# ESTABLISHMENT OF JOINT ATTENTION IN DYADS INVOLVING HEARING MOTHERS OF DEAF AND HEARING CHILDREN, AND ITS RELATION TO ADAPTIVE SOCIAL BEHAVIOR

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**MOUNTING EVIDENCE points to joint attention as a mediating variable in children's adaptive behavior. Joint attention in interactions between hearing mothers and congenitally deaf ($n$ = 27) and hearing ($n$ = 29) children, ages 18–36 months, was examined. All deaf children had severe to profound hearing loss. Mother-child interactions were coded for maternally initiated and child-initiated success rates in establishing joint attention; mothers completed ratings of their children's adaptive behavior. Hearing mother–deaf child dyads had significantly lower maternally initiated success rates. No significant between-group differences on child-initiated success rates were shown. Maternal ratings of adaptive behavior were significantly lower for deaf children, and related positively and significantly to both child-initiated and maternally initiated success rates. The findings suggest that mother-child interactions that are low in successful establishment of joint attention might mediate development of socioemotional problems evident in deaf children with hearing families.**

Every year in North America, approximately 4 in 1,000 infants are born deaf (Ontario Ministry of Health and Long-Term Care, 2002). Ninety percent of these children are born to hearing parents who have little or no experience with hearing loss (Lederberg & Mobley, 1990). Because of the mismatched modes of communication between hearing mothers and deaf children and the lack of responsiveness of deaf children, these dyads often struggle to achieve the same levels of mother-child interactions as those experienced by hearing mother–hearing child dyads (Prezbindowski, Adamson, & Lederberg, 1998; Spencer, 2000; Spencer, Bodner-Johnson, & Gutfreund, 1992; Waxman, Spencer, & Poisson, 1996).

Research has shown that as deaf children get older and expectations for language comprehension increase, interactions between hearing mothers and deaf children break down. The mutual comprehension required between hearing mothers and deaf children for successful mother-child interactions decreases, with the result that deaf children do not comprehend their mothers' initiation acts and thus do not respond to them (Lederberg & Mobley,

1990; Meadow-Orlans & Steinberg, 1993). Further, hearing mothers of deaf children tend to be more controlling in their interactions than hearing mothers of hearing children (Lederberg & Mobley, 1990). Findings suggest that hearing mothers make more demands and are less likely to respond to and expand on their deaf children's initiations, communicative acts, and foci of interest (Caissie & Cole, 1993; Lederberg & Mobley, 1990; Schlesinger & Meadow, 1972). In these situations, deaf children of hearing mothers become more passive, and are less likely to initiate interactions and to ask questions to gain more information about their world (Cross, Johnson-Morris, & Nienhuys, 1980; Schlesinger & Meadow, 1972). This pattern of behavior may result in a reduction of joint attention between hearing mothers and their deaf children, which in turn may result in mother-child interactions that are less frequent, shorter, and of poorer quality.

An important and specific component of mother-child interactions is *joint attention*, which is defined as the use of eye contact, gestures, or verbalizations in an attempt to first get a social partner's attention, and then to direct the partner's attention toward a particular object or event in the environment in order to share that experience with the partner (Jamieson, 1995). Joint attention begins to develop around 12 to 18 months of age in typically developing children (Charman et al., 2000; Sheinkopf, Mundy, Claussen, & Willoughby, 2004; Tomasello & Farrar, 1986), and is a theoretically well-established construct in the early adaptive and socioemotional development literature (Claussen, Mundy, Mallik, & Willoughby, 2002; Dube, MacDonald, Mansfield, Holcomb, & Ahearn, 2004; Greenspan, 1990; Ingsholt, 2002; Mundy & Gomes, 1998; Mundy & Neal, 2001; Mundy & Willoughby, 1996; Sheinkopf et al., 2004; Tomasello, 1995; Trevarthen & Aitken, 2001; Vaughan et al., 2003).

Deaf children can and do establish joint attention with their mothers (hearing and deaf), and follow the same developmental trajectory for joint attention as typically developing children (Spencer, 2000; Spencer et al., 1992; Watkins, 2004). Spencer studied four groups of dyads (19 deaf children with deaf mothers, 18 deaf children with hearing mothers, 19 hearing children with deaf mothers, and 21 hearing children with hearing mothers) at three different points: when the children were 9, 12, and 18 months of age. As the children became older—in all groups, regardless of hearing status—the amount of time they spent focusing solely on objects during free play decreased, and the amount of time they spent in *coordinated joint attention*, which is defined as a mutual active focus between mother and child on the same object, increased. However, the total amount of time spent in coordinated joint attention at 18 months differed among the dyads, such that deaf children with hearing mothers and hearing children with deaf mothers spent significantly less time in coordinated joint attention compared to hearing children with hearing mothers and deaf children with deaf mothers. The lack of significant differences between the amount of time deaf children with deaf mothers and hearing children with hearing mothers spent in coordinated joint attention suggests that auditory input may not be necessary for the development of joint attention, but rather that similar communicative modes are key factors in the successful establishment and maintenance of joint attention (Spencer et al., 1992; Waxman et al., 1996).

Other researchers have obtained similar results using a modified coding scheme and working with older children. Prezbindowski and colleagues (1998), for example, found that deaf children between the ages of 20 and 24 months and their hearing mothers spent significantly less time in joint attention than hearing mothers and their hearing children. Furthermore, the hearing mothers and their deaf children spent significantly less time in *symbol-infused joint attention*, defined as the most advanced form of joint attention, which incorporates symbols (e.g., a toy banana used as a telephone) in the interaction between mother and child. The smaller amount of time that hearing mothers and their deaf children spent engaged in symbol-infused joint attention was attributed to two factors: (a) Significantly fewer hearing mother–deaf child dyads engaged in symbol-infused joint attention; and (b) those hearing mother–deaf child dyads that did engage in symbol-infused joint attention did so for significantly shorter periods than the hearing mother–hearing child dyads.

Spencer and colleagues (Spencer et al., 1992; Spencer, Swisher, & Waxman, 2004) examined the factors that play a role in establishing joint attention in dyads involving hearing and deaf mothers and their hearing and deaf children, in an attempt to elucidate the reasons for the differences in the quantity of joint attention that is established and shared between hearing mothers and their deaf children. Spencer and colleagues (1992) studied three groups of 12-to-13-month-old infants: deaf children with deaf mothers ($n$ = 4), deaf children with hearing mothers ($n$ = 3), and hearing children with hearing mothers ($n$ = 7). They found that differences in the frequency with which joint attention was established between hearing mothers and deaf children, compared

to hearing mothers and hearing children and deaf mothers and deaf children, were largely due to a lack of sensitivity of the hearing mothers to their deaf children's visual and tactile forms of communication and to their deaf children's reliance on *sequential forms of communication*, defined as communication styles in which the mother waits until the child is visually focused on her before communicating with the child.

In a more recent, longitudinal study, Spencer and colleagues (2004) used the same sample as that in Spencer's 2000 study. The researchers found that the deaf mothers used various visual-tactile attention-getting strategies, such as producing signs and gestures, tapping on the child's body, or tapping on the floor, that were not used by any of the hearing mothers. Other auditory and visual—but not tactile—accommodations, such as signing in the child's field of vision and tapping on objects to get the child's attention, were found equally among all dyads that included a deaf partner. Hearing mothers of deaf children were also significantly more likely to perform an attention-getting behavior but then not follow up on it. These results suggest that, although hearing mothers of deaf children do attempt to accommodate the qualitatively different communicative needs of their deaf children, they do not do so to the same extent as deaf mothers of deaf children. This pattern likely reflects a skill deficit over and above any differences in maternal sensitivity. It might also be that hearing mothers lack the necessary skills to follow up on, expand, or "use" the attention opportunity when their initial attention-getting behavior is successful in eliciting their deaf children's attention.

Although both maternal sensitivity and skill appear to be associated with the frequency or *quantity* of joint attention interactions, more recent studies point to the importance of maternal sensitivity specifically in the *quality* of mother-child interactions in dyads with hearing mothers and deaf children. For instance, Spencer and colleagues (2004) found that when maternal sensitivity was taken into consideration, hearing status was no longer a significant predictor of the quality of mother-child interactions, a finding that suggests that maternal sensitivity is a key factor in the determination of the quality of mother-child interactions, regardless of hearing or communication status. Other researchers have also found that there is a great deal of individual variability in the quality of mother-child interactions in dyads with hearing mothers and deaf children (Harris & Chasin, 2005; Spencer & Harris, 2006), thus suggesting that differences in communication modes and maternal skill, though important, are not the only factors that contribute to the observed differences in the quality of mother-child interactions.

The present study had four goals—to examine

1. the quantity and quality of interactive behaviors of hearing mothers and their deaf and hearing children using a larger sample of children than had been used in previous studies
2. behavioral measures derived from direct observation of dyadic interactions across multiple contexts
3. between-group differences on the measure of children's adaptive behavior
4. whether adaptive behavior was related to mother- or child-initiated success rates in the establishment of joint attention

We collected data from 27 hearing mother–deaf child dyads (HD dyads) and 29 hearing mother–hearing child dyads (HH dyads) throughout free play and four semistructured tasks that are widely used to elicit joint attention: bubbles, laser pointer, bumble ball, and book sharing. We also used a modified conceptualization of joint attention developed by Tasker and Schmidt (2008). Joint attention was defined as a mutual focus by both mother and child on the same object or event in which both mother and child were aware of each others' active and intentional attention and participation. Joint attention was considered to have been initiated when either the mother or the child performed an *initiation act*, defined as a communicative act to attain the attention of the other for the purpose of sharing a particular object or event (Jamieson, 1995). *Establishment of joint attention* (EJA) was operationalized as the outcome of three sequential, time-constrained, and contingent on-topic communicative acts that followed a maternal or child initiation act (Tasker & Schmidt, 2008).

We coded all interactive behaviors beginning with an initiation act and leading up to EJA in the free-play and semistructured joint attention episodes. *Maternal and child success rates*, defined as the percentage of initiations by, respectively, the mother and the child that resulted in EJA, were then calculated. The reasoning behind distinguishing between the success rates for maternal and child initiation in EJA was that the mother and child have different roles in the set of contingent responses, depending on who initiates. For example, if the mother initiates, the child is responsible for responding to the initiation act, while if the child initiates, the mother is responsible for responding. Mothers also completed ratings on their children's adaptive social behavior.

We tested three predictions:

1. Hearing mother–deaf child dyads would exhibit significantly lower success rates for maternal initiation and child initiation than hearing mother–hearing child dyads.
2. Deaf children would be rated significantly lower than hearing children by their hearing mothers on adaptive social behavior.
3. The success rates of maternal initiation and child initiation in EJA would be significantly and positively correlated with mothers' ratings of their children's adaptive social behavior.

## Method

### Participants

Fifty-six children ages 18 to 36 months old and their mothers served as participants. Prior to participation in the interactive episodes with their children, all mothers completed a demographic questionnaire asking standard information such as their age, the age of their child, their educational background, and their family status. Mothers of the deaf children also completed a questionnaire asking about their child's deafness (e.g., when they first noticed that something seemed wrong, when their child was diagnosed as being deaf, whether their child had a cochlear implant, and which communication option they used).

### *Hearing Mother–Deaf Toddler Dyads*

The HD dyads ($n$ = 27; 13 boys, 14 girls) were recruited from the Ministry of Education and Training Preschool Home Visiting Program of the provincial government of Ontario, Canada. The mean age of the deaf children was 26.85 months ($SD$ = 6.23 months, range = 17–41 months), and the mean age of the hearing mothers of deaf children was 31.61 years ($SD$ = 4.07 years, range = 24–41 years). All but four of the hearing mothers of deaf children were married, and their mean level of education was college/university.

All the deaf children were born healthy at term (i.e., 36 or more weeks of gestation). Deafness was not due to prenatal or postpartum infections, substance abuse, perinatal birth trauma, or accidents. There were no structural abnormalities of the auricle or ear canal. The children were born with bilateral permanent hearing loss ranging from severe (70–89 dB in the better ear) to profound (> 90 dB).

The mean age of identification of deafness was 11.67 months ($SD$ = 6.45 months, range = 1–23 months). When the data were collected, the mean amount of time since the children had been formally identified with deafness was 14.69 months ($SD$ = 7.06 months, range = 4–35 months). The children's mean age when the families started to use their chosen form of communication with the children was 14.13 months ($SD$ = 7.64 months, range = birth to 28 months). The modes of communication that the families of the deaf children in the sample used were American Sign Language (ASL; $n$ = 2), auditory verbal (AV; $n$ = 9), oral ($n$ = 5), Total Communication (TC; $n$ = 3), and a combination of AV and oral ($n$ = 8). Demographic data are summarized in Table 1.

The communication options employed by the families of the deaf children were operationalized per the following descriptions: *American Sign Language* (ASL) is a manual *language* composed of signs and sign sentences with a linguistic structure that is different from spoken English (Mayberry, 2003, p. 490; Watkins, 2004). ASL is a natural language that has evolved independently of spoken or written English and is perceived by the eyes (i.e., the sensory component) and expressed with the hands, arms, body, and face (the motor component) (Mayberry, 2003, pp. 490–496).

*Auditory verbal* (AV) is a communication training program that emphasizes auditory skills by teaching the child listening skills through one-to-one therapy. Residual hearing with the aid of amplification (hearing aid, cochlear implant) is the focal modality of information and language input. No manual communication is used, and the child is discouraged from using visual cues (John Perks, Director, Ontario Provincial Schools Preschool Home-Visiting Program, personal communication, June 2003).

*Oralism* (aural/oral) is a vocal-only mode of instruction that encourages the deaf child to maximize the use of residual hearing through amplification (hearing aids, cochlear implantation, FM systems) and to "watch" the spoken word on the lips of others (i.e., to speechread). Any form of manual sign language is discouraged, although the use of conventional gestures is accepted (Mayberry, 2003, p. 498; Watkins, 2004).

*Total Communication* (TC) is the use of the "all input" approach, inclusive of simultaneous signing and speaking to communicate with the deaf child. TC emerged in 1967 as a communication and educational philosophy and is an attempt to embrace, and tolerate, all approaches to supporting communication, and to teach vocabulary and language in whatever way works. That is, manual, oral, auditory, and written modes of communication through the use of sign, gesture, mime, speech, speechreading, listening, pictures, print, and writing are all supported and accepted (Mayberry, 2003, p. 498; Watkins, 2004, pp. 317, 1536; see also Sister Claudette, Principal, St. Vincent School for the Deaf, Johannesburg,

**Table 1**
Demographic Characteristics of the Children and Their Mothers: Full Sample (*N* = 56)

| | *Hearing mother–deaf child dyads (n = 27)* | | *Hearing mother–hearing child dyads (n = 29)* | | *Statistic* | *p (two-tailed)* |
|---|---|---|---|---|---|---|
| **Child variables** | | | | | | |
| Sex | 13 males, 14 females | | 16 males, 13 females | | $X^2(1) = .28$ | $p > .05$ |
| Day care/preschool attendance[1] | 14 attended, 12 did not | | 16 attended, 12 did not | | $X^2(1) = .65$ | $p > .05$ |
| | *M* | *SD* | *M* | *SD* | | |
| Hours per week | 15.86 | 14.60 | 19.77 | 13.47 | $t(28) = .76$ | $p > .056$ |
| Chronological age (months) | 26.85 | 6.23 | 26.04 | 5.20 | $t(54) = -.54$ | $p > .05$ |
| Age (months) when deafness was confirmed | 11.67 | 6.45 | | | | |
| Age (months) when mother knew something was "wrong" | 8.13 | 5.24 | | | | |
| Time (months) from when mother knew something was "wrong" to identification | 4.40 | 4.44 | | | | |
| Time (months) from identification to study participation | 14.69 | 7.06 | | | | |
| | *M* | *SD* | | | | |
| Age (months) when communication option was begun | 14.13 | 7.64 | | | | |
| **Maternal variables** | | | | | | |
| Marital status | 23 married, 4 not married | | 28 married, 1 not married | | $X^2(1) = 2.22$ | $p > .05$ |
| English as first language | 25 yes, 2 no | | 29 yes | | $X^2(1) = 2.23$ | $p > .05$ |
| Number of other children | 1 | 0.92 | 0.72 | 0.92 | $t(54) = -1.12$ | $p > .05$ |
| Age (years) of other children | 6 | 4.27 | 4.73 | 1.85 | $t(27) = -.93$ | $p > .05$ |
| Level of education[2] | 5.42 | 1.10 | 5.62 | 0.82 | $t(53) = .76$ | $p > .05$ |

[1]Data were missing for one hearing child and one deaf child.
[2]1 = less than 7th grade, 2 = junior high school, 3 = grade 10/grade 11, 4 = high school graduate, 5 = partial college or at least 1 year of specialized training, 6 = college or university graduate, 7 = graduate professional training (M.A., M.Sc., M.D., M.B.A., Ph.D.).

South Africa, personal communication, September 2003, and John Perks, personal communication, June 2003). In addition, the use of residual hearing by means of hearing aids, cochlear implants, or FM systems is encouraged, and the child's development of listening and speaking skills are held as important goals.

Sixteen of the deaf children in the sample had cochlear implants. However, 4 of these children had received their cochlear implants only 2 weeks before their participation in the study, which meant that the implants had not yet been activated. Another 2 of these children had had their cochlear implants activated for only 1 week prior to participating in the study. These 6 children were not considered to have the use of cochlear implants for the purposes of the study. Thus, 10 deaf children were regarded as having cochlear implants. Comparisons examining differences between deaf children with cochlear implants and deaf children without implants on demographic and behavioral measures showed no significant differences between the groups. Accordingly, the HD dyads were considered a homogenous group, and implantation was not considered a confounding factor in any of the statistical analyses (see Table 2).

The hearing of all but 8 of the 27 deaf children in the present study was aided (with hearing aids or cochlear implants) during collection of the observational data. Three of these 8 children were not fitted with hearing aids, 1 used his hearing aid inconsistently and was not aided during data collection, and 4 were those who were newly implanted and whose cochlear implants had not yet been activated (see Table 2).

Language development of the deaf children was assessed by means of the SKI-HI language development measure from the SKI-HI curriculum (Watkins, 2004), which is used by the

**Table 2**
Demographic Characteristics Within the Hearing Mother–Deaf Child Group, by Absence or Presence of Aid From a Cochlear Implant

| | *Hearing mother–deaf child dyads (n = 27)* | | *Hearing mother–hearing child dyads (n = 29)* | | *Statistic* | *p (two-tailed)* |
|---|---|---|---|---|---|---|
| **Child variables** | | | | | | |
| Sex | 10 males, 7 females | | 3 males, 7 females | | $X^2(1) = 2.10$ | $p > .05$ |
| Day care/preschool attendance | 9 attended, 8 did not | | 3 attended, 7 did not | | $X^2(1) = 1.34$ | $p > .05$ |
| | *M* | *SD* | *M* | *SD* | | |
| Hours per week | 14.75 | 14.89 | 20.00 | 15.61 | $t(12) = -.54$ | $p > .05$ |
| Age (months) when deafness was confirmed | 13.10 | 7.00 | 9.25 | 4.84 | $t(25) = 1.53$ | $p > .05$ |
| Age (months) when mother knew something was "wrong"[1] | 6.87 | 4.20 | 10.50 | 6.41 | $t(23) = .32$ | $p > .05$ |
| Time (months) from when mother knew something was "wrong" to identification[2] | 4.63 | 4.94 | 4.05 | 3.79 | $t(23) = .32$ | $p > .05$ |
| Time (months) from identification to study participation | 15.59 | 8.37 | 13.25 | 4.26 | $t(24) = .82$ | $p = .42$ |
| | *M* | *SD* | *M* | *SD* | | |
| Age (months) when communication option was begun[1,2] | 14.07 | 7.67 | 14.22 | 8.04 | $t(21) = -.05$ | *p = .96* |
| Duration (months) of exposure to communication option[1] | 12.07 | 11.17 | 13.89 | 8.45 | $t(23) = -.42$ | *p = .68* |
| **Maternal variables** | | | | | | |
| Marital status | 14 married, 3 not married | | 9 married, 1 not married | | $X^2(1) = .29$ | $p > .05$ |
| | *M* | *SD* | *M* | *SD* | | |
| Age (years) | 31.56 | 4.08 | 31.7 | 4.27 | $t(25) = -.09$ | $p > .05$ |
| Age (years) of other children | 6.90 | 5.33 | 4.88 | 2.28 | $t(16) = 1.00$ | $p > .05$ |
| Level of education[1,3] | 5.53 | 0.94 | 5.22 | 1.39 | $t(24) = .67$ | $p > .05$ |

[1]Discrepant sample sizes are explained by missing data for some of the children and mothers.
[2]American Sign Language, auditory verbal therapy, oral, Total Communication.
[3]Level of education was assessed as follows: 1 = less than 7th grade, 2 = junior high school, 3 = grade 10/grade 11, 4 = high school graduate, 5 = partial college/at least 1 year of specialized training, 6 = college or university graduate, and7 = graduate professional training (M.A., M.Sc., M.D., M.B.A., Ph.D.).

Ontario Provincial Schools' Preschool Home-Visiting Program. This assessment is normed on deaf and hearing children from birth to 6 years of age (chronological age). Results showed a mean listening age (aided, except for children not fitted with hearing aids or cochlear implants) of 10.81 months (*SD* = 6.07, range = 4–26 months, *n* = 16). Mean expressive age was 8.94 months (*SD* = 3.63, range = 3–14 months, *n* = 17), and receptive age was 9.59 months (*SD* = 4.02, range = 3–16 months, *n* = 17).

### *Hearing Mother–Hearing Toddler Dyads*

The HH dyads (*n* = 29; 16 boys, 13 girls) were recruited by means of the Child Database in the Department of Psychology at McMaster University, in Hamilton, Canada, of families previously recruited at birth through the McMaster University Medical Centre and St. Joseph's Healthcare, Hamilton. The mean age of the hearing children was 26.04 months (*SD* = 5.20 months, range = 18–36 months), and the mean age of their hearing mothers was 33.38 years (*SD* = 4.59 years, range = 26–45 years). All of the hearing children were born healthy at term (i.e., 36 weeks or more of gestation), and none had a family history of hereditary childhood sensorineural hearing loss. With the exception of

one hearing mother, all of the hearing mothers of hearing children were married, and their mean level of education was college/university (see Table 1).

## Procedure

All procedures were approved by the McMaster University Research Ethics Board, and written consent was obtained from the mothers. Children were given toys as a token of our appreciation for their participation at the end of the present study.

The mothers and children in the HD and HH dyads were observed and videotaped in their homes in five joint attention–eliciting tasks: an unstructured free-play task and four semistructured tasks: bubbles, laser pointer, bumble ball, and book sharing. The unstructured free-play task was based on the protocols used by Bakeman and Adamson (1984) and Tomasello and Farrar (1986), and the semistructured joint attention–eliciting tasks were modified protocols based on the Early Social Communication Scales (Mundy, Sigman, & Kasari, 1990) and the Communication and Symbolic Behavior Scales (CSBS; Wetherby & Prizant, 1990).

The child and mother were seated on the floor among a standard set of toys including a baby doll, a tea set, a kitchen stove with miniature pots and pans and cutlery, blocks or a wooden puzzle (or both), and farm animal figures. The mother was instructed to play with her child as she would if she had some free time. Mothers and children were given a maximum warm-up period of 1 minute before the unstructured free-play task (5 minutes) began. After free play, the experimenter solicited the mother's attention by waving her hand, and the mother started the bubble task (3 minutes) by blowing bubbles in the air away from the child's face but toward where the child was sitting. After 3 minutes, the experimenter again solicited the mother's attention by waving her hand, indicating to the mother to close the bottle of bubble soap and put it away. The experimenter waited between 20 seconds and 1 minute to start the laser pointer task. During this task (1 minute), the experimenter moved and pointed a red laser beam on the floor directly in front of the mother and child and turned the laser pointer on and off three times. After the laser pointer task period, the experimenter again waited between 20 seconds and 1 minute before turning on the bumble ball (1 minute). The bumble ball was released toward the child, and it bounced around on the floor in front of the mother and child. After 1 minute, the experimenter picked up the bumble ball and turned it off, at the same time giving the mother three books. During the book-sharing task (3 minutes), the mother was instructed to present the three books to the child and have him or her pick one. She then allowed the child to explore the chosen book. If the child lost interest in the book, the mother had been instructed to re-present the other two books to the child and let him or her pick a new book. At the end of the 3 minutes, the experimenter announced the end of the session.

To ensure that the children's behaviors during the free-play and semistructured interaction tasks were typical for a play situation with their mothers and were not modified by the presence of the experimenter or video camera, mothers were asked to complete the caregiver perception rating questionnaire from the CSBS (Wetherby & Prizant, 1990) immediately following the dyadic interaction procedure. Mothers used a 3-point scale (1 = less than usual, 2 = typical, 3 = more than usual) to rate how "typical" their child's behavior was during the observation period on the following items: alertness, emotionality, interest and attention, comfort, activity, communication, and play. There were no differences between the HD and HH dyads in the scores on the CSBS questionnaire. For both groups, the mothers rated their child's behavior during the videotaped interactions as typical for all six items assessed. The internal consistency of the CSBS questionnaire in the present study was .74.

### *Behavioral Coding*

All instances in the behavioral videotapes when the mother or child displayed an initiatory act were coded and followed to see if the initiation acts resulted in EJA or if the responses broke off before joint attention was established. A primary coder coded all of the tapes. To assess reliability, a secondary coder coded 5 randomly selected HH dyads and 5 randomly selected HD dyads (18% of all dyads) on all of the coding variables of the behavioral protocol. The secondary coder was blind to the hypotheses of the study. Although neither the primary nor the secondary coder was told the hearing status of the children, blinding was difficult because many of the deaf children's cochlear implants or hearing aids were visible. Intraclass correlation coefficients (ICCs) were computed to assess interobserver reliability for all of the coding variables of the behavior protocol. Interobserver reliability was high across all individual measures: mean ICC = .93 for HH dyads (range = .89–.97); mean ICC = .83 for the HD dyads (range = .71–.93).

Frequency counts for all maternal and child initiation acts and EJA across

all five tasks were recorded. In total, the dyads were observed in the behavioral protocol for a total of 13 minutes. However, there was some variability in the duration of the behavioral protocol across dyads either because mothers ended tasks prior to being directed to do so by the experimenter or because of experimenter error. To account for this variability, the total frequency counts across all five tasks for each of the coded measures were changed to relative frequency counts by multiplying each frequency by 13 (i.e., the total number of minutes the behavioral protocol was supposed to last) and then dividing this result by the actual duration (in minutes and seconds) of the behavioral protocol. Two HH dyads were lost, because of a broken tape and a lost transcript. Therefore, the statistical analyses were conducted on a sample of 54 dyads (27 HH dyads and 27 HD dyads).

### *Behavioral Measures*

Three behavioral measures were coded and derived: initiatory acts, EJA, and success rates. Given the qualitatively different nature of the negotiation of joint attention between hearing mothers and deaf children, the response time parameters for the present study were clinic-metrically established by drawing on the expertise of the team of preschool teachers of the deaf (one teacher herself deaf) of the Ontario Ministry of Education and Training's Preschool Home-Visiting Program. Specifically, 15 seconds and 5 seconds were used as the time criteria for the HD dyads and the HH dyads, respectively. Vandell and George (1981) employed a 5-second response time between deaf and hearing preschool social partners. But if we take deaf mothers as the gold-standard interactive partners with deaf children, then the descriptions by Spencer and colleagues (1992) and Watkins (2004) of deaf mothers intuitively understanding the qualitative difference in sequential forms of communication, as demonstrated through their provision of longer "wait times" for the deaf child to respond, fit with the opinion of the preschool teachers of the deaf children in our sample.

### *Initiatory Acts*

*Initiatory acts* were defined as spontaneous, intentional verbal or nonverbal behaviors that were used to direct or get the social partner's attention (Landry, Smith, Miller-Loncar, & Swank, 1998; Newland, Roggman, & Boyce, 2001) for the purpose of sharing the experience of an object or event with the social partner (Mundy & Willoughby, 1996). Tasker and Schmidt (2008) operationalized an initiatory act as any behavioral or communicative act that was clearly directed to the social partner, and which was not part of an existing interaction. Further, an initiatory act was considered successful if the social partner to whom it was directed responded within 5 seconds (HH dyads) or 15 seconds (HD dyads). Two types of initiation acts were coded, maternal initiatory acts and child initiatory acts. For each type of initiation act, both "successful" initiation acts (i.e., those that resulted in EJA) and "unsuccessful" initiation acts (i.e., those that did not result in EJA) were coded.

*Maternal initiatory acts* were either (a) intentional and active attempts by the mother to get, direct, and share in the child's attention to a particular object or event on which the child was not presently focused (Tasker & Schmidt, 2008) or (b) active attempts by the mother to follow into and mutually share the child's present focus of attention through the use of verbal and nonverbal communication directed toward the child's focus of attention (Hundert, Mahoney, Mundy, & Vernon, 1998).

*Child initiatory acts* were intentional verbal and nonverbal acts directed toward the mother by the child for the purpose of getting, directing, and sharing in the mother's attention to an object or event (Hundert et al., 1998; Prendergast & McCollum, 1996; Tasker & Schmidt, 2008).

### *Establishment of Joint Attention*

Our coding protocol for EJA was a modified version of the coding protocol developed by Bakeman and Adamson (1984). Bakeman and Adamson considered joint attention to be established following 3 seconds of a mutual active focus of attention by mother and child on a shared object. Behaviors exhibited by the child such as turn taking, communicating with the mother about the object of focus, switching his or her gaze from the object to the mother and back to the object, and verbally or nonverbally responding to the mother's comments about the object were considered indications that the child was actively engaged in joint attention. Bakeman and Adamson's coding protocol was such that EJA was either present or absent. Missing from their coding protocol, however, was any consideration of what *leads up to* EJA. More simply stated, no behavioral chain of reciprocal and contingent acts, beginning with an initiation act by either the mother or the child, was considered.

Consequently, we used a modified coding protocol developed by Tasker and Schmidt (2008) that outlined contingent behavioral responses required for joint attention to be considered established. This conceptualization of EJA required three sequential, time-constrained, contingent, on-topic communicative acts to follow the maternal or child initiation act before joint at-

tention was considered established. Further, as we have already discussed in the present article, this coding protocol took into account the differing communication styles of HD and HH dyads. A four-part sequence of initiation and contingent response acts had to occur between the mother and child for joint attention to be considered established:

1. The mother or child displayed an initiation act to elicit the social partner's attention to an object, event, or activity.
2. The social partner responded either through a communicative act or behaviorally within 5 seconds (HH dyads) or 15 seconds (HD dyads), and the response lasted at least 3 seconds.
3. The initiating partner responded to the social partner either communicatively or behaviorally to indicate awareness of the shared attention.
4. The mother and child visually focused on the object, activity, or event of shared attention, or communicatively engaged one another and the object for at least 3 seconds.

### *Maternal and Child Success Rates*

We used the child and maternal initiation acts and EJA measures to calculate a success rate for each mother and child in successfully initiating and establishing joint attention. Namely, for each mother and child, we divided the number of initiation acts that resulted in EJA by the total number of initiation acts (i.e., sum of initiation acts that resulted in or failed to result in EJA). For example, the success rate for maternal initiation acts was calculated by dividing the number of maternal initiation acts that resulted in EJA by the total number of maternal initiation acts displayed during the behavioral sample.

### *Maternal Report of Behavior: The Adaptive Social Behavior Inventory*

We asked mothers to complete the Adaptive Social Behavior Inventory, or ASBI (Hogan, Scott, & Bauer, 1992), in order to compare maternal ratings of social competence for the deaf and hearing children as well as to investigate whether maternal ratings of social competence were related to EJA success rates. The ASBI is a 30-item maternal report questionnaire on the child's social competencies and behaviors. Questions are related to the child's behaviors in a variety of social situations including interactions with peers and adults, social knowledge, and self-control. With the exception of two questions, the ASBI is appropriate for both hearing and deaf children, as it focuses on children's behaviors in a variety of social situations without a strong emphasis on hearing and speaking. Two questions, however, ask about the child's participation in social conversations—for example, "*Says* 'Please' and 'Thank you' when reminded" [emphasis not in the original]. We modified these two questions by including signing or gesture as a form of conversational participation (e.g., "Says/signs 'Please' and 'Thank you' when reminded"). All items are rated on a scale of 1 (never) to 3 (often). The ASBI contains three subscales: *Express* (13 items), *Comply* (10 items), and *Disrupt* (7 items). A *Prosocial* score is obtained by summing the *Express* and *Comply* items, and a total score is obtained by summing all of the individual items, with reverse scoring for the Disrupt subscale. The internal consistencies for the Express, Comply, Disrupt, and Prosocial subscales in the present study were .75, .82, .67, and .85, respectively.

### *Data Analyses*

Given that we had three specific a priori hypotheses, we performed separate independent-samples *t* tests with *group* (HD dyad, HH dyad) as the between-subjects factor on each of the three dependent measures: maternally initiated success rates, child-initiated success rates, and maternal ratings of children's adaptive social behavior (i.e., ASBI total score). Cohen's effect sizes were also computed for the between-group comparisons. Pearson correlations were computed to determine the relation between ASBI total scores and maternally initiated and child-initiated success rates in EJA.

## Results

### Preliminary Analyses

All analyses were one-tailed because we had a priori hypotheses that predicted the direction of differences. The statistical significance level was set at $p < .05$, which is the convention for behavioral studies. No significant differences were found between groups on any of the demographic variables. Thus, the dyads differed only in their hearing status (see Table 1). There were no significant differences between the two groups in the duration of the videotaped behavior samples used to collect behavioral data.

### Between-Group Analyses

#### *Success Rates*

We examined between-group differences on the separate measures of maternally initiated and child-initiated success rates in EJA. As predicted, the HD dyads ($M = 36.77$, $SD = 21.42$) exhibited significantly lower maternally initiated success rates than the HH dyads: $M = 49.44$, $SD = 21.66$; $t(52) = -2.16$, $p = .018$, Cohen's $d = 0.59$ (see Figure 1, part A). Contrary to prediction, there were no significant differences between the HD dyads ($M = 48.33$, $SD = 34.42$) and HH dyads

($M$ = 57.11, $SD$ = 29.10) on child-initiated success rates: $t(52) = -1.01$. $p = .16$, Cohen's $d = 0.28$ (see Figure 1, part B).

### *Adaptive Social Behavior*

We next examined between-group differences on the maternal ratings of children's adaptive social behavior. As predicted, hearing mothers rated their deaf children ($M$ = 71.84, $SD$ = 7.43) significantly lower on adaptive social behavior than hearing mothers rated their hearing children: $M$ = 76.70, $SD$ = 6.06, $t(52) = -2.63$, $p < .01$, Cohen's $d = 0.72$ (see Figure 2).

### Within-Group Analyses

There were significant positive relations between the maternal ratings of adaptive social behavior measures and maternally initiated success rates, $r(54) = .30$, $p = .014$, and child-initiated success rates, $r(54) = .28$, $p = .021$. As predicted, higher maternally initiated and child-initiated dyadic success rates in EJA were associated with higher maternal ratings of adaptive social behavior regardless of hearing status.

## Discussion

We found that the HD dyads were significantly less successful than the HH dyads in regard to maternal initiation of EJA. Our finding of an effect size of 0.59 translates to the average mother in the HH dyads being more successful in initiating and establishing joint attention with her hearing child than 73% of the mothers in the HD dyads (see Coe, 2002, on effect size). Interestingly, and contrary to our predictions, we found no differences between groups regarding child-initiated success rates in EJA. In the present study, maternally initiated and child-initiated success rates were viewed as different processes. Depending on whether the mother or the child initiated, there were differ-

**Figure 1**
Comparison Between the Success Rates of Hearing-Deaf Dyads ($n$ = 27) and Hearing-Hearing Dyads ($n$ = 27) in the Establishment of Joint Attention

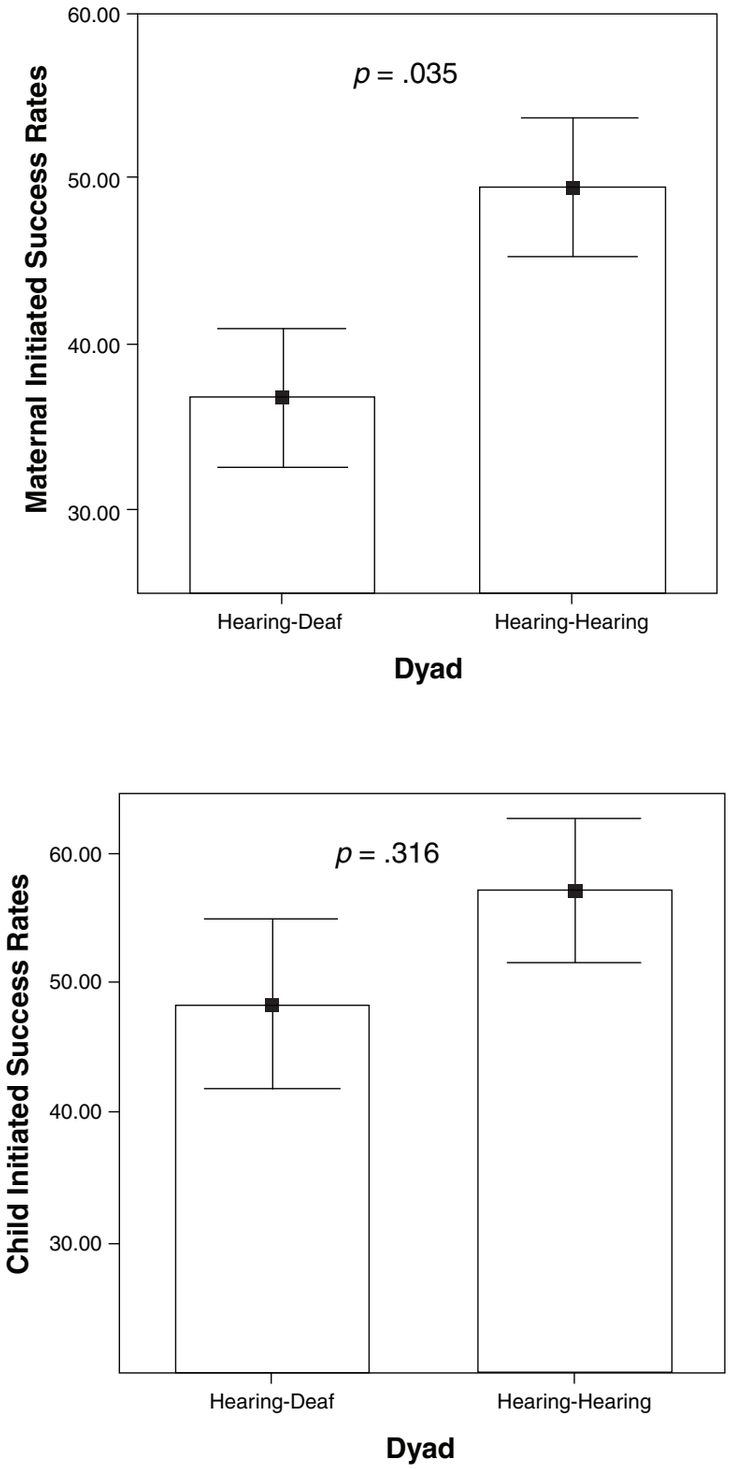
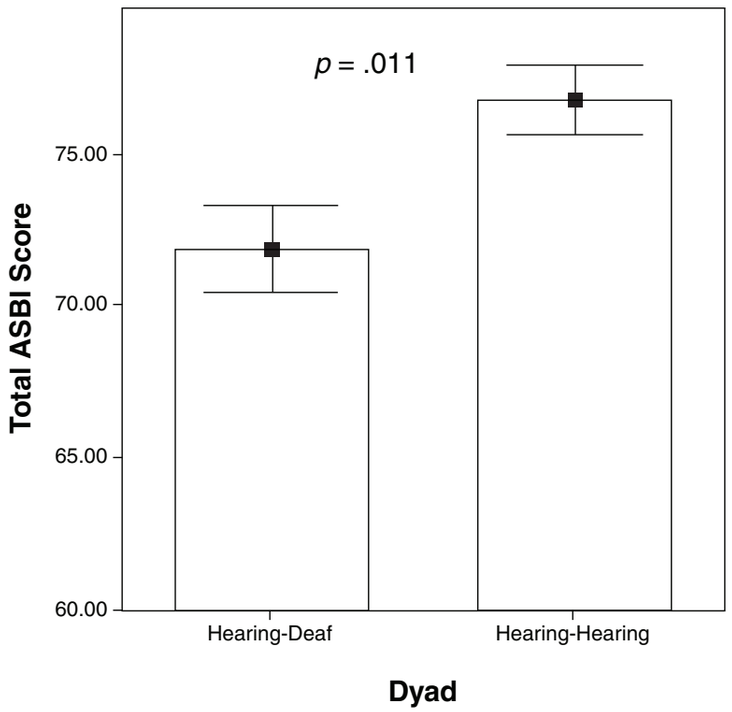


**Figure 2**
Comparison Between Mothers in Hearing-Deaf Dyads ($n$ = 27) and Mothers in Hearing-Hearing Dyads ($n$ = 27) in Their Ratings of Their Children on the Adaptive Social Behavior Inventory (ASBI




ences in the communicative acts that the child and mother were responsible for in the sequence of responses necessary for EJA. For instance, when the mother initiated, the child was responsible for responding to the mother, while if the child initiated, the mother was responsible for responding to the child.

Our results suggest that it is not just a general breakdown that is occurring in interactions between hearing mothers and their deaf children, but that the breakdown appears to be specific to the sequence of behaviors that make up the maternally initiated success rate measure. Two points are important here. First, it appears that, compared to hearing mothers of hearing children, hearing mothers of deaf children are just as sensitive and successful in responding to and building on their deaf children's initiation acts, a finding that suggests that they are sensitive to their deaf children's differing communication needs. This finding varies from those of past studies that found that hearing mothers are less sensitive to or less skilled in addressing their deaf children's differing communication needs. The discrepancy in findings may be due to the fact that most studies have focused on mother-child interactions in HD dyads from the perspective of maternal initiations (e.g., Spencer et al., 1992).

Second, there are two plausible mechanisms for explaining why breakdowns in interactions appear to occur when the mother is responsible for initiating joint attention interactions: (a) It is possible that deaf and hearing children differ in their ability to detect and respond to their mothers' initiation acts, such that deaf children are less likely to detect or comprehend their mothers' initiation acts and thus fail to respond to them (Lederberg & Mobley, 1990; Meadow-Orlans & Steinberg, 1993); and (b) it may be the case that the breakdown occurs at the level of the mother, in that hearing mothers of deaf children do not have the necessary skills to first attract and attain the attention of their deaf children, or that they fail to follow up on their initiation acts. Consistent with this viewpoint, Spencer, Swisher, and Waxman found that hearing mothers of deaf children were significantly more likely than hearing mothers of hearing children to fail to follow up on displayed initiation acts or bids for their child's attention.

We also found that the deaf children were rated significantly lower than the hearing children on a measure of children's adaptive social behavior. Again, interpretation of the effect size (Coe, 2002) shows that the score of the average hearing child as rated by his or her mother exceeded the scores of at least 76% of the deaf children.

Past studies have suggested that deaf children of hearing mothers tend to be more dependent on adults (Jamieson, 1995; Meadow, 1980), show difficulties with behavioral regulation, and display a greater number of socially disruptive behaviors (Jung & Short, 2002; Koester & Meadow-Orlans, 1999). These findings are consistent with our finding that hearing mothers rated their deaf children significantly lower on adaptive social behavior than their hearing children. Further, we found that lower ratings of children's adaptive social behavior were related to lower maternally initiated and child-initiated success rates in EJA. This result can be explained in two ways. First, it is possible that children who are disruptive and have difficulty self-regulating are less likely to

show an interest in interacting with their mothers and are less likely to respond appropriately and satisfy the contingent responses required for successful EJA. Thus, lower ratings of socially appropriate behavior or higher ratings of disruptive behavior exhibited by the child are related to lower levels of maternally initiated and child-initiated success rates in EJA. Alternatively, it is possible that from a developmental perspective, the decreased amount of time that is spent in EJA episodes underlies and results in children's lower levels of social behavior (Mundy & Willloughby, 1996). Joint attention is a state in which the mother and child engage in bouts of communication that are rich in learning opportunities, including the learning of socially appropriate skills such as turn taking and self-regulation. Consequently, a lack of time spent in joint attention episodes can lead to poorer social abilities, which in turn can make the establishment of future joint attention episodes challenging.

Our results provide further evidence for the idea that HD dyads are less successful in the EJA and that deaf children exhibit less adaptive social behavior than hearing children. However, it appears that HD dyads are not just less successful in EJA in general but that the breakdown is specific to particular behaviors and responses, particularly when joint attention is initiated by the mother. Hearing mothers of deaf children face unique challenges in communicating with their deaf children, given that hearing mothers have been part of the hearing world all their lives. Our results also provide support for the idea that early mother-child joint attention interactions are critical for children's socioemotional development, given that we found a positive relation between maternally initiated and child-initiated success rates in EJA and higher maternal ratings of adaptive social behavior.

Further studies are needed that apply the same definition of joint attention that was used in the present study. These studies should more closely investigate the interactions *outside of* and *leading up to* EJA between hearing mothers and their deaf children. This approach would inform research as to the point at which the breakdown occurs and whether the breakdown occurs at the level of the mother, the child, or both. As well, a more detailed investigation into what occurs *inside* established episodes of joint attention, one that would look at the contingent back-and-forth responses within HD dyads, may also provide further information about the interaction differences in both process and content between HD dyads and HH dyads. This knowledge would be instructive for interventions, as it would guide clinicians in determining whether the mother or the child should be the main focus of interventions to improve mother-child interactions in HD dyads.

## Limitations

It is important to note that the present study had several limitations.

*First*, the study did not include dyads consisting of deaf mothers and deaf children or deaf mothers and hearing children. The inclusion of these two groups would have strengthened and enriched the findings, and is recommended for future work.

*Second*, there was heterogeneity in communication options within the HD group. Although the epochs in which the dyads were observed did not require or favor a particular mode of communication, given that the purpose was to observe the quantity and quality of the mother-child interaction and coding was conducted for both verbal and nonverbal behaviors, it is still possible that the heterogeneity of communication options may have confounded the behavioral results.

*Third*, because communication for 22 of the 27 dyads was primarily oral, results can only be cautiously generalized to HD dyads using other modes of communication or where cochlear implants are in place. Future studies using larger samples of HD dyads should attempt to distinguish between the various communication modes to determine whether the results differ depending on the communication option that is used.

*Fourth*, we collapsed across children with, and without, cochlear implants to create one HD group that had a relatively large sample size. Although there were no significant differences between the HD dyads with and without cochlear implants on demographic and behavioral measures, we do recognize that the children with cochlear implants had a very different early childhood experience from that of deaf children without cochlear implants. Deaf children with cochlear implants and their mothers experienced the early stressors of hospitalization, surgery, and the activation of the implant, which has often been found to be overwhelming and disorienting for a deaf child due to the sudden bombardment of sound.

*Fifth*, on average, the deaf children were not identified as being deaf until age 11.67 months, and on average the mothers of deaf children knew something was wrong at 8.13 months. Consequently, on average, during the first year of development there was most likely a large degree of uncertainty in the hearing mother–deaf child dyads as to what was wrong and how to deal with the situation. The stressors associated with this high level of uncertainty and concern may have had a negative impact on the developing mother-child interactions. However, this con-

founding factor is not unique to the present study. Future studies with toddlers who were identified at birth as being deaf would be helpful in further elucidating the meaning and significance of our results (i.e., whether they were a reflection of mismatched communication modes or a reflection of disruptions in mother-child interactions during the first year of life).

*Sixth*, attempts were made to avoid biasing the results through the absence of deaf researchers by consulting with a number of coordinators and teachers of the deaf, including one teacher who was deaf and was herself a mother, during the development and operationalization of the coding and testing procedure. However, the fact that all the researchers were hearing may have biased the results.

*Seventh*, other factors that influence mother-child interaction, such as attachment and maternal depression, were not considered in the study, which also might have confounded the results. With respect to attachment, however, we point out that Lederberg and Mobley's (1990) finding that hearing mothers were less likely to share in their deaf child's focus of attention on objects or activities was independent of the quality of attachment between 22- month-old deaf and hearing children and their mothers. As well, Lederberg and Mobley's finding of no differences in attachment security between deaf and hearing children and their hearing mothers is corroborated by others' research (Hadadian, 1995; Lederberg & Prezbindowski, 2000).

*Eighth*, the ratings of the children's adaptive social behavior were completed by their mothers, and the interactions that were coded for success rates in EJA were also between mother and child. Consequently, our correlational result may have been biased by the fact that the mothers' interactive experiences with their children, which we used to code for success rates, may have influenced how they rated their children on the adaptive social behavior measure.

## Conclusion and Implications

There are four strengths of the present study worthy of final comment:

1. Studies on deafness are often confounded by mixed etiology of deafness and the presence of other disabilities. The present study had stringent inclusion criteria.
2. By clinical population standards, our final sample size was relatively large (i.e., 27 HD dyads and 27 HH dyads) in relation those of prior studies (e.g., Spencer et al., 1992).
3. Data collection took place in the homes of the dyads, increasing the ecological validity of the results and making them more generalizable to natural settings.
4. The study proposed a modified coding protocol for EJA that we feel further clarifies the interactive process involved in EJA and provides a means by which to identify, in the future, where breakdowns in EJA are occurring.

The mother-child relationship is usually the first social relationship that the young infant experiences, and it sets the stage for the manner in which the infant will navigate future relationships. Consequently, the quality of the mother-child relationship in general, and the quality of mother-child interactions in particular, has major implications for the child's social, emotional, and cognitive development (Charman et al., 2000; Delgado et al., 2002; Tomasello & Farrar, 1986). One factor known to influence mother-child interactions is mismatched hearing status (Prezbindowski et al., 1998; Spencer, 2000; Spencer et al., 1992; Waxman et al., 1996).

The overall results of the present study corroborate the current literature on mother-child interactions in hearing mothers and their deaf children. Our findings provide further evidence that hearing mothers and deaf children struggle to achieve successful contingent responses in interactions initiated by mothers and that deaf children exhibit lower levels of adaptive social behavior, which are related to maternally initiated and child-initiated success rates in EJA. The current results have clinical implications, in that they highlight the need for hearing mothers of deaf children to be educated in the successful initiation of joint attention interactions with their deaf children. Further, using the modified coding protocol employed in the present study, researchers will be able to conduct microanalytical investigations of the sequence of initiations and responses that lead to and maintain EJA. This will allow researchers to determine specific areas of mother-child interaction inside and outside of EJA that HD dyads struggle with, and to develop interventions that address and can, potentially, alleviate these challenges.

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