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Developing reciprocity between one-year-old children with visual impairment and additional disabilities and their mothers: The effects of bodily-tactile early intervention

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ABSTRACT

Reciprocal interactions between parents and their children with visual impairment (VI) and additional disabilities (AD) may be compromised due to the children's disabilities. Children with VIAD may not be able to access their parents' nonverbal expressions, such as gazes or facial gestures. Moreover, the children's expressions can be difficult for their parents to read. The bodily-tactile modality can be used in interactions to compensate for a child's lack of vision. This multiple-case study investigated the effects of a bodily-tactile early intervention on interactional reciprocity in three sighted mothers and their one-year-old children with VIAD. The data consisted of eight hours of video recordings from four baseline, eight intervention, and three follow-up sessions. Baseline and intervention recordings were made weekly. The follow-up recordings were made one week, five weeks, and nine weeks after the last intervention session. The video data were analyzed using the principles of multimodal conversation analysis. The sequential analysis showed that interactive reciprocity between the mothers and their children increased during the intervention. The mothers began to use more of the bodily-tactile modality in early social play routines. Moreover, they started to treat their children's movements as meaningful turns in interaction and to give more time and space for their children to take their turns. The results suggest that the bodily actions of children with VIAD can become resources for their participation through their mothers' actions.

1. Introduction

Early interaction is the basis of healthy socio-emotional development. It is characterized by reciprocity, which is tied to dialogical turn-taking activity (Papoušek, 1995) and mutual emotional responsiveness (Biringen et al., 2014). When a child has a visual

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impairment (VI) and additional disabilities (AD), such as developmental delay, cerebral palsy, or hearing impairment, reciprocal interactions with his or her parents are challenged from the start (Grumi et al., 2021; Rowland, 1984). These challenges in reciprocity are related to difficulties in accessibility. That is, children with VIAD may not be able to access their parents' facial or gestural responses or other actions. Likewise, the bodily expressions of children with VIAD can be difficult for their parents to perceive (Nafstad & Rødbroe, 2015). These mutual obstacles in accessing information related to bodily and gestural actions may hamper the development of reciprocal interactions, which can lead to passivity and underachievement in children with VIAD. However, the bodily-tactile modality could compensate for the lack of the child's vision in parents' interactions with their children with VIAD. For this potential benefit to be realized, however, early intervention is key.

In the International Classification of Functioning, Disability and Health (ICF) model, environmental factors are understood as potential resources to promote children's participation in interactions, which makes family-centered involvement essential in early intervention (World Health Organization [WHO], 2013). However, only a few studies have investigated the effects of family-centered early interventions for children with VIAD aged 0–2 and their parents. In these studies, early play routines (Rogow, 1982), daily routines (Chen et al., 2007), and music therapy (Metell, 2015) have been used as contexts for fostering interaction and communication of children with VIAD. In addition, an interactive technology-based playmat, the Barti-mat, has been utilized to promote sensitive and responsive parental behaviors, such as mirroring, thus helping parents connect with their children with VIAD (Dyzel et al., 2023). Similarly, Video-feedback Intervention to promote Positive Parenting for parents of children with Visual or visual-and-intellectual disabilities (VIPP-V) has been used to foster parents' sensitivity in interactions with their children with VIAD by videotaping parent-child dyads, providing feedback on the videos to the parents, and sharing information on sensitive responsiveness and visual-and-intellectual disabilities (Platje et al., 2018).

It is crucial to better understand the processes that foster the participation of children with typical development in their early interactions to encourage similar processes in children with disabilities (Van keer et al., 2017; see also Fantasia & Delafield-Butt, 2023). Typically developing infants are active participants in interactions with their parents from the start and express themselves through preverbal expressions, such as movements, gazes, facial expressions, gestures, and vocalizations (Nomikou et al., 2017). Parents engage their infants in turn-taking exchanges through child-directed speech that involves frequent questions (Sierra, 2017; Snow, 1977). In her seminal study, Snow (1977) found that mothers posed questions to their 3-month-old infants, who could not yet make verbal responses. Thus, it appeared that the mothers' frequent questions were a method of stimulating early conversations with their infants, as the questions created expectations and a reciprocal frame for the infants' responses. Furthermore, the mothers integrated their children's preverbal expressions into conversations by responding to them as intentional actions (Rączaszek-Leonardi et al., 2013; Sierra, 2017; Snow, 1977).

Children make use of formal sequential structures of activities as resources for their actions (Lerner et al., 2011). For instance, early play routines (Nomikou et al., 2017; Ratner & Bruner, 1978) and daily routines (Lerner et al., 2011) involve repetitive, narrative-like sequential structures of action (Delafield-Butt & Trevarthen, 2015), which children can learn to use as resources for their participation (Fantasia & Delafield-Butt, 2023). Lerner et al. (2011) found that the child in their case study recognized and projected the sequential actions of serving breakfast and used the transition space for taking her turns. Similarly, children begin to predict successive actions in early play routines and gradually perform them (e.g., Nomikou et al., 2017). First, they participate in play through movements and body patterns (Fantasia et al., 2014), and later through vocalizations, gestures, and words (Ratner & Bruner, 1978). These changes are facilitated by their parents' interactive behaviors as they structure play routines optimally for their children's participation and treat their children's actions as intentional (Ninio & Bruner, 1978). Thus, through active participation in play routines, children gradually gain more complex communication skills (Fantasia & Delafield-Butt, 2023; Rączaszek-Leonardi et al., 2013).

There is a lack of research reporting how children with VIAD develop participation in early interactions, and the existing knowledge is mostly based on findings on children with VI. Infants with VI have been found to be less responsive vocally to their mothers than sighted infants (Rogers & Puchalski, 1984), but they do use bodily expressions to participate in early interactions. Preisler (1991) found that 3–6-month-old infants with VI anticipated the subsequent parts of early play routines by opening their mouths or moving their arms. At nine months, some infants initiated body games by making movements or partial movements related to the games. At age 10–11 months, some infants with VI used body and hand movements to construct symbolic representations of actions (e.g., hand movements representing splashing when the mother talked about splashing hands in the water). Thus, Preisler's (1991) results suggest that infants with VI may develop their expressions from movements into gestures. These children with VI have approximately a half-year delay in their productive vocabulary acquisition compared to sighted children (Campbell et al., 2024). However, children with VIAD may have difficulties developing speech and may rely on nonverbal communication for years or all their lives (e.g., Argyropoulos et al., 2020; Ayyıldız et al., 2016). They could have resources to participate and develop their expressive communication skills through movements and gestures in early interactions with their parents (e.g., Rogow, 1982), but this has not been studied sufficiently.

For mothers with VI, touch is a natural modality resource that compensates for their lack of vision in interactions with their infants (Chiesa et al., 2015). The same resource can also be used by sighted parents in interactions with their children with VIAD. The compensatory use of touch is different from affectionate touch and aims to make different components of social interaction observable for a child with VIAD through the bodily-tactile modality (e.g., Nicholas, 2010). For instance, the bodily-tactile modality can be used by parents to share information about their vision-based interactive behaviors, such as *anticipation* (e.g., Nomikou et al., 2017). When parents inform their children about upcoming actions verbally and in the bodily-tactile modality (e.g., touching a child's legs gently before moving them), it can establish a shared orientation and help the children prepare for their parents' actions. Parents can also use the bodily-tactile modality to *notice* their children's expressions (e.g., by touching the part of the body that the child moved). In this way, the child can perceive the touch as co-referential in relation to his or her movement (Nafstad & Rødbroe, 2015). Moreover, when early play routines have a bodily-tactile frame (touch and movements), they are more accessible to children with VIAD. This helps

them learn play sequences and participate in play routines through touch, movements, and gestures (e.g., Ask Larsen, 2003). Finally, developing the children's participation in the bodily-tactile modality is a prerequisite for developing shareable cultural forms of symbolic communication, such as tactile signs, which are tactile adaptations of manual signs (e.g., Nafstad & Rødbroe, 2015).

Multimodality and contextual resources are not enough on their own to increase the participation of children with VIAD in interaction if the structures of early play routines are not optimally adjusted to encourage their participation. For instance, children with VIAD may need more time than typically developing children to take turns in interactions (Johnson & Parker, 2013). Moreover, because parents typically observe their infants' gaze-based social-communicative behaviors (e.g., Rączaszek-Leonardi et al., 2013), professionals can guide parents to detect their children's bodily expressions and interpret them (Nafstad & Rødbroe, 2015). In this way, children's bodily actions become accessible to their parents.

Recent research has indicated the need for evidence-based practices for early interventions focusing on reciprocal interactions between children with VI or VIAD and their parents (e.g., Grumi et al., 2021) and early interventionist training (Ely et al., 2020). This study fills the gap in previous research by investigating the effects of bodily-tactile early intervention on reciprocity between children with VIAD and their mothers. We examined longitudinally whether there were observable changes in reciprocity between children with VIAD and their mothers from baseline to intervention to follow-up sessions and, if so, how the mothers' actions related to their children's participation. Moreover, we investigated how the children used their bodily actions for turn-taking before, during, and after the intervention. We hypothesized that the intervention would increase reciprocity in the mother-child interactions through the changes in the mothers' actions. We also hypothesized that the intervention would increase the children's possibilities to take turns in interactions through bodily actions.

2. Method

2.1. Participants

The participating children were reached through university hospitals in Southern Finland. The inclusion criteria were as follows: (a) aged 0–24 months, (b) severe VI, (c) preverbal stage of language development (max. 10 words or signs in use), and (d) Finnish as the language spoken at home. The study was approved by the ethics committee of the Helsinki and Uusimaa Hospital District, and research permits were granted from the university hospitals in Southern Finland. Staff members at the university hospitals provided an information letter about the study to the candidate families. The information letter stated that the general practice of guidance for parents of children with VIAD can include learning communication strategies that their children can understand. Moreover, the information letter explained to the parents that their interactions with their children with VIAD would be videorecorded, and these recordings would be used during the intervention at home (or in another environment, if they preferred). The parents were also informed about the number and duration of the visits. After reading the letter, the mothers contacted the first author, and the parents gave their written consent for their children's participation.

The child participants are referred to by the pseudonyms Thea, Sara, and Alex. Information related to the children was gathered from medical records and parental interviews. All the children had VI due to disorders of the visual cortex, normal hearing, cerebral palsy (a movement disorder), developmental delay, and epilepsy. They had difficulties making voluntary movements, and they needed to be supported when seated.

2.1.1. Thea

Thea (1.0 years old) could make eye contact for only a moment. She enjoyed bodily contact and early play routines with strong tactile sensory stimulation. Thea used facial expressions, vocalizations, and crying to express herself. She did not imitate her parents. Thea's mother used some haptices (touch messages; Lahtinen, 2008) in interaction with Thea. Thea detected objects with a strong contrast in color and movement. She was medically vulnerable and lived at home with nursing assistance. Thea's mother wished she could receive guidance for elaborating on the haptices and developing reciprocal interactions with Thea.

2.1.2. Sara

Sara (1.9 years old) was able to make eye contact for short periods. She enjoyed bodily contact and interaction and expressed herself through facial expressions, vocalizations, crying, and bodily expressions. If her parents imitated her vocalization, Sara could sometimes respond imitatively. Sara's mother used toys and physiotherapy exercises to play with her child. Sara could see toys with bright colors or clear figures and detected them best from a distance of 20–30 cm. Sara's mother wished her daughter could develop her expressive communication and that they could have more reciprocal interactions.

2.1.3. Alex

Alex (1.7 years old) liked to be touched and close to others. He expressed himself by smiling, crying, laughing, and moving his body. Alex did not imitate his parents' expressions. Alex's mother used stretching, chatting, and toys to play with Alex. It was unclear how Alex could use his vision. However, his vision had improved, and he was able to perceive some objects. His mother wished Alex could express himself more fully and engage in play experiences.

2.2. Design and procedure

This paper replicates a pilot study (Peltokorpi et al., 2023), with modifications. The number of baseline recordings was increased

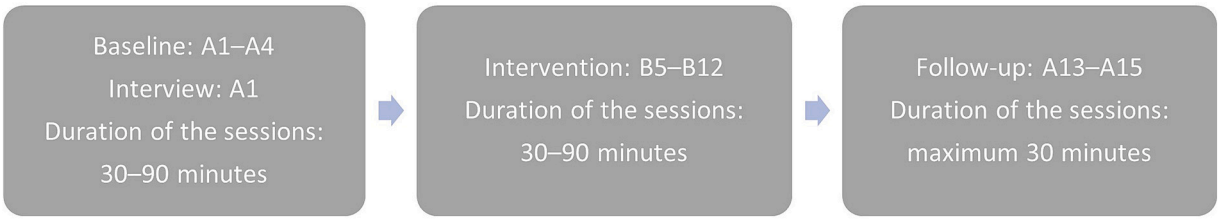

Fig. 1. Progress of the data collection.

from three to four to extend the baseline period. During the first meeting, the parents were interviewed. Due to the decisions of the families, only the mothers participated in the study. Free play between the mothers and their children was recorded with two video cameras during four baseline, eight intervention, and three follow-up sessions at home. During the free play, the mothers were asked to play with their children as they liked. Baseline and intervention recordings were made weekly, with some exceptions due to the children's health or family reasons. The follow-up recordings were made one week, five weeks, and nine weeks after the last intervention session. Only Alex's last follow-up recording was delayed due to the coronavirus pandemic. Two video recordings were made in each intervention session. The first recording included play between the therapist, the mother, and her child, and the second video recorded free play between the mother and her child. Fig. 1 presents the process of data collection. "A" refers to sessions without intervention and "B" to intervention sessions.

The bodily-tactile early intervention used in this study was theoretically based on the *transactional model of development* (Sameroff & Chandler, 1975). In this model, a child's developmental outcome is considered a result of the interactions between the child and his or her social environment over time. Thus, the intervention focused on the mothers and aimed to increase reciprocity in the mother-child interactions by targeting the aspect of accessibility. We aimed to enhance the accessibility of interactions by guiding the mothers to systematically use the bodily-tactile modality in early social play routines and communication. Moreover, the mothers were guided to observe their children's bodily actions and respond to them through touch and movement. The children's bodily actions were operationalized as movements and gestures. The mothers' bodily-tactile actions were operationalized as touches, movements, gestures, and signs, which were made in such a way that their children with VIAD could perceive them through the sense of touch. Reciprocity was operationalized as turn-taking, in which the turns could consist of vocal or bodily-tactile actions.

The intervention was based on different intervention models (e.g., Nafstad & Rødbroe, 2015; Salo et al., 2019) and tactile strategies (e.g., Chen & Downing, 2006; McLinden & McCall, 2002) and was individualized for each family. It was designed and implemented by the first author.

The intervention sessions consisted of three parts.

Discussion and video feedback. Discussion and video examples were used to inform the mothers of how the bodily-tactile modality can be used in play routines and communicative functions. The mothers were also shown video examples of reciprocal interactions with their own children.

Triadic play session. The therapist informed the mothers that their children could use tactile contact instead of eye contact (Peltokorpi et al., 2023). The therapist also modeled early social play routines and different communicative functions of touch for the mothers, who were instructed to repeat them with their children. The sessions had five main themes: 1) The mothers were guided to create slots for turn-taking and to observe their children's expressions. 2) When the mothers detected movements of their children, they were instructed to notice the movements in the bodily-tactile modality (e.g., touching the child's hand after his or her hand movement). This noticing was aimed at informing the children of their mothers' attention toward their bodily actions and fostering the children's agency (Nafstad & Rødbroe, 2015). 3) Activities were anticipated in the bodily-tactile modality (e.g., touching the child's hands gently before guiding them). This was aimed at helping the children prepare for the mothers' actions and learn to predict them (Nomikou et al., 2017). 4) The mothers were shown how the bodily-tactile modality can be used for imitation (Peltokorpi et al., 2020). 5) The mothers were informed about tactile signs, and practiced some of these in the play routines. The bodily-tactile play routines and themes were rehearsed several times during the sessions. Moreover, some other functions of touch, such as hand-under-hand guidance (Chen & Downing, 2006), were addressed in the discussions with the mothers, but these functions were not actively practiced during the sessions.

Free play session. Free play between the mothers and their children was recorded in each intervention session.

2.3. Data and analysis

The analysis was based on longitudinal conversation analysis (CA), which examines how people's practices for action change over time (Deppermann & Pekarek Doehler, 2021). The principles of multimodal CA were used in the video analysis. Multimodal CA was chosen to analyze the data due to its potential to reveal the competencies of persons with disabilities (Antaki, 2011). That is, multimodal CA includes microanalyses of interactions that can be used to discover how people with disabilities engage in conversations and to understand the features of their expressions. This analytical process can utilize knowledge and concepts related to typical conversations (Antaki, 2011). Moreover, multimodal CA was considered a valid method because it has been found applicable for exploring tactile interactions (e.g., Iwasaki et al., 2019). Early play routines were chosen as the context for the analysis because they

Table 1
The analyzed play routines of mothers and children.

	Baseline	Intervention	Follow-up	Duration of play routines
Thea	**The Elephant March**	**The Elephant March**	The Wheels on the Bus	26 min
	Head, Shoulders, Knees, and Toes	Head, Shoulders, Knees, and Toes		
	Five Little Ducks (2)	**The Wheels on the Bus** (3)		
Sara	**Soft piano**[a]	**The Wheels on the Bus** (2)	The counting game	33 min
	Teddy bear	**The Little Dog Sings**		
	Soft book	The bouncing play		
	Tambourine	Magpie Makes Porridge		
Alex	Peek-a-boo	**The swinging game** (2)	Arm stretches	22 min
	Lifting up game	Arm stretches		
	Leg stretches	The dog game		
	Arm stretches	The counting game		

Note. If the same play routine was analyzed more than once (i.e., it appeared in several recordings), the number is indicated in brackets. The play routines presented in the extracts are bolded.

[a] The data in the baseline did not include play routines without toys (such as peek-a-boo or nursery rhymes).

offer the potential for analyzing sequences, which are turns organized as serial units (Jefferson, 1972). Analyzing sequences can provide a more comprehensive understanding of parent-child interactions than the analysis of single expressions, since sequences reveal not only parents' strategies to engage their children but also their children's involvement (Chen, 1996).

The videos of free play between the mothers and their children were viewed several times to find play routines that showed a potential increase in reciprocity. Ten play routines without toys, in which the children were most actively engaged, were selected for the analysis from each dyad: four routines from the baseline, five from the intervention, and one from the follow-up recordings. Altogether, 81 min of video data were analyzed. Table 1 summarizes the analyzed play routines.

ELAN (2021) software was used to make annotations and rough transcriptions. The mothers' verbal expressions were annotated, which was followed by adding to the transcriptions their actions related to touching or moving their children. The children's participation was operationalized as their use of bodily actions and vocalizations (e.g., Fantasia et al., 2014; Fantasia & Delafield-Butt, 2023). The children's bodily actions and vocalizations with phonation, grunting, and smacking sounds were annotated. If the children moved their legs while their mothers were holding their legs, these movements were annotated for the children only if their mothers' verbal comments confirmed this; otherwise, it was difficult to determine whether it was the child or the mother who moved the child's legs. Children's head movements connected to difficulties keeping their heads upright or epilepsy were not annotated. Their loud breathing sounds, silent mouth movements, and yawning were annotated only if they were responded to by the mothers. In the first phase, the children's bodily expressions to which their mothers responded were tagged and analyzed in detail with the other authors of this article. This analytical decision was based on the literature suggesting that parents' responses may sensitize children's perceptions of their expressions as social acts and modify them (e.g., Rączaszek-Leonardi et al., 2013). In the second phase, the analysis focused on the mothers' actions in asking questions. This focus was based on data observations and the literature suggesting the importance of mothers' questions in creating dialogues and reciprocity with children (e.g., Snow, 1977). It was of special interest to explore whether the mothers expected answers from their children and, if they did, what kind of actions from their children they treated as answers.

2.4. Transcription

From the rough ELAN annotations, three play routines from each mother-child dyad were transcribed in further detail by applying the principles of multimodal transcription (Mondada, 2018, 2022). Multimodal transcriptions include information about participants' nonverbal and verbal actions (Mondada, 2018). For this study, the transcriptions were simplified, and some additional transcription conventions were used (see Appendix A). The focus of the transcriptions was on embodied actions, and the entire moving bodies of the participants were considered (Iwasaki et al., 2019; Mondada, 2018). It was of special interest to analyze the sequences composed of children's movements and their mothers' verbal and nonverbal actions. The pauses were marked in the transcriptions only in moments when there were no bodily-tactile or vocal actions. This was a child-based analytical decision. From the perspective of children with VIAD, their mothers have a turn not only during speech but also when they are actively touching or moving their children. From the multimodally transcribed play routines, the sequences that were the most representative in baseline and demonstrated changes in reciprocity during the intervention are presented in this paper.

The mothers' speech was transcribed in Finnish in bold letters with English translation in italics below (see Example 1, Line 01).

Example 1.

```
01 MOT:    +Ooksä /valmis ele[fanttimarssiin+                          +
            Are you ready for The Elephant March
   mot     +MAKES STEPS WITH T'S LEGS-------+MAKES A STEP WITH T'S R LEG+
   the           /smiles--->

02 THE:                        [TURNS HER HEAD AND STRAIGHTENS HER R ARM
```

All the children's vocalizations were transcribed with lowercase letters. However, only the vocalizations with phonation were

transcribed as their turns. This analytical decision was based on the data-based finding that the mothers responded almost exclusively to their children's vocalizations with phonation. The participants' nonverbal actions were transcribed with capital letters below the transcript of the speech. Only the mothers' nonverbal actions that were accessible to their children through the bodily-tactile modality were transcribed (see Iwasaki et al., 2019). If a bodily-tactile action appeared as an independent act without speech, it was transcribed on a line of its own (see Example 1, Line 02). All the children's movements were transcribed. However, only the movements that their mothers responded to were marked as turns. The observations related to the mothers' gazes were written in double parentheses. The children's smiling was transcribed and marked in italics below their bodily-tactile actions. The beginning and end of smiling were indicated with a slash. Only the smiles that the mothers responded to verbally were marked as turns.

3. Results

The findings from each mother-child dyad are described individually. Their interactions during baseline and intervention are analyzed with examples. The analysis focuses on the children's movements and their mothers' actions in creating reciprocal interactions using the bodily-tactile modality.

3.1. Thea and her mother: creating slots for turn-taking during play routines

The following analysis shows how Thea's mother changed her way of structuring the play routines from baseline (Extract 1) to intervention (Extracts 2 and 3). More specifically, the mother began to create slots for Thea's bodily (re)actions by releasing her hold of Thea, observing, and waiting for what Thea might do next, thus enabling reciprocity in taking turns. Furthermore, when she noticed Thea's movement during a slot, she touched the part of the body Thea had moved.

3.1.1. Baseline

In the baseline, the mother frequently played with Thea, singing nursery rhymes including touch and movement while Thea was positioned on her back, face-to-face with her mother. During these plays, the mother's gaze was focused on Thea's face rather than on her bodily actions. When the mother asked questions during the games, she did not wait for responses from Thea, or she waited for Thea to turn her head toward her. She did not offer slots for Thea to act spontaneously during the songs. Extract 1 illustrates the way the mother construed her actions during the song "The Elephant March" in the first baseline session (A1). The extract is taken from the end of the first verse, when the mother finishes singing and takes a short pause before the next verse.

Extract 1. Thea's mother plays "The Elephant March" with Thea (T) in baseline session A1.

```
01 MOT:   /*Ko:ska matka oli ha:uska/niin*+                    +
            Because the journey was fun
   mot    >>MAKES STEPS WITH T'S LEGS-----+LIFTS UP T'S LEGS+
   the     *STRAIGHTENS HER ARMS----------*
   the    /smiles-------------------/

02 MOT:   pyysi +hän mukaan yhden*to:ve:ri:n+ Joo*          +(0.5)#+
           she asked one friend to join her    Yes
   mot          +TAPS T'S FEET TOGETHER----+BENDS T'S LEGS+HOLDS T'S LEGS+
   mot                                      ((GAZES AT T'S FACE))
   the                          *STRAIGHTENS R HAND*
   fig                                                    #fig. 2

03 MOT:   +.hh               +°Kak°si pientä e:*lefanttia ma:rssi*näin
                               Two little elephants marched like this
   mot    +LIFTS UP T'S R LEG+MOVES T'S LEGS SEQUENTIALLY--->>
   the                                      *TURNS HEAD------*
```

The mother moves Thea's legs during the song (Lines 01–02). In this way, the play activity is accessible to Thea, and she shows excitement by straightening her arms and smiling (Line 01). When her mother stops singing, she keeps holding Thea's legs until the end of the 0.5 s pause (Line 02, Fig. 2). During the pause, the mother's gaze is focused on Thea's face, as if she is waiting for an emotional facial or vocal response from her (Line 02). Thus, she does not expect Thea to take her turn through movement. Moreover, as the mother is holding Thea's legs during the pause, it may signal to Thea that her mother is continuing her turn.

Fig. 2. Thea's mother holds Thea's legs during the 0.5 s slot (Line 02).

3.1.2. Intervention

During the intervention, the mother's way of playing "The Elephant March" and "Head, Shoulders, Knees, and Toes" changed. She started paying less attention to the game that was being played and focused more on Thea's participation. She began to offer slots for turn-taking by releasing her hold of Thea and observing her bodily expressions during the slots. Thea's mother also began to *expect* bodily responses from Thea in response to her questions. Furthermore, when she noticed Thea's body movement (e.g., moving a leg), she responded verbally and tactilely. This way, i.e., touching the leg that Thea had just moved, Thea could become aware that her mother had noticed her leg movement. Extract 2 illustrates Thea's mother's behavior in "The Elephant March" during the second session of intervention (B6) and is from the same part of the game as Extract 1.

Extract 2. Thea's mother plays "The Elephant March" with Thea (T) in intervention session B6.

```
01 MOT:   Ko:ska matka oli ha:uska niin
          Because the journey was fun
   mot    >>MOVES T'S LEGS IN THE RHYTHM--->

02 MOT:   pyysi hän mukaan yhden to:ve:ri+:n+              +
          she asked one friend to join her
   mot                                ---->+,,,+RELEASES HOLD+

03        #(1.8)
   mot     ((OBSERVES T'S BODY))
   fig    #fig. 3

04 THE:   #BENDS HER L KNEE (0.4)
   fig    #fig. 4

05 MOT:   +#Hyvä+
            Good
   mot    +TOUCHES T'S L KNEE AND GRASPS HER LEG+
   fig     #fig. 5
```

As Thea's mother finishes singing "The Elephant March," she offers a slot for turn-taking by releasing her hold of Thea's legs (Lines 02–03, Fig. 3). The mother's nonaction offers a sequential space for Thea's reciprocal action and functions like a question in a conversation in that it projects the relevance of the next action/answer (Schegloff, 2007). In other words, it shows that the mother is *expecting* a reciprocal action from the child. In addition, the mother's gaze (Line 03) reveals a change in her expectations. She observes not only Thea's face but her whole body and considers her movements as affordances for participation.

By releasing Thea's legs, the mother gives her more space and bodily resources to respond. This adjustment is crucial as Thea's mother has moved Thea's legs during the song (Lines 01–02), they are potential loci for Thea's next action. Moreover, the action of releasing hold of Thea's legs creates segmentation in the mother's bodily-tactile activity, and it may signal the ending of her turn. It is likely that this information is important for Thea as she uses the same modality for expressing herself. Next, Thea acts by bending her left knee (Fig. 4) in a transition-relevance place of interaction (Sacks et al., 1974). That is, Thea recognizes the end of the bodily-tactile play sequence and the moment of turn transition.

Fig. 3. Thea's mother observes Thea's body during the slot (Line 03).

Fig. 4. Thea bends her left knee (Line 04).

The sequence in Extract 2 resembles an adjacency pair, which is considered a basic unit in the interactional structure (Schegloff, 2007). An adjacency pair is composed of two turns from different speakers placed one after the other in such a way that the first part *initiates* the exchange, and the second part *responds* to the action of the first part accordingly (e.g., question-answer; Schegloff, 2007). Thus, the mother's expectancy after the action resembles the first part, as it initiates the exchange. Thea's movement acts like the second part, as it responds to her mother's expectancy. The mother's *interpretation* is revealed by her assessment *Hyvä*, "good" (Line 05), which is fundamental in attributing intention to Thea's movement (cf. Rączaszek-Leonardi et al., 2013; Sierra, 2017; Snow, 1977; Vierijärvi, 1999). Thus, the sequence consists of three parts, with an *assessment* in the third position. Through an assessment, the speaker of the first part can express a stance toward the contribution made by the speaker of the second part (Schegloff, 2007). Moreover, simultaneously with the assessment, the mother touches Thea's knee with her right hand (Fig. 5), which informs Thea that her mother has noticed her leg movement. It is possible that the mother's noticing responses related to Thea's movements fostered Thea's agency because she was active in moving her legs during the slots. Overall, the changes in the mother's way of structuring the play routines and interpreting Thea's movements were observed in all the analyzed games from intervention to follow-up. Typically, the sequences consisted of three parts.

In B7, a new song, "The Wheels on the Bus," appeared for the first time. In this song, Thea participated by bending one or both of her knees during the time slots. During intervention session B10, another new change appeared in Thea's participation. She not only moved her legs during the offered sequential slot but also used them for making the bicycling movement in "The Wheels on the Bus." This change was possible because Thea's mother released her grasp of one of Thea's legs, alternately enabling Thea to make a half round of pedaling independently. Her movements were captured in the recordings in B10, B12, and A15. Extract 3 illustrates Thea's participation in making half of the bicycling movement during the first phrase of the "The Wheels on the Bus" in B10.

Fig. 5. Thea's mother touches Thea's knee (Line 05).

Extract 3. Thea (T) makes co-constructed leg movements in "The Wheels on the Bus" in intervention session B10.

```
01 MOT:    +.hh Pyörät ne pyör+            +[ivä]+t
                The wheels on the bus       go round
   mot     +BICYCLING MOVEMENT+RELEASES HOLD+     +GRASPS T'S R LEG--->

02 THE:                                          [BENDS R KNEE]

03 MOT:      ym+#             +[pä:#]+ri+
              and                round
   mot     --->+RELEASES HOLD+       +GRASPS T'S L LEG+
   fig          #fig. 6

04 THE:                          [BENDS# L KNEE]
   fig                                 #fig. 7
```

In the beginning of the play sequence, Thea's mother releases her grasp of Thea's left leg (Fig. 6). Next, Thea makes part of the bicycling movement by bending her left knee (Fig. 7). This kind of co-performed sequential movement pattern was repeated several times with both of Thea's legs during the first verse. Rączaszek-Leonardi et al. (2013) suggested that these types of co-actions are crucial for intentionality to emerge.

Fig. 6. The mother releases her hold of Thea's left leg (Line 03).

Fig. 7. Thea bends her left knee during the bicycling movement (Line 04).

In summary, the changes in her mother's interactive behavior gave Thea new resources and agency for participation through her leg movements. First, Thea began to move her left leg during the slots, and later also her right leg. At the end of the intervention, Thea could co-construct a bicycling movement with her mother during "The Wheels on the Bus" by doing some of the pedaling independently.

3.2. Sara and her mother: new play routines and resources for participation

The following analysis shows how Sara's mother changed the type of play and her structuring of the play routines from baseline (Extract 4) to intervention (Extracts 5 and 6). During the intervention, the mother started engaging with Sara in early play routines without toys. Moreover, she began to make slots in the play routines, offering a sequential space for Sara's turn-taking and observing her bodily actions. When the mother noticed Sara's movements during the intervention, she often touched the part of the body Sara had moved and verbally responded to the actions as if they were intentional.

3.2.1. Baseline

In the baseline, Sara's mother typically played with Sara using sound toys while Sara sat in front of her on the floor (Extract 4). The mother's gaze was focused on the toys and Sara's face rather than on Sara's bodily expressions. Sara's mother asked Sara frequent questions. However, as Sara could only occasionally take her turn through vocalization, her mother often answered the questions herself (e.g., "*Do you like the song?*" (pause) "*Do you?*" (pause) "*Yeah*"). She also used questions to inform Sara about the following actions and to respond to Sara's vocalizations or smiling. She did not offer time or space for Sara's bodily actions, and she responded to Sara's movements infrequently, which is a common finding for mothers of infants with typical verbal development (Rączaszek-Leonardi et al., 2013; Sierra, 2017; Vierijärvi, 1999). Extract 4 illustrates a moment of interaction from the first baseline session (A1), in which Sara's mother responds to the change in Sara's emotional expression, orientation, and vocalization. They are playing a soft piano.

Extract 4. Sara's (S) bodily and emotional responses during baseline session A1.

```
01 MOT:   +Sit sielä on +ka*toppa* (1.2)
           And look then there is
   mot    +PLAYS A QUACK SOUND+((GAZES AT THE PIANO))
   sar                    *LIFTS UP HER HEAD*

02 MOT:   +Ank*kavankka+* (0.6)
           A duckie duck
   mot    +PLAYS THE QUACK SOUND+((GAZES AT S'S FACE))
   sar        *TURNS HER HEAD*

03 MOT:   [Wau:      Mi+tä:#+]
           Wow       What
   mot                 +PLAYS THE QUACK SOUND+((GAZES AT S'S FACE))

04 SAR:   [SMILES AND TURNS #HERSELF TOWARD HER MOTHER]
   fig                      #fig. 8

05 MOT:   (0.7) /Oliks se ankka kiva:/+(0.9)+
                 Was it a nice duck
   mot          ((GAZES AT S'S FACE))+PLAYS THE QUACK SOUND+
   sar           /smiles--------------/

06 MOT:   Oliko:
          Was it
   mot    ((GAZES AT S'S FACE))

07 SAR:   +Aaah+
   mot    +PLAYS THE QUACK SOUND+

08 MOT:   Joo (0.2).hh (.) Ja sit sielä on sammakko (0.3)
          Yes              And then there is a frog
   mot    ((GAZES AT S'S FACE AND THEN AT THE BOOK))
```

Sara's mother plays a quack sound, and Sara responds by lifting her head up (Line 01). This reflects her attentiveness to and interest in sounds. Next, her mother replays the "quack" sound, names it, and gazes at Sara's face (Line 02). Sara responds by smiling and turning toward her (Line 04, Fig. 8), with possible eye contact. The repetition of the familiar sound, which is connected to Sara's tactile and visual focus of attention, creates a multimodal sensation that prompts Sara's action of orientating herself toward her mother (Nomikou et al., 2013). Moreover, the sequential context of Sara's actions is likely to help her mother relate Sara's actions to the quack sound. Because Sara's actions are typical gaze-based social-communicative behaviors, her mother detects them easily and treats them as an opening of a dialogue sequence (Nomikou et al., 2013). The mother responds with a question (Line 03) and an assessment, which is an interpretation of Sara's actions (Line 05). By repeating her question (Line 06), the mother asks for Sara's confirmation of her

Fig. 8. Sara turns toward her mother (Line 04).

interpretation. Sara vocalizes (Line 07), which her mother accepts as an answer (Line 08). Overall, the extract shows the mother's active role in giving turns to Sara through her questions and interpreting Sara's actions as turns in the conversation. Sara's smile, the change in her orientation (Line 04), and her vocalization (Line 07) are important responses for the mother, and they encourage her to continue the sequence (for similar findings on typically developing children, see Vierijärvi, 1999).

3.2.2. Intervention

During the intervention, Sara's mother started to play with Sara without toys. This time, Sara was either on her back on the floor (Extract 5) or on her mother's lap (Extract 6), which gave her more possibilities to move her legs. In the intervention sessions, Sara's mother changed her way of asking Sara questions, as she began to expect more answers from Sara through her bodily actions. She also started to engage Sara more in interactions and embed her behaviors in the game by creating slots for turn-taking and observing Sara's bodily expressions during the slots. When she noticed Sara's bodily expressions, she responded to them verbally as intentional actions and often acknowledged them tactilely. By doing so, she made her actions accessible to Sara.

Extract 5 illustrates a moment of interaction in the first intervention session (B5) in which Sara and her mother have finished the first verse of "The Wheels on the Bus." Sara's mother asks Sara three times if she would like to sing the next verse with leg movements (Lines 01–04). Next, Sara moves her body (Line 05), which her mother interprets as an answer to her question (Line 04).

Extract 5. Sara's mother interprets Sara's (S) movements as a response to her question in intervention session B5.

```
01 MOT:   *Otetaanko sitte vielä jalat rakas*+
          Shall we take the legs again darling
   mot    >>TOUCHES S'S LEGS-----------------+((AND GLANCES AT THEM))
   sar    *MOVES HER R HAND-----------------*

02 MOT:   +#°Otetaanko°+ (1.8)
             Shall we
   mot    +TAPS S'S LEGS+((GAZES AT S'S FACE))
   fig     #fig. 9

03 MOT:   Oisko ne kivat +vielä ottaa tähän+ mukaa
          Would it be nice to take them along
   mot                   +TAPS S'S LEGS---+

04 MOT:   ku ne [heiluu niin kivasti#  +Joo:+] (0.2)
          as they swing so nicely       Yes
   mot                                 +TOUCHES S'S LEGS+
   mot                              ((GAZES AT S'S LEGS AND FACE))

05 SAR:         [TURNS AND MOVES HER# LEGS]
   fig                               #fig. 10

06 MOT:   +*Otetaan sit pyyhkijät*+
            Let's take the wipers next
   mot    +LIFTS UP S'S LEGS------+
   sar     *MOVES HER R HAND AND HEAD*
```

The sequence in Extract 5 consists of three main parts: *the first part* is the mother's question with repetitions (Lines 01–04); *the second part* consists of Sara's bodily action (Line 05, Fig. 10); and *the third part* is the mother's confirmation *joo* "yes" and touch (Line 04). The question as the first part sets up the conditional relevance of the second part of an adjacency pair, which is an answer. Sara's mother repeats her questions (Lines 01–04) until she gets a response, which reflects an inner model of conditional relevance (Snow, 1977; Vierijärvi, 1999). Further, the mother touches Sara's legs (Lines 01–03, Fig. 9), which directs both partners' attention to the same locus. Next, Sara makes a movement (Line 05, Fig. 10). The "nextness" of her turn helps her mother understand the action as an answer to her question, which she then acknowledges verbally and tactilely (Line 04). The mother's *interpretation* is pivotal in making Sara's bodily action a second-pair part of the adjacency pair. Sierra (2017) described similar findings of a mother who interpreted the movement of her child with typical verbal development as an answer to her question.

The findings suggest that the mother's *knowledge* of Sara's movements as a resource for participating changed her interactive behavior. That is, she showed *expectancy* toward Sara's bodily responses, and when she noticed them, she verbally interpreted them as intentional. Thus, parents' knowledge of their children's potential can make a crucial difference in the reciprocity of interactions and in their children's development. Similarly, Ninio and Bruner (1978) found that when mothers of infants with typical verbal

Fig. 9. Sara is still during her mother's question and touches (Line 02).

Fig. 10. Sara turns and moves her legs (Line 05).

development became aware of their children's new vocal abilities, their responses changed qualitatively in a way that promoted their children's vocal development.

The mother also began to treat Sara's actions as intentional in other contexts in which she did not ask her anything. In these moments, she interpreted Sara's bodily actions as her way of participating in the game. Extract 6 from the sixth session of the intervention (B10) illustrates Sara's contemporaneous movements with her mother's actions during "A Little Dog Sings." In the beginning of the verse, Sara's mother sings and makes a body sign "CAT" on Sara's left hand (Line 01). Next, Sara joins in the song.

Extract 6. Sara's mother considers Sara's (S) movements as singing in intervention session B10.

```
01 MOT:   *Iso* kissa lau+laa miu miu+ [miu
           A big cat sings meow meow meow
   mot                  +MAKES SIGNS ON S'S HAND+
   mot              ((GAZES AT S'S FACE))          ((GAZES AT S'S LEGS))
   sar   *TURNS HEAD*

02 SAR:                                  [LEANS BACKWARDS

03 MOT:   [+Joo: venyt#telee +kaulaa miu miu+ mi#u  Hyvä ra+ka:s]
           Yeah stretches her neck meow meow meow   Well done darling
   mot   +PLACES HAND ON S'S HAND+MAKES SIGNS ON S'S HAND+TAPS S'S L LEG+
   mot                                      ((GAZES AT S'S LEGS))

04 SAR:   [MAKES NUMER#OUS KICKING MOVEMENTS WITH# HER L LEG]
   fig                #fig. 11                   #fig. 12

05 MOT:   *Nyt +lähti potpuri+ päälle*
           Now a potpourri started
   mot         +TAPS S'S R LEG+STROKES S'S R LEG--->
   sar   *KEEPS HER BODY AND LEGS EXTENDED*

06 MOT:   Nyt*kö tuli semmone muistiku+va et+tä hei*
          Now did you get a memory that yes
   mot                            --->+.....+TAPS S'S L KNEE--->
   sar       *EXTENDS HER LEGS---------------------*

07 MOT:        +tää ei oo mi*kään uus juttu
                this is not a new thing
   mot   --->+STROKES S'S L LEG--->
   sar                    *EXTENDS HER LEGS--->

08 MOT:   tätä me ollaan laulettu+ en+nenki          +Niinkö:* (0.2)
          this we have been singing also before       Right
    mot                      --->+....+TAPS S'S R LEG+
   sar                                              --->*

09 MOT:   +*Hyvä rak*a:s+  (0.7)
            Well done darling
   mot   +TOUCHES S'S L KNEE AND LIFTS HER UP+
   sar     *MOVES HER L LEG*

10 MOT:   +°Hyvä°+
            Well done
   mot   +MOVES S DOWNWARDS+

11 MOT:   +Hie*nosti lauloit äitin kaa Joo:+*
           You sang so well with mother Yeah
   mot   +STROKES S'S CHEST WITH HER THUMB+
   sar         *MOVES HER HEAD--------------*
```

Sara leans back (Line 02) and moves her legs (Fig. 11) during the song, which her mother acknowledges and responds to with a positive assessment (Line 03) and tactile noticing (Fig. 12). Sara's initiative creates a kind of side sequence (Jefferson, 1972), which is contemporaneous with her mother's ongoing action. Co-actions are typical also in vocal interactions between 4 and 10-month-old infants and their mothers, and the literature suggests a developmental process in which the child's ability to take turns gradually increases (Harder et al., 2015). Thus, there may be a similar developmental process of turn-taking in the bodily-tactile modality.

The sequence continues with the mother's interpretation of Sara's bodily actions (Lines 05–08). The mother's comment (Line 05) expresses that her expectation of Sara's participation was fulfilled. Finally, Sara's mother makes other positive assessments (Lines 09–11) and interprets Sara's bodily action as her means of participating in the singing (Line 11). This example illustrates how Sara's mother actively embeds Sara's bodily movements within the play sequences and considers them intentional. In this way, the mother's responses may have sensitized Sara's perception of her movements as social acts and fostered her communicative agency (Fantasia & Delafield-Butt, 2023; Rączaszek-Leonardi et al., 2013). Overall, the changes in the mother's way of playing new play routines with Sara and responding to her were observed in all the analyzed games during the intervention and follow-up sessions.

In summary, the changes in the mother's interactive behavior transformed the nature of the interactions between her and Sara to become more reciprocal. Sara gained new resources for participating in play routines through her bodily actions.

Fig. 11. Sara makes kicking movements (Line 04).

Fig. 12. The mother taps Sara's leg during her kicking movements (Lines 03–04).

3.3. Alex and his mother: responding to body movements as intentional actions

The analysis shows how Alex's mother changed her way of structuring the play routines and responding to Alex's expressions from baseline (Extract 7) to intervention (Extract 8). She began to create sequential slots for Alex to take his turn through bodily actions and to observe them. When she noticed Alex's subtle movements, she treated them as intentional actions and typically interpreted them as requests.

3.3.1. Baseline

In the baseline, the mother often used physical activities in her play with Alex, who was on his mother's lap, on his back on the floor, or held face-to-face by his mother. Typically, the mother's gaze was focused on Alex's face, and she tried to make eye contact with him. The mother asked Alex questions frequently; however, she did not wait for answers from him. She used questions to inform Alex about the upcoming actions or to comment on his expressions or on the actions in the game. Sometimes, her questions expressed her wish to get Alex's visual attention. Typically, she responded to Alex's vocalizations and smiles, but not to his movements. Extract 7 illustrates a moment in the lifting-up game from the first baseline session (A1). The sequence begins with the mother's question (Line 01), which she uses to inform Alex about the following action. Her gaze is directed at Alex's face.

Extract 7. Alex's mother responds to Alex's smiling in baseline session A1.

```
01 MOT:   +°Nostetaanks sua vähän pystyy°  Oi::+
            Shall we lift you up           Oh
   mot    +LIFTS ALEX UP ----------------------+((GAZES AT HIS FACE))

02 ALE:   Mmh

03 MOT:   .hh +Oi::+
               Oh
   mot        +LIFTS ALEX UP HIGH+((GAZES AT HIS FACE))

04 ALE:   SMILES

05 MOT:   /Onks se kivaa/((speaks with a laugh))
            Is it fun
   mot      ((GAZES AT ALEX'S FACE))
   ale      /smiles-------/
```

Alex's mother lifts him up twice (Lines 01 and 03), which makes him smile (Line 04). His mother responds to his smile with laughter and a question (Line 05), which is an assessment of Alex's response. Alex's emotional responses appeared to be easy for his mother to read and interpret. This observation is equivalent to the findings of studies that have examined the interaction between children with VIAD and their caretakers (Daelman, 2003; Rowland, 1984).

In this extract, Alex's gaze behavior was not possible to observe due to his position. However, typically, he did not have eye contact with his mother, which sometimes made her insecure of his attention. This is natural because mothers typically find their infants' gazes important for initiating and maintaining interactions with them (e.g., Rączaszek-Leonardi et al., 2013; Snow, 1977; Vierijärvi, 1999), and if the infants look away, the mothers interpret their behavior as a signal to finish the game (Vierijärvi, 1999). Children with VIAD often look away in interactions with their parents, which can be misinterpreted as disinterest. Instead of eye contact, children with VIAD can make tactile contact (e.g., Peltokorpi et al., 2023) and demonstrate attendance through their bodies.

3.3.2. Intervention

During the intervention, Alex's mother developed new bodily-tactile play routines with Alex. She also started creating more time slots for Alex's turn-taking and observed his bodily actions during the slots. Moreover, she began to wait for bodily responses from Alex in response to her questions. When she noticed his subtle movements, she often verbally interpreted them as requests and acknowledged them tactilely, which made her noticing accessible to Alex.

A swinging game appeared for the first time in the fourth intervention session (B8), without observable movements from Alex. In the fifth (B9) and eighth (B12) intervention sessions, the mother started responding to Alex's emerging movements as intentional acts. Extract 8 illustrates the mother's actions in responding to Alex's emerging movements (B12). Alex sits on his mother's lap during the swinging (Fig. 13). The game is accessible to him through the bodily-tactile modality, and he responds to the beginning of the movement with a smile (Line 01). After swinging, his mother makes a slot for turn-taking and observes Alex (Line 01). Next, she utters a soft exclamation *hui* "oh," expressing their shared experience (Line 02) while waiting for a response from Alex.

Extract 8. Alex's mother interprets his subtle movements as intentional actions in intervention session B12.

```
01 MOT:   +.hh /kiik#kaa kaak°kaa° .hh °kiik/*kaa kaakkaa:°+* (1.8)
               ((A Finnish catchphrase connected to swinging))
   mot    +SWINGS ALEX ON HER LAP--------------------------+
   mot                                          ((GAZES AT ALEX'S FACE))
   ale                                      *BREATHES IN LOUDLY*
   ale         /smiles----------------------/
   fig              #fig. 13

02 MOT:   °Hui::°   (1.3)*              *(0.5)*          *(3.8)
            Oh
   mot    ((GAZES AT ALEX'S FACE))
   ale                  *LEANS BACKWARDS*     *TURNS HEAD*

03 ALE:   #LEANS BACKWARDS AND MOVES HIS L LEG AND HEAD+ (0.5)
   mot     ((GAZES AT ALEX'S FACE))                      +.....--->
   fig    #fig. 14

04 MOT:      °Te+hään*kö lis*ää tehään+kö#°+
              Shall we do some more shall we
   mot       --->+TOUCHES ALEX'S HEAD+TOUCHES ALEX'S L LEG+
   mot                                    ((GAZES AT HIS FACE))
   ale               *TURNS HIS HEAD*
   fig                                  #fig. 15
```

Alex responds to his mother's expectancy by leaning slightly backwards (Line 02). His mother may perceive this movement but does not respond to it. Next, Alex turns his head (Line 02), and after a pause, he leans back and makes a subtle movement with his left

Fig. 13. The swinging movement begins (Line 01).

Fig. 14. Alex leans backwards and moves his left leg (Line 03).

leg (Line 03, Fig. 14). His emerging movements mirror swinging and may demonstrate his bodily experience of the game. Similar observations of mirroring movements have also been observed in other children with VIAD (e.g., Rogow, 1982). Moreover, as Alex's movement (Line 03) is a repetition, it may also be an attempt for communication repair (Dincer & Erbas, 2010), as his first movement was not responded to. Next, Alex's mother verbally *interprets* Alex's action as a request to continue (Line 04), which is crucial for creating a shared meaning with Alex (for similar findings, see Rączaszek-Leonardi et al., 2013). If she had evaluated Alex's movements as non-intentional and had not responded to them, this would have meant that their potential to be used in interaction would have been unfulfilled. Moreover, his mother acknowledges Alex's movements by touching the loci of his body where she perceived his movements (Line 04, Fig. 15). This touch informs Alex of his mother's attention and makes her noticing accessible to him.

The swinging game offers many resources for Alex's participation. First, it is easy to access through the bodily-tactile modality. Second, it has a very simple structure consisting of only one action, swinging. Third, the game has a regular rhythm, which has been found to strengthen the togetherness between children with VIAD and their caregivers (Metell, 2015). Lastly, the long slots during the game may have sensitized Alex to perceive his mother's movements and participate in the game (cf. Johnson & Parker, 2013; Rączaszek-Leonardi et al., 2013). Overall, the changes in the mother's structuring of the play routines and responding to Alex's bodily actions were observed in the analyzed games from the intervention to follow-up sessions.

In summary, the changes in his mother's interactive behavior created a sequential space and time for Alex to take his turn in interactions. When Alex made bodily movements, his mother interpreted them as intentional contributions to the game. In this way, Alex's movements acted as new resources to allow reciprocal interaction.

Fig. 15. The mother notices Alex's leg movement tactilely (Line 04).

4. Discussion

This study explored the reciprocity of interactions between children with VIAD and their mothers before, during, and after the bodily-tactile early intervention. The results suggest that the turn-taking exchanges between children with VIAD and their mothers increased during the intervention. The mothers began to use more of the bodily-tactile modality in interactions, create slots for their children's turn-taking, and consider more of their children's bodily actions as turns. The children had more active roles in the play routines during the intervention, as they got more resources for turn-taking through their bodily actions. These findings supported our hypotheses and offered new information about the possibilities to enhance reciprocity in early interactions between children with VIAD and their mothers.

The findings of this study are in line with other studies that found early play routines to be resources for increasing children's participation (e.g., Fantasia et al., 2014; Nomikou et al., 2017). Our results, however, indicate that simply playing these games in typical ways may not be enough to create reciprocal interactions with children with VIAD. Modifications in the modalities used and structuring of play routines may be needed to enhance children's participation. Our findings shed light on mothers' actions in creating reciprocal interactions with their children with VIAD. Furthermore, our results illustrate how children's bodily actions can become part of interactional sequences through their mothers' actions and what these sequences look like at the initial stage of children's communicative development.

The participating mothers were already actively interacting with their children with VIAD during the baseline through neurotypical vocal and gaze-based social communicative behaviors. However, they had not naturally adapted the systematic use of the bodily-tactile modality in their interactions. Vervloed et al. (2006) had similar findings on the non-systematic use of bodily-tactile modality by a teacher interacting with a three-year-old child with congenital deafblindness. Our results demonstrate that mothers can learn to use the bodily-tactile modality systematically in interactions with their children during a rather short intervention, which confirms the findings of a previous case study (Peltokorpi et al., 2023). This is an important outcome because accessibility through the bodily-tactile modality is the first step in developing reciprocal interactions with children with VIAD.

The mothers adapted the bodily-tactile modality smoothly in their interactional patterns, as they were all motivated to learn new interaction strategies. However, how quickly they began to use the strategies in free play with their children with VIAD varied individually. The mothers also had individual preferences related to play routines. For instance, one of them preferred not to sing in front of the video camera; therefore, other types of play routines were created with her. It was noted that the mothers did not always have time to try out the suggested strategies at home between the sessions. Thus, there might have been a need to guide them more systematically in using the strategies in their daily activities. It is also important to note that the mothers were acting under social pressure while being videorecorded during the intervention, and, thus, we cannot know whether they will continue using the bodily-tactile modality in future activities beyond the follow-up. However, the mothers appeared to be empowered by the new strategies and ideas, so it is possible that the change in their interactive behaviors will not be limited to the intervention. Nonetheless, even if the mothers continued using the strategies, they might not be able on their own to scaffold the communicative development of their children with VIAD beyond the present stage. Thus, families could benefit from near-future interventions in which bodily-tactile strategies are adapted to respond to their children's new abilities and needs.

In this study, the mothers did not typically wait for responses from their children at baseline, which is understandable from a transactional perspective (Sameroff & Chandler, 1975). That is, the mothers may have detected very limited responses from their

children through typical gaze-based social communicative behaviors (cf. Rączaszek-Leonardi et al., 2013), which led them to respond to their questions themselves and maintain interaction through their own continuous actions. This behavioral tendency, however, provides fewer opportunities for children with VIAD to take their turns in interactions and may compromise the parent-child transactions (see Rowland, 1984). After the mothers were informed about their children's movements as resources for participation, they started waiting for more responses from their children through bodily actions and responded to them. This finding is in line with Sameroff and MacKenzie (2003a), who argue that transactions are located in the way the communication partners think about each other.

Our findings revealed changes in the children's participation during the intervention directed at the mothers, which supports the transactional model of development. Indeed, Sameroff and MacKenzie (2003b) argue that transactional processes are observed when interventions aimed at the parent show later effects in the actions of the child (e.g., eliciting a new action from him/her). Over time, the new interactional patterns may have further positive effects on the children's development. For instance, the change in the children's roles from recipients to actors could be essential to promote their communication and language development (see Smith & Fluck, 2000). We found that the children's participation increased when their mothers gave them more time to respond. Johnson and Parker (2013) also found that longer waiting times facilitated responses in children with VIAD. Moreover, our results suggest that children with VIAD need sequential space and bodily adjustments for their turn-taking. Bodily adjustments for the following turn are also present in tactile sign language users who project speaker and recipient positions by changing their hand positions (Iwasaki et al., 2019).

The participating children expressed their engagement in interactions through body movements, which is in line with the findings of typically (Fantasia et al., 2014) and atypically developing children (Preisler, 1991; Rogow, 1982). Moreover, our results suggest that some of the children's movements may have mirrored their bodily-tactile play experiences, which corresponds with the findings of Preisler (1991). Ask Larsen (2003) and Peltokorpi et al. (2023) had equivalent results also for gestural expressions in children with congenital deafblindness or VIAD. Thus, our theoretical assumption is that children with VIAD can develop their participation in stages with the help of competent communication partners. The stages of this process may closely follow the development of typically developing (e.g., Fantasia & Delafield-Butt, 2023) and blind infants (Preisler, 1991). First, children with VIAD may engage in play routines through movements, and gradually, they may learn to anticipate some parts of the routines. Next, they may perform some part of the play routine in the joint activity. Later, children with VIAD might be able to use a specific action of the play as a referential body gesture (Preisler, 1991; Rogow, 1982) or hand gesture (e.g., Ask Larsen, 2003). Through sharing and negotiation, the referential gestures may evolve to be used as signs (cf. Nafstad & Rødbroe, 2015). Whether some children with VIAD may acquire cultural language if they are offered access to tactile sign language remains to be explored more systematically. Thus, the development of communication in a child with VIAD results from the child's diverse abilities and his or her experiences of social interactions over time (Sameroff & MacKenzie, 2003a). These processes need to be investigated in detail in future studies.

Our findings showed that the mothers started to respond to their children's movements through touch during the interventions, which Peltokorpi et al. (2023) also reported. Active touch has the power to elicit a child's attention (Stack & Muir, 1992). Moreover, when the parent touches the locus of the body in which the child's movement occurs, it may inform the child that his or her action was noticed by the parent. Such responsive touch could also attribute intention to the child's movement and foster the development of joint attention in the tactile modality. Similarly, Reddy (2003) argues that typically developing infants show awareness of the self as an object of the parents' gaze before they develop joint attention skills to objects.

In reciprocal interactions, children with VIAD are active participants, which is the right of every child (United Nations [UN], 1989), including preverbal children. For these children, the most important context for participation is the relationship with their parents, which can be fostered (Våpenstad & Bakkenget, 2021). However, too often, national policies and practices promoting children's participation ignore preverbal children, providing them with little support (Våpenstad & Bakkenget, 2021). Bodily-tactile early intervention provides an opportunity for parents to construct intersubjective understanding (cf. Sorjonen et al., 2021) with their children with VIAD through bodily interactions. It can also be an important foundation for future interventions.

The observations of this study showed that CA-based models and findings on turn-taking and sequence organization have built a knowledge base that can be drawn on in analyzing atypical interactions and detecting subtle changes in them. This knowledge is also valid for evaluating and planning effective interventions. In this study, CA captured the dialogicality of interactions between the participants (Linell, 2009). That is, the CA analysis showed that the communication intervention succeeded in fulfilling the relational intentions of the mothers by helping them develop conversations with their children through the shareable bodily-tactile modality. These findings could have been easily lost using other methods.

4.1. Limitations and future directions

Due to the small number of participants, the results of this study cannot be generalized to other children with VIAD and their mothers. Therefore, replication studies are needed to show the effects of the bodily-tactile early intervention model in a larger group of children with VIAD and their parents. However, it is not easy to find large samples in this population. The effects of this intervention on interactions between children with VIAD and their caretakers in early childhood education should also be studied.

One limitation of this study is that the children's body positions during the play routines were not considered, as the focus was on fulfilling the mothers' intentions to communicate with their children. Future research should pay more attention to the position of the

children with VIAD during play routines to afford them more resources to use touch and movements in reciprocal exchanges (see Fiss et al., 2023). This type of research would be ideal to conduct in collaboration with physiotherapists. The segments of different bodily-tactile play routines could be co-analyzed with the physiotherapists to design routines that match the children's sensory-motor abilities and help them discover new movements. In addition, the bodily-tactile play routines that children with VIAD enjoy and engage in with their bodily actions may enhance their motor learning and hence be useful therapeutic tools for physiotherapists (see Håkstad et al., 2017).

Furthermore, future studies should pay greater attention to movements as resources for participation in young children with VIAD or multiple disabilities. For instance, the children's simultaneous movements during their parents' actions should be investigated in more detail to reveal the potentials and resources for their participation. It should also be investigated whether parents' tactile and bodily responses to their children's movements increase the children's engagement in play routines and the intentionality of their bodily actions. Moreover, it would be important to find out in more detail how the complexity of play routines could be adapted to children's levels of participation.

This study could only reveal changes in the interactional patterns of mother-child dyads. Thus, longitudinal studies are needed to capture the effect of the bodily-tactile early intervention in reciprocal processes over time. For instance, it would be important to study whether children with VIAD learn to perform more play-based movements over time and to investigate how they use these movements during play routines and possibly in other contexts. Finally, studies are needed to explore the potential developmental continuum from movements to gestural expressions in children with VIAD.

5. Conclusions

The CA findings of this study suggest that bodily-tactile early intervention was effective in increasing the reciprocal interactions between the participating children and their mothers. The positive outcomes were related to changes in the mothers' actions. The mothers started using the bodily-tactile modality in early social play routines. Moreover, they began to allow more time and space for their children's participation and waited for bodily responses from their children. When the children engaged in interactions through movements, their mothers responded to their actions as intentional and through the bodily-tactile modality. This created conversation-like sequences in the interactions. Reciprocal interactions are essential for the emotional well-being of mothers and their children with VIAD. Importantly, through active participation, children with VIAD can achieve their full developmental potential.

CRediT authorship contribution statement

Sini Peltokorpi: Writing – original draft, Visualization, Investigation, Formal analysis, Conceptualization, Methodology, Writing – review & editing. **Saara Salo:** Writing – review & editing, Supervision, Conceptualization, Methodology, Investigation. **Paul Hart:** Writing – review & editing, Conceptualization, Methodology, Investigation. **Anne Nafstad:** Writing – review & editing, Conceptualization, Methodology, Formal analysis, Investigation. **Anu Kajamies:** Writing – review & editing, Validation. **Minna Laakso:** Writing – review & editing, Supervision, Conceptualization, Methodology, Investigation, Formal analysis.

Declaration of competing interest

We have no known conflicts of interest to disclose.

Data availability

The data used in this study are confidential.

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Appendix A

Multimodal transcript conventions

The following conventions were developed by Lorenza Mondada (2018, 2022).

* *	Descriptions of embodied actions are delimited between
+ +	two identical symbols (one symbol per participant and per type of action)
	that are synchronized with correspondent stretches of talk or time indications
*--->	The action described continues across subsequent lines
---->*	until the same symbol is reached
>>	The action described begins before the excerpt's beginning
--->>	The action described continues after the excerpt's end
.....	Action's preparation
----	Action's apex is reached and maintained
,,,,,	Action's retraction
the	Participant doing the embodied action is identified in small caps in the margin
fig	The exact moment at which a screen shot has been taken
#	is indicated with a sign (#) showing its position within the turn/a time measure
((sighs))	Transcriber's descriptions

Other

[	Beginning of overlap
]	End of overlap
.hh	Inbreath
(0.5)	A pause and its duration in tenths of seconds
(.)	Micropause (less than 0.2 s)
°yes°	A silently pronounced word
mu:	A stretch (a colon indicates lengthening of a sound)

MOVES THEA'S LEGS	Bodily-tactile actions are described in capital letters.
/Ooksä valmis/	The children's smiling is indicated below their bodily-tactile
/*smiles*---------/	actions, and the corresponding time during their mothers' speech is marked with a slash until the end of the smiling.

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