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Theory of mind and emotion processing training for patients with schizophrenia: Preliminary findings

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ABSTRACT

Impairments in social cognition are critical predictors of social functioning in patients with schizophrenia. Emotion processing (EP) and theory of mind (ToM) are hypothesized to influence real-world behavior more directly than basic cognition and represent important targets of intervention. The use of video scenes depicting human interactions could constitute an appropriate tool to enhance understanding of characters behavior and stimulate inferences on mental states. The aim of our pilot study was to evaluate longitudinally, with a controlled trial, the feasibility and the efficacy of a single-paradigm emotion recognition and ToM training designed for outpatients affected by schizophrenia, with the goal to create an ecological treatment, overcoming artificial laboratory biases, by the use of specific videotaped material. Fifty-two outpatients were randomly assigned to an EP and ToM video-based training ($n = 27$) or to a standard social cognitive rehabilitation treatment ($n = 24$). They were assessed before and after 12 weeks of intervention and compared to a time-matched control group ($n = 24$). Our results show a statistically significant improvement in ToM abilities, confirming the hypothesis of the enhancing potential of social cognitive interventions, but no changes with respect to EP; despite the need for a deeper examination, these data support further development of this treatment approach.

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1. Introduction

A wide array of everyday skills necessary to community living is markedly impaired in patients with schizophrenia (Bellack et al., 2007) and subsequent deficient functional outcomes frequently flow into deterioration of quality of life and disability (educational achievement, un- or underemployment, social isolation, increased medical morbidity, reliance on caregiver). Many patients exhibit a low level of community functioning even prior to the onset of the first psychotic episode and it generally worsens over the course of the disorder (Addington and Addington, 2000). Social disruption, besides being an important diagnostic criterion, is the most weakening and treatment refractory dysfunctional area in patients affected by schizophrenia; social difficulties manifest pre-morbidly and in remitted patients (Bora et al., 2008) and are often present in first-degree relatives of patients diagnosed with schizophrenia (Couture et al., 2006). Disentangling the determinants of poor functional outcome and defining the potentially treatable factors have become a fundamental goal of schizophrenia research.

Patients with schizophrenia have extensively demonstrated cognitive deficits and several studies have related them with impairment in daily operations (Green, 1996; Green et al., 2000, 2001, 2005; Milev et al., 2005; McClure et al., 2007; Cavallaro et al., 2009; Penadés et al., 2010), although basic neurocognitive deficits account only for 10% to 40% of the variance in functional outcome (Pinkham and Penn, 2006; Fett et al., 2011). There is a growing consensus among researchers about the critical role of a cognitive domain more proximal and deeply associated with social functioning (Brune and Brune-Cohrs, 2005). Cognitive processes involved in recognition and interpretation of social stimuli, commonly referred to as “social cognition” (Adolphs, 2001) show signs of mediating the relationship between basic neurocognition and functional outcome (Brekke et al., 2005; Addington et al., 2006). The multifaceted construct of social cognition refers to mental operations underlying social interactions, as perceiving, interpreting and generating responses to intentions, dispositions and behaviors of others (Brothers, 1990; Fiske and Taylor, 1991; Kunda, 1999). Patients with schizophrenia manifest impairment in several aspects of social cognition (Brune and Brune-Cohrs, 2005; Penn et al., 2006), often early in the course of illness and even as prodrome. Among these, the abilities to decipher facially expressed emotions and to reflect upon one's own and other persons' mental state including desires, beliefs, knowledge, intentions and feelings (theory of mind or ToM; Frith and Frith, 2003) are particularly relevant. Emotional processing (EP) and ToM are hypothesized to influence real-world behaviors more directly than

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neurocognition and psychopathology (Penn et al., 1996; Couture et al., 2006; Gur et al., 2006; Pinkham and Penn, 2006; Mehl et al., 2010) and because of this are both ranked as key predictors of interpersonal functioning reduction and as good targets for social cognitive intervention. Several experiments revealed the improving potential of social cognition targeted training, demonstrating that brief experimental manipulations as well as more intensive psychosocial interventions can enhance patients' social cognitive abilities (Horan et al., 2009), both through single function- and broad-based strategies of treatment (Kurzban et al., 2010; Kurtz and Richardson, 2011).

Facial affect recognition (EP) is enhanced by means of attentional shaping and monetary reinforcement (Penn et al., 2000; Combs et al., 2006), micro expression training tools (METT: Russell et al., 2006, 2008) and training for affect recognition (TAR: Wölwer et al., 2005). Similarly, the introduction of verbalization and explicit manipulation of information about others' mental states significantly improved performance of patients affected by schizophrenia in a comic strip task assessing ToM skills (Sarfaty et al., 2000).

Among broad-based treatments, some interventions combine cognitive and social cognitive trainings, such as Integrated Psychological Therapy (IPT: Brenner et al., 1992) and cognitive enhancement therapy (CET: Hogarty et al., 2004). Twelve weeks of social perception subprogram of IPT improved the perception and interpretation of social situations in 20 out-patients with schizophrenia relative to controls (Garcia et al., 2002).

Hogarty et al. (2004) tested the improvement of social cognition in patients with schizophrenia by a multidimensional and developmental approach that integrates computer-assisted training in neurocognition with social cognitive group exercises focused on formation of gistful, problem solving of real-life and social dilemmas (CET, cognitive enhancement therapy). The experimental group obtained better results on social cognition and Social Adjustment scores compared with a state of-the-art enriched supportive therapy.

Other rehabilitation programs incorporate multiple interventions, each designed for a specific domain of social cognition. Mazza et al. (2010) developed a group's treatment based on observation of photos, paintings, figures and strips and imitation of facial emotion expressions. 16 out-patients with schizophrenia that completed the Emotion and ToM Imitation Training (ETIT), compared to a Problem Solving training group, improved on measures of emotion recognition, ToM, cognition, flexibility and social functioning. However, most of these studies relied on complex verbal descriptions or impoverished social stimuli that are far from real human relations. Video scenes showing interactions between human beings have been considered more ecological stimuli than comic strip and powerful enough to detect theory of mind abnormalities in patients affected by schizophrenia (Bazin et al., 2009). Videotape has been used by several authors for assessment of social understanding and problem solving skills in schizophrenia (Kayser et al., 2006), but it is currently utilized for training purpose only by few research groups and could constitute a promising tool of social cognition enhancement. Penn et al. (2005), Penn et al. (2007), Combs et al. (2009) and Roberts and Penn, 2009; Roberts et al., 2010 developed the social cognition and interaction training (SCIT), a 20-week intervention package targeting dysfunctional social-cognitive processes which includes specialized videos among stimuli and addresses several aspects of social cognition: EP, ToM and attributional bias (AB). SCIT consists of three phases: 1) emotion training (defining emotions, emotion mimicry and understanding suspiciousness), 2) figuring out situations (social cognitive biases) and 3) integration (putting into practice in real life what learned). It includes videos, photographs and computerized stimuli and the general goal is to train patients to become better "social detectives". An uncontrolled pilot study (2005) conducted on 7 inpatients showed improvement attributable to SCIT in AB and ToM but not in EP; in a subsequent study (Combs et al., 2007a) a SCIT modified intervention was administered to 18 inpatients and demonstrated to enhance ToM and EP compared with treatment as usual (TAU). In a quasi-experimental study recently conducted (2009) authors evaluated a sample of 31 out-

patients receiving SCIT plus TAU vs a TAU-only group; SCIT participants significantly improved on facial EP task but not on the other two targeted functions. Roberts et al. (2010) also performed a SCIT feasibility study in community setting with positive findings.

In spite of these good issues, it remains unclear how the multi-component stimuli adopted weigh on the result's differences and how many outcomes lean on basic neurocognition changes or on symptomatology. Therefore, Horan et al. (2009) conducted a randomized controlled clinical trial on 31 outpatients with psychotic disorders assigned to a new 6-week intervention designed to train 4 domains (facial EP, ToM, AB and social perception (SP) or to a time-matched control condition (illness self management and relapse prevention skills training); social cognitive intervention consisted of newly developed didactic presentations and exercises that incorporated digitized still photos, sets of written vignettes that describe different social situations and film clips drawn from existing sources, SCIT included. Individuals who received the social cognitive intervention showed significant improvement in EP skills, not attributable to changes in basic neurocognition nor symptomatology.

Due to the "embedded nature" of training procedures within multi-component programs, it is difficult to attribute specifically any intervention effects to the sub-modules of treatment and to differentiate among the achieved results all individual contributions owing to each type of stimuli. Moreover, the possibility of incurring artificial laboratory bias is existing as the didactic method applied is not ecological, far from the abilities carried out during normal daily interactions. The advantages of using film clips as single and ecological rehabilitation paradigm allowed to work in the context of "social attunement" (Stanghellini and Ballerini, 2002; 2011a; 2011b), a concept borrowed from phenomenology which indicates an immediate, pre-reflexive and anti-predicative ability to make emotional contact and understand intuitively the mental manifestations of others. In movies, indeed, the process of attunement is facilitated by the convergence of structural and thematic elements (framings, visual details, speech prosody, colors and music, speed of action, etc.) on the construction of scenes' meaning. Coherently, as shown by Mazza and colleagues and in the frame of the Embodied Simulation Theory of ToM (Gallese and Goldman, 1998), the observation and understanding of emotions and interactions can induce changes in social cognition anomalies of patients affected with schizophrenia.

The usefulness of video as single stimuli has been shown by Kayser et al. (2006). The authors trained 8 schizophrenic patients to analyze videos, chosen from recent French cinema movies, paying particular attention to the characters' mental states. Despite the ToM training shortness, 12 short video scenes presented in two sessions, the video group significantly improved in communication abilities and intentions attribution measures.

These encouraging disclosures resulting from various studies point out some limits (sample size, training brevity, absence of time-matched active control group, recruitment of inpatients, failing in improving all targeted social abilities) and the variability in treatment stimuli makes the comparison difficult, but if taken together they highlight the feasibility of effective treatments and support further efforts in this direction.

Therefore, the aim of our pilot study was to evaluate longitudinally, with a controlled trial, the feasibility and the efficacy of a single-paradigm emotion recognition and ToM training designed for schizophrenic outpatients, with the goal to create an ecological treatment, overcoming artificial laboratory biases, by the use of specific videotaped material and to evaluate the effect of a single paradigm on different targets of intervention.

2. Methods

2.1. Subjects

Seventy six outpatients were recruited from the Department of Clinical Neurosciences, San Raffaele Hospital, Milan. They all met DSM IV-R criteria for schizophrenia, as

determined by trained psychiatrists by using medical records and DSM IV-R Structured Clinical Interview, and were clinically stabilized. Exclusion criteria were substance dependence or abuse, co-morbid diagnosis on Axis I or II, major neurological illness, perinatal trauma and mental retardation. Patients had been treated with a stable dose of the same antipsychotic therapy for at least 3 months and remained on the same medication throughout the study. An informed written consent was obtained from every participant.

2.2. Design

We compared three groups of patients who were administered with, respectively: 1) domain-specific cognitive remediation intervention and standard social cognitive training; 2) domain-specific cognitive remediation and video-based social cognitive training; 3) no-treatment group (see flowchart in the Appendix A). We scheduled a randomized allocation in regard to both treatment groups but not in regard to the allocation to the treatment vs no treatment condition.

Fifty two patients agreed to attend a socio-cognitive training group, they were randomly assigned to Integrated Psychological Therapy social cognitive training (IPT, $n=24$) or video-based social cognitive training (VST, $n=28$) by means of a random number table. All participants attended a group intervention, consisting of 1-h sessions once weekly for 3 months. They all had started a 3-month course of Cognitive Remediation Therapy (CRT, individual 1-h sessions, twice weekly) in the last 6 months.

Therefore, time elapsed between the end of CRT and start of social cognitive training was 3 months at the most. In Standard Rehabilitation Treatment group (SRT: CRT + IPT) 17 participants had completed CRT within the last 3 months and seven subjects started CRT and IPT in the same month. In video-based social cognitive training group (SCT: CRT + VST) 19 patients had completed CRT within the last 3 months and eight patients started CRT and VST in the same month.

Twenty four outpatients who weren't attending any rehabilitation program were allocated in the time-matched control group (NT); they were regularly visited every two weeks through a routine check with the psychiatrist.

All interventions were conducted by trained psychotherapists (graduates in Clinical Psychology who had completed a four-year postgraduate course in Psychotherapy at a training school recognized by the State and had collected years of clinical experience) and facilitators (graduates in Clinical Psychology who was completing the obligatory internship period).

Performances of interest (EP and ToM) were compared at the baseline and after 3 months between and within subjects. Psychologists who administered the neuropsychological assessment were blind to the IPT or VST condition, they weren't blind to the allocation to treatment/no-treatment group condition (NT vs IPT or VST). The study complies with the principles of the Declaration of Helsinki.

2.3. Assessment

Patients were assessed for psychopathology and neurocognitive performance at the baseline and for EP and ToM abilities before and after 3 months of experimental treatment.

Psychopathology was assessed by means of the PANSS (Kay et al., 1987), administered by trained psychiatrists.

Neurocognitive deficits were evaluated with the Italian version of BACS (Brief Assessment of Cognition in Schizophrenia, Keefe et al., 2004) adjusted for age and education (Anselmetti et al., 2008). The entire battery administration lasts approximately 30 min and test included are word recall (verbal memory), digits sequencing (working memory), token motor task (psychomotor speed and coordination), symbol coding (selective attention), semantic and phonemic fluency (verbal fluency) and Tower of London (executive functions). For a more specific description, see Keefe et al. (2004).

To test EP, a computerized version of the Pictures of Facial Affect (POFA; Ekman and Friesen, 1976) task, implemented in SuperLab software, was used. 110 black and white photographs of the POFA, depicting faces of women and men of different ages who exhibit basic emotions (happiness, sadness, fear, disgust, surprise, anger) and neutral expression too, were displayed in random order on a pc screen for 10 seconds each. Patients were asked to attribute the correct emotions to stimuli, by pressing the previously labeled keys on a keyboard. Outcomes provided by the test are: total of correct and wrong answers, number and reaction time of correct recognitions for each emotion, amount of missing answers and error type in case of incorrect, misreading, attribution (for example, if a response "anger" is given at a face expressing "disgust"); the raw scores were then converted into percentages. For the purpose of this study, we considered the percentage of correct answers. 25 stimuli were presented in a preliminary training session to allow patients to get acquainted with the task, the remaining 85 were utilized for the assessment.

ToM was assessed using the Theory of Mind Picture Sequencing Task (PST; Brune, 2003), consisting of six cartoon picture stories of four cards each, depicting (1) two scenarios where two characters cooperated, (2) two scenarios where one character deceived a second character and (3) two scenarios showing two characters cooperating to deceive a third. For example, in a scenario a boy captures a bee in a paper bag (first picture) which then presents to a girl (second picture); she grabs into the bag (third picture) and is stung by the bee (fourth picture).

The cards were presented face-down in mixed order; the participants were asked to turn the cards over and to order them in a logical sequence of events. In the Sequencing task, two points were given for the first and last correctly sequenced cards and one point each for correct sequencing of the two middle cards.

In addition, a ToM Questionnaire with 23 questions was given to the subjects to test their ability to appreciate the mental states of the characters involved in the cartoon stories. The questions referred to the mental states of the characters according to different levels of complexity and included first to third false belief questions, questions involving the understanding of cheating detection and two reality questions, basically included to rule out major attention problem. For example, in the "bee scenario" the first order false belief question was "What does the girl think there is in the paper bag?", the second order false belief question was "What does the girl think the boy intends?", the third order false belief question was "What does the boy expect the girl thinks he wants to do?" and the reality question "What is there in the paper bag?". For each correctly answered ToM question was assigned one point. An answer was considered incorrect and scored 0 if involving errors about the facts depicted in the story or inappropriate inference on characters' mental states, motivations or beliefs. Raters had been previously trained on the scoring of Questionnaire responses and were not the same psychologists who delivered the interventions. If subjects failed to sequence the story correctly, pictures were brought into the correct order by assessors before administering the Questionnaire.

The variables of interest of this study were the total scores at Sequencing, Questionnaire, First, second and third order false beliefs and Cheating detection.

The scale demonstrated a good internal consistency (Cronbach's alpha coefficient = 0.86).

2.4. Interventions

The ToM and EP training administered in the SCT condition was conducted by a trained psychologist and a facilitator over 12 weeks (one 1-h session/week) on groups of about 5 members and made use of short videos selected from international cinema movies ("Le fabuleux destin d'Amélie Poulain," "The Big Lebowski," "Cape Fear" "Marnie" "Meet the Parents," "Four Weddings and a Funeral") depicting human social interactions. In order to select the right and proper stimuli, before the training started, we showed the clips to a group of healthy subjects to verify the clearness of social cues, the expression of emotion and to select scenes understandable independently of the whole film's view. A total of 36 film excerpts were selected; the scenes followed a growing difficulty order of presentation. Twenty four clips represented basic emotions (happiness, sadness, anger, surprise, fear and disgust) in a single-actor speechless scene or manifested in multi actors verbal interaction; 12 clips represented ToM-centered situations: irony, gaffe, misunderstanding and implicit meanings. Enclosed scenes last between 30 and 70 s and need recognition of emotions (happiness, sadness, anger, surprise, fear and disgust) and ToM abilities (decoding beliefs, irony, misunderstandings and intentions) to be correctly comprehended. In each session two or three clips were presented and could be viewed several times, according to the requests of patients. As in the Penn study, patients were asked to become "social detectives", collecting every concrete and meaningful piece of information they saw (place, time, characters actions and physical features) and hypothesize interpretations of the scenes based on expressed emotions, relationships between characters, implicit motivations and mental states. A guided discussion of hypotheses followed.

SRT group received a standard rehabilitation program, focused on the main community goals of social abilities subprograms of IPT (verbal communication, social skill training and problem solving). Patients attended group intervention lasting 1 h, once weekly, with approximately five participants.

Both SRT and SCT were engaged or had been engaged in the former 6 months in a neurocognitive individual training employing the Cogpack Software (for more details see Cavallaro et al., 2009).

CRT consisted of two 1-h sessions a week of domain-specific computer-aided exercises, for a period of 12 weeks. Sets of exercises were individually created for each patient on the basis of the quality of baseline performances at neuropsychological assessment.

2.5. Data analysis

Demographic and clinical characteristics of the sample were analyzed with Chi-Squared test or analysis of variance (ANOVA); a MANOVA was conducted for BACS scores at the baseline to evaluate the comparability of the groups on neuropsychological performance. To account for any between-group difference at pre-treatment, we performed an ANOVA for each variable of interest (ToM and EP measures).

Pre- to post-treatment changes in SRT, SCT and NT groups were calculated with a series of mixed ANOVAs (2×3 , $P < 0.05$, two-tailed) entering ToM and EP measures (ToM: PST Questionnaire, sequencing, first order false beliefs, second order false beliefs, third order false beliefs and cheating detection; EP: POFA total score) as dependent variables and treatment as independent variables (respectively, within- and between-groups factor). Tukey's post-hoc corrections for multiple comparison followed.

To quantify the magnitude of changes in relation to treatments, within-group effect sizes were then estimated using Cohen's d (Cohen, 1998).

Subsequently, as in Horan et al. (2009), we compared SRT and SCT with an ANCOVA for each ToM variable, entering post-treatment scores as dependent variable, group as fixed variable and pre-treatment scores as covariate; then we computed between group effect sizes using Cohen's partial eta squared (η^2p). This allowed us to compare directly the two training strategies excluding the influence of scores decrease in NT group from the estimate of treatments effects.

3. Results

Results are summarized in Tables 1, 2 and 3 and Fig. 1.

At the baseline, there was no significant difference between groups in demographic and clinical variables and qualitative characteristics were equally represented among groups. The multivariate group effect on neurocognitive measures was not significant (Wilks $\lambda = 0.79$, $P = 0.24$) but univariate analyses revealed a difference between groups in performance on token motor test ($P = 0.05$); nevertheless this difference didn't survive the Bonferroni's correction for multiple comparisons (Table 1).

Groups didn't differ at pre-test with respect to ToM and EP measures (Questionnaire: $F(2,72) = 0.82$, $P = 0.44$; sequencing: $F(2,72) = 0.06$, $P = 0.94$; first order false beliefs: $F(2,72) = 0.20$, $P = 0.82$; second order false beliefs: $F(2,72) = 0.01$, $P = 0.99$; third order false beliefs: $F(2,72) = 0.21$, $P = 0.80$; cheating detection: $F(2,72) = 1.23$, $P = 0.30$; POFA total score: $F(2,70) = 0.17$, $P = 0.85$).

ANOVAs showed significant time (pre- vs post-treatment) \times group (SRT, SCT and NT) interactions in every PST outcome variable but Third order false beliefs (see Table 2), a significant main effect for treatment group in the Questionnaire and a trend toward significance in first order false beliefs (respectively: $F(2,70) = 4.34$, $P = 0.02$; $F(2,70) = 2.91$, $P = 0.06$). In third order false beliefs a significant effect of time was found ($P = 0.04$). As revealed by post-hoc Tukey test, SCT group improved significantly from pre- to post- test in all ToM measures but Sequencing (which lost significance after multiple comparisons correction) and Third order false beliefs, whereas SRT and NT groups did not. On the POFA (EP task) neither of main effects nor interaction reached statistical significance.

The SCT group's improvement in ToM measures of Questionnaire ($d = 0.74$), First ($d = 0.64$) and Second order false beliefs ($d = 0.73$) and Cheating detection ($d = 0.91$) corresponded to medium to large effect sizes.

Results of ANCOVAs in SRT vs SCT comparisons for each variable are presented in Table 3. A significant group effect in the predicted direction emerged for Questionnaire total scores ($P = 0.008$), first and third false order beliefs (both, $P = 0.02$) and cheating detection ($P = 0.03$). The effect of treatment showed a trend toward significance ($P = 0.07$) on second order false beliefs and no significance in

sequencing. The magnitude of the between-group effect sizes was medium to large ($0.07 < \eta^2 p < 0.13$).

4. Discussion

Our pilot study provides initial evidence for the feasibility of a new social cognitive intervention for outpatients affected by schizophrenia. In a controlled trial design, patients who were member of social cognitive training obtained significant improvements in theory of mind skills, one of the high order component in the multifaceted construct of social cognition, whereas training had no effect on emotion recognition.

Other studies have already confirmed the feasibility and effectiveness of social cognition training but the results are not often concordant. This variability could be explained by sample recruitment, training brevity, absence of time-matched active control group, recruitment of inpatients; in addition, the use of didactic multi-component stimuli, far from daily living, could constitute a not ecological laboratory bias. We took into consideration all these limits to design our study, so we included in our sample only outpatients, to reduce the influence of disorganization and positive symptoms on ToM abilities (Abdel-Hamid et al., 2009). We chose a medium length training, compared to SCIT or Kayser training (Kayser et al., 2006), to preserve the patients' attention and minimize drop out. Laboratory bias and lack of ecological stimuli are common and wide issues of social treatment in schizophrenia. Moreover, in a multi-component stimuli treatment, is difficult to discriminate the effect of the whole training over each target of the intervention. We tried to overcome these questions by a new treatment strategy which attempted to simplify the multi-component stimuli, used in other social cognition interventions, into a single stimuli rehabilitation program, which has the main goal to make the training as ecological as possible. As in Kayser et al. (2006), we opted for videotaped material as ecological stimuli (Bazin et al., 2009); we selected scenes from recent international cinema movies in which characters perform, individually or in social interaction, basic emotions and ToM. As in Penn et al. (2005) we trained patients to become better "social detectives" in order to understand and feel what in their minds could explain their behavior.

We included two different control conditions: a no treatment control group of outpatients with schizophrenia and a social active matched control condition. This study compares two social cognition treatments and the good results obtained remark the necessity to develop new strategy of intervention in this high priority research area.

One of the limits of this study could be the randomization of the sample. In fact we scheduled a randomized allocation in regard to both treatment groups but not in regard to the treatment vs no treatment condition, but we observed no differences among all neuropsychological, psychopathological and demographic measures at baseline between groups. Furthermore we directly analysed the effects of SCT and SRT among patient allocated to the treatment conditions in order to compare the two social cognitive interventions.

Our results indicate an improvement on ToM skills in SCT group with respect to SRT and NT conditions; post-hoc analysis confirms that only the experimental group reached a statistically significant pre- to post-treatment change for Questionnaire, First and Second order false beliefs and Cheating detection scores of Pictures Sequencing Task (PST; Brune, 2003). The comparison between the two social cognition treatments shows that SRT produced greater improvements than SCT in Questionnaire, first and third order false beliefs and cheating detection. Differently from previous analysis, in this comparison second order false beliefs approached the statistical significance at a trend level. The magnitude of pre- to post-improvements within SCT participants and the difference in improvements between SCT and SRT groups was medium to large.

Despite a slight increment of scores in SCT and SRT groups, post hoc analysis didn't confirm a significant improvement for the experimental group on sequencing; we speculate that this could be due to the nature of the task which requires implicit (and therefore more

Table 1
Demographic and clinical data.

	SRT ($n = 24$) %/mean \pm S.D.)	SCT ($n = 28$)	NT ($n = 24$)	P
Age	38.00 \pm 8.73	37.14 \pm 10.02	40.20 \pm 8.99	0.48
Male (%)	63	68	67	0.91
Education (years)	11.75 \pm 3.28	12.07 \pm 3.16	10.62 \pm 2.90	0.23
Onset	22.00 \pm 4.32	23.14 \pm 4.81	23.58 \pm 5.71	0.54
Illness duration (years)	15.14 \pm 6.38	14.00 \pm 9.08	16.62 \pm 6.40	0.46
I.Q.	87.52 \pm 14.51	86.15 \pm 11.41	80.00 \pm 8.23	0.14
Antipsychotics (%)				
Typical	13	16	13	
Atypical	87	84	87	
PANNS tot	83.88 \pm 18.90	73.44 \pm 21.81	71.33 \pm 17.53	0.15
Positive	19.64 \pm 6.45	17.33 \pm 4.97	16.40 \pm 5.90	0.26
Negative	24.94 \pm 5.59	20.38 \pm 7.55	21.73 \pm 5.72	0.11
General	39.29 \pm 10.06	35.72 \pm 11.32	33.20 \pm 9.07	0.24
BACS				
Verbal memory	40.55 \pm 12.29	42.10 \pm 8.96	37.7 \pm 9.15	0.35
Working memory	16.11 \pm 4.48	16.31 \pm 3.97	15.31 \pm 5.50	0.75
Coordination	76.03 \pm 18.34	65.32 \pm 13.65	67.82 \pm 13.93	0.05*
Attention	39.73 \pm 13.20	39.98 \pm 13.15	34.10 \pm 13.97	0.27
Fluency	38.61 \pm 13.69	41.50 \pm 11.19	33.80 \pm 10.17	0.09
Executive functions	13.84 \pm 3.92	15.32 \pm 3.18	12.00 \pm 8.53	0.13

* Significant difference which didn't survive post-hoc test (Bonferroni correction for multiple comparisons).

Table 2
Mixed ANOVAs.

	SRT		P	SCT		P	NT		P	G × T	
	pre	post		pre	post		pre	post		F(2,70)	P
PST											
Questionnaire	16.95 (5.1)	17.41 (4.7)	0.99	16.64 (4.9)	19.66 (3.3)	<0.01*	15.29 (4.1)	13.95 (5.2)	0.59	7.90	<0.01**
Sequencing	25.94 (9.1)	28.45 (8.3)	0.99	26.96 (8.1)	28.96 (8.6)	0.83	26.16 (16.4)	22.77 (9.5)	0.19	4.53	0.01**
First order false beliefs	1.95 (0.9)	2.04 (0.9)	0.99	2.10 (0.8)	2.55 (0.6)	0.04*	2.0 (0.7)	1.63 (0.7)	0.24	6.66	<0.01**
Second order false beliefs	1.75 (1.5)	2.00 (1.1)	0.91	1.75 (1.1)	2.44 (0.8)	0.02*	1.7 (1.1)	1.36 (1.1)	0.83	4.90	0.01**
Third order false beliefs	1.42 (1.06)	1.54 (1.02)	0.99	1.59 (1.08)	2.19 (0.88)	0.11	1.36 (0.84)	1.50 (1.14)	0.99	1.30	0.28
Cheating detection	1.75 (0.53)	1.71 (0.62)	0.99	1.48 (0.64)	1.93 (0.27)	0.01*	1.59 (0.67)	1.32 (0.89)	0.42	7.30	<0.01**
POFA tot	61.69 (18.2)	56.52 (23.5)	0.31	63.76 (14.8)	64.80 (14.5)	0.99	60.84 (14.1)	58.54 (14.5)	0.95	1.68	0.19

Repeated measures (pre- to post-treatment changes) and interactions outcomes are reported.

* Significant within-group differences marked; P corrected for multiple comparisons (Tukey post-hoc).

** Significant group × time interactions marked.

difficult) ToM abilities and relies on neurocognitive skills. The effect of the latter could manifest in re-test, given the administration procedure: the task consists on sequencing the card in the right order to form a coherent story; if the patient fails to do it, the test requires the psychologist, before going ahead with questions assessing the comprehension of the history, to show the correct sequence. This could be some sort of “scaffolding”. Consequently, the recalling of correct order from one administration to another could be pointed by CRT in SCT and SRT but not in NT.

This is the first trial where PST is used repeatedly in pre- and post-treatment assessment. We decided to use PST since it seemed to us that many other ToM tasks did not sufficiently resemble real-life situations and PST was designed to depict online different levels of intentionality in a single task. PST includes several degrees of comprehension of other mind and depicts more closely and in a simple manner the complexity of real social interactions. Furthermore, it involves low attention and memory load (Brune, 2003). Nevertheless, even if the Cronbach's alpha confirmed a good internal consistency, the use of PST could carry some limits: the unavailability of retest reliability and change sensitivity and the absence in literature of a standardization of PST scores. However, in the time-matched condition, none of the considered ToM and EP variables showed a significant difference between the assessment at the baseline and after 3 months, allowing us to assume PST as a reliable scale.

Moreover, in order to decrease the likelihood of rate bias in the Questionnaire scoring, assessors were extensively trained and they were blind to the treatment group.

We obtained different results regarding EP: there were no changes among groups after treatment. We can assume that it could be due to different reasons, including the nature of the training we ideated and the mismatch between training (what we trained) and assessment (what we measured).

The main studies that have led to encouraging results in the recognition of emotions focus exclusively on the deficit, especially on facial scanning (es. attentional shaping, Combs et al., 2009), and even in programs incorporating EP among other trainings (as in SCIT;

Roberts and Penn, 2009) emotion recognition takes a very large part of the treatment. Trying to make it ecological, we centred our training on a “synthetic” processing of emotions (emerging from the context, intuition guided and inference-based) rather than on an “analytic” scanning of the facial configuration of an emotion. Perhaps we worked on a construct nearest to the concept of empathy than basic emotions and it would be a good cue for the future to add a preliminary unit focused on the learning of basic emotions besides measures to assess empathy.

Another issue regards the assessment of EP: we used static stimuli to assess the outcome of a training based on dynamic stimuli. In fact, despite the facial expressions are dynamic stimuli, most studies on the recognition are based on static stimuli. Recent researches have shown that the dynamic manifestations of emotion are recognized more accurately than the static ones, as they cause more easily spontaneous mimicry and higher levels of activation (Johnston et al., 2008); this could be another interesting aspect to investigate in the future.

Finally the major result obtained in our study is the improvement of theory of mind ability after a social cognition training. The observation of lower improvements of ToM ability among patients in control condition who participated to a standard social ability rehabilitation suggests us that the progresses showed by the SCT group are not only ascribable to an unspecific effect of rehabilitation or to neurocognitive enhancement therapy but mainly to the SCT's effect.

Actually our preliminary results tend towards the hypothesis of a specific impairment of ToM processing, rather than a general deficit in the ability of processing (Anselmetti et al., 2009). This argument is supported by the effect size of ToM ability improvement verified in the SCT group. The good effect size in the SCT group suggests that our treatment is specific to the deficit of ToM and it's not the product of a general effect of IPT and CRT; moreover, it confirms recent studies arguing the potential remediability of ToM impairment.

Table 3
Differences between SRT and SCT group.

	F(1,48)	P	Effect sizes (η^2p)
Questionnaire	7.69	0.008*	0.13
Sequencing	0.08	0.78	0.002
First order false beliefs	5.36	0.02*	0.10
Second order false beliefs	3.50	0.07	0.07
Third order false beliefs	5.42	0.02*	0.10
Cheating detection	4.75	0.03*	0.09

F-tests based on ANCOVAs using post-treatment scores as dependent variables, group as categorical factor and pre-treatment scores as covariates. Positive effect sizes indicate greater improvement in SCT group.

* Significant differences marked.

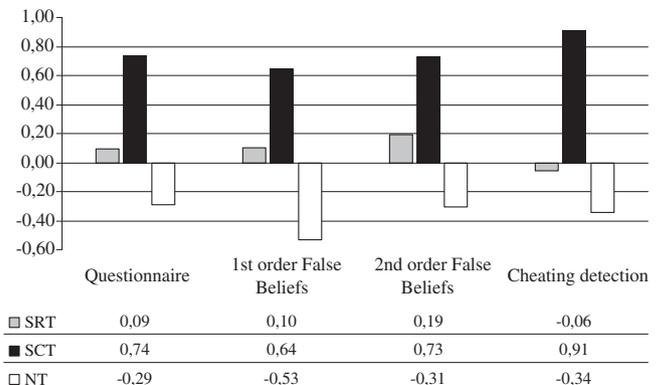


Fig. 1. Within-group effect size (Cohen's d). Positive effect sizes indicate improvement from pre- to post-treatment.

An interesting future development, that currently constitutes a limit of this study, would be to weight and to distinguish the synergic effects of CRT and SCT on cognitive, socio-cognitive and daily functioning in schizophrenic patients (Cavallaro et al., 2009; Penadés et al., 2010). Given the promising results achieved in the present research, we designed a new study aimed to contribute the controversy about the nature of social cognition and the role of basic neurocognition, both embodied in a more complex general processing network (Janssen et al., 2003; Brune and Brune-Cohrs, 2005).

Appendix A. Supplementary data

Supplementary data to this article can be found online at doi:10.1016/j.psychres.2012.02.004.

References

- Abdel-Hamid, M., Lehmkaemper, C., Sonntag, C., Juckel, G., Daum, I., Brüne, M., 2009. Theory of mind in schizophrenia: the role of clinical symptomatology and neurocognition in understanding other people's thoughts and intentions. *Psychiatry Research* 165, 19–26.
- Addington, J., Addington, D., 2000. Neurocognitive and social functioning in schizophrenia: a 2.5 year follow-up study. *Schizophrenia Research* 44, 47–56.
- Addington, J., Saeedi, H., Addington, D., 2006. Facial affect recognition: a mediator between cognitive and social functioning in psychosis? *Schizophrenia Research* 85, 142–150.
- Adolphs, R., 2001. The neurobiology of social cognition. *Current Opinion in Neurobiology* 11, 231–239.
- Anselmetti, S., Poletti, S., Ermoli, E., Bechi, M., Cappa, S., Venneri, A., Smeraldi, E., Cavallaro, R., 2008. The brief assessment of cognition in schizophrenia. Normative data for the Italian population. *Neurological Science* 29, 85–92.
- Anselmetti, S., Bechi, M., Bosia, M., Quarticelli, C., Ermoli, E., Smeraldi, E., Cavallaro, R., 2009. Theory of mind impairment in patients affected by schizophrenia and in their parents. *Schizophrenia Research* 115, 278–285.
- Bazin, N., Brunet-Gouet, E., Bourdet, C., Kayser, N., Falissard, B., Hardy-Baylé, M.C., Passerieux, C., 2009. Quantitative assessment of attribution of intentions to others in schizophrenia using an ecological video-based task: a comparison with manic and depressed patients. *Psychiatry Research* 167 (1–2), 28–35.
- Bellack, A.S., Green, M.F., Cook, J.A., Fenton, W., Harvey, P.D., Heaton, R.K., Laughren, T., Leon, A.C., Mayo, D.J., Patrick, D.L., Patterson, T.L., Rose, A., Stover, E., Wykes, T., 2007. Assessment of community functioning in people with schizophrenia and other severe mental illnesses: a white paper based on an NIMH-sponsored workshop. *Schizophrenia Bulletin* 33, 805–822.
- Bora, E., Gokcen, S., Kayahan, B., Veznedaroglu, B., 2008. Deficits of social-cognitive and social-perceptual aspects of theory of mind in remitted patients with schizophrenia: effect of residual symptoms. *The Journal of Nervous and Mental Disease* 196, 95–99.
- Brekke, J., Kay, D.D., Leeb, K.S., Green, M.F., 2005. Biosocial pathways to functional outcome in schizophrenia. *Schizophrenia Research* 80, 213–225.
- Brenner, H.D., Bettina, H., Roder, V., Corrigan, P., 1992. Treatment of cognitive dysfunctions and behavioural deficits in schizophrenia: Integrated Psychological Therapy. *Schizophrenia Bulletin* 18, 21–26.
- Brothers, L., 1990. The social brain: a project for integrating primate behavior and neurophysiology in a new domain. *Concepts in Neuroscience* 1, 27–51.
- Brune, M., 2003. Theory of mind and role of IQ in chronic disorganized schizophrenia. *Schizophrenia Research* 60, 57–64.
- Brune, M., Brune-Cohrs, U., 2005. Theory of mind-evolution, ontogeny, brain mechanisms and psychopathology. *Neuroscience and Biobehavioral Reviews* 30, 437–455.
- Cavallaro, R., Anselmetti, S., Poletti, S., Bechi, M., Ermoli, E., Cocchi, C., Stratta, P., Vita, A., Rossi, A., Smeraldi, E., 2009. Computer-aided neurocognitive remediation as an enhancing strategy for schizophrenia rehabilitation. *Psychiatry Research* 169, 191–196.
- Cohen, J., 1998. *Statistical Power Analysis for the Behavioral Sciences*, 2nd ed. Erlbaum, Hillsdale, NJ.
- Combs, D.R., Tosheva, A., Wanner, J., Basso, M.R., 2006. Remediation of emotion perception deficits in schizophrenia: the use of attentional prompts. *Schizophrenia Research* 87, 340–341.
- Combs, D.R., Adams, S.D., Penn, D.L., Roberts, D.L., Tiegreen, J., Stem, P., 2007a. Social Cognition and Interaction Training (SCIT) for inpatients with schizophrenia spectrum disorders: preliminary findings. *Schizophrenia Research* 91, 112–116.
- Combs, D.R., Elerson, K., Penn, D.L., Tiegreen, J.A., Nelson, A., Ledet, S.N., Basso, M.R., 2009. Stability and generalization of Social Cognition and Interaction Training (SCIT) for schizophrenia: six-month follow-up results. *Schizophrenia Research* 112, 196–197.
- Couture, S., Penn, D.L., Roberts, D.L., 2006. The functional significance of social cognition in schizophrenia: a review. *Schizophrenia Bulletin* (Suppl. 1), S-44–S-63.
- Ekman, P., Friesen, W., 1976. *Picture of Facial Affect*. Consulting Psychologists Press, Palo Alto, CA.
- Fett, A.K., Viechtbauer, W., Dominguez, M.D., Penn, D.L., van Os, J., Krabbendam, L., 2011. The relationship between neurocognition and social cognition with functional outcomes in schizophrenia: a meta-analysis. *Neuroscience and Biobehavioral Reviews* 35, 573–588.
- Fiske, S.T., Taylor, S.E., 1991. *Social Cognition*, 2nd edn. McGraw Hill, New York.
- Frith, U., Frith, C.D., 2003. Development and neurophysiology of mentalizing. *Philosophical Transactions of the Royal Society* 358, 459–473.
- Gallese, V., Goldman, A., 1998. Mirror neurons and the simulation theory of mind-reading. *Trends in Cognitive Sciences* 1 (2), 493–501.
- García, B., Grupo, G.E.O.P.T.E., 2002. Functionality as a goal in the treatment of schizophrenia. *Actas Espanolas De Psiquiatria* 30 (5), 312–325.
- Green, M.F., 1996. What are the functional consequences of neurocognitive deficits in schizophrenia? *The American Journal of Psychiatry* 153, 321–330.
- Green, M.F., Kern, R.S., Braff, D.L., Mintz, J., 2000. Neurocognitive deficits and functional outcome in schizophrenia: are we measuring the right stuff? *Schizophrenia Bulletin* 26 (1), 119–136.
- Green, M.F., Brekke, J.S., Kohrt, B., 2001. Neuropsychological functioning as a moderator of the relationship between psychosocial functioning and the subjective experience of self and life in schizophrenia. *Schizophrenia Bulletin* 27, 697–708.
- Green, M.F., Olivier, B., Crawley, J.N., 2005. Social cognition in schizophrenia: recommendations from the measurement and treatment research to improve cognition in schizophrenia new approaches conference. *Schizophrenia Bulletin* 31, 882–887.
- Gur, R.E., Kohler, C.G., Ragland, J.D., Siegel, S.J., Lesko, K., Bilker, W.B., Gur, R.C., 2006. Flat affect in schizophrenia: relation to emotion processing and neurocognitive measure. *Schizophrenia Bulletin* 32, 279–287.
- Hogarty, G.E., Flesher, S., Ulrich, R., Carter, M., Greenwald, D., Pogue-Geile, M., Kechavan, M., Cooley, S., DiBarry, A.L., Garrett, A., Parepally, H., Zoretich, R., 2004. Cognitive enhancement therapy for schizophrenia. Effects of a 2-Year Randomized Trial on Cognition and Behavior Archives General Psychiatry 61, 866–876.
- Horan, W.P., Kern, R.S., Shokat-Fadai, K., Sergi, M.J., Wynne, J.K., Green, M.F., 2009. Social cognitive skills training in schizophrenia: an initial efficacy study of stabilized outpatients. *Schizophrenia Research* 107, 47–54.
- Janssen, I., Krabbendam, L., Jolles, J., Van Os, J., 2003. Alterations in theory of mind in patients with schizophrenia and non-psychotic relatives. *Acta Psychiatrica Scandinavica* 108, 110–117.
- Johnston, P.J., Enticott, P.G., Mayes, A.K., Hoy, K.E., Herring, S.E., Fitzgerald, P.B., 2008. Symptom correlates of static and dynamic facial affect processing in schizophrenia: evidence of a double dissociation? *Schizophrenia Bulletin* 36, 680–687.
- Kay, S.R., Fiszbein, A., Opler, L.A., 1987. The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. *Schizophrenia Bulletin* 13, 261–275.
- Kayser, N., Sarfati, Y., Besche, C., Hardy-Baylé, M.C., 2006. Elaboration of a rehabilitation method based on a pathogenetic hypothesis of “theory of mind” impairment in schizophrenia. *Neuropsychological Rehabilitation* 16, 83–95.
- Keefe, R.S.E., Goldberg, T.E., Harvey, P.D., Gold, J.M., Poe, M., Coughenour, L., 2004. The brief assessment of cognition in schizophrenia: reliability, sensitivity and comparison with a standard neurocognitive battery. *Schizophrenia Research* 68, 283–297.
- Kunda, Z., 1999. *Social Cognition: Making Sense of People*. MIT Press, Cambridge, MA.
- Kurtz, M.M., Richardson, C.L., 2011. Social cognitive training for schizophrenia: a meta-analytic investigation of controlled research. *Schizophrenia Bulletin*. (Electronic publication ahead of print).
- Kurzban, S., Davis, L., Brekke, J.S., 2010. Vocational, social, and cognitive rehabilitation for individuals diagnosed with schizophrenia: a review of recent research and trends. *Current Psychiatry Reports* 12, 345–355.
- Mazza, M., Lucc, G., Pacitti, F., Pino, M.C., Mariano, M., Casacchia, M., Roncone, R., 2010. Could schizophrenic subjects improve their social cognition abilities only with observation and imitation of social situations? *Neuropsychological Rehabilitation* 20 (5), 675–703.
- McClure, M.M., Bowie, C.R., Patterson, T.L., Heaton, R.K., Weaver, C., Anderson, H., Harvey, P.D., 2007. Correlations of functional capacity and neuropsychological performance in older patients with schizophrenia: evidence for specificity of relationships? *Schizophrenia Research* 89, 330–338.
- Mehl, S., Rief, W., Mink, K., Lullmann, E., Lincoln, T.M., 2010. Social performance is more closely associated with theory of mind and autobiographical memory than with psychopathological symptoms in clinically stable patients with schizophrenia-spectrum disorders. *Psychiatry Research* 178, 276–283.
- Milev, P., Ho, B.C., Arndt, S., Andreasen, N.C., 2005. Predictive value of neurocognition and negative symptoms on functional outcome in schizophrenia: a longitudinal first-episode study with 7-year follow-up. *The American Journal of Psychiatry* 162, 495–506.
- Penadés, R., Catalán, R., Puig, O., Masana, G., Pujol, N., Navarro, V., Guarch, J., Gastó, C., 2010. Executive function needs to be target to improve social functioning with Cognitive Remediation Therapy (CRT) in schizophrenia. *Psychiatry Research* 177, 41–45.
- Penn, D.L., Spaulding, W., Reed, D., 1996. The relationship of social cognition to ward behaviour in chronic schizophrenia. *Schizophrenia Research* 20, 327–335.
- Penn, D.L., Combs, D.R., Ritchie, M., Francis, J., Cassisi, J., Morris, S., 2000. Emotion recognition in schizophrenia: further investigation of generalized versus specific deficit models. *Journal of Abnormal Psychology* 109, 512–516.
- Penn, D.L., Roberts, D., Munt, E.D., Silverstein, E., Jones, N., Sheitman, B., 2005. A pilot study of Social Cognition and Interaction Training (SCIT) for schizophrenia. *Schizophrenia Research* 80, 357–359.
- Penn, D.L., Addington, J., Pinkham, A., 2006. *Social Cognitive Impairments*. American Psychiatric Association Textbook of Schizophrenia. American Psychiatric Publishing Press, Arlington, VA, pp. 261–274.
- Penn, D.L., Roberts, D.L., Combs, D., Sterne, A., 2007. The development of the social cognition and interaction training program for schizophrenia spectrum disorders. *Psychiatric Services* 58, 449–451.
- Pinkham, A.E., Penn, D.L., 2006. Neurocognitive and social cognitive predictors of interpersonal skill in schizophrenia. *Psychiatry Research* 143, 167–178.

- Roberts, D.L., Penn, D.L., 2009. Social Cognition and Interaction Training (SCIT) for outpatients with schizophrenia: a preliminary study. *Psychiatry Research* 166, 141–147.
- Roberts, D.L., Penn, D.L., Labate, D., Margolis, S.A., Sterne, A., 2010. Transportability and feasibility of social cognition and interaction training (SCIT) in community settings. *Behavioural and Cognitive Psychotherapy* 38, 35–47.
- Russell, T.A., Chu, E., Phillips, M.L., 2006. A pilot study to investigate the effectiveness of emotion recognition remediation in schizophrenia using the micro-expression training tool. *The British Journal of Clinical Psychology* 45, 579–584.
- Russell, T.A., Green, M.J., Simpson, I., Coltheart, M., 2008. Remediation of facial emotion perception in schizophrenia: concomitant changes in visual attention. *Schizophrenia Research* 103, 248–256.
- Sarfati, Y., Passerieux, C., Hardy-Baylè, M.C., 2000. Can verbalization remedy the theory of mind deficit in schizophrenia? *Psychopathology* 33, 246–251.
- Stanghellini, G., Ballerini, M., 2002. Dissociality: the phenomenological approach to social dysfunction in schizophrenia. *World Psychiatry* 1 (2), 102–106.
- Stanghellini, G., Ballerini, M., 2011a. What is it like to be a person with schizophrenia in the social world? A first-person perspective study on Schizophrenic Dissociality - part 1: state of the art. *Psychopathology* 44 (3), 172–182.
- Stanghellini, G., Ballerini, M., 2011b. What is it like to be a person with Schizophrenia in the social world? A first-person perspective study on Schizophrenic Dissociality - part 2: methodological issues and empirical findings. *Psychopathology* 44 (3), 183–192.
- Wölwer, W., Frommann, N., Halfmann, S., Piaszek, A., Streit, M., Gaebel, W., 2005. Remediation of impairments in facial affect recognition in schizophrenia: efficacy and specificity of a new training program. *Schizophrenia Research* 80, 295–303.