Does the autistic child have a metarepresentational deficit?*

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Abstract


This study examines the claim that autistic children lack a "theory of mind" because of an inability to metarepresent. We argue that if autistic children have a "metarepresentational" deficit in Leslie's (1987, 1988) sense of the term, then they should have difficulty not only with mental representations such as false beliefs, but also with external representations such as photographs. Autistic children's understanding of photographic representations was tested using Zaitchik's (1990) task. This task is modelled on the false belief task (Baron-Cohen, Leslie, & Frith, 1985; Wimmer & Perner, 1983) but involves "false" photographs where a photographic representation does not conform with the current state of the real world. Like Zaitchik (1990) we found that normal 3 and 4-year-olds found this task as difficult as the false belief task. In sharp contrast, however, the autistic children in our study

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passed the photograph task but failed the false belief task. As both tasks require the ability to decouple, this evidence challenges the view that autistic children lack "metarepresentational" ability in Leslie’s sense. However, the results leave open the question of whether autistic children have a metarepresentational ability in the different sense of the term intended by Pylyshyn (1978), that is, representing the relationship between a representation and what it represents.

Introduction

Since 1985, when Baron-Cohen, Leslie, and Frith first proposed that autistic children lack a "theory of mind", the evidence in support of this hypothesis has been growing. We now know that autistic children have difficulty understanding mental states such as beliefs (Baron-Cohen et al., 1985; Perner, Frith, Leslie, & Leekam, 1989), knowledge and ignorance (Leslie & Frith, 1988; Perner et al., 1989). They do not tend to use mental state terms in their spontaneous speech (Tager-Flusberg, 1989a), and do not reliably take account of a listener's knowledge when communicating (Perner et al., 1989). In addition, they have difficulty distinguishing mental from physical entities, do not recognize the mental function of the brain and cannot take account of their own mental states (Baron-Cohen, 1989a).

The reason for this impairment, it is claimed, is a "metarepresentational" deficit (Leslie, 1987). The term "metarepresentation" has acquired several different meanings. It was first used by Pylyshyn (1978, p. 593) in the sense of "recursive metarepresentational capacity", which Pylyshyn referred to as the ability to "represent the representational relationship itself". Leslie (1987, p. 417) then borrowed the term from Pylyshyn but gave it a different meaning in his explanation of how pretence becomes possible in the second year of life: "The basic feature of my model is the creation of a pretence by the copying of a primary expression into a metarepresentational context... the metarepresentational context decouples the primary expression from its normal input-output relations" (Leslie, 1987, p. 417).

Leslie’s sense of metarepresentational ability refers to the ability to decouple, that is, the ability to copy a primary representation into a metarepresentational context. This metarepresentational context “renders opaque the expression that was previously transparent” (Leslie, 1987, p. 417) so that instead of directly representing objects or states in the world (e.g., “cup contains water”), the metarepresentation is detached or screened off from its causal tie to reality (e.g., “I PRETEND ‘cup contains tea’” or “X BELIEVES ‘cup contains tea’”). Leslie claims that this ability to form metarepresentations first emerges with the ability to engage in pretend play at around 18 months to 2 years and is also demonstrated in the ability to attribute mental states to others at the age of 3 and 4 years.
As Perner (1988, 1991a, 1991b) points out, Leslie's sense of “metarepresentational ability” is not the same as Pylyshyn’s sense of this term. In Pylyshyn’s sense it refers to the ability to represent the representational relationship between a primary representation and what it represents. Perner (1991a) claims that this ability appears to emerge in normal children at the later age of about 4 years as evidenced by their understanding of false belief (Wimmer & Perner, 1983), their understanding of level 2 perspective taking tasks (Masangkay, McCluskey, McIntyre, Sims-Knight, Vaughn, & Flavell, 1974) and their ability to distinguish between appearance and reality (Flavell, Flavell, & Green, 1983).

The “metarepresentational deficit” problem in autism refers primarily to Leslie’s rather than Pylyshyn’s use of the term. Leslie (1987) argues that the autistic child’s impaired theory of mind may be due to a failure to decouple caused by failure in a specific decoupling mechanism: “This fairly complex pattern of deficits and abilities can be succinctly explained by the hypothesis that [autistic] children are decoupling impaired” (Leslie, 1987, p. 424).

To date, the best-documented evidence for the autistic child’s impaired theory of mind and their corresponding “metarepresentational” (decoupling) deficit in Leslie’s sense rests with their performance on the false belief test. In this task, a person puts an object in a location (A) and then leaves the room. In the person’s absence the object is unexpectedly moved to another location (B). Children are then asked to predict where the mistaken person will look for the object. Normal children seem to have acquired this understanding by the time they are 4 years old and correctly point to location A. Before this age, however, they make the characteristic error of predicting that the person will look for the object where it really is now, that is, location B (Perner, Leekam, & Wimmer, 1987; Wimmer & Perner, 1983).

Autistic children persistently fail this test (Baron-Cohen, 1989b; Baron-Cohen et al., 1985; Leslie & Frith, 1988; Perner et al., 1989; Prior, Dahlstrom, & Squires, 1990; Russell, Mauthner, Sharpe, & Tidswell, 1991). Their difficulty is not a general problem of mental retardation. In several studies (Baron-Cohen, 1989b; Baron-Cohen et al., 1985), groups of autistic children with a mental age of 4 years and above have been matched with groups of Down’s syndrome children of the same mental age, and the results of these studies show that only 20–30% of autistic children pass the false belief test, compared with 80% of Down’s syndrome children. Studies using control groups of language-disabled children (Leslie & Frith, 1988; Perner et al., 1989) also show that language impairment in itself cannot explain the problem, although verbal ability within the autistic group is related to success on the false belief task (Baron-Cohen, 1989b; Prior et al., 1990; Eisenmajer & Prior, 1991). The false belief task has now been tested using different methods and materials (Baron-Cohen, 1989b; Baron-Cohen et al., 1985; Leslie & Frith, 1988; Perner et al., 1989) and the results of all these studies show that autistic children have severe difficulty with understanding false belief.
Autistic children's performance on the false belief test is compatible with Leslie's claim that they are decoupling impaired. For the child to successfully "metarepresent", the decoupling mechanism should be able to copy the primary representation (perception of object in location B) into a "metarepresentational" context, create a decoupled representation of the form (other BELIEVES "object in location A") and anchor this representation to the primary representation. Such an ability to create mental representations like "I PRETEND . . . ." or "X BELIEVES . . . ." prevents the problem of representational abuse – Leslie's main justification for introducing the decoupler. Representational abuse is avoided because the decoupling allows the proposition "object is in location A", which describes the content of the person's belief, to be screened off and hence spared from being confused with the description of the real location ("object is in location B").

If, as Leslie suggests, the autistic child's difficulty with false belief is due to an inability to form the prerequisite type of mental structure for representing the content of a belief, then why should this difficulty be restricted to mental states like belief, knowledge and pretence? Presumably autistic children may also have problems with representing the content of other kinds of representations such as photographs and drawings that are not mental states. Such a possibility is indicated by normal children's difficulty in predicting the content of photographic representations where the content of the photograph differs from the real world. This ability does not emerge in normal children until the age of 4–5 years – about the same time as the understanding of belief.

Zaitchik (1990) demonstrated this difficulty in normal children with her ingenious photograph task – a task which was structurally very similar to the false belief task and was closely modelled on its procedure. In the photograph task, children were first instructed on how to use a Polaroid camera. They then took a picture of an object in location A. Instead of a person putting an object in location A and leaving the room, as in the false belief task, a photograph is taken of the object in location A. While the Polaroid photograph is developing, the object is moved to a new location (B), just as in the false belief task. The child then has to predict where the object will be in the photograph. Zaitchik's results showed that performance on the two tasks was closely related. Normal children of 3–4 years who had difficulty with false beliefs also had difficulty with the "false" photograph task.

Although originally designed with Pylyshyn's meaning of metarepresentation in mind, Zaitchik's task also requires the more basic skill of decoupling, that is, "metarepresentational" ability in Leslie's sense. That this is so can be easily seen from Leslie's descriptions of primary representations: "primary representations are by definition transparent – that is, they directly represent objects, states of affairs and situations in the world" (Leslie, 1987, pp. 416, 417).

To predict what is in the photograph in Zaitchik's task, the child has to
mentally represent that in the photograph “the object is in the old location”. This mental expression cannot be primary since it does not represent a situation in the world (where the object is already in the new place) but a situation in the photograph. In Leslie’s terms, the mental expressions describing the photograph exhibit the same logic of opacity as those constructed for pretence or belief. The expression “in the photograph”, just like the expressions “I pretend” or “He believes”, creates a logically opaque context, so that the truth (or falsehood) of expressions embedded in it (i.e., “the object is in the old place”) is no longer logically implied (compare Leslie, 1987, p. 416). Given that Zaitchik’s task requires the ability to form decoupled representations, autistic children should fail both the false belief task and the photograph task.

Method

The aim of this experiment was to replicate Zaitchik’s task with autistic children. Because of autistic children’s known difficulties with language, we tried to match the false belief and photograph tasks as closely as possible. The result was a slight change in the two tasks from their original form.

For the photograph task, subjects were first instructed in how to use a Polaroid camera. They then took a picture of a doll (Judy) in a RED dress. Whilst the photograph was developing (1–2 minutes) the doll’s dress was changed for a GREEN one. Then, before looking at the developed photograph, subjects had to predict what colour the doll would be IN THE PICTURE.

For the matched false belief task, instead of the camera “looking” at the doll in her original colour, another doll (Susan) looked at Judy. After noting what colour Judy was wearing, Susan went out to get a belt for Judy’s dress. Whilst Susan was out, Judy changed the colour of her dress. Then, before Susan returned, children had to predict what colour Susan would THINK Judy is.

We were concerned to keep the questions as syntactically simple and well matched as possible. In our form of Zaitchik’s task, the test question, “In the picture, what colour is Judy?”, might be glossed “What colour is Judy?”, which would lead to an incorrect “Reality” response. Although there is evidence that autistic children’s syntactic abilities are unimpaired (Tager-Flusberg, 1989b), we took the precaution of introducing two types of test question: one (question A) based on Zaitchik, that is, “In the picture, what colour is Judy?”, and the other (question B) reversed form of question, “What colour is Judy in the picture?” Unfortunately, the test question for the false belief task could not be matched exactly. The equivalent would be something like “In Susan’s head what colour is Judy?” or “What colour is Judy in Susan’s head?” Such sentence forms are not used in everyday life and their use also makes the assumption that preschool children consider beliefs to be located in the head. The single original form of
false belief test question was therefore used. that is. ‘‘What colour does Susan think Judy is?’’ This question includes an embedded clause, but previous evidence suggests that this syntactic construction should not be unduly difficult for autistic children. Tager-Flusberg. Calkins. Nolin. Baumberger. Anderson. and Chadwick-Dias (1990) have shown that the development of specific grammatical constructions and the development of the lexicon are highly correlated in autistic. normal and Down's syndrome children and that the acquisition of syntactic and morphological forms follows the same order for all three groups. This gives indirect evidence that autistic children should have no more difficulty than normal children with this construction. Autistic children acquire specific grammatical constructions in the same order as normal children. and their lexical ability is a good indicator of their level of syntactic skill in comparison with the normal child. The fact that autistic children perform no differently on false belief tasks which use different forms of question, for example. ‘‘Where will X look?’’ (Baron-Cohen et al.. 1985). ‘‘What will X say?’’ (Perner et al.. 1989). gives further support for this indirect evidence.

**Subjects**

**Autistic group**

Twenty subjects from two special schools for autistic children in London were tested. After the testing it was discovered that four of these subjects had been referred to the school by a psychiatrist on the grounds of their suitability for this type of education and as having ‘‘autistic-like behaviours’’ but without having been actually diagnosed as autistic according to standard criteria. The other 16

<table>
<thead>
<tr>
<th></th>
<th>CA</th>
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<th>Verbal</th>
<th>Non-verbal</th>
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<td>Autistic</td>
<td>Mean</td>
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<td>Non-autistic</td>
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*Age is shown in years and months.

*One subject's non-verbal score was too low to compute.
had been diagnosed as autistic by a psychiatrist in accordance with DSM-III (American Psychiatric Association, 1980).

Subjects were preselected for the experiment on the basis of their mental age. Two IQ tests were administered: a non-verbal test – Raven's Coloured Progressive Matrices; and a verbal test – The British Picture Vocabulary Test. Table 1 shows the subjects according to chronological age (CA) and mental age (MA). As commonly found, non-verbal scores were higher than verbal scores.

Only subjects with a verbal mental age of 4 years and above on the British Picture Vocabulary Test were selected for the study. One diagnosed subject (CA 18;4; verbal MA 4;8) failed every single memory and control question and was therefore excluded from the sample before analysis. This left 15 subjects in the diagnosed group and 19 in total. The 4 non-diagnosed subjects ranged from 11;2 to 17;5 in chronological age and from 5;2 to 6;2 in verbal MA.

**Non-autistic control group**

Thirty-five 3 to 4-year-olds from a nursery school in Brighton, Sussex, took part. There were 16 3-year-olds (12 boys, 4 girls) and 19 4-year-olds (11 boys, 8 girls).

**Materials**

The photograph task and the false belief task both involved a 19-cm high wooden jointed doll and a set of different coloured dresses. Photographs were taken with a Polaroid camera.

**Design**

A within-subjects design was used for the photograph and false belief conditions. Half the subjects in each group (autistic/non-autistic) had questions “In the picture . . . ?” (type A), and the other half had questions “. . . in the picture?” (type B). Within these subgroups, half had the false belief task before the photograph task and half had the reverse order. The doll’s dress colour was also counterbalanced within these subgroups. For example half the subjects first changed a red dress for a green one (or green for red) and half first changed a yellow dress for a blue one (or blue for yellow). Each subject had different coloured pairs of dresses for each (false belief and photograph) task.

**Procedure**

Subjects sat to the left of the experimenter and participated in the task by dressing and undressing the doll and operating the camera themselves. The experimenter followed a routine script for both the false belief and photograph tasks as shown in Table 2. Subjects’ responses were recorded by the experimenter on the script and the entire test for each subject was also recorded on videotape.

Each subject was first given a colour labelling pre-test. The experimenter
Table 2.  **False belief and photograph tasks**

<table>
<thead>
<tr>
<th>False belief</th>
<th>Photograph</th>
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<tbody>
<tr>
<td>This is Judy. She has 2 dresses. They are different colours. Let's put this RED dress on her.</td>
<td>Here is Judy. Let’s put this RED dress on her.</td>
</tr>
<tr>
<td>Now here comes Susan, Judy’s friend. She wants to see what colour Judy is wearing. So she has a look.</td>
<td>This is a machine (camera) with a piece of paper in it. If you press this button it makes a “click”. When it goes click it makes a picture of Judy wearing this colour.</td>
</tr>
<tr>
<td><strong>PROMPT: What colour does Susan see?</strong> (RED)</td>
<td><strong>PROMPT: What colour is Judy?</strong> (RED)</td>
</tr>
<tr>
<td>Susan says to Judy “Ah, I see you are in RED today.”</td>
<td><strong>OPERATE CAMERA</strong></td>
</tr>
<tr>
<td>Now Susan goes out to fetch the belt for Judy’s dress. Now we have to wait until Susan comes back. While we’re waiting let’s change her dress.</td>
<td>Now we have to wait. Now can you remember what happened when we worked the machine? You pressed the button, yes. And it made a click. So what’s going to happen? Yes, it’s going to make a picture of Judy wearing this colour.</td>
</tr>
<tr>
<td><strong>CHANGE RED for GREEN</strong></td>
<td>While we’re waiting let’s change the RED for GREEN.</td>
</tr>
<tr>
<td>So she puts on the GREEN one.</td>
<td>The picture is coming out now (ask before showing).</td>
</tr>
<tr>
<td><strong>Reality Q:</strong> What colour is Judy now?</td>
<td><strong>Reality Q:</strong> What colour is Judy now?</td>
</tr>
<tr>
<td><strong>Memory Q:</strong> What colour was Judy when Susan came round to see her?</td>
<td><strong>Memory Q:</strong> What colour was Judy when you pressed the button?</td>
</tr>
<tr>
<td><strong>Test Q:</strong> What colour does Susan think Judy is?</td>
<td><strong>Test Q:</strong> In the picture, what colour is Judy? <em>(question type A)</em> OR –</td>
</tr>
<tr>
<td></td>
<td>What colour is Judy in the picture? <em>(question type B)</em></td>
</tr>
</tbody>
</table>

pointed to each of the coloured dresses and asked subjects “What colour is this?” This was a qualifying condition for acceptance on the experimental tasks. All subjects passed this pre-test. Testing proper started with either the false belief task or the photograph task. These tasks all ended with a series of questions. First a reality question, then a memory question, and finally a test question as shown in Table 2.
If subjects gave wrong answers to the memory question, they were gently prompted by the experimenter with clues (“Can you remember when Susan came in... / When you pressed the button, what colour was Judy then?”). If they still failed to respond correctly the answer was given to them.

Results

The numbers of children giving correct answers to the test question in the photograph task and in the false belief task are shown in Table 3. Data for the four children who did not have a definite diagnosis of autism according to DSM-III are shown separately but, for the most part, data from all autistic children are analysed together. Since type of question (“In the picture...?” vs. “... in the picture?”) for the photo task had no discernible effect the data were collapsed for further analysis.

The response pattern on the photo and false belief tasks for autistic children in Table 3 differs significantly from that for the non-autistic children: $\chi^2 = 18.20$, d.f. = 2, $p < 0.001$ (to avoid small expected frequencies we collapsed rows 3 and 4 of Table 3). This difference reflects the fact that the 3 to 4-year-olds were not significantly better (51% correct) than the autistic group (32% correct) ($\chi^2 = 1.96$, d.f. = 1, $0.10 < p < 0.20$) on the false belief task but on the photograph task the autistic group by far outstripped (95% correct) the non-autistic 3 and 4-year-olds (51% correct) ($\chi^2 = 10.39$, d.f. = 1, $p < 0.01$).

As there were several subjects who answered the memory question wrongly (all subjects passed the reality question) we checked whether omission of these subjects from the analysis would affect interpretation of the main results. The

| Table 3. Contingency between correct answers on false belief and photograph tasks |
|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Correct on                    | Autistic                      | Non-autistic                  |                                |
|                               | Group                         |                               |                                |
|                               | Diagnosed                     | Non-diagnosed                 | All                           |
|                               | 3 years                       | 4 years                      | All                           |
| Both tasks                    | 3                             | 2                             | 5                             |
| Photo only                    | 11                            | 2                             | 13                            |
| False belief only             | 1                             | 0                             | 1                             |
| Neither                       | 0                             | 0                             | 8                             |
| Total                         | 15                            | 4                             | 19                            |

|                               |                               |                               |                               |
|                               |                               |                               | 3                             |
|                               |                               |                               | 4                             |
|                               |                               |                               | All                           |
|                               | 16                            | 19                            | 19                            |
|                               | 35                            |                               |                               |
interpretation remained the same. Although sample sizes reduced to 15 autistic and 30 3 to 4-year-olds there was still a significant difference between the two groups in their response patterns on the photograph and false belief task ($\chi^2 = 12.86$, d.f. = 2, $p < 0.01$). The interaction remained the same, that is, no difference between groups for the false belief task ($\chi^2 = 0.27$, d.f. = 1) but a significant difference for the photograph task ($\chi^2 = 9.79$, d.f. = 1, $p < 0.01$).

Analysis of the 3 and 4-year-old age groups separately showed that for the false belief task autistic subjects were no different in their performance than 3-year-olds ($\chi^2 = 0.00$, d.f. = 1) but were significantly worse than 4-year-olds ($\chi^2 = 5.17$, d.f. = 1, $p < 0.05$). In contrast, for the photograph task, autistic subjects were significantly better than both 3-year-olds ($\chi^2 = 8.71$, d.f. = 1, $p < 0.01$) and 4-year-olds ($\chi^2 = 5.24$, d.f. = 1, $p < 0.05$).

The results reported here replicate previous results on similar tasks. For the photograph task, 44% of 3-year-olds and 58% of 4-year-olds gave correct answers in our study, compared with 29% and 61% reported by Zaitchik (1990, experiments 1, 3 and 5). For the false belief task, results also replicated previous findings for both 3 and 4-year-olds and for autistic subjects. Results for the 3 and 4-year-olds showed an improvement with age from 25% correct at the age of 3 years to 74% correct at the age of 4 years ($\chi^2 = 8.24$, d.f. = 1, $p < 0.01$). These percentages match those reported for these ages in previous research: for instance, Wimmer and Perner (1983) – 15% at age 3 and 76% at age 4; Hogrefe, Wimmer, and Perner (1986) – 17% and 56%; Perner et al. (1987) – 40% and 87%; Zaitchik (1990, experiments 1 and 5 compared) – 40% and 84%.

Results for the autistic sample, in particular those diagnosed according to DSM-III, were also very similar to previous studies. The 27% of subjects who gave correct performance in our study compares with other studies using similar selection criteria (i.e., MA > 4 years): for example, Baron-Cohen et al. (1985) – 20%; Leslie and Frith (1988) – 28%; Perner et al. (1989) – 17%; Eisenmajer and Prior (1991) – 38%; Russell et al. (1991) – 27%.

An additional finding for the autistic sample was an association between verbal mental age and performance on the false belief task. The mean age of the 6 subjects who passed the false belief task (7;5) was significantly higher than the mean age (6;0) of those 13 who failed ($t = 2.59$, d.f. = 17, $p < 0.02$). This finding also held for the DSM-III-diagnosed group separately ($t = 3.71$, d.f. = 13, $p < 0.01$). The correlation between verbal mental age and success on the false belief test was significantly different from zero for the diagnosed group (point biserial correlation: $r_{pbi} = 0.497$; $t = 2.53$, d.f. = 13, $p < 0.05$ (two-tailed)) but not for the total group as a whole ($r_{pbi} = 0.38$; $t = 1.99$, d.f. = 17, $p < 0.10$ (two-tailed)). This result replicates previous studies showing a correlation between mental age and false belief performance (Baron-Cohen, 1989b; Prior et al., 1990). No differences were found for CA or non-verbal MA.
Discussion

The main result of this experiment was the almost perfect performance by autistic children on the photograph task compared with their poor performance on the closely matched false belief task. In contrast, 3 and 4-year-olds found these tasks to be of equal difficulty. They tended either to pass both tasks or fail both tasks rather than give differential responses. How should these results be interpreted? Does this evidence suggest that autistic children do not have a metarepresentational deficit after all? To explain these findings we need to examine Leslie’s original proposal more closely.

Evaluation of Leslie’s (1987) original proposal that autistic children suffer from a decoupling deficit is complicated by the fact that the proposed decoupler consists of three different submechanisms, any of which might be faulty in the case of the autistic child. The three submechanisms are an “expression raiser”, which copies the primary expression and “quarantines” this copy from its original primary representation, a “manipulator”, which manipulates the decoupled expression into the appropriate metarepresentational context (e.g., PRETEND or BELIEVES) and marks it as such, and finally an interpreter, which anchors the decoupled expression to its primary representation and translates it back to reality.

So far, two of these submechanisms have been suggested as the specific source of the autistic syndrome. Leslie (1987, p. 424) originally suggested, by way of example, that autistic children “suffer a dysfunction in expression raising”. Such an “expression-raising deficit” hypothesis is clearly incompatible with autistic children’s near-perfect performance on the photograph task. The expression raiser is, according to Leslie, responsible for decoupling primary representations and for putting them into quotation marks to mark the opacity of the newly created “metarepresentational” context. By doing so their content is duly quarantined so that it will not interfere with the truth expressed by primary representations. The dangers of failing to do so can be clearly seen in the photograph task. If the description “Judy is in red”, specifying the content of the photograph, cannot be marked as secondary, it therefore remains a primary representation and would be mistaken as a literal description of reality. Children would therefore be confused as to whether Judy is actually dressed in green or red.

Later Leslie (1988) and Leslie and Frith (1990) emphasized malfunction in the second submechanism (manipulator) as the main source of autism. The first task of the manipulator is to form a raised expression, for example: Susan – believe – “Judy is in red”. Since Leslie intended to capture here what philosophers have been calling “propositional attitudes” we might term this specific proposal, loosely speaking, the propositional-attitude deficit hypothesis. Of course, since photographs can neither pretend nor believe, the photograph task does not
require children to use the same relational terms as in the pretence and the false belief task. Structurally, however, the same kind of expression has to be formed: the picture shows "Judy is in red", in order to understand that it is in the picture where Judy is shown as red.

In response to their own replication of our results Leslie and Thaiss (unpublished) made this specific deficit theory even more specific by restricting it to propositional attitudes towards mental representations entertained by agents only. This, then, excludes photographs from the range of their theory. Apart from being a somewhat post hoc explanation of the photograph task data, this theory makes autism again a specifically social deficit confined to understanding human agents. This suggestion therefore deprives the original idea of one of its most interesting implications, namely that autism might involve very specific problems which do not involve the understanding of human agents in particular. Also the specific hypothesis that autism results in the failure to represent attitudes between human agents and proposition leaves unexplained why autistic children seem almost unimpaired in their understanding of some propositional attitudes like seeing (Hobson, 1984; Tan & Harris, unpublished), simple emotions (Baron-Cohen, 1989c) and desires (Baron-Cohen, 1991; Harris, 1990).

To summarize, we argue that these results are incompatible with a "metarepresentational" deficit in Leslie's (1987) original sense of a decoupling deficit. There is now some conjecture over whether one submechanism, the manipulator, may be damaged, but existing evidence does not substantiate this claim.1

Having suggested that these results do not support the idea of a metarepresentational deficit in Leslie's sense of a decoupling deficit, we now turn to Pylyshyn's original definition of metarepresentation in terms of "representing the representational relationship itself". As this sense of metarepresentation has not been applied to autism before, what can these results tell us about autistic children's ability to metarepresent in this sense?

To interpret our findings for autistic children in the light of Pylyshyn's use of the term, we should look again at Pylyshyn's definition of metarepresentational ability. Pylyshyn (1978, p. 593) implicitly defined metarepresentation as "representation of the representational relationship itself". The term "representational relationship" refers to the link between a representation and what that representation represents. This definition makes clear the importance of the dual aspect of representations: the fact that representations (e.g., beliefs, photographs) do not just represent something, they also represent something as being a certain way (e.g., as being a certain colour or in a certain location). This distinction between representing and representing-as, made by Goodman (1976) in the context of pictorial representations, is also reflected in Frege's (1892/1960) earlier distinction between sense and reference as two aspects of word meaning.

1See Perner (1991b) for a more detailed discussion of the evidence for and against this claim.
Hence one clear indicator that children can represent that something is a representation is their ability to distinguish sense from reference. The ability to represent the link between sense and reference is difficult to demonstrate in the case of veridical representations because a representation of something or someone usually depicts them as they really are. However, in the case of misrepresentation (e.g., false belief), we do have one example of the divergence between sense and reference. In this case, something (referent) is represented as being different (sense) from how it really is. In our false belief task, for example, the real situation in which Judy is wearing green (referent) is misrepresented by the friend as a situation in which Judy is wearing red (sense).

The structurally similar photograph task seems to require the same ability, except that it is the camera which is doing the misrepresenting instead of the friend. Zaitchik (1990) even argued that, like the false belief task, the problem with the photograph task for younger normal children lay in “assigning truth to a claim which the child’s own perceptual representation denies” (p. 64). However, a closer analysis of the photograph task shows that it is not the same as false belief. In the belief task, Judy’s friend misrepresents Judy’s current colour of dress. The friend’s outdated belief is that Judy is dressed in red. Although this belief is outdated, it still makes reference to Judy’s present colour of dress, which is not red but green. In contrast, the “false” photograph does not involve misrepresentation because it does not make reference to Judy’s present colour of dress. Instead it truthfully reflects her past state (at the time the photograph was taken) as wearing red.

Why then do normal children fail the photograph task whilst autistic children pass? One possibility is that autistic children are “situation theorists” in Perner’s (1988, 1991a) sense. They do not interpret the photograph as a representation of the external scene but instead interpret it as a situation which remains unchanged. Since the autistic child may have had several more years of experience with cameras than 3-year-olds, they may have learned that situations in a picture stay fixed and never change, whereas 3-year-olds are simply at a loss about how people or dolls behave in a photograph. Because the task emphasizes that the photograph is of an external person but does not stress its unchangeable nature, 3-year-olds may simply assume that Judy does the same things in the picture as outside.

Normal children’s understanding of the task may be revolutionized within a year’s time without much specific experience with cameras because they switch to an understanding of photographs as representations. It is this switch that also allows them to understand the misrepresentation involved in false belief tasks. This would explain why correct performance on false belief tasks and correct performance on Zaitchik’s photograph task tend to emerge at roughly the same age.

Autistic children, in contrast, may never acquire an understanding of repre-
sentation (metarepresentational ability in Pylyshyn's sense), which is the reason why they never understand false belief. In short, they may give correct answers on the photograph task, not because they understand the photograph as a representation of the external scene, but because they have learned through prolonged experience that the situation in photographs tends to be fixed and unchangeable. One hypothesis then is that the autistic child has a metarepresentational impairment in the Pylyshyn sense, but that this impairment is not revealed in the photograph task because autistic children can interpret the photograph as a fixed, unchanged situation rather than as a representation.

The hypothesis that autistic children fail to understand misrepresentation, and hence have a metarepresentational deficit in Pylyshyn's sense of the term, still remains to be tested. Whatever the interpretation of our results, however, it is worth pointing out that the surprisingly good performance on the photograph task by our sample of autistic children is not a statistical fluke or due to the particular material used in our study. Essentially the same results have been obtained in two replications of our results – one by Leslie and Thaiss (unpublished) using photographs and the other by Baron-Cohen and Charman (unpublished) using drawings.

To conclude, we claim that autistic children do not have a metarepresentational deficit in Leslie's sense of a decoupling failure. However, our data leave open the question of whether autistic children have a metarepresentational failure in Pylyshyn's sense of distinguishing sense and reference. This suggestion of a metarepresentational failure in Pylyshyn's sense should not be seen as attempting to account for the source of the autistic syndrome, however. We have no theory to offer as to what is responsible for autism. Indeed, the origin of autism may be completely unconnected with understanding the representational aspect of mind, as others have suggested (e.g., Hobson, 1989; Mundy & Sigman, 1989). Our analysis merely points to one important consequence of the autistic syndrome, namely that it is characterized by a metarepresentational failure to understand misrepresentation.

References


