Siblings and Theory of Mind in Deaf Native Signing Children

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We report a study designed to examine the basis of "theory of mind" (ToM) reasoning in deaf children who are native signers of British Sign Language. The participants were 20 native signers (aged 4–8 years) and their siblings. The children were given a measure of the quality of sibling relations together with a referential communication test concerning physical representations of objects and people. Sibling quality as perceived by siblings predicted children's ToM scores over and above age and referential communication. We conclude that the process of ToM understanding is linked to positive sibling relations that may permit access to knowledge about the inner worlds of beliefs and other mental states.

To possess a theory of mind (ToM) involves the knowledge that the beliefs of others can differ from one's own and also from reality. There is a consensus that by the age of about 4 years most typically developing children demonstrate ToM reasoning by understanding that others can hold false beliefs about the location or contents of an object that do not accord with reality (Perner, Leekam, & Wimmer, 1987; Surian & Leslie, 1999). The role of language has often been seen as in some sense fundamental to ToM understanding in both deaf and hearing children (Astington & Jenkins, 1999; Courtin & Melot, 1998; de Villiers, 2000; de Villiers & de Villiers, 2000; Deleau, 1996; Deleau, Guéhéneuc, Le Sourn, & Ricard, 1999; Figueras-Costa & Harris, 2001; Harris, 1996; Lundy, 2002; Tager-Flusberg, 2000). In this respect, it is now established that deaf children who are native signers of a sign language (usually second-generation deaf children who have been raised by signing deaf parents) and have a communicative partner in the family display evidence of ToM development at a similar rate to typically developing hearing children. By contrast, children who are later signers (often learning sign language only once at school) display considerable difficulty in ToM development, even though they may be comparable to native signers in their sign language ability, nonverbal intelligence, and reasoning in the domains of physics and biology, which do not involve consideration of others' beliefs (Peterson & Siegal, 1997, 1999; Woolfe, Want, & Siegal, 2002).

One proposal to account for the advantage of native signers is that children's exposure to talk about mental states gives rise to ToM reasoning (Siegal, Varley, & Want, 2001). On the one hand, because native signers are exposed to sign language (and thus conversation) from birth, they develop ToM as do hearing children. On the other hand, late signers have more restricted access to conversation during early childhood, thus developing ToM later. According to this view, language is the medium through which children learn about the unobservable mental states of others; through immersion in conversation, children become aware of mental states and develop pragmatic knowledge in following the purpose and relevance of messages in conversation. They come to understand others' beliefs and communicative intentions and how these may differ from their own. The

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presence of siblings potentially increases talk about mental states within the home, in that there will be frequent references to the mental states of one child directed toward another in resolving conflict or in various other social situations. Following Howe and Ross's (1990) observation that siblings may be particularly important in the development of the ability to take the perspective of others, numerous studies have revealed associations among exposure to siblings and performance on ToM tasks (Jenkins & Astington, 1996; Lewis, Freeman, Kyriakidou, Maridaki-Kassotaki, & Berridge, 1996; Perner, Ruffman, & Leekam, 1994; Ruffman, Perner, Naito, Parkin, & Clements, 1998; but see Cole & Mitchell, 2000, and Cutting & Dunn, 1999, for studies in which such an association was not found). In particular, Peterson (2000) carried out a large-scale investigation of ToM with 265 children aged 3–5 years. She found that children who had at least one sibling in the age range between 12 months and 12 years outperformed those who did not. She concluded that the opportunity to play and converse with siblings permits access to knowledge about others' beliefs and how these may differ from one's own.

To date, studies of the effects of siblings on ToM responses have been restricted to populations of typically developing hearing children. Such studies have established a link between the presence of siblings and ToM. In the present study, we wished to explore this link in greater detail. In particular, we aimed to determine whether the quality of relations and communication between siblings promotes ToM development over and above the influence provided by the mere presence of the sibling (as suggested by Cutting & Dunn, 1999). It is plausible that siblings exert a baseline positive effect on ToM reasoning simply because their presence increases the use of mental state language by the child's parents (i.e., they refer to the sibling's point of view in resolving disputes or explaining behavior). However, in addition, siblings may discuss mental states among themselves. In this case, the greater the opportunity for discussion between the child and sibling, the more positive the sibling effect would be. One index of the scope of opportunity for communication is the quality of the relationship between the child and the sibling, giving rise to a link between ToM performance and the quality of the sibling relationship. Therefore, this study aimed to examine native signers' ToM performance in terms of the closeness of sibling relations and measures relevant to general effectiveness in communication about the physical world (as shown on referential communication tasks).

Method

Participants

These were 20 prelingually profoundly deaf children and their siblings. Both parents of the children were deaf, and all children were native signers of British Sign Language (BSL). The children had a mean age at the time of testing of 5 years 11 months (SD = 17.24 months, range 4;0–8;6). The mean age of their siblings was 7 years 11 months (SD = 35.67 months, range 4;2–16;3), significantly older than that of the children themselves, $t(19) = 18.55$, $p < .001$. Table 1 gives characteristics of the children and siblings. If a child had more than one sibling, the sibling nearest the age of the child was included in the study.

Procedure

All participants were tested in BSL by a deaf experimenter who himself was a native BSL signer. Testing took place either at home or in school.

Referential communication. The children were given a referential communication (RC) test to examine their ease at communicating complex matter about the physical world. The procedure and materials were adapted from Lloyd, Camaioni, and Ercolani (1995). The child and sibling were tested together. One was assigned the "speaker" role, and the other was the "listener." Both the child and the sibling participated in each role, in two separate tests. The order in which the child and sibling participated in each role was determined randomly. All of the children were videotaped during the speaker condition when providing messages in BSL to their siblings.

The children sat across from each other, about 3 m apart. The speaker and listener were each provided with a stack of 14 cards that contained pictures of objects and people. The pair was shown the first card from each stack, which featured four orange shapes (a wheel, a cloud, a star, and a heart), together. They were shown that although both cards contained the same pictures,

Table 1 Number and presence of siblings in the native signers ($N = 20$)

Child		Sibling			
Age	Gender	Age	Gender	Hearing status of sibling	Age difference (months)
4;0	M	8;4	F	Hearing	52
4;0	F	11;4	F	Deaf	88
4;2	M	6;11	F	Deaf	33
4;3	M	5;2	M	Deaf	11
4;8	F	10;0	F	Hearing	52
5;1	M	7;5	F	Deaf	28
5;2	M	4;3	M	Deaf	11
5;3	M	8;8	F	Hearing	41
5;4	M	9;10	M	Hearing	54
5;9	M	10;5	F	Deaf	56
5;11	M	7;8	M	Deaf	21
6;0	M	4;6	M	Hearing	18
6;5	F	8;6	M	Deaf	25
6;10	M	16;3	M	Hearing	113
6;11	F	4;2	M	Deaf	33
7;5	F	5;1	M	Deaf	28
7;6	F	6;6	M	Hearing	12
7;8	M	5;11	M	Deaf	21
8;4	M	10;7	M	Deaf	27
8;6	M	6;5	F	Deaf	25

the pictures were in different locations on the two cards. This instruction was necessary to emphasize that the speaker was required to communicate the features of a selected picture and could not simply hint where the illustration was located on the card. The children were instructed that the experimenter would point to one of the illustrations on the speaker's card using a red laser-point beam and that the speaker had to tell the sibling which illustration it was without pointing to the cards or showing them to the sibling. The children were encouraged to sign at their best and to make sure the video camera could see their hands. The listener had to point to the corresponding picture he or she thought was correct. When a child was considered to have lost concentration or did not understand what to do, the experimenter helped with a few prompts, but only for the first three of the 14 cards. After that time, no prompts were needed. As the test progressed, there were an increasing number of pictures on each card, up a maximum of eight. When all the cards had been presented, the children swapped places and took on the opposite role. The procedure was repeated, although the specific pictures to be communicated were changed.

Children scored one point for each correct picture selected by the listener. Each child received two scores, ranging from 0 to 14: one for the test in which he or she acted as the speaker and the sibling acted as the listener (RC-speaker condition) and one for the test in which the sibling acted as the speaker and he or she acted as the listener (RC-listener condition). In both cases, the score was derived from the choices of the listener.

The videotaped messages were also analyzed for use of the critical features of BSL to determine whether sufficient relevant information was given for the listener to identify the correct shape. The assessment of BSL involved the transcription of linguistic features. Simplistic signs, such as TRIANGLE, can be either drawn or formed in BSL. More complex signs require other features, such as negation (which includes the shaking of the head while giving information), facial expressions, or reference to parts of the body. Gestures were classified using the following coding system: (a) hands draw referent, (b) hands form referent or part of referent, (c) hands indicate how referent is held, (d) hands point to referent on body, (e) hands point to example of referent (not on body), (f) whole body or face represents referent.

The use of the face and mouth was also analyzed for its use in portraying the picture chosen. Sometimes the mouth is used to indicate an expression or to show the size of a feature. Using STAR to illustrate a simplistic sign, a transcription of sufficient information would be:

Target: *star*
Sign: STAR
Mouth: (none)
Face: (none)
Gesture: b
Translation: *star*

To indicate a picture of a Christmas tree without a star or candles, a transcription of sufficient information would be transcribed as below:

Target: *Christmas tree without star/candles*
Sign: CHRISTMAS TREE, NO STAR, NO CANDLES
Mouth:
Face: negation negation
Gesture: a b b
Translation: Christmas tree without star or candles

However, a transcription of insufficient information (e.g., no negation and missing item) would be:

Target: *Christmas tree without star/candles*
Sign: CHRISTMAS TREE, CANDLES
Mouth:
Face:
Gesture: a b
Translation: Christmas tree with candles
Other notes: insufficient information owing to the lack of negation and information about star

An independent coder coded the videotapes of signed dialogue to judge whether a child gave sufficient information. Interrater reliability with the judgments made by the experimenter was assessed for a randomly selected 51% of subjects' responses. Agreement of 89.92% was attained for judgments of sufficient BSL production within the RC test.

Quality of sibling relations. To provide insight into the link between the sibling relationship and ToM, the children received the Sibling Quality Interview (SQI) (Stormshak, Bellanti & Bierman, 1996). This consisted of a book in which each page revealed a pair of pictures with circles beneath them. There were nine pairs of pictures altogether; five referred to positive themes, such as shared play, exchanging secrets, and comfort from the sibling, and four referred to negative themes, such as fighting, showing off, and aggressive behaviors. Two opposing illustrations of sibling relations were on each sheet. One always depicted closeness (i.e., hugging or comforting), and the other did not (i.e., not hugging or not comforting). Beneath each picture there was a big circle and a small circle. The children had to indicate which picture reflected the quality of their own relationship with their sibling and the frequency of this type of interaction by selecting one of the circles.

The experimenter indicated that the characters within each picture were brothers or sisters. The book of pictures selected always matched the gender of the child and the sibling involved in the referential task. The child was asked in BSL to select which picture reflected his or her relationship with the sibling: "Which (point) same you and your (sister/brother)?" After indicating which picture by pointing, the child was then asked about the frequency: "Lots?" (big circle) or "Few?" (little circle). If a child chose a big circle after having chosen the positive alternative, he or she received a score of 4 points. The choice of a little circle for a positive alternative was given 3 points, a little circle for the nonpositive alternative was given 2 points, and a big circle for a nonpositive alternative was given 1 point. The scoring system was reversed for the items on the negative themes. Thus, for each item, a child could indicate a quality of up to 4 points, giving a total of up to 36 points. Reliability analyses for internal test consistency on the SQI indicated that the responses of the siblings were more reliable than were those of the children themselves. Cronbach's alpha for the children was only.22 but for their siblings (who were on average nearly two years older than the children), this figure rose to.74. Only the siblings' ratings on the SQI were used in subsequent analyses.

ToM and BSL tests. Approximately 2 months before being given the referential communication and sibling quality measures, the children had been tested for ToM and BSL as part of an earlier investigation (for procedural details, see Woolfe et al., 2002). The ToM test

Table 2 Results for both conditions in the referential communication task, sufficiency of each child in giving information in BSL and quality of sibling relation as perceived by sibling ($N = 20$)

Item	Mean (SD)	Minimum	Maximum
RC-listener	11.6 (1.93)	5	14
RC-speaker	11.30 (1.84)	7	14
BSL sufficiency by child	10.95 (1.82)	8	14
BSL sufficiency by sibling	10.75 (3.13)	0	14
Quality of sibling relations	24.55 (5.7)	15	36

consisted of two thought-picture tasks. For example, in one task, the children were presented with pictures showing that a boy who believes he has caught a fish with his fishing rod has, in reality, caught a boot. To pass these tasks, children had to respond correctly to questions about both the reality (that the protagonist had caught a boot) and the protagonist's belief (that he had caught a fish). If both reality and belief questions were answered correctly, the child scored 1 point for each picture, giving a score from 0 to 2. Of the 20 children, 13 were able to report both the reality and the protagonist's false belief correctly for both pictures, thus achieving a score of 2. Six children reported both the reality and the false belief correctly for only one of the two tasks (achieving a score of 1), and one child failed to report either the reality or the false belief correctly for both pictures (achieving a score of 0). The children all passed corresponding "true belief" control tasks.

The British Sign Language Receptive Skills Test (Herman, Holmes, & Woll, 1999) was used to measure the children's receptive skill in the syntax and morphology of BSL. The children had a mean BSL score of 108.75 ($SD = 12.10$, range 85–129).

Results

Table 2 provides the mean and range of RC scores as well as the number of RC trials on which sufficient BSL information was provided and the quality of the sibling relationship as perceived by the sibling. As shown in Table 3, ToM scores correlated significantly with age of child ($r[19] = .45, p < .05$), RC in the speaker condition ($r[19] = .50, p < .03$), and SQ ($r[19] = .52, p < .03$). As would be expected in a group of native signers who are proficient in a sign language and who thus have the requisite linguistic skills to comprehend ToM tasks, BSL scores and RC sufficiency in BSL by both the child and sibling were not significantly correlated with ToM.

To determine whether SQ exerts an effect on ToM that is independent of RC, two hierarchical multiple regressions were carried out. The results are summarized in Table 4. After Step 1, with age in the equation, $R^2 = .21$, $F(1,18) = 4.68$, $p < .05$. After Step 2, with age and SQ scores in the equation, there is a significant increase in R^2, $\Delta R^2 = .25$, $F(1,17) = 7.62$, $p < .05$. After Step 3, when RC scores in the speaker condition are entered into the equation, there is a nonsignificant increase in R^2, $\Delta R^2 = .03$, $F(1, 16) = 1.10$, $p = .32$. When the order of entry of RC-speaker and SQ is reversed, this pattern still holds. At Step 2, with age and RC-speaker in the equation, there is a nonsignificant increase in R^2, $\Delta R^2 = .11$, $F(1, 17) = 2.80$, $p = .11$. At Step 3, when sibling quality is entered into the equation, there is a significant increase in R^2, $\Delta R^2 = .17$, $F(1, 16) = 5.22$, $p < .05$. SQ was therefore a significant predictor of ToM performance after the effect of age was partialled out, but referential communication success was not.

This finding was confirmed by nonparametric analyses. Of the 12 children who had high scores on the SQI (25 or above out of 36), 10 were successful on both ToM tasks, and 2 others on one of the two. This pattern was far above what would be expected by chance alone, with a 25% success rate on both items, $p < .01$ (by Kolmogorov-Smirnov Test). By contrast, of the eight children who were rated by their siblings as having a poor quality of relationship, three were successful on both ToM tasks, four were successful on one, and one child failed both—a level of performance that did not differ from chance. The one boy who failed both ToM tasks had the lowest SQ score: 15 out of 36, a figure shared by only one other child. For six of the nine SQ situations, this boy's sister rated the quality of their re-

Table 3 Correlations among sibling quality; BSL, RC, and ToM measures; and child and sibling characteristics ($N = 20$)

Item	Sufficient BSL child	Sufficient BSL sibling	Child BSL score	Age of child	Age of sibling	No. of siblings	No. of older siblings	RC-speaker	RC listener	ToM score
Quality of sibling relations	.125	−.063	−.057	.045	−.367	.199	−.146	.310	−.103	.516**
Sufficient BSL by child	—	.451*	.301	.514	.288	−.057	.007	.587***	.309	.319
Sufficient BSL by sibling		—	−.194	−.033	.561***	−.112	.464*	.527**	.828***	.169
BSL score			—	.073	−.007	.148	.037	.072	−.140	−.305
Age of child				—	−.074	.103	−.209	.430	.119	.454*
Age of sibling					—	−.287	.409	.073	.348	.042
Number of siblings						—	.494*	.336	.128	.138
Number of older siblings							—	.302	.543**	.063
RC-speaker								—	.614***	.498*
RC-listener									—	.219

*$p < .05$; **$p < .02$; *** $p < .01$

Table 4 Hierarchical regression analyses of age, SQ, and RC-speaker as predictors of ToM scores ($N = 20$)

Step	*B*	SEB	Beta	Change in R^2	Step	*B*	SEB	Beta	Change in R^2
Step 1					Step 1				
Age	.016	.007	.454	.206*	Age	.016	.007	.454	.206*
Step 2					Step 2				
Age	.015	.006	.432		Age	.010	.008	.295	
SQ	.052	.019	.496	.246*	RC	.121	.072	.371	.112
Step 3					Step 3				
Age	.012	.007	.341		Age	.012	.007	.341	
SQ	.045	.020	.433		RC	.071	.068	.217	
RC	.071	.068	.217	.034	SQ	.045	.020	.433	.168*

*$p < .05$

lationship at only 1 on a scale of 1–4, including a score of 1 on the amount of anger and fighting. There were no significant differences in SQ, RC, BSL, or ToM between the 13 children who had a deaf sibling and the 7 who had a hearing one.

Discussion

These results demonstrate the importance of the link between quality of sibling relations and ToM reasoning in native signers. Nearly all the native signers whose siblings indicated closeness in their relationship had scored well on the ToM tasks. By contrast, several of the native signers for whom the relationship was not rated as close did not perform well on the ToM tasks. The quality of the sibling relationship predicted ToM reasoning over and above the age of the children and the effectiveness of conversation about the physical world (as measured by the RC task). This pattern of results is consistent with the position that good sibling quality exerts its positive effects on ToM development by providing increased scope for conversation, specifically about the world of mental states. It appears that siblings in the deaf home, as well as in the hearing home, can provide a positive environment in which children are exposed to talk about mental states that alerts them to the possibility that beliefs may differ from reality. Future work will perhaps provide a further test of this hypothesis by assessing the level of mental state language between siblings and its link to ToM reasoning.

A second key issue for future research concerns the extent to which any ToM benefit accrued by children with increased access to conversation about mental states is specific to siblings. One possibility is that the measure of sibling quality used in this study indicates the sociability of the child. Thus it could be that children who received high sibling quality scores (as rated by their siblings) are regarded by many of their relatives, schoolmates, teachers, and other potential conversational partners as more agreeable than those with lower

scores. In this case, all these groups are likely to converse more positively with that child than with a child who is seen as less sociable. Future research may usefully investigate the role of this wider community of conversational partners.

It is also reasonable to examine whether those children who do not have close sibling relations (or other close relationships) can eventually catch up in their ToM reasoning or, alternatively, whether their performance is persistently impaired over a long period of time. The large majority of typically developing hearing children as well as deaf native signers with positive sibling relations clearly excel on ToM tasks by the age of 4–5 years. Only late signers, as shown in previous research, and the few native signers who lack closeness in the quality of their sibling relations appear to be delayed. Is ToM reasoning in this sense triggered by exposure to early experience during a sensitive period? In the case of hearing children and deaf native signers, positive sibling relations may speed up a maturational process that is triggered through some minimal early exposure to conversation, in particular, conversation about how others are repositories of information about mental states, such as beliefs that may not coincide with reality. This process may not occur for late-signing children or for native signers who lack positive sibling relations. Consistent with this position, Russell et al. (1998) have found that problems on certain ToM tasks requiring verbal story comprehension linger in late-signing deaf children even at 13–16 years of age. Similarly, Dahlgren, Dahlgren-Sandberg, and Hjelmquist (2003) suggest that nonvocal children with cerebral palsy are specifically impaired in their ToM reasoning because they also are blocked in access to conversation about the mental states of others. As seems the case for verbal language development (Grimshaw, Adelstein, Bryden, & MacKinnon, 1998), only if there is no early exposure at all to relevant early experience may there be a lasting impairment. Nevertheless, such a conclusion is premature and awaits further study, given the suggestion of an extended but not lasting delay in the ToM of groups of deaf children with heterogeneous language backgrounds (Deleau, 1996; Lundy, 2002).

Moreover, ToM reasoning may not accurately characterize the complexities of children's understanding of mental states. As reported by Marschark, Green, Hindmarsh, and Walker (2000), late signers aged 8–13 do have the ability to attribute mental states correctly in generating stories about others with whom they have interacted hypothetically. They may simply have difficulty expressing these attributions on ToM tasks because such tasks often involve the need to follow inferences in conversation that have to do with the nature of the test questions (Bloom & German, 2000). For example, children may assume that the ToM test questions refer to what the protagonist will eventually discover to be reality, rather than to his or her initial false belief. It may be in this respect that the deaf native signers without close sibling relations, as well as late signers generally, fall behind, rather than specifically in their understanding of the nature of false beliefs.

Deaf native signing children are rare; only about 1 of 10 children born congenitally deaf have deaf parents. Given the relatively small sample size in our study, it is not surprising that the number of siblings (or number of older siblings) was not significantly associated with ToM. More research using a larger sample of children and a larger variety of tasks is needed to determine the conditions under which children display ToM reasoning. Nevertheless, the results of our study highlight the importance of the quality of sibling relations, rather than the mere presence of siblings as a possible advantage for performance on ToM tasks.

References

Astington, J. W., & Jenkins, J. M. (1999). A longitudinal study of the relation between language and theory-of-mind development. *Developmental Psychology, 35,* 1311–1320.

Bloom, P., & German, T. (2000). Two reasons to abandon the false belief task as a test of theory of mind. *Cognition, 77,* B25–B31.

Cole, K., & Mitchell, P. (2000). Siblings in the development of executive control and theory of mind. *British Journal of Developmental Psychology, 18,* 279–295.

Courtin, C., & Melot, A. M. (1998). Development of theories of mind in deaf children. In M. Marschark (Ed.), *Psychological perspectives on deafness* (pp. 79–102). Malwah, NJ: Erlbaum.

Cutting A.L., & Dunn, J. (1999). Theory of mind, emotional understanding, language and family background: Individual differences and interrelations. *Child Development, 70*(4), 853–865.

Dahlgren, S., Dahlgren-Sandberg, A., & Hjelmquist, E. (2003). The nonspecificity of theory of mind deficits: Evidence from children with communicative disabilities. *European Journal of Cognitive Psychology, 15,* 129–155.

de Villiers, J. (2000). Language and theory of mind: What are the

developmental relationships? In S. Baron-Cohen, H. Tager-Flusberg, & D.J. Cohen (Eds.), *Understanding other minds: Perspectives from developmental cognitive neuroscience* (pp. 83–123). New York: Oxford University Press.

de Villiers, J. G., & de Villiers, P.A. (2000). Linguistic determinism and the understanding of false beliefs. In P. Mitchell & K. Riggs (Eds.), *Children's reasoning about the mind* (pp. 191–228). Hove, UK: Psychology Press.

Deleau, M. (1996). L'attribution d'états mentaux chez les enfants sourds et entendants: Une approche du role de l'expérience langagière sur une théorie de l'esprit. *Bulletin de Psychologie, 5,* 48–56.

Deleau, M., Guéhéneuc, K., Le Sourn, S., & Ricard, M. (1999). Clairvoyance conversationnelle et théorie de l'esprit. *Enfance, 3,* 238–247.

Figueras-Costa, D., & Harris, P. L. (2001). Theory of mind development in deaf children: A nonverbal test of false-belief understanding. *Journal of Deaf Studies and Deaf Education, 6,* 92–102.

Grimshaw, G. M., Adelstein, A., Bryden, M. P., & MacKinnon, G. E. (1998). First-language acquisition in adolescence: Evidence for a critical period for verbal language development. *Brain and Language, 63,* 237–255.

Harris, P. L. (1996). Desires, beliefs, and language. In P. Carruthers & P. K. Smith (Eds.), *Theories of theory of mind* (pp. 200–220). New York: Cambridge University Press.

Herman, R., Holmes, S., & Woll, B. (1999). *Assessing BSL development: Receptive Skills Test.* Coleford, Gloucester, UK: Forest Books.

Howe, N., & Ross, H.S. (1990). Socialization, perspective taking, and the sibling relationship. *Developmental Psychology, 26,* 160–165.

Jenkins, J. M., & Astington, J.W. (1996). Cognitive factors and family structure associated with theory of mind development in young children. *Developmental Psychology, 32,* 70–78.

Lewis, C., Freeman, N. H., Kyriakidou, C., Maridaki-Kassotaki, K., & Berridge, D. M. (1996). Social influences on false belief access: Specific sibling influences or general apprenticeship. *Child Development, 67,* 2930–2947.

Lloyd, P., Camaioni, L., & Ercolani, P. (1995) Assessing referential communication skills in the primary school years: A comparative study. *British Journal of Developmental Psychology, 13,* 13–29.

Lundy, J. E. B. (2002). Age and language skills of deaf children in relation to theory of mind development. *Journal of Deaf Studies and Deaf Education,* 7, 41–56.

Marschark, M., Green, V., Hindmarsh, G., & Walker, S. (2000). Understanding theory of mind in children who are deaf. *Journal of Child Psychology and Psychiatry, 41,* 1067–1073.

Perner, J., Leekam, S.R., & Wimmer, H. (1987). Three-year-olds' difficulty with false belief: The case for a conceptual deficit. *British Journal of Developmental Psychology, 5,* 125–137.

Perner, J., Ruffman, T., & Leekam, S. R. (1994). Theory of mind is contagious: You catch it from your sibs. *Child Development, 65,* 1228–1238.

Peterson, C.C. (2000). Kindred spirits: Influences of siblings' perspectives on theory of mind. *Cognitive Development, 15,* 435–455.

Peterson, C. C., & Siegal, M. (1997). Psychological, physical, and biological thinking in normal, autistic, and deaf children. In H. M. Wellman & K. Inagaki (Eds.), *The emergence of core domains of thought: New directions for child development,* No. 75 (pp. 55–70). San Francisco, CA: Jossey-Bass.

Peterson, C. C., & Siegal, M. (1999). Representing inner worlds: Theory of mind in autistic, deaf, and normal hearing children, *Psychological Science, 10,* 126–129.

Ruffman, T., Perner, J., Naito, M., Parkin, L., & Clements, W. A. (1998). Older (but not younger) siblings facilitate false belief understanding. *Developmental Psychology, 34,* 161–174.

Russell, P. A., Hosie, J. A., Gray, C. D., Scott, C., Hunter, N., Banks, J. S., et al. (1998). The development of theory of mind in deaf children. *Journal of Child Psychology and Psychiatry, 15,* 129–155.

Siegal, M., Varley, R., & Want, S. C. (2001). Mind over grammar: Reasoning in aphasia and development, *Trends in Cognitive Sciences,* 5, 296–301.

Stormshak, E.A., Bellanti, C.J., & Bierman, K.L. (1996). The quality of sibling relationships and the development of social competence and behavioral control in aggressive children. *Developmental Psychology, 32,* 79–89.

Surian, L., & Leslie, A.M. (1999). Competence and performance in false belief understanding: A comparison of autistic and normal 3-year-old children. *British Journal of Developmental Psychology, 17,* 141–155.

Tager-Flusberg, H. (2000). Language and understanding minds: Connections in autism. In S. Baron-Cohen, H. Tager-Flusberg, & D. Cohen (Eds.), *Understanding other minds: Perspectives from developmental cognitive neuroscience* (pp. 124–149). New York: Oxford University Press.

Woolfe, T., Want, S.C., & Siegal, M. (2002). Signposts to development: Theory of mind in deaf children. *Child Development, 73,* 768–778.

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Can the Emotion Recognition Ability of Deaf Children be Enhanced? A Pilot Study

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We evaluated the effectiveness of an 11-lesson psychoeducational program designed to enhance the ability of deaf children to understand the emotional experience of themselves and other people. The "Funny Faces Program" was provided to 14 children, aged 9 to 13, with moderate to profound hearing impairments. All children were enrolled in an "oral" education program at a school for the deaf. Alternate forms of the Emotion Recognition Scales (Dyck, Ferguson, & Shochet, 2001) were administered at pretest and posttest. Results indicate significant increases in emotion vocabulary and emotion comprehension but not in the speed or accuracy of emotion recognition (ER), from pretest to posttest. At posttest, children whose hearing loss was moderate to severe did not differ from hearing children in ER abilities but children with profound hearing loss continued to show substantial ability deficits.

When a deaf child is not exposed to a natural language from infancy (Isham & Kamin, 1993), severe prelingual deafness is typically followed by pronounced delays in language acquisition, in academic achievement and verbal intelligence (Bracken & Cato, 1986), in social knowledge and competence (Kusche, Garfield, & Greenberg, 1983; Weisel & Bar-Lev, 1992), and in psychological (Mahapatra, 1974) and social adjustment (Vernon & Greenberg, 1999). During the last decade, research has shown that deaf children are also delayed in acquiring a theory of mind (ToM; Peterson & Siegal, 1995, 1998).

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This was an important finding for at least two reasons. On the one hand, this finding implied that acquisition of a ToM might itself depend on the acquisition of language (e.g., the syntax of complementation; Tager-Flusberg, 1997). Conversely, it implied that the social problems of deaf children might be mediated by the same cognitive deficits that were thought to account for the social and behavioral problems shown by children with autism (Baron-Cohen, Leslie, & Frith, 1985).

In populations where ToM deficits are observed, deficits in the ability to understand the emotional experience of other people are also typically observed. For example, children with autism or mental retardation have emotion recognition (ER) and understanding deficits that are proportionately greater than their general intellectual deficits (Dyck, Ferguson, & Shochet, 2001; Hobson, Ouston, & Lee, 1988; Loveland et al., 1997). Children with a specific language impairment who pass first-order ToM tasks (Leslie & Frith, 1988; Perner, Frith, Leslie, & Leekam, 1989) but have difficulty with second-order ToM tasks (Patchell, Reed, Coggins, & Hand, 2001) have problems in recognizing nonverbal emotional expressions (Wiig & Harris, 1974), understanding facial expressions accompanying spoken messages (Larson & McKinley, 1995), and matching facial expressions with emotional tone of voice (Courtright & Courtright, 1983).

Among deaf children, results have been equivocal. Earlier studies indicated that deaf children make more errors in recognizing facial expressions of emotion than do hearing children, and the number of errors is related

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