Journal of Autism and Developmental Disorders, Vol. 33, No. 5, October 2003 (© 2003)

Theory of Mind–Based Action in Children from the Autism Spectrum

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In this study we investigated whether task interest facilitated the application of Theory of Mind capacities in high-functioning children from the autism spectrum. Children were invited to carry out two simple tasks. Sabotage of both tasks by a third party resulted in the experimenter appearing to have a false belief. Whereas pervasive developmental disorder not otherwise specified (PDDNOS) children tended to correct the experimenter's false belief in the rewarded task condition, children with autism were not influenced by task condition. These results highlight the role played by social and communicative factors in the application of Theory of Mind knowledge in the former clinical group.

KEY WORDS: Autism; PDDNOS; high-functioning; Theory of Mind; action.

INTRODUCTION

Various studies have shown that high-functioning children from the autism spectrum (ASD) are impaired in their ability to understand representational mental states. These children have difficulty understanding that behavior is usually regulated by mental states, such as beliefs (thoughts, expectations, etc.), desires (wishes, preferences), and intentions and not by the objective reality (Baron-Cohen, Tager-Flusberg, & Cohen, 1993; Rieffe, Koops, & Meerum Terwogt, 1996; Rieffe, Meerum Terwogt, Koops, & Hagenaar, 2000). This insight, currently known as the Theory of Mind (ToM), became known to a wide audience when it was applied by Premack and Woodruff (1978) in their study with chimpanzees. The developmental study of Theory of Mind skills, in a sense, goes back to Piaget's work on children's thinking and egocentrism (Carruthers and Smith, 1996; Piaget, 1929). Problems in the human development of ToM are often associated with the social and communicative problems that characterize children from the autism spectrum—also known as pervasive development disorders (PDDs; Wing, 1988). However, recent findings have shown that the application of ToM knowledge can depend on environmental factors or task variables (Rieffe, Meerum Terwogt, & Stockmann, 2000; Serra, Minderaa, van Geert, & Jackson, 1999). In this study, we look at factors that can influence the application of ToM by children from the autism spectrum in a real-life situation.

ToM competence is often investigated by testing children's understanding of false belief. In false belief tasks, participants are usually asked to predict the behavior of a story character, given information about the false belief of this protagonist and knowledge about the real state of affairs. To pass such tasks, children are required to acknowledge that a person's behavior is

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determined by their beliefs about reality, even when these beliefs are wrong, rather than by reality itself. A well-known example of a false belief task concerns the famous doll Maxi. The participant in this task sees Maxi putting a candy bar into a green cupboard. Maxi then leaves the kitchen. Afterward, in full view of the participant, but in Maxi's absence, Maxi's mother moves the candy bar to a white cupboard. Finally, Maxi returns to retrieve his candy bar. On answering the question of where Maxi will look for his candy bar, a majority of 3 year olds respond that Maxi will look in the white cupboard, the place where the candy bar actually is. They predict Maxi's behavior based on their knowledge of reality. Most 4 year olds, however, take Maxi's false belief into account and correctly predict that Maxi will look in the green cupboard, where he will find that his candy is gone (Perner & Wimmer, 1983). In addition to this, most 4 year olds are able to create false beliefs in others (Peskin, 1992; Sodian, Taylor, Harris, & Perner, 1991). In sum, most 4 year olds appreciate the basic principles of Theory of Mind.

Children from the autism spectrum however, show poor knowledge of ToM, even when they are older. Predictions of a person's behavior or emotion are generally based on knowledge about reality, ignoring the (false) belief of the person in question. Moreover, these findings cannot simply be attributed to poor verbal abilities in ASD children (Baron-Cohen, Leslie, & Frith, 1985; Perner, Frith, Leslie, & Leekam, 1989). The impaired capacities of children from the autism spectrum on the traditional false belief task are usually explained by referring to an impaired conceptual understanding. These children are said to be mind-blind (Baron-Cohen, 1995), meaning that they are incapable of discerning mental activities such as thinking, dreaming, and hoping.

However, studies into ToM and autism often rely on a very limited range of tasks, with false belief performance usually taken as the sole indicator of ToM competence (Hughes, Adlam, Happé, Jackson, Taylor, & Caspi, 2000). However, the false belief task may not be an entirely reliable indicator of a functional ToM (Meerum Terwogt-Kouwenhoven & Meerum Terwogt, 1993; Rieffe & Meerum Terwogt, 2000). Failing a standard false belief task does not necessarily indicate the absence of mental-state understanding. Other factors, such as poor linguistic competence or poor concentration abilities, can hinder performance on the task. Thus, a child who fails the task could be wrongly assessed as having poor ToM (Siegel & Beattie, 1991). Interestingly, a recent study by Newton, Reddy, & Bull (2000) has shown that false belief performance in normally developing children is poor at predicting the application of ToM in everyday situations, such as the ability to create false beliefs in others and the ability to deceive. To put it briefly, impaired ToM knowledge may not be the only reason for failing a false belief task; several task variables may be involved in the task performance, and the ecological validity of the task is unclear. In contrast, we can look at how false belief performance of ASD children compares with ToM capacity as measured by other ToM tasks. ASD children have also been shown to be impaired in their ToM capacities as measured by deception tasks (Baron-Cohen, 1992, Sodian & Frith, 1992). However, there is other evidence that these children perform as well as non-ASD children of the same age (Rieffe *et al.,* 2000; Serra *et al.,* 1999). In sum, we suggest that ToM knowledge can be present in ASD participants, but may not be applied the same way as by non-ASD controls.

Thus, the question arises of whether there are factors that can encourage the application of ToM in ASD children. Existing evidence to help us address this question is sparse. However, there is some evidence that certain variables—independent from the construct to be measured—interfere with the performance of ASD children on other cognitive tasks. Successful performance on these tasks seems to increase with the regular reinforcement of any behavior regardless of its nature, or the presentation of a well-known task in the middle of the task in question (Dunlap, 1984; O'Dell, Dunlap, & Koegel, 1983). Other factors that appear to facilitate performance are active participation in the task; for example, having the child decide which materials will be used, what activity will be done, or what the content of the test will be (O'Dell & Koegel, 1981). In short, factors that increase involvement in the task seem to have a positive influence on the task performance of ASD children.

To reiterate, the performance of ASD children on standard false belief tasks may be partly influenced by ToM independent variables such as linguistic skills, concentration abilities (Siegel & Beattie, 1991), and low task motivation (Koegel & Mentis, 1985). Moreover, the function of beliefs is usually not considered in these tasks; beliefs are intended to be an exact representation of reality (Searle, 1983), yet, in the case of false belief tasks, children are asked to reason based on beliefs that do not represent reality. This seems contradictory, as false beliefs are generally immediately corrected in daily life (Meerum Terwogt, Rieffe, Tuijn, Harris, & Mant, 1999). Because task involvement has a positive effect on the performance of ASD children, and there is evidence of a lack of ecological validity in traditional false belief tasks, this study will consider the role of task involvement in correcting real-life false beliefs. Correcting a false belief will be more to likely occur if someone's personal gain is at stake. The role played by this active engagement in the correction of false beliefs is the object of this study, based on the actions of participants in a direct interaction with the experimenter. This real-life setting and the emphasis on behavior will provide us with an ecologically valid insight into the ability to apply ToM knowledge in daily life. After all, in addition to ToM understanding, the application of this understanding in daily life is of at least equal importance. A similar design to Meerum Terwogt *et al.* (1998) was chosen in which it was in the participant's own interest to spontaneously correct a false belief in the experimenter.

In the absence of the experimenter, but in full view of the child, a confederate of the experimenter removed an essential piece of two elementary tasks to be carried out by the child. On return, the experimenter, who appeared ignorant of the sabotage, began to commence the task. We measured how long it took the children to correct the experimenter's false belief. On the basis of earlier ToM research, we expected that ASD children would not intervene, or would intervene less often than normally developing children, and would wait longer before correcting the false belief of the experimenter on his return. After all, these children possess less intrinsic motivation to perform such tasks than normally developing children. By giving a reward for completion of one of the tasks, we expected to increase this task involvement, and consequently make the participants more likely to react in the rewarded than in the nonrewarded condition.

Within the autism spectrum, several subgroups can be distinguished. The prevalence of children with autism and pervasive developmental disorder not otherwise specified (PDDNOS) is highest. PDDNOS children show similar social problems as children with autism, albeit in a milder form, as fewer of the DSM-IV symptoms can be found in these participants. According to a rough calculation, the prevalence of PDDNOS children in Holland is four to five times greater than the prevalence of children with autism (Van der Gaag & Verhulst, 1996). Nonetheless, the quantity of research with PDDNOS children is substantially lower than the studies on children with autism; another reason to include both clinical groups in this study.

METHOD

Participants

22 children with a diagnosis within the autism spectrum participated in this study. The classification of these children was based on a diagnostic investigation, in which the children were observed by a psychiatrist (L.S.) during 3 months and classified according to the DSM-IV criteria (American Psychiatric Association, 1994). The ASD group consisted of 12 children with PDDNOS (mean age, 9–7 years; range, 7–3 to 12–0 years; 10 boys and two girls) and 10 boys with autism (mean age, 9–6 years; range, 6–8 to 11–4 years; all boys). IQ scores of four children were unknown. All other children had a verbal and performance IQ of >80, based on the Wechsler Intelligence Scale for Children-III (Wechsler, 1991). The difference between the mean full-scale IQ of the ASD group (103.2, SD 7.55, $n = 9$) and the PDDNOS group (93.1, SD 12.8, $n = 11$) was nonsignificant. A control group of 27 children (mean age, 9–9 years; range, 9–1 to 10–9 years; 22 boys and five girls), matched for age, gender, and intelligence, was recruited from primary schools around Amsterdam, the Netherlands.

Material

The materials used for the two tasks consisted of an elementary jigsaw puzzle, intended for 4 year olds, and a cassette player with a tape in it. The reward given for one of the tasks was a piece of candy, to be taken from a glass jar, centrally positioned on the test table. A video recorder was used to tape the reactions of the children.

Procedure

Children were taken outside the classroom individually by an experimenter and brought to a quiet room for a session of approximately 20 minutes. In this room, a confederate was introduced as a colleague who was working there because of a lack of office space. The confederate was not involved in the interaction between the child and the experimenter. Subsequently, the experimenter explained the two tasks to be executed; a jigsaw puzzle had to be made, and a story had to be told and tape-recorded. The participants were told only one of these tasks would be rewarded with a piece of candy; half the children were promised the candy for a quick completion of the puzzle, the other half for

Table I. Successive Remarks of Experimenter

Order	Remark
1	Experimenter returns and takes a seat
Story task	
2	"So, we'll begin with the cassette player"
3	"Then I can see how clear you can tell the story"
4	"There, here's the cassette player"
5	"Okay, you can start, then I will turn the cassette player on"
6 (control)	"Hey, there's no tape, do you know how that happened?"
Puzzle task	
2	"So, we will start with the puzzle"
3	"Then I can have a look at how quick you can do it"
4	"There, here are the pieces of the puzzle"
5	"Okay, you can start, and I will start the stopwatch"
6 (control)	"Hey, it seems like there are not as many pieces in the puzzle anymore. Do you know how that can be?"

telling a distinctly pronounced story. The candy was to be taken from a glass jar, positioned centrally on the test table, within sight of the participants. The sequence of both type of task (puzzle/story) and reward (candy/no candy) were varied following a Latin square design (Cotton, 1993).

After giving the explanation to the participants, the experimenter told them he was going to get a cup of coffee and that they would start the experiment on his return. Hereupon he left the room for a short time. In the absence of the experimenter, but in full view of the child, the confederate got up and removed one essential item from each task, announcing, as if thinking aloud, that she was going to work somewhere else, and needed a piece of the puzzle and the tape from the cassette player. She then took the objects mentioned and left the room. On his return, the experimenter made it clear that he was unaware of the missing objects, behaving as if he did not know the confederate had taken two crucial items from the tasks. The experimenter prompted the child he (falsely) believed could begin the experiment, using cues—subtle hints (see Table I) that made it increasingly clear to the participant that the experimenter (falsely) believed he could begin the task. For each task, we measured the mean number of prompts taken for the child to correct the false belief of the experimenter.

Scoring

The experimenter used a series of successive remarks (Table 1) to make it increasingly obvious that he was going to start the experiment. This was also done to ensure the participants knew that he did not know anything about the items taken away by his confederate. Between each successive remark, the experimenter waited for 2 seconds. When participants had given no reaction after six prompts, the experimenter made an explicit remark about the absence of the item from the task at hand. If no response followed from the participant, we checked whether they knew the confederate had taken away the items. In the case of a response during the successive prompts, the remaining prompts were dropped.

RESULTS

Before discussing the results it is important to note that the children reacted more quickly in the second task than in the first task. This was because the children often mentioned the item missing from the second task directly after mentioning the item missing from the first task. This artifact had no influence on the results, as the reward was equally distributed over the first and second task. The type of task (puzzle or story) had no influence on the children's reaction time.

Table II shows the mean number of prompts given to the clinical and control groups before they mentioned the missing items, by reward and nonreward conditions. Notice that a low score shows a quick response to the false belief of the experimenter. From this table, it can be seen that the control group reacted more quickly than the clinical group in both the reward and the nonreward condition. In fact, more than half the control participants reacted as soon as the experimenter returned. A plausible explanation for this finding seems to be that control children are less socially inhibited, and therefore react more spontaneously to the experimenter (whom they have only just met). The expected

Table II. Mean Amount of Remarks from the Experimenter, as Function of Group (Control/ASD) and Condition (No Reward/Reward)

	Condition		
Group	No Reward	Reward	Total over conditions[a]
Control group (n = 27)	2.04 (1.72)	1.74 (1.63)	3.78 (2.98)
Autism group (n = 22)	3.81 (2.30)	3.14 (2.38)	6.95 (3.86)

Note: Numbers in parentheses are standard deviations.
[a] $F(1,45) = 10.58$, $p < .01$.

difference between the reward and the nonreward condition was not observed in either group. A 2 (Group: deviant or control) × 2 (Reward: yes or no) MANOVA with repeated measures on reward revealed a main effect for Group [$F(1,45) = 10.58$, $p < .01$]. However, a main effect of Reward was not observed [$F(1,45) = 2.62$, $p = .11$], nor was Reward found to interact with Group [$F(1,45) = 0.41$, $p = .53$].

Further examination of the results, subdividing the clinical group into a group with PDDNOS and an group with autism, revealed a marked difference between the two subgroups. In the nonreward condition, both groups reacted relatively late in comparison to the control group (see Figure 1). In the reward condition the children with autism showed the same pattern, only reacting between the fourth and fifth prompt of the experimenter. The striking result came from the PDDNOS children. It was found that the PDD children's performances improved when they were rewarded compared with the nonrewarded condition, with it taking them significantly fewer prompts to correct the experimenter, performing at the same level as the control group. A 3 (Group: control, PDDNOS, or autism) × 2 (Reward) MANOVA, splitting up the clinical group, revealed a main effect from Group [$F(2,46) = 8.40$, $p < .01$], and the interaction effect for Group × Reward also reached significance [$F(2,46) = 2.44$, $p < .05$].

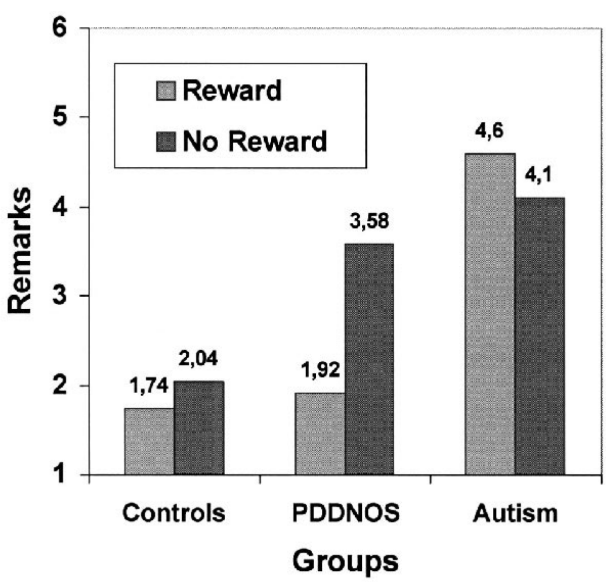

Fig. 1. Mean amount of remarks by the experimenter as function of Group (Controls, PDDNOS or autism) and Condition (Reward/No Reward).

The speed with which the children intervene in correcting the false belief of a communicative partner has important implications for interpersonal interactions and can indicate impaired or diminished ToM use. However, a late intervention, that is, just before the experimenter draws explicit attention to the missing object, can still be an indication of ToM knowledge. It therefore seems to be of equal importance to look at whether ToM knowledge is applied at all by these participants. In an additional analysis, we did not look at the number of prompts taken but only looked at whether or not the children intervened. The reactions of the participants were divided into two categories: a ToM category, consisting of children reacting before the experimenter's remark that the task was sabotaged (prompt 6) and a category of reactions after this remark, indicating no ToM knowledge.

Table III shows the results of this dichotomous scoring and confirms the earlier findings; all but one of the PDDNOS children responded in the reward condition, whereas only half of them responded in the nonreward condition. The children with autism performed quite poorly and were unaffected by the reward, whereas the control children performed well in both conditions. A 3 (Group) × 2 (Reward) MANOVA once again revealed a main effect for Group [$F(2,48) = 9.16$, $p < .001$] and an interaction effect for Group × Reward [$F(2,48) = 6.38$, $p < .01$]. In sum, even without consideration of the speed at which the experimenter's false belief was corrected, the PDDNOS group still appeared to respond significantly more quickly in the reward condition compared with the nonreward condition.

Table III. Reaction Patterns Divided for Spontaneous ToM Applications, as Function of Group (Autism, PDDNOS, and Controls) and Condition (Spontaneous/ No Spontaneous ToM Application)

	Group		
Condition	Autism	PDDNOS[a]	Controls
Nonrewarded Condition			
Spontaneous	6	6	24
ToM application	(60.0%)	(50.0%)	(88.9%)
No spontaneous	4	6	3
ToM application	(40.0%)	(50.0%)	(11.1%)
Rewarded Condition			
Spontaneous	3	11	25
ToM application	(30.0%)	(91.7%)	(92.6%)
No spontaneous	7	1	2
ToM application	(70.0%)	(8.3%)	(7.4%)

[a] $F(2,48) = 9.16$, $p < .001$.

DISCUSSION

This study investigated the spontaneous application of ToM knowledge of children with autism and PDDNOS in an everyday situation; correcting someone else's false belief. These children, as expected, were found to perform more poorly than normally developing children, matched for age, gender, and intelligence, if they were not externally rewarded. About half the children of the clinical group did not intervene at all after the experimenter returned and waited for the experimenter to find out for himself that items were missing from the task. Children from the control group showed a very different pattern; 90% of these children informed the experimenter about the change in the situation that had occurred during his absence, and half the children did this directly on his return. These differences between groups from autism spectrum and normally developing populations were in agreement with the diminished or impaired ToM capacities of participants from the autism spectrum (Baron-Cohen, 1995; Happé & Frith, 1996). The attempt to increase the task interest of the children had the expected effect on PDDNOS children only; their response rates were similar to the control children in the rewarded condition. Children with autism tended not to respond, independent of the prospect of a reward. A time-independent analysis of the results, merely focusing on whether the children reacted at all, revealed the same pattern; PDDNOS children made a significant shift in their performance when they were rewarded, controls responded well in both conditions, and children with autism did not tend to respond in either reward condition.

The question was why the children with PDDNOS, but not the children with autism, were appreciative of the reward. We noted in the introduction that PDDNOS children show fewer features of the DSM-IV criteria of autism than children with autism, as a result of which, this diagnosis can be referred to as a "milder" variant of autism. Buitelaar, van der Gaag, Klin, & Volkmar (1998) remarked that PDDNOS children are featured by social handicaps that closely resemble those of children with autism while showing significantly fewer problems in their communication, activities, and interests. Furthermore, PDDNOS children were deficient in ToM abilities, but to a lesser extent than children with autism in a study by Sicotte & Stemberger (1999). One of the explanations for this difference could be that PDDNOS children possessed the competence for ToM reasoning but did not use this knowledge as normally developing children do because of their delay in social interactions. Children with autism, however, could indeed be "mind-blind" (Baron-Cohen, 1995), which explains why these children did not perform better on the reward task than the nonreward task. In this case, we would not be dealing with one continuous dimension of autism underlying the whole autism spectrum, thus enhancing the feasibility of different graduations of the same disorder, but instead distinguish fundamentally different groups. However, without an in-depth analysis of this problem, it should be acknowledged that age-adequate ToM applications have been shown in participants with autism as well. Rieffe *et al.* (2000) demonstrated three subgroups from the autism spectrum (autism, PDDNOS, and Multicomplex Development Disorder) to be able to apply ToM-based knowledge if asked to explain unusual emotional reactions of others. Still, more research is needed to investigate the status of differences between participants with PDDNOS or autism. Only then can it be decided whether a more fundamental distinction between these groups is justified or whether they should be considered as different manifestations of the same underlying disorder.

When we considered the hypothesis that children with autism have the same dormant ToM competence as the PDDNOS participants, the question became why these children did not apply their knowledge in either condition. On the one hand, the candy might not have been rewarding enough to raise the task motivation to a sufficient level, or even be unsuitable as catalyst of task motivation at all for these children. On the other hand, the study required children to initiate communication with the experimenter. Difficulties with initiating communication may have resulted in the impaired responding observed. After all, the children were confronted with an unknown adult man, whose actions they had to correct out of their own accord. The DSM-IV highlights an impaired ability to initiate and maintain communication as one of the characteristics distinguishing between a diagnosis as PDDNOS and autism (Buitelaar *et al.,* 1998).

The results of this study might also be interpreted alternatively. Hypothetically, participants could give an adequate response without calling on their ToM competence, a false positive response. If that were the case, only communicative factors such as spontaneity (with "spontaneous" children intervening quicker than "nonspontaneous" children) or impulsiveness would be responsible for the differences in the responses of the children in this study. It would not have been these children's intention to correct the experimenter's false belief, but only to point out that "something" had happened, "That woman took something!" Children would then have merely displayed joint attention, an ability often said to be precursive, yet not characteristic of full-grown ToM (Baron-Cohen, 1995). However, the fact that children's responses—directed at the returning experimenter—were in all cases explicit remarks about the missing items showed an intention to inform the experimenter about the altered situation. If the children were merely commenting on the situation or trouble shooting, without the acknowledgement that the experimenter was unaware of the problem, one would also expect remarks that directly or indirectly indicated shared knowledge; "But there is no tape, *is there*?" or "But the tape is *still* missing!" Nevertheless, this kind of remark was completely absent.

Moreover, even if the time to respond was not considered in the analysis, and we only looked at whether or not ToM knowledge was applied, participants showed the same response pattern as the earlier analysis that included the time aspect. That is, just like the controls, nearly all rewarded PDDNOS participants intervened eventually, whereas only half the nonrewarded PDDNOS participants intervened, resembling the reaction of the children with autism. Given the fact that the pattern remained, independent of the time taken to respond, it seemed irrational to explain the results based on communicative spontaneity alone. Where this factor may have played a role, it could not account for the improved responses of the PDDNOS children in the rewarded condition without having to rely on ToM knowledge. It seemed more plausible, therefore, to explain the absence of adequate responses of the nonrewarded PDDNOS children as false negatives; these children did posses the required ToM knowledge but were not able to apply this knowledge the way normally developing children did; only if a reward was given and the consequences of their actions were obvious did the PDDNOS participants respond, whereas normally developing children responded without needing this catalyst.

In conclusion, the improved performance of the PDDNOS group supported the hypothesis that the daily application of ToM knowledge can be dependent on external factors, in this case a reward. This showed us that the application of ToM knowledge by PDDNOS children may be different from normally developing children, but cannot be explained based on a fundamental lack of knowledge, as suggested in the "mind-blindness" hypothesis. The discussion about the often-observed ToM problems in ASD children shifts from the degree in which ToM knowledge has developed to the availability of dormant ToM knowledge. PDDNOS participants seemed to have the ability for ToM reasoning, but they did not automatically use this ability. They could see, but did not know where to look.

Recently, a new trend of "advanced" ToM tests has emerged that pursue more subtle and ecologically valid indications of ToM. In addition to laboratory studies that laid emphasis on a more pragmatic understanding of others' intentions, these tests also focused on actual ToM-related behavior. One approach was the use of filmed interactions, for instance, of uncomfortable social situations; high functioning autism spectrum disorder (HFASD) adults were found to answer questions about affective mental states of characters less accurately. Also, when footage was used of natural interactions between people who were unaware of being filmed, HFASD adults displayed less empathic accuracy than controls. The sensitivity of the latter test was even more impressive as a replication of the Strange Stories test (another "advanced ToM" test) failed to find group differences in the same sample (Happé, 1994; Jolliffe, & Baron-Cohen, 1999; Heavey, Phillips, Baron-Cohen, & Rutter, 2000; Roeyers, Buysse, Ponnet, & Pichal, 2001). Measures of ToM understanding have also been linked to actual ToM-related behavior such as conversational abilities, specific social behavior, peer interactions, prosocial behavior, and everyday social competence (Capps, Kehres, & Sigman, 1998; Eisenmajer & Prior, 1991; Frith, Happé, & Siddons, 1994). However, others failed to find a relationship between ToM understanding and ToM behavior, in particular when controlling for linguistic competence (Fombonne, Siddons, Achard, & Frith, 1994; Travis, Sigman, & Ruskin, 2001).

The lack of group differences between HFASD and matched controls in tasks designed to measure ToM understanding administered under structured laboratory conditions could provide a biased view of ToM competence in HFASD participants for two reasons. First, their ToM competence could be overestimated because of the simplification of reality in these tasks. One of the core problems of ASD children is a lack in central coherence (Frith, 1989). They fail to filter reality into digestible pieces and often focus too much on irrelevant information. The coherent information presented in structured laboratory tasks can guide participants in certain directions and thus overcome the problem of central coherence that is apparent in daily life. Second, the idea has been offered that HFASD arrive at ToM understanding through a reasoning process in which normally developing children achieve the same understanding in a more intuitive way (Travis *et al.,* 2001). The measures of ToM understanding often do not allow for a differentiation in the way at which the children arrive at their answers. Future studies of actual behavior could be helpful here.

An important question is how ToM understanding is related to ToM behavior. Travis *et al.* (2001) suggested a relatively direct link in ASD participants between intuitive, nonverbal forms of social understanding and social behavior. In contrast, they suggested a weaker link between consciously accessible, nonintuitive verbal social knowledge such as false belief understanding, and social behavior. Nonintuitive social knowledge may fail to support social interaction, because it is slow and rigid compared with intuitive social knowledge (Bowler, 1992). The limited relation of nonintuitive cognitive ToM understanding and actual ToM behavior such as outlined by Travis *et al.* (2001) showed an advantage of measures of more intuitive ToM understanding. Moreover, this finding also made a strong case for direct measures of actual ToM-related behavior. This study has illuminated the variability of ToM-related behavior. The finding that the application of daily life mind-reading abilities in HFASD individuals varied depending on the interest in the task at hand indicated that the use of ToM understanding in real interactions could be activated. This seems to be an important issue in the discussion about the relation between ToM understanding and actual ToM behavior in HFASD participants.

Future research needs to investigate other factors that might stimulate the application of ToM knowledge within the different subgroups of the autism spectrum. This is a clear break with tradition, stemming from the more than 750 studies in which false belief tasks were used in the last 15 years (Hughes *et al.,* 2000). The focus in these studies is usually on the revelation of "true" ToM knowledge of test participants, rather than the application of this knowledge. Failing a false belief task should not automatically lead to the conclusion that ToM knowledge is not available or impaired, rather, the communicative and social factors that play a role in the expression of this competence should be considered.

ACKNOWLEDGMENTS

Riëtta Oberink and Barry Holwerda are thankfully acknowledged for assisting in the data collection. The first author was supported by grants from the Paedologisch Instituut, Duivendrecht, and the Vrije Universiteit, Amsterdam, Holland.

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