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A matter of meaning

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Chapter 2

Communication between Children with Deafness, Blindness and Deafblindness and their Social Partners: An Intersubjective Developmental Perspective*

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Abstract

Trevarthen's theory of innate intersubjectivity is relevant to understanding communication problems in children with sensory disabilities. Trevarthen and Aitken (2001) used the term 'intersubjectivity' to describe 'the ability of humans to detect and change each other's minds and behavior' (p.18). When children lack auditory and/or visual means of interaction, they may not be able to fully develop intersubjectivity, which impedes the development of more complex interpersonal communication. This article presents a review of 31 studies about intersubjectivity in children with sensory disabilities. The results indicate that the intersubjective development of children with sensory disabilities is often delayed. The studies also describe similar strategies for mediating intersubjectivity in children with sensory disabilities and in typical children, but say that specific adaptations may be needed. From an intersubjectivity perspective, symbolic communication delays in children with sensory disabilities may be improved through specific, purposeful forms of social interaction.

2.1 Introduction

Developing the ability to share meanings with other people is intricately connected to engaging in social interactions with familiar people. Children with sensory disabilities may have difficulty actively contributing to meaning making as a result of their impairments in the use and perception of common communicative behaviors such as eye contact, facial expressions or speech. This study investigates whether children with sensory disabilities and their social partners are able to find non-visual or non-auditory means of interpersonal communication or whether supportive interventions are always required.

The aim of this paper is to discuss the potential benefits of an intersubjective developmental perspective for understanding and treating communication problems between children with blindness, deafness or deafblindness and their social partners. When referring to these three groups of children, this article will use the term 'children with sensory disabilities'. Our perspective is based on Trevarthen's theory about newborns' ability to share meanings with others (Trevarthen & Hubley, 1978; Trevarthen, 1980; Trevarthen & Aitken, 2001), which manifests itself and develops through interpersonal communication as children grow older.

Communication is an important topic in the education of children with sensory disabilities such as congenital deafblindness, because their symbolic communication skills may be seriously delayed (Bruce, 2005; Hartmann, 2012; Paul & Roth, 2011). There are many interventions that aim at teaching communication and language skills to individual children using speech (LeBlanc, 2004) or alternative and augmentative communication systems (cf. Sigafos, Didden, Schlosser, Green, O'Reilly, & Lancioni, 2008 for a review). The natural development of communication begins after birth and occurs during daily social interaction. An important question is whether Trevarthen's theory of innate intersubjectivity can contribute to understanding the development of communication in children with sensory disabilities and whether applying this theory could help ameliorate delays or stagnations.

Bruce (2005) and Hartmann (2012) both discussed symbolic understanding and socio-cognitive development as relevant frameworks for the education of people with deafblindness. Bruce stated that specific developmental markers, such as joint attention, abstract play, object permanence and imitation, are important for the development of symbolic communication in these people. She identified ways in which knowledge on the development of symbolic communication might aid in the education of students with deafblindness, but also noted the lack of interventions and practices with such a focus. Hartmann used the broader framework of socio-cognitive theory to describe good practices and empirical findings among children with deafblindness. Hartmann's review also noted the lack of research on symbolic understanding and socio-cognitive development, and ended with a call to test the efficacy of interventions and practices

based on this framework. She also called for systematic review of research on education for people with deafblindness.

Intersubjectivity theory may provide researchers and clinical workers who approach deafblindness from developmental and socio-cognitive perspectives with a coherent set of principles, propositions, and concepts that can guide them in studying the development of interpersonal communication. Furthermore, because of the strong basis of intersubjectivity theory in typical developmental studies, comparison studies may help clarify the specific limitations, challenges and adaptations faced by people with sensory difficulties. To assess these potential benefits, the aim of this study was to use an intersubjective developmental perspective to systematically review empirical studies of people with visual and/or auditory disabilities.

In this paper we will first present a number of relevant aspects from Trevarthen's theory of innate intersubjectivity. We will then systematically review the scientific literature about intersubjective development in children with sensory disabilities.

2.1.1 Intersubjective Development and Communication

According to theory of innate intersubjectivity (Trevarthen & Hubley, 1978; Trevarthen 1979, 1980; Trevarthen & Aitken, 2001; Bråten & Trevarthen, 2007; Reddy, 2008), human beings are all born with an innate motivation for interpersonal communication. Empirical evidence demonstrates that children are able to share meanings long before they have acquired language and cultural knowledge. Trevarthen's theory claims that newborns display 'primary intersubjectivity', which is defined as an 'active and responsive conscious appreciation of the adult's communicative intentions' (Trevarthen & Aitken, 2001, p. 5). Trevarthen calls this the first layer of intersubjective development and explains that this layer is characterised by infants' attention to the expressions of a familiar caregiver, imitation and turn-taking activities (1979).

The first layer of intersubjective development forms the basis for two other developmental layers (see Table 1). The second layer, called 'secondary intersubjectivity', is associated with the moment when objects become involved in interpersonal communication (Trevarthen & Hubley, 1978) and the child starts to display different communicative purposes, such as affirmation or acceptance (Trevarthen & Aitken, 2001). The third layer, 'tertiary intersubjectivity', builds upon the first and second layers and is characterised by symbolic communication, narrative imagination and the ability to simulate the perspective of the other (Bråten & Trevarthen, 2007, p. 23).

2.1.2 Measuring Intersubjectivity

The theoretical assumptions that intersubjectivity is developed in early childhood and that there are three distinct layers are based on empirical studies in which infants were followed throughout the first two years of life (Trevarthen & Aitken, 2001). Comparing

Table 1

Three layers of Intersubjective development, the corresponding abilities, manifestations and ages at which layers are developed in typical children (according to Trevarthen)

| Layer | Ability | Manifestations | Age |
|-----------------------------|---|---|-----------------------|
| Primary intersubjectivity | Other awareness | Attention to the expressions of familiar caregivers Imitation of adults expressions Turn taking activities Reproduction of game routines | from the first months |
| Secondary intersubjectivity | Mutual awareness | Joint attention Involvement of objects in interpersonal communication Display of different communicative purposes | from about 9 months |
| Tertiary intersubjectivity | A sense of verbal and narrative self and other Understanding of other's minds and emotion (theory of simulation of mind) | Symbolic communication Narrative imagination Simulating the perspective of the other Use of conventional communication forms | between 2 and 6 years |

infant-mother dyads at different ages showed that as infants mature, they become more skilled in communicating about purposes and concerns (Bråten & Trevarthen, 2007).

The discovery of turn taking and mutual imitations between newborns and their mothers was made possible by 'frame-by-frame' micro-analysis (Trevarthen, 1979; Trevarthen & Aitken, 2001) of video sections lasting a few seconds to a few minutes. Transcriptions of video recordings of longer ongoing interactions between an infant when she was 6 to 10 months old and her mother showed changes in the participants' expressions and the development of meaning making (Trevarthen & Hubley, 1978).

2.1.3 Mediating Intersubjectivity: Partner Strategies and Social Activities

As typical children interact with other people, they gradually develop more complex interpersonal communication because of how the interaction takes place (Trevarthen & Aitken, 2001). Partner strategies such as responding to a child's behaviors and demonstrating positive affect help mediate progression in intersubjectivity. Another partner strategy is 'child-directed speech', which is speech with 'exaggerated but modulated expressivity, organised in repeated phrases, and slowly changing, cyclic narratives of emotions with the purpose to engage attention, communicate affect and facilitate interaction' (Trevarthen & Aitken, 2001, p. 8).

Social activities are a second category of mediating strategies. They can be observed at different stages in intersubjective development: for example, body games and nursery songs can be observed at the first layer (Trevarthen, 2001), play with objects at the second layer (Trevarthen & Hubley, 1978) and imaginative play at the third layer (Trevarthen, 2001).

2.1.4 Theory of Intersubjectivity: Children with Atypical Development

According to Recchia (1997), it is important to study intersubjectivity in children who are at risk for delays in social cognition and communication. Several authors have used theory of innate intersubjectivity to understand and treat communication problems in children with sensory disabilities. The aim of this review is to evaluate the progress that has been made by using this theoretical approach to study communication development in this target group, and to chart the directions that are most in need of further exploration. We will address the following questions: a) How is intersubjectivity measured in children with sensory disabilities? b) What levels of intersubjective development are measured in these children? c) Are there any interventions that are specifically related to intersubjective development in children with sensory disabilities? and d) What do these interventions achieve with respect to both intersubjectivity and communication?

2.2 Method

2.2.1 Data Collection Process

The literature on intersubjective development in children with sensory disabilities was collected by conducting a systematic multi-step literature search. A flow diagram is presented in Figure 1 to make the separate steps visible, in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analysis (otherwise known as the PRISMA statement; Moher, Liberati, Tetzlaff, & Altman, 2009).

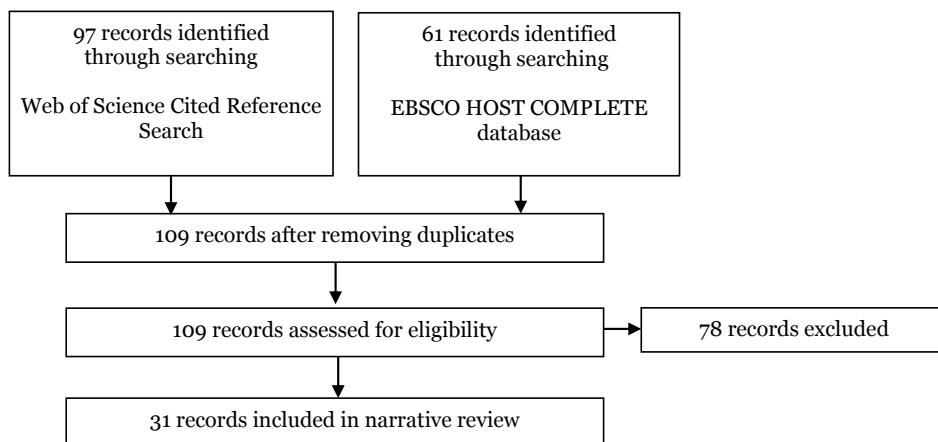


Figure 1. Flow of information during the different phases of our systematic review

First, we conducted an electronic search in Web of Science to find relevant articles that used citations from Trevarthen. We did a cited reference search and applied the term ‘Trevarthen, C*’ in combination with one of the following terms: ‘deaf’, ‘blind’, ‘deaf AND blind’, ‘sensory disorder’, ‘sensory impairment’ and ‘sensory disabilit*’. Second, we searched the EBSCO Host Complete database (1985–1 December 2012), which performs a combined search of 31 databases. We searched for the terms ‘intersubjectivity’ or ‘Trevarthen’ in combination with one of the following terms: ‘deaf’, ‘blind’, ‘deaf AND blind’, ‘sensory disorder’, ‘sensory impairment’ and ‘sensory disabilit*’. Neither search produced any positive results for the terms ‘sensory disability’ or ‘sensory disabilities’ in combination with the terms ‘intersubjectivity’ or ‘Trevarthen’. The other search terms resulted in the identification of 158 papers. Forty-nine of those papers were duplicates; after removing them, 109 papers remained.

2.2.2 Inclusion and Exclusion Criteria

We applied additional criteria to the remaining 109 full-text articles: a) focus on social interaction, b) involving children with either visual or hearing disabilities or a combination, c) participants not diagnosed with autism spectrum disorders, d) published as an empirical study or case description(s), e) published in a peer-reviewed journal or as a book chapter with reference to other studies, and f) written in English. Application of these criteria led to the exclusion of 78 full-text articles and the inclusion of 31 articles in the narrative analysis. We also considered doing a quantitative synthesis (meta-analysis) after conducting a narrative analysis of intervention effects. However, the wide variation of effects studied in the papers precluded any meaningful quantitative summary.

2.2.3 Interrater Reliability

All of the papers found in the database search (except the duplicates) were fully assessed for eligibility by the main reviewer (first author) using the abovementioned criteria. A second reviewer independently assessed a random subset of 20% of the papers ($n = 22$) to check that the inclusion and exclusion criteria had been applied accurately (Liberati, Altman, Tetzlaff, Mulrow, Gøtzsche, Ioannidis, & Moher, 2009). Next, an interrater reliability analysis was performed using the kappa statistic to determine consistency among raters. The kappa value was 0.69 (good agreement; Fleiss, 1981).

A coding system was used to analyse the 31 articles included in our review. The main reviewer (first author) coded all the articles. A second reviewer also independently coded a random subset of 20% of the articles ($n = 7$) using all key variables from the analysis (Liberati et al., 2009): measured variables, instruments, intersubjectivity layers and, for intervention studies, the type of intervention. The kappa values showed adequate levels of agreement for these categories, with kappa values ranging from 0.75 (variables, intersubjectivity layers) to 1.0 (instruments, type of intervention).

2.3 Results

Using the abovementioned criteria, we selected 31 studies: 12 included children with deafness, 12 included children with blindness, 6 included children with deafblindness, and 1 included children with either deafness or blindness. Most of these studies were characterised as intervention studies ($k = 15$). All of the studies that involved participants with deafblindness ($k = 6$) were intervention studies, but only one intervention study (Damen, Kef, Worm, Janssen, & Schuengel, 2011) involved participants with blindness.

In addition to intervention studies, the search also found other types of studies: seven case studies, six experiments and three observation studies. Most of them (12 out of 16) used a developmental approach: they explored intersubjectivity longitudinally, compared different age groups or compared children with sensory disabilities with

typical children of a similar age. Unfortunately, the diversity of these studies' target groups was limited, because the majority of the studies with a developmental approach (9 out of 12) involved subjects with blindness and no subjects with deafblindness.

Various numbers of children participated in these studies: they ranged from one subject (in six studies) to 116 subjects (Markman, Quittner, Eisenberg, Tobey, Thal, Niparko, Wang, & The CDaCI Investigate Team, 2011). However, the majority of studies involved 10 or fewer participants ($k = 19$) from different age groups. A majority of studies ($k = 26$) involved children between 0 and 3 years old or 6 and 12 years old.

2.3.1 Intersubjectivity Measures

The term 'intersubjectivity' was not used for the study variables in most of these studies (except for Loots, Devisé, & Jacquet, 2005; Saliés & Starosky, 2008). Although other authors did not explicitly measure 'intersubjectivity', they measured variables that could be attributed to one of the layers of intersubjectivity Trevarthen described.

The following section will describe three aspects of these studies. First, we will present categories that were formed for each layer of intersubjectivity after clustering the measured variables. Second, we will describe the instruments used to measure these variables. Finally, we will present the focus of these variables, indicating whether the researchers' perspective focused on the child, parent or interaction.

Of the 95 measured variables, 81 could be attributed to one of the three layers of intersubjectivity and were clustered into 20 categories (see Table 2). Most categories were found in the first layer of intersubjective development. The following categories were measured for this layer: 'affective attunement', 'responsiveness', 'initiatives', 'shared experiences', 'emotional expression', 'regulation' and 'dyadic interaction' involving 17 different studies. A comparison of these categories with the characteristics of primary intersubjectivity in typical children such as described by Bråten and Trevarthen (see Table 1) revealed that all the described characteristics were measured. Most studies measured 'initiatives' and all three of the target groups: children with deafness, blindness or deafblindness. All three target groups were also found in studies that measured variables clustered in the 'responsiveness' and 'shared experiences' categories.

Table 2

Overview of variables measured in the included studies, clustered and distinguished by layer of intersubjective development at which variables are observed in typical children

| Variables | Deaf studies | Blind studies | Deafblind studies |
|---|-----------------------------|--|---|
| Primary Intersubjectivity Layer | | | |
| Affective attunement | | Damen et al. (2011) ¹ | |
| Affective mutuality | | | Janssen et al.(2003b; 2006; 2011; 2012) ¹ |
| Affective involvement | | | |
| Child and adult's emotional Availability | | Campbell (2007) Campbell & Johnston (2009) ² | |
| Child and adult sharing emotions. | | | Kirkebaek (2007) ¹ |
| Responsiveness | | | |
| Child's and/or adult's responsiveness | | Damen et al. (2011) ¹ Preisler (1991) ¹ | Dammeyer (2009) ¹ Kirkebaek (2007) ¹ |
| Child's attention to the social interaction/partner | Bigelow (1994) ² | | Dammeyer (2009) ¹ |
| Adult's confirmation of child's Initiative | | Damen et al. (2011) ¹ | Janssen et al.(2003b; 2006; 2011; 2012) ¹ |
| Child's confirmation of adult's Initiative | | | Janssen et al.(2003b; 2006; 2011; 2012) ¹ |
| Child's and adult's answer to an utterance of the partner | | | Janssen et al.(2003b; 2006; 2011; 2012) ¹ |

Table 2 (continued)

| Variables | Deaf studies | Blind studies | Deafblind studies |
|--|------------------------------------|--|--|
| Primary Intersubjectivity Layer | | | |
| Initiatives | | | |
| Child's or adult's expressions | Preisler et al.(2002) ¹ | Preisler (1991) ¹ | |
| Interaction initiatives of child | Preisler (1995) ¹ | Preisler (1995) ¹ | Janssen et al. (2003b; 2006; 2011; 2012) ¹ Kirkebaek (2007) ¹ Dammeyer (2009) ¹ |
| Interaction initiative of adult | | | Janssen et al. (2003b; 2006; 2011; 2012) ¹ |
| Child's and adult's attempts to get attention. | Jamieson (1994) ² | | |
| Child an adult directing attention towards partner's body or face. | Jamieson (1994) ² | | |
| Shared experiences | | | |
| Sharing attention, experiences/ activities | Preisler (1995) ¹ | Preisler (1995) ¹ | Janssen et al. (2003b; 2006; 2011; 2012) ¹ |
| Taking part in/initiating e.g. play, body-touching games, songs | Preisler(1995) ¹ | Preisler (1995) ¹ Preisler (1991) ¹ | |

Table 2 (continued)

| Variables | Deaf studies | Blind studies | Deafblind studies |
|--|---------------------------------|--|--|
| | Primary Intersubjectivity Layer | | |
| Emotional expressions | | | |
| Child's expressions of emotions | | Galati et al. (2001) ² Galati et al. (2003) ² Peleg et al. (2009) ² | Kirkebaek (2007) ¹ |
| Regulation | | | |
| Child's and adult's regulation of the tension and tempo within an interaction and the apparent processing of information | | | Janssen et al. (2003b; 2006; 2011; 2012) ¹ |
| Child needing breaks | | | Kirkebaek (2007) ¹ |
| Novelty in interaction | | | |
| Interaction flow | | | Kirkebaek (2007) ¹ Kirkebaek (2007) ¹ |
| Quality of communication: impact of a communicational act on communication flow | | | Dammeyer (2009) ¹ |
| Dyadic interaction | | | |
| Turn taking and/ or turn giving in interaction | | | Janssen et al. (2003b; 2006, 2011, 2012) ¹ |
| Maintaining close contact | | | Kirkebaek (2007) ¹ |
| Child taking part in protoconversations | | | |
| Imitation | | Preisler (1991) ¹ Preisler (1991) ¹ | |

Table 2 (continued)

| Variables | Deaf studies | Blind studies | Deafblind studies |
|---|--|---|---|
| | Secondary Intersubjectivity Layer | | |
| Communicative intentionality Child's pre-verbal/non-linguistic communication | | Preisler (1995) ¹ Bigelow (1994) ² | Dammeyer (2009) ¹ |
| Play with objects Social/triadic play between child and adult | Preisler (1995) ¹ Preisler et al. (2002) ¹ | Preisler (1995) ¹ | Dammeyer (2009) ¹ Kirkebaek (2007) ¹ |
| Exploration of toys | Preisler (1995) ¹ | Preisler (1995) ¹ | Dammeyer (2009) ¹ |
| Child's manipulation of objects in interaction | | | |
| Understanding emotions Child's understanding of emotions | | Roch-Levecq (2006) ⁶ | |
| Book sharing Parent's organisation of listening and watching during book sharing | Swanwick & Watson (2007) ² | | |
| Parent's focus on print, letter, sound or shapes of books | Swanwick & Watson (2007) ² | | |
| Joint Attention Child and adult initiating joint attention | Cramér-Wolrath (2011) ¹ Nowakowski et al. (2009) ² Swanwick & Watson (2007) ² | Preisler (1991) ¹ | |

Table 2 (continued)

| Variables | Deaf studies | Blind studies | Deafblind studies |
|---|---|-----------------------------------|-------------------|
| | Secondary Intersubjectivity Layer | | |
| Child and adult re-establishing joint attention | Cramér-Wolrath (2011) ¹ | | |
| Child and adult directing attention toward toy in interaction | Jamieson (1994) ² | | |
| Adult's response to infant's attention signals to objects | Tasker & Schmidt (2008)* | Preisler(1991) ¹ | |
| Joint attention between child and adult | Nowakowski et al. (2009) ² Swanwick & Watson (2007) ² Tasker & Schmidt (2008)* Tasker et al. (2010) ² | Bigelow (2003) ² | |
| Joint attention quality between child and adult | Tasker & Schmidt (2008)* Tasker et al. (2010) ² | | |
| Child's ability to point at targets | | Gaunet et al. (2006) ⁴ | |
| Role reversal | | | |
| Role reversal between child and adult | Saliés & Starovsky (2008) ² Swanwick & Watson (2007) ² | | |

Table 2 (continued)

| Variables | Deaf studies | Blind studies | Deafblind studies |
|--|---|-------------------------------------|------------------------------|
| | Tertiary Intersubjectivity Layer | | |
| Symbolic communication Childs' use of linguistic or semiotic signs / sign language | Preisler et al. (2002) ¹ Preisler et al. (2005) ³ Swanwick & Watson (2007) ² | Junefelt (2004) ¹ | Dammeyer (2009) ¹ |
| Symbolic intersubjectivity | Loots & Devisé (2005) ² | | |
| Dialogue Taking part in conversations | Preisler et al. (1997) ¹ | | |
| Child's comprehension | Swanwick & Watson (2007) ² | | |
| Partner strategies for checking comprehension | Swanwick & Watson (2007) ² | | |
| Discourse patterns between child and adult | Wilson & Peters (1988) ¹ | | |
| Speech Child's speech/spoken language / use of function and content words | Markman et al. (2011) ⁴ Preisler et al. (1997) ¹ Preisler et al. (2005) ¹ | Junefelt (2004) ¹ | Dammeyer (2009) ¹ |
| Child's sentence grammar | Salés & Starosky (2008) ² | Wilson & Peters (1988) ¹ | |

Table 2 (continued)

| Variables | Deaf studies | Blind studies | Deafblind studies |
|--|---|---------------------------------|-------------------|
| | Tertiary Intersubjectivity Layer | | |
| Child's comprehension of spoken language | Markman et al. (2011) ⁶ Preisler et al. (1997) ¹ Preisler et al. (2002) ¹ Preisler et al. (2005) ³ | | |
| Symbolic play | Preisler (1995) ¹ | Preisler (1995) ¹ | |
| Peer relations | | | |
| Peer relations /play | Preisler et al. (1997) ¹ Preisler et al. (2002) ¹ Preisler et al. (2005) ³ | | |
| Theory of mind | | | |
| Child's understanding of mental entities, such as false belief | | Roch-Levecq (2006) ⁶ | |
| Child's ability to take the other person's perspective | | Junefelt (2004) ¹ | |
| Identity | | | |
| Child's identity development | | Junefelt (2004) ¹ | |

Table 2 (continued)

| Variables | Deaf studies | Blind studies | Deafblind studies |
|---|--|---------------|---|
| | No specific Layer of Intersubjectivity Development | | |
| Topics | | | |
| Content of dialogue/play | Preisler et al. (2002) ¹ | | |
| Themes in interaction | Preisler et al. (1997) ¹ Preisler et al. (2002) ¹ | | |
| Intersubjective development | | | |
| Level of intersubjectivity | Loots & Devisé (2005) ² | | |
| Child's subjectivity/ intersubjectivity | Saliés & Starosky (2008) ² | | |
| Communicative means | | | |
| Child's and adult's communicative means | Preisler et al. (1997) ¹ Preisler et al. (2002) ¹ Jamieson (1994) ² | | |
| Adaptive behavior | | | |
| Child's level of adaptive social behavior | Nowakowski et al. (2009) ¹ | | |
| Child's independent acting | | | Janssen et al. (2003b; 2006; 2012) ¹ |

Table 2 (continued)

| Variables | Deaf studies | Blind studies | Deafblind studies |
|---|---|--|-------------------|
| | No specific Layer of Intersubjectivity Development | | |
| Language input Adult's language | Salies & Starovsky (2008) ² Swanwick & Watson (2007) ² | Campbell (2007) ¹ Campbell & Johnston (2009) ² Wilson & Peters (1988) ¹ | |
| Adult's use of personal references | | Campbell (2007) ¹ Campbell & Johnston (2009) ² | |
| Interaction style Adult's communicative style | Preisler et al. (1997) ¹ Preisler et al. (2002) ¹ | Preisler(1991) ¹ | |
| Compensatory strategies Adult's use of visual-tactile communication strategies | Loots et al. (2005) ² | | |

¹ Measured by naturalistic observation

² Measured by observation in a controlled or semi-controlled situation

³ Measured by interview

⁴ Measured by a standardised test

*No information was given about the instruments

The second layer, 'secondary intersubjectivity', was measured by fewer variables than the other two layers but had a similar number of categories as the third layer. The following categories were measured: 'communicative intentionality', 'play with objects', 'understanding emotions', 'book sharing', 'joint attention' and 'role reversal'. 'Joint attention' was measured in the greatest number of studies, mostly involving children with deafness (7 out of 10 studies). A comparison of these categories with the second layer characteristics described in typical children by Bråten and Trevarthen (see Table 1) revealed that all the characteristics were measured except for the 'display of different communicative purposes'.

For the third layer, 'tertiary intersubjectivity', seven categories were measured: 'symbolic communication', 'dialogue', 'speech', 'symbolic play', 'peer relations', 'theory of mind' and 'identity'. These categories involved all the characteristics of this layer such as displayed by typical children (see table 1). The categories 'speech' and 'symbolic communication' involved variables measured in all target groups. 'Speech' was measured by the greatest number of studies, with an overrepresentation of studies involving subjects with deafness (8 out of 11 studies). 'Symbolic play' was measured in both subjects with deafness and blindness, but only in one study (Preisler, 1995). We found fewer studies that measured tertiary intersubjectivity in children with deafblindness compared to studies involving children with blindness or deafness.

Seven categories could not be attributed to any of the three layers of intersubjectivity. For some of them, the specific outcome of the variables appeared to be indicative of one of the layers of intersubjectivity, in particular 'intersubjective development' and 'communicative means'. Other categories, such as 'language input', 'interaction style' and 'compensatory strategies', seemed to belong to the bigger category of 'mediating strategies' used by the subject's social partner. A third category, 'topics', involved variables related to the interaction's content. One category, 'adaptive behavior', reflected the child's independence.

With regard to the instruments, most variables were measured by naturalistic observation, followed by observation in a controlled or semi-controlled situation (e.g., controlled by use of a standard set of toys). The majority of the observation studies explicitly mentioned that they recorded interactions on video. Video recordings were transcribed in six studies (Preisler, 1991, 1995; Preisler, Tvingstedt, & Ahlstrom, 2002, 2005; Junefelt, 2004; Saliés & Starosky, 2008). These studies usually involved longer video recordings than studies in which no transcript was made and the focus was more on the sequence of behaviors, rather than occurrences of single behaviors.

There was the least variation between instruments for variables at the primary layer of intersubjectivity. The greatest variation was found for tertiary intersubjectivity, involving observations, interviews and tests.

Based on the studies' focuses, we made a distinction between variables according to the following three perspectives: a) child's perspective, b) adult's perspective and c) interaction perspective. The 'interaction initiatives of the child' is an example of one of the variables that took a child's perspective, 'adult's language input' an example that was considered to represent the adult's perspective and 'reciprocity' an example of the interaction perspective. The three perspectives were equally represented in the first and second layers of intersubjectivity. The variables measured at the third layer of intersubjectivity, however, focused mainly on the child.

2.3.2 Outcomes of Intersubjectivity Measures

The outcomes of studies with a developmental approach provided information about the natural development of intersubjectivity in children with sensory disabilities and enabled us to compare their development to that of typical children. None of these studies involved children with deafblindness.

Four studies concerned the development of primary intersubjectivity in children with visual disabilities. Two (Preisler, 1991, 1995) were longitudinal studies that partly looked at the same infants with blindness. These studies described the interactions of these infants (who were between 3 and 6 months old) with their mothers as quite similar to interactions between typical infants and their mothers. As observed in interactions of sighted infants with sighted mothers, the infants with visual disabilities elicited contact and responded to their mothers' initiatives and the mothers initiated different body-touching games and songs.

However, not all the interactions between infants with blindness and their mothers were harmonious. In the first study (Preisler, 1991), one infant with blindness rarely smiled or vocalised and two mothers did not respond to their children's turns as the other mothers did. In contrast to observations of typical infants, Preisler (1991, 1995) also observed that infants with blindness primarily used vocal means to elicit contact and that their mothers used their voices and tactile means of communication. Overall, it was difficult to interpret these studies' findings as natural development, because the method section of the first paper revealed that parents received video-feedback coaching during the study.

Four other studies involving children with blindness (Galati, Miceli, & Sini, 2001; Galati, Sini, Schmidt, & Tinti, 2003; Roch-Levecq, 2006; Peleg, Katzir, Peleg, Kamara, Brodsky, & Hel-Or, 2009) measured variables relevant to primary intersubjectivity by analysing facial expressions of emotions. However, the subjects were much older (see Table 2) than 2 to 6 months, which is the age when typical children start expressing facial emotions. All three studies showed that, despite their inability to watch other people's facial expressions, children with blindness had an even clearer and more congruent display of emotions than their sighted counterparts. An exception is the emotion 'anger', for which Peleg et al. (2009) found a less clear display in subjects with blindness than in

subjects with sight. The authors suggest that subjects with blindness may prefer to mask a clear display of anger to avoid rejection by their social partners.

Three studies (Cramer-Wolrath, 2012; Jamieson, 1994; Preisler, 1995) measured the development of primary intersubjectivity in children with deafness. In Preisler's study (1995), relevant behaviors were observed in a 6-month-old child with deafness who spent all the video recorded time in dyadic interaction. This child's mother imitated his facial expressions as a way of sharing affect and joy.

Visual interaction was also described between three children with deafness and their mothers with deafness in Jamieson's study (1994) and between a child with deafness and her mother with deafness in Cramer-Wolrath's study (2012). The mothers in both studies consistently obtained their children's visual attention before taking initiatives. In Cramer-Wolrath's study, a 10-month-old girl with deafness also used visual interaction strategies: she positioned herself beside her mother, enabling mutual gaze contact and allowing the child to watch her mother's gestures and signs.

Jamieson (1994) showed that intersubjective development can be different when parents of a child with deafness are not deaf themselves. In this study, the hearing mothers of children with deafness did not adapt their interactional strategies as the mothers with deafness did. Also, less interaction was observed between preschool-aged children with deafness who had hearing mothers than between children and parents who both have deafness and between children and parents who both can hear.

The studies also found that children with blindness had a delay in the development of secondary intersubjectivity. Preisler (1991; 1995) described how at 9 and 10 months of age, infants with blindness did not yet show 'joint attention': the sharing of objects with another person. At 12 months of age, they still showed difficulty with secondary intersubjectivity, presumably resulting from an absence of coordinated eye, finger or hand pointing that diminished the natural opportunities for infants with blindness and their parents to refer to external events (Preisler, 1995). A notable finding was that infants with blindness showed interest in things happening around them by making a slight head or upper body movement towards the sound source, but their parents often did not recognise these 'body pointings' as attention markers (Preisler, 1991, 1995).

Bigelow (2003) also found that children with blindness exhibited a delay in the development of secondary intersubjectivity. Two 13-month-old infants with blindness exhibited preliminary joint attention by using their partners as tools to find objects. Bigelow found no examples of fully developed joint attention in children before they reached the ages of 18 and 23 months, respectively. It was also found that the interactions with the highest level of joint attention were all initiated by the adults. According to Bigelow, this shows the facilitating effect of adults' speech in establishing joint attention with children with blindness, especially when it concerns an infant's current focus of attention.

Joint attention was not the only variable studied at the second intersubjectivity layer. Gaunet, Ittyerah, and Rossetti (2007) measured the abilities of children who have congenital blindness and children with normal sight who were blindfolded to point at targets. However, the age of these children (see Table 2) was much higher than the age at which typical children start pointing at targets (between 9 and 12 months of age). Contrary to expectations, early visual experience and higher age did not result in enhanced pointing abilities.

Variables at the second layer of intersubjectivity were also measured in children with deafness. Preisler (1995) reported that children with deafness developed faster than children with blindness. At 9 months of age, two infants with deafness whose parents also had deafness were displaying involvement with objects and people in their surroundings in interactions with their parents. Cramer-Wolrath (2012) described joint attention involving one 10-month-old infant with deafness and her mother with deafness.

In contrast with the normal development of joint attention found by Preisler (1995) and Cramer-Wolrath (2012), Tasker and Schmidt (2008) and Nowakowski, Tasker, and Schmidt (2009) found that children with deafness were delayed compared to children with normal hearing. In these studies, all the children had hearing parents; in the studies of Preisler and Cramer-Wolrath, the parents had deafness. This suggests that parents' deafness has a positive impact on the development of secondary intersubjectivity in children with deafness.

Preisler (1991, 1995) and Roch-Levecq (2006) reported a significant delay in the development of tertiary intersubjectivity in subjects with blindness. At 12 months old, children with blindness often checked the presence of their mothers in the room by vocalising (Preisler, 1991, 1995). Children with partial sight, however, visually checked the affect and opinions of their parents (Preisler, 1991). In Roch-Levecq's study, 20 children with blindness between the ages of 4 and 8 years showed significantly more problems in understanding other people's minds than sighted children of a similar age. In older children, aged 8 to 12 years, this difference had disappeared.

Preisler (1995) considers the absence of imitation and pretend play in children with blindness, which is due to a lack of visual information, to be an explanation for their delay in tertiary intersubjectivity. Two single-case studies (Junefelt, 2004; Wilson & Peters, 1988) showed that social experiences are also relevant for understanding the development of tertiary intersubjectivity in children with blindness. Wilson and Peters (1988) explained the errors made by a 38-month-old boy with blindness in the formulation of 'why' questions as attempts to take over the role of the father, who often asked him to complete specific sentences that were part of a social routine. Junefelt (2004) explained the conversation of an 8-year-old boy with a doll as imitation of familiar people. The author points to the importance of social experiences for the development of both intersubjectivity and identity. Wilson and Peters saw these experiences as a

motivation for acquiring specific linguistic forms and pointed to the importance of diminishing adult support (scaffolding) as children acquire language skills.

While studies showed that children with blindness experienced a delay in their development of secondary and tertiary intersubjectivity, Preisler (1995) presented evidence that children with deafness develop normally. Three of the subjects with deafness in this study were interested in taking part in symbolic communication at the age of 12 months. We have to note that all these children had parents with deafness and it was the only developmental study we found on tertiary intersubjectivity involving subjects with deafness.

2.3.3 Interventions and their Effects

Four types of interventions were found in the studies: cochlear implants, video-feedback training, social activities, and augmentative and alternative communication (see Table 3). Cochlear implants (CIs) were the most frequently studied interventions. These devices are surgically attached in the bone behind the ear, where they receive auditory signals and transport them into the cochlea. Based on the auditory means of interaction and communication between typical children and their parents, the expectation was that CIs would have a positive effect on the development of intersubjectivity in children with deafness or deafblindness. Like children with blindness who have normal hearing, young CI users who have deafblindness would, however, still have problems in developing secondary and tertiary intersubjectivity.

As expected, one study (Dammeyer, 2009) found improved social interaction when children with congenital deafblindness had their CIs switched on compared to when they had them switched off. The subjects in this study were between 5 and 8 years old and had used their implants for at least one year. The aspects that improved, such as quality of communication ('communication flow'), attention and emotional response, are all relevant to primary intersubjectivity. The improved 'manipulation of objects' suggests a positive impact on aspects of secondary intersubjectivity as well. The mean scores of 'modality of communication' showed that the subjects were able to use both speech and signs to interact, whether their devices were working or not. This means that switching on CIs did not affect aspects of tertiary intersubjectivity. Notably, the author mentioned that parents had received parental support and sign language training, which we propose could have influenced both the acquisition of speech and signs in these children, as well as the lack of an effect of the CI on speech and signs found in the study.

Four other studies also found that CIs affected aspects relevant to intersubjective development, but these studies described children with normal sight. Tasker and Schmidt (2010) looked at 26 children with deafness who were between 20 and 40 months of age and found that CIs had an effect on joint attention. Three other studies (Markman et al., 2011; Preisler et al., 1997, 2005) found improvements in spoken language. In the study by Markman et al. (2011), which looked at 116 school-aged children who were

Table 3

Overview of interventions in the included studies and their achievements with respect to interpersonal communication

| Intervention | Studies | Subjects with sensory disabilities | Procedure | Method | Achievements |
|-----------------------|-------------------------------------|--|--|---|--|
| Cochlear implantation | Dammeyer (2009) | Five subjects with congenital deafblindness between 5 and 8 years of age | Cochlear implant (CI) was placed at 2.2-4.2 years (M=3.6). All children had used a CI for at least 1 year (M=2.8). | Interactions where CI was switched on were compared with interactions where CI was switched off. | The condition where CI had been switched on showed significantly higher scores compared with the alternative condition (CI switched off) on the following measures: quality of communication, attention, manipulation of objects and emotional response. There was no effect on spoken language. |
| | Markman et al. (2011) | 116 school-age children born with deafness | Children had received an implant 4-5 years prior to assessment | Two groups of children were compared: those who received an implant before 18 months of age and those who received a CI at 18 months or older. Children were tested with the Reynell Developmental Language Scales. | Children in the early implant group showed better results for spoken language. Other factors influencing speech performance were hearing variables, maternal sensitivity and social economic status. |
| | Preisler et al. (1997) | 19 preschool children with cochlear implants who used sign language | Children had used a CI for at least 2 years. | Children were observed in natural interaction settings. | Majority of children used spoken words but only on request; 6 children used spoken words in dialogue when topic of reference was clear; no participation in age adequate peer play when speech was used. |
| | Preisler et al. (2002) ¹ | 22 children with CI, between 2 and 5 years of age. | Children had used their implants between 1 and 3.5 years. | Interactions between children and their parents, teachers and peers were observed during a 2-year period. | Results indicate that meaningful communication was more easily achieved in home setting than in preschool setting. Children with best oral skills were also good signers. Factors influencing the communication were: communication style, meaningful, joyful communication, ability to take part in age adequate play with peer and use of sign language with others. |

Table 3 (continued)

| Intervention | Studies | Subjects with sensory disabilities | Procedure | Method | Achievements |
|-------------------------------------|-------------------------------------|---|--|---|--|
| | Preisler et al. (2005) ³ | 11 children born with deafness between 8,5 and 10.5 years of age | Children had worn their implants between 5 and 7.5 years. | Children were interviewed about their memories of the operation, living with the implant, hearing, communication in the family setting and in the classroom, peer interaction, use of sign language and/or speech. | CI enabled sound perception. Some of the children in regular classes could take part in one-to-one conversation with teachers but had difficulty following teaching and discussion. Peer interaction was best when other children used some signs. |
| | Tasker & Schmidt (2010) | 26 children with deafness between 20 months and 40 months of age | Nine children were wearing a CI and 17 children did not wear a CI. | Two subgroups of children with deafness (with and without CIs) were compared with each other and with hearing subjects of similar age. Joint Attention (JA) was observed in a naturalistic situation and a controlled task situation. | Three groups of children were equally successful in initiating and establishing JA. Authors conclude that CI influences the quantity and quality of sustained JA between hearing mothers and deaf children. |
| Video-feedback interaction training | Damen et al. (2011) ¹ | 12 subjects diagnosed with visual and intellectual disabilities between 13 and 54 years of age (M=35 years), of which three children were 13, 16 and 19 years old | Professional caregivers received a one-day education program and four video-feedback sessions. | A multiple baseline across subjects design was applied to compare three measurement occasions in the intervention period with two measurement occasions at the baseline. | There was a significant improvement in affective mutuality between the subjects and their caregivers. Caregivers showed significantly more confirmation and responsiveness. |
| | Janssen et al. (2003) | Six subjects with congenitally deafblindness between 3 and 19 of age | Individual and group coaching was provided to educators. Video analysis was the most important tool. | The effects of the intervention were assessed for each case individually. | Gains of 20% to 1250% from baseline to intervention was achieved for the different behavior categories: initiatives, confirmation, turns, regulation, independent acting and affective involvement. |

Table 3 (continued)

| Intervention | Studies | Subjects with sensory disabilities | Procedure | Method | Achievements |
|-----------------|--------------------------|---|--|--|---|
| | Janssen et al. (2006) | One 10-year-old subject with congenital deafblindness | Eight individual coaching sessions were provided involving video analysis and two sessions with coaching and modelling at the workplace. | Baseline, intervention and follow up observations were used to measure the effects of the intervention. | Positive intervention effects were found for initiatives, confirmation, answers, independent acting, regulation and affective involvement for the subject and his teacher. |
| | Janssen et al. (2011) | One subject with congenital deafblindness aged 5 | Interaction coaching and video feedback was provided to a professional caregiver in five sessions. | Observational categories were scored for observations performed at baseline and intervention | The mean scores for caregiver interactive behaviors changed in the desired direction for all categories. Interactive behaviors of the subject improved, such as answers and regulation of intensity. There were positive effects on turn taking. |
| | Janssen et al. (2012) | Six children with congenital deafblindness aged 5 to 19 | Individual and group coaching was provided to educators. Video analysis was the most important tool. | Sequences of sustained interaction were recorded in terms of the duration in seconds, the duration of the longest sequence and the mean number of turns in a sequence. | The intervention had positive effects on sustained interaction across all the cases and communication modalities, |
| Social activity | Saliés & Starosky (2010) | One 10-year-old boy with deafness | The child received eight sessions with a speech therapist in which they played different board games. | The therapy sessions were analysed using an action research framework. | The analysis indicates development of intersubjectivity during the intervention period, seen in his communicative strategies. At the end, the child changed roles with his partner. Authors point to the importance of repetition as a strategy for meaning making, cultural learning and discursive involvement. |

Table 3 (continued)

| Intervention | Studies | Subjects with sensory disabilities | Procedure | Method | Achievements |
|--|--------------------------|--|---|--|--|
| | Kirkebaek (2007) | One 8-year-old boy with congenital deafblindness | The child received a music improvisation session with a musician. | The music session was videotaped and analysed by the musician. | Analysis of the session on video indicates exchange of emotions, turn taking between child and adult and regulation by the adult. |
| Augmentative and Alternative Communication | Loots et al. (2005) | 16 children with hearing impairment between 18 and 24 months | Four children had parents with deafness who used Flemish Sign Language; 12 children had hearing parents of which half used other forms of AAC and half used speech. | Each mother-infant and father-infant dyad was videotaped during 24 minutes of free play in a semi-structured setting and analysed using an intersubjective framework. | The use of sign language in a sequential visual way of communication enabled the deaf parents to involve their infants in symbolic communication. Hearing parents who used other forms of AAC were more similar to deaf parents than hearing parents who used speech but only developed mutual exchange of behaviors, intentions or objects, not linguistic or symbolic meaning. |
| | Swanwick & Watson (2007) | 12 children with deafness aged between 3 and 5 years, six with parents who used British Sign Language and six with hearing parents who used spoken English | Children were provided with book sharing activities at home. | The video recordings were analysed using categories such as language use, roles, focus. Parents used a diary about book sharing over a four-week period. Subsequently, an interview was held with the mothers. Results were connected to an intersubjective framework. | All families were engaged in sharing books. Sign language families concentrated on using the book to promote sign language development and engaged in discussion about the book without referring to the text. Spoken language families focused on features of the text and did not use the book to promote wider knowledge. |

born with deafness, improvements in spoken language were more evident for those children who received their CIs before the age of 18 months. Preisler et al. (1997) reported that their participants, 19 preschool-aged children with deafness who used CIs, used spoken words in dialogues with adults about the here-and-now and when the topic was clear. However, these dialogues were rarely spontaneous. A later study by Preisler (2002) found that participants between 2 and 5 years of age achieved more meaningful communication in a home setting than in a preschool setting. Another study conducted by Preisler et al. (2005) found that children with deafness who use CIs and are between 8.5 and 10.5 years of age used spoken words in one-to-one conversations with teachers. However, they reported problems in following teaching and discussions in regular school classes.

Interestingly, some outcomes in CI studies appeared to be confounded. Markman et al. (2011) studied 116 school-aged children who were born with deafness and found that hearing variables, maternal sensitivity and socio-economic status influenced their speech performance. Preisler et al. (2002, 2005) studied 22 children between the ages of 2 and 5 years and 11 children between the ages of 8.5 and 10.5 years. They described the following factors that positively influenced these children's use of their CIs: the adult's child-directed communication style, meaningful and joyful communication for the child, ability to take part in age-adequate play with peers, the use of sign language and a home setting compared with a preschool setting.

A second type of intervention is video-feedback interaction training. Five of the studies (Damen, Worm, Kef & Schuengel, 2011; Janssen, Riksen-Walraven, & Van Dijk, 2003, 2006; Janssen, Riksen-Walraven, Van Dijk, Huisman, & Ruijsenaars, 2011, 2012) tested the effects of a specific video-feedback training developed by Janssen and colleagues (Janssen, Riksen-Walraven, & Van Dijk, 2003, 2006; Janssen, Riksen-Walraven, Van Dijk, Huisman, & Ruijsenaars 2011, 2012), named the Diagnostic Intervention Model (DIM) and Contact Program. The core ingredients of the DIM/Contact program are individual and group coaching of educators, using videos of their interactions with the subjects. Central to the coaching are eight observation categories: initiatives, confirmation, answering, attention, turns, affective involvement, regulation and independent acting. These observation categories are relevant for primary intersubjectivity, so this intervention should positively influence the first layer.

However, this expectation may not be applicable to the studies that tested the effect of the DIM/Contact program for a number of reasons. First, the ages of the subjects studied by Janssen et al. (2003, 2006, 2011, 2012) and Damen et al. (2011) is higher than the age at which typical children establish primary intersubjectivity. In the four studies conducted by Janssen et al. (2003, 2006, 2011, 2012), the participants were all children with congenital deafblindness: the first study looked at six children between the ages of 3 and 19 years and the other three studies looked at one 10-year-old child, one 5-year-old child and six children between the ages of 5 and 19 years, respectively.

The study conducted by Damen et al. looked at 12 subjects who had been diagnosed with visual and intellectual disabilities and who were between 13 and 54 years of age. Furthermore, the social partners involved in these interactions were professional caregivers and teachers, which is a different situation than the dyads involving mothers that were described by Trevarthen and his colleagues.

In all the effect studies of the DIM/Contact program, positive effects were described with respect to primary intersubjectivity. For example, the first study (Janssen et al., 2003) found gains of 20% to 1250% on initiatives, turn taking and confirmation in the intervention period for both children with deafblindness and their educators, when compared to the baseline period. Changes in educator behaviors and in the amount of affective involvement were found as well. Damen et al. (2011) found positive effects on affective attunement between subjects with visual and intellectual disabilities and their caregivers and on the caregivers' confirmation and responsiveness. In contrast to Janssen's studies (2003, 2006, 2011, 2012), these children's initiatives did not show significant improvement after the start of the intervention but improved at the end of the intervention. Damen and colleagues (2011) suggested that participants with visual and intellectual disabilities need time to change their individual signal repertoire in reaction to changes in caregiver strategies.

The third type of intervention involved social activities. Saliés and Starosky (2008) analysed eight interactions between a 10-year-old child with deafness and a speech therapist playing a number of board games. Kirkebaek described a case description (2007) involving musical improvisation as the social activity between a musician and an 8-year-old boy with congenital deafblindness. We expected the two interventions to lead to different results. The study by Saliés and Starosky used several board games that had specific rules and required perspective taking in order to beat the opponent; thus, these games involved abilities developed at the highest layer of intersubjectivity. In line with the theory of intersubjective development, the establishment of this layer would depend on the successful establishment of the first two layers of intersubjectivity. The music improvisation in Kirkebaek's study was described in terms of basic principles of responding and turn taking, which should stimulate primary intersubjectivity.

After their analysis of the transcribed videos from the sessions, Saliés and Starosky (2008) concluded that their subject increasingly used his own perspective, talked about his feelings and understood that his opponent had the opportunity to cheat. These abilities are found in with the third layer of intersubjective development. The authors also stressed the importance of 'repetition' as a partner strategy. Their definition of this strategy was similar to the definitions given for aspects such as 'confirmation' and 'imitation', which have been described as relevant for the mediation of primary intersubjectivity. These findings support the idea that this level has to be mediated in order to develop higher levels of intersubjective development. From the descriptions of the sessions, it can be concluded that the use of different play objects may have mediated

secondary intersubjectivity and that tertiary intersubjectivity may have been mediated by providing a significant amount of adult speech and language scaffolding.

In line with descriptions of primary intersubjectivity, Kirkebaek (2007) provided examples of a child with deafblindness taking active part in interaction and exchanging emotions. The examples suggest that the engagement of the child in dyadic interaction was mediated by both the 'music improvisation' activity and his social partner's strategies. Kirkebaek described partner contributions such as maintaining close contact and using novelty. She also described the social partner's acknowledgment that the subject needed to take breaks in the interaction. This is in line with the interaction category 'regulation of intensity' described by Janssen et al. (2003, 2006, 2011, 2012) as a target in the DIM/Contact program. Janssen used this term for both the processing time needed by the child with deafblindness as well as the partner's attunement to this need.

The last types of intervention are different forms of Alternative and Augmentative Communication (AAC). Fossett and Mirenda (2007) wrote that AAC is used by individuals 'to compensate for severe speech-language impairments in the expression of spoken and written language' (p. 330). The American Speech-Language-Hearing Association (2002) described a variety of AAC systems, such as picture communication symbols, tangible objects and manual signs. We found two studies (Loots et al., 2005; Swanwick & Watson, 2007) that compared participants exposed to an AAC condition with participants who were not exposed to this condition. In both studies, the participants were provided with a social activity (play with objects and book sharing) and the intervention was not set up as a program that was to be implemented in a specific setting. Instead, the parents of the children with deafness had been trained to use an adapted symbolic communication system for interaction. On the basis of the descriptions of the development of typical children (Trevorthen & Hubley, 1978; Trevorthen, 1979, 1980), the expectation was that the AAC intervention would support the development of the two highest layers of intersubjectivity in the subjects with hearing impairments and deafness.

As they expected, Loots et al. (2005) found higher intersubjectivity levels in parents who used AAC compared to parents who used spoken language. Swanwick and Watson (2007) described similar results. Children with parents who used sign language were engaged in lively discussions during book sharing, and asked questions, repeated information and talked about pictures; in contrast, children with deafness with parents who do not use sign language only occasionally used books for a wider conversation. Both studies found that using visual interaction strategies in combination with AAC created opportunities for children with deafness to develop secondary intersubjectivity. However, only the combination of sign language and visual-tactile strategies, such as making the sign for 'car' on top of a play car, was responsible for the creation and exchange of shared symbolic and linguistic meaning (Loots et al., 2005) and was thus relevant to tertiary intersubjectivity.

2.4 Discussion

The aim of this review was to show the relevance of Trevarthen's theory of innate intersubjectivity for understanding and treating communication problems in children with sensory disabilities. The reviewed studies showed that, despite the sensory disabilities present in children with deafness, blindness or deafblindness, intersubjectivity can be measured and involves each of the three layers of intersubjective development. For the highest level of intersubjectivity, fewer studies were found involving children with deafblindness compared to studies involving children with blindness or deafness, and they were all intervention studies. The studies that were found however, give sufficient evidence to state that the highest level of intersubjectivity development is also relevant for children with deafblindness.

Our overview revealed that problems in the use and comprehension of symbolic communication contribute to delays in children with sensory disabilities developing ways to share subjective states with others. These delays have been found in children with sensory disabilities as early as the age of 3 months and can perhaps even be observed earlier. One very commonly reported delay concerns the acquisition of joint attention skills. Children who have blindness or deafness and who have hearing parents need more time than typical children to develop the ability to share their attention for objects and people with another person. According to Preisler (1991), who compared subjects with blindness and deafness to each other, visual abilities seem to be more crucial for this development than auditory abilities.

Intersubjective developmental theory may not only lead to a better understanding of problems in the interaction and communication of children with sensory disabilities, but may also lead to the discovery of novel ways to support high-quality communication with this target group. Several studies (e.g. Preisler, 1991, 1995) presented evidence for the similar importance of strategies used by parents of typical young children, such as imitating the child's expressions and reflecting their emotions. These studies provided evidence for the proposition of other researchers (e.g. Bruce, 2005; Hartmann, 2012) that children with sensory disabilities acquire communication skills in the same kind of developmental process as typical children do and that their communication delays can be understood by the interplay between the characteristics of the child and characteristics of the social environment.

The association between intersubjectivity outcomes and the use of adaptations by parents with deafness compared to hearing parents of children with deafness (Jamieson, 1994; Nowakowski et al., 2009; Tasker & Schmidt, 2008) demonstrated that partner strategies need to be adapted to account for modalities accessible to the child. Furthermore, it appears to be important that social partners recognise and acknowledge the specific manifestations of intersubjectivity in children, such as the way children with blindness point to interesting sounds using a slight movement of their heads or upper bodies (Preisler, 1991).

From an intersubjective developmental perspective, the treatment of communication problems should focus on partner strategies and on creating opportunities for social interaction rather than on training a child in individual language skills. In this review, we found one intervention that explicitly focused on this kind of optimisation: the DIM/Contact program (Janssen et al., 2003). This intervention has proven effective for developing primary intersubjectivity in children with visual impairments (Damen et al., 2011) and deafblindness (Janssen et al., 2003, 2006, 2011, 2012). This intervention might also help establish sustained dyadic interaction between children with deafness and their hearing partners, paving the way for sharing different kinds of meanings in conversations. Although the effects of the video-feedback intervention on more elaborate ways of meaning making are as yet unclear, studies that concern the development of tertiary intersubjectivity in children with deafness (Saliés & Starosky, 2008; Loots et al., 2005; Swanwick & Watson, 2007) and blindness (Junefelt, 2004; Wilson & Peters, 1988) suggest that other partner strategies need to be added to mediate the development of joint attention and the use of referential and symbolic communication. Such strategies included the provision of meaningful social activities, language scaffolding and the natural use of sign language in interaction.

It is worth discussing some theoretical and methodological issues related to measuring intersubjectivity. Although all the publications referred to intersubjectivity theory as a foundation for their empirical studies, only a limited number (e.g. Loots et al., 2005) explicitly used intersubjectivity as a measure. We therefore had to attribute the variables to intersubjective development post-hoc. The great diversity in the way intersubjectivity was studied also made it more difficult to compare results and it precluded a quantitative synthesis of the study findings. These methodological problems and the small number of subjects in the studies are limitations of this study.

A systematic way of measuring intersubjectivity in children with sensory disabilities would be helpful for clinical practice, because interventions are needed to support interpersonal communication in this target group. We propose that the way intersubjective development was first studied in typical children can form a basis for the assessment of intersubjectivity in an individual child with sensory disabilities. Studies (e.g. Damen et al., 2011; Dammeyer, 2009) have shown that, similar to Trevarthen's and Hubley's methodology (1978), a detailed analysis using relatively small episodes on video (two to five minutes) can reveal the specific contributions of a child in interaction with an adult and the mutual responses. Furthermore, other studies (e.g. Cramer-Wolrath, 2012; Preisler et al., 2002) have shown that analysing longer observations (more than 15 minutes) and describing conversational turns in a transcript can reveal the ways in which children and adults deal with a task and engage socially, share topics of interest and develop mutual understanding while the dialogue progresses.

However, clinical workers need considerable knowledge of intersubjectivity theory to make a valid evaluation of the interpersonal communication abilities of a child with

sensory disabilities. The specific manifestations of intersubjectivity in subgroups of children with sensory disabilities, such as body pointing by children with blindness and positioning in the visual field by parents and children with deafness, illustrate that clinical workers also need to know the specific manifestations of each intersubjectivity layer for the subgroup that the child belongs to.

Another discussion point is the measurement of children's abilities within an interaction situation that is not well adapted to their individual needs. The studies in this review showed that these children's communicative abilities are affected by the extent to which their social partners are able to attune their strategies to the child's specific abilities and needs, to provide interesting and motivating activities, and to have an open mind about the way the child expresses himself or herself and the topics he or she brings into the conversation (e.g. Markman et al., 2011; Preisler et al., 2002, 2005). We propose that this adaptation should be optimised before assessment of a child's abilities takes place. This also means that the assessor should always evaluate a child's abilities in relation to partner strategies and the interaction situation. The studies of Junefelt (2004) and Wilson and Peters (1988) showed that the child's social experiences must also be taken into account during the assessment.

We recommend further research on natural intersubjective development in children with sensory disabilities starting from birth, especially for children with deafblindness (for which intersubjective development has not yet been studied). We also recommend studies be conducted on the effectiveness of the DIM/Contact program that focus on the development of secondary and tertiary intersubjectivity in children with sensory disabilities. Lastly we recommend replication of studies that test the effectiveness of interventions on specific aspects of intersubjectivity found by other researchers, such as the study of the effectiveness of music therapy on dyadic interaction and the effects of therapeutic play sessions on the development of meaning making. This will enable a quantitative comparison of the effects of these interventions. Such an analysis is needed to provide practitioners with sufficient knowledge about the scientific evidence for the effectiveness of interventions that they regularly apply to children with sensory disabilities.

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