The Impact of Visual Communication on the Intersubjective Development of Early Parent–Child Interaction With 18- to 24-Month-Old Deaf Toddlers

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This article presents a study that examined the impact of visual communication on the quality of the early interaction between deaf and hearing mothers and fathers and their deaf children aged between 18 and 24 months. Three communication mode groups of parent–deaf child dyads that differed by the use of signing and visual–tactile communication strategies were involved: (a) hearing parents communicating with their deaf child in an auditory/oral way, (b) hearing parents using total communication, and (c) deaf parents using sign language. Based on Loots and colleagues’ intersubjective developmental theory, parent–deaf child interaction was analyzed according to the occurrence of intersubjectivity during free play with a standard set of toys. The data analyses indicated that the use of sign language in a sequential visual way of communication enabled the deaf parents to involve their 18- to 24-month-old deaf infants in symbolic intersubjectivity, whereas hearing parents who hold on to oral-only communication were excluded from involvement in symbolic intersubjectivity with their deaf infants. Hearing parents using total communication were more similar to deaf parents, but they still differed from deaf parents in exchanging and sharing symbolic and linguistic meaning with their deaf child.

Although most researchers emphasize the importance of synchrony, reciprocity, contingency, and joint involvement during parent–infant interactions, studies on early parent–deaf child interaction mostly concentrate on the individual behaviors of caregivers and/or children as the unit of analysis, rather than focusing on the dynamic quality of the interaction itself. Much research has been directed towards identifying the characteristics of hearing and deaf mothers or their deaf infants that affects the nature of their interaction, or the infants’ later development, or both. Apart from some studies that used rating scales to assess the quality of the mother–deaf child dyadic unit as a whole (Lederberg & Mobley, 1991; MacTurk, Meadow-Orlans, Koester, & Spencer, 1990; Meadow-Orlans, 1997; Meadow-Orlans & Steinberg, 1993; Schlesinger & Meadow, 1972; Wedell-Monnig & Lumley, 1980), there are few tools to examine the interactions directly. Because of the difficulties of measuring and operationalizing the dyadic qualities of mother–infant interaction, Koester, Papousek, and Smith-Gray (2000) suggested a concentration on a constellation of maternal and infant behaviors that contribute to the qualities of the dyadic unit as a whole (Koester et al., 2000).

Recently, Loots and colleagues (Loots & Devisé, 2003a; Loots, Devisé, & Sermijn, 2003) have presented an intersubjective developmental theory of the early caregiver–child interaction that focuses primarily on the development of the dyadic interaction between parent and infant instead of focusing on parental and child behaviors separately. The intersubjective developmental theory conceptualizes the quality of the early parent–child interaction in terms of the development of intersubjective interaction sequences between parent and child throughout the child’s first years of life. Loots and Devisé have used this theoretical framework to integrate research findings on the interaction between deaf and hearing mothers and their deaf infants.
The Intersubjective Developmental Theory of Early Caregiver–Child Interaction

Intersubjectivity

Intersubjectivity as the core concept of the developmental theory of early caregiver–child interaction refers to interaction sequences of shared involvement in a reciprocal exchange (Loots et al., 2003, p. 405). This definition is based on the work of Crossley (1996), who noted that intersubjectivity is, in the first place, a relational concept belonging to the interpersonal space, not reducible to the subjective experiences of interaction partners, as stated in most definitions used in developmental psychology, and referring to an awareness of shared attention (Baldwin, 1995; Wells, 1981), shared experience (Raver & Leadbeater, 1995; Stern, 1985; Trevarthen & Hubley, 1978), or a sense of togetherness (Ninio & Snow, 1996). Most definitions used in developmental psychology—even those that conceptualize intersubjectivity as an innate capacity (e.g., Trevarthen & Aitken, 2001)—assume that intersubjectivity requires an awareness of subjectivity, that is, an awareness of individual consciousness and intentionality, and an awareness of subjective states in other persons.

In his philosophical approach to intersubjectivity, Crossley (1996) distinguished between “radical” and “egological” intersubjectivity. Radical intersubjectivity refers to Martin Buber’s “I-thou” relations (1923/1976) and includes an openness to and involvement with the other without seeing oneself and the other as different entities. The actions of the self and the other interlock and engage, each motivated and coordinated by and through an orientation to the other, but without reflective awareness of either oneself or the other. Individuals do not think about their others. They respond to them and are absorbed in a common action. Each action by the one calls forth an action from the other, which calls forth an action from the first, and so on (Crossley, 1996). From this prereflective interpersonal involvement and exchange grow subjective experiences and awareness of the self and the other as different subjects, a process that leads to egological intersubjectivity. Egological intersubjectivity is based on Edmund Husserl’s concept of empathic intentionality (1929/1973). The other is seen as a conscious subject, as someone who feels and sees the world and experiences the one as part of the world. In this way, individuals see the world as seen by others and see themselves as seen by others (Crossley, 1996). According to Crossley, human relations vary between prereflective moments of shared involvement in communication and reflective moments of anticipation, imaging, and empathy. The first refer to radical intersubjectivity, the latter to egological intersubjectivity. This radical–egological duality of human relations and the assumption that egological intersubjectivity develops itself out of radical intersubjectivity are the core of Crossley’s model of intersubjectivity.

Development of Intersubjectivity

Based on the philosophical work of Crossley (1996) and inspired by the interpersonal developmental theory of Stern (1985), the intersubjective developmental theory distinguishes four stages in the development of intersubjectivity, differing according to the kind of parent–infant involvement and the nature of reciprocal exchange. These are described in Table 1. Emerging intersubjectivity (birth to 2 months), the first stage of development, refers to sequences of interaction during the first weeks of life that physically involve mothers and their babies in joined synchronizations of behavior patterns and vitality affects (i.e., feelings elicited by vital processes of life, such as breathing, getting hungry, falling asleep, and emerging out of sleep; changes in motivational states; and tension) (Stern, 1985). By being involved in repetitive and rhythmical interaction routines, the baby is invited to predict and anticipate the mother’s behavior and starts to participate in a more active and reciprocal way. This leads to the second developmental stage of intersubjectivity—physical intersubjectivity (2–8 months). During moments of physical intersubjectivity, parent and infant get involved in a mutual exchange of behavior patterns and vitality affects. It is during those moments of reciprocal interaction routines that, according to the intersubjective developmental theory, infants learn to see themselves and others as intentional actors or subjects. When this occurs, parent and infant get involved in interaction sequences of reciprocal exchange of intentions, feelings, and objects of joint attention that characterize the next
developmental stage of intersubjectivity—existential intersubjectivity (8–13 months). Symbolic intersubjectivity (13 months and more)—the fourth developmental stage of intersubjectivity—refers to interaction sequences of mental involvement in a mutual exchange of linguistic or symbolic meaning. In this stage linguistic symbols are introduced into the interpersonal space between parent and infant, who get increasingly involved in a process of meaning creation and language acquisition, that exceeds the immediate here-and-now context (for a more extensive description of the theory see Loots & Devisé, 2003a; Loots et al., 2003).

The Intersubjective Development of Early Mother–Deaf Child Interaction

On the basis of a review of research findings on the interaction between deaf and hearing mothers and their deaf infants, Loots and Devisé (2003a, p. 31) presented an intersubjective developmental model for early mother–deaf child interaction. The main idea of this model is that the development of symbolic intersubjectivity during the child’s second year of life depends on the degree to which the mother–deaf infant dyad succeeds in establishing sequential visual communication patterns. The adult–child sequential visual communication patterns help deaf and hard-of-hearing infants to sequentially divide their visual attention between objects or events of joint attention and maternal language input, facilitating the transition from existential to symbolic intersubjectivity.

There is quite a lot of empirical evidence that hearing children acquire language more readily when their mothers talk about objects and events on which children are already focusing attention (Akhtar, Dunham, & Dunham, 1991; Dunham & Dunham, 1995; Tomasello, 1988, 1995; Tomasello & Farrar, 1986; Tomasello & Todd, 1983). In contrast to hearing infants, who are usually able to listen to adult speech and simultaneously observe the objects and events to which it refers, deaf infants must shift visual attention back and forth between the environment and their communication partners in order to obtain and connect both sources of information to share meaning and to acquire language. They have to do in sequence what the hearing infant gets simultaneously in a visual–auditory way (Gallaway, 1998; Harris, 2000; Harris, Clibbens, Tibbitts, & Chasin, 1987; Harris & Mohay, 1997; Jamieson, 1994a, 1994b, 1995; Meadow-Orlans, 1997; Mohay, 2000; Mohay, Milton, Hindmarsh, & Ganley, 1998; Swisher, 1991, 1992, 2000; Wood, Wood, Griffiths, & Howarth, 1987).

<table>
<thead>
<tr>
<th>Developmental stage</th>
<th>Age of onset</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emerging intersubjectivity</td>
<td>Birth</td>
<td>Physical involvement in a joined synchronization of behavior patterns and vitality affects</td>
<td>Facing the infant, mother moves her head back and forth towards the infant, the infant looks to mother, opening and closing the mouth at a similar rate as mother’s head movements</td>
</tr>
<tr>
<td>Physical intersubjectivity</td>
<td>2–3 months</td>
<td>Physical involvement in a mutual exchange of behavior patterns and vitality affects</td>
<td>Mother tickles and the infant laughs, mother is ready to tickle again, waiting for a smile, the infant smiles, mother tickles and the infant laughs again, and so on</td>
</tr>
<tr>
<td>Existential intersubjectivity</td>
<td>8–10 months</td>
<td>Concrete and affective involvement in a mutual exchange of intentions, feelings and objects</td>
<td>The infant points to a toy, when looking to mother, mother takes the toy naming it, and gives it to the infant, who gives it back, and so on</td>
</tr>
<tr>
<td>Symbolical intersubjectivity</td>
<td>13–15 months</td>
<td>Mental involvement in a mutual exchange of linguistic or symbolic meaning</td>
<td>The infant points to a doll, when looking to mother, mother takes the doll, saying “Let’s comb her hair”, the infants looks for the comb, gives it to mother, and so on</td>
</tr>
</tbody>
</table>
In hearing mother–deaf infant dyads, the issue of sequentially shifting visual attention seems to restrict the creation of coordinated joint attention and the infusion of symbols in episodes of joint attention (Lederberg & Everhart, 2000; Lederberg & Prezbindowski, 2000; Prezbindowski, Adamson, & Lederberg, 1998; Spencer, 2000). These findings are consistent with data of earlier research comparing hearing mothers and their deaf/hard-of-hearing children to hearing mother–child dyads. Most of these studies indicated communication difficulties in hearing mother–deaf child interactions and pointed to the development of a controlling interaction dynamic from the age of about 18 months on, when language usually starts to play an important role in the mother–child interaction (for reviews see Gallaway & Woll, 1994; Jamieson, 1995; Lederberg & Everhart, 2000; Lederberg & Prezbindowski, 2000; Loots & Devisé, 2003a, 2003b; Meadow-Orlans, 1997, Musselman & Churchill, 1993).

On the other hand, deaf infants from deaf families, observed at 9, 12, and 18 months of age, seemed to spend at least as much time in coordinated joint attention as hearing children and significantly more than deaf children from hearing families (Spencer, 2000; Spencer & Lederberg, 1997). Several authors emphasized the skillfulness of deaf infants from deaf families to shift visual attention periodically between the objects in the environment and their parents by the age of 20 months and stated that this routine of periodic gaze shifting or attention switching facilitated the deaf child’s engagement in interaction sequences of exchanging and creating shared symbolic and linguistic meaning (Harris, Clibbens, Chasin, & Tibbitts, 1989; Jamieson, 1994a, 1994b, 1995; Kyle, Woll, & Ackerman, 1989; Swisher, 1991, 1992, 2000). Furthermore, Koester and colleagues observed differences in visual attention-switching patterns between deaf infants with deaf mothers and deaf infants with hearing mothers at the age of 6 months. They found that 6-month-old infants with deaf, signing mothers alternate their gaze back and forth between mother and the environment more frequently and sustain their gaze to their mother longer than do deaf 6 month olds with hearing mothers (Koester et al., 2000). Spencer, Bodner-Johnson, and Gutfreund (1992) stated that deaf mothers and deaf 12-month-old infants more often attended sequentially to each other and the object of attention, with the mothers as well as the infants orienting themselves alternatively toward the object and the communication partner.

The intersubjective developmental model for early mother–deaf child interaction includes development of deaf mother–deaf child sequential visual communication patterns on the basis of deaf mothers’ early use of different visual–tactile communication strategies (Loots & Devisé, 2003a). Loots and Devisé suggested that the use of different visual–tactile communication strategies from the child’s birth on enables deaf mothers to involve their deaf infants in sequential visual communication patterns that make linguistic information visually accessible and raise communicative interactions to the level of symbolic intersubjectivity. Moreover, hearing mothers, who hold on to a simultaneous auditory–visual way of communication, risk being excluded from involvement in symbolic intersubjectivity with their deaf infants, and the development of the mother–infant interaction is at risk of stagnating in the transition from existential to symbolic intersubjectivity.

The Early Use of Visual–Tactile Communication Strategies by Deaf Mothers

From the beginning of life, deaf mothers of deaf babies seem to depend more on visual, kinetic, and tactile behaviors to elicit sequences of synchronized and reciprocal interaction and to involve their infants into interaction routines than do hearing mothers with hearing and deaf babies (Koester et al., 2000). Usually, reciprocal interaction routines are created because mothers apply intentions to their babies’ behaviors, approaching them as conversation turns (Dunham & Dunham, 1995; Kaye & Charney, 1981; Melzoff & Gopnik, 1993; Messer, 1994; Snow, 1979). Deaf mothers of deaf children assign intentions more to nonverbal behaviors with more pronounced nonverbal reactions, such as more body language, gesture, positive facial expression, and smiling (Erting, Prezioso, & O’Grady Hynes, 1990; Harris, 2001; Koester, 1992, 1995; Koester, Brooks, & Karkowski, 1998; Koester et al., 2000; Maestas y Moores, 1980; Meadow-Orlans,
Compared to hearing mothers, deaf mothers of deaf infants respond more sensitively to the infant’s looks, treating the infant’s eye contact as a request and the infant’s changes in gaze direction as a topic initiation to give a contingent response (Kyle et al., 1989; Prendergast & McCollum, 1996; Spencer & Gutfreund, 1993; Swisher, 2000). Deaf mothers of deaf infants are likely to respect their infants looking away at something else in the surrounding by waiting for the child’s attention without intervening and comment about the child’s immediately preceding attention when he or she looks back at her (Erting et al., 1990; Harris, 2000, 2001; Jamieson, 1994a; Koester et al., 1998; Smith-Gray & Koester, 1995; Spencer & Gutfreund, 1993; Spencer et al., 1992). This sequential timing of language input seems to be an adjustment to the children’s need to get both environmental and linguistic information through the visual channel and increases the likelihood that the expressed intentions are perceived (Swisher, 1991, 1992, 2000).

Deaf mothers also facilitate the immediate connection of linguistic symbols with shared objects and events in the environment by displacing many of their signs so that both sign and nonverbal context can be observed simultaneously (Erting et al., 1990; Harris, 2000; Harris et al., 1987, 1989; Harris & Mohay, 1997; Koester, 1992; Loots & Devisé, 2003a, 2003b; Swisher, 1991; Waxman, Spencer, & Poisson, 1996). In a detailed analyses of the interaction between two deaf mothers with their deaf children at ages 7 and 10 months, Harris et al. (1987) found that two thirds of their signed utterances were presented within the children’s line of vision. This was mainly achieved by the mothers signing within the child’s preexisting focus of attention in such a way that the child could often observe the sign while still attending to the context to which the sign related (Harris et al., 1987). Sign displacement frequently used by deaf mothers during the child’s age period between 7 and 18 months has mainly given way to signing in normal location by the time children are 20 months old (Harris, 2000; Harris et al., 1989; Waxman et al., 1996). Signing in normal location offers the deaf child full access to the syntactical complexity of sign language but requires the child to look at its mother, either spontaneously or in response to a cue, and then to continue looking until the message is complete (Harris & Mohay, 1997).

Besides respecting the infant’s looks and responding contingently to the infant’s visual attention, deaf mothers are very active in the use of overt attention-getting and attention-maintaining strategies, especially from the child’s age of 18 months on (Swisher, 2000). Touching the child, waving the hands, or moving the body into the child’s field of visual attention and attracting and maintaining the child’s visual attention with objects or toys are the strategies that researchers most frequently observed and described (Erting et al., 1990; Harris, 2000, 2001; Harris et al., 1987, 1989; Harris & Mohay, 1997; Jamieson, 1994a, 1994b, 1995; Koester, 1992; Koester et al., 2000; Loots & Devisé, 2003a, 2003b; Maestas y Moores, 1980; Meadow-Orlans, 1997; Mohay et al., 1998; Spencer, 2000; Spencer & Gutfreund, 1993; Spencer et al., 1992; Swisher, 1991, 1992, 2000; Waxman & Spencer, 1997). The nature and intensity of the deaf mothers’ use of those visual–tactile communication strategies change over time, depending on the development of the infant’s communication skills (Harris, 2001; Loots & Devisé, 2003a, 2003b; Swisher, 2000; Waxman & Spencer, 1997; Waxman et al., 1996).

Although hearing mothers appear to intuitively adapt to their deaf infants’ visual communication needs by an increase in the use of visual and tactile communication (Koester et al., 2000; Lederberg & Everhart, 2000; Loots & Devisé, 2003b; Spencer & Lederberg, 1997), their life-long auditory–verbal communicative experiences and habits harden a sensitive tuning to the sequential visual communication needs of their children (Jamieson, 1994a; 1994b; Koester, 1992; Spencer & Gutfreund, 1993; Spencer et al., 1992; Swisher, 1991, 1992; Waxman & Spencer, 1997; Waxman et al., 1996). Many researchers argue that the intuitive visual–tactile communication strategies of deaf mothers should be taught as early as possible to hearing parents (Devisé & Loots, 2003; Harris, 2001; Jamieson, 1994b; Koester, 1992; Lederberg & Everhart, 2000; Meadow-Orlans, 1997; Mohay et al., 1998; Prendergast & McCollum, 1996; Spencer & Gutfreund, 1993; Spencer et al., 1992; Swisher, 1991, 1992; Waxman & Spencer, 1997). Some of these authors have developed training programs to
introduce hearing parents to the use of visually organized communication (Devisé & Loots, 2003; Mohay et al., 1998). Others emphasized the involvement of deaf adults as models of effective sequential visual communication (Jamieson, 1994b; Spencer & Gutfreund, 1993). Other techniques suggested for highlighting the visual communication needs of deaf children are to encourage hearing parents to sign without voice (Swisher, 1991) or to videotape the hearing parent–deaf child in interaction and then play back the tape for the parents without sound (Prendergast & McCollum, 1996).

The Early Use of Sign Language

Besides the use of visual–tactile communication strategies, researchers have emphasized the early use of sign language to engage the child in sequential visual communication patterns. Waxman et al. (1996) found that hearing mothers who were learning and using sign language for communication with their deaf infants seemed to be more sensitive to their infants’ visual needs than were mothers who primarily depended on use of vocal language (Waxman et al., 1996). Spencer (2000) noticed that children (deaf and hearing) with deaf mothers, who used sign language, spent more time watching their mothers than did groups of infants (hearing and deaf) whose mothers were hearing and who were less likely than deaf mothers to produce visual communication. Mothers who signed and gestured more often to their deaf infants had children who engaged more in interaction sequences of coordinated joint attention. Furthermore, Spencer suggested that the longer mean length of coordinated joint attention episodes for deaf children with deaf mothers at 18 months reflected the infants’ incorporation of language and other symbolic communications in those episodes (Spencer, 2000). Swisher (1991) noticed that sign language is simultaneous in its morphology and syntax, which allows information to be transmitted quickly and compactly, in contrast to spoken language that is sequentially strung out in time. Furthermore, sign language is adapted to being seen in peripheral vision at the grammatical level as well as at the lexical level, and the knowledge of sign language grammar offers enough information to recognize the final signs when shifting from gaze to no gaze before the end of a sentence (Swisher, 1991).


Despite the aforementioned detailed descriptions of the use of visually organized communication by deaf mothers, there are hardly any empirical data, to date, that document the effects of the use of visual–tactile communication strategies on the quality of early parent–deaf child interaction. Swisher (2000) found no connection between mothers’ use of attention getting and children’s communicative skills at attention switching and turn taking in her longitudinal study at 9, 12, and 18 months of age of a group of nine deaf mothers with deaf infants who developed good coordinated joint attention. In another longitudinal study at 9, 12, and 18 months of age, Spencer (2000) found only at 18 months a significant association between deaf and hearing mothers’ use of visual and tactile attention-directing signals and deaf infants’ time spent in coordinated joint attention. Furthermore, mothers’ use of signs and/or gestures was also significantly positively related to infants’ coordinated joint attention at 18 months. No significant correlations were found across ages, indicating that no causal relations could be assumed. However, both of those studies were focusing on mothers’ use of visual–tactile communication strategies and infants’ attention behaviors separately, without connecting them in the flow of interaction.

The study presented here was carried out to test empirically the effects of the use of visual–tactile communication—that is, the use of visual–tactile communication strategies and the use of signing—on the intersubjective quality of the interaction between deaf and hearing parents and their deaf children between 18 to 24 months of age. Three groups of parent–deaf child dyads that differed by the use of communication mode were identified. The three groups were those described in Loots and Devisé (2003b): (a) hearing parents (mothers and fathers) communicating with their deaf child in an auditory/oral way (hearing A/O), (b) hearing parents using Signed Dutch (hearing TC), and (c) deaf parents using Flemish Sign Language (deaf FSL). The groups not only differed
by the use of signing but also by the use of visual–tactile communication strategies. Hearing mothers and fathers communicating with their deaf children at 18–24 months in an auditory/oral way used visual–tactile communication strategies significantly less frequently than deaf mothers and fathers who used sign language. The group of hearing mothers and hearing fathers using Signed Dutch with their children used visual–tactile communication strategies more often, but they still differed from deaf mothers and deaf fathers (for a full description of the three groups, see Loots & Deviseé, 2003b).

In the first part of this article, we investigated the relationship between the use of visual–tactile communication and parent–deaf child intersubjectivity by comparing the occurrence of intersubjectivity in the three communication mode groups mentioned above. Based on the aforementioned research, it was hypothesized that moments of symbolic intersubjectivity occur more often in deaf mother–child dyads and deaf father–child dyads than in hearing parent–deaf child dyads (Hypothesis 1). Furthermore, it was hypothesized that hearing mothers and hearing fathers using Signed Dutch get more involved in symbolic intersubjectivity with their deaf children than do hearing A/O parents (Hypothesis 2).

In the second part of the study, we used sequential analyses to examine more exactly the causal connection between parents’ use of visual–tactile communication strategies and the creation of parent–child intersubjectivity for each of the three groups of parent–deaf child dyads. We wondered to what extent parental interaction turns that are characterized by the presence of visual–tactile communication strategies facilitate moments of intersubjectivity, and more specifically moments of symbolic intersubjectivity.

**Method**

**Participants**

The study included 31 parents and 16 deaf/hard-of-hearing children. Participants were recruited in cooperation with four early intervention services spread all over Flanders (Belgium). The group of parents consisted of 4 deaf couples, 11 hearing couples, and 1 unmarried hearing mother. Of the hearing parents, 57% had postsecondary education and all spoke Dutch; 74% communicated in spoken language only; and 26% or three pairs of parents used Signed Dutch. They used signs to support spoken language input to their children most of the time. All deaf couples received vocational training in schools for the deaf and all used Flemish Sign Language (FSL).

As Table 2 shows, all children had a hearing loss of more than 40 dB averaged across the speech frequencies (500, 1,000, and 2,000 Hz), with 88% of the children

| Table 2  | Mean hearing levels (dB) and mean ages (months), standard deviations, and statistical comparisons (Kruskal–Wallis test/Mann–Whitney U test) for the children of the three communication mode groups |
|-----------------|---------------------------------|-----------------|-----------------|-----------------|-----------------|
| Hearing level without hearing aids | Hearing A/O | TC | Deaf FSL | Statistical comparison |
| Mean (SD) | 85 (23.19) | 115 (5.00) | 97 (19.98) | Kruskal–Wallis test: |
| Minimum–maximum | 52–120 | 110–120 | 75–120 | $H = 3.08, df = 2, p = .214 = ns$ |
| Hearing level with hearing aids | Hearing A/O | TC | Deaf FSL | Statistical comparison |
| Mean (SD) | 50 (30.73) | 80 (0.00) | 76 (29.63) | Kruskal–Wallis test: |
| Age of diagnosis | Hearing A/O | TC | Deaf FSL | Statistical comparison |
| Mean (SD) | 9 (4.21) | 13 (5.03) | 3 (4.00) | Kruskal–Wallis test: |
| Minimum–maximum | 3–18 | 8–18 | 1–9 | $H = 6.30, df = 2, p = .043 < .05$ |
| Age at start of early intervention | Hearing A/O | TC | Deaf FSL | Statistical comparison |
| Mean (SD) | 11 (4.72) | 15 (5.57) | 7 (1.73) | Kruskal–Wallis test: |
| Minimum–maximum | 4–20 | 9–20 | 6–9 | $H = 4.24, df = 2, p = .120 = ns$ |

*Note. Hearing A/O = hearing parents (mothers and fathers) communicating with their deaf child in an auditory/oral way; hearing TC = hearing parents using Signed Dutch; deaf FSL = and deaf parents using Flemish Sign Language. *p < .05.
exhibiting severe to profound hearing losses. The ages of the children ranged from 18 to 29 months ($M = 21.8$, $SD = 3.04$). The group consisted of 11 boys (69%) and 5 girls (31%). The children did not have any additional impairment, except for one child. She had cerebral palsy (moderate hemiplegia). Children of hearing A/O parents were diagnosed as deaf/hard-of-hearing at a mean age of 9 months ($SD = 4.21$), children of hearing TC parents were diagnosed at a mean age of 13 months ($SD = 5.03$), and children of deaf parents were diagnosed at a mean age of 3 ($SD = 4.00$) months. The age of diagnosis was the only significant difference among the three communication mode groups due to a significant difference between the hearing A/O communication group and the deaf FSL group ($U = 4, p = .034$, Mann–Whitney $U$ test). However, children of deaf parents involved in the study were diagnosed at earlier ages and also got early intervention services at earlier ages than children of hearing parents. For the children of hearing parents, early intervention services started at about 11 months of age ($M = 10.9$ months, $SD = 4.8$), compared to 7 months for the children of deaf parents. The early intervention programs for the children of deaf parents mainly included infant-directed auditory training and speech therapy a few times a week. In addition, compared to hearing parents, deaf parents got more opportunities to provide their children with access to language by offering FSL from the child’s birth. Those differences have to be considered in interpreting the results.

Procedure

Data collection. Each mother–infant and father–infant dyad was videotaped during 24 min of free play in a semistructured setting, including play with a standard set of toys (colored building blocks, Fisher Price farm, a doll with eating and bathing set) during the last 8 min. Parents were asked to play with their infant as they would usually do. Most videotaping was conducted in the homes. On a few occasions, taping occurred in the early intervention centers to suit the maximum comfort of the parents.

Data coding. The Computer Acquisition of Multiple Ethological Records and Analysis coding system of Van der Vlugt, Kruk, Geuze, and Bertels (1994) was used to analyze the videotapes of the middle 5 min of free play with the standard set of toys according to a sequential event-sampling procedure. The coding procedure is presented fully elsewhere (Loots & Devisé, 2003b) and so will be only briefly summarized here. All initiations and responses of both parent and infant were registered as labels on the videos. Initiations were defined as interaction turns (i.e., a sequence of one or more behaviors directed to another person and followed by a pause of 1 s or more) intended to influence the attention and/or behavior of the other one and to elicit a reaction. Initiations were not preceded by either an interaction turn of the other person or a reaction to a preceding interaction turn of the other person. Responses were defined as one or more changes in attention or behavior as a reaction to an interaction turn of the other person.

Then, the parental initiations and responses labeled on the videos were coded according to the absence or presence of the nine visual–tactile communication strategies described by Loots and Devisé (2003b) (Table 3).

The interrater reliability coefficient was .82 (Cohen’s $\kappa$) for both the registration of parental interaction turns and the registration of infants’ interaction turns. For the coding of the visual–tactile communication strategies, the interrater reliability coefficient was above .90 (Cohen’s $\kappa$).

Intersubjectivity. Loots et al. (2003) defined intersubjectivity as an interaction state of shared involvement in a reciprocal exchange. Shared involvement refers to simultaneous looking or simultaneously focusing on the same aspect of the environment at the same time (Baldwin, 1995; Butterworth, 1991, 1995; Sigman & Kasari, 1995; Tomasello, 1995). Reciprocal exchange refers to an active and mutually responsive involvement of both interaction partners, physically in coordinated behavior patterns and vitality affects, existentially in the sharing of intentions, feelings, and objects of joint attention, or symbolically in the creation of linguistic and symbolic meaning.

In accordance with the previous definition of intersubjectivity, we defined a moment of intersubjectivity as a sequence of interaction turns that succeeds an initiation of the parent or the infant and that meets the next three terms:
1. The interaction moment consists of four or more consecutive interaction turns between parent (P) and infant (I). One member of the dyad directs an interaction behavior toward the other, and the second member responds with a related interactive behavior within a time span of 5 s, and so on (e.g., at least PI, IP, PI, IP, or vice versa). This condition corresponds to the definition of complex interaction bouts (e.g., Lyon, 1985; Meadow, Greenberg, Erting, & Carmichael, 1981).

2. The interaction moment is characterized by topic continuity. The topic of each interaction turn is referred to in any part of the prior turn (Hoff-Ginsberg, 1987), for example:

   Child: Shows horse to mother
   Mother: “A horse,” shows trough
   Child: Puts head of the horse in the trough
   Mother: “The horse is hungry,” takes cow “The cow is hungry too”
   Child: Points to cow “Milk.”

3. Behavior and/or attention focus of both parent and infant keep on being directed to the same activity, object, or event, with no interruption of 1 s or more (Baldwin, 1995; Butterworth, 1991, 1995, Sigman & Kasari, 1995; Tomasello, 1995).

   To record the moments of intersubjectivity, the initiating turns of parents and infants labeled on the videos were used as points of entry in the behavior streams of parent–child interactions (Raver, 1996). For the purpose of this study, moments of intersubjectivity were coded according to the number of interaction turns and according to nonsymbolic (physical or existential) intersubjectivity versus symbolic intersubjectivity. Moments of intersubjectivity were coded as symbolic, when the infants used words and/or signs/referential gestures or when the infants responded adequately to the words and/or signs used by the parents, at least one time during the moment of intersubjectivity (see Table 1 for an example). As linguistic symbols, words and signs/referential gestures denote a precise referent. In other words, they have a semantic content (meaning) that does not change depending on the context (Caselli, 1990, p. 57). Moments of intersubjectivity were coded as symbolic only when the infant clearly used the semantic content of the linguistic symbol or responded to it.
Otherwise, the moment of intersubjectivity was coded as physical/existential (see Table 1 for examples).

Finally, all parental initiations and responses labeled on the videos were coded according to the following three categories: (a) interaction turns that are not followed by interaction behavior that is part of a moment of intersubjectivity, (b) interaction turns that initiate or continue moments of physical/existential intersubjectivity, and (c) interaction turns that initiate or continue moments of symbolic intersubjectivity. The set of categories was mutually exclusive and exhaustive.

**Interrater reliability.** Two coders, the first and second author, recorded and coded the moments of intersubjectivity. Both of them were involved in early intervention programs for deaf children for several years and are familiar with FSL. After 8 hr of training, three (10%) tapes were coded independently by both coders. Average interobserver agreement for the registration of the moments of intersubjectivity was 96%. The interrater reliability coefficient for the coding of the moments of intersubjectivity was 1.00 (Cohen’s $\kappa$). The interrater agreement for the number of interaction turns per moment of intersubjectivity ranged from 75% to 100%. Low percentages of agreement were due to a lack of clarity about including a nonresponded initiation at the end of an intersubjectivity moment. Therefore, it was agreed to include these interaction turns as part of the moments of intersubjectivity. The average interrater reliability coefficient for the coding of parental initiations and responses according to the three categories of intersubjectivity was .88 (Cohen’s $\kappa$).

**Results**

**Visual–Tactile Communication and Intersubjectivity**

To express in what degree parent–infant dyads got involved in moments of intersubjectivity, we computed for each dyad an intersubjectivity index (ISI). The ISI is the multiplication of the number of moments of intersubjectivity by the mean length of those intersubjectivity moments (mean number of interaction turns per moment of intersubjectivity). Table 4 compares the mean number and the mean length of moments of intersubjectivity and the mean ISI among the three communication mode groups for mother–infant dyads and father–infant dyads. Mother–infant dyads and father–infant dyads were analyzed separately to meet the independence assumption for observations, which underlies all statistical tests, parametric or nonparametric. The mean number of moments of symbolic intersubjectivity was used to compare in what degree each of the three groups of mother–infant dyads and father–infant dyads got involved in symbolic intersubjectivity.

As Table 4 shows, the mean ISI scores differ significantly among the three communication groups for both mother–infant dyads ($H = 6.58, df = 2, p = .035$) and father–infant dyads ($H = 9.79, df = 2, p = .007$). Post hoc comparisons show a significant difference between the group of hearing mothers communicating in an auditory/oral way (hearing A/O) and the group of hearing mothers using Signed Dutch (hearing TC) ($U = 1, p = .018$, Mann–Whitney $U$ test). This difference in ISI scores is based on a significant difference in the amount of intersubjectivity moments between both groups of hearing mothers ($U = 1, p = .018$). Hearing A/O mothers seem to be less easily involved in moments of intersubjectivity with their deaf infants than do hearing TC mothers. Also, hearing A/O fathers are less easily involved in intersubjectivity with their deaf infants than hearing TC fathers (ISI: $U = 0, p = .012$) and deaf FSL fathers (ISI: $U = 1, p = .008$), mainly due to differences in the amount of intersubjectivity moments. No differences were found in the degree of involvement in moments of intersubjectivity between hearing TC parents and deaf FSL parents.

Deaf FSL mother–infant dyads are significantly more involved in moments of symbolic intersubjectivity than both hearing A/O mother–deaf infant dyads ($U = 0, p = .002$) and hearing TC mother–deaf infant dyads ($U = 0, p = .029$). Furthermore, deaf FSL father–infant dyads also differ from hearing A/O father–deaf infant dyads ($U = 1, p = .004$) and hearing TC father–deaf infant dyads ($U = 1, p = .057$) in creating moments of symbolic intersubjectivity. Table 4 seems to indicate that hearing A/O mothers and fathers are rarely involved in moments of symbolic intersubjectivity with their 18- to 24-month-old deaf children, in contrast to deaf FSL mothers and fathers,
but seemingly not in contrast to hearing TC mothers ($U = 6.5, p = .105$) and hearing TC fathers ($U = 4.5, p = .066$). Due to fewer cases, it can be possible that the power of the Mann–Whitney $U$ test is insufficient to generate significance.

### Visual–Tactile Communication Strategies, Communication Mode, and Intersubjectivity

To study the impact of visual–tactile communication strategies on the creation of parent–infant intersubjectivity, parental initiations and responses were cross-classified according to both coding dimensions: (a) the absence or presence of visual–tactile communication strategies and (b) the three categories of intersubjectivity classifying the interaction behavior immediately following the parental interaction turn. Cross-classified data were represented in a $3 \times 2$ contingency table and described in terms of simple and transitive probabilities for each parent–deaf infant dyad (Bakeman & Gottman, 1997). For several parent–deaf infant dyads, the distribution of parental interaction turns among the possible codes resulted in insufficient tallies for various codes to conduct reliable statistics. As suggested by Bakeman and Gottman, data were pooled across all dyads to increase the reliability of the statistics.
The pooling of data over dyads resulted in a four-dimensional $3 \times 3 \times 2 \times 3$ table—intersubjectivity (I, categorized as interaction turn followed by no intersubjectivity, physical/existential, or symbolic intersubjectivity) by visual–tactile strategies (V, categorized as absence or presence of visual–tactile communication strategies) by communication mode (M, categorized as hearing A/O, hearing TC, or deaf FSL) by gender (G, categorized as mother or father) contingency table. Intersubjectivity (I) is considered as the outcome variable and visual–tactile strategies (V) as the predictor variable of most interest. Because the absence or presence of visual–tactile communication strategies immediately precedes intersubjectivity states, we expect a first-order Markov or lag-1 model (Gottman & Roy, 1990) based on the assumption that the presence of visual–tactile communication strategies facilitates the initiation or continuity of intersubjectivity. Communication mode (M) and gender (G) are considered as conditional or interactive variables, which possibly influence the first-order Markov or [IV] model.

The data are analyzed using the hierarchical log-linear modeling procedure suggested by Bakeman and Robinson (1994). The major goal of this log-linear analysis is to identify the simplest model (i.e., the model with the fewest terms) that generates expected frequencies not too discrepant from the observed ones, as assessed with a likelihood-ratio $\chi^2$ or $G^2$ goodness-of-fit test (Bakeman & Robinson, 1994; Gottman & Roy, 1990). This is done by eliminating terms step by step, beginning with the highest order term [IVMG] of the saturated model and ends with the base model [I] [V] [M] [G] or model of independence, which assumes that the four variables are not related (see Table 5). The difference between the $G^2$ values computed for two successive models in the hierarchical series—or partial $G^2$ ($\chi^2$ or $G^2$ goodness-of-fit test (Bakeman & Robinson, 1994; Gottman & Roy, 1990). This is done by eliminating terms step by step, beginning with the highest order term [IVMG] of the saturated model and ends with the base model [I] [V] [M] [G] or model of independence, which assumes that the four variables are not related (see Table 5). The difference between the $G^2$ values computed for two successive models in the hierarchical series—or partial $G^2$ ($\chi^2$ or $G^2$)—is used to test the statistical significance of the removed terms. Due to the large sample size ($N = 1,226$), even small changes in $G^2$ that occur when a term or terms are removed are significant. Therefore, we also present $Q^2$ and $\chi^2$ to indicate the amount of variability accounted for by the model ($Q^2$) or by the deleted term or terms ($\chi^2$). The $Q^2$ and $\chi^2$ are used as statistics to assess log-linear effect size. Although not directly comparable, $Q^2$ can be interpreted as an $R^2$ analog used in multiple

### Table 5  Hierarchical series of models for the $I \times V \times M \times G$ four-factor table

| Step | Model | $Q^2$ | $\chi Q^2$ | $G^2$ | df | Terms deleted | $\chi^2$ | $\chi df$
<table>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>[IVMG]</td>
<td>1.00</td>
<td>0.0</td>
<td>0</td>
<td></td>
<td>0</td>
<td>1.00</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>[IV] [IVG] [IMG] [VMG]</td>
<td>0.98</td>
<td>0.02</td>
<td>6.9</td>
<td>4</td>
<td>IVMG</td>
<td>6.9</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>[IV] [IMG] [VMG] [VG] [MG]</td>
<td>0.96</td>
<td>0.03</td>
<td>16.6</td>
<td>16</td>
<td>IVMG IMG VMG VG [MG]</td>
<td>9.7</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>[I] [V] [M] [G]</td>
<td>0.01</td>
<td>0.95</td>
<td>373.4***</td>
<td>29</td>
<td>IV IM IG VM VG [MG]</td>
<td>356.8***</td>
<td>13</td>
</tr>
</tbody>
</table>

#### Determining the appropriate level

| Step | Model | $Q^2$ | $\chi Q^2$ | $G^2$ | df | Terms deleted | $\chi^2$ | $\chi df$
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.96</td>
<td>0.0</td>
<td>16.6</td>
<td>16</td>
<td>0</td>
<td>0.02 6.9 4</td>
<td>IVMG</td>
</tr>
<tr>
<td>6</td>
<td>[IV] [IMG] [VMG] [VG] [MG]</td>
<td>0.88</td>
<td>0.08</td>
<td>46.3***</td>
<td>18</td>
<td>IV</td>
<td>29.7*** 2</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.36</td>
<td>0.52</td>
<td>241.7***</td>
<td>22</td>
<td>IM</td>
<td>195.4*** 4</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.36</td>
<td>0.00</td>
<td>242.4***</td>
<td>24</td>
<td>IG</td>
<td>0.7 2</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.04</td>
<td>0.32</td>
<td>362.5***</td>
<td>26</td>
<td>VM</td>
<td>120.1*** 2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.01</td>
<td>0.02</td>
<td>371.5***</td>
<td>27</td>
<td>VG</td>
<td>9.0** 1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.01</td>
<td>0.00</td>
<td>373.4***</td>
<td>29</td>
<td>MG</td>
<td>1.9 2</td>
<td></td>
</tr>
</tbody>
</table>

#### Deleting the two-way terms

| Step | Model | $Q^2$ | $\chi Q^2$ | $G^2$ | df | Terms deleted | $\chi^2$ | $\chi df$
<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>12</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.96</td>
<td>0.0</td>
<td>16.6</td>
<td>16</td>
<td>0</td>
<td>0.02 6.9 4</td>
<td>IVMG</td>
</tr>
<tr>
<td>13</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.92</td>
<td>0.04</td>
<td>30.1</td>
<td>22</td>
<td>IG VG MG G</td>
<td>13.5* 6</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.84</td>
<td>0.08</td>
<td>59.5***</td>
<td>24</td>
<td>IV</td>
<td>29.4*** 2</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.32</td>
<td>0.52</td>
<td>255.2***</td>
<td>28</td>
<td>IM</td>
<td>195.7*** 4</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.00</td>
<td>0.32</td>
<td>375.9***</td>
<td>30</td>
<td>VM</td>
<td>120.7*** 2</td>
<td></td>
</tr>
</tbody>
</table>

#### Deleting G term before two-way terms

| Step | Model | $Q^2$ | $\chi Q^2$ | $G^2$ | df | Terms deleted | $\chi^2$ | $\chi df$
<table>
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</thead>
<tbody>
<tr>
<td>17</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.96</td>
<td>0.0</td>
<td>16.6</td>
<td>16</td>
<td>0</td>
<td>0.02 6.9 4</td>
<td>IVMG</td>
</tr>
<tr>
<td>18</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.92</td>
<td>0.04</td>
<td>30.1</td>
<td>22</td>
<td>IG VG MG</td>
<td>13.5* 6</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.84</td>
<td>0.08</td>
<td>59.5***</td>
<td>24</td>
<td>IV</td>
<td>29.4*** 2</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.32</td>
<td>0.52</td>
<td>255.2***</td>
<td>28</td>
<td>IM</td>
<td>195.7*** 4</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>[IV] [IMG] [VMG]</td>
<td>0.00</td>
<td>0.32</td>
<td>375.9***</td>
<td>30</td>
<td>VM</td>
<td>120.7*** 2</td>
<td></td>
</tr>
</tbody>
</table>

Note. I, V, M, and G represent intersubjectivity, visual–tactile communication strategies, communication mode, and gender, respectively; $\chi Q^2$, $\chi^2$, and $\chi df$ represent changes in $Q^2$, $G^2$, and $\chi df$ when terms are deleted.

* $p < .05$. ** $p < .01$. *** $p < .001$. 

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regression and ANOVA (Bakeman & Robinson, 1994; Knoke & Burke, 1980).

In the first four steps of Table 5, all terms of the same order are removed level by level. This preliminary analysis suggests that the simplest model fitting the observed data will contain some two-way terms. Removal of the four-way term (Step 2) and all three-way terms (Step 3) causes no significant deterioration in fit. The model consisting of all two-way terms fits reasonably well \( G^2(16) = 16.6, ns \), but the model consisting of all one-way terms clearly does not \( G^2(29) = 373.4, p < .001 \). These results suggest that the effect of visual communication strategies on the creation of intersubjectivity is neither influenced by parents’ communication mode nor by gender. The two-way terms contributing significantly to the model that fits the observed data are presented in Steps 5 to 11. Removal of the IV term (Step 6) causes a significant deterioration in fit \( \chi^2(2) = 29.7, p < .001 \). There seems to be a first-order or lag-1 relationship between the use of visual–tactile communication strategies and the occurrence of intersubjectivity. However, the effect of visual communication strategies carries considerably less weight (\( \chi^2 Q^2 = .08 \)) than the effect of the term IM (\( \chi^2 Q^2 = .52 \)). When the term IM is removed, \( G^2 \) increases 52% (relative to the base model). Also the term VM contributes significantly and strongly to the model that fits the data \( \chi^2 G^2(2) = 120.1, p < .001; \chi^2 Q^2 = .32 \). Communication mode seems to be the most important variable that affects both the occurrence of intersubjectivity and the use of visual–tactile communication strategies but does not seem to affect the relationship between both terms. All terms involving G (e.g., IG, VG, MG) are too weak to be included in the final model. When G is removed (Step 13), the \( Q^2 \) associated with the [IV] [IM] [VM] model is .92, and may be regarded as providing a satisfactory fit to the data (Bakeman & Robinson, 1994; Knoke & Burke, 1980). The findings seem to be similar for mothers and fathers.

A post hoc analysis of the data first of all focuses on the impact of communication mode on both the occurrence of intersubjectivity and the use of visual–tactile communication strategies. A comparison of the observed data with the [I] [M] independence model \( G^2(4) = 195.7, p < .001 \) generates standardized residuals greater than 2.0 for six of the nine cells of the \( 3 \times 3 \) (I \( \times \) M) table. In the hearing A/O group, 84% of the interaction turns are not followed by intersubjectivity, which is significantly more than expected \( (s = 3.37) \); 13% of the interaction turns are followed by physical/existential intersubjectivity, and only 3% of the turns precede interaction behavior that is part of symbolic intersubjectivity \( (s = 6.69) \). The hearing TC group has significantly more interaction turns followed by physical/existential intersubjectivity than expected \( (s = 4.97) \); 28% of the turns precede physical/existential intersubjectivity and 11% precedes symbolic intersubjectivity. In the deaf FSL group, 33% of the parental interaction turns are followed by symbolic intersubjectivity \( (s = 10.80) \), and 11% by physical/existential intersubjectivity.

In sum, the hearing A/O group is characterized by the use of significantly more interaction turns that are not followed by intersubjectivity. The hearing TC group is characterized by interaction turns that precede physical/existential intersubjectivity, and the deaf FSL group is characterized by significantly more turns that initiate or continue symbolic intersubjectivity.

A comparison of the observed data with the [V] [M] independence model \( G^2(2) = 120.7, p < .001 \) shows significantly more interaction turns without the use of visual–tactile communication strategies than expected \( (s = 4.68) \) in the hearing A/O group and significantly more interaction turns characterized by the use of visual–tactile communication strategies in the deaf FSL group \( (s = 5.45) \). In the hearing A/O group, 48% of the interaction turns were characterized by the use of visual–tactile communication strategies versus 84% in the deaf FSL group.

Taking into account the strong effects of communication mode, Table 6 does show the impact of visual–tactile communication strategies on the occurrence of intersubjectivity for each of the three communication mode groups separately, although the hierarchical log-linear modeling procedure has not suggested any influence of parents’ communication mode.

Beyond the similar patterns of cell frequencies for each of the three communication mode groups, we notice a difference between the group of deaf parents and both groups of hearing parents. Due to the
The high frequency of interaction turns characterized by the use of visual–tactile communication strategies (84%) in the deaf FSL group, it is not possible to determine the effect of visual–tactile communication on the creation of intersubjectivity. Other variables seem to play an important role here. For both hearing groups, Table 6 shows that interaction turns without any visual–tactile communication strategy are more frequently followed by no intersubjectivity (hearing A/O: $z = 4.00$; hearing TC: $z = 3.33$) than expected in comparison with the zero-order Markov model or [I] [V] model. On the other hand, interaction turns characterized by the use of visual–tactile communication strategies precede more frequently physical/existential intersubjectivity (hearing A/O: $z = 4.13$; hearing TC: $z = 3.16$) but not symbolic intersubjectivity (hearing A/O: $z = 0.41$; hearing TC: $z = 0.66$). Visual–tactile communication strategies seem to facilitate moments of physical/existential intersubjectivity but not symbolic intersubjectivity in both hearing groups. However, this specific function of facilitating nonsymbolic intersubjectivity is not observed in the group of deaf parents who use sign language and visual–tactile communication strategies nearly all the time and communicate more often on a symbolic intersubjectivity level.

**Discussion**

The purpose of this article was to examine the impact of the use of visually organized communication on the intersubjective quality of the early interaction between deaf and hearing parents and their deaf children. More specific, the study aimed to verify the hypothesis that the use of visual–tactile communication—that is characterized by the use of visual–tactile communication strategies and signing—enables deaf and hearing parents to involve their 18- to 24-month-old deaf infants in symbolic intersubjectivity, in contrast to parents who hold on to an auditory/oral way of communication. It has been hypothesized that hearing parents using a simultaneous auditory/oral way of communication...
more likely are hardly ever involved in symbolic intersubjectivity with their deaf infants, and the development of the parent–infant interaction seems to stagnate in the transition from existential to symbolic intersubjectivity (Loots & Devisé, 2003a).

Both data analyses presented in this study confirm the impact of visual–tactile communication on the intersubjective quality of early parent–deaf child interaction and seem to offer empirical evidence to accept the preceding hypothesis provisionally. As yet, comparative data among the three communication mode groups of parent–deaf infant dyads involved in the study indicate that deaf parents who use sign language and visual–tactile communication strategies nearly all the time are significantly more involved in moments of symbolic intersubjectivity with their deaf infants than are the hearing parents using total communication and those using oral-only communication. These findings are consistent with earlier studies comparing the communicative behavior of deaf mothers and their deaf infants with that of hearing mothers and their deaf infants (e.g., Harris, 2000, 2001; Harris & Mohay, 1997; Jamieson, 1994a, 1994b, 1995; Koester et al., 2000; Meadow et al., 1981; Meadow-Orlans, 1997; Prendergast & McCollum, 1996; Spencer, 2000; Spencer & Gutfreund, 1993; Spencer & Lederberg, 1997; Spencer & Meadow-Orlans, 1996; Spencer et al., 1992; Swisher, 1991; Waxman & Spencer, 1997; Waxman et al., 1996).

In contrast to deaf parents, hearing parents communicating in an auditory/oral way are hardly involved in moments of symbolic intersubjectivity with their deaf infants. The results of this study confirm that hearing parents using oral-only communication with their deaf 18- to 24-month-old infants risk being excluded from interaction sequences of exchanging and creating shared symbolic and linguistic meaning. Consistent with the findings of Prendergast and McCollum (1996), it is assumed that a simultaneous visual–auditory way of communication in spoken language is unlikely to serve as an invitation to communication for an infant who is deaf and who is involved in toy play. This mode of communication seems to be less available to facilitate the development of symbolic intersubjectivity. Furthermore, hearing parents using oral-only communication are significantly less easily involved in moments of intersubjectivity than hearing parents using total communication. The use of total communication by hearing parents seems to be associated with the same amount of intersubjectivity as that between deaf parents and their deaf infants. However, the increase in intersubjectivity is not accompanied by a similar increase in symbolic intersubjectivity. Compared to the use of sign language by deaf parent–deaf infant dyads, total communication does nearly enhance the creation and exchange of shared symbolic and linguistic meaning. The comparatively poor performance on symbolic intersubjectivity of the hearing parent–deaf infant dyads using total communication might be seen as reinforcement for previous investigators’ pronouncements on the importance of the early use of sign language to engage deaf infants in sequential visual communication patterns and enhance communicative interaction to the level of conversation (Harris & Mohay, 1997; Spencer, 2000; Swisher, 1991; Waxman et al., 1996).

Data from the hierarchical log-linear modeling procedure presented in the second part of this study confirm the former findings of the comparative analysis. The communication mode of the parents seems to be the most important factor that significantly affects the occurrence of intersubjectivity in a direct as well as indirect way. When playing with their deaf infants, about 84% of the initiations and responses of the group of hearing parents using auditory/oral communication are not followed by intersubjectivity. About 13% of the interaction turns initiate or continue physical/existential intersubjectivity and only 3% of the turns precede interaction behavior that is part of symbolic intersubjectivity. In the group of hearing parents using total communication, 28% of the parents’ initiations and responses are followed by physical/existential intersubjectivity and 11% precede symbolic intersubjectivity. As a group, deaf parents are characterized by significantly more turns (33%) that initiate or continue symbolic intersubjectivity.

Further, the communication mode of the parents also indirectly affects the occurrence of intersubjectivity by its effect on the parent’s use of visual–tactile communication strategies. The results of the log-linear analysis indicate a significant and strong relation between the communication mode of the parents and
the use of visual–tactile communication strategies. The group of hearing parents using signs in communication with their deaf infants contains more interaction turns characterized by visual–tactile communication strategies than the group of hearing parents communicating in an auditory/oral way (respectively, 63% vs. 48%). The results seem to confirm that the use of signs by hearing parents is associated with more sensitivity to a sequential visual communication style as suggested by Loots and Devisé (2003b). In the group of deaf parents, 84% of the interaction turns contain one or more visual–tactile communication strategies. This finding is consistent with earlier studies and emphasizes that deaf parents not only own sign language, but also own a sequential visual communication style to organize early parent–child interaction in a typical nonauditory way (Gallaway, 1998; Harris et al., 1987, 1989; Jamieson, 1995; Koester, 1992; Koester et al., 1998, 2000; Kyle et al., 1989; Loots & Devisé, 2003a, 2003b; Mohay, 2000; Spencer, 2000; Swisher, 1991, 1992, 2000).

A sequential analysis examining the impact of parents’ use of visual–tactile communication strategies on the creation of intersubjectivity, and more specifically on the creation of symbolic intersubjectivity, indicates no immediate sequential relation between both variables in the group of deaf parents. Deaf parents’ interaction turns with and without visual–tactile communication strategies are equally followed by physical/existential intersubjectivity (respectively, 11% vs. 9%) and symbolic intersubjectivity (respectively, 33% vs. 28%). Due to the high frequency of interaction turns characterized by the use of visual–tactile communication strategies, other variables seem to influence the incidence of moments of intersubjectivity. Harris (2001) found that deaf mothers were mainly relying on their deaf children turning to look at them to see what they were signing, by the time that the children were about 18 months old. Visible and context salience signing was almost always achieved as a result of the child turning to look at the mother spontaneously or was elicited. Also, other authors emphasized that periodic gaze shifting and sustained looking facilitated the deaf child’s engagement in interaction sequences of exchanging and creating shared symbolic and linguistic meaning (Jamieson, 1994a, 1994b, 1995; Kyle et al., 1989; Swisher, 1991, 1992, 2000). Possibly, once the attention-switching strategy and sustained looking are developed, the deaf child’s spontaneous and active use of visual attention becomes more important in initiating and continuing moments of intersubjectivity than the continuous use of visual–tactile communication strategies.

On the other hand, a first-order sequential effect of the use of visual–tactile communication strategies on the creation of moments of physical/existential intersubjectivity is found in both communication mode groups of hearing parent–deaf infant dyads. The use of visual–tactile communication strategies by hearing parents seems to facilitate parent–deaf infant involvement in moments of reciprocal exchange of intentions, feelings, and objects of joint attention in a direct, concrete, and nonsymbolic way. However, an immediate sequential impact of visual–tactile communication strategies on the creation of symbolic intersubjectivity—as assumed in the aforementioned hypothesis—has not been found. Visual–tactile communication strategies seem to have no immediate sequential impact on hearing parent–deaf infant involvement in interaction sequences of mutual exchange of linguistic or symbolic meaning. The data of the sequential analysis suggest that the creation of symbolic intersubjectivity is not so much based on the use of visual–tactile communication strategies but is based much more on the use of sign language in a sequential visual–tactile communication context.

This finding puts into perspective the seemingly overstressed importance of the use of visual–tactile communication strategies as suggested in some training programs for hearing parents of deaf children (e.g., Devisé & Loots, 2003; Mohay, 2000; Mohay et al., 1998). These programs promote the use of visual–tactile communication strategies irrespective of the mode of communication hearing parents choose. However, the results of this study suggest that the use of visual–tactile communication strategies has a specific impact on the development of intersubjectivity. Visual–tactile communication strategies seem to facilitate the creation of a shared interpersonal space in which language can be introduced in a visually accessible way, but the use of sign language seems to be necessary to ensure the development of symbolic intersubjectivity.
during the second year of life. Such information may be relevant to early intervention practices.

First, the results of this study emphasize the importance of teaching hearing parents the use of visual–tactile communication strategies as early as possible in order to facilitate the early development of physical and existential intersubjectivity. According to the intersubjective developmental theory, moments of physical and existential intersubjectivity offer the interpersonal space between parents and infants to introduce, create, and share linguistic and symbolic meaning during the child's second year of life. Next, the study also stresses the importance of teaching hearing parents sign language or, more exactly, of teaching hearing parents the use of sign language in a sequential visual–tactile way. For, more than auroral oral communication, the early use of sign language seems to facilitate parents and their deaf infants to be involved in the process of meaning creation and language acquisition, which characterizes the development of symbolic intersubjectivity. On the one side, symbolic intersubjectivity leads to language acquisition, whereas on the other side, symbolic intersubjectivity is expanded by language (Loots & Devise, 2003a; Devise & Loots, 2003a; Ninio & Snow, 1996; Wells, 1981).

However, we have to be cautious in offering the aforementioned suggestions for early intervention practices based on the results of this study. As indicated earlier, children of deaf parents involved in the study were diagnosed at earlier ages and also got intervention services at earlier ages than children of hearing parents. These differences may have biased research findings (e.g., Yoshinaga-Itano, 2003). Furthermore, the use of communication mode corresponds to parental hearing status in this study. All parents who used FSL were born deaf or were deaf from early childhood. In contrast to hearing parents, these deaf parents had extensive life-long experience in organizing communication in a visual–tactile way. Not only communication mode but also parental hearing status may have influenced the development of symbolic intersubjectivity. Longitudinal research on larger samples is needed to verify more exactly the impact of communication mode and language use (spoken versus sign language) on the intersubjective development of early parent–deaf child interaction.

References


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