Brief Reports

Brief Report: Theory of Mind in High-Functioning Children with Autism

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INTRODUCTION

One of the key components in the understanding of relationships is what children understand about themselves and other people—an understanding of "other minds" (Dunn, 1993). Normally developing children are able to talk about feelings—their own and those of others from their second year. Around 3–5 years, children are able to make the link between people's behaviors and their intentions, desires, and beliefs (Harris, 1989). They have developed a "theory of mind." Since theory of mind is viewed as a necessary prerequisite for social interaction and social relationships (Baron-Cohen, 1988; Dennett, 1978; Wellman, 1990), an inability to develop a theory of mind (TOM) is considered by many as a common explanation for the difficulties autistic children have in social interactions (Baron-Cohen, 1989a, 1989b, 1991, 1993; Baron-Cohen, Leslie, & Frith, 1985; Perner, Frith, Leslie, & Leekam, 1989; Yirmiya, Solomonica-Levi, & Shulman, 1996).

Theory of mind is defined as the ability to construct people in terms of internal mental states such as their beliefs, desires, intentions, and emotions (Wellman, 1993). Interactions between people involve attributions about other people's mental states at several levels. First-order belief describes what people think about real events. However, social interaction is largely based on interactions that can be properly understood only when one takes into account what people think about other people's thoughts (second-order beliefs) and even what people think that others think about their thoughts (higher order beliefs) (Perner & Wimmer, 1985). Den-

nett (1978) argued that understanding false belief might constitute a litmus test of a TOM, in that in such cases, it becomes possible to distinguish unambiguously between the child's (true) belief and the child's awareness of someone else's different (false) belief.

Although many studies have now examined false belief abilities in children with autism, findings are still inconclusive in terms of the universality of the deficit in autism. Most studies have shown that understanding false belief is difficult for the majority of children with autism who also are mentally retarded (e.g., Baron-Cohen *et al.*, 1985; Leekam & Perner, 1991; Leslie & Frith, 1988; Leslie & Thaiss, 1992). Other studies have found a positive link between cognitive abilities (mainly verbal IQ or verbal mental age) and performance on first-order false belief tasks (e.g., Happe, 1994a, 1995; Yirmiya, Solomonica-Levi, Shulman, & Pilowsky, 1996). Few studies have examined false belief second-order tasks in samples of high-functioning children with autism who *all* function above the mentally retarded level (e.g., Dahlgren & Trillingsgaard, 1996; Happe, 1994b; Ozonoff & McEvoy, 1994; Ozonoff, Pennington, &, Rogers 1991; Tager-Flusberg & Sullivan, 1994). The results of these few studies, too, have been inconclusive regarding the extent that general cognitive abilities play in false belief tasks.

In examining second-order false belief tasks, researchers have tended to examine only one measure of cognitive functioning (e.g., verbal IQ) and one aspect of performance on the false belief task (e.g., belief or justification). Happé (1994b), for example, focused on verbal IQ skills and Tager-Flusberg and Sullivan (1994) examined full-scale IQ. Ozonoff and McEvoy (1994) and Dahlgren and Trillingsgaard (1996) examined all three IQ scales (verbal, performance, and full) but with an interest in the belief question solely without examining the subject's ability to justify their answers.

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It is important to examine both performance on the belief question and the ability to justify answers. Bowler (1992) found that children with Asperger syndrome (these individuals are high-functioning and share similarities with autism) did not differ from typically developing children in their ability to pass a second-order false belief task but did differ in their ability to justify their answers. It might be that more able children with autism can pass the belief question but have difficulties explaining their answers. The justification for the belief question requires a more extensive social understanding and it might require higher cognitive abilities. Altogether, it is unclear the extent to which general cognitive abilities mediate performance in second-order false belief tasks (both belief and justification).

In sum, the present study adds to the existing literature regarding false belief deficits in autism in at least four important ways. First, we examined a theory of mind—second-order false belief task—in very able children with autism. All of the children with autism functioned above the mental retardation level. Second, we matched subjects with a control group of typically developing children on all three scales of IQ. We also examined the association between all three scales of IQ with the belief and justification questions, thus testing the link between false belief abilities and more general cognitive abilities. Finally, the subjects in the present study present a more limited age range compared to other studies with high-functioning individuals with autism (see, e.g., Happé, 1994b). The findings of the present study are important to the hypothesis of false belief in autism because if even very able children with autism have difficulties passing the belief question or providing justification for their answers, we can conclude that a deficit in false belief is universal to children with autism, regardless of their general cognitive abilities.

METHOD

Participants

Participants included 22 high-functioning children with autism (1 girl) between the ages of 7.11 and 14.8 years and 19 typical children (1 girl) between the ages of 7.8 and 14.5 years. Full-scale IQ scores for the autistic children, as measured on the WISC-R ranged from 84–138 and from 92–129 for the typical children. The children with autism were recruited from the UCLA Neuropsychiatric Institute and local Regional Centers. The typical children were recruited from local public schools

and matched to the sample of autistic children on chronological age, IQ, gender, and ethnicity. Both the autistic and typical subjects were recruited from Los Angeles and Orange Counties in Southern California.

Prior to participating in the study, children with autism were diagnosed by licensed psychologists and psychiatrists not associated with the current study. All autistic children met DSM-IV (American Psychiatric Associations, 1994) criteria for autistic disorder including (a) onset prior to 36 months of age, (b) qualitative impairment in social interaction, (c) qualitative impairment in communication (e.g., deficits or abnormalities in language development or deficits in play, particularly symbolic play); (d) restricted and repetitive stereotyped behaviors which may include bizarre responses to various aspects of the environment, such as resistance to change.

The Autism Diagnostic Interview-Revised (ADI-R; Le Couteur; et al., 1989) was administered to the parents of the children with autism to verify diagnosis and to provide additional information about the children's developmental and current histories. The ADI-R is a standardized investigator-based interview. It is administrated to the individual's primary caregiver by a trained interviewer. Based on the ICD-10 criteria (World Health Organization, 1990) for autism, the ADI-R emphasizes detailed descriptions of behaviors that focus on developmental deviance rather than on developmental delay. The ADI-R focuses on meeting criteria for autism in three main areas: reciprocal social interaction; communication and language; and repetitive, restrictive, and stereotyped behaviors. The child also needs to show evidence of developmental delay or deviance prior to the age of 36 months (Le Couteur et al., 1989). All 22 children with autism met criteria of evidence of developmental delay prior to 36 months. Eighteen children met all four criteria of the ADI-R, the remaining 4 children met three out of four criteria.

As shown in Table I, the control group of typically developing children was matched to the children with autism on chronological age, full-scale, verbal, and performance IQ scores, gender, mother's education and ethnicity. T tests revealed no group differences with regard to any demographic variables.

Measures and Coding Procedures

Theory of Mind—Second-Order Belief Attribution Task

A widely used task to measure children's TOM is the second-order belief attribution task of Perner and

Table I. Sample Characteristics[a]

	Autism	Typical
Chronological age (in years, months)		
M (SD)	10.74 (2.14)	10.89 (2.10)
Range	7.11–14.08	7.08–14.05
Full-scale IQ		
M (SD)	108.14 (15.09)	115.73 (9.75)
Range	84–138	92–129
Verbal IQ		
M (SD)	107.22 (15.08)	114.84 (11.03)
Range	78–132	91–129
Performance IQ		
M (SD)	108.27 (16.16)	113.68 (9.93)
Range	73–141	94–129
Male/female	21/1	18/1
Ethnicity (White/Af-Am)	21/1	18/1
Mother's education [M (SD)]	6.73 (1.20)	7.00 (.88)

[a] No significant differences between groups on Chronological age, Verbal IQ, Performance IQ, Full-scale IQ, mother education, and gender. IQ scores are based on the WISC-R. Mother's education was calculated according to 1–8 scale (1 = less than 7th grade; 2 = junior high; 3 = some high school; 4 = high school; 5 = some college; 6 = special training after high school; 7 = college; 8 = graduate/professional training).

Wimmer (1985). Second-order belief is when one takes into account what people think about other people's thoughts. The task involves the use of a toy village which includes two houses, a school, a park (a few trees) and four characters (e.g., two children: John and Mary and two adults—John's mother and an ice-cream man). The experimenter sets up the village in front of the child, and then tells the following story while moving the doll characters accordingly.

> The story starts when John and Mary are in the park and see an ice-cream man coming to the park. John wants to buy an ice cream, but does not have money. The ice-cream man tells John that he can go home and get money, because he is planing to stay in the park all afternoon. Then John goes home to get money. Now, the ice-cream man changes his mind and decides to go and sell ice cream in the school. Mary knows that the ice-cream man has changed his mind. She also knows that John could not know that (e.g., John already went home). The ice-cream man goes to school, and on his way he passes John's house. John sees him and asks him where is he going. The ice-cream man tells John that he is going to school to sell ice cream there. Mary at that time was still in the park—thus could not hear their conversation. Then Mary goes home, and later she goes to John's house. John's mother tells Mary that John had gone to buy an ice cream.

Throughout the story, children are prompted for their understanding. For example: When the ice-cream man

tells John he will be in the park all afternoon, the child is asked: "Where did the ice-cream man say to John he would be all afternoon"?. When Mary approaches John's mother, the child is asked the *belief* question: "Where does Mary think that John has gone to buy an ice cream"? A correct answer is "in the park" since Mary does not know that the ice-cream man had talked to John. The child is then asked a justification question ("why?") so as to explain the answer the child gave on the belief question. The justification question is an indication of the child's ability to take Mary's point of view. This is a second-order belief attribution task because the child needed to understand that: *Mary thinks* that *John thinks* that the ice-cream man is in the *park*, when in fact, *John knows* that the ice-cream man is at the *school*. The justification question verifies the child's ability to differentiate between the self and others and gives evidence of the child's development of theory of mind.

At the end of the story the child is asked a reality question: "Where did John really go to buy an ice cream"? and a memory question: "Where was the ice-cream man in the beginning of the story?" The memory question is used to verify that an incorrect answer on the belief question did not stem from lack of memory regarding the location of the icecream man at the beginning of the story. The reality question is used to verify that the child's answer stems from his understanding of the story.

Coding

Belief. The child's answer on the belief question ("Where does Mary think John had gone to buy an ice cream") was coded as passed (a score of 1) if the child's response was: "in or at the park" and failed (a score of 0) if the child's response was: "at school" or any other response that did not mention the park as an answer.

Justification. Children's answers were coded following Perner and Wimmer's (1985) coding procedure as follows: (1) belief–location—responses that reflect the initial location of the ice-cream man. For example: "Because the ice-cream man was at the park in the beginning of the story" or "because the ice-cream said he would be at the park all afternoon"; (2) belief–information—responses that include information that is nested within a belief. For example: "Mary did not know that the ice-cream man told John he is going to school" or "Mary heard that John and the ice-cream man were suppose to meet at the park"; and (3) belief–belief justification—the highest level of attribution in which the child is able

to articulate the other child's thinking process. For example: "*Mary* still *thinks* that *John thinks* the ice-cream man is in the park" or "Mary does not *know* that John already *knows* where the ice-cream man is". A child obtained a score of 3 if he provided the *belief–belief* justification, a score of 2 reflected the *belief–information* justification, a score of 1 reflected the *belief–location* justification, and a score of 0 reflected a wrong answer.

Reliability. Interrater reliability was determined by two raters who independently coded 25% of the responses, randomly selected on the justification question and evenly distributed across typical and autistic subjects. Reliability was calculated using Generalizability (G) coefficients (Algina, 1978; Mitchell, 1979). In this study, the G coefficients represent the ratio of subject score variance over the sum of subject variance plus rater by error variance (Mitchell, 1979). The average G coefficient was .88. Consensus was reached on all disagreements.

Data Collection Procedures

The data were collected individually with each child. For the autistic group, assessments took place in a laboratory classroom on the UCLA campus. Measures were obtained in a separate classroom free of interference and distractions. The majority of the children in the control group were assessed in their homes. As the autistic child was being assessed, his parents were interviewed, using the ADI-R (Le Couteur *et al.*, 1989). The parents were also asked to fill out demographic information forms.

RESULTS

Belief Question. Sixty eight percent (15 children out of 22) of the high-functioning children with autism passed the belief question on the theory of mind—false belief task, compared to 89.5% of the typically developing (17 out of 19 children). Fisher's Exact probability test yielded no group differences. Children with autism who passed the belief question had significantly higher Full and Verbal IQ scores (M = 112.9, SD = 14.8; M = 112.9, SD = 12.2, respectively) as compared to children with autism who failed (M = 98, SD = 10.6; M = 95.1, SD = 14.2, respectively), $t(20)$ = 2.38, p < .05 for full IQ, and $t(20)$ = 3.02, p < .01 for verbal IQ.

Justification. Nine out of 22 children with autism gave wrong or irrelevant justification to the belief question. Two children with autism (among the 9 mentioned

Table II. Correlations Between CA, IQ, and Theory of Mind Measures by Group

	CA	Full IQ	Verbal IQ	Performance IQ
Autism				
False belief question	.17	.47[a]	.56[b]	.28
Justification	.33	.73[c]	.61[b]	.69[c]
Typical				
False belief question	.06	−.08	−.05	.08
Justification	.29	−.34	−.23	−.23

[a] p < .05.
[b] p < .01.
[c] p < .001.

above) passed the belief question but gave a wrong explanation to their answer. In the typically developing children all the children that passed the TOM task on the belief question gave an accurate and relevant justification to their answer. Thus, the pattern of giving an accurate answer to the belief question and a wrong answer to the justification question is unique to the group with autism. Altogether, children with autism were more likely to provide wrong justification on the belief question as compared to typically developing children, $X^2(1, 41)$ = 4.78, p < .05. Of the children in both groups that gave relevant justification to the belief question (n = 13 in autism, n = 17 in typical), children in both groups had a similar frequency distribution among the three justification options: belief–location; belief–information; and belief–belief justification. Thus, the two groups differ on the ability to provide an accurate justification on the belief question and not on the type of the justification.

Relations Between CA, IQ, and Theory of Mind

Within-group correlation analyses were computed between CA, IQ (Full, Verbal, and Performance) and theory of mind (false belief question and type of justification). In the children with autism, Full and Verbal IQ scores were significantly associated with performance on the false belief question (r = .47, p < .05, r = .56, p < .01, respectively). Type of justification was associated with all three scales of IQ (Full, r = .73, p < .001; Verbal, r = .61, p < .01; and Performance, r = .69, p < .001). None of the aforementioned correlations achieved significance for the typically developing children (Table II). Moreover, Fisher's z coefficient tests were computed to test for significant differences between correlation coefficients in the two groups. Each signifi-

cant correlation in the autism sample was significantly different from the correlation in the typical group ($p <$ .05, Fisher's z tests).

DISCUSSION

The results of the present study demonstrate an association between cognitive abilities and performance on a second-order false belief task in a sample of very able children with autism. High-functioning children with autism did not differ from typically developing children in their performance on the belief question in a second-order false belief task. Children with autism who passed the belief question, however, had significantly *higher* full-scale and verbal IQ scores. In like manner, neither autistic nor typical children differed on the complexity of the justification they provided to the belief question. Again, however, IQ scores were significantly associated with the level of complexity on the justification question in the children with autism, but not the typical children. These findings suggest that, like typical children, children with autism can provide correct answers on a test of false belief and justify their answers at similar levels of complexity, but their ability to do so is more closely related to general cognitive ability.

In spite of the above similarities, the autistic children, as a group, gave more irrelevant or wrong responses when asked to explain their answers to the belief question. Such performance suggests that high cognitive abilities do not fully compensate for deficiencies in social understanding. To provide an appropriate justification for their belief, children had to verbalize their thinking process during task completion and use social conventions. The fact that more children with autism gave irrelevant justification responses likely reflects their confusion in social understanding.

Although high cognitive abilities may be useful in solving TOM tasks, they may not be enough to function well in real social situations. Indeed, Ozonoff and Miller (1995) successfully taught able children with autism the mental state concept of theory of mind. In spite of demonstrated improvement in false belief tests, there was little improvement in their more global performance in social skills. Other studies find similar effects. Even very able children with autism, or children with Asperger syndrome, have difficulties in applying theory of mind when faced with a real social situation (e.g., Bowler, 1992; Happe, 1994b, 1994c; Ozonoff & McEvoy, 1994; Rutter & Bailey, 1993). Thus, the gap remains between

performance on a paper-and-pencil theory of mind task and performance in real-world situations.

In general, our findings are inconsistent with early studies of false belief abilities in autism. For example, Baron-Cohen (1989b) was the first to test false belief tasks in children with autism and found that no one in a sample of 10 autistic children was able to pass the belief question. But the subjects in his study were *not* high-functioning (CA = 15.3; Verbal MA–expressive = 12.2; and Verbal MA–receptive = 7.8; Nonverbal MA = 10.7). The higher cognitive abilities of the participants in the present study might explain the discrepancy in findings between the two studies.

Our findings, however, are consistent with Dahlgren and Trillingsgaard's (1996) study which examined the "John and Mary" second-order false belief procedure with a sample of able children with autism (at the same age range of the present study) and found a similar percentage of children with autism (60 vs. 68% of the present study) who could pass the belief question. These authors did not, however, examine justification responses of the children.

The results of this study provide further support for considering the importance of cognitive abilities in autistic children's performance on false belief tasks. Moreover, these results suggest that autism does not involve a specific impairment in theory of mind and that theory of mind deficits are not unique to autism. Because there seem to be issues in the measurement of TOM (actual situations vs. experimental tasks), future studies should examine other methods for studying false belief and TOM abilities in autism. Given the persistent problems in social functioning among autistic children, and the potential link between theory of mind abilities and social skills, it is important to have a better understanding of these skills in autism. Ultimately such information should assist in designing interventions to improve functioning of autistic children in naturally occurring social situations.

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