

CORRELATION OF THE THEORY OF MIND AND THE LEVEL OF COGNITIVE FUNCTIONING IN AUTISTIC CHILDREN

Katarzyna Markiewicz¹, Bożena Grochmal-Bach²

¹ Institute of Psychology, Maria Curie-Skłodowska University, Lublin, Poland

² Institute of Applied Psychology, Jagiellonian University, Cracow, Poland

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SUMMARY

Introduction. A deficit in "theory of mind" (ToM), i.e. an inability to conceive what others may be thinking or feeling, has often been posited as an essential feature of childhood autism. Our research goal was to search for correlation between ToM-related tasks and the overall level of cognitive performance in autistic children.

Material and methods. The study included 25 autistic children under treatment at the Specialised Clinic of Diagnosis and Rehabilitation in Lublin, Poland. Each child had been under the care of the clinics for at least three years, and three consecutive series of examinations were administered to each child. We assessed the subjects' ability to initiate interpersonal contact and to make a parent look at an object presented by the subject (task ToM1), as well as their ability to simulate a given action with the use of symbolic objects (task ToM2). The ability to imitate others and the level of cognitive performance was assessed with the Psychoeducational Profile Revised.

Results. We found significant correlation between performance on both ToM tasks and cognitive functioning, as well as cognitive verbal scores and the ability to imitate others.

Conclusions. The autistic children we studied are capable of making inferences about the mental states of other people and of understanding and predicting their behavior. Moreover, the results of the study suggest that the ability to make social inferences is connected with the level of development of these skills.

INTRODUCTION

A number of authors have suggested that autism is related to difficulties in acquiring a theory of mind (ToM, cf. Frith, 1993; Baron-Cohen, 1995), i.e. the ability to infer the mental states of other people and understand and predict their behavior (Leslie, 1994). It has been theorized that an absent or inadequate ToM may be due to the malfunction of mirror neurons that are activated while one is watching various actions being performed (Gallese & Goldman, 1998); hence, they are significant for reading the intentions of others, a major component of ToM. Oberman et al. (2005) stated that in autistic people mirror neurons show activity only when they perform certain tasks, which may explain their mind-blindness, as well as their lack of ability to imitate the behavior of other persons.

It is worth considering, however, whether the inability of autistic persons to imitate others is indeed due to the dysfunction of mirror neurons, or rather to disturbances in the development of social skills, which then lead to the lack of activation of these neurons. In other words, the direction of cause and effect remains unclear. We therefore decided to evaluate the mutual relationships between the theory of mind, the ability to imitate, and overall cognitive functioning in a group of autistic children.

MATERIAL AND METHODS

The study involved 25 autistic children, patients of the Special Clinics for Early Diagnosis and Rehabilitation in Lublin, Poland. Each child had been under the care of the clinics for at least three years. The subjects, who were tested in three consecutive series of examinations, are described in Table 1.

The results were analyzed in accordance with three age groups, as generally accepted in developmental psychology:

- under 55 months of age;
- 56-79 months of age;
- over 80 months of age.

The following correlates of ToM were evaluated:

Table 1. Description of subjects

Examination		N	Age in months		
			Mean	Minimum	Maximum
1 st examination	Boys	21	52.33	48	54
	Girls	4	49.75	43	53
	Total	25	51.92	43	54
2 nd examination	Boys	21	74.81	68	79
	Girls	4	67.25	59	70
	Total	25	73.60	59	79
3 rd examination	Boys	21	94.71	83	110
	Girls	4	92.75	90	99
	Total	25	94.40	83	110

- The ability to initiate interpersonal contact and to make a parent look at an object presented by the autistic child (task ToM1);
- The ability to simulate a given action with the use of symbolic objects (task ToM2).

The first task (ToM1) made it possible to assess the child's ability to understand the visual perspective of another person. The examiner and the child were seated at a table, and at the opposite corner of the room one of the parents was seated at another table. The child was able to see the whole room, while the parent was seated diagonally at the other side, facing away. The examiner attempted to arouse the interest of the child in a puppet made of blocks strung on a stick. The blocks could be arranged in different orders, so that the shape of the puppet was changed. After a short period of joint play, the examiner handed the puppet to the child, saying "Show it to your Mom (or Dad)"; the instruction was supported by an appropriate gesture at the same time. The parents were instructed to:

- put their hands over their eyes;
- sit with their backs to the child.

As a result, the child had to approach the parent and make her look at the puppet, for example by pulling on her hand. Altogether six tasks were performed, and the means of their results were then calculated for further analysis.

The second task (ToM2) evaluated the child's ability to simulate symbolic actions. In the preparatory phase, the examiner put 4 blocks in front of the child: two white, flat blocks at the left hand of the child, and two large brown cubical bricks at the right hand. Then she put on a glove puppet (a duck) and said, "The duck is hungry, here is some porridge" and reached for the white block. She pretended to feed the duck, saying "Yum yum." Next she handed the block to the child, saying: "The duck is hungry – feed him", and persuaded the child to start feeding the duck. After "feeding" the duck, the examiner put the white block back in its place, and changed the duck for another glove puppet. She said, "The puppet is hungry – here is some cake" and reached for the brown block. She then pretended to feed the puppet, saying: "Yum yum". The next step was to encourage the child to repeat the action, that is, to feed the puppet.

In the test phase, the examiner presented the child the two puppets in random order. She named them and asked whether they wanted to eat porridge or cake. Correct reactions were registered, that is, attributing one of the blocks to the appropriate symbol of "porridge" or "cake." The scores obtained during three tests were then analyzed.

The ability to imitate and the level of cognitive performance were assessed with the Psychoeducational Profile Revised (Schopler et al., 1990). This made it possible to evaluate the developmental level of the respective functions on the following scales:

I – Imitation;
P – Perception;
FM – Fine Motor;
GM – Gross Motor;
EHC – Eye-Hand Coordination;
CP – Cognitive Performance;
CV – Cognitive Verbal.

The following hypotheses were formulated:

1. Progressive changes in the ability to imitate and in the level of cognitive performance correlate with an ability to initiate contact and to make the parent look at an object presented to her (ToM1).
2. Progressive changes in the development of the ability to imitate and in the level of cognitive performance correlate with the ability to simulate actions with the use of symbolic objects (ToM2).

The following variables were taken into account:

- main independent variable – the type of disorder;
- controlled variables – the level of cognitive functions, age, and the series of tests
- dependent variable – the level of ToM evaluated in terms of the number of points scored in the individual tasks.

Statistical analysis was performed with the SPSS 12.0 PL program for Windows. In order to evaluate the correlation among the particular variables, the Kendall coefficient τ was measured.

RESULTS

An analysis of correlations among the particular ToM tasks and the PER-R developmental sub-scales showed a number of significant relations.

In the first series of tasks, we found significant correlation between the ability to initiate contact and make the parent look at the demonstrated object (ToM1) and the level of cognitive performance ($\tau = 0.483$; $p < 0.01$). The ability to engage in symbolic play (ToM2) was related to imitation ($\tau = 0.416$; $p < 0.05$), cognitive performance ($\tau = 0.440$; $p < 0.05$), and cognitive verbal scores ($\tau = 0.390$; $p < 0.05$).

A strong correlation was also observed in the second series between ToM1 tasks and imitation ($\tau = 0.447$; $p < 0.01$), cognitive performance ($\tau = 0.408$; $p < 0.01$), and cognitive verbal scores ($\tau = 0.547$; $p < 0.01$). In the case of ToM2 tasks, there was a statistically significant relationship between cognitive performance ($\tau = 0.382$; $p < 0.05$) and cognitive verbal scores ($\tau = 0.484$; $p < 0.01$).

The third series of examinations revealed a strong correlation between ToM1 tasks and imitation ($\tau = 0.353$; $p < 0.05$), cognitive performance ($\tau = 0.589$; $p < 0.01$), and cognitive verbal scores ($\tau = 0.392$; $p < 0.05$). A significant correlation was also observed between ToM2 tasks and imitation ($\tau = 0.353$;

$p < 0.05$), cognitive performance ($\tau = 0.465$; $p < 0.01$), and cognitive verbal scores ($\tau = 0.432$; $p < 0.01$).

These results permit us to conclude that the ability to make social inferences is connected with the level of such developmental skills as imitation, cognitive performance, and communication.

DISCUSSION AND CONCLUSIONS

While discussing the Theory of Mind in autism, different authors point to different aspects. Some concentrate on such simple behaviors as facial expressions expressing the emotional and mental states of other persons (Gross, 2004), others on complex social situations (Happé, 1993; Hill, Berthoz, Frith, 2004). The present study evaluated the autistic child's ability to understand the perspective of others and to engage in symbolic play.

Perner (1991) and Wellman et al. (2001) state that the ability to "read the minds" of others is acquired after the fifth year of age in the course of normal development. This results, however, from the accumulation of previously acquired abilities and experience. The results of the present study confirm this assumption. The development of imitative learning seems to be pivotal for successful social interactions. It is true that the nature of these interactions is significantly deformed due to the character of autism, but it is essential for these children to be able to communicate that they have fulfilled a given task (Pachalska et al. 2007). This enables autistic children to become more self-dependent, even if communication is carried out in a specific way, provided that it remains effective.

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Address for correspondence:

Dr Katarzyna Markiewicz
Institute of Psychology
Maria Curie-Skłodowska University
Pac Litewski 5
20-080 Lublin
e-mail: k.markiew@wp.pl

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