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Scaffolding the Communication of People With Congenital Deafblindness: An Analysis of Sequential Interaction Patterns

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The High Quality Communication intervention aims to stimulate interpersonal communication between individuals with congenital deafblindness (CDB) and their social partners. Found effective in multiple-case experiments, the intervention is based on Trevarthen's theory of intersubjective development (Bråten & Trevarthen, 2007), which describes children's innate and developing ability to share subjective states in interpersonal communication and social partners' mediating role in this development. One implication of this theory is that social partners can support the emergence of higher-complexity communication behaviors in individuals who are still developing these behaviors. To test this proposition, communication patterns between individuals with CDB and their parents, teachers, and professional caregivers were analyzed. Analysis of two-event sequences of communicative behaviors showed a highly significant correspondence between the behavior of the social partner and the subsequent behavior of the individual with CDB, confirming that social partners can scaffold higher-complexity communication within interpersonal communication.

Keywords: deafblindness, communication, interaction, observation

People with congenital deafblindness (CDB) are born with a combination of visual and auditory disabilities or acquire this combination before language development starts (Ask Larsen & Damen, 2014; Dammeyer, 2010). Unique communication challenges have been reported for people with CDB as well as for their social partners. Researchers (e.g., Bruce, 2005; Hartmann, 2012; Mar & Sall, 1994) have found that without intervention, many individuals with CDB do not develop language and communicate their intentions using nonsymbolic or presymbolic behaviors such as body language, vocalizations, and gestures. Researchers have also reported communication problems in daily communication with others in the forms of communication breakdowns (Heine & Browning, 2002) and mutual misunderstandings (Dalby et al., 2009). Rødbroe and Souriau (1999) observed that many people with CDB seem to lack experience in communicating with other people for the purpose of exchanging thoughts (i.e., declarative communication). Instead, they use communication imperatively, to obtain something

or direct someone. Thus, people with CDB remain excluded from very common and valuable domains of communication.

Several authors have theorized that communication challenges are the result of the communication characteristics of people with CDB and the difficulty that seeing and hearing social partners have in adapting their communication strategies to these characteristics. For example, partners may miss idiosyncratic communicative attempts made by the partner with CDB or may not know how to respond to or initiate bodily-tactile means of interacting (Bjerkan, 1997; Bruce, Mann, Jones, & Gavin, 2007; Vervloed, R. Van Dijk, Knoors, & J. Van Dijk, 2006).

Trevarthen's theory of innate intersubjectivity may provide a theoretical framework for finding ways in which social partners can adapt their strategies to meet the needs of an individual with communicative disabilities. This theory describes how, usually within the first 6 years of life, interpersonal communication develops through meaningful social interaction with sympathetic adults (Bråten & Trevarthen, 2007). The interpersonal communication development seen at the first stage of intersubjectivity is called *first-layer intersubjectivity*. At this layer, a child is able to express *other-awareness*. This ability is supported by the partner's attunement to the child's behaviors and emotions, use of child-directed speech, and engagement in imitation, turn-taking, and body games with the child.

When children are around 9 months old, they begin to develop *second-layer intersubjectivity*, which is characterized by the ability to experience mutual awareness. By involving objects in children's utterances and scaffolding their efforts to map references to the things in the world and use communication for different purposes, partners facilitate mutual awareness.

When children are between 2 and 6 years old, they develop *third-layer intersubjectivity*, which is characterized by the awareness of a verbal and narrative self and other. Partner strategies that facilitate the development of this highest layer of intersubjectivity include telling stories, stimulating imaginative play activities, using symbolic communication, and sharing opinions, ideas, and personal experiences with the child.

A crucial proposition in intersubjectivity theory is that interactions at higher layers of intersubjective development emerge from interactions at lower levels (Trevarthen & Aitken, 2001). Trevarthen's theory follows Vygotsky's theory of the zone of proximate development, which states that individuals can be supported by others to develop skills that are at a level just above their current developmental level (Vygotsky, 1978). This type of support is referred to as *scaffolding* (Stone, 1998).

Trevarthen's theory of innate intersubjectivity was used to develop the High Quality Communication (HQC) intervention, which aims to support social partners in adapting their communication strategies to the abilities and needs of people with CDB. The intervention was also based on the Contact program developed by Janssen, Riksen-Walraven, and J. Van Dijk (2003, 2006). The HQC intervention is set up as a training program for social partners of individuals with CDB, such as parents, teachers, and caregivers. Core ingredients of the training are education and video interaction guidance, which a coach provides to the social partners. Based on Trevarthen's descriptions of parents' strategies that mediate a developing complexity in children's interpersonal communication as they grow older, the training focuses on supporting two types of strategies in social partners: (a) attunement and (b) meaning making.

The HQC intervention has two phases. In the first phase, social partners are supported in their attempts to attune their behaviors and emotions to those of the individual with CDB in order to develop dyadic interactions and shared emotions. For example, social partners discuss with the coach how they can share emotions in a tactile way. In the second intervention phase, coaches support social partners in their attempts to stimulate more complex forms of intersubjective communication such as negotiating and sharing meanings in interpersonal communication. For example, the social partners are encouraged to refer to objects, people, and activities in a way that is perceivable by the individual with CDB.

A single-case experiment by Damen, Janssen, Huisman, Ruijssenaars, and Schuengel (2014) found that the HQC intervention had positive effects on interpersonal communication between three social partners and a 19-year-old man who was partially hearing and blind and had an estimated developmental age between 1.5 and 4.0 years. The intervention increased communicative behaviors at all three layers of intersubjective development. A multiple-case experiment involving a child, an adolescent, and three adults with CDB (Damen, Janssen, Ruijssenaars, & Schuengel, 2015) found similar effects for first- and second-layer communicative behaviors. It also found effects for communication at the third and highest layer of intersubjective development for three participants.

Although there is evidence to support the effectiveness of the HQC intervention, there is none so far for the presumed working principle. To test whether the purported scaffolding of highly complex interpersonal commu-

nication occurs, we conducted a sequential analysis of interaction patterns in nine dyads. Each dyad consisted of one person with CDB and one social partner (i.e., a parent, teacher, or professional caregiver). We formulated the following research questions:

1. Is there a correspondence between the social partner's level of communicative behavior and that which is subsequently displayed by the person with CDB?
2. Would a social partner's display of a specific type of communication predict the display of that type of communication by the participant with CDB?
3. Is the correspondence between the social partner's higher-complexity communicative behaviors and those of the person with CDB associated with the extent to which these behaviors are part of the communication repertoire of the person with CDB?

We expected to find a correspondence between the level and type of communicative behavior displayed by the social partner in interaction and the subsequent communicative behavior of the individual with CDB. However, we suspected that this correspondence would be less evident for communicative behaviors that the individual with CDB already managed before the start of the intervention, since he or she did not need the example of the partner to display these behaviors in interactions.

Method

Participants

The participants in the present study were two children and three adults with CDB. Each participant had one or two social partners. Table 1 presents the participants' characteristics and the types of social partners involved. We use pseudonyms when referring to the participants. The acronym *CDB* (for *congenital deafblindness*) is used in the study to describe vision and hearing impairments present from birth or before the start of language development. Two of the participants were blind and profoundly deaf, two had partial sight and were profoundly deaf, and one was blind and severely deaf.

Two participants (Nathan and Lisa) had a moderate cognitive delay and the other three had a severe or profound cognitive delay. Cognitive delays were determined on the basis of care provider records. This information was generally based on the outcomes of standardized assessment tools for people with intellectual disabilities, such as the Dutch version of the Vineland Adaptive Behavior Scales (De Bildt & Kraijer, 2003), which are not specifically designed for people with dual sensory loss. Care provider records also revealed that four of the participants communicated using signs and one used speech, and that the participants had different purposes for their communication (see Table 1).

Observations of each participant were made in two settings: the place where he or she lived (either the parents' home or a group home) and the school or day care facility. Social partners were parents, professional caregivers, and teachers. They were instructed to act as they normally would. We analyzed two dyads for every participant except Lisa, for whom we only analyzed one dyad. Even though her mother and her teacher were involved in the intervention, Lisa changed schools at the end of the second intervention phase. We therefore only analyzed the dyads that included her mother.

Observations

In total, we made 73 observations with a mean duration of 17.77 minutes (range = 7.42–23.18; *SD* = 3.90). We used a random selection of one observation per dyad in each phase (baseline, intervention 1, intervention 2, follow-up). For information on the content of the two intervention phases and the way the fidelity of the intervention was checked, we refer the reader to previous publications (Damen et al., 2014, 2015). For each observation, the first 10 minutes was used to analyze the two-event sequences of social partner behavior and subsequent behavior of the participant. An example of such a sequence is the social partner signing "GOOD" and the participant subsequently laughing. The 10-minute duration was chosen after we checked to see which duration provided at least 50 two-event sequences for each dyad. The sequential behavior results presented in the present article are based on 2,332 two-event sequences, with a mean of 248.13 sequences for each pair (range = 144–393; *SD* = 84.71).

Coding Scheme

To code intersubjective behaviors in the observations, we followed a multistep procedure that had been tested in a single-case experiment (Damen et al., 2014) and an additional procedure to enable sequential analysis. First, the observation was transcribed. Acts of participants and their social partners on the video were described in conversational turns. Acts could be spoken language, but also gestures and signs, behaviors, facial expressions, or vocalizations. The transcripts were then manually coded on a printed global coding sheet, with the support of additional viewing of the videotapes.

To enable sequential analysis, codes were then entered in an observational analysis package called The Observer (Noldus, 1991). The use of this computer program required us to make the coding system mutually exclusive and exhaustive (Bakeman & Gottman,

Table 1
Characteristics of the Study Participants ($N = 5$)

Pseudo-nym	Gender	Age group	Etiology	Visual status	Hearing loss	Cognitive delay	Main communication systems	Communicative purposes	Type(s) of social partner(s)
1 Mark	Male	Adult	Unknown	Blind	Profound	Profound	Body language, tangible objects	Social contact, accepting or refusing, asking for something or someone	1 parent (father), 1 professional caregiver
2 Nathan	Male	Child	CHARGE syndrome	Partially sighted	Profound	Moderate	Sign language, pictograms	Social contact, accepting or refusing, asking for something or someone, asking and giving information, sharing experiences	1 parent (mother), 1 teacher
3 Lisa	Female	Child	CHARGE syndrome	Partially sighted	Profound	Moderate	Sign language, pictograms, drawings	Social contact, accepting or refusing, asking for something or someone, asking and giving information	1 parent (mother)
4 Jane	Female	Adult	Congenital rubella syndrome	Blind	Profound	Profound	Body language, single signs	Accepting or refusing	2 professional caregivers
5 Don	Male	Adult	Premature birth	Blind	Severe	Severe	Speech, single signs	Social contact, accepting or refusing, asking for something or someone, asking for information	2 professional caregivers

1997) and to distinguish between participant and partner behavior.

In the coding scheme we used in The Observer, we always separately coded the highest level of complexity for the behavior of the participant and the social partner. The amount of complexity was determined by the layer of intersubjective development with which the behavior was associated and by the hierarchy within layers (see Table 2). Thus, for each communicative act, we decided whether it was "nonreferential," "referential," "meaning negotiation," or "declarative communication." For example, when Lisa signed "DADDY CAMERA," she was using referential communication. However, we coded this behavior as declarative communication because she had referred to an event in the past, thus sharing an experience rather than asking for something or someone. (Her father had filmed her earlier that week.) When her partner signed "WHAT" in response, she used referential communication as well, but she also negotiated about the meaning of Lisa's preceding act. Because meaning negotiation is considered to be more complex than referential communication, we coded this as meaning negotiation.

In the digital coding scheme, all the categories were coded for both the participants and the social partners. There was one exception: the category "shared meaning." This category was operationalized as a specific participant behavior (showing that he or she felt that the communication partner had understood the meaning or purpose of the preceding communicative acts), and therefore was only coded for the participants.

Reliability

One observer coded all the transcribed observations during an additional viewing of the videotapes, after receiving a rating of interrater reliability with a second observer (the first author) of at least 80% for each category during a training period. Both observers were educational psychologists working at the Bartiméus Expertise Centre for Deafblindness (located in Doorn, Netherlands). The second coder also independently double-coded 20% of the material as a reliability check. The kappa values showed substantial or almost perfect interrater reliability (Landis & Koch, 1977), with a range between 0.94 and 1 for all observations in the following categories: noncommunicative acts, nonreferential communication, and referential communication. The other kappa values were as follows: k values of meaning negotiation varied between 0.92 and 1, of shared meaning between 0.94 and 1, and k values of declarative communication varied between 0.71 and 1.

Data Analysis

Research questions 1 and 2, concerning the correspondence between the type and the level of intersubjective

Table 2
Categories of the Coding Scheme

Observational category (by ascending complexity)	*Operational definitions and case examples*	*Layer of intersubjective behavior*
Noncommunicative act	This was the initial situation at the beginning of the observation for both partners, but it was also coded when acts during the interaction were not perceivable by or directed to the partner. An example comes from an observation of Lisa's social partner, who verbally commented on the fact that Lisa solved a puzzle, saying "Yes, very well." This was coded as a noncommunicative act since Lisa could not hear.	No specific layer
Nonreferential communication	An act or combination of acts during the interaction that do not refer to an object, person, or event. The acts are directed to the partner and performed in a way that is perceivable by the partner. An example is Mark touching his social partner's hand.	First layer
Referential communication	An act or combination of acts during the interaction that refer to an object, person, or event. The acts are directed to and performed in a way that is perceivable by the partner. An example of referential communication comes from an observation of Lisa walking to a planning board with her partner and then pointing at a pictogram showing the next activity in the daily program.	Second layer
Meaning negotiation	Efforts of the social partner to get more information about the participant's meaning or the purpose of the preceding act or combination of acts during the interaction, and the participant's efforts to give this information. An example comes from Nathan's teachers, who asked him, "YOU SIGNING WHAT?" Nathan then repeated what he had signed earlier: "I BOY, YOU GIRL." In this case, meaning negotiation was coded for both partners.	Second layer
Shared meaning	A communicative act in which the participant shows that the social partner has understood the meaning or purpose of his or her preceding act(s). An example comes from Don, who shook his hands enthusiastically after his social partner explained in a loud voice that she understood that he wanted to get a coffee.	Second layer
Declarative communication	An act or combination of acts during the interaction with one of the following topics: emotion, opinion, features, the past, the future, or mental processes. An example comes from Lisa, who signed to her social partner that her father had been filming: "DADDY, CAMERA."	Third layer

behavior of the participant and the social partner, were tested by digital coding. The digital coding scheme enabled the collection of a sequential record of each participant's actions with one social partner. Lag sequential analysis (Bakeman & Gottman, 1997) was used to assess the number of times behaviors of interest followed selected behaviors. Behaviors lagged against are referred to as *criterion categories*. Behaviors searched for at lagged steps from the criterion behavior are referred to as *matching categories* (Bakeman & Gottman, 1997). The present study examined matching categories at lag 1 (i.e., the behavior that immediately followed the criterion categories). Except for shared meaning, each variable listed in the digital coding scheme (see Table 2) was used as a criterion when performed by the social partners and as a matching category when performed by the participants. Shared meaning is a category that was only scored for the participants and was therefore only used as a matching criterion.

To analyze the overall correspondence between the level of the social partners' intersubjective behaviors and the subsequent display of participants' intersubjective behaviors across participants and social partners (research question 1), we analyzed the correspondence between the intersubjective behaviors in a cross-table. We used a Pearson chi-square test to determine whether there was a significant correspondence between the levels of behaviors of the participants and their

social partners in all the measured two-event sequences.

To analyze the probability that the social partners' single intersubjective behaviors were followed by the same type of intersubjective behaviors by the participants (research question 2), we calculated the frequency of occurrence and the transitional probability for all possible transitions between the criterion and matching categories for each dyad and study phase. A transitional probability is the probability that a particular matching event occurred relative to a criterion event. For example, if the participant used referential communication 5 times after the social partner used referential communication 10 times, then the probability of the participant's use of referential communication given the social partner's referential communication would be 0.5. When we tabulated these findings, we decided to depict only transitional probabilities of 0.3 or greater to reduce the number of transitions displayed in the table (Bakeman & Gottman, 1997). Subsequently, we used the Wilcoxon signed-rank test for two dependent samples to test the significance of the difference in the occurrence of participants' behavior that was preceded by the same behavior by the social partners in comparison to that behavior preceded by other types of behavior by the social partners.

To answer research question 3, concerning the association between the level at which specific second- and third-layer intersubjective behaviors were part of the repertoire of the participant before the start of the intervention and the correspondence between behaviors in the two-event sequences, we calculated the mean rate of intersubjective behavior in the baseline observations. The behavior rates of referential communication and declarative communication were calculated as the proportion of instances of each of these types of behavior relative to the total number of communicative acts displayed by the participant with CDB.

We calculated the behavior rate for the meaning negotiation category differently. First, we determined the duration of each meaning negotiation, using a scale of 1–5. This scale gave the observers guidelines for how to code the duration in a way that acknowledged the back-and-forth contributions of both partners. Subsequently, the observers calculated the mean duration of all the meaning negotiations and multiplied that number by the total occurrences of meaning negotiation in an observation. Finally, they applied a time correction. Based on the mean behavior rate of single intersubjective behaviors in the baseline phases, we determined which participants had already managed specific communicative behaviors. A mean of at least 10 occurrences in the baseline observations was used as the criterion for this determination. We then ran the Wilcoxon signed-rank test for two dependent samples again to compare similar versus other behavior combinations in all the observed two-event sequences, but this time the participants who had already managed these behaviors were left out of the comparisons. The result was then compared with the result for all participants to evaluate the effect of leaving out the participants who had managed the behaviors. This enabled us to evaluate the importance of examples of particular behaviors provided by the social partner for participants who did not show this behavior or only showed this behavior to a limited extent.

Results

Correspondence Between Levels of Communicative Behavior (Question 1)

The overall correspondence between the level of intersubjective behavior in the two-event sequences in the observed dyads was strong: chi-square = 550.03, $df = 9$, exact sig. (2-sided) = .00. This means that, generally, the communication used by the individual with CDB that immediately followed the communication of the social partner corresponded to the level of complexity of the communication by the partner.

Prediction of a Specific Type of Intersubjective Behavior on the Basis of the Social Partner's Type of Behavior (Question 2)

Results regarding the correspondence between types of intersubjective behaviors in the observed two-event sequences showed that the type of communication of the individual with CDB could be predicted from the preceding type of communication by the social partner. This predictability was evident from the transitional probabilities of the intersubjective communication behaviors. Table 3 provides an overview of the number of dyads for whom a transitional probability of 0.3 or greater was found. All the dyads showed a heightened probability that nonreferential communication by the social partner was followed by nonreferential communication by the participant in every phase except the second intervention phase. Heightened probabilities for combinations of the same intersubjective communication behaviors were also commonly found for referential communication by the social partner with subsequent referential communication by the participant and for meaning negotiation with subsequent meaning negotiation.

It was striking that highly probable behaviors of the participant at the second and third layers were generally preceded by exactly the same behaviors by the social partner. However, high transitional probabilities were

Table 3
Overview of the Number of Dyads for Which a Transitional Probability of 0.3 or Larger Was Found (for Each Behavior Combination and Phase)

	Behavior of participant with congenital deafblindness (CDB), lag 1																							
Social partner behavior,	*Non-communicative act (NC)*				*Nonreferential communication (NR)*				*Referential communication (RC)*				*Meaning negotiation (MN)*				*Shared meaning (SM)*				*Declarative communication (DC)*			
lag 0	*bas*	*int1*	*int2*	*Fu*	*bas*	*int1*	*int2*	*fu*	*bas*	*int1*	*int2*	*fu*	*bas*	*int1*	*int2*	*fu*	*bas*	*int1*	*int2*	*fu*	*bas*	*int1*	*int2*	*fu*
NC	**3**	1	**3**	1	3	3	4	8	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
NR	–	–	–	–	**9**	9	**8**	9	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
RC	–	–	–	–	4	5	6	8	**3**	4	**5**	4	–	–	–	–	1	1	–	–	1	–	–	–
MN	–	–	–	–	1	–	–	–	–	–	1	–	**4**	5	**0**	4	–	–	–	–	–	–	–	–
DC	1	–	–	–	5	4	5	5	1	3	–	–	–	–	–	–	–	–	–	–	**2**	–	**2**	2

Notes. bas = baseline; int1 = intervention phase 1; int2 = intervention phase 2; fu = follow-up. Similar behaviors of the social partner and the participant with CDB are bolded.

also found for combinations of behaviors by the social partner and participant that were not similar. In two of these combinations, the social partner's behavior was at a higher level of intersubjective development than the behavior of the participant. This was the case for referential communication of the social partner with subsequent nonreferential communication by the participant and for declarative communication of the social partner with subsequent nonreferential communication by the participant.

In one behavior combination with a frequently measured high transitional probability, the participant communicated at a higher level than the social partner. This was the case for noncommunicative acts of the social partner with subsequent nonreferential communication. For this combination, a transitional probability of 0.3 or higher was found in three to eight dyads, depending on the phase of the study. The category *shared meaning* appeared only once in the baseline and once in the first intervention phase; it was associated with a heightened transitional probability. In both cases, the participant displayed this behavior after the social partner displayed referential communication.

Some additional information was revealed by comparing two-event sequences in which intersubjective behavior was preceded by the same intersubjective behavior of the social partner with sequences in which the social partner showed other types of behavior (see Table 4). As expected, for both nonreferential communication and meaning negotiation, the occurrence of sequences with similar behavior of the social partner was greater than the occurrence of sequences with other behavior, and this difference was significant. However, this was not the case for noncommunicative acts, or for referential and declarative communication.

Effects of the Extent to Which Behaviors Were Part of the Repertoire of the Individual With CDB (Question 3)

For the analysis of the effects of the extent to which second-and third-layer communicative behaviors were already present in the participants' repertoires on the correspondence between the behavior of the participants and that of the social partners, the dyads of Nathan and Don appeared to be especially relevant. The analysis of the amount of second- and third-layer intersubjective behavior displayed by the participants in the baseline phase (see Table 5) revealed that for Nathan and Don referential communication was already present in a relatively larger amount, and at a level that we had determined beforehand to be substantial ($M = 10$). Nathan used a substantial amount of declarative communication as well. These findings appear to have affected the results of the comparisons of two-event sequences with similar versus different behaviors of these participants and their social partners. We found different results when we removed Nathan and Don from the comparison of two-event sequences with participants' display of referential communication and when we removed Nathan from the analysis of two-event sequences in which the participant used declarative communication. Although we found no significant difference between similar or different referential and declarative communication of participants subsequent to that behavior of the social partner when all the participants were included, this difference appeared significant when we removed the participants who had already managed referential and declarative communication (see Table 4).

Table 4
Comparison of Two-Event Sequences in Which the Participant's Intersubjective Behaviors Were Preceded by Similar or Other Behavior by the Partner

Types of two-event sequences compared	*Total occurrences*	*M (SD)*	*Z score and p value (exact sig., 2-sided)*
NC-NC versus #NC-NC: Noncommunicative act of the participant preceded by a noncommunicative act of the social partner / Noncommunicative act of the participant preceded by other behavior of the social partner	25 / 16	0.69 (1.09) / 0.44 (0.69)	$Z = -1.093$; $p = .286$
NR-NR versus #NR-NR: Nonreferential communication of the participant preceded by nonreferential communication of the social partner / Nonreferential communication of the participant preceded by other behavior of the social partner	1,118 / 500	31.06 (13.00) / 13.89 (11.58)	$Z = -4.177$; $p = .000$
RC-RC versus #RC-RC: Referential communication of the participant preceded by referential communication of the social partner / Referential communication of the participant preceded by other behavior of the social partner	103 / 182 *Except Nathan and Don: 92 / 1*	2.86 (3.80) /5.06 (6.06) *Except Nathan and Don: 1.45 (0.21) / .05 (.22)*	$Z = -2.532$; $p = .01$ *Except Nathan and Don:* ***Z = –2.546; p = .008***
MN-MN versus #MN-MN: Meaning negotiation of the participant preceded by meaning negotiation of the social partner / Meaning negotiation of the participant preceded by other behavior of the social partner	45 / 22	1.25 (1.95) / 0.61 (1.18)	$Z = -2.576$; ***p = .009***
DC-DC versus #DC-DC: Declarative communication of the participant preceded by declarative communication of the social partner / Declarative communication of the participant preceded by other behavior of the social partner	43 / 68 *Except Nathan: 17 / 1*	1.19 (2.08) / 1.89 (4.12) *Except Nathan: 0.61 (1.13) /0 .04 (.19)*	$Z = -.600$; $p = .549$ *Except Nathan:* ***Z = –2.414; p = .016***

Note. Z scores were obtained with the Wilcoxon signed-rank test. Significant differences that were according to expectations are bolded.

Conclusion

The present study found that social partners' display of communication at a specific layer of intersubjective development corresponded with communication at this layer displayed by the participants toward their social partners. Almost all the higher-layer intersubjective behaviors displayed by the participants were preceded by the same type of behavior by their partners. Furthermore, the display of a specific type of behavior by participants at the three layers of intersubjective behavior was significantly more often preceded by the same behavior by their social partners. Exceptions to this finding were dyads with participants who already showed higher levels of referential and declarative communication in the baseline period. This finding was in line with our expectation and supports the pragmatic implication of Trevarthen's theory of intersubjective development: Social partners can support the emergence of highly complex communication behaviors of individuals who are still developing these behaviors.

Limitations of the Study

The present study had several limitations. First, due to the limited number of data points in each phase, we did not analyze changes in the frequencies of the two-event sequences, nor in the size of the transitional probabilities. Visual inspection of the transitional probabilities of 0.3 and larger (see Table 3) gave the impression that the probability that a specific behavior by the participant would be followed by a specific behavior by the social partner was not affected by the different study phases.

Another limitation is that we looked at one specific pattern for the sequential analysis, namely, one behavior by the social partner followed by one behavior by the participant. We were specifically interested in analyzing this

Table 5
Rates of Second- and Third-Layer Intersubjective Behaviors Before the Start of the Intervention

Behavior	*Participant*	*T1*	*T2*	*T3*	*T4*	*M (SD)*
Referential communication	Mark	0	0	1.53	0	0.38 (0.77)
	Nathan	33.00	35.00	29.00	43.42	**35.11** (6.03)
	Lisa	5.00	7.00	—	—	6 (1.41)
	Jane	0	1.00	0	16.00	4.25 (7.85)
	Don	34.48	14.29	16.67	36.11	**25.39** (11.5)
Meaning negotiation	Mark	13.90	0	12.07	0	6.49 (7.53)
	Nathan	0	1.77	1.88	9.00	3.16 (3.99)
	Lisa	3.55	2.01	—	—	2.78 (1.09)
	Jane	0	0	0	0	0 (0)
	Don	0	0	0	3.29	0.82 (1.65)
Declarative communication	Mark	0	0	0	0	0 (0)
	Nathan	4.00	9.00	10.00	22.41	**11.35** (7.82)
	Lisa	3.29	0	—	—	1.65 (2.33)
	Jane	0	0	0	0	0 (0)
	Don	3.81	1.17	5.05	6.58	4.15 (2.29)

Note. Mean relative occurrences of = 10 are bolded; this was formulated as an indication that the participant had sufficiently managed the behavior. The double dash (—) indicates that no measurement was carried out.

pattern to see whether and how specific participant behaviors could be elicited by the social partner. Other two-event patterns, such as multiple behaviors by the participant or longer patterns, were not analyzed.

A third limitation is that the same observer coded the behaviors of both the participants and the social partners. Using different observers for single communication partners would be one way to control for observer bias. Our observer did, however, code the behaviors of each social partner in separate observations.

Discussion

The observed sequential relationship between intersubjective behaviors in dyads involving participants with CDB is a powerful argument in favor of social partners focusing on scaffolding higher layers of intersubjective development for people who are congenitally deafblind. The strong sequential association can also be understood as a confirmation of the main assumption behind the HQC intervention. Our study suggests that social partners of people with CDB can scaffold communication behaviors of greater complexity on the part of people with CDB.

The rates of intersubjective behaviors before the start of the intervention and the number of two-event sequences in single dyads showed substantial variations. There were also variations among behavior rates of the same individual that may have been influenced by partner characteristics. In the cases of two individuals with CDB, a parent as well as a professional (teacher or caregiver) participated in the study. Comparison of second- and third-layer intersubjective behavior of the parent and professional by means of the Wilcoxon signed-ranks test produced a significant difference for one dyad ($Z = 2.054$; exact sig., 2-sided, = 0.042), revealing that the caregiver used more of these behaviors. More case studies are needed to see how characteristics of the participant and the social partner influence their interpersonal communication.

We have several recommendations for future studies. First, changes in communication patterns over time could be analyzed to test whether intervening on the level of the social partner's communicative behaviors affects the correspondence between that partner's communicative behaviors and those of the individual with CDB. Second, a future study could involve more social partners to test whether the effect of scaffolding is stronger if scaffolding is performed by more than one or two social partners.

The different communication patterns of the two participants who showed higher levels of referential and declarative communication before the intervention started (i.e., Nathan and Don) suggest that they needed less partner support to show their communicative potential than the other participants. Measuring the amount of communication at the three levels of intersubjective development before starting communication treatment and during treatment may help determine how much intervention is needed and what kind of focus is actually necessary.

Sequential analysis is a different way of analyzing interpersonal communication in the context of an intervention

than event coding. In earlier studies, event coding revealed that the HQC intervention is effective in enhancing the quality of communication between individuals with CDB and their social partners. The analysis of the sequential patterns appeared to be a way of explaining these effects, by revealing microprocesses within interpersonal communication. We therefore strongly recommend that sequential analysis be used by other researchers interested in communication patterns.

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