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The Autistic Child's Theory of Mind: a Case of Specific Developmental Delay

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Abstract—In previous tests of the lowest level of a "theory of mind" (i.e. first-order belief attribution), 80% of autistic children were found to be impaired relative to a non-autistic mentally-handicapped control group. The present study examines the 20% of autistic children who have a theory of mind at the lowest level, and tests their ability to use a theory of mind at higher levels (i.e. second-order belief attribution). This autistic subgroup, in comparison to Down's Syndrome and normal control groups, was found to be severely impaired at the higher level. Autism is discussed as a possible case of specific developmental delay.

Keywords: Autism, social cognition, developmental delay, theory of mind

Introduction

Autism is a pervasive developmental disorder which begins in the first 36 months of life (DSM-IIIR, 1987). Symptoms include deficits in the pragmatic aspects of language (Tager-Flusberg, 1985; Baron-Cohen, 1988), an absence of symbolic play (Ungerer & Sigman, 1981; Baron-Cohen, 1987a), and the presence of ritualistic behaviour (DSM-IIIR, 1987). Autistic children also suffer a severe impairment in their ability to relate socially (Kanner, 1943; Rutter, 1983).

The social impairment is nowadays seen as the primary symptom of the disorder (Rutter, 1983; Fein, Pennington, Markowitz, Braverman & Waterhouse, 1986; Volkmar, 1987; Baron-Cohen, 1988), and follow-up studies suggest that the social impairment is life-long (Kanner, Rodriguez & Ashenden, 1972; Newson, Dawson & Everard, 1984; Rutter, Greenfield & Lockyer, 1967; Paul, 1987), and is found regardless of IQ. Since reviews of the social impairment exist elsewhere (Shah & Wing, 1986; Volkmar, 1987; Howlin, 1986; Baron-Cohen, 1988), it will not be described in detail here.

Various theories of the social impairment have been proposed. Bettelheim (1967) and Tinbergen and Tinbergen (1983) proposed that it results from the child perceiving the social environment as traumatic and uncontrollable, but evidence from studies of children who have been reared under conditions of severe abuse does not substantiate this view (Rutter, 1983; Skuse, 1984). Hobson (in press) has argued that an innate

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inability to respond emotionally to others causes the observed social impairment in autism; results from emotion-recognition tasks offer some support for this view (Hobson, 1986a & b).

However, there are two key reasons why this affective theory is insufficient to account for the social impairment in autism. First, emotion-recognition deficits are found in a wide range of clinical populations (Cicone, Wapner & Gardner, 1980; Ross & Mesulam, 1979; Cutting, 1981; Novic, Luchins & Perline, 1984; Odom, Blanton & Laukhuf, 1973; Gray, Fraser & Leudar, 1983; Camras, Grow & Ribordy, 1983), and are therefore not autism-specific. Secondly, some interpersonal emotional responsivity is frequently present in autism (Volkmar, 1987; Baron-Cohen, 1988; Sigman & Ungerer, 1984; Shapiro, Sherman, Calamari & Koch, 1987). This suggests that *non-affective* factors must also be involved.

A range of *cognitive* deficits has been found in autism (Hermelin & O'Connor, 1970; Frith, 1982; Shah & Frith, 1983), and this has led to the hypothesis that cognitive deficits may also underlie the social impairment. One such aspect of social cognition which has been found to be impaired in autism is the ability to attribute beliefs to others, (Baron-Cohen, Leslie & Frith, 1985, 1986). Such an ability is distinct from perceptual role-taking, which is intact in autism (Hobson, 1984; Baron-Cohen, in press), and might be more accurately called conceptual role-taking (Flavell, Botkin, Fry, Wright & Jarvis, 1968). It has also been called a "theory of mind" (Premack & Woodruff, 1978), because it involves the person postulating the existence of mental states and then using these to explain and predict another person's behaviour.

In our earlier study, we used a task (designed by Wimmer & Perner, 1983, and illustrated in Fig. 1) in which children watch a puppet play, during which an object (a marble) is moved while a character is absent. We found that whereas normal children of 3½ yrs old and Down's Syndrome children of below average intelligence could attribute a false (and therefore different) belief to the character (e.g. the marble is in the basket), and use this to predict the character's behaviour (e.g. she will look in the basket), 80% of autistic children whose intelligence was in the normal range showed no evidence of such an ability (Baron-Cohen *et al.*, 1985).

To pass this test of the simplest level of a theory of mind, the subject must attribute a belief to another person. Such an ability can be termed "first-order belief attribution" (Wimmer & Perner, 1983).* This deficit in autism has recently been replicated using a gift-choosing paradigm (Dawson & Fernald, 1987) and using people instead of dolls (Leslie & Frith, 1988; Perner, Frith, Leslie & Leekham, 1988), and suggests that a severe cognitive deficit may underlie the social impairment in autism, such that the fundamental "Intentional stance" (Dennett, 1978)† may be beyond the

*When a subject distinguishes his/her own belief from someone else's belief, Perner and Wimmer (1985) call this a "first-order belief attribution", although they recognize that this requires two levels of representation (i.e. the subject's belief refering to another belief). In this paper, we follow Perner and Wimmer's convention of employing the term first-order belief attribution rather than "second-order (or meta-) representation" (Dennett, 1978; Pylyshyn, 1978; Johnson-Laird, 1983; Leslie, 1987). However, the general rule is that, when counting levels of representation, the levels of attribution are always one less than this.

†The term "Intentional stance" (with a capital I) is taken from Dennett (1978) and others and is used to denote a subject's ability to appreciate mental states with content (i.e. beliefs, thoughts, desires, intentions, expectations etc.).

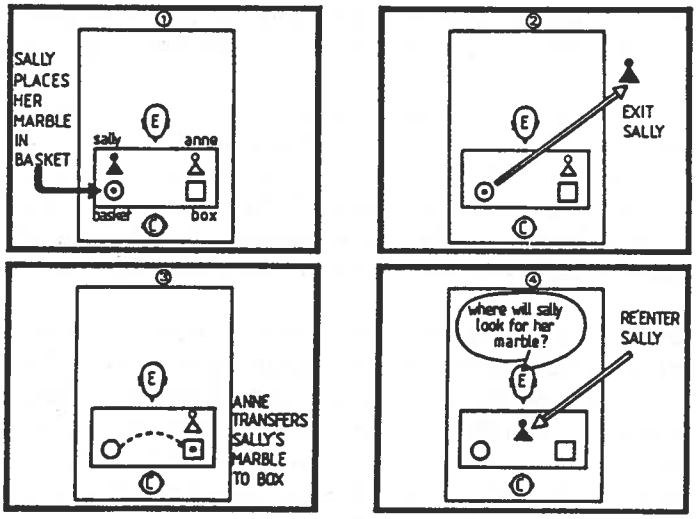

Fig. 1. Scenario of test of first-order belief attribution.
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experience of most autistic children. Lacking such an ability would render one incapable of making sense of the social world or of communicating with others (Humphrey, 1983; Wellman, 1985; Lyons, 1987). Some developmental psychologists have argued that a theory of mind has its origins in normal children at the end of their first year of life (Leslie, 1987; Bretherton, McNew & Beeghly-Smith, 1981).

The specific developmental delay hypothesis

In our previous paper, we interpreted this cognitive deficit in terms of a failure to develop a *meta-representational capacity* which is assumed to underlie belief attribution (Pylyshyn, 1978; Johnson-Laird, 1983; Leslie, 1987; Baron-Cohen, 1988). In this paper we explore the possibility that in autism there is a specific delay in the development of this mechanism. Such an idea could explain why our earlier results applied to 80% of a high autistic sample, but not to the remaining 20%. These other children were striking, in that they could, in the above tests, make first-order belief attributions (i.e. of the form *'Mary thinks the marble is in the basket'*).

The specific developmental delay hypothesis derives its name firstly from the evidence that autistic children's impaired theory of mind is not related to *general* developmental delay (as the data from Down's Syndrome subjects show), and secondly from the possibility that some older autistic children may eventually develop a theory of mind at the lowest level, many years after it would normally be present.

In this respect the 20% of our previous sample who had developed a theory of mind become critical. They actually comprised only four individuals. Analysis of the age of these subjects revealed that they were among the oldest of the sample (Baron-Cohen *et al.*, 1985, 1986). This is therefore compatible with a specific developmental delay hypothesis. The strongest test of this hypothesis would of course be a *longitudinal* study, and this is planned. In the cross-sectional study to be reported here however,

we surmised that if in autism there is a true delay in the development of a theory of mind, it should also show up in this subgroup's inability to use a more advanced theory of mind.

Normal 6–7-yr-old children are able to make what can be called "second-order belief attributions" (i.e. of the form *'Mary thinks John thinks the ice-cream van is in the park')* (Perner & Wimmer, 1985). This can be called "recursive thinking" (Miller, Kessel & Flavell, 1970; Eliot, Lovell, Dayton & McGrady, 1979; Landry & Lyons-Ruth, 1980; Shultz & Cloghesy, 1981). We predicted that if we could test these and other similar autistic children for second-order belief attribution ability, they would be impaired.

In testing a person's theory of mind, it is essential that these two different levels (first- and second-order belief attribution) are clearly distinguished. Flavell *et al.* (1968) used the terms "Level 1 perspective taking" and "Level 2 perspective taking" to describe this distinction, and defined these as follows: level 1 perspective taking is the ability to think about another person's thoughts about an objective event; level 2 perspective taking is the ability to think about another person's thoughts about a third person's thoughts about an objective event.

Flavell *et al.*'s (1968) paradigm, and others used by Miller *et al.* (1970) and Barenboim (1978), failed to elicit evidence of second-order belief attribution in children below the age of 11 yrs old. We must assume that the task demands in these experiments were over-complicated, since Perner and Wimmer (1985) found that children as young as 6 yrs old could make such attributions. Perner and Wimmer's (1985) paradigm is also methodologically tighter than previous paradigms in that their test distinguishes unambiguously whether a subject is making first- or second-order belief attributions in a way that other studies do not (Shultz & Cloghesy, 1981; Landry & Lyons-Ruth, 1980). In our experiment with autistic children we used an adapted version of Perner and Wimmer's (1985) procedure. This is described below.

The experiment

Subjects

We tested three groups of ten subjects—autistic, Down's Syndrome and normal children. All the autistic children except one (who had completed mainstream education) were attending special schools for autism in or around London, and had been diagnosed according to established criteria (ICD-9, 1978; DSM-IIIR, 1987; Rutter, 1978). The Down's group were attending an inner London school for people with learning disabilities, and the normal group were drawn from an inner London primary school. The control groups were predominantly from working class families, whilst the autistic group represented a range of socio-economic classes.

Our inclusion criterion was the ability to pass the developmentally earlier/simpler test of a theory of mind (involving first-order belief attribution only) as described by Wimmer and Perner (1983) (and see Fig. 1). As mentioned earlier we had previously found four subjects in a school of 20 autistic children who met this criterion (Baron-Cohen *et al.*, 1985), and these took part in a pilot experiment using the present paradigm. This is described elsewhere (Baron-Cohen, 1985). In the present study, four more autistic children passed the inclusion criterion from another school of 14 who were screened, and this percentage (29%) is in line with and extends the database of our earlier findings (20%) (Baron-Cohen *et al.*, 1985). Of the remaining two autistic subjects, one was from a third school and was identified as being "socially aware" during a separate study (Baron-Cohen, 1987a), whilst the other was a teenager who had left school and was holding down a job, and who was referred to our clinic for social skills training. Both of these subjects proved eligible for this study.

The normal children were taken from the 7-yr age group, since Perner and Wimmer (1985) suggest that this age is sufficient for development of the ability to make second-order belief attributions. In addition, we assessed the two clinical groups for receptive verbal mental age (MA) using the British Picture Vocabulary Scale (BPVS) Long Form (Dunn, Dunn, Whetton & Pintilie, 1982), expressive verbal MA using the Expressive One-Word Picture Vocabulary Test (EOWPVT) (Gardner, 1979) and non-verbal MA using the Leiter International Performance Scale (Arthur, 1952). Details of these subjects are summarized in Table 1. Four of the 10 autistic and four of the 10 Down's Syndrome subjects were not tested using the EOWPVT, as they were unavailable when the expressive language test was carried out.

Table 1. Chronological age (CA) and mental age (MA) of subjects in the Experiment

Diagnostic groups	*n*		CA	Verbal MA Expressive*	Verbal MA Receptive†	Non-verbal MA‡
Autistic	10	Mean	15.3	12.2	7.8	10.7
		SD	2.7	3.7	4.0	2.8
		Range	10.9–18.9	7.3–17.7	2.8–17.9	8.3–18.0
Down's	10	Mean	14.3	7.5	4.7	6.8
Syndrome		SD	2.8	1.3	1.6	1.3
		Range	9.3–17.6	6.1–9.8	2.5–6.8	5.0–8.5
Normal	10	Mean	7.5			
		SD	0.3	—	—	—
		Range	7.2–7.8			

*EOWPVT ($n = 6$ in each group); †BPVS; ‡Leiter.

The autistic group's mean chronological age (CA) was 15.3 yrs, whilst that of the Down's group was 14.3 yrs. This was not significantly different ($t = 0.76$, 17.9df, $p < 0.46$). However, the autistic group was superior to the Down's Syndrome group not only in terms of their non-verbal MA (mean = 10.7 yrs; $t = 4.06$, 12.5df, $p < 0.001$), but also in terms of their expressive verbal MA (mean = 12.2 yrs; $t = 2.926$, 10df, $p < 0.02$) and their receptive verbal MA (mean = 7.8 years; $t = 2.2$, 11.9df, $p < 0.05$) (t scores are adjusted for unequal variance). This selection of an autistic group which was superior to controls in MA allowed us to test the hypothesis that there was a *specific* deficit in the autistic group's ability to make second-order belief attributions independent of any *general* developmental delay. We assumed that the MA of the normal group would roughly correspond to their CA.

It is relevant here to report on the characteristics of those autistic children who were screened for inclusion in the experiment but who failed the first-order belief attribution test (Wimmer & Perner, 1983) and so were not tested in the present experiment. Their CAs and MAs (verbal and non-verbal) are summarized in Table 2. For 16 of the 26 autistic children who did not meet inclusion criteria, no expressive MA was obtained as these subjects were not available.

The autistic children who did meet the inclusion criterion did not differ significantly in CA ($t = 1.9$, 34df, $p < 0.6$) or in non-verbal MA ($t = 1.8$, 34df, $p < 0.08$) from those who did not pass the inclusion test, but had a significantly higher verbal MA, both expressive ($t = 3.5$, 14df, $p < 0.004$) and receptive ($t = 3.2$, 34df, $p < 0.003$).

Table 2. CAs and MAs of autistic subjects who failed to meet the inclusion criteria

n		CA	Verbal MA Expressive*	Verbal MA Receptive†	Non-verbal MA‡
26	Mean	13.0	6.5	4.8	9.0
	SD	3.3	2.9	1.6	2.1
	Range	6.1–18.3	1.8–7.4	1.7–7.4	5.0–15.8

*EOWPVT ($n = 10$); †BPVS; ‡Leiter.

Materials

The test employed a toy village which comprised two houses, a church, a fence to separate the park and the road, four 'playpeople' (about 3in. high) and an ice-cream van. In addition, there was a row of trees, so that it was not possible for the story characters to 'see' the church or John's house from the park (or vice versa). The buildings were about 5in. high. The whole village fitted onto a table-top 2 feet square; this is shown schematically in the first picture of Fig. 2. The subsequent six pictures in Fig. 2 depict the experimental scenario. All the materials were commercially available in a children's toy-shop.

Procedure

Each child was tested individually. The experimenter laid out the toy village on the table in front of the child. First the child was asked to name all the toys, which all the subjects could do easily. The experimenter then told the following story, moving the characters (dolls) and the ice-cream van accordingly:

> This is John and this is Mary. They live in this village.
> *Naming question: Which is John/Mary?*
> Here they are in the park. Along comes the ice-cream man. John would like to buy an ice-cream but he has left his money at home. He is very sad. 'Don't worry' says the ice-cream man, 'you can go home and get your money and buy some ice-cream later. I'll be here in the park all afternoon . . .'. 'Oh good' says John, 'I'll be back in the afternoon to buy an ice-cream'.
> *Prompt question [1]: Where did the ice-cream man say to John he would be all afternoon?*
> So John goes home. He lives in this house. Now, the ice-cream man says 'I am going to drive my van to the church to see if I can sell my ice-creams outside there'.
> *Prompt question [2]: Where did the ice-cream man say he was going?*
> *Prompt question [3]: Did John hear that?*
> The ice-cream man drives over to the church. On his way he passes John's house. John sees him and says 'Where are you going?'. The ice-cream man says 'I'm going to sell some ice-cream outside the church'. So off he drives to the church.
> *Prompt question [4]: Where did the ice-cream man tell John he was going?*
> *Prompt question [5]: Does Mary know that the ice-cream man has talked to John?*
> Now Mary goes home. She lives in this house. Then she goes to John's house. She knocks on the door and says 'Is John in?'. 'No,' says his mother, 'he's gone out to buy an ice-cream'.
> *Belief question: Where does Mary think John has gone to buy an ice-cream?*
> *Justification question: Why?*
> *Reality question: Where did John really go to buy his ice-cream?*
> *Memory question: Where was the ice-cream man in the beginning?*

This story is shown in schematic form in Fig. 2.

At the end of the story, the child's responses to the five prompt questions, the belief question and the three control questions (the justification, reality and memory questions) were noted down. Then the whole experiment was repeated (Trial 2), this time reversing the locations. The three control questions were necessary to ensure that the child had both knowledge of the real location of the object and an accurate memory of its previous location, as well as providing evidence of which level belief attribution the subject was making. In the version of the story given above, a pass on the belief question was scored if the child pointed to or said ''the park''.

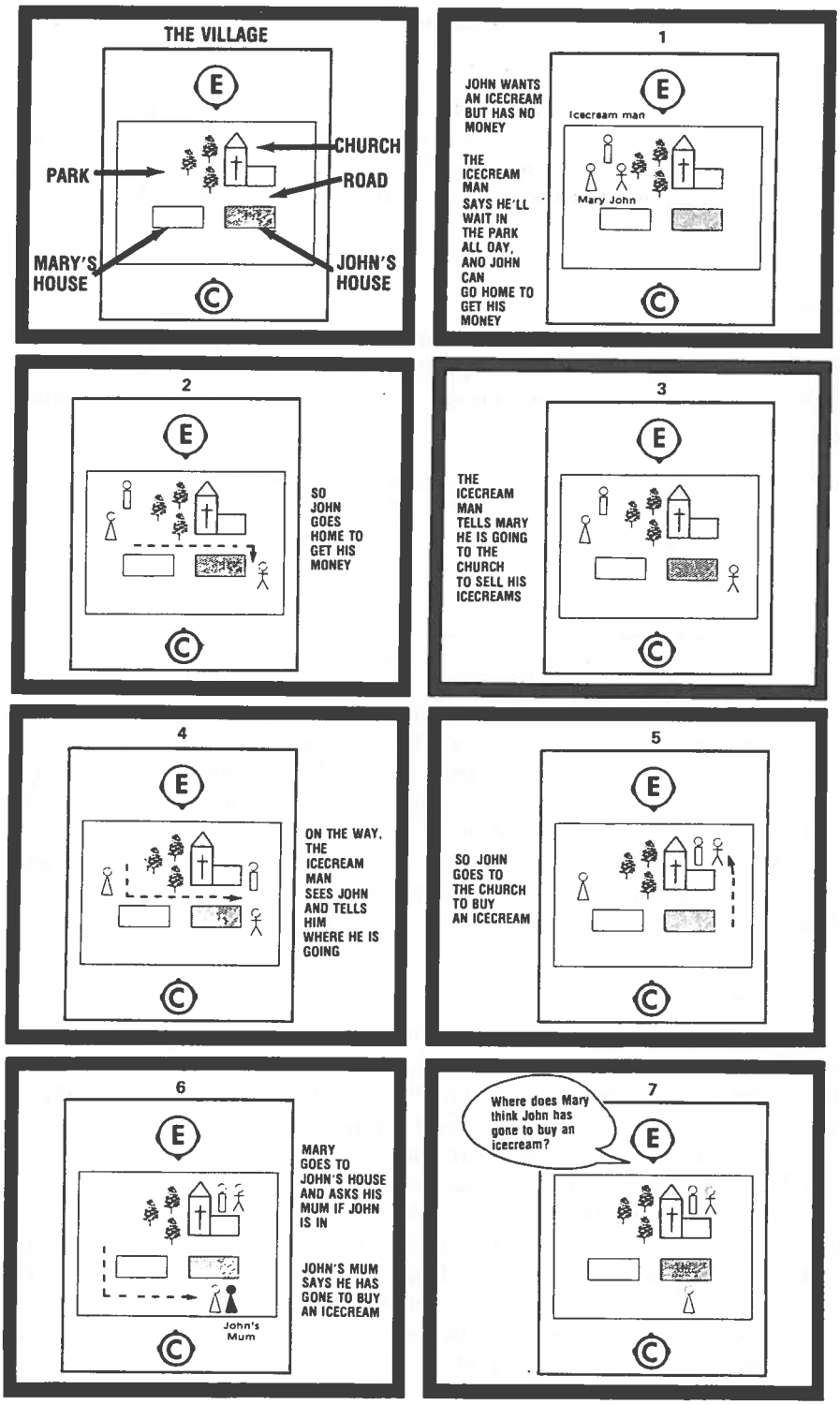

Fig. 2. Scenario of test of second-order belief attribution.

Results

Control questions

All subjects except one autistic child (who had very little language) passed the naming question, the reality question and the memory question in both trials. One Down's Syndrome subject failed prompt questions 3 and 5 on trial 1, and had to be corrected. One autistic child failed all the questions. Otherwise, all other subjects passed the prompt questions in both trials.

Belief question

With the exception of two children in the Down's Syndrome group, all subjects performed consistently on the belief question in each of the two trials. Therefore, the results for this question are collapsed in Table 3. (Inconsistent performance is scored as fail.)

Table 3. Consistent performance on the belief question

Groups	Pass	Fail
Normal	9	1
Down's Syndrome	6	4
Autistic	0*	10*

*Fisher exact probability test, $p < 0.01$.

As Table 2 shows, 90% of the normal children and 60% of the Down's Syndrome subjects passed the belief question on both trials, whilst none of the autistic group did so. The Down's Syndrome and normal groups did not differ significantly (Fisher's Exact, $p > 0.05$), whereas the autistic group was significantly worse than the Down's Syndrome group (Fisher's Exact, $p < 0.01$). All the autistic subjects except one pointed to where the van really was, rather than to where Mary thought John believed it was. Thus they consistently chose the wrong location, and this specific error rate is significantly above chance (Binomial test, $p < 0.011$).

Justification question

The other data collected in this experiment were responses to the justification question. Transcriptions of responses are included in the Appendix. Responses were coded into one of three categories of belief attribution (second-order, first-order or zero-order) according to whether the subject (implicitly or explicitly) took account of:

(a) John's *and* Mary's beliefs (second-order);
(b) John's *or* Mary's beliefs (first-order); or
(c) Neither of their beliefs (zero-order).

Using a conservative system, a response was only coded as second-order if it was unambiguously so; otherwise it was relegated to the first-order category. If it was ambiguous in the first-order category, it was rated as zero-order. In fact, only one response was completely ambiguous (autistic subject number 7 said 'She'll go to find him'), and this was accordingly rated as zero-order.

One Down's Syndrome and one autistic subject gave no response to the justification question at all. Of the others, all subjects who passed the belief question demonstrated they were making second-order belief attributions by answering the justification question with such explanations as 'She don't know the ice-cream man talked to him' (i.e. they saw the usefulness of prompt question 5), or more explicitly with 'She thinks he doesn't know it's at the church'. In contrast, those subjects who failed the belief question demonstrated that they inappropriately used a first-order belief attribution by answering the justification question with 'He knows the ice-cream man is at the church'. Five autistic children also used what may be a zero-order strategy, saying simply 'It [the van] is at the church'.

Discussion

First, the experiment extends the database of our earlier study in that only 29% of all autistic subjects screened passed the inclusion criterion of being able to attribute beliefs at the simplest level (that is, to *one* person about an event or object). Second, the present experiment found that even these subjects are unable to attribute beliefs at a more advanced level (that is, to one person about another person's beliefs). In contrast, non-autistic control children (normal and Down's Syndrome subjects) with a lower MA are able to attribute beliefs at this more advanced level (second-order belief attribution). These results support our prediction that the autistic children who have developed a theory of mind at the lower level are nevertheless specifically delayed in the acquisition of a more complex theory of mind.

The autistic children's failure on this task cannot have been due to an inability to follow the movements of people or objects in the story or to remember the plot, since the autistic group were as accurate as the control groups in their answers to the reality and memory questions. Neither can their failure have been due to a lack of a "theory of mind" *per se,* as the majority demonstrated their ability to make first-order belief attributions in response to the prompt questions and the justification question.

Their performance does not appear to be the result of poor motivation or "negativism", as their failure was selectively found in response to the belief question rather than throughout the task in general. Neither can CA or MA (verbal or non-verbal) account for this failure, as the Down's Syndrome control group possessed the same CA and a lower MA, and the normal controls possessed a lower CA and MA, and yet both of these groups were able to pass the belief question.

Was their failure due to the linguistic complexity of the belief question? This contained only one mental state term ('Where does Mary *think* John has gone to get an ice-cream?') and in this respect is similar to the prompt questions (e.g. 'Does Mary *know* the ice-cream man talked to John?') on which the autistic subjects succeeded. However, the belief question is postulated to differ in terms of its *psycholinguistic* (or conceptual) complexity, as it requires the subject to make a second-order belief attribution. We propose that the autistic group's failure to respond correctly to this question was due to their inability to make such attributions. The evidence from the justification question supports such a view.

Analysis of the background variables of the autistic subjects who met the inclusion criterion for the present experiment (the "included group") suggests that a minimum CA may be necessary, in that none of our included autistic subjects were aged less than about 11 yrs. The included autistic subjects as a group also had a higher verbal MA (receptive and expressive) than the excluded autistic subjects. There were autistic subjects who had similar levels of ability in the excluded group, which implies that a high verbal MA is a necessary but not sufficient condition for the development of a theory of mind, even at the simplest level of first-order belief attribution. In contrast, this social cognitive ability seems to be *independent* of verbal MA for the non-autistic subjects, beyond an MA of 4 yrs. This pattern is consistent with our earlier findings on a much smaller sample ($n = 4$) (Baron-Cohen *et al.*, 1985).

We interpret this pattern of results as indicating that the autistic subjects who have a theory of mind may be chronologically very delayed in the development of this capacity—on average by 7 chronological years in contrast to normal subjects, and delayed relative to their MA as well. In this respect, this may be considered a possible case of specific developmental delay. Such a hypothesis requires further testing from longitudinal data, as the present cross-sectional study leaves open the possibility that the delay in developing an ability for first-order belief attribution in autism may be shorter.

This experiment is a closer model of the complexities of "real" social interaction than our earlier tests (Baron-Cohen *et al.*, 1985; 1986) in that much social interaction involves appreciating what another person thinks about a third person (Perner & Wimmer, 1985). This more able autistic subgroup's social impairment may therefore be related to their deficit at this more sophisticated level of social cognition. Such sophistication is nevertheless mastered by normal 7-yr-old children, as the results from our control group show. This replicates Perner and Wimmer's (1985) results. The search for why a theory of mind fails to develop or is severely delayed in autism remains a key question for future research, and raises the clinical issue of whether any intervention could reduce this specific delay.

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Appendix

Justification question data

Down's Syndrome subjects

1. Cuz he told her he was going to the church (1st order).
2. She thinks he doesn't know it's at the church (2nd order).
3. Cuz she don't know the ice-cream man talked to him (2nd order).
4. No response.
5. Cuz she thinks he thinks it's still in the park (2nd order).
6. Cuz it's at the church (zero order).
7. She don't know the ice-cream man talked to him (2nd order).
8. Cuz she thinks he doesn't know the ice-cream man is at the church (2nd order).
9. She might think he'll think it's still in the park (2nd order).
10. Cuz he knows it's at the church (1st order).

Autistic subjects

1. He knows the ice-cream man is at the church (1st order).
2. The ice-cream man told him (1st order).
3. He knows the ice-cream man went to the church (1st order).
4. No response.
5. It's there (zero order).
6. To get his ice-cream (zero order).
7. She'll go to find him (zero order).
8. It's at the church (zero order).
9. It's at the church (zero order).
10. She knows it's at the church (1st order).

Normal subjects

1. She thinks he thinks it's in the park (2nd order).
2. She don't know the ice-cream man talked to him (2nd order).
3. Cuz she thinks he don't know it's moved (2nd order).
4. Cuz she don't know he knows it's at the church (2nd order).
5. He knows it's at the church (1st order).
6. Cuz she thinks he still thinks it's there (2nd order).
7. She don't know the ice-cream man talked to John (2nd order).
8. Maybe she'll think he'll go back to the park after he got his money (2nd order).
9. She don't know he knows it's here (2nd order).
10. She couldn't see the ice-cream man talked to John (2nd order).