New evidence in theory of mind deficits in subjects with chronic schizophrenia and first episode: correlation with symptoms, neurocognition and social function

Nuove evidenze nei deficit di teoria della mente in soggetti affetti da schizofrenia cronica e al primo episodio psicotico: correlazione tra sintomi, funzionamento neuro-cognitivo e sociale

MONICA MAZZA, ROCCO POLLICE, FRANCESCA PACITTI, MARIA CHIARA PINO, MELANIA MARIANO, SIMONA TRIPALDI, MASSIMO CASACCHIA, RITA RONCONE
E-mail address:monica.mazza@cc.univaq.it

Department of Science of Health, University of L'Aquila, Italy

SUMMARY. Aim. Currently substantial evidence exists about Theory of Mind (ToM) impairment in subjects affected by chronic and first episode schizophrenia. In particular, in order to enhance the validity of our construct, we used in this study classical false beliefs tasks and advanced theory of mind tasks, together with the application of structural equation model, in order to examine whether we are using ToM tasks with good psychometric properties. The main goal of the present study was to examine ToM deficits in a large sample including subjects suffering from chronic schizophrenia, first episode of schizophrenia and normal controls, by observing in the same task the relationship with symptomatological gravity, neurocognition and social function. **Materials and methods.** A sample of 178 patients with chronic schizophrenia, a sample of 49 subjects with a first episode of psychosis and 484 healthy controls participated to this study. Measures of social cognition included task of false belief and advanced theory of mind task. **Results.** No significant differences were found on ToM tasks between subjects affected by chronic and first episode schizophrenia. Social cognition showed in both groups a strong correlation with negative symptoms and social function, but did not evidence any relationship with neurocognition. **Conclusion.** ToM deficits exist in subjects suffering from chronic and first episode schizophrenia. These impairments do not seem to be a consequence of illness condition, they are likely to be state-independent and appear to be the most important cognitive mediator of social functioning in both groups.

KEY WORDS: theory of mind, schizophrenia, first episode, neurocognition, symptoms and social function.

RIASSUNTO. Scopo. Attualmente, esistono numerose evidenze circa la compromissione della Teoria della Mente (ToM) in soggetti affetti da schizofrenia cronica e al primo episodio. L'obiettivo del presente studio è stato quello di esaminare se la ToM, cioè la capacità di comprendere lo stato mentale altrui, possa mediare gli effetti di altre variabili, quali la neuro-cognizione e il funzionamento sociale e di comunità come la frequenza di contatti sociali e l'abilità di relazionarci con gli altri. Per migliorare la validità del nostro costrutto, abbiamo utilizzato in questo studio compiti di falsa credenza e di ToM, insieme con l'applicazione del modello di equazione strutturale, per poter esaminare la consistenza dei compiti ToM con buone proprietà psicometriche. **Materiali e metodi.** Hanno partecipato a questo studio un campione di 178 pazienti con schizofrenia cronica, un campione di 49 soggetti con un primo episodio di psicosi e 484 controlli sani. Sono stati utilizzati compiti di cognizione sociale: compiti di falsa credenza e di ToM. **Risultati.** Non sono state riscontrate differenze significative nei compiti di ToM tra i soggetti affetti da schizofrenia cronica e i soggetti con primo episodio psicotico. Infatti, tutti i pazienti hanno mostrato una riduzione delle prestazioni ToM rispetto al gruppo di controllo. È stata riscontrata inoltre una forte correlazione tra impoverimento della cognizione sociale e sintomi negativi e funzionamento sociale in entrambi i gruppi ma non è stato evidenziato alcun rapporto con la neuro-cognizione. **Conclusione.** Sia i soggetti al primo episodio psicotico, sia i soggetti con schizofrenia cronica soffrono di deficit di ToM. Questi disturbi non sembrano essere una conseguenza della condizione di malattia, ma dallo stato della malattia. I nostri risultati suggeriscono che la misura di ToM rappresenta il più importante mediatore cognitivo di funzionamento sociale in entrambi i gruppi e questo sottolinea l'importanza di utilizzare strumenti preziosi nella pratica clinica e misure più precise per la rilevazione del disturbo

PAROLE CHIAVE: teoria della mente, schizofrenia, primo episodio psicotico, neuro-cognizione, funzionamento sociale.

INTRODUCTION

Theory of Mind (ToM) is a cognitive capacity to represent one's own and other persons' mental states, for instance, in terms of thinking, believing, or pretending. The term was first used by the primatologists and psychologists Premack and Woodruff, who wondered whether the chimpanzee had a ToM (1). In human people, ToM indicates a competence used in everyday life during social interaction with other people.

Impaired ToM has been described in a variety of neuropsychiatric disorders and the most extensive ToM studies have been carried out in autistic spectrum disorders (2), in chronic schizophrenia (3) and in recent onset, but also in adult patients with frontal lobe damage (4,5).

Many tests applied in schizophrenia and aimed at examining ToM competences were developed to test young children s ability to infer mental states of other individuals (6).

The classic false beliefs tasks as Sally and Anne Test (7) involves the experimental creation of a situation in which a tested person has to distinguish his/her own knowledge that an object has been hidden by one character (Anne) in the absence of another person (Sally) from the knowledge of other characters involved (**Figura 1**).

The crucial issue is the place where Sally would look for the object when she comes back: the place where it was before she left the scene, or the place where it has been moved by Anne.

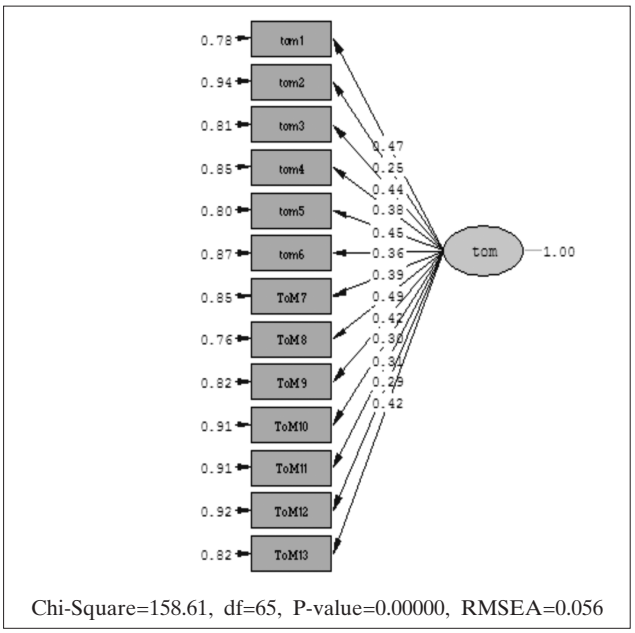

Figure 1. Relationships between the factors referred to as theory of mind I and II level.

Children under the age of 4 usually perform quite poorly on this test. The cognitive capacity to pass the test requires the ability to "metarepresent" Sally's mental state, that is: "I know that she does not know where the object really is". The Sally and Anne Test therefore encompasses what is called the understanding of a first order false belief. Many studies which describe the application of false beliefs tasks in order to study ToM disorders in autistic children surely bring univocal results (2).

On the contrary, studies of ToM disorder in schizophrenia do not provide conclusive evidence for an intact ToM in healthy adults and in adults affected by schizophrenia. Such tests, which have been developed for children, cause a ceiling effect in these samples (8). It is therefore impossible to determine with high probability whether subjects suffering from schizophrenia are intact or impaired in their theory-of-mind skills.

To bypass this problem, more sophisticated cognitive capacities related to ToM, including the understanding of higher order false belief tasks, hinting task, metaphor, irony, and *faux pas*, have been used with subjects affected by chronic schizophrenia and with first-episode psychosis samples (9).

Therefore, it has been argued that the ability of understanding metaphor, hinting, irony, and faux pas requires at least first and second order ToM comprehension: for instance, the understanding of methaphor requires first order ToM, whereas irony involves second order ToM, because these processes relate to the ability to go beyond the literal meaning of utterances by inferring what the speaker actually may intend (10,11).

It is possible to argue therefore that the understanding of ToM remains the basic process to study in examining social cognition competences in subjects affected by both chronic and recent onset schizophrenia.

Moreover, in terms of presentation of ToM tasks, usually first and second order false beliefs may be depicted using picture or may be performed with prompts.

These devices allow the subjects to understand more easily the task. Over the years, ToM tasks used in schizophrenia research have been modified in order to better control any other interference with attention, memory, "general" intelligence, and verbalization. A problem in earlier studies was that patients suffering from schizophrenia not only performed poorly on ToM tasks, but also often failed to correctly answer to the control or "reality" questions and memory questions, and although researchers used pictures to illustrate the stories, these remained however long and not simple to follow (12).

Moreover, it is also important to consider the issue of the clinical use of instruments to test "theory of mind":

the false beliefs tasks cannot satisfactorily be resolved in experimental laboratory "offline" test conditions.

Usually, in clinical practice, it is important to reduce as much as possible the time of examination, and it would also be very useful to use a task which could be administered in the clinical practice, which could examine ToM in subjects affected by schizophrenia and which already exists in literature.

Some studies report different tasks used to examine ToM in adults. In particular Happe (13), tested subjects with Asperger Syndrome by using an "advanced" theory-of-mind task. This task involved story comprehension, where the key questions concerned either a character's mental state or physical events. She found that even competent persons suffering from autism showed more difficulties with mental state stories than did matched controls, and that they used fewer and more inappropriate mental state terms than the control group in their explication of the reason why the characters behaved as they did.

Some authors later replicated to this finding by using a modified version of the story battery with individuals with Asperger Syndrom (14,15) and other authors used this task in a patients with frontal lobes lesions (4,16).

In recent years some authors reported similar ToM disorders both in subjects affected by schizophrenia and in patients with brain damage (17-19).

Patients with frontal lobe lesions, in fact, have been described as presenting diminished social cognition competences similar to schizophrenic subjects (4,16).

The aim of the present study is to examine theory of mind competences in a large sample of subjects affected by chronic schizophrenia and a sample with a recent onset of schizophrenia spectrum psychosis using two tasks to assess a first and second order false belief tasks by Happe (13) and compare their performances in same task.

We used a task just present in literature and easy to perform also in clinical practice. However, it has never been deeply tested so far the structure of advanced theory of mind test, in order to examine whether the task really examine theory of mind.

Moreover, in order to enhance the validity of the construct, we used also classical false beliefs tasks, which allow us to explore whether the task really examines ToM, and is therefore a good measure of mentalizing abilities and we applied structural equation model to examine whether we were using ToM tasks properly from a psychometric point of view.

Finally, the relationship between ToM and clinical variables, such as symptoms and social function, have also been explored.

MATERIALS AND METHODS

Two groups of subjects suffering from schizophrenia participated to the study.

The first group was composed of 178 people affected by chronic schizophrenia (124 males and 54 females), diagnosed according to DSM-IV-R (20) criteria.

Subjects were in-patients of the Day Hospital (DH) service of the University of L'Aquila Psychiatry Department from January 2000 to January 2009.

The average age was 34,5 years (sd 8,4), the average years of schooling 11,54 (sd 2,7).

All the subjects gave informed consent to the participation in symptoms assessment for therapeutic management in DH.

Every subjects' assessment took place when clinically stable within a month from the day of admission to DH and establishment/confirmation of diagnosis. 98% was treated with maintenance atypical antipsychotic drugs. The mean daily dose was 210.3 (sd 143.67) mg/equivalents of chlorpromazine (21). We classified this group as "remitted" according the criterion used by Krabbendam (22).

The second group was composed of 49 first episode (FE) subjects affected by schizophrenia (33 males, 16 females) whose mean age was 26,8 years (sd 6,4), the average years of schooling 10,8 (sd 2,8). None of them showed any concurrent medical condition at the time of the assessment. This was defined "first episode" group and consisted of patients who had been diagnosed with an interval of 3 months from first diagnosis (i.e., at time of first hospitalization or presentation to the services).

All patients were free of other medical conditions or substance abuse. The majority of the FE sample was single (88%) and lived at home (78%). In terms of education 34% attended some years of high school education, 18% had completed high school, 34% had some post-graduate training and 14% was graduated. Diagnoses for these patients included schizophrenia, schizoaffective disorder and schizophreniform disorder.

All subjects were in-patients consecutively admitted to the SMILE Services. The SMILE (Service for Monitoring and early Intervention against psychoLogical and mEntal suffering in young people) is a service composed of a multidisciplinary team (senior psychiatrist, resident psychiatrists, child neuropsychiatrist, neuropsychologist, psychiatric rehabilitation technician) inside the Outpatients Department of the San Salvatore Hospital, L'Aquila, Italy.

Diagnoses of both groups were completed at baseline. DSM-IV-TR diagnoses of schizophrenia or schizoaffective disorder based on the Structured Clinical Interview for DSM-IV- Patient Edition (SCID) (23) before being confirmed through a consensus meeting attended by at least two senior psychiatrists. 67% was treated with maintenance atypical antipsychotic drugs whose mean daily dose was 98.3 (sd 95.76) Mg/Equivalents of Chlorpromazine (24). The mean IQ level was assessed through Raven's Progressive Matrices Scale (1938).

Subjects were compared to two control normal samples. The first group was composed of 386 (71 males, 53 females) subjects taken from students who matched with FE group for age and education.

The second group was composed of 96 (51 males, 45 females) subjects selected from normal Italian population, who matched with subjects suffering from chronic schizophrenia for age and education. Socio-demographic and clinical details are reported in **Table 1**.

Psychopathology measures

The severity of psychopathology was assessed with the following instruments:

Brief Psychiatric Rating Scale-24 in its Italian version. Each symptom on the 24-item scale was rated on a scale from 1 to 7 (1=absence of symptom; 7=very severe symptom). The key score was composed by the total points gathered throughout the complete scale. 6 symptom clusters were evidenced as following, after performing a factor analysis on the BPRS scores on a larger sample composed of 225 psychiatric patients: Disorganised cluster, including items 12 (Bizarre behaviour), 13 (Self-neglect), 14 (Disorientation), 15 (Conceptual disorganisation); Negative affect cluster, including items 16 (Blunted affect), 17 (emotional withdrawal), 18 (Motor retardation); Positive symptoms cluster, including 9 (Suspiciousness), 10 (Hallucinations), 11 (Unusual content of thoughts); Mania cluster, including items 7 (Mood elevation), 8 (Grandiosity), 21 (Excitement), 23 (Motion hyperactivity); Depression cluster 3 (Depression), 4 (Suicidality), 5 (Guilty) and Anxiety cluster 1(somatic concern), 2 (anxiety).

Social function

The VADO Personal and Social Functioning Scale (FPS) consists in a modified version of the Social and Occupational Functioning Assessment Scale (SOFAS) (25). As with the SOFAS, the FPS scores range from 100 (excellent functioning) to 1 (extremely severe impairment with risk for survival). The instructions for scoring the 10 points within each level are very detailed. The rater is instructed to take into account four main areas: work and/or socially useful activities; family, personal and social relationships; self-care; aggressive and destructive behaviours. Suicide risk is considered in the score as much as suicidal ruminations may interfere with social-functioning. The FPS requires a brief and simple training, that is described in the VADO manual. The FPS can be easily scored by rehabilitation workers, including those with a limited psychiatric experience. It is, therefore, an very useful tool to assess severity and outcome in routine practice.

Neuropsychological assessment

All subjects were administered a Phonemic Verbal Fluency Test and verbal reasoning test. All participants completed a comprehensive battery of neuropsychological test. The different raw scores were converted into T-scores (Mean: 50; SD:10) and, in order to make all scores comparable, we applied appropriate norms for age and educational level outlined in the manual covering each test. The neurocognitive assessment was carried out through the following instruments: Estimated IQ: Raven Progressive matrices; Working Memory: forward and backward Digit Span; Psychomotor Speed: Trail Making Test-A (TMT-A);

Table 1. Clinical and socio-demographic features of participants

	Chronic schizophrenics	Recent onset schizophrenics	T Students	CL 95%
Age	34.57 (8.4)	26.4 (7.56)	7.872; p<0.000	8.14-13.367
Years of education	11.54 (2.7)	12.6 (2.4)	-	-
Intellectual level	76.9 (34.9)	79.7 (12.9)	-	-
Duration of illness (years)	10.9 (2.9)	1.01 (0.5)	9.320; p<0.00	7.77-11.94
FPS	45,5 (16,5)	39,1 (15,8)	2.35; p<0.019	1.09-11.06
BPRS totale score	47.5 (14.7)	63.79 (16)	6.55; p<0.00	21.147-11.369
Positive cluster	9.7 (4.7)	13.6 (4.4)	7.68; p<0.00	7.34-4.34
Negative cluster	6.5 (3.2)	7.2 (3.2)	2.91; p<0.00	.549-2.674
Disorg. cluster	16.06 (7.35)	21.6 (14.6)	8.06; p<0.00	12.6-7.6
Mania cluster	4.4 (6.5)	5.1 (3.4)	10.49; p<0.00	5.66-3.87
Depression cluster	5.6 (2.4)	4.8 (1.8)	3.23; p<0.00	.409-1.978
Anxiety cluster	5.1 (2.3)	5.4 (2.3)	4.47; p<0.00	.943-2.43

Value are means, standard deviations are in parenthesis.

Verbal Memory: Rey Auditory Verbal Learning Test (RAVLT); Executive Function: tower of London, Trail Making Test-B (TMT-B); Verbal Fluency; key search (BADS); Zoo map test (BADS).

Experimental tasks. Advanced ToM scale.

This task is an Italian adaptation of a cognitive task used by Blair and Cipolotti proposed in literature by Happe (26).

This task consists in a short version of 24 short vignettes, each accompanied by a picture and two questions; the comprehension question "Was it true, what X said?", and the justification question "Why did X say that?". The 12 story-types included Lie, White Lie, Joke, Pretend, Misunderget, Double Bluff and Contrary Emotion. A set of control "physical stories" was also given to the subjects. These stories did not involve mental states but described instead an unforeseen outcome with a mechanical physical cause. An example of the experimental stories and control stories can be found in the Appendix (26).

Scoring procedure

The explication given in response to the "Why" question was rated as either correct or incorrect. A justification could be incorrect because it involved errors about the facts given in the story, or because it involved an inference which was inappropriate as a reason for the story characters' utterance. The justifications were also scored as either involving mental state or physical states. Many of the story characters' utterances could be justified correctly either in term of mental states or physical states. Mental states answers included those that referred to thoughts, feelings, desires, traits, and dispositions. It was given only one score per story, giving the subject credit for patient's "best" answer. That is, if a subject gave a correct answer and an inappropriate one, it would be selected the correct answer (26).

Procedure

Each participant was tested alone in a room which was free from distractions. The experimenter introduced each story as follows: "Here are some stories and some questions. I am going to read the stories, and I'd like you to listen carefully and answer the questions at the end of each story. If you want, you may read the stories yourself while I am listening. OK? Let's start". The experimenter sat next to the individual and read out each story. The participants preferred sometimes reading the story out loud to the experimenter. The sheet remained in front of the participant throughout the reading and questioning tasks. This was done in order to minimize memory requirement.

First and Second Order Theory of mind was also investigated through the comprehension of false beliefs stories. Two stories were read to the participants individually in order to assess second order ToM competence (the capacity to understand other people's false beliefs): The Washing Machine story (5,19) and The Wallpaper Story (5,19).

Each participant was tested alone in a room which was free from distractions. The experimenter introduced each story as follows: "Here are some stories and some questions. I am going to read the stories, and I'd like you to listen carefully and answer the questions at the end of each story".

These stories were presented to the subjects in a series of cartoons in which the various actions of the characters are depicted in sequences. All the subjects were asked a ToM question and three control questions.

False belief test question. This was designed to elicit a response that demonstrated the ability to make inferences about another individual's mental state, namely, the fact that a character in the story holds a false belief.

Fact question. This was posed in order to determine subject's understanding of the actual sequence of relevant events that had occurred in the story, which is in contrast with the sequence understanding of one of the characters in the story and that leads to his coming to a false conclusion.

Memory question. This was used to assess whether memory for story details was approximately intact. The stories were the same for all the subjects examined. Each subject obtained a score ranging from 0 to 1 for each answer to False-belief questions, fact questions and memory questions, where 0 = incorrect answer; 1 = correct answer. If the subject gives a correct answer to both first order stories, s/he obtains a global score for first order ToM equal to 1 (non-casual performance).

RESULTS

In the first phase of the study we analyze the sociodemographic and clinical details of our sample; as a second step, we examined the factorial structure of advanced ToM task through a structural equation model. Finally we examined the differences between 3 groups in all measures.

Sociodemographic and clinical details

We performed One Way Anova to analyse differences in age and education in all groups.

Our results showed statistically significant differences in age ($F_{3,542}=8.6$, $p<.000$) and education ($F_{3,542}=2.917$, $p<.018$).

Post hoc (Bonferroni methods) analysis evidenced that subjects suffering from chronic schizophrenia differ for age both from recent onset patients (mean differences= .949, p<0,000) and young healthy controls (age mean differences= .529, p<0,000) and that recent onset subjects differ both from chronic subjects (mean differences= .949, p<0,000) and from chronic healthy controls (mean differences= .949, p<0,000).

With regard to education, *Post hoc analysis* (Bonferroni methods) evidenced that subjects affected by chron-

ic schizophrenia and recent onset schizophrenia patients differ from young healthy controls (age mean differences= .185, p<0,000) and from patients with chronic schizophrenia (mean differences= .261, p<0,000).

We performed *t*-test in order to analyze differences in duration of illness, IQ level and clinical measures between recent onset and chronic schizophrenia. There were significant differences between the groups in BPRS total score (t 200=2.76, p<.006, recent onset <of chronic Subjects with schizophrenia) and in Positive Cluster (t 200=4.46, p<.000, recent onset <of chronic Subjects with schizophrenia). Clinical results are reported on **Table 1**.

To have a better comprehension of the relationship between the variable on advanced theory of mind scale, we used a structural equation model. This statistical approach allows to explain how the variables of the present scales are related to each other, through the computation of quantitative and goodness of fit.

Infact we analaze SEM with the strength of the correlational links between the plausibility of causal factors hypothesized. Through the use of models and can see if the scale that we used actually looks at the ability of mind reading in a manner similar to the false belief task.

In order to evaluate the comprehension adaptation statistical fitness of our model we considered the following indices of fit: 2 (and the respective degrees of liberty, df), Goodness of Fit Index (GFI) (27), Adjusted Goodness of Fit Index (AGFI) (27,28), Comparative Fit Index (CFI) (29), Nonnormed Fit Index (NNFI) (30), Root-Mean-Square Error of Approximation (RMSEA) (31), GFI, AGFI, CFI and NNFI are indexes varying between 0 and 1 which express the level of adaptation, the better the closer they approach level 1. RMSEA, instead, indicates a good adaptation when results are less than 0.06 (32).

The pattern of relationships between the factors referred to as ToM I and II level is shown graphically in **Figure 1**.

In this model we calculated for each item values of saturation (λ) and respective errors of variance (θδ). The optimal solution obtained from the item analysis are reported in **Table 2**. As it is possible to observe our model shows perfect solution allows to confirm the relation between all the items in the Advanced level and the two false belief tasks used showed that all factors used in the model belong to a single theoretical construct.

Advanced ToM scale

The comparison between subjects affected by chronic and recent onset schizophrenia and all controls showed statistically significant differences in total score of ToM scale task (F 3,658=40.500; p<.000).

Post hoc (Bonferroni methods) comparisons showed that chronic schizophrenic group's performance differed significantly from both normal samples performances (old normal sample: mean differences= -1.92; p<0,000; young normal sample: mean differences=-2.56; p<0,000; effect size d=1,32; r=0,55) but not from recent onset group; comparisons showed also that recent onset group's performance differed significantly from those of both normal samples (old normal sample: mean differences= -1,76, p<0,000; young normal sample: mean differences=-2.40, p<0,000 effect size d=1.02; r=0,45) but not from subjects suffering from chronic schizophrenia (**Table 3**).

First-order false belief tasks

False-belief test question: groups differed significantly on the non-parametric Kruskall-Wallis test: 2(3) = 212.604, df=3 p < 0.000). *Post hoc* (Bonferroni methods) comparisons showed that chronic schizophrenic group's performance differed significantly from both normal samples performances (old normal sample: mean differences= -.798, p<0,000; young normal sample: mean differences=-.892, p<0,000) but not from recent onset group; comparisons showed also that recent group's performance differed significantly from those of both normal samples (old normal sample: mean differences= -.875, p<0,000; young normal sample: mean differences=-.891, p<0,000) but not from subjects affected by chronic schizophrenia.

Fact questions: the percentage of correct scores revealed no significant overall differences between groups.

Memory questions: the percentage of correct scores showed no significant group differences (**Table 3, Figure 2a**).

Second order theory of mind

False-belief test question: groups differed significantly: Kruskall-Wallis 2(3) = 138,317, df=3, p = 0.000). *Post hoc* (Bonferroni methods) comparisons showed that chronic schizophrenic group's performance dif-

Table 2. Advanced ToM and index of fit

MODEL	ITEM	Chi2	gl	GFI	AGFI	RMSEA	RMSEA 90%	CFI	NFI	NNFI	AIC (model)
Advanced Theory of mind	13	158.61	65	.95	.93	.056	.045 - .067	.90	.84	.88	210.61

Table 3. Performances of all participants to the study in experimental tasks

	Schizophrenic subjects		Matched Healthy controls	
	Chronic	**Recent onset**	**Matched with chronic**	**Matched with recent onset**
Advanced ToM Scale	6.7 (4.1)	7.8 (4.4)	10.5 (2.2)	9.9 (2.25)
First order Theory of Mind (% correct/ % uncorrect)	37,6/62,3	38,3/61,7	89,3/10,7	83,3/14,4
Second order Theory of Mind (% correct/ % uncorrect)	32/68	25,5/74,5	70,1/29,9	61,5/38,9

fered significantly from both normal samples performances (old normal sample: mean differences= -.798, p<0,000; young normal sample: mean differences=-.892, p<0,000) but not from recent onset group; comparisons showed also that recent onset group's performance differed significantly from those of both normal samples (old normal sample: mean differences= -.875, p<0,000; young normal sample: mean differences=-.891, p<0,000) but not from subjects suffering from chronic schizophrenia.

Fact questions: the percentage of correct scores revealed no significant overall difference between groups. *Memory questions* The percentage of correct scores showed no significant group differences (**Table 3, Figure 2b**).

Correlation with symptoms, neurocognitive and social function measures

A Pearson's bivariate correlation analysis was conducted to compare the scores obtained on advanced ToM task scale total score and other measures used. The analysis showed an inverse correlation between advanced ToM tasks show a lower level of negative cluster in BPRS in patients with chronic schizophrenia and in recent onset subjects: the higher the score achieved in total score of Tom Advanced, the lower the negative symptomatology both in chronic and in recent onset schizophrenia patients. On the other hand, we obtained a correlation between scores at ToM tasks and social function measured with FPS scale: the lower the ability to understand other people s beliefs, the lower the global social function. Finally we obtained a good correlation between advanced ToM score order false beliefs task in chronic (r=,236;p<0,000) in recent onset (r=,278; p<0,000) and in all normal controls (r=,262; p<0,000). The results are reported in **Table 4**.

DISCUSSION

This study examined ToM skills in a group of subjects affected by chronic schizophrenia and a group of patients who experienced the first episode of this disease.

We applied a structural equation model in order to examine the psychometric properties of the Advanced ToM scale. A careful study provides the guarantee to obtain reliable measures of what is observed.

Structural equation models (27) consent a better management of the complex phenomena we are observing. Structural equation models allow in fact to test a precise factorial hypothesis throughout the presence/ab-

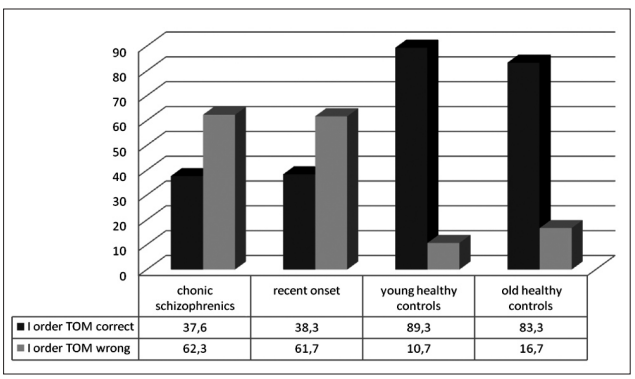

Figure 2A. Results on First order ToM stories in all groups. The figure show the percentages of correct/uncorrect response in ToM tasks.

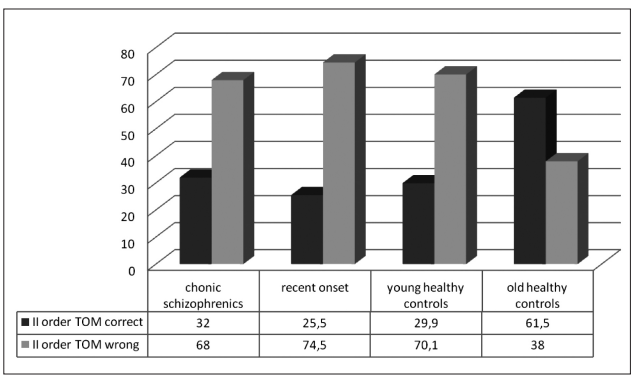

Figure 2B. Results on Second order ToM stories in all groups. The figure show the percentages of correct/uncorrect response in ToM tasks.

Table 4. Correlation in chronic schizophrenics subgroup between advanced ToM total score with first and second order false beliefs tasks, symptoms, neurocognition and social function

	Chronic schizophrenics	Recent onset schizophrenics
Negative cluster	-,334*	-,383**
Verbal reasoning	-.062	-.058
Verbal Fluency -,195	-,095	
IQ level	-,121	,047
False beliefs First order	.236*	.278*
False beliefs Second order	.213*	.234*
Social function (FPS total score)	-,337*	-,380**
***p<,05; ** p<,000**		

sence of an item in a given cluster, allowing thereby to test the model's correctness by the analysis of fit indexes. This evidently brings an important clinical effect.

Good psychometric properties of a clinical instrument not only guarantee to obtain reliable measures of what is observed, but they represent the base for a generalized use and a standardized scale. By applying structural equation modelling we examine the good properties of the advanced ToM test. The theoretical construction of the scale seems to find again its coherence in the validation of the instrument. These conclusions allow to assume that latent features of the instrument are effectively confirmed.

On the basis of the results obtained in previous studies, indicating that deficits of theory of mind, in particular in understanding first and second order false beliefs, are present in subjects affected by chronic schizophrenia (33-37) and in first episode schizophrenic subjects (9,38-40), our results evidenced that subjects suffering from chronic schizophrenia with remitted symptomatology showed similar ToM disorders in classic false beliefs and in advanced theory of mind tasks (26) to first episode subjects.

According to metanalyses of Bora (8) only few studies reported data from remitted patients, and with regard to ToM tasks, patients revealed significant impairments when compared to healthy controls. Studies on metanalysis showed significant and stable mentalizing impairment in case of schizophrenia. The finding that patients in remission are also impaired favours the notion that mentalising impairment represents a possible trait-marker of schizophrenia (41,42).

Similar to remitted subjects from schizophrenia, a first episode sample showed the same disorders in theory of mind, both in false beliefs and in advanced tasks.

Moreover, the distribution of effect sizes was more homogenous for individual tasks, especially in "remitted" patients.

While state variables and task specific differences explain at a large degree the heterogeneity of the ToM findings observed in previous studies, the persistence of ToM deficits in "remitted" patients suggests that there are trait related metalizing impairments in schizophrenia.

Our review also suggests that future research should consider the potential moderating influence of IQ deficits on ToM performance in "remitted" patients, as well as the potential effects of residual symptoms (8,43).

Some studies clearly indicated that the deficits of social cognition in first episode psychosis extend beyond specific theory of mind impairments and reveal general deficits in the field of social cognition (39,44).

More specifically, the results obtained in the present study showed that first episode psychosis cause the same difficulties founded in subjects with chronic schizophrenia.

Our results are consistent with previous studies conducted on first episode psychosis patients, which clearly demonstrated the existence of theory of mind disorders in this population (44,45).

In literature it has been used a variety of non-homogeneous test batteries, for that reason it is difficult to compare the results of the different studies.

In our research we compare performances in a large group of very stable schizophrenic patients to the performances of a first episode schizophrenia group in a same task of ToM. In literature very few studies in fact that examine both groups in a same ToM task, including moreover a very large normal sample at the same time.

Interestingly, the first episode group's mean performance in this study nearly matched the mean scores obtained in previous studies conducted on a more chronically affected group (33,43,46).

This similarity between the two populations seems to indicate that in case of schizophrenia, illness chronicity may not exacerbate social cognitive deficits, although only longitudinal studies of a number of first episode situations could provide a more definitive answer in this regard. This represents another interesting result in our correlation between negative symptomatology on both groups.

It is evident that ToM impairment is more severe in the acute phase of schizophrenia, and differences in symptom characteristics of the various studies may therefore contribute to the heterogeneity of the reported findings.

However, our results suggest that ToM impairments in schizophrenia persist even after the remission of acute psychosis. These results suggest that there is a trait related to ToM impairment in schizophrenia, because ToM abilities deficits are not influenced by symptoms since our sample was in remission.

This result contradicts theoretical positions of Frith (47) and Hardy-Bayle (48). Frith's concept of ToM deficit in schizophrenia suggests a state related impairment. This model proposed that psychotic symptoms in schizophrenia may be explained by mentalising impairment. Consistent with this model, several studies by Frith and his colleagues showed intact ToM performances in remitted patients. While the model of Hardy-Bayle suggests an association of ToM impairment with another symptom dimension of schizophrenia (disorganized thought), it also considers ToM deficit as a characteristic state of schizophrenia. However, other findings demonstrating ToM impairment in remitted patients and in people at genetic risk of schizophrenia support the notion that ToM dysfunction may be a characteristic trait of schizophrenia.

Results of metanalysis of Bora (8) and results of Sprong (43) are also consistent with this opinion.

The present study exceeds the limitation of other studies in which insufficient power due to small sample size was able to explain only some results.

Definition of remission is clearly important for a proper interpretation of the findings since residual positive and persistent negative symptoms are commonly observed in recent onset and in stable subjects affected by schizophrenia.

The finding related to the absence of the effect of IQ level on ToM impairment in schizophrenia is an important result. In our study we did not observe any correlation and these results suggested that cognitive deficits and IQ could not explain the ToM impairment in both groups suffering from schizophrenia. We also obtained a correlation between ToM and social function in both groups: few studies have directly investigated the relationship between ToM deficits and social functioning (49) in schizophrenia (46, 50).

At the same time, the impact of mental state decoding tasks on social dysfunction has also not yet been investigated. In this study, our results showed the relationship between ToM deficits and social functioning in subjects affected by chronic and first episode schizophrenia.

It is then possible to conclude that mental state decoding skills appear to be the most important cognitive mediator of social functioning in both groups.

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