to be larger or equal to the mean size of the productive vocabulary of their Finnish monolingual age peers in Lyytinen's (1999) study. This indicated that the bilingual development of the KODAs followed the typical language trajectory.

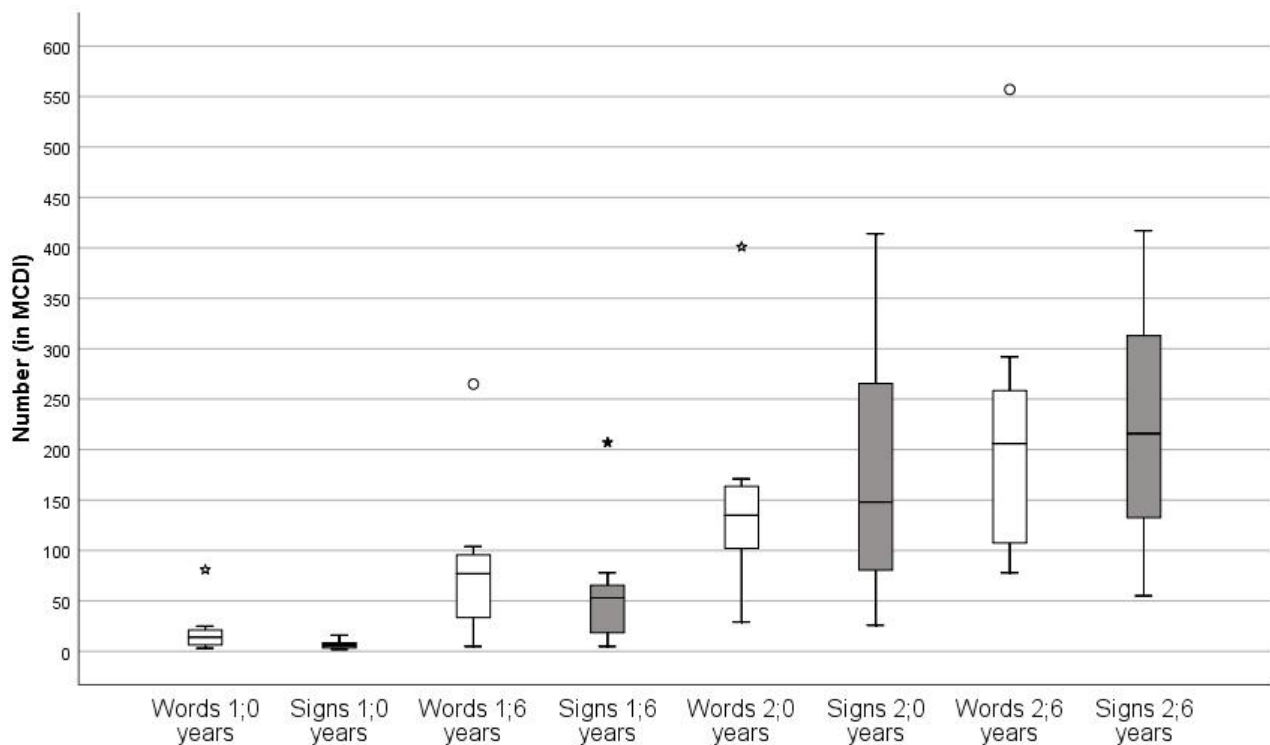


Figure 1.

Parent-reported Sizes of Expressive Vocabulary (Numbers of Words and Signs in the MCDI) of the KODAs at Ages 1;0 to 2;6

In hearing-parented, Finnish-speaking families, all parents had completed at least secondary education, either at an upper secondary school or a vocational school. Their children (hearing children of hearing parents [HH]) were monolingual and had regular and consistent exposure to Finnish at home and elsewhere in their living environments. Hearing-parented families were recruited by informing families via electronic mailing lists, and families interested in the research project contacted the second author. HH were tested with standardised tests at the age of 3;0, Reynell Developmental Language Scales III (Edwards et al., 1997) and Bo Ege (Ege, 1998), covering vocabulary, and at the age of 5;0 with the Boston Naming Test (Kaplan, Goodglass, Weintraub & Segal, 2001) to confirm the typicality of their language development.

No ethical board approval was sought because the parents who volunteered to participate in the study provided written informed consent for their own and their child's participation in the study, and the children were not known to have any medical or developmental challenges. During the data collection period, no medical or human sciences ethical boards in Finland were involved in pre-reviewing the study protocols of typically developing children. The study conforms with the principles stipulated in the Declaration of Helsinki, which regulates research concerning human participants.

Procedure

In all families, data were collected during video-recorded play sessions at each longitudinal data collection time point (at the child's age of 1;0, 1;6, 2;0, 2;6, and 3;0). The same researcher, the first author, video-recorded all the book reading and play sessions of the KODAs, and with a few exceptions, the same researcher video-recorded the HHs. All the children were video-recorded at their homes during play sessions with their parents. In the deaf-parented families, children played with a deaf parent, and in hearing-parented families, play sessions were organised with the child and always the same parent involved. During the play sessions, the parents were asked to play with their children as they would normally do. A standard set of books and toys suitable for the child's age was provided to all families, but the parent and child were not restricted to playing with them.

Altogether, 35 play sessions between a deaf parent and a hearing child and 25 play sessions between a hearing parent and a hearing child were video recorded. The most linguistically active 10-minute period, during which the child produced the highest number of utterances and longest utterances, was selected for the analysis. In the deaf-parented families, a few play sessions lasted less than 10 minutes. On these occasions, the whole play session was selected for analysis. The sizes of the data analysed are presented in Table 2.

Table 2.

Data (in Minutes) Analysed at the Different Age Points of the Children

| | | 1;0 | 1;6 | 2;0 | 2;6 | 3;0 |
|---|---------------|-------------|-------------|-------------|-------------|-------------|
| KODAs (<i>n</i> = 7)* | <i>M</i> (SD) | 9.57 (0.78) | 8.71 (1.70) | 9.86 (0.38) | 9.57 (1.13) | 10.0 (0) |
| | Min–Max | 8–10 | 6–10 | 9–10 | 7–10 | 10–10 |
| Hearing children of hearing parents (<i>n</i> = 5)** | <i>M</i> (SD) | 10.1 (0.17) | 10.3 (0.31) | 10 (0.05) | 10.2 (0.36) | 10.2 (0.20) |
| | Min–Max | 9.9–10.3 | 10.0–10.7 | 10.0–10.1 | 9.9–10.7 | 10.0–10.5 |
| Total duration*** | | 117 min | 112 min | 119 min | 117 min | 120 min |

*Total 5 h 35 min, **Total 4 h 10 min, ***9 h 45 min

Coding and analysing utterances

Each video-recorded play session was annotated: speech orthographically and signs by using glosses (sign-word correspondence written in capital letters), following the guidelines of Salonen, Wainio,

Kronqvist & Keränen (2018). Annotation was made using the ELAN software (see, e.g., Lausberg & Sloetjes, 2009).

All communicative (intentional) vocalisation, speech, signs, and pointing produced by both children and adults, either spontaneously or by imitation, were analysed. In intentional communication, children direct their manual and/or vocal acts towards the interlocutor(s) by using eye gaze, body orientation, or physical contact, and await a response from the adult, as evidenced by hesitatingly looking at the adult or persisting in the communicative act (Sarimski, 2002). With this criterion, periods of self-talk with no intention to communicate with the interlocutor were excluded from the analyses. The children's productions were coded to contain a sign or word if they were similar in form to adult language and were used in an appropriate context, given the meaning of the adult sign or word (see Lyytinen, 1999; Vihman & McCune, 1994).

Some additional coding criteria for signs were established because gestures, manual babbling, and signs are produced in the same modality and because children's early signs are known to be difficult to separate from gestures (Bonvillian, Orlansky & Folven, 1994). In the present study, a communicative manual act was defined as a *sign* when it had at least one phonetic unit (place, orientation, and/or handshape) that resembled the adult form of that sign in FinSL. If the nature of the motor act was not clear, it was defined as a sign if it occurred in the parent's *child-directed signing* of sign language. In child-directed signing, deaf parents exaggerate and repeat their expressions and simplify the phonological structure of a sign to make it easier for a child to understand and produce language. Similar features in child-directed signing can be found in the sign and spoken language utterances of parents (Lieberman, Hatrak & Mayberry, 2014). Manual babbling (see, e.g., Petitto, Holowka, Sergio, Levy & Ostra, 2004; Petitto & Marentette, 1991) was judged to be in question when a manual act resembled a sign in all its linguistic features (e.g., hand shape, location, orientation, and movement) but was not understood by the parents or the hearing researcher. Communicative speech was coded as vocalisation if it did not contain any intelligible words but was nonetheless produced for the purpose of intentional communication, as described earlier.

All children's outputs (vocalisation, manual babbling, pointing, signs, and speech) were divided into utterances. Like Iverson, Capirci, Longobardi and Caselli (1999), Petitto et al. (2001) and Van den Bogaerde and Baker (2008) found that sequences that contained speech, signs, vocalisation, manual babbling, or pointing were preceded and followed by silence and had a change in intonation pattern or conversational turn coded as an utterance. In the case of pointing and the use of FinSL, silence

refers to a pause in communicative motor action before and after a sequence defined as an utterance. When pointing actions were included in the number of utterances, even an isolated pointing action was considered to form an utterance.

To evaluate the syntactic complexity of the utterances produced by both children and adults, the *Mean Length of the Ten Longest Utterances* (MLU10) for Finnish and FinSL were analysed on the basis of the utterances in signs and words. The MLU10 provides information on the longest structures a child or parent produces, and this can be used to evaluate the child's language development and analyse how parents accommodate their language use according to their children's developmental stage. The MLU10 was used by Van den Bogaerde (2000), Kanto et al. (2017), and Klatter-Folmer, van Hout, Kolen and Verhoeven (2006) to assess KODAs and deaf children of deaf and hearing parents.

Coding and analysis of pointing

Two criteria were used to ensure that pointing functioned as a communicative symbol (see Butcher, Mylander & Goldin-Meadow, 1991; Özçaliskan & Goldin-Meadow, 2009). 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; see Petitto, 1988). No acts performed on objects were included. Pointing used during ritual play was excluded from pointing actions.

Only manual pointing produced by the children and their parents was counted. On this basis, other ways of pointing, such as the use of eye gaze or head or body movement (Kendon, 2016), were excluded from the analysis. Even though they are important parts of interaction, this study specifically focused on determining whether there were differences in the frequency of manual pointing between the two types of parent-child dyads studied.

When a child or parent extended a finger, multiple fingers, or a palm towards a referent, the act was considered pointing (see e.g., Franco, Perucchini & March, 2009). As pointing is fully integrated into both the linguistic and gestural systems of languages, categorising pointing as having a gestural or linguistic nature is extremely challenging and beyond the scope of this research. In the present study, the main aims were to observe the frequency of finger/hand pointing during parent-child interactions and to compare the frequency of pointing between two types of parent-child dyads, so pointing need not be classified as being either linguistic (e.g., pronoun) or gestural. For this purpose, the annotation of pointing in this study followed the annotation procedures of the corpus of FinSL (Jantunen et al.,

2016). Pointing was treated as a semantically and formally independent unit and annotated without any information prefixed to them. As mentioned earlier, pointing was also categorically regarded as neither a gesture nor a pronoun. However, additional information regarding the referent towards which the pointing was directed (e.g., the first or second person, objects, locations) was marked each time a pointing was identified. HH and their parents did not sign. For comparison, all pointings were analysed in the same way, and the pointing actions of KODAs and their deaf parents were therefore not classified as pointing signs of FinSL.

The intercoder reliability of coding was examined by randomising five parent-child dyads to be analysed by five coders. The first author and four research assistants were carefully trained to annotate video recordings. For reliability analyses, 8% of the data were cross-annotated always by two coders; that is, one video recording was randomly drawn from each of the five data points from the age of 1;0 to 3;0 and then cross-analysed. The agreement rate was calculated for all five recordings because even in the case of 100% agreement between some coders, Cohen's kappa did not realistically reflect the level of agreement. The mean agreement rate was 92% (SD, 5.7, min 89%, max 100%) for the use of pointing by parents, 88% (SD, 7.5, min 85%, max 100%) for coding children's pointing use, and 91% (SD, 6.5; min 85%, max 100%) when the agreement was based on both the parents' and their children's data.

Statistical analyses

Raw scores and relative percentages, that is, the frequency of pointing related to the number of utterances in the 10-minute video-recorded session multiplied by 100, are reported herein. Raw scores are presented in tables, and relative percentages in figures. Differences between the two child groups (KODAs and children of hearing families) and between the two parent groups were based on relative percentages. Owing to unequal and small group sizes, only non-parametric statistical tests were used. Friedman's Two-Way Analysis of Variance (ANOVA, with the effect sizes expressed using the Kendall's W) and the Wilcoxon Signed Ranks Test for detecting developmental trajectories from the age of 1;0 to 3;0, and the Mann-Whitney U test (with effect sizes also calculated) for comparing the results of deaf and hearing parents, and KODAs and HHs. The Spearman's correlation coefficient was applied in examining the associations between the children's pointing frequency and the MLU10, the number of words and FinSL signs produced, and between the children's and their parents' pointing frequencies.

Results

The research questions were aimed at examining how frequently children use pointing as a function of their developing language when interacting with their parents. To show the children's language use and trajectory of language development during the follow-up between the age of 1;0 and 3;0, the number and length of utterances and the numbers of signs and words produced by the children during the video-recorded sessions were calculated. The results showed that as an indication of their developing language, the raw numbers of utterances, mean length of the 10 longest utterances (MLU10), signs, and words produced by KODAs and HHs increased during follow-up (Table 3). The language the children preferred to use in interaction with their parents was reflected in the numbers of signs and words produced by the two types of parent-child dyads. Naturally, the HHs only produced spoken words when communicating with their parents. However, at each data point from the age of 1;0 onwards, the KODAs preferred to use FinSL when communicating with their deaf parents and thus produced clearly more signs than words during the video-recorded play sessions. At the ages of 2;6 and 3;0 years, the number of words the HHs produced during the video-recorded sessions was significantly higher than that produced by the KODAs (at both age points: Mann Whitney $U = 0.00$, $p = .003$, $r = .82$, with the effect size reflecting the large between-group differences; Cohen, 1988).

As shown in Table 3, at four of the five data points, the mean sum of spoken words and FinSL signs of the KODAs did not reach the number of words that the HHs produced during the video-recorded sessions. In sign language, pointing actions can also be considered as signs. However, when the total number of pointings, words and signs produced by the KODAS was compared with the HH children's number of words, the combined total number of pointings, signs and words the KODAs produced was still significantly less than the number of words the HHs produced in the video-recorded sessions at the ages of 2;6 and 3;0 years ($U = 3.00$, $p = .018$, $r = .68$ and $U = 1.00$, $p = .005$, $r = .77$, respectively). At the 1;0- and 3;0-year data points, the Spearman's correlation coefficients (concurrent correlation) showed that the numbers of FinSL signs and spoken words produced by the KODAs correlated with each other significantly ($r_s = .82$, $p = .025$ and $r_s = .79$, $p = .036$, respectively). Compared with the KODAs, the HHs produced significantly more utterances in the video recordings at the ages of 1;6 (Mann Whitney $U = 3.50$, $p = .018$, $r = .66$), 2;6 ($U = 4.50$, $p = .030$, $r = .61$), and 3;0 ($U = 2.00$, $p = .010$, $r = .72$). The differences in the numbers of utterances, signs, and words between the children might partly reflect the interaction context where the attentions of the child and parent were directed to the books and toys. As a pattern of interaction, the behaviour in parent-child

dyads often differs according to the modality of the language used. When spoken language is used in interactions, a parent and a child simultaneously speak when their attentions are directed to, for example, books or toys. In sign language interactions, a child and a parent must shift the directions of their attention and gaze to the signing interlocutor from the books and toys they are playing with. This may result in fewer utterances than those in interactions in which spoken language is used.

Table 3.

Descriptions of the Number of Utterances, MLU10, Finnish Words, and FinSL Signs of the KODAs and Children of Hearing Families

| KODAs | | | | | Hearing children of hearing families | | | |
|------------------------------|----------|-----------|------------|----------------|--------------------------------------|-----------|------------|----------------|
| | <i>M</i> | <i>SD</i> | <i>Mdn</i> | <i>Min–Max</i> | <i>M</i> | <i>SD</i> | <i>Mdn</i> | <i>Min–Max</i> |
| Utterances | | | | | | | | |
| 1;0 | 28.3 | 19.95 | 29.0 | 5–55 | 49.8 | 22.03 | 50.0 | 16–76 |
| 1;6 | 46.7 | 23.20 | 44.0 | 11–77 | 89.4 | 24.46 | 80.0 | 65–124 |
| 2;0 | 62.0 | 22.89 | 66.0 | 17–87 | 100.4 | 48.10 | 82.0 | 46–173 |
| 2;6 | 67.0 | 22.06 | 64.0 | 34–105 | 108.0 | 40.09 | 97.0 | 80–178 |
| 3;0 | 51.9 | 21.19 | 52.0 | 27–82 | 104.2 | 23.57 | 111.0 | 72–131 |
| MLU10 | | | | | | | | |
| 1;0 | 0.5 | 0.79 | 0 | 0–1.8 | 0.6 | 0.55 | 1.0 | 0–1.0 |
| 1;6 | 0.8 | 0.75 | 1.0 | 0–1.6 | 1.0 | 0.68 | 1.1 | 0–1.9 |
| 2;0 | 2.4 | 1.31 | 2.6 | 0–4.1 | 2.2 | 0.87 | 2.3 | 1.3–3.3 |
| 2;6 | 2.4 | 0.67 | 2.3 | 1.6–3.7 | 4.8 | 1.05 | 4.7 | 3.50–6.40 |
| 3;0 | 2.2 | 0.93 | 1.8 | 1.1–3.4 | 5.8 | 0.31 | 5.7 | 5.50–6.20 |
| Words | | | | | | | | |
| 1;0 | 2.6 | 3.88 | 1.0 | 0–11 | 3.8 | 6.87 | 1.0 | 0–16 |
| 1;6 | 6.9 | 6.84 | 6.0 | 0–19 | 30.0 | 29.15 | 23.0 | 0–78 |
| 2;0 | 35.6 | 45.73 | 22.0 | 0–127 | 96.0 | 64.30 | 91.0 | 29–185 |
| 2;6 | 26.7 | 20.29 | 23.0 | 0–56 | 179.6 | 55.48 | 180.0 | 99–254 |
| 3;0 | 25.9 | 24.41 | 20.0 | 1–79 | 223.2 | 41.16 | 222.0 | 168–271 |
| FinSL signs | | | | | | | | |
| 1;0 | 9.9 | 15.44 | 3.0 | 0–42 | N/A | N/A | N/A | N/A |
| 1;6 | 19.4 | 21.91 | 14.0 | 2–62 | N/A | N/A | N/A | N/A |
| 2;0 | 46.3 | 29.11 | 51.0 | 4–84 | N/A | N/A | N/A | N/A |
| 2;6 | 46.0 | 29.26 | 42.0 | 14–90 | N/A | N/A | N/A | N/A |
| 3;0 | 40.9 | 28.23 | 31.0 | 10–91 | N/A | N/A | N/A | N/A |
| Sum of words and FinSL signs | | | | | | | | |
| 1;0 | 12.4 | 19.22 | 4.0 | 1–53 | N/A | N/A | N/A | N/A |
| 1;6 | 26.3 | 24.99 | 21.0 | 4–74 | N/A | N/A | N/A | N/A |
| 2;0 | 81.86 | 57.16 | 84.0 | 7–191 | N/A | N/A | N/A | N/A |
| 2;6 | 72.71 | 25.02 | 76.0 | 42–105 | N/A | N/A | N/A | N/A |
| 3;0 | 66.71 | 47.55 | 49.0 | 18–144 | N/A | N/A | N/A | N/A |

Notes. MLU10, Mean Length of the 10 longest Utterances. In KODAs, the MLU10 was based on the Sum of the Numbers of Spoken Language Words and FinSL signs. N/A = Not Applicable.

These findings show that the KODAs and HHs used different languages in the video-recorded play sessions. The KODAs preferred to use more FinSL with their deaf parents, and the HHs, naturally used only Finnish. Also, the way the languages were used differed between the children, as the numbers of utterances, signs, and words produced by the KODAs were fewer than those of the utterances and words produced by the HH. However, the way languages were used differed among the children. Compared with the numbers of utterances and words that the HH produced, the KODAs produced fewer utterances, signs, and words.

Use of pointing by children

When the children included in the study were 1;0 to 3;0, the KODAs used pointing in 36% to 47% of their utterances, on average (mean across all data points, 42%; SD, 12.60; see Figures 2 and 3). During the video-recorded sessions, no significant differences were found in the use of pointing (raw scores) as a function of the ages of the KODAs. Corresponding with the raw scores, no significant differences were found in the relative percentage of pointing as a function of age [Friedman's ANOVA $\chi^2(4) = 4.91$, $p = .296$, effect size .18]. In this study, relative percentage refers to the proportion of pointing gestures related to the number of utterances multiplied by 100.

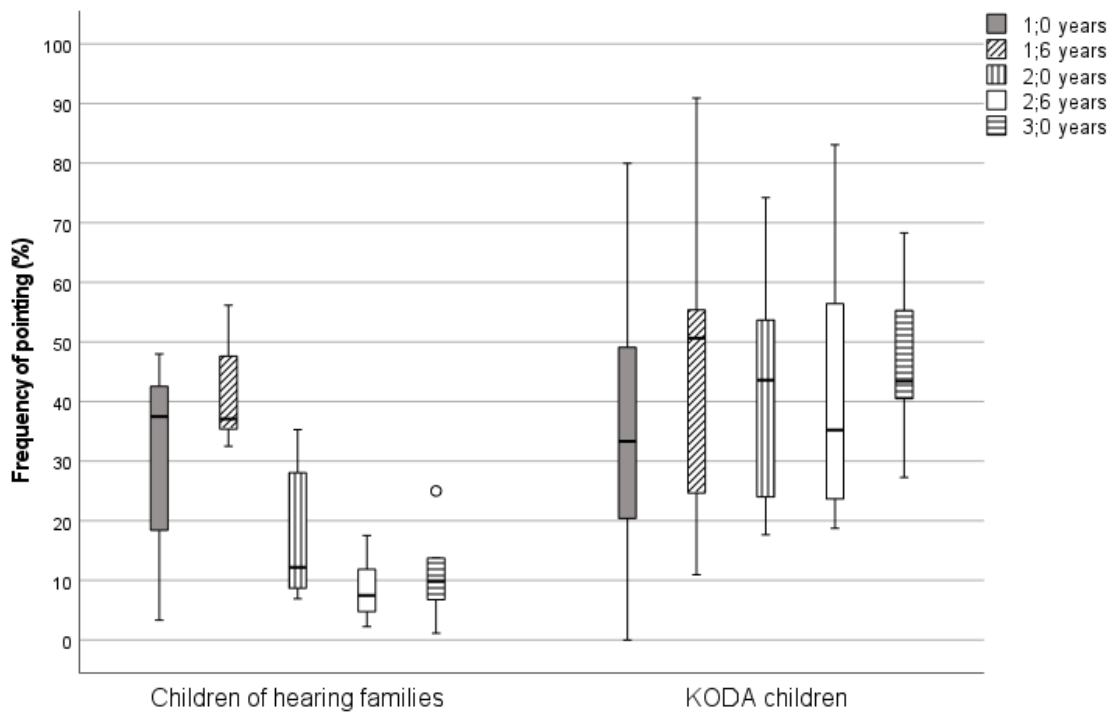


Figure 2.

Comparison of Longitudinal Group-Wise Trends of the Relative Percentage of Pointing Between Children of Hearing Families and KODAs. The relative percentage is expressed in proportion to the number of utterances in 10-minute video-recorded sessions and multiplied by 100.

For the HHs, Friedman's ANOVA revealed changes in the frequency of pointing (expressed as raw scores) across all data collection points [$\chi^2(4) = 10.22, p = .037$, effect size .51]. At 1;6 the number of pointing actions was significantly higher than that at 2;6 years of age ($Z = 2.90$, Bonferroni-corrected $p = .037$). However, their relative pointing frequency, which ranged from 9% to 42% at different data points (mean across all data points, 22%; SD, 6.39), did not show any significant differences between any of the video-recorded play sessions [$\chi^2(4) = 5.92, p = .205$, effect size .30].

As the number of utterances of HHs was significantly higher than that of the KODAs at three of the five data points, it is important to examine the relative percentage of pointing when comparing the two groups of children (see Figure 3; parents' results are explained later in the text). At the ages of 2;6 and 3;0 percentage of pointing used by the KODAs was significantly higher than that used by the HHs (Mann Whitney $U = 35.00$ and $p = .003$ at both data points). At both age points, the effect size was large ($r = .82$).

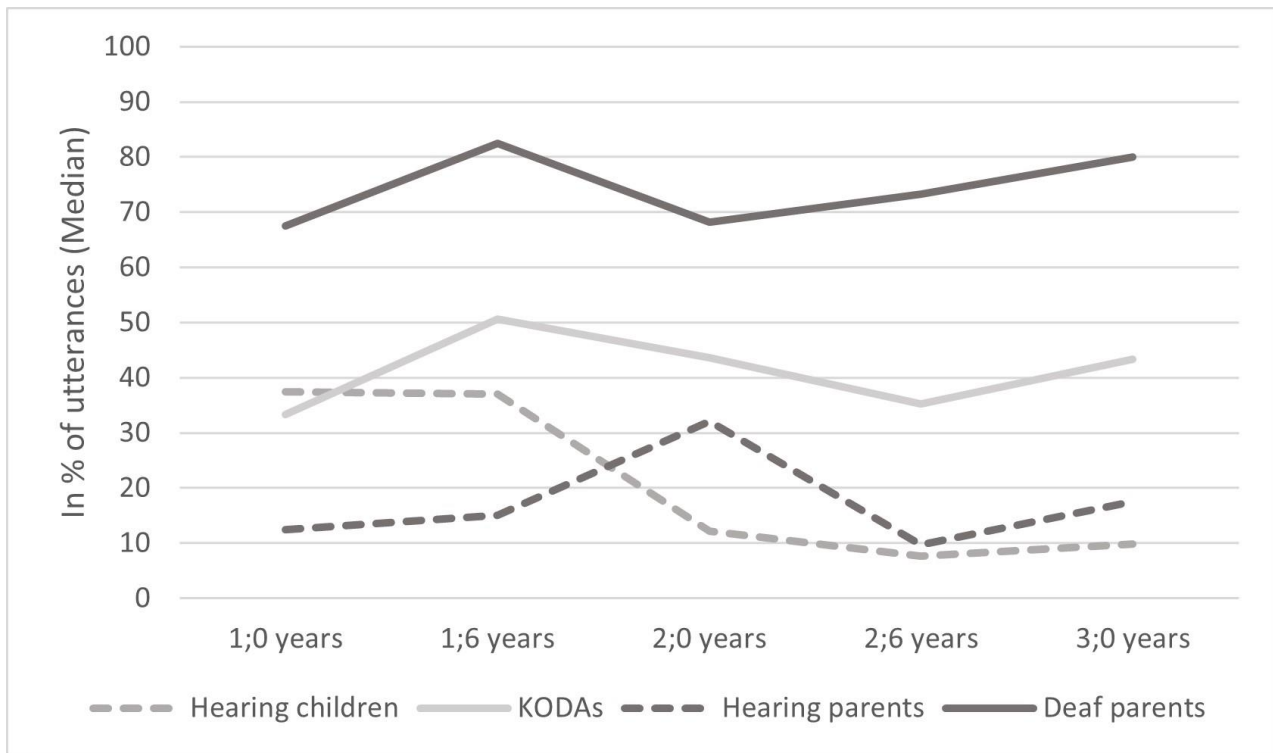


Figure 3.
Relative Percentages of Pointing by Children and their Parents at Different Follow-up Points.

The association between the number of pointing by each child and the number of words and/or FinSL signs the same child used was also examined. The Spearman's rank correlation analysis revealed that the higher the raw frequencies of pointing by the KODAs during the recorded play session at the age of 1;0, the more they produced FinSL signs ($r_s = .92, p = .003$) and the higher their combined numbers of words and FinSL signs produced during the session ($r_s = .87, p = .012$). No significant correlations were found between these variables after the age of 1;0 (correlations ranged between $-.18$ and $.22$). However, some pointing actions could also be classified as FinSL signs, but to compare the pointing actions produced by the KODAs and HHs in this study, pointings are presented as a category of their own and excluded from the total number of signs produced by KODAs.

The raw number of pointing actions produced by the HHs at the age of 3;0 correlated negatively with the number of words they produced ($r_s = -.90, p = .037$); the higher the number of words produced during the play session, the lower the pointing frequency. In other data points such correlations ranged from $r_s = -.87$ to $r_s = .50$ and were not significant. In line with a well-known developmental trajectory, among the HHs, pointing was more frequent than their word production at the ages of 1;0 and 1;6 (see Figure 4).

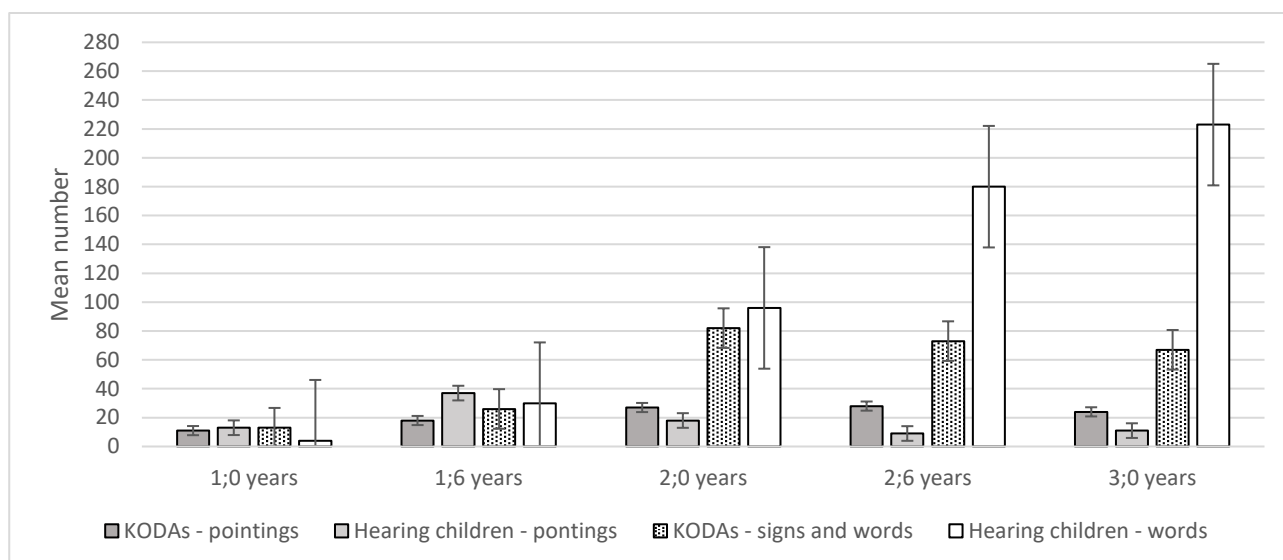


Figure 4.
Comparison of the Mean Number (with SDs) of Pointings (Raw Score Means), Mean Number of Words (of the HHs), or Mean Sum of the Numbers of Words and FinSL Signs (of the KODAs) Produced by Children at Different Follow-up Time Points.

As pointing can have grammatical, gestural, and interactional functions, partly depending on where the pointing is directed, such as to a person or an object, the direction of each pointing was analysed. During the time span from 1;0 to 3;0, at different data points, the KODAs pointed at themselves (in the meaning of first person) or their parent (in the meaning of second person) from a mean of 0 to 1.86 times. Because the KODAs, at different data points, pointed at objects, on average, from 9.86 to 25.43 times, they had a mean of 19 more points targeted to objects than to the first or the second person. Across all data collection points, the HHs never pointed at themselves or their parents and had a mean of 16 points directed towards objects. When the KODAs and HHs were aged 1;6, they pointed at objects 18 and 34 times, on average, respectively. At the age of 2;6, KODAs pointed at objects 25 times and HHs eight times, on average. These differences at the ages of 1;6 and 2;6 years were significant (Mann-Whitney $U = 5.00$, $p = .048$, effect size .59, and $U = 31.00$, $p = .030$, effect size .64). In all other video recordings, no significant differences were found between these two groups of children in pointing at objects or persons. This implies that the KODAs and HHs had rather similar profiles in terms of their pointing targets.

To summarise, in relation to their linguistic development and language use during the video-recorded play sessions, both the frequency and relative percentage of pointing significantly differed between

the KODAs and the HHs. The pointing by the KODAs remained stable during the follow-up time, whereas the frequency of pointing by the HHs decreased after the age of 1;6 as their spoken language developed further.

Use of pointing by parents

In the different video-recorded play sessions, the mean number of utterances produced by the deaf parents ranged from 92 to 117, whereas a mean of 106 to 134 utterances were produced by the hearing parents. The numbers of utterances produced by the deaf and hearing parents did not significantly differ at any data collection point (Mann-Whitney results ranged from $U = 10.00$, $p = .268$, effect size .35, to $U = 20.00$, $p = .755$, effect size .12).

The parents' use of pointing was then examined as their communicative behaviour formed, for their part, in the context of interaction observed in the video-recorded play sessions. Typically, parents of KODAs pointed at the target such as a picture in a book, signed their message, and then re-pointed at the target. In the deaf parents, the results of Friedman's ANOVA indicated that the raw scores of pointing significantly varied across different data collection points [$\chi^2(4) = 12.80$, $p = .012$, effect size .46]. According to the pairwise comparisons, the number of pointing actions was significantly higher at the data point of 3;0 than at 1;0 ($Z = -2.57$, Bonferroni-corrected $p = .023$, effect size .89). The relative percentage of pointing by the deaf parents was then examined. As shown in Figure 3, the video recordings taken at ages 1;0 to 3;0 showed that the median number of pointing actions by the deaf parents of KODAs ranged from 68% to 83%, per data collection point ($M = 73.00$, $SD = 13.23$). This relative percentage of pointing did not significantly change across the different data points ($\chi^2(4) = 3.66$, $p = .454$, effect size .13).

According to the results of Friedman's ANOVA, the pointing frequency (as raw scores) of the hearing parents did not significantly differ at different ages of their children ($\chi^2(4) = 3.68$, $p = .452$, effect size .18). Their median relative pointing frequency ranged from 10% to 32% ($M = 19$, $SD = 5.45$), with no significant changes found across the different data collection points. At all data points, the relative percentage of pointing by the deaf parents was significantly higher than that of the hearing parents (Mann-Whitney $U = 32-35$ and $p = .003-.018$). The effect sizes were large, ranging from $r = .68$ to .82.

When analysing the targets of pointing during the follow-up period, at different data points deaf parents pointed at themselves (in the meaning of the first person) or their child (in the meaning of the second person) from an average of 2.03 to 12.43. As, at different data points, deaf parents pointed at objects, on average, from 56.71 to 81.71, they had a mean of 64 more points targeted to objects than to the first or the second person. Across all data points hearing parents never pointed at themselves or their child and had an average of 20 points directed towards objects. At all other data points, except at their children's age of 2;0, the deaf parents pointing frequency towards objects was significantly higher than that of the hearing parents (Mann-Whitney $U = 33-35$ and $p = .003-.010$). The effect sizes ranged from $r = .73$ to $.82$. Additionally, at all data points, except at the children's age of 1;6, the deaf parents pointed at themselves, and their child significantly more often than the hearing parents did (Mann-Whitney $U = 32.5-35$ and $p = .003-.010$, effect size $r = .75-.86$).

In summary, the deaf parents used sign language when communicating with their children, and their relative percentage of pointing actions was clearly higher than that of the hearing parents who used spoken language. The deaf parents' raw number of pointing actions increased during the 2-year follow-up period, but the relative frequency remained rather stable. Among the hearing parents, neither the raw number nor the relative percentage of pointing significantly changed during the follow-up period.

Inter-relationship between the pointing frequencies of the parents and their children

The pointing frequencies, as raw scores, of the deaf parents and KODAs significantly positively correlated at the child's age of 1;0 (Spearman's $r_s = 0.79$, $p = .036$). The relative percentage of pointing did not correlate between the deaf parents and their children at any age point. Pointing use (as raw scores) by the hearing parents was most frequent when their children were aged 2;0, and the number of pointing actions between the hearing parents and their children significantly positively correlated at the child's age of 1;6 ($r_s = 0.90$, $p = .037$) and 3;0 ($r_s = 0.98$, $p = .005$). The relative percentage of pointing by the hearing parents and their children positively correlated at the ages of 2;0 and 3;0 ($r_s = 0.90$, $p = .037$ in both cases).

The deaf and hearing parents' use of pointing was stable at all time points from 1;0 to 3;0. Regarding the relative percentage of pointing, the deaf parents used significantly more pointing actions than the hearing parents did (see Figure 3). Some correlation was found mostly between the hearing parents' and their children's use of pointing. Neither hearing parents nor their children targeted their pointing

towards a person (in the meaning of the first or the second person), but, instead, targeted the pointing only towards the objects whereas both the deaf parents and the KODAs directed their pointing not only to the objects but also to the first or the second person. However, the number of pointings directed towards the persons were clearly lower than the number of pointings directed at objects.

Discussion

In the current research, the use of pointing was studied longitudinally between the two types of parent-child dyads, one using sign and the other using spoken language. The research questions focused on elucidating, first, how frequently did KODAs and their deaf parents and hearing children and their hearing parents use pointing in their interaction during video-recorded play sessions from the children's age of 1;0 to the age of 3;0. The second research questions aimed to focus to examine how the frequency of pointing differed among the two types of parent-child dyads as a function of different languages used and a function of children's increasing age and developing language.

According to the main findings of this study, the relative pointing frequency (pointing rate in relation to the number of utterances multiplied by 100) of the KODAs and their deaf parents was higher than that of the hearing children and their hearing parents. From the ages of 1;0 to 3;0 the KODAs used pointing in an average of 42% of the utterances they produced during the 10-minute interaction sessions. The average relative percentage of pointing by the HHs was only half (22%) of that by the KODAs and was significantly less than that by KODAs when the children were aged 2;6 and 3;0. This finding is in line with the previous case study of Morgernstern et al. (2010) where the researchers found that the KODA used pointing more frequently than a hearing monolingual child acquiring spoken language.

In addition, the results of this study showed that, in relation to children's age and language development both the frequency and relative percentage of pointing significantly differed between the KODAs and the HHs. In this study, the number of produced utterances, MLU10 and produced signs and words increased during the follow-up as an indication of KODAs and HHs developing language. The use of pointing by the KODAs and deaf parents was rather stable over the 2-year follow-up period. Whereas the pointing frequency of the HHs peaked at the age of 1;6 and clearly decreased thereafter as their started to produce more speech. This finding is consistent with the findings of a previous study on hearing children acquiring spoken language (Lüke et al., 2017).

Moreover, it has been shown earlier that by the age of 3 to 4 years, hearing children's use of pointing with speech begins to be comparable with hearing adults' use of pointing during speech (Nicoladis et al., 1999). The results of this study are in line with this finding, as the relative percentage of pointing of both the hearing children and their hearing parents was low at the children's age of 3 years. These results suggest that the use of pointing is based on early language development and communication and is further shaped by the language and modality used.

From the interactional perspective, pointing is used to indicate, establish, and direct joint and sustained attention and holds interactional functions in both sign language and spoken language conversations (Ferrara, 2020; van Herreweghe, 2002; Yoshida et al., 2020). In the present study the significantly higher relative pointing frequency among deaf parents than among hearing parents from the very beginning and during the whole follow-up possibly indicates pointing functioning in parent-child interaction as a means to direct a child's attention to the target the parent wants to show or discuss with the child. Sign language, as a visual-gestural language, emphasises and sets different prerequisites for visual attention compared with spoken language, representing an auditory-oral modality. Just as the reception of spoken languages necessitates auditory attention, sign languages necessitate visual attention. For this reason, in early sign language interactions, deaf parents have been reported to actively engage their children with specific visual and tactile strategies to attract, maintain, and guide their visual attention (Brooks, Singleton & Meltzoff, 2020; Harris & Mohay, 1997). These studies have also found that even at a very early age, children acquiring sign language already learn to shift their visual attention (gaze) rapidly and purposefully between the target (e.g., a book) and the signer. As the KODAs in the present study also frequently used pointing across all follow-up time points, they appeared to have learned the function of pointing and used pointing in similar ways as their parents did. Therefore, the function of pointing in indicating and directing the attention of others might partly explain the higher and more stable pointing frequency during the follow-up among the KODAs and deaf parents than among the hearing parents and their children.

In spoken languages, parent-child interactions are based on auditory and vocal features, whereas visual-tactile strategies are less often used in directing attention (Harris & Mohay, 1997). In this study, the pointing frequency of the hearing parents and their children decreased as the children grew older and the children's spoken language developed further. This result could be partly linguistically and interactionally motivated, as spoken language requires more auditory attention and processing, and the determined functions of pointing can partly be replaced by spoken words such as demonstrative pronouns (Cartmill, Hunsicker & Goldin-Meadow, 2014). Partly for this reason,

hearing parents do not use visual-tactile strategies similar to those used by deaf parents (Bosworth & Stone, 2021; Harris, 2001). In addition, sign language signs are partly produced in the same modality as pointing, which might also contribute to a higher number of pointing actions by children and adults using sign language than by children and adults using spoken language. With spoken language, pointing can be held at the same time as speech, whereas in signing, both hands are sometimes needed to produce signs. Hence, children and adults might first point to the target, sign the meaning of the target, and then point again at the same target. Therefore, when acquiring sign language in a visual-gestural modality, KODAs are acquainted with both the character of language input in a visual-gestural modality and the special type of interaction and parental interaction strategies that emphasise directing visual attention to other people and, more specifically, to bodily social-communicative acts. This finding aligns with the previous results of Kanto et al., (2015) where the researchers found that KODAs used pointing more frequently when interacting with their deaf parent than with a hearing person between the ages of 1;0 and 3;0. Despite being bilingual in Finnish and FinSL, in this study KODAs pointing frequency resembled that of their deaf parents more than that of the HHs and their hearing parents. This result suggests that the function of pointing actions starts to differ in sign and spoken interactions from the children's age 1 to 3 years. However, in the light of the results of this study, further research on the specific functions of pointing in early sign language and spoken language interaction is clearly needed.

As documented in previous studies and shown in this study, children and both deaf and hearing parents use pointing. However, there have been contradictory perspectives in recent studies on the relationship and definition between pointing and language and, more specifically, on how pointing has been viewed by different researchers studying spoken and sign languages and language acquisition. In many previous research articles, pointing has been interpreted as only a pre-linguistic gesture and somewhat separate from the developing language (Goodwyn & Acredolo, 1998; Iverson et al., 1999; Özçaliskan & Goldin-Meadow, 2009; Rowe & Goldin-Meadow, 2009). Studies on pointing among children acquiring sign language have also first regarded pointing as a primitive, pre-linguistic gesture discrete from language that will be developed into pronouns alongside language development (Hatzopoulou, 2008; Petitto, 1994). Recent studies on sign language have regarded pointing, including its gestural and linguistic elements, as an innate and inseparable part of all languages (2013a, 2013b). Johnston (2013a, 2013b) also argued that to convey meanings that are more linked to the context, both signers and speakers use gestures and gestural elements such as pointing in a similar way, but the frequencies of the different gestural elements used differ depending on the language (see also Morgernstern, 2014). This cognitive-functional framework holds the

conception that pointing can have pronominal functions similar to those of pronouns in spoken languages but at the same time have unconventional gestural elements as well. Hence, pointing in sign language is categorically and grammatically regarded neither as a pronoun nor a gesture but sharing multiple functions (Cormier et al., 2013; Johnston, 2013a; Liddell, 2003; Schembri, Cormier, & Fenlon, 2018). Thus, the question arises as to how these gradient and unconventional elements that are gestural in nature and at the same time holding grammatical functions should be regarded and seen inside the developing language of children.

The findings of this study did demonstrate that the frequency of pointing of the KODAs was rather stable across the different data points, even though their language skills clearly developed during the data collection period, whereas the pointing frequency of the HHs and their hearing parents decreased over the time of the follow-up. Thus, the connection between the use of pointing and language development among KODAs and HH slightly differed. In this study the results showed that the more KODAs produced signs at the age of 1;0 the more they produced pointing at the same age. On the other hand, more HHs produced words at the age of 3;0 the less they produced pointing at the same age. This way the use pointing by KODAs resembled more the pointing frequency by their deaf parents than the use of pointing by HHs and their hearing parents. This finding suggests that the KODAs, who were simultaneously acquiring both Finnish and FinSL, were already acquainted particularly with the use of pointing in their interactions and use of sign language with their deaf parents. This result may indicate the changing function of pointing in relation to children's increasing age and developing language. During the language developmental path pointing may start to hold more pronominal functions among KODAs whereas among HHs these functions are partly taking over by Finnish pronouns and demonstratives. Therefore, the findings of this study suggest that pointing in a child's language is not only a pre-linguistic preliminary element but a more inseparable part of their developing language from the beginning of language acquisition and the use of pointing to be partly linguistically motivated. However, the question remains as to whether pointing used by signers is more conventionalised holding more grammatical functions than pointing used by speakers and, if so, how and when KODAs are conventionalising the pointing alongside their language development to become a more conventional element of language than at the earliest phases of their language acquisition. In further research, qualitative analysis is needed to describe both the interactional and linguistical functions of pointing and how pointing is used in spoken and signed phrases during parent-child interactions and during the different phases of children's language development.

It should be highlighted that the comparison between the KODAs and children of hearing parents and two types of parent-child dyads must be made with caution, and the use of pointing and language should also be considered in light of the differences between the language and the modality used. With their deaf parents, the KODAs preferred to use sign language instead of spoken language. The number of utterances produced by the HHs was higher than that produced by KODAs. This is concordant with the findings of previous studies that have reported lower numbers of utterances and word/signs produced between the children and parents using sign language than those between the children and their parents using spoken language (see, e.g., Morgenstern et al., 2010; Spencer & Harris, 2006). It has been suggested that these differences are related to the features of early sign language interactions and child-directed signing, where deaf parents have been reported to sign only when their children can see the signs and actively engage their children with specific visual and tactile strategies to attract, maintain, and guide the visual attention of their children. However, in this study, the number of utterances produced by hearing and deaf parents did not differ significantly.

This study had a small sample collected during natural play sessions, which were subject to many factors such as temperament, moment-to-moment varying concentration ability, and the interests of the children. The results should therefore be regarded with caution, as only a limited number of samples of behaviours were analysed from the video recordings (approximately 50 minutes per parent-child dyad). These samples do not indicate children's total language and interaction capacity and the ways pointing is used in daily interaction in different discourse contexts and situations. In future research, it is important to study the use of pointing with larger samples of participants in more diverse interaction contexts. Partly related to the data collection methods of the present study, the attentions of the children and parents were more directed to the toys and books present in the video-recorded play sessions. Further, collecting data from more diverse interaction contexts is important to determine how multifaceted the way pointing is used in different interaction contexts. Quantitative methods were used to analyse and report the data of the present study. It is also important to conduct qualitative analyses in the future. For this reason, only careful conclusions can be drawn on the basis of the results of this study, whose generalisability is limited. Moreover, corpus-based research with large data sets on the way adults use pointing both in Finnish and FinSL is urgently needed to provide a stronger theoretical background for further research on children's use of pointing in Finnish and FinSL.

Conclusion

In spoken and sign languages, pointing is a multifunctional phenomenon in interactions and children's language acquisition. The aim of this study was to broaden the understanding of the multidimensional aspects of pointing in parent-child interactions and its relationship to the acquisition of spoken and sign languages. The results of the present study show, concordantly with previous studies, that pointing is a fundamental element of parents' and children's interactions regardless of the language used. However, our findings also show that the use of pointing clearly has not only similarities but also differences regarding the pointing frequency between signers and speakers among children and parents. The findings of this study suggest that the use of pointing in parent-child interactions is motivated by the interactions themselves to initiate and maintain joint and sustained attention while being guided by the gestural and linguistic features and the modality of the language used.

KODAs continue to use pointing as part of their signed utterances, whereas the frequency of pointing of hearing children using spoken language decreases. This study is an opening for further research and increases the understanding of pointing actions by suggesting that pointing is not strictly either gestural or linguistic but plays a multifunctional role in interactions and children's developing language. Pointing by KODAs may shift from a predominantly gestural one into a multifunctional gestural-linguistic action but further research is clearly needed. The results of this study highlight the importance of examining further the different functions of pointing. This could be accomplished from a qualitative perspective for seeing how pointing is integrated into children's linguistic development.

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