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Anne & Emma

A study on the communication strategies and sign quality of a communication partner of an individual with congenital deafblindness

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Preface

Summary

Title: Anne & Emma: A study on the communication strategies and sign quality of a communication partner of an individual with congenital deafblindness (CDB). **Background:** Indiviudals with CDB experience developmental challenges, amongst which communicative and linguistic ones. In order for them to develop intersubjectivity to its fullest, competent communication partners who consistently offer correct (tactile) (sign) language is key. **Aim:** This study aims to measure the effect of the *Influencing Communication & Language (ICL)* intervention on the communication skills of a selected caregiver of an individual with CDB, as well as her sign quality and how this influences their interaction success. **Method:** In this N=1 study, the intervention effect was measured by coding (in ELAN) six communication skills of the partner in recordings of their intereaction during every intervention phase and comparing the results to similar recordings in the baseline. This analysis was done through visual inspection and NAP calculations. The sign quality was measured in one recording per phase and the baseline by annotating (in ELAN) all semantic and phonological errors and all discrepancies between spoken and signed/gesticulated utterances of the caregiver. The interaction success was measured by categorising all utterances of both partners and determining whether or not logical connections were present between those. **Results:** An average intervention effect was found on the skills 'tactile strategies' and 'symbolic communication' and a strong effect in the categories 'meaning negotiation' and 'perspective taking'. No significant effect was found on the skills 'shared attention' and 'adding communication'. Several semantic and phonological errors were found, but no clear correlation between those and the level of interaction success. Some discrepancies were found as well, with some correlation to unsuccessful interations. **Conclusion:** The ICL intervention has had a significantly positive effect on some of the caregiver's communication skills, and not on others. A majority of the interaction between her and the client with CDB are successful and semantic and phonological errors do not seem to negatively influence this. Discrepancies more often lead to unsuccessful interaction.

Key words: congenital deafblindness, intersubjectivity, ICL intervention, N=1 study, communication skills, sign quality, interaction success

Table of Contents

Anne & Emma

A study on the communication strategies and sign quality of a communication partner of an individual with congenital deafblindness

As human beings, from the day we are born, we experience the world by using our senses. At first mostly the tactile sense and soon also the two that allow us to gather a lot of information at once and from afar: sight and hearing (Siegler et al., 2011). If one of these two senses does not function fully, people tend to compensate with the other (Papagno et al., 2016). However, if both these senses are impaired, one has to rely more on the other senses, mainly the tactile one (Dalby et al., 2009; Rødbroe & Janssen, 2008). This combination of visual and auditory disabilities, often called deafblindness[1] can be seen as a distinct disability that has more consequences than only those of being deaf and being blind combined (Dammeyer, 2012; Jensen et al., 2018; Nordens välfärdcenter, 2021). Individuals with deafblindness face multiple challenges in life, for example when it comes to gaining information about the world around them, communicating with others, orientation in space and mobility or maintaining an acceptable energy level (Bosman, 2006; Jensen et al., 2018). There are no exact numbers on the prevalence of deafblindness for multiple reasons[2], but the World Federation of the Deafblind approximated it at 0.2-2% of the world population in 2018 and Vaal and colleagues (2007) reported an estimate of 30,000 to 40,000 individuals with deafblindness in the Netherlands at the beginning of this milennium, equalling 0.18-0.24% of the Dutch population at the time[3]. This group of individuals with deafblindness should not be seen as one, though. Furthermore, the classification 'deafblindness' encompasses a highly heterogeneous population that can be further subcategorised in various ways (Ask Larsen & Damen, 2014),

[1] A/N: There is an ongoing terminological debate amongst professionals in this field (Ask Larsen & Damen, 2014). The most commonly used term to refer to people with visual and auditory disabilities today is 'deafblindness', but many argue that this term unjustly suggests a complete absence of hearing and vision, which does not have to be the case; someone who is hard of hearing and has a visual impairment can be considered deafblind under most definitions (Bosman, 2006; Damen & Worm, 2013). Additionally, those who lose their hearing and sight because of older age usually do not feel comfortable with the label 'deafblind'. However, to keep in line with current practice, the author of this thesis opts to use the term 'deafblindness' anyway.

[2] The heterogeneity of the group of individuals with deafblindness hampers recognition and sometimes results in misdiagnosis as another disability because of the similarity in presentation of behaviours caused by it (Wolf-Schein, 1998; Wehner, 2012; Dammeyer, 2011; Bruhn & Dammeyer, 2012). Also, there is little consensus in terminology and definitions in this field, leading to discrepancies in overviews and difficulties in comparing research data (Ask Larsen & Damen, 2014).

[3] 16.36 million (https://www.cbs.nl/nl-nl/visualisaties/dashboard-bevolking/bevolkingsteller)

one of which is by the moment of onset and more specifically, whether the deafblindness is present before or after the acquisition of language. Those who are or become visually and auditorily impaired before they learn a language, have what is called prelingual or congenital deafblindness (CDB) (Dammeyer, 2014). In the Netherlands, around 2,000 individuals with CDB were identified in 2013 (Damen & Worm, 2013). Although this group of individuals has the same innate motivation to learn as others, and goes through the same cognitive developmental stages, they face additional challenges and developmental risks (Bruce, 2005; 2010).

Development of Individuals with Congenital Deafblindness

Because individuals with CDB experience a dearth of sensory information, also called deprivation, from a very young age (Van Dijk & Janssen, 1993), they lack opportunities for social contact and the appurtenant incidental learning (Boers, 2015; Damen, 2015; Downing & Falvey, 2015; Moller, 2003). They are often granted little autonomy and chances for participation in society, with parents, teachers and caregivers deciding everything about their lives and therewith creating a learned helplessness, which contributes to less independence later in life (Correa Torres, 2008; Prain et al., 2010; Marks, 1998). Even fewer opportunities to act independently are (and can be) granted to those with CDB who additionally develop an intellectual disability as a result of the barriers they experience in their cognitive and emotional development. They face among other challenges a "lack of overview, poor mastery of skills, problem behaviour and problems with communication" (Damen & Worm, 2020:19).

These problems with communication and language development are for example that individuals with CDB are often exposed only to functional and imperative, but not to declarative communication[4], meaning that there is no true reciprocity or sustained interaction[5] (Rowland, 1990; Janssen, 2003; Damen & Worm, 2013) and sometimes no effective communication at all (Preisler, 2006). It is not hard to imagine thate limited input will result in communicative problems, and indeed Dammeyer and Ask Larsen (2016) report that less than

[4] Functional communication are utterances aimed at reaching practical goals, with imperative communication specifically pertaining to directives, prompts, yes-or-no-questions and requests. Examples of this type of communication are parents or caregivers telling children to finish their food, asking them to hand something over et cetera. Declarative communication however, refers to the sharing of one's thoughts, feelings and wishes or narratives and it is this type of communication that invites interaction.

[5] In this context reciprocity and sustained interaction mean an ongoing back-and-forth (turn taking) between two communication parties, instead of one of them being in charge of the interaction and the other only following their lead.

one fifth of individuals with CDB reaches verbal[6] communication without delay, 40% are delayed to some extent but do reach it and 40% never master verbal communication. This often delayed or even stunted communicative development is not an isolated issue, because without proper communication options, one cannot connect to other human beings and such connections are not only necessary for one's mental wellbeing, but also to develop social competence through intersubjectivity (Miles & Riggio, 1999).

According to the intersubjectivity theory (Trevarthen, 1979; Trevarthen & Aiken, 2001; Bråden & Trevarthen, 2007) all children are born with an innate ability to develop an awareness of the self and of others. This awareness is displayed when sharing experiences and is developed through interaction with others. In developing children, three layers of intersubjectivity can be perceived, each new layer adding more interactive, communicative or linguistic skills. The primary layer (reached between 0-9 months) entails a dyadic awareness (I & You) and is characterised by imitation and turn-taking (games). On the secondary layer (reached between 9 months - 2 years) children show triadic awareness (I & You & It) and start to explore the world around them in the here and now, through shared attention for objects and learning to name said objects (i.e. meaning fostering through negotiation). Having reached the tertiary layer (between 2-6 years) children develop a symbolic and narrative awareness (I & You & It beyond the here and now) and become able to use their imagination and communicate about the past, the future and about people, places and things beyond themselves. They start to co-create stories. Research has shown that individuals with CDB are able to reach the same levels of intersubjectivity as typically developing children, albeit at a later age (Janssen & Rødbroe, 2008). Specifically for this target group, Wolthuis and colleagues (2019; Wolthuis, 2021) developed the Layered Communication Model (LCM), which discerns three similar layers of intersubjective development.

In order for individuals with CDB to develop their intersubjectivity, some prerequisites have to be met. Most importantly, there has to be a shared communication system that both parties have access to. Without speaking the same 'language' (in the broadest sense of the word), there can be no uptake (let alone intake) of the information provided by one party (their output and the other's input) (Van den Bogaerde, 2000). Access to a fitting linguistic system is the key variable that determines the quality of communication for individuals with CDB, more so than for example the severity of their auditory and visual impairments or their cognitive

[6] 'Verbal' is derived from the Latin *verbum*, which means 'word'. Merriam-Webster dictionary defines it as "of, relating to, or consisting of words" (https://www.merriam-webster.com/dictionary/verbal). Ergo, 'verbal' does not necessarily mean 'spoken'; it can also mean 'signed'.

abilities (Ask Larsen, 2016). Depending on the amount of residual hearing and vision, this could be an oral (i.e. spoken) system, a visual (i.e. signed) system or a tactile one. There are several tactile communication methods, of which fingerspelling in the palm of the hand and tactile sign (language)[7] are used the most (Dalby et al., 2009; Hersch, 2013; Janssen, 2003; Mesch, 2001).

Communication with Individuals with Congenital Deafblindness

Several studies have shown that the milestones of sign language development in deaf children (and hearing children of deaf parents) are similar to those of spoken language development in hearing children. The age at which all these children generally reach these milestones are similar as well (Meier, 2016; Baker et al., 2016). Placing the most commonly researched mileposts in Trevarthen's intersubjectivity layers, one could say that the primary layer roughly coincides with (manual) babbling, the secondary layer with single word/sign utterances, understanding short sentences and the concept of questions, linguistic turn taking and later initiating conversation and producing short sentences (from a vocabulary of approximately fifty words/signs) with basic grammatical structures, and the tertiary layer with longer and more grammatically and semantically complex sentences, which from the age of 4-6 also have more narrative features (storytelling) and are more and more often flawless (Visser-Bochane et al., 2019; Harley, 2008; Siegler et al., 2011; Baker et al.).

If the preferred method of communication for a particular child with CDB is visual sign language, there are several conditions that need to be met in order for them to properly acquire this language. First of all, the communication partners have to encourage visual attention skills in the child, for example stimulating them to look up when the partner tries to get their attention by moving into their visual sign field and also giving them time to switch their gaze between the signing partner and an object that their interaction is about (Baker et al., 2016). Additionally, the communication partners should use a child directed form of signing, which is relatively large, slow and short compared to adult signing and has a more repetitive structure (Pizer et al., 2011; Baker et al., 2016). This repetition is also crucial in meeting another prerequisite: offering enough acknowledgement, replication and gradually expansion in reaction to the child's utterances, preferably in a set context of rituals and routines. By doing

[7] A/N: Sign linguistics is a relatively young field of study and the research into tactile sign is even less developed, with the still ongoing debate on whether or not it should be considered a language separate from visual sign language. Interesting as this topic is, it will not be investigated further in this thesis, since the subject of this particular study does not use tactile sign (language), but rather visual sign language.

so, the child can match the linguistic labels (i.e. signs) to both the referents and the underlying concepts, step by step expanding their vocabulary and embedding the sign language elements into their brain, a process called scaffolding (Damen et al., 2017; Souriau et al., 2009).

It should be stressed that prior research has shown that communicative systems with made up signals do not work and that it is therefore important that a conventional form of communication (for example an official sign language) is offered to individuals with CDB. Consistently offering the exact same signs over time is a prerequisite for language intake and later output in individuals with CDB. With a continuous offer of a conventional language, they can become more self-determined and influential in their interactions with others, and develop higher cognitive abilities and reach their full communicative potential. Several researchers found that linguistic deprivation in children with deaf(blind)ness during their critical period[8] leads to more than solely language pathologies. Cognitive problems (e.g. memory problems) and psychosocial problems, resulting from isolation and frustration over the inability to fully express themselves and wholly understand others can also arise. Other important arguments for the consequent use of a conventional language are the idea that it is only ethical to offer individuals with CDB the same linguistic opportunities as any other person and the fact that people who use more idiosyncratic language have lower readability by others (apart from their parents/caregivers) and therefore more miscommunications. (Ask Larsen, 2016; Bruce & Vargas, 2007; Dammeyer, 2014; Humphries et al., 2012; Souriau et al., 2009)

Low readability and misunderstandings frequently occur in communication with individuals with CDB. In order for them to develop their communicative skills and to use those to understand the world around them, they rely heavily on their communication partners (Janssen et al., 2006; Bodsworth et al., 2011). The more competent partners they have to communicate with, the more possibilities they have to 'become themselves' (Snow, 1989). This competency, however, can be a challenge. Several researchers in the field report daily struggles in interpersonal communication between individuals with CDB and their communication partners (Bruce, 2005; Souriau et al., 2009; Ask Larsen, 2016) and Rorije (2017) further states that there are currently not enough competent communication partners for individuals with CDB in the Netherlands. She sees insufficient levels of insight, expertise and skill when it

[8] The critical period refers to period in which children still have the innate ability to naturally learn any language and become fluent in it. There is debate among researchers as to whether or not this critical period really exists and if so, between which ages. Most neurolinguists mark the end of the critical period between the ages of 5-16. (Harley, 2008).

comes to three important aspects of communication with individuals with CDB: (i) noticing initiatives and understanding utterances; (ii) attunement; and (iii) the use of tactile strategies.

Communication partners do not always recognise the communication initiatives that individuals with CDB take (Damen & Worm, 2013; Bruce, 2010). This is also partly due to the fact that the development and cognition of individuals with CDB are organised and presented in an atypical manner and therefore not always correctly interpreted by others (Damen et al., 2020). Additionally, many of them have underdeveloped skills in symbolic communication and therefore often have difficulties expressing themselves and making others understand what they mean (Bruce, 2005; Damen et al., 2015a).

Even when communication partners notice and understand the initiatives and utterances of the individual with CDB, they do not always react to these in a way that is accessible to the other (Hart, 2006) or at the appropriate level, since this is difficult for them to estimate (Rorije, 2017). They should at all times try to attune their communication to the individual with CDB in order to minimise miscommunication and to maximise successful interaction (Janssen, 2003; Janssen & Rødbroe, 2008). This works best if the individual with CDB and their communication partner know each other well, if they share knowledge on the context they are in and negotiate the meaning of each other's utterances and if they are able to challenge their own assumptions. That way the communication partners can produce communication that has a higher chance of being understood by the individual with CDB (Nafstad & Rødbroe, 2015).

Another essential element in contact with individuals with CDB is the use of tactile strategies. If tactile sign language is deemed most fit for a specific individual with CDB, tactile sign proficiency and fluency on the part of the communication partner leads to less misunderstandings (Björk et al., 2020), but also if an individual with CDB can communicate through speech or visual sign, tactile contact remains important (Dalby et al., 2009; Ask Larsen, 2016).

Not only researchers have come to the conclusions summed up above; communication partners themselves have requested extra guidance in their communication with individuals with CDB (Damen & Worm, 2013; Rorije, 2017). They require knowledge of the different communicative possibilities and options and they have to be trained in several communication skills so they learn how to better adjust their communication to the specific needs of every individual person with CDB (Damen et al., 2017; Skilton et al., 2018).

Interventions

In the past decades, several intervention programmes have been developed and their effects studied to do just that. An often-used intervention methodology in this field is the combination of group training sessions and (individual) video interaction feedback sessions by communication coaches (Boers et al., 2013). This method was used in the proven to be effective intervention method 'Contact', which focused mainly on improving interaction on the first intersubjectivity layer by supporting communication partners in their attunement to individuals with CDB and also to some degree on stimulating the sharing of emotions (Janssen et al., 2003). Next, experts built on this method and developed a new programme that can be considered an expansion: 'High Quality Communication' (HQC). In this intervention attention for the relevance of attunement (first layer of intersubjectivity) remained, but the scope was broadened to the importance of meaning negotiation (second layer) and symbolic communication (third layer). The HQC intervention method was found to be effective on the first and second layer and partly effective on the third. (Damen et al., 2015b). More recently, the intervention method 'Influencing Communication and Language' (ICL) was developed. This programme continues with the goals of the previous two methods, with a focus on a twofold objective: "to improve bodily-tactile communication and language between individuals with CDB and their [communication] partners and to improve self-determination in communication [by the individuals with CDB]" (Rorije, 2017:5). Improvement on these two aspects should lead to better everyday communication resulting in both more communication control and agency and stronger language skills and higher communication forms in the individuals with CDB. As a result, isolation of and severe challenging behaviours by individuals with CDB can be decreased and their quality of life increased. Furthermore, the communication partners will improve their self-efficacy in communication. The effectiveness of the ICL method is currently being researched by PhD-candidate Rorije in her 'Tell it' project. (Rorije, 2017).

In the ICL intervention the communication partners of the individuals with CDB are guided by specifically trained communication coaches through training sessions and video feedback sessions. The intervention consists of three phases, based on the intersubjectivity layers of Trevarthen (1979), and aims to improve six specific communication skills in the partners. Each phase is kicked off by a training session that focuses on skills that specifically fit one of the layers. The first session focuses on the quality of the interaction, specifically on fostering attunement by using bodily-tactile strategies. The first phase lasts 5 weeks and contains two video feedback sessions. The second session focuses on the quality of the communication and specifically on shared attention for objects and transfer of meanings

through negotiation. The second phase lasts 8 weeks and contains two video feedback sessions. The third and final session focuses on the expansion of communication and language, specifically by adding symbolic communication and perspective taking. The third phase lasts 10 weeks and contains three video feedback sessions. Table 1 shows an overview of the intervention structure. (Rorije, 2017).

Table 1

Structure of the ICL intervention

Intervention phase	Intersubjectivity layer	Main communication skills in training session	Practical information
Phase 1	First layer (dyadic)	Tactile strategies	5 weeks 2 VIF sessions
Phase 2	Second layer (triadic)	Shared attention Meaning negotiation	8 weeks 2 VIF sessions
Phase 3	Third layer (narrative)	Adding communication Symbolic communication Perspective taking	10 weeks 3 VIF sessions

Aim & Research Questions

The two primary aims of this study are to (i) contribute to the 'Tell it' project by measuring the effect of the ICL intervention on a specific communication pair, and to (ii) analyse the sign quality as expressed by the communication partner of the client with CDB and the effect of this quality on the success of their interaction.

This means first researching the caregiver's side of the interaction on a functional level, as has been done in several earlier effect studies. All these studies showed at least an average effect on at least one of the measured communication skills that were offered during the intervention's training sessions (Damen et al, 2020), and more often in one of the skills in the first or second intersubjectivity layer rather than the third, since the prior two were found easier to execute and improve (Damen et al., 2015b; 2021; Martens et al., 2017). De Boer (2021) conducted a study similar to this one, also as part of the 'Tell it' project, and on the same six communication skills mentioned in Table 1. De Boer found a strong effect on the skills 'tactile strategies' and 'shared attention' and some effect on the skills 'adding communication' and 'perspective taking'. No significant effect was found on the skills 'meaning negotiation' and 'symbolic communication'. Most of the effects (except for those on perspective taking) were present (or stronger) after the training session on that particular skill had taken place, and not before. For example, tactile strategies were discussed during the first training session at the beginning of phase 1 and a strong improvement of this skill was seen directly in phase 1 compared to the baseline; adding communication was discussed during the third training session, at the beginning of phase 3, and one of the communicational partners showed a strong improvement in phase 3 compared to the baseline, but no improvement yet in phases 1 and 2. The results of this study are expected to be similar: at least an average effect on at least one of the communication skills, and more likely the skills linked to the first and second intersubjectivity layer than the third, and most likely after improvement support for that specific skill has been offered in a training session.

Additionally, this research zooms in on the form of the communication as well. Since being offered correct and conventional sign quality is of high importance for language acquisition, this investigation also aims to analyse the sign quality as expressed by the communication partner during the interactions with this client with CDB and the effect of this quality on their interaction success. Because sign fluency on the part of the communication partner reduces misunderstandings, it is expected that a higher sign quality will lead to

successful interactions and a relatively lower sign quality to unsuccessful interactions and misunderstandings.

Two research questions, corresponding to these two aims, were formulated.

Research Question 1

To which extent has the ICL intervention influenced the communication skills of the selected caregiver during interaction with this client with CDB?

Research Question 2

What is the sign quality of the selected caregiver during communication with this client with CDB and how does this effect their interaction success?

Method

To answer these research questions, data from Rorije's project were used.

Ethics

The study as set up by Rorije has passed the Ethical Review Boards of the University of Groningen. All participants (or in the case of the clients with CDB, their legal representatives) gave informed consent and were involved in the decision-making process. They were all allowed to stop the intervention at any time and to receive insight into the data and the results. Rorije made sure that there would be no extra burden for the clients with CDB, since the interventions and observations would take place in a natural setting during their daily routines. Finally, the clients would most likely benefit from the intervention and the results of the study, so there was an expected benevolence to it. Because Rorije's research had been deemed ethically approved, it was not necessary to submit the research proposal for this thesis to the Ethical Review Boards.

Participants

To find participants for her research, Rorije used purposive occasion sampling. The department of University of Groningen where Rorije conducts her research, often cooperates with three care and educational organisations[9] that have locations throughout the Netherlands. Multiple treatment coordinators of these three institutions were asked to nominate clients who they believed fit the criteria[10].

One of those clients was Emma[11], who is the subject of the N=1 study for this thesis. Emma was born in 2000 and has been diagnosed with Pierre Robin Sequence and attachment disorder. Auditory and visual testing was last done in, respectively, 2015 and 2016. She then showed responses to auditory input from 100 dB[12] and a vision of 0.08 (8% clarity). At the most recent testing through VABS[13] in 2011, her communicational development was estimated at 1.5 years of age. She lives in a group home with other adolescents with CDB and communicates with her caregivers through non-tactile Sign Language of the Netherlands

[9] Royal Kentalis, Bartiméus and Royal Visio
[10] See Rorije's research proposal (2017) for the criteria.
[11] Fictitious name to protect the client's privacy. The information on Emma presented in this paragraph was provided by PhD-researcher Rorije and Emma's caregiver.
[12] For reference, 100dB is approximately the volume of a jet fighter passing over at a height of 330 yards. This means that Emma cannot hear any sound softer than that (like speech).
[13] Vineland adaptive Behaviour Scales

(NGT; *Nederlandse Gebarentaal*). It has been reported by Emma's caregivers that she accepts tactile communications, but does not respond well to tactile sign language.

Once Emma was deemed fit and fitting to participate, her caregivers were asked to participate as well. Of those who fit the criteria, several were chosen to participate. One of them was Anne[14]. Anne (born in 1991) is a social worker specialised in pedagogy. She has been working as a caregiver for individuals with CDB for 8 years, seven of which with Emma, among others. Anne did not know any sign language before she started working at her current place of work, but she received a basic NGT course when she was hired. If she does not know a relevant sign, she also regularly looks up signs online or asks deaf colleagues for help.

Data Collection Procedure

The research data were collected by Rorije through video recordings of moments of interaction between the clients with CDB and their communication partners. The indication was to film a similar type of interaction each time, to make sure the data were comparable, and to choose moments of interaction without any time pressure. Usually, the communication partners themselves were the ones who filmed the interaction with a video recorder on a tripod. They recorded five moments of a 20-minute interaction during every intervention phase and five moments before the first session, to establish the baseline. Rorije randomly selected three recordings for every phase per communication pair.

The recurring interaction moment that Anne decided to film for this research was on Wednesday afternoons, a day she always works with Emma. On those afternoons, Emma returns from her daytime activities in another building to her residential home to go through her diary with the caregiver on duty. The timeline for the intervention with this communication pair was the following: baseline from May to August 2019, phase 1 from October 2019 to January 2020, phase 2 from March to April 2020[15] and phase 3 from August to November 2020.

Annotation Instrument for RQ1

Of every video that Rorije randomly selected to be part of the dataset, the first 5 minutes were coded. This coding of the videos was done in the computer programme ELAN[16] (2022), using

[14] Fictitious name to protect the caregiver's privacy. The information on Anne presented in this paragraph was provided by herself, during personal contact with the author.
[15] In this phase only four recordings were made (instead of five) due to problems stemming from the COVID pandemic.
[16] EUDICO Linguistic Annotator

an observational instrument developed by Rorije, with some slight adaptations and additions the researcher and Rorije agreed upon for the current communication pair. The instrument is called ‘Codebook 1.2 for Communicational Strategies by the Communication Partner’ and consists of the same six skill categories as mentioned before, that can be found present or absent in every 10-second interval which were coded on tiers in ELAN. An abbreviated version of the adapted codebook is presented in Table 2; the full codebook can be found in Appendix A.

Table 2

Codebook 1.2 for Communicational Strategies by Communication Partners

Category	Specific actions	Adaptions/additions for this pair
1. Using suitable bodily-tactile strategies	Using tactile communication, activating hand-under-hand or hand-over-hand, communicating on the body, keeping contact, using haptices, shaping signs, moving together during an activity/experience, activation other senses, reactivating (bodily) experiences by movement or touch	All skin-to-skin contact, even if it is by accident
2. Creating shared attention	Shared attention for an object in the vicinity of the client (initiated by the communication partner), communicating about an object	The diary (almost continuously)
3. Offering meaning negotiation	Showing misunderstanding, asking: "What?"	*None*
4. Adding communication	Adding/expanding communication, introducing a new sign or referrer, starting new topics, drawing something, introducing an object	*None*
5. Offering symbolic communication	Name signs of people not present, communication about anything other than the here/now, all signs referring to the non-tangible, referrers	Pictures Drawings in diary
6. Offering perspective taking	Sharing information about oneself or someone else, giving own opinion, reacting to client's feelings	Signing "Good!" (because this shows the communication partner's appreciation, hence their opinion)

Validity

At the base of the development of this instrument lies another master's thesis, by Postma (2020). Through a literature study, Postma found 27 behavioural aspects that are now part of the instrument, cast into the six skill categories shown in Table 2. The instrumented was tested by Postma and deemed valid before being taken into use for Rorije's research programme.

Reliability

Interrater reliability (IRR) of the coding was calculated for the first 3 minutes of one video per phase, totalling four videos including the baseline. The IRR was measured both in percentages of consensus (%CON.), as well as by calculating Cohen's *kappa* (κ) for each video. The benefit of *kappa* over percentages is the correction for chance, but in categories with little data, *kappa* can be impossible to calculate or unreliable and that is where percentages paint a more accurate picture. Table 3 shows the results of both types of IRR measurement.

Table 3

Interrater Reliability of Coding in Percentages of Consensus and Cohen's Kappa

Category	Baseline		Phase 1		Phase 2		Phase 3	
	%CON.	κ	%CON.	κ	%CON.	κ	%CON.	κ
1	100	1	89	.6	100	1	100	1
2	83	.675	89	.62	100	1	94	.886
3	100	x	100	x	94	x	100	1
4	100	1	89	.753	89	.684	94	.870
5	100	1	100	1	89	.609	94	.886
6	94	.64	100	1	94	.852	100	1

In order to deem the coding reliable, a lower limit of 80% consensus and a *kappa* of at least .4 (acceptable) but preferably .6-1 (good to excellent) was required. Both types of IRR ratings for all categories and phases were above these minima.

Annotation Instrument for RQ2

Sign quality can be measured on different linguistic levels, from phonological, to semantic, to syntactic and pragmatic. Since Emma's level of communication does not allow her communication partners to formulate structurally complex sentences with any regularity and because pragmatical errors generally occur less frequently, the syntax and pragmatics were not evaluated in this research.

Semantic Errors

Semantics is the linguistic field that focuses on meaning. This can be the meaning of individual words/signs, or their combined meaning in sentences or larger utterances. Human brains map all the words/signs a person knows in networks, so they can recall them when needed. Sometimes when two words/signs are semantically related, a semantic substitution can take place, where a wrong word/sign is selected in a particular sentence. These are semantic errors. (Schermer & Pfau, 2008).

Because the utterances directed at Emma are often short and simple, (complex) sentences or lager units of language will hardly be present, and therefore the focus in semantic errors here is on semantic substitutions on the lexical level.

Phonological Errors

Phonology is the linguistic field that focuses on the smallest 'building blocks' of words/signs, called parameters in sign linguistics. Each sign consists of five parameters: handshape, location, movement, orientation and non-manual part[17]. If even one of these parameters is expressed differently than in the conventional sign, the meaning of the sign can change or it can render the sign incorrect. These are phonological errors. (Schermer & Pfau, 2008).

Since Emma's eye sight is not good enough to distinguish mouthings, the parameter 'non-manual part' was not considered during annotation.

[17] Handshape = the shape of the hand when articulating a particular sign. Location = the position of the hand on or near the body when articulating a particular sign. Movement = the type of movement a hand makes during the articulation of a particular sign as well as the number of times this movement is made. Orientation = the direction in which the palm of the hand points when articulating a particular sign, as wel as the direction in which the fingers point during articulation. Non-manual part = all features that are a crucial element of a particular sign that are not expressed with one of the hands/arms, for example posture, facial expressions and mouthings. (Van der Kooij & Crasborn, 2008)

Discrepancies

When Anne communicates with Emma, she uses not only signs, but often also speaks aloud in Dutch at the same time. This is called Sign Supported Dutch (SSD) and is considered a sign *system* rather than an actual sign *language* (Schermer, 1991). In addition to semantic and phonological errors, sign quality in SSD is also influenced by the number of discrepancies between the spoken and the signed utterances.

Because Emma cannot hear spoken words, everything that is not supported by a sign (or gesture) is not accessible to her (no uptake). However, not every non-supported word is considered a relevant discrepancy in this context. In the analysis of the results, it is important to distinguish between words that are not, but should be supported by a sign (e.g. all content words like (pro)nouns, adjectives and verbs and also question words), and those that do not need to be signed, since they are not a part of sign language (e.g. articles, 'and' and conjugations of 'to be') (Schermer, 1991).

Interaction Success

Interaction is defined as a "mutual or reciprocal action or influence" (Merriam-Webster, n.d.), implying a logical connection between the utterances and actions of communication partners. In order to determine whether or not successful interaction is attained at a certain moment in a conversation, one measurement is the presence or absence of a logical connection between distinctive utterances of both partners. This means that first all utterances have to be categorised into different types. For this study, the author used a simplified version of the verbal communicative acts classification for mother-infant interaction by Ninio and Wheeler (1987). Table 4 shows the different types of opening utterances and their logical responses.

Table 4

Utterance Types, adapted by the author from Ninio & Wheeler (1987)

Opening utterances	Responses
Declarative[18]	Confirmation/acknowledgement
	Correction/negation
	Continuation/addition/expansion
Interrogative[19]	Answer
Directive/imperative[20]	Execution
	Explanation of noncompliance

All declarative opening utterances can stand alone without any reaction by the other. These are considered neutral utterances, as long as the communication partner has attention for the utterance. If not, the interaction is considered unsuccessful, and if a fitting response (i.e. confirmation/acknowledement, correction/negation or continuation/addition/expansion) follows a declarative opening utterance, it is considered successful. Interrogative and directive/imperative utterances however, always require some sort of response from the communication partner. If a fitting response is given, the interaction is considered successful. If an ill-fitting response or no response al all is given, the interaction is considered unsuccessful[21].

Based on the information above, a second instrument was developed by the author that was applied to the first video of every phase (four in total). This instrument aims to map out the sign quality of the communication partner in the recorded situations, as well as the connection between the (interactive) utterances by both the partner and the client with CDB. The instrument is called 'Codebook for Sign Quality of Caregiver & Interaction Success' and consists of eight categories, which were coded on distinct tiers in ELAN. An abbreviated version of the adapted codebook is presented in Table 5; the full codebook can be found in Appendix B.

[18] Declarative utterances are used to state facts or opinions.
[19] Interrogative utterances are used to ask questions.
[20] Directive and imperative utterances are used to make requests and give orders.
[21] A/N: The author is aware that this seems to be a *contradictio in terminis*. The definition of an 'interaction' as given above implies a logical and therefore also successful connection between utterances. However, since interaction was attemped by using an interrogative or directive/imperative opening utterance, but (successful) interaction was not reached, 'unsuccessful interaction' remains the best descriptor for this phenomenon.

Table 5

Codebook for Sign Quality of Caregiver & Interaction Success

Category	Content of Code
Speech Anne	Literal transcript of everything Anne says Transcript of every meaningful sound Anne makes
Discrepancies GLOSS-speech	Literal transcript of everything Anne says that is <u>not</u> supported visually
GLOSS Anne	Literal transcript of everything Anne signs Transcript of everything Anne gesticulates
Semantic errors	Transcript of spoken words by Anne that are supported by an incorrect, but existing sign
Phonological errors	All parameters of a sign that are articulated incorrectly
Interaction type Anne	Categorisation of every utterance by Anne
Interaction type Emma	Categorisation of every utterance by Emma
Interaction succes	Are Anne's and Emma's utterances logically connected? Yes = successful. No = neutral/insuccessful.

Validity

Since all sign language related categories in this codebook are derived from the linguistic features of this language, and all utterance categories in this codebook are based on categories found in Ninio and Wheeler (1987), the author believes this instrument is fit to measure sign quality and interaction success within the given context of this study.

Reliability

The reliability of this instrument was not tested prior to using it in this study.

Data Analysis

Once all the videos were coded in ELAN, the data were exported to Microsoft Excel to be analysed. Since the data used to answer the first research question were subjected to a quantitative analysis and the data used to answer the second research question to qualitative analyses, the analyses will be explained separately below.

Data Analysis for RQ1

To calculate the effect of the ILC intervention on Anne's communication skills in interaction with Emma, the measurements in each category where calculated and compared per phase. This was done by exporting the data from ELAN to Microsoft Excel to calculate the number of times a communicative skill belonging to each category was reported per recording and to calculate the mean and standard deviation of each. These results were processed into graphs for visual presentation.

To measure the effect strength, the raw data were also transferred from Excel into an online Non-overlap-of-All-Pairs, or NAP-calculator, which calculated the percentage of all pairwise comparisons per category across the baseline and phase 1, phase 2 and phase 3 respectively. These results were added to the means and standard deviations that had already been calculated and were processed into tables per category. A colour coding system was used to show whether the effect was weak (orange for a NAP of 0-0.65), average (yellow for a NAP of 0.66-0.92) or strong (green for a NAP of 0.93-1.0). Only average and strong NAP-effects are considered meaningful. (Parker & Vannest, 2009).

Data Analysis for RQ2

In order to analyse the sign quality and the (interactive) utterances, structured multiple layer searches were programmed and conducted in ELAN and the resulting data then imported into Microsoft Excel[22]. The data were rearranged in such fashion that one could both have an overview of all the data, as well as filter them to only show certain types of data[23].

Once the edited dataset was compiled, several observations were made by visual inspection and processed in the following tables: an overview of all semantic errors, an overview of all phonological errors, an overview of all discrepancies between Anne's spoken and signed utterances, the number and percentage of (un)successful interactions and neutral utterances per phase and the number of sign problems (errors and discrepancies) in (un)successful interactions.

[22] See Appendix C for a full, technical description of the search programming.
[23] See Appendix D for several screenshots of the data to paint a picture of the edited data set.

Results

RQ1 - Effect in Category 1: Tactile Strategies

Graph 1 and Table 6 show that the number of times Anne used tactile strategies (focused on in the training session at the beginning of phase 1), increased after the first intervention session compared to the baseline measurements, but then dropped again in phase 2 and was similar to the baseline in phase 3. NAP calculations show that the increase of tactile strategies Anne used in phase 1 is an average and therefore meaningful effect.

Graph 1

Effect in Category 1: Tactile Strategies

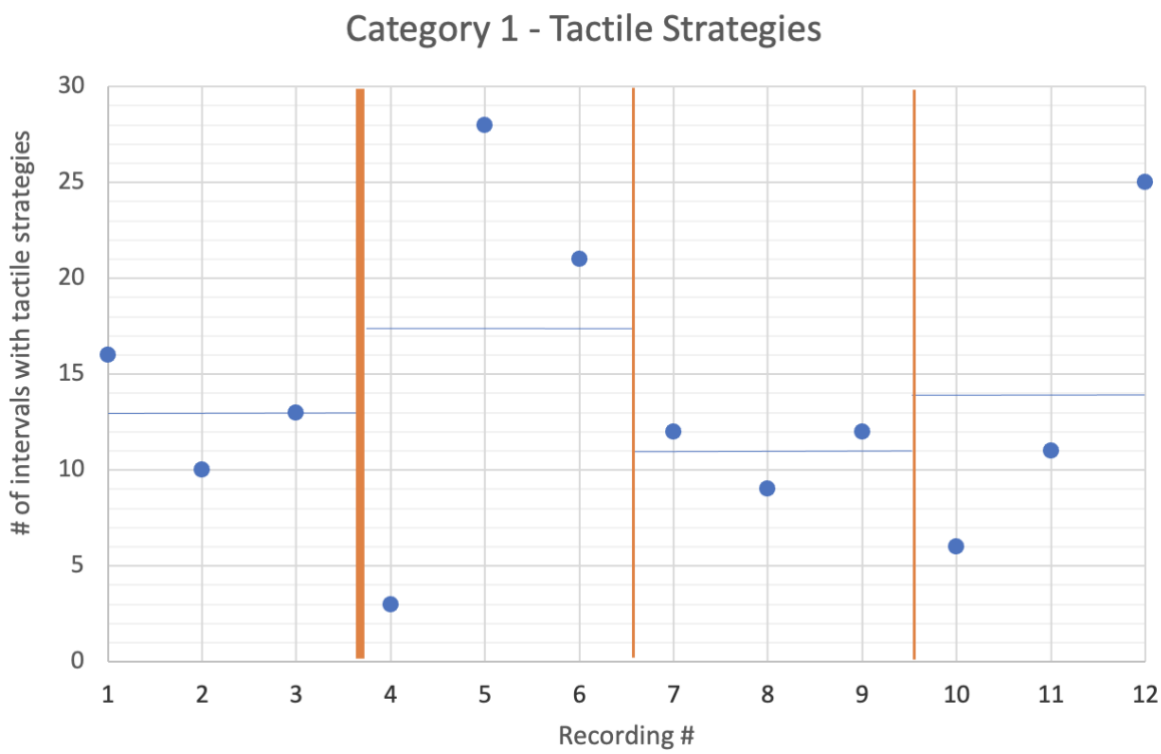


Table 6

Effect in Category 1: Tactile Strategies

	Baseline			Phase 1			Phase 2			Phase 3		
Recording #	1	2	3	4	5	6	7	8	9	10	11	12
Mean	13,00			17,33			11,00			14,00		
SD	3,00			12,90			1,73			9,85		
NAP				0,67			0,22			0,44		

RQ1 - Effect in Category 2: Shared Attention

Graph 2 and Table 7 show that the number of times Anne created shared attention (focused on in the training session at the beginning of phase 2) increased only slightly after the first intervention session and did not increase further over time. In fact, it dropped during phase 2 and phase 3, even below the measurements in the baseline. NAP calculations show that the small increase that was seen in phase 1 is a weak and therefore not a significant one.

Graph 2

Effect in Category 2: Shared Attention

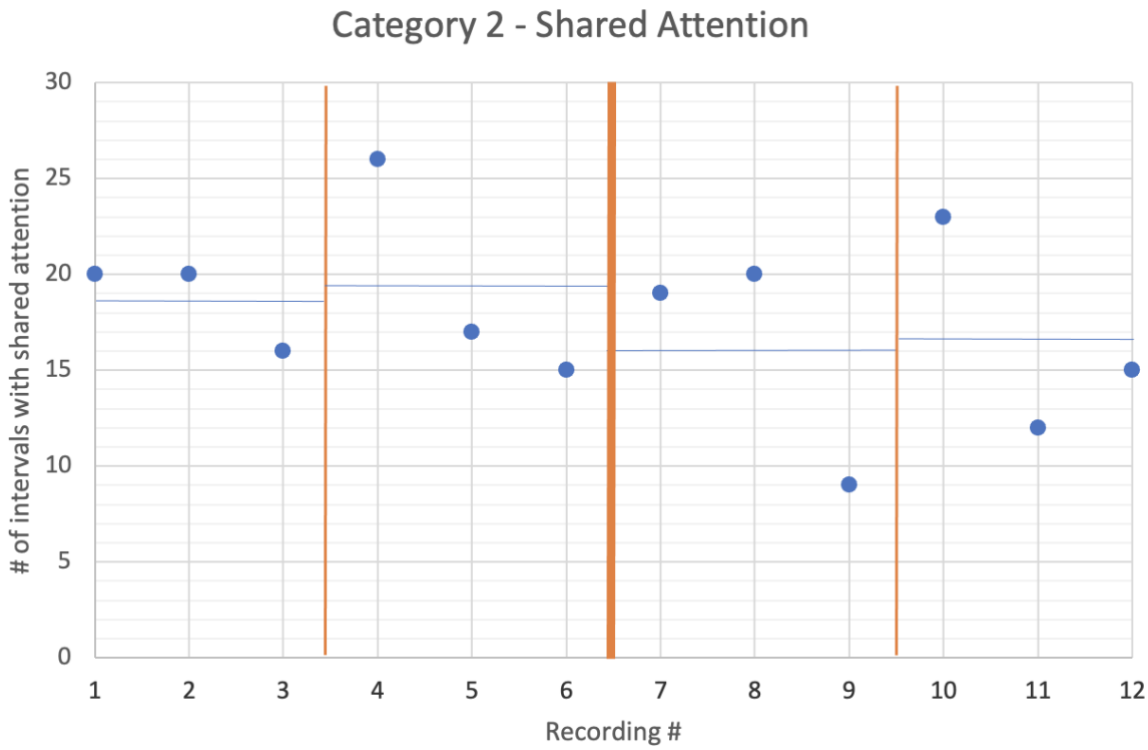


Table 7

Effect in Category 2: Shared Attention

	Baseline			Phase 1			Phase 2			Phase 3		
Recording #	1	2	3	4	5	6	7	8	9	10	11	12
Mean	18,67			19,33			16,00			16,67		
SD	2,31			5,86			6,08			5,69		
NAP				0,44			0,33			0,30		

RQ1 - Effect in Category 3: Meaning Negotiation

Graph 3 and Table 8 show that the number of times Anne used meaning negotiation (focused on in the training session at the beginning of phase 2) was very low throughout the entire observation period. It did increase a little in phase 1 and a lot in phase 3. NAP calculations show that the small increase that was seen in phase 1 is a weak and therefore not a significant one, but the increase in phase 3 is a strong and meaningful one.

Graph 3

Effect in Category 3: Meaning Negotiation

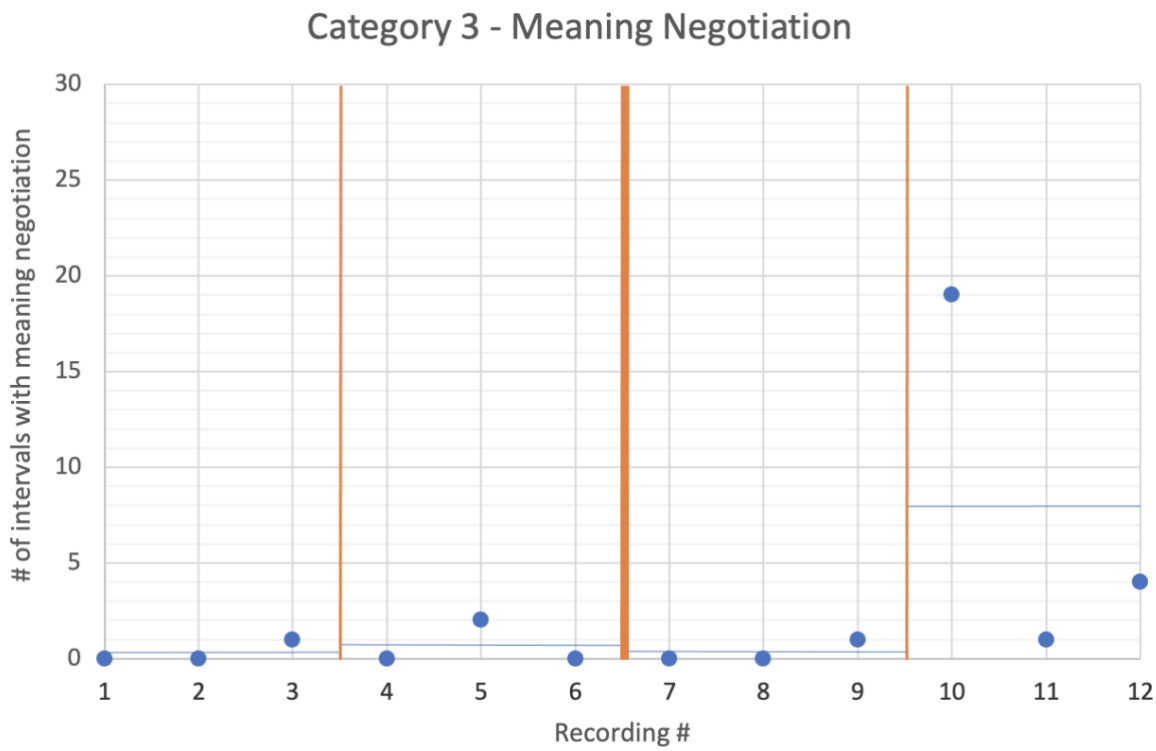


Table 8

Effect in Category 3: Meaning Negotiation

	Baseline	Phase 1	Phase 2	Phase 3
Recording #	1 2 3	4 5 6	7 8 9	10 11 12
Mean	0,33	0,67	0,33	8,00
SD	0,58	1,15	0,58	9,64
NAP		0,56	0,50	0,94

RQ1 - Effect in Category 4: Adding Communication

Graph 4 and Table 9 show a decrease in the number of times Anne added communication (focused on in the training session at the beginning of phase 3) throughout the research period from the baseline to phase 1 and later again from phase 2 to phase 3.

Graph 4

Effect in Category 4: Adding Communication

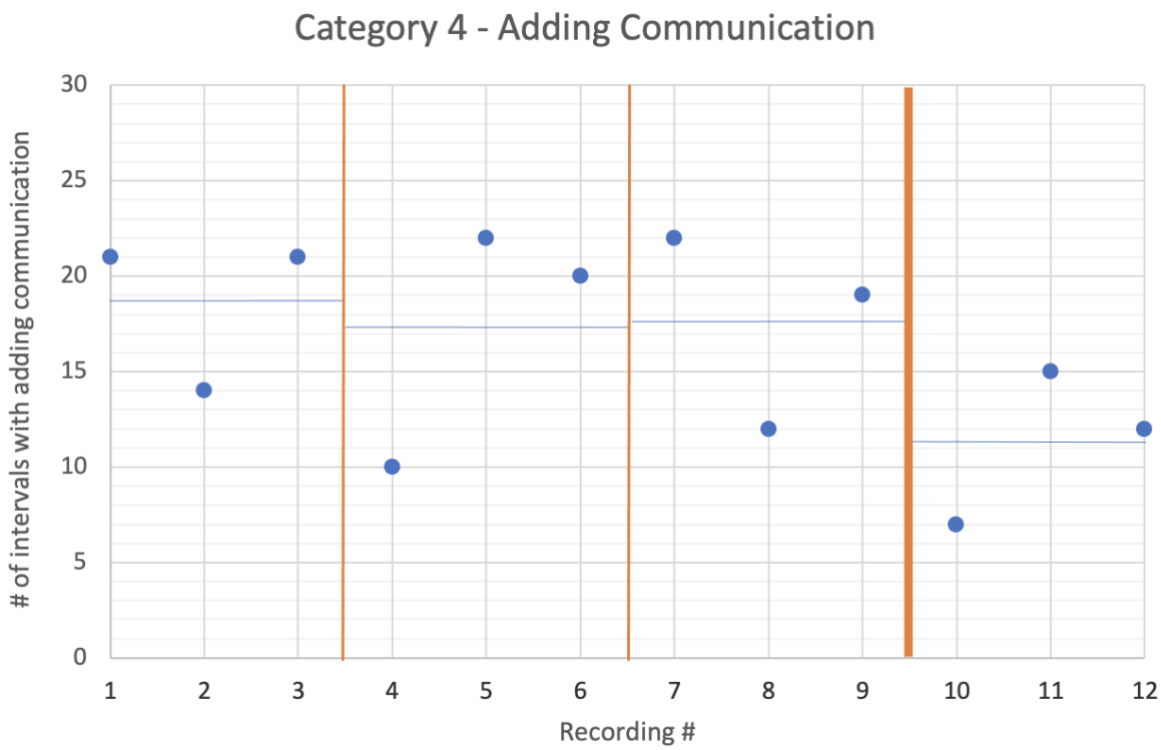


Table 9

Effect in Category 4: Adding communication

	Baseline			Phase 1			Phase 2			Phase 3		
Recording #	1	2	3	4	5	6	7	8	9	10	11	12
Mean	18,67			17,33			17,67			11,33		
SD	4,04			6,43			5,13			4,04		
NAP				0,44			0,44			0,11		

RQ1 - Effect in Category 5: Symbolic Communication

Graph 5 and Table 10 show that the number of times Anne used symbolic communication (focused on in the training session at the beginning of phase 3) varied during the research period. It increased between the baseline and phase 1, but then went back down to the same level as in the baseline during phase 2, and then back up again in phase 3. NAP calculations show that the increase that was seen in phase 1 is a weak and therefore not a significant one, but the increase in phase 3 is an average and therewith meaningful one.

Graph 5

Effect in Category 5: Symbolic Communication

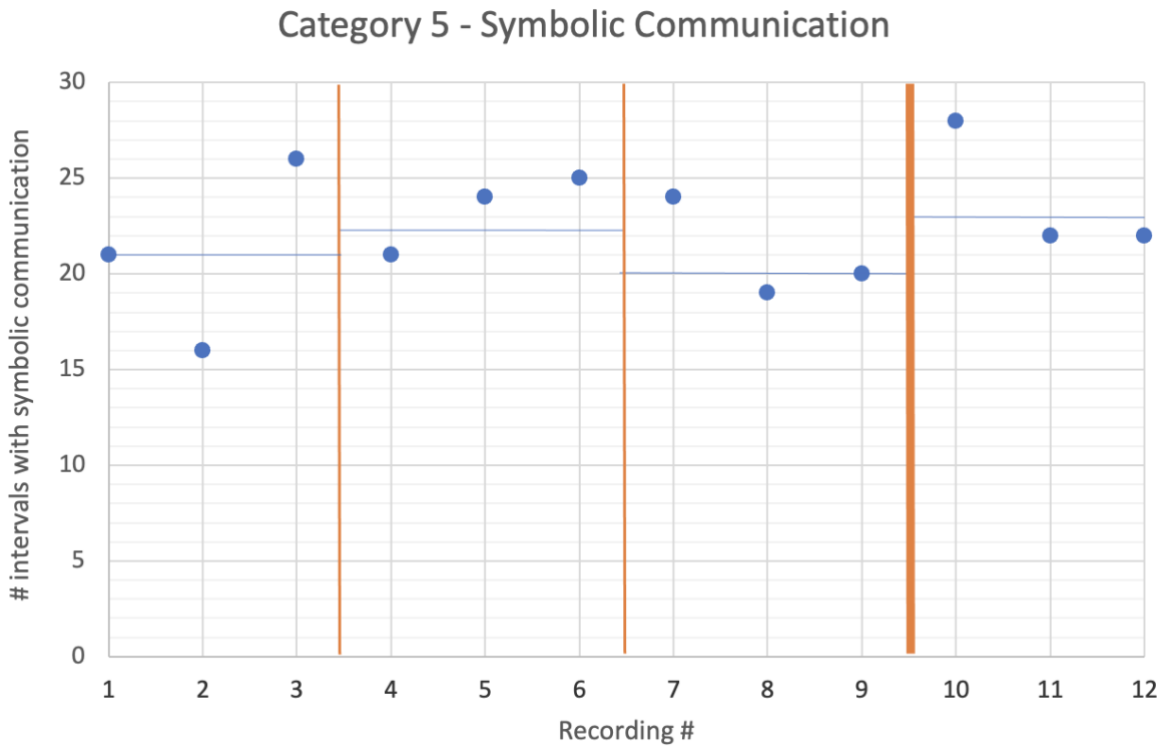


Table 10

Effect in Category 5: Symbolic Communication

	Baseline	Phase 1	Phase 2	Phase 3
Recording #	1 2 3	4 5 6	7 8 9	10 11 12
Mean	21,00	23,33	21,00	24,00
SD	5,00	2,08	2,65	3,46
NAP		0,61	0,44	0,78

RQ1 - Effect in Category 6: Perspective Taking

Graph 6 and Table 11 show that the number of times Anne stimulated perspective taking (focused on in the training session at the beginning of phase 3) in Emma increased steadily during the research period. NAP calculations show that the increases in phase 1 and 2 are of average strength, and that the increase in phase 3 is a strong one. All these increases in stimulation of perspective taking are therefore meaningful.

Graph 6

Effect in Category 6: Perspective Taking

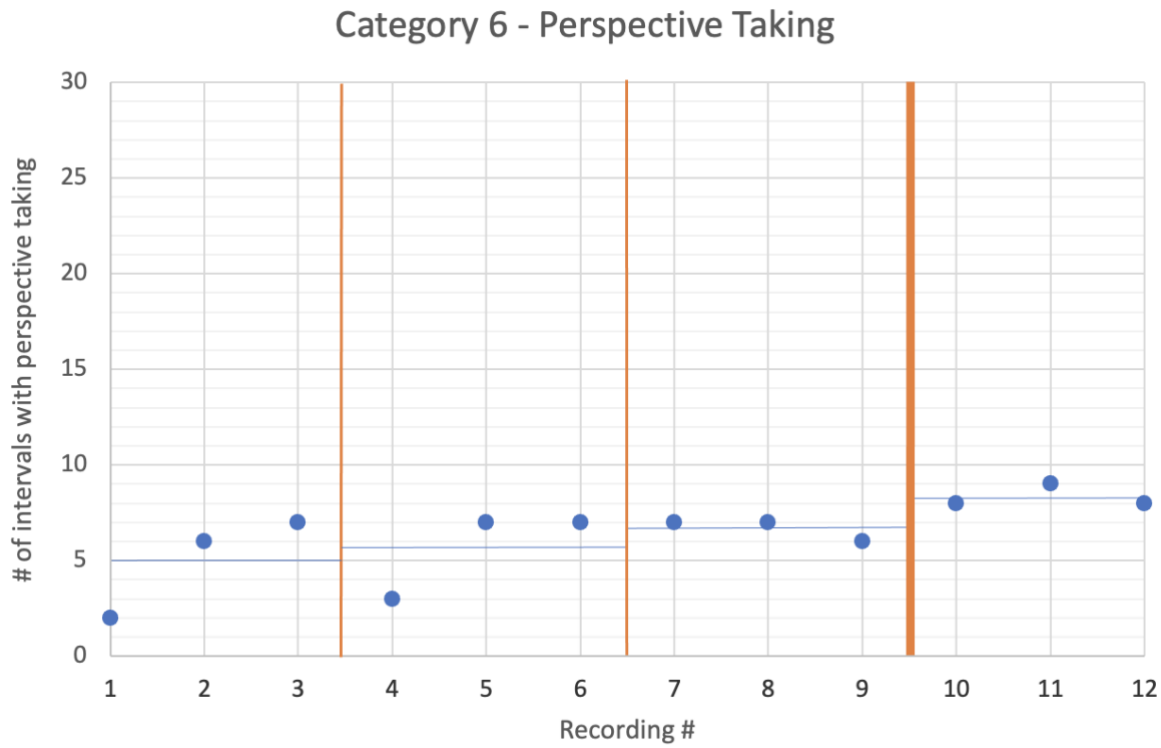


Table 11

Effect in Category 6: Perspective Taking

	Baseline			Phase 1			Phase 2			Phase 3		
Recording #	1	2	3	4	5	6	7	8	9	10	11	12
Mean		5,00			5,67			6,67			8,33	
SD		2,65			2,31			0,58			0,58	
NAP					0,67			0,72			1,00	

RQ2 - Sign Quality

The language used by Anne in the analysed videos contained some semantic and phonological errors (see Table 12 and Table 13, respectively). The semantic errors occurred in verbs, nouns and some other word types. Consistent substitutions were used for the words 'to plan', 'to lie down', 'mother', 'father' and 'house/home'. The wrongly chosen signs were related to the one that was meant in all cases but one (WHAT instead of NO). One neologism was found (pregnant).

Table 12

Overview of Semantic Errors

Meaning	Chosen sign	Baseline	Phase 1	Phase 2	Phase 3
To plan	PROGRAMME	x	xx	xx	
Done	PAST	x			
To lie down	TO-SLEEP	xx			
Mum/dad	MOTHER/FATHER		xx	xx	
House/home	TENT/ROOF		xx	xx	
To come (here)	TO-GO-WITH		x		
Toy(s)	TO-PLAY		x		
No	WHAT		x		
Together	They/them (2ppl)			x	
Marker(s)	TO-DRAW			x	
Pregnant	*neologism*				xx

The phonological errors were mostly on the movement parameter and sometimes on the handshape and/or orientation parameter. Signs that were consistently executed with one or more phonological error were TO-WALK/STROLL, TO-TAKE/GRAB, THEN, TO-DRAW, and THURSDAY. The location parameter was only wrongly executed once (DOESN'T-HAVE-TO) and this seemed like sloppiness rather than a structural mistake, since the researcher has seen Anne make the same sign in the correct location in other recordings.

Table 13

Overview of Phonological Errors

Sign	Incorrect paramaters	Baseline	Phase 1	Phase 2	Phase 3
TO-WALK/STROLL	hs, mov, or	x		x	
TO-TAKE/GRAB	hs, mov, or	xx			
THEN	hs	xx	x		xx
TO-DRAW	or	xx		x	
ILL	mov	x			
TO-SEARCH	mov		x		
THURSDAY	mov			xx	
DOESN'T-HAVE-TO	loc			x	
AGAIN	mov				x

RQ2 - Discrepancies

Sometimes Anne vocally says something which she does not support with a sign or gesture or in another visual way that makes the utterance accessible to Emma. After filtering out the words that are not supposed to be supported by a sign in a free sign system like SSD, several types of relevant discrepancies were found (see Table 14). Anne often leaves out the subject of the sentence in her signing ("You …" becomes "…" and "I …" becomes "…"). She sometimes leaves out the signals for suggestions or requests ("Let's …" becomes "…" and "Please …" becomes "…"). She also sometimes seems to speak her own thoughts out loud, which do not seem to be directed at Emma and probably are not meant for her to take in. Examples of these are "The toys are getting more and more extensive" and "What have I got on me?! Crumbs… Seems like powdered sugar…". It also happens that she leaves out a negation, apology or conditional conjunction, but these seem to be more incidental than consistent drops. The same goes for specific words that she left out in the analysed materials. There did not seem to be a pattern to those, so this seems to be a random selection of words she just happened to forget to sign at these specific moments.

Table 14

Discrepancies

General types of discrepancies	Baseline	Phase 1	Phase 2	Phase 3
Suggestion	xx	x		
Negation	x			
Request			x	xx
Apology				xx
Subject of the sentence left out	x	xx	xx	xx
Conditional conjunction left out	x			
Own thought spoken aloud (not meant for Emma)		x	x	
Specific words that were left out	**Baseline**	**Phase 1**	**Phase 2**	**Phase 3**
Yes	x			
Finished/done/ready	x		x	x
To-sign	x			
To-get/to-receive	x			
To (as in: go to…)		x	x	x
Then			xx	
To finish				x

RQ2 - Interaction Success

To determine the development of the interaction, the frequency of logically connecting turns taken between Anne and Emma was measured. All interactions were categorised into successful ones (declarative utterances followed by a confirmation, correction or continuation, interrogative utterances followed by answers and directive/imperative utterances followed by execution or an explanation of noncompliance), unsuccessful ones (declarative utterances done when the communication partner is not attentive, unanswered interrogative utterances and without explanation unexecuted directive/imperative utterances) and neutral ones (declarative utterances that are possibly seen by the other, but incite no reaction).

In total, 44 interactions were coded in the selected video from the baseline, 22 from phase 1, 47 from phase 2, and 46 from phase 3. Table 15 shows the number and percentage of successful and unsuccessful interactions and the neutral utterances.

Table 15

Number/Percentage of (un)successful interaction and neutral utterances

	Baseline (44)		Phase 1 (22)		Phase 2 (47)		Phase 3 (46)	
Unsuccessful	12	27%	8	36%	9	19%	10	22%
Successful	22	50%	14	64%	31	66%	31	67%
Neutral	10	23%	0	0%	7	15%	5	11%

There does not seem to be a clear pattern in the unsuccessful interactions. However, the successful interactions increased after the first intervention from half of the interactions being successful in the baseline video to two thirds in the videos of phase 1, phase 2 and phase 3. This seems to be an improvement after the first intervention and then stabilisation throughout the rest of the research period.

Table 16 shows the found sign problems, cross referenced with the success of the interactions. It can be deduced from these data that sign problems (errors and discrepancies) more often than not (70% versus 30%) did not impede successful interactions between Anne and Emma, that 40% of the successful interactions still contained one or more sign problem, and that unsuccessful interactions had sign problems in less than half the cases (44%). These sign problems in (un)successful interactions can be broken down by type. Graph 7 shows that whenever semantic or phonological errors occurred, in the large majority of cases (respectively 88% and 86%), this did not lead to unsuccessful interaction. The discrepancies, however, paint a much more nuanced picture, with only 60% still leading to successful interaction. In both absolute and relative terms, the proportion of discrepancies leading to unsuccessful interaction is larger than that of errors leading to unsuccesful interaction.

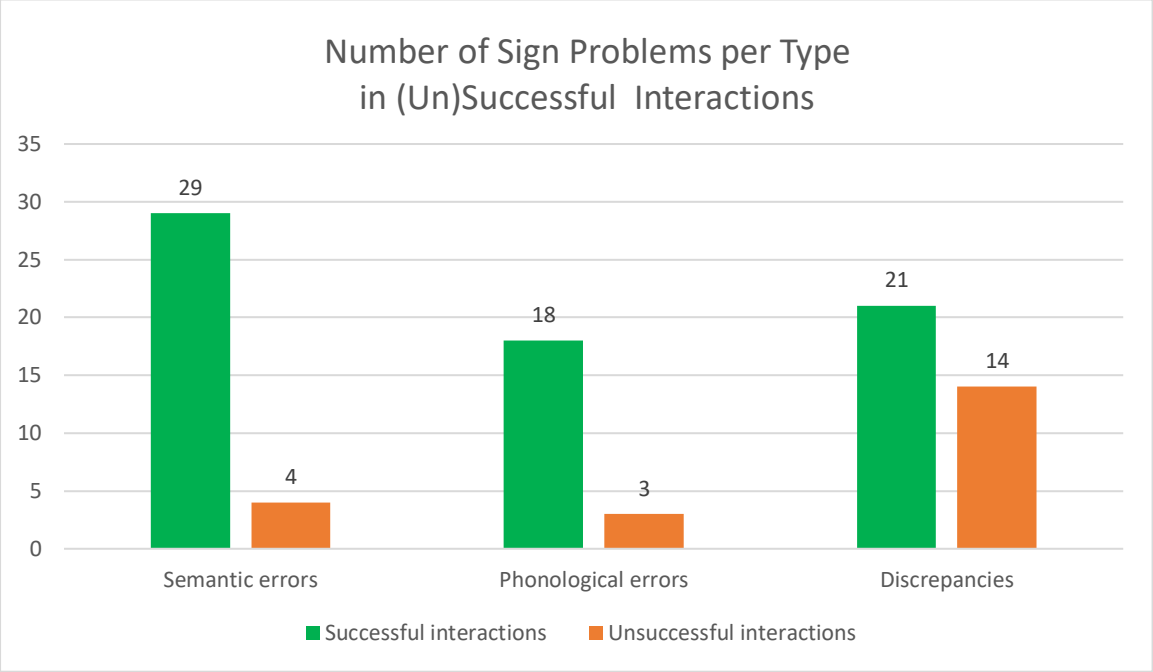
Table 16

Number/Percentage of Sign Problems in (Un)Successful Interactions

	Successful interactions	Unsuccessful interactions	TOTAL
Problem free interactions	59 73% 60%	22 27% 56%	81 100%
Interactions with one or multiple problems	39 70% 40%	17 30% 44%	56 100%
TOTAL	98 100%	39 100%	137

Graph 7

Number of Sign Problems per Type in (Un)Successful Interactions



Discussion

The first aim of this study was to contribute to the 'Tell it' project by measuring the effect of the ICL intervention on a specific communication pair: Emma, who has CDB, and her caregiver Anne. Based on previous research, it was hypothesised that at least an average effect would be found in at least one of the communication skill categories that were tested, most likely pertaining to the first and/or second layer of intersubjectivity and possibly only after that specific skill had been the subject of a training session. These expectations were mostly met. In the **first category (tactile strategies)** an average effect was found in phase 1, but no effect in phase 2 and 3, with the average number of times she used tactile strategies even dipping below the baseline in the second phase. This could simply be a coincidence, but it is also possible that Anne was focused on this skill during phase 1, having just been trained on it, and then shifted her focus to other skills in the next two phases, after receiving training sessions on those. The **second category (shared attention)** showed no significant improvement. At first, the author believed this could be related to a lack of visual attention skills, because Emma cannot look at an object and Anne's signs at the same time, but when looking back at the recordings, the moments without shared attention were not when Emma was looking at Anne, but rather when there was no object to look at or when Emma was unattentive in general. Another explanation for this lack of significant improvement could be a ceiling effect, since Anne already created shared attention in an average of almost two thirds[24] of the intervals in the baseline measurements. In the **third category (meaning negotiation)** a strong effect was measured, but only in phase 3, despite this theme being the subject of the training session at the beginning of the second phase. A simple explanation for this could be that it took some more time for the information on this theme to sink in and be put into practice. This effect is comparable to one Damen and colleagues (2011) found in another study on individuals with both visual and intellectual disabilities (like Emma), but without auditory disabilities (unlike Emma). They found that the intervention effects on the interactive skills of the clients only improved at the end of or even after the intervention had ended and not in the earlier phases of the intervention. The **fourth category (adding communication)** showed no significant improvement. Since Anne already presented this skill in an average of almost two thirds of the intervals in the baseline measurement, this could again be attributed to a ceiling effect. However, another explanation is possible. This skill is related to the third intersubjectivity

[24] This is a little lower than the presence that was considered a plausible explanation for the ceiling effect in a research by Janssen and colleagues in 2002 on the interaction between children with deafblindness and their teachers (87.3%).

layer, the one that prior research has shown to be more difficult to execute and improve. That could also be the case here. Both in the **fifth (symbolic communication)** and **sixth (perspective taking)** category significant effects were measured: average effects in phase 1 and 2 for category 6 and an average effect for category 5 and a strong effect for category 6 in phase 3. The fact that the strongest effects in these categories were measured in phase 3 is explained by the moment of intervention; both skills (related to the third intersubjectivity layer) were addressed at the beginning of that phase.

The second aim of this study was to analyse the sign quality of caregiver Anne during the interactions with client Emma, and the effect of this quality on their interaction. It was hypothesised that high sign quality would lead to successful interactions and a relatively lower sign quality to less successful interactions and more misunderstandings. This hypothesis was not supported. Both **semantic and phonological errors** were found in some of Anne's utterances. She consistently substituted several signs (of several word types) with other, incorrect signs with a different meaning, and she consistently articulated several signs with one or more incorrect parameters (mostly movement errors and sometimes handshape and/or orientation errors). There were also some **discrepancies** between her spoken and signed utterances. She left out visual support (sign or gesticulation) of some of her spoken utterances. These visual omissions were most often the sentence subject, signals for suggestions or requests, her own thoughts and sometimes random words in a sentence with no clear pattern as to which words she left out.

No clear pattern was found in the number of unsuccessful interactions throughout the intervention process, but the number of successful interactions increased over the period of the observation, from half of the interactions being successful during the baseline, gradually rising to two thirds in phase 3. When removing the neutral utterances from the equation, almost three quarters of all analysed interactions were successful, regardless of whether they contained sign problems. Of all interactions with one or multiple problems, 70% was still successful. Conversly, when offsetting the successful interactions to the unsuccessful ones, comparable rates of problems were found: 40% of the successful interactions and 44% of the unsuccessful interactions contained problems. Based on these data, no relationship is indicated between the occurrence of sign problems and the interactive success.

However, it is salient that the part discrepancies played (compared to semantic and phonological errors) in problem-containing unsuccessful interactions is much larger than in problem-containing successful interactions. This means that errors made by Anne in her sign choice and articulation had a smaller negative impact on her interaction with Emma than

leaving out signs altogether. This is easily explained by the fact that when Anne leaves out a sign or gesture and only speaks it vocally, it is not accessible to Emma, who then receives an incomplete message. When Anne makes a semantic or phonological error, the impact is much smaller since there is still accessible information. Because Anne and Emma know each other well and communicate often, and because Anne's errors are mostly consistent, Emma is probably used to Anne signing to her that way and understands these 'problem' signs regardless. So lower sign quality on a semantic and phonological level does not lead to less successful interactions, as long as the errors are made consistently and the communication partners are attuned to one another. However, if Emma were to communicate with a new partner, one who does not know and use Anne's sign substitutes and phonological ideosyncracies, but rather the conventional ones, there is a chance Emma would not understand this partner and that the partner might not understand Emma if she uses 'Anne's' signs[25].

Limitations

The study described in this thesis was conducted within the context of a master's programme. Therefore only a relatively short amount of time[26] was available and choices had to be made on what to include and, similarly important, what not to. Elements that were excluded for lack of time were also analysing Emma's sign quality (in addition to Anne's) and linking the results of the second research question to those of the first, especially relating the interaction success to the use of communication strategies. For example: it would be expected that the intervals in which one or more of the six communication skills were present, would correlate to successful interaction. This hypothesis was not tested in this study. Also due to time restrictions, only one video per phase (four in total) was coded and analysed for the qualitative part of this study, instead of all 12 available recordings that were used for the quantitative part, and these codings were done by the author alone, without any IRR checks by another coder/researcher.

In addition to the limitations mentioned above that are related specifically to this thesis study, the author was surprised at two elements of the original 'Tell it' research design, which also influenced this thesis study. First, only three recordings were coded and analysed per phase, the minimum number for reliable NAP-analysis. As the term 'minimum' indicates, this

[25] A/N: During the presentation of this master's thesis to classmates and lecturers of the master's programme, dr. Saskia Damen posed an interesting question that was not taken into account in this conclusion: how do we know it is Anne who 'develops' these signs and Emma who might copy them, instead of vice versa? Maybe it is Emma who chooses and articulates these signs and Anne who copies them off of her instead. This would be interesting to find out in a follow-up study. More on this in the recommendations section of this thesis.
[26] One year for the master's programme in general, but only 3 months for the actual thesis research and writing, after the thesis proposal had been approved.

is not too little, but neither is it ample. If only one of these recorded moments is in any way a divergence from the usual, an anomaly, this already skews the results. In the author's opinion, it would be advised to expand the number of recordings per phase to at least four or preferably five. Second, during the IRR meetings all moments where initial coding consensus was absent were discussed. On most of these, the author and the PhD-researcher quickly did reach consensus, often because one of the two admitted to having missed something and immediately agreeing with the other's coding. For the analysis however, the author was instructed to use their own, original data anyway, even if it had been decided during the IRR meetings that they had made a mistake and that the coding of the PhD-researcher was in fact the correct one. This method was said to be non-problematic because of the IRR of more than 80% in every category for every video. It was also said to be necessary to stick to the original codings to guard the independency of the data, but in the author's opinion it would make the results more reliable (and therefore stronger) if noticed and admitted mistakes had been corrected before the data analysis.

Recommendations

Based on this study, the author has a sole recommendation for the organisation governing the facility that Emma lives in (and other organisations working with individuals with (congenital) deafblindness): to closely involve sign language teachers to support the communication partners in keeping their signing up to par, i.e. to consistently adhere to the conventional signs of (in this case) NGT and, as was seen in this study even more importantly, to not leave out important signs. That way, the same correct signs are offered to all clients by all caregivers, in such manner that uptake and intake is possible for the clients, opening up myriad possibilities for linguistic and communicative/interactive devlopment, strengthening the basis for their cognitive and psychosocial development.

For future research, many recommendations can be made, since this study was a limited one, as was already mentioned above. An obvious direction is to perform an IRR check on the four videos that were coded for the second research question, in order to check the reliability of the developed instrument. Based on the results of the IRR check, the instrument could (and should) be edited. Options that would then be interesting to explore in the near future in the case of Emma, are (i) expanding the qualitative part of this study by also coding and analysing the other nine recordings of the interactions between her and Anne, (ii) also analysing Emma's utterances on sign quality and (iii) additionally analysing interactions between Emma and other caregivers. The latter two suggestions are relevant to find out whether Emma uses the same

signs and articulations as Anne and which signs and articulations the other communication partners use. This could be combined with interviews with all caregivers to address the question where the sign problems found in this study originated: with Anne, with Emma (and if so, who taught her these signs) or with another caregiver? Or even with a sign language teacher or communication coach who taught all of them these non-conventional signs, maybe even leading to the development of a distinct culture with its own sign system, specific to this organisation?

Another question that arose during the presentation of this master's thesis is a more philosophical one[27]: if this study shows that Emma and Anne understand each other most of the time (with over half of their interactions being successful, even up tot two thirds during the last phase of this intervention period), can you call Anne's sign problems truly 'problems'? This is an interesting question that can and will not be answered here, but that could be the subject of a future master's thesis. An important consideration when looking into this theme, is Paul Hart's personal formula: ask yourself whether or not the individual with CDB (in this case Emma) will likely enter and participate in regular (deafblind) society in the future or not. This determines whether it is more important for her to communicate about a broad range of subjects with only a small group of people (her caregivers and parents) or to communicate with a broader range of people in larger society, but probably on a lot less subjects with a smaller vocabulary, if everything she signs has to be conventionally speaking correct.

Finally, the author would recommend duplication of this study (both the quantitative research for the first question and the qualitative research for the second question and preferrably combined and linked more than was done in this thesis), since the group of individuals with CDB is highly heterogeneous and therefore more research is necessary in order to discover patterns that can then be used to further develop this intervention and others.

Conclusions

With the results of this study, the research questions can be answered as follows. The ICL intervention influenced the communication skills of caregiver Anne during her interactions with Emma, who has CDB, to the extent that she uses slightly more tactile strategies and symbolic communication and significantly more meaning negotiation and perspective taking after the intervention than before. Her sign quality differs per interaction, her signs sometimes being free of problems and sometimes containing semantic or phonological errors, and there

[27] Brought to the table by dr. Paul Hart.

are some discrepancies between her spoken and signed utterances. No effect of these sign problems on the success of their interactions was indicated, although the discrepancies seemed to play a bigger role in creating unsuccessful interactions than the semantic and phonological errors.

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Appendix A: Codebook 1.2 for Communicational Strategies by Communication Partners

Hoofdcategorieën	Toelichting en voorbeelden/strategieën
1. Gebruikt geschikte lichamelijk-tactiele strategieën	Definitie 'geschikt': *een strategie die past bij de mogelijkheden en voorkeuren van de cliënt: zie ook persoonlijke handleiding.* Gebruik vierhanden of tactiele communicatie. Activeren 'hand-onder-hand': *CP legt de eigen handen onder de handen van de cliënt → dit gebeurt actief, de CP neemt hierin initiatief en stimuleert dit. Bijv. door een tikje op de hand van de cliënt, waardoor de cliënt weet dat die hand positie wordt aangenomen.* Activeren 'hand-over-hand: *Wanneer dit wordt ingezet in spreker/luisteraar context. <u>Niet</u> wanneer de CP de handen van de ander pakt om iets te gebaren.* Communicatieve uitingen op het lichaam: *CP maakt gebruik van aanraking op het lichaam (niet de handen) van de cliënt (wel met communicatief doel!) Bijvoorbeeld over de arm wrijven, schouderklopje, of wrijven over schouder wanneer de CP even weggaat. Ook wanneer een aanraking per ongeluk is of lijkt, dan is dit wel zo scoren als een tactiele strategie.* Contact onderhoud: *de CP houdt contact tussen de beurten in. Bijvoorbeeld door de handen van de cliënt te blijven aanraken of door contact met de benen. Geldt ook wanneer er gelopen wordt en de CP de handen van de cliënt vasthoudt, of dat de cliënt op de CP kan leunen.* Aanvulling: rolstoel duwen is geen contact onderhoud. Bij het lopen moet er een aanraking zijn. Gebruik van haptices: *Dit zijn communicatieve uitingen op het lichaam die (vaak op de rug) worden ingezet om informatie te geven over omgeving (bijv. sfeer) rondom de cliënt. De communicatiepartner maakt gebruik van haptices. Door de intensiteit van de lichamelijke aanraking kunnen gevoelens en ervaringen gedeeld worden.* Het 'shapen' van een gebaar: *meestal bij een nieuw gebaar, dat de CP met de handen van de cliënt het gebaar vormt.* Samen bewegen tijdens een ervaring, in een activiteit: *CP doet dit op een bewuste manier.. Het gaat om intentioneel samen bewegen (met handen, lichaam) in de activiteit (samen een stuk fruit pellen/schillen, samen heen en weer wiegen).* Activeren van andere zintuigen: *bijvoorbeeld geur, blazen, trillingen (bijv. met een muziekinstrument, of op tafel tikken), smaak, temperatuur (bijv. een mok met warm drinken).* Her-activeren van een (lichamelijke) ervaring door een beweging, of aanraking op het lichaam: *een specifieke beweging verwijst naar de eerdere ervaring of CP raakt een plek aan op*

	het lichaam waar die eerdere ervaring werd gevoeld (bijv. de cliënt die was gevallen, en dan die plek op het lichaam aanraken).
2. Creëert een moment van gedeelde aandacht	*De CP laat merken aandacht te hebben voor een bepaald voorwerp, waar de cliënt of CP het over wil hebben. CP toont initiatief om ook de aandacht van de cliënt hiervoor te krijgen. Zet hierbij communicatie in wat is afgestemd op de cliënt, inzet van tast en/of visus.* *Situatie: de cliënt wil het over een bepaald voorwerp hebben, wanneer de CP hier alleen naar kijkt, is dit niet voldoende. Belangrijk dat ze laat weten dat ze er naar kijkt.* Het voorwerp moet in de nabije aanwezigheid zijn van de cliënt. Dat hij/zij weet of kan weten dat het er is. Communicatie over het voorwerp valt hier ook onder. *Bijv. iets zeggen over het voorwerp waar aandacht voor is.*
3. Biedt van momenten van betekenisonderhandeling	Uiting van (niet)begrijpen: *CP laat merken dat hij de cliënt wel of niet begrijpt. Het gaat hier om een combinatie van zowel het imiteren van het gebaar + een uiting van wel of niet begrijpen, of meer info vragen (bijv. 'wat?') of uiting toevoegen.* *Alleen ja of nee is niet voldoende. Alleen imiteren is ook niet genoeg.* *Het is geen betekenisonderhandeling als de cp al denkt te begrijpen wat de ander bedoelt, en het niet checkt, dus je moet het checken.* Het kan een strategie van de CP zijn om bewust om meer info te vragen, of om te doen alsof ze het niet begrijpt.
4. Toevoegen van communicatie	Voegt communicatie toe: *door een gebaar of uiting van de cliënt te herhalen + uitbreiding (dit is niet hetzelfde als bij betekenisonderhandeling, wanneer het niet wordt gecheckt!) Bijv.: cliënt gebaart 'drinken', CP gebaart: 'jij' 'drinken' 'limonade' = uitbreiden communicatie. 'Jij' 'drinken' 'wat' = betekenisonderhandeling* *Het introduceren van een nieuw gebaar of verwijzer.* Wanneer de cliënt zelf nog niet veel gebaart kan de CP dit ook doen door in de context meer informatie te geven/taal toe te voegen. *Bijv. de cliënt doet een specifieke beweging/uiting en de CP reageert hierop + voegt meer communicatie toe.* *De CP kan ook een uiting of lichaamstaal van de cliënt benoemen. Bijvoorbeeld wanneer de cliënt huilt of lacht, dat de CP dit dan benoemt in een (tactiel) gebaar of uiting.* *Nieuwe onderwerpen aandragen is ook onderdeel van de uitbreiding woordenschat.*

	Wanneer er als communicatiemiddel wordt getekend, kan dit ook als uitbreiding worden gezien. De cliënt stelt een vraag en de reactie van de CP is ja of nee, dan is het geen toevoegen communicatie. Wanneer de CP hier verder op doorgaat, dan is er wel sprake van communicatie toevoegen. Toevoegen van een voorwerp is ook toevoegen van de communicatie, maar dit geldt dan in principe alleen het eerste interval. Pakt de CP het voorwerp er later weer bij, dan scoor je het wel weer opnieuw.
5. Biedt momenten van symbolische communicatie	Symbolisch: *communicatie buiten het hier en nu, over het verleden of de toekomst, of communicatie over abstracte onderwerpen. Hieronder vallen ook emoties en gebaren zoals: 'klaar', 'weg', ' pakken' 'wat', 'ja' 'nee' ín', 'goed', 'open'(de kastwoordjes) en begrippen zoals dagen van de week of kleuren. <u>Eigenlijk alle gebaren die niet tastbaar zijn</u> (of die niet direct te koppelen zijn aan de actie).* Afhankelijk van het niveau van de cliënt kan dit met gebaren, verwijzers of d.m.v. tekenen en foto's. Naamgebaren: symbolisch wanneer de persoon niet aanwezig is. Dit geldt dus niet voor eigen naamgebaren (van cliënt/cp). Het kan wel zo gescoord worden in het interval wanneer er vervolgens symbolische gebaren aan toegevoegd worden.
6. Biedt momenten van perspectief nemen	Delen van informatie over zichzelf: *Bijv. CP zegt wat/hij zij gaat doen, CP deelt mening, gevoel. Nb.: niet bij iets zeggen over 'wij' of 'jij en ik'.* *Het gebruik van 'nee' & 'ja' kan een mening zijn, maar dit hangt wel af van de context. Is het in de context van betekenisonderhandeling of bevestiging, dan is het geen mening. Bijv. 'ja ik heb je gezien', 'nee, het is geen vrijdag'. Is het gekoppeld aan de ik persoon, of wordt duidelijk gezegd dat iets niet mag namens de communicatiepartner, dan kan het wel een mening zijn. Bijv. de cliënt wil iets pakken, en de cp. maakt het nee gebaar (= nee ik vind dat dat niet mag, zo zou je het kunnen interpreteren).* *Goed = een vorm van perspectief geven.* Delen van informatie over een ander: *idem als het delen van informatie over zichzelf. Het gaat hier dan wel over iemand anders, en niet over de cliënt zelf.* Reageren op gevoelens van de cliënt*: reageert op een gevoel die de CP waarneemt/denk waar te nemen bij de cliënt. Voorbeeld: troosten wanneer de cliënt huilt.*

Appendix B: Codebook for Sign Quality of Caregiver & Interaction Success

Category	Content of Code
Speech Anne *Per sentence*	Literal transcript of everything Anne says Transcript of all sounds Anne makes that convey meaning *Not: sounds Anne makes that don't convey meaning* *Not: sounds in the background*
Discrepancies GLOSS-speech *Per sentence*	Literal transcript of everything Anne says that is <u>not</u> supported visually
GLOSS Anne *Per sign*	Literal transcript of everything Anne signs Transcript of everything Anne gesticulates
Semantic errors *Per sign*	Transcript of spoken words by Anne that are supported by an incorrect sign
Phonetic errors *Per sign*	All incorrect parameters of the sign: Handshape (hv) Location (loc) Movement (bew) Orientation (or)
Interaction type Anne *Per utterance*	Categorisation of every utterance by Anne: Declarative Confirmation/acknowledgement Correction/negation Continuation/addition/expansion Interrogative Answer Directive/imperative Execution Explanation of noncompliance *Inattention*
Interaction type Emma *Per utterance*	Categorisation of every utterance by Emma: Declarative Confirmation/acknowledgement Correction/negation Continuation/addition/expansion Interrogative Answer Directive/imperative Execution Explanation of noncompliance *Inattention*
Interaction *Per interaction*	Connection between utterances: **S**uccessful **U**nsuccessful **N**eutral

Appendix C: Technical Description of Search Programming RQ2

This is a full technical description of all the steps in the search programming that were executed to retrieve the data that were necessary for analysis in order to answer the second research question.

ELAN

1. A new Search Domain was defined in ELAN consisting of the coded .eaf file of the first recording of each phase, so videos 1, 4, 7 and 10.
2. Two Queries were constructed in ELAN, one to extract all semantic and phonological errors and one to extract all discrepancies:

Semantic & phonological errors	
^*$ (any annotation)	on the tier Interaction_success
overlapping with ^*$ (any annotation)	on the tier Phonology; Semantics
fully aligns with ^*$ (any annotation)	on the tier Gloss_Anne

Discrepancies	
^*$ (any annotation)	on the tier Interaction_success
overlapping with ^*$ (any annotation)	on the tier Discrepancies_gloss_speech

3. A Multipe Layer Search through all four .eaf files was done for both queries, extracting the TierName and the Annotiation on the selected tiers.

Microsoft Excel

4. The results of both MLS's were imported into the same Excel file and divided by phase over four separate tabs.
5. The data were manually reorganised in order to end up with all data in the following columns with this content: *see next page*

Column name	Content
Interaction #	Number of interaction + letter and colour to show whether the interaction was successful (green S), unsuccessful (orange U) or neutral (white N)
Sth wrong?	Green with an 'x' for errorless interactions; orange with 'sem'/'phono'/'discr' for interactions with an error in it
Words/signs	For discrepancies: the word(s) that were left out visually For semantic errors: the spoken word For phonological errors: the incorrectly articulated sign GLOSS
Sem error	The incorrectly selected sign
Phono error	The incorrect parameter(s)

6. Finally, filters were added (mostly on the S/U/N in the interaction column) and data sorted (mostly alphabetically in the interaction and error type ('Sth wrong?') columns) in order to do be able to map the connectins and do a visual inspection of the data.

Appendix D: Impression of Data Overview for Analysis RQ2

This is an impression of a part of the data without any filters, ordered chronologically:

	A	B	C	D	E
1	**Interaction #**	**Sth wrong?**	**Words/signs**	**Sem error**	**Phono error**
2	42S	x			
3	43S	x			
4	44S	x			
5	45S	Discr	Voorstel (moet *je* even)		
6	46M	Discr	*Het wordt wel een steeds uitgebreider speelgoedje, die eh (?) van jou*		
7	47S	x			
8	48S	x			
9	49S	Semantics	plannen	PROGRAMMA	
10	49S	Semantics	mama	MOEDER	
11	49S	Semantics	huis	TENT	
12	49S	Phonology	ZOEKEN		bew
13	50S	Discr	*jij*		
14	51M	x			
15	52S	x			
16	53S	Discr	*naar*		
17	53S	Semantics	plannen	PROGRAMMA	
18	53S	Semantics	mama	MOEDER	
19	53S	Semantics	hier-komen	MEE	
20	53S	Semantics	huis	TENT	
21	53S	Semantics	speelgoed	SPELEN	
22	53S	Phonology	DAN		hv
23	54M	x			
24	55M	x			

This is an impression of a part of the data when subjected to a filter (only successful interactions) and sorted by type of error:

	A	B	C	D	E
1	**Interaction #**	**Sth wrong?**	**Words/signs**	**Sem error**	**Phono error**
13	3S	Discr	Ontkenning (niet)		
14	8S	Discr	*ja*		
15	9S	Discr	Voorwaarde (als), *gebaren*		
16	13S	Discr	Voorstel (zal ik even)		
17	14S	Discr	Voorstel (zal ik even)		
19	15S	Discr	Voorstel (zal ik even)		
20	18S	Discr	*krijg jij*		
21	28S	Discr	Voorstel (zal even)		
22	35S	Discr	Voorstel (gaan we even, kom je mee)		
23	37aS	Discr	Voorstel (vanavond gaan we)		
24	40S	Discr	*krijg jij*		
25	9S	Phonology	DAN		hv
27	9S	Phonology	GEBAREN^SPEL		loc; bew; or
28	13S	Phonology	TEKENEN		or
36	33S	Phonology	DAN		hv
37	35S	Phonology	PAKKEN++		hv; bew; or
39	35S	Phonology	SAMEN (2-en)		or
42	38S	Phonology	DAN		hv
45	41S	Phonology	ZIEK		bew
47	10S	Semantics	geweest	VERLEDEN	
48	13S	Semantics	liggen	SLAPEN	
49	14S	Semantics	liggen	SLAPEN	
50	15S	Semantics	liggen	SLAPEN	