THE UNIVERSITY OF HULL

The Relationship between Theory of Mind, Empathy, and Social Functioning in People with a Diagnosis of Schizophrenia

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by

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Overview

The portfolio has three parts.

Part One is a systematic literature review, concerning social cognition rehabilitation for people with a diagnosis of schizophrenia. Studies investigating rehabilitation for schizophrenia in a variety of different social cognition domains are reviewed and critically evaluated.

Part Two is an empirical paper, which explores the relationship between theory of mind, empathy, and social functioning. A model is presented detailing a hypothetical structure for the relationship between the three constructs. This is tested empirically by comparing performance between a group of people with a diagnosis of schizophrenia (N=22) and a control group of people without a diagnosis of schizophrenia (N=36) on measures of theory of mind, empathy, and social functioning. Correlations between these measures are also assessed. It is concluded that there is insufficient evidence to support the model.

Part Three comprises the Appendices.

Table of Contents

Part Three: Appendices

List of Figures of Tables

Part One: Effectiveness of Different Domains of Social Cognition Rehabilitation for People with a Diagnosis of Schizophrenia: A Systematic Literature Review

Part Two: The Relationship between Theory of Mind, Empathy, and Social Functioning in People with a Diagnosis of Schizophrenia

Part One

Effectiveness of Different Domains of Social Cognition Rehabilitation for People with a Diagnosis of Schizophrenia: A Systematic Literature Review.

This paper is written in the format ready for submission to the journal 'Schizophrenia Bulletin'. Please see Appendix B for the guidelines for authors.

Abstract

Growing interest in the nature of social cognition in people with a diagnosis of schizophrenia has led to an increase in research investigating the possibility of rehabilitating identified deficits. A model for describing the relationship between different domains of social cognition, based on that of Couture, Penn and Roberts[1], is described. This model is then used to define search terms for a systematic literature review, investigating the effectiveness of rehabilitation across different domains, including emotion perception, social perception, theory of mind and attributional style, and social problem solving. Each domain is reviewed separately, allowing comparisons to be drawn between different domains of social cognition. Studies combining different domains of social cognition in their rehabilitation programme are also reviewed. Evidence suggests that rehabilitation in each domain improves performance on measures of that particular social cognitive skill, implying that rehabilitation does have some positive effects. However, research investigating the clinical utility of such rehabilitation (for example the impact on social functioning) is lacking. There is some evidence to suggest that theory of mind rehabilitation and disparate social cognition research may have some clinical utility. In other domains, more research is needed.

Key words: REMEDIATION, SCHIZOPHRENIA SPECTRUM DISORDERS, COGNITION

1. Introduction

Social cognition has been defined as 'the processes and functions that allow a person to understand, act on, and benefit from the interpersonal world' (Corrigan & Penn[2], pp. 3). Social cognition is therefore not a single entity, but an umbrella term encompassing a wide range of different abilities that people use when interacting with other people, such as the ability to recognise the emotional state of other people, or the ability to take the perspective of another person.

In recent years, much research has been done looking into how people with a diagnosis of schizophrenia perform on measures of social cognition. The area is important to investigate because impairment in social functioning is one of the key features of schizophrenia.[3] Couture, Penn and Roberts[1] reviewed the literature looking at the relationship between social cognition and functional outcome, and concluded that poor social functioning was related to a variety of different strands of social cognition. It is hoped that by developing an understanding of social cognition in schizophrenia, it may be possible to better understand the difficulties in social functioning.

1.1. Social cognition deficits associated with schizophrenia.

Emotion perception. Research suggests that people with a diagnosis of schizophrenia have difficulties in various different aspects of social cognition. For example, several studies have found that people with a diagnosis of schizophrenia have difficulty recognising emotions in other people.[4,5,6] Marwick and Hall[6] conducted a narrative review of literature around face processing in people with a diagnosis of schizophrenia, and found that a wide range of studies showed impairment in facial affect recognition. This impairment seems to be unlikely to be accounted for by low level face processing,

as studies controlling for possible difficulties in facial identity recognition still demonstrated the deficit in affect recognition.[7] Similarly, Hoekert, Kahn, Pijnenborg and Aleman[4] conducted a meta-analysis of studies exploring recognition of emotional prosody in people with a diagnosis of schizophrenia, and found that processing of emotional prosody was significantly impaired in people with a diagnosis of schizophrenia, and the effect size overall was large. Thus it seems that people with a diagnosis of schizophrenia have difficulty recognising emotion in both faces and voices.

Perception of social cues. The deficit in emotion perception seems to extend to other social stimuli. Kim et al[8] found that people with a diagnosis of schizophrenia displayed poorer performance than healthy controls on a virtual reality task which assessed aspects of social perception such as recognition of physical gestures, recognition of polite or rude dialogue, and recognition of suitable or unsuitable behaviour in a given situation. Similarly, Zhu et al[9] found that people with a diagnosis of schizophrenia performed significantly worse than controls on an eye gaze task. Thus, people with a diagnosis of schizophrenia may have difficulties in the perception of a variety of different social cues, including but not limited to emotion perception.

Theory of Mind. A different social cognition skill where deficits have been identified is Theory of Mind.[10,11,12,13] Theory of Mind can be defined as 'the ability to infer what another individual is thinking or feeling' (Schenkel, Spaulding, & Silverstein[13] pp. 499). Brune[11] reviewed the literature on theory of mind in people with a diagnosis of schizophrenia, and concluded that deficits in Theory of Mind were specific, and not due to general cognitive impairment. Supporting this, Brune[14] found that the deficits could not be accounted for by difficulties in executive functioning. Bora, Yucel & Pantelis[10]

conducted a meta-analysis of theory of mind deficits in schizophrenia, and found the effect size to be large. Frith[12] argued that deficits in Theory of Mind may underlie all other symptoms of psychosis, for example difficulty in monitoring other people's thoughts and intentions may lead to feelings of paranoia. Corcoran[15] suggests that the evidence to support this position is promising.

Attribution bias. An area of social cognition that is related to theory of mind is attribution bias. Attribution bias is the tendency of people to interpret the causes of events in particular ways. Healthy individuals tend to interpret positive events to internal causes (e.g. I passed the test because I am clever) and negative events to external, non-personal causes (e.g. I failed the test because the paper was unusually difficult). This is phenomenon is known as the self-serving bias.[16] People with a diagnosis of paranoid schizophrenia exaggerate this bias, and also show a tendency to attribute negative events to external, personal causes[17,18] (e.g. I failed the test because the examiner hates me). It has been suggested that this cognitive strategy may reflect an unconscious defence against low self esteem.[17]

Social problem solving. A final aspect of social cognition where deficits have been identified in schizophrenia is social problem solving. This is the ability to identify and define a social problem, to identify and evaluate potential solutions to the problem, to select a solution, and to evaluate the effectiveness of the chosen solution.[19] Evidence suggests that people with a diagnosis of schizophrenia are significantly impaired in this ability, compared to healthy controls.[19,20] Often in the literature, social problem solving has been regarded as a dependent variable used to assess social functioning,[1] or as an aspect of social skills training.[21] However, the process of identifying, evaluating and

selecting solutions is a cognitive one, akin to the non-social cognitive ability of executive functioning.[20] It will therefore be argued for the purposes of this review that social problem solving falls under the umbrella term of social cognition.

Social knowledge. An area related to social cognition is social knowledge. This involves an awareness of rules, roles and goals associated with social situations.[22] Social knowledge impacts on all other aspects of social cognition, for example one cannot develop effective solutions to social problems without understanding the rules for appropriate behaviour in the given situation. Addington, Saeedi and Addington[22] found that a group of people with a diagnosis of schizophrenia performed significantly worse than controls on a measure of social knowledge, and this difficulty remained stable over the course of a year.

1.2. Models for conceptualising social cognition in schizophrenia

Given that the term 'social cognition' encompasses such a range of different skills, it is necessary to build models that attempt to draw the different aspects of social cognition together, and explain how they relate to each other. Couture, Penn and Roberts[1] have proposed that difficulties in social perception may cause people with a diagnosis of schizophrenia to misperceive social cues like emotional expressions, leading to erroneous conclusions such as assuming that a friend is angry. Difficulties with theory of mind and attributional style may then cause difficulty in understanding the reasons for the perceived emotion, reinforcing the faulty assumptions, such as the assumption that the friend in question is angry with the client. This may then cause the client to behave in a way that is unhelpful in promoting good social functioning, such as acting in a hostile way towards the friend (Couture, Penn & Roberts,[1] pp S45).

This model is very helpful in conceptualising social functioning. However, it ignores the role of social problem solving, and social knowledge. Figure 1 demonstrates an expanded version of the model, incorporating social problem solving. For example, once the client has developed an assumption about a friend based on faulty attributions, they are faced with a social problem; how to behave towards a friend who is angry with them for a reason that they do not know. Several solutions to the problem exist, such as asking the friend why they are angry with them, asking another friend what they think might be wrong, trying particularly hard to be nice to the friend, or acting in a hostile manner. Deficits in social problem solving may reduce the client's ability to weigh up the pros and cons of each option, leading to poor solutions being chosen.

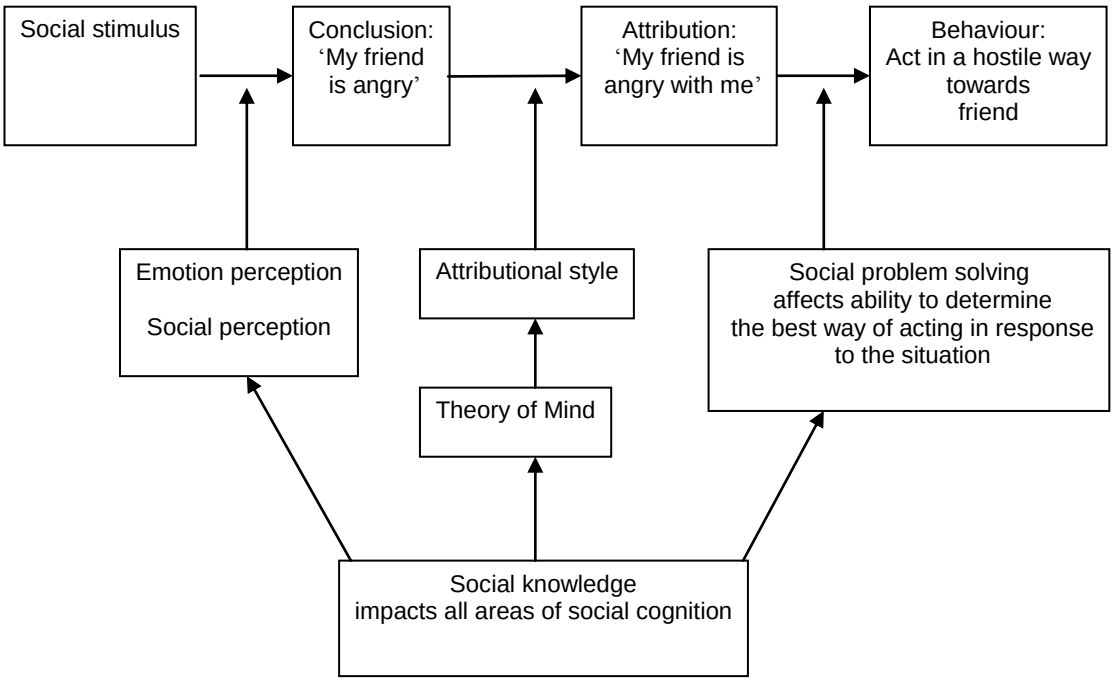

Fig. 1. Expanded Conceptual Framework for Understanding the Interplay Between Social Cognition and Social Functioning, Based on the Model by Couture, Penn & Roberts,[1] pp. S46.

Social knowledge has also been incorporated into the model, as it influences all aspects of social cognition. For example, knowledge of how a friend has expressed anger in the past may affect whether or not their behaviour is perceived as angry. Knowledge of the rules and norms around social conversation within a particular friendship group may affect attribution of the intention behind the behaviour, and knowledge of rules and norms for resolving conflict may affect social problem solving.

1.3. Social skills training and cognitive rehabilitation in people with a diagnosis of schizophrenia

It seems that social cognition difficulties in schizophrenia are diffuse and prominent. It is therefore important to develop an understanding of what can be done to help reduce the impact of these problems.

Much research has been done investigating the effectiveness of social skills training in schizophrenia, including medication self management training,[23] brief conversation skills,[24] and workplace skills.[25] Kurtz and Mueser[26] conducted a meta-analysis of controlled studies of social skills training for people with a diagnosis of schizophrenia, and found a large weighted mean effect size (d=1.2), indicating that training did lead to improvement in the areas of skill taught. However, the effect on measures of overall psychosocial functioning was much smaller (d=0.52). It appears that whilst social skills training is effective at teaching people with a diagnosis of schizophrenia specific skills which can improve their quality of life, it is less effective in teaching people general social abilities which can be used in a variety of different situations.

There is also a large literature on the effectiveness of cognitive rehabilitation for people with a diagnosis of schizophrenia. General cognitive deficits linked with schizophrenia, such as difficulties with attention, memory, learning, and executive functioning can hinder many areas of functioning, and interfere with other rehabilitation efforts.[27] Techniques used in an attempt to improve cognition in these areas include behavioural techniques such as reinforcement, shaping and environmental manipulation. Scaffolding (i.e. support from an educator, which is gradually removed over time) and errorless learning have received particular emphasis. Computer programmes have also been used, as have pen and paper tasks designed to practice the use of certain cognitive abilities.[27] McGurk, Twamley, Sitzer, McHugo and Mueser[28] conducted a meta-analysis of cognitive rehabilitation in schizophrenia, looking at the effectiveness of cognitive rehabilitation generally and across various different categories of cognitive skill. They found overall improved cognitive performance after cognitive rehabilitation, although the effect size was not significant for the category 'visual learning and memory'. They also found that cognitive rehabilitation was associated with a small to medium effect size for improvement in functioning. However, not all reviews have found cognitive rehabilitation to be effective in improving psychosocial functioning.[29]

1.4. Social cognition rehabilitation

Cognitive rehabilitation sometimes includes social cognition elements. For example, Integrated Psychological Therapy (IPT) is a group rehabilitation programme that involves 5 sub programmes; cognitive differentiation, social perception, verbal communication, social competence, and interpersonal problem solving.[30] The programme thus combines elements of cognitive rehabilitation, social cognition rehabilitation, and social skills training. Muller, Roder & Brenner[31] conducted a meta-

analysis of 28 studies evaluating the effectiveness of IPT for people with a diagnosis of schizophrenia. They found a favourable overall effect size for IPT groups compared to control groups, and suggest that IPT should be considered 'an 'empirically valid treatment' according to American Psychiatric Association guidelines' (Muller, Roder & Brenner,[31] pp. 63). Similarly, Cognitive Enhancement Therapy attempts to enhance social cognition by building up skills in attention, memory and problem solving, then using small group tasks to help participants develop the ability to get the 'gist' of social situations.[32,33]

Some rehabilitation programmes have been designed to focus solely on improving social cognition abilities. Social Cognition Interaction Training (SCIT) attempts to improve impairments in social cognition by training individuals in aspects of social cognition such as emotion recognition, and theory of mind.[34]

Social cognition rehabilitation is an interesting area, because several studies suggest that certain aspects of social cognition may be mediators between cognitive ability and social functioning in schizophrenia.[22,35,36] Furthermore, Combs et al[34] suggest that social cognition should be a target of rehabilitation, as social cognition appears to have a stronger link to social functioning than general neurocognition.[37,38] Social cognition rehabilitation may thus provide a forum that is generalizable to many situations in the same way as cognitive rehabilitation, but focussed on social areas, making it more functionally relevant.

Horen, Kern, Green and Penn[39] reviewed the effectiveness of social cognition training, dividing papers up into 'proof of concept' studies (*N*=7), which used brief

manipulations to demonstrate that social cognition was remediable; 'broad based studies' (*N*=5) which looked at social cognition remediation as part of broader cognitive remediation programmes; and 'targeted treatment studies' (*N*=6), which used rehabilitation programmes focussed exclusively on social cognition. The review concluded that the evidence suggested 'a strong rationale for intervention at the level of social cognition' (Horen et al,[39] pp. 242).

The review by Horen et al[39] provides a thoughtful overview of the literature on social cognition rehabilitation. However, the method of grouping studies treats social cognition as a unitary concept, making it difficult to determine whether there are differences between different aspects of social cognition, such as emotion perception and theory of mind. This contrasts with other reviews of social cognition, which have grouped studies according to a model of social cognition (e.g. Couture, Penn & Roberts[1]). In addition, Horan et al[39] do not systematically consider the effect social cognition rehabilitation has on social functioning, symptomology, or client ratings of helpfulness. This point is crucial in determining whether or not a rehabilitation programme is clinically effective. It is possible that training a client in facial emotion recognition will improve that client's scores on a test of facial emotion recognition, but unless the training has some impact on the client's day to day life, the client will not have benefited from the training.

Horen et al[39] did not systematically review the quality of the studies included in their review. This may have lead to an overly optimistic view of the research findings. In addition, they did not include studies examining whether deficits in social problem solving or social knowledge are remediable.

1.5. Scope and aims of the review

The current review aims to expand on the findings of Horen et al[39] by using the model outlined in Figure 1 to guide the review process. Articles are categorised according to specific social cognitive skill, allowing for a clearer understanding of the evidence of effectiveness for rehabilitation in each area of social cognition. The categories of 'theory of mind' and 'attribution bias' are combined, as, although theoretically distinct, in practice the two skills overlap so much that efforts to remediate one may easily affect the other.

The review considers the quality of each study, including this information in the data synthesis tables. Information on the effect of rehabilitation on domains outside social cognition such as social functioning will be systematically considered and included in the data synthesis tables, thus allowing a better assessment of whether social cognitive rehabilitation is clinically useful.

The review focuses on social cognition, and excludes any studies which include elements of social skills training, neurocognitive rehabilitation, or therapy such as family therapy or cognitive behavioural therapy. This ensures that any positive outcomes are attributable solely to the social cognitive rehabilitation.

2. Method

2.1. Domains compromising the review

Using the model outlined in Figure 1, five domains of social cognition were identified. These were 'emotion perception', 'social perception', 'theory of mind and attributional style', 'social problem solving' and 'social knowledge'. In addition, the domain

‘disparate social cognitive rehabilitation’ was included in order to capture rehabilitation programmes which focussed on more than one aspect of social cognition.

2.2. Data sources and search strategy

Computerised data bases searched were: the Cochrane Library (1800 - 2009), CINAHL (1999 - 2008), EMBASE (1980 – 2009), MEDLINE (1950 – 2009), PsychINFO (1972 – 2008), SCOPUS (1960 - 2009), and the Web of Knowledge (1970 - 2009).

Search terms used to encapsulate schizophrenia were:

1. schizophren*
2. schizoaffective

Search terms used to encapsulate rehabilitation were:

1. rehab*
2. remediation
3. training

Search terms used to encapsulate the various domains of social cognition were:

1. social cognit*
2. social thinking
3. mentalizing
4. mind reading
5. metacognition
6. theory of mind
7. emotion perception
8. emotion recognition
9. social perception
10. social knowledge
11. social problem solving
12. interpersonal problem solving
13. attribution bias

Online titles and abstracts were reviewed, and full copies of potentially eligible articles were obtained. Reference sections of full articles were hand searched by the researcher for additionally relevant studies. The abstracts of these additional studies were reviewed, and full copies were obtained when relevant. In addition, researchers with an interest in social cognition and schizophrenia were contacted for advice and details of any other articles (see Appendix F).

2.3. Study selection criteria and quality assessment

Inclusion criteria:

- Any study investigating the effectiveness of some form of social cognition rehabilitation in people with a diagnosis of schizophrenia, schizoaffective disorder, or schizophrenia spectrum disorder. Studies combining schizophrenic groups with other clinical populations were excluded.

- A focus on social cognition rehabilitation. Studies with neurocognition rehabilitation elements were excluded, any studies with social skills training elements were excluded, and any studies with other therapy elements (e.g. cognitive behavioural therapy or family therapy) were excluded.

- Publication in a peer-reviewed journal. Unpublished articles, dissertations, and meeting abstracts were excluded.

- Publication in English. Papers written in a language other than English were excluded.

Assessing quality in this area is a challenge, because research in the area is fairly new, and few high quality randomised controlled studies have been conducted. Stringent quality criteria would mean that few studies would be identified, whereas lax criteria would mean that conclusions drawn may be erroneous. It was decided that rather than use quality as an exclusion criterion, a quality score would be awarded for each paper, and reported in the synthesis tables. This prevents the exclusion of multiple relevant

papers, whilst drawing attention to issues of methodology, and allowing the reader to come to their own conclusions.

Khan, ter Riet, Popay, Nixon and Kleijnen[40] suggest a hierarchy of study designs for effectiveness, see Table 1. It was decided to include studies in the first four levels, and to exclude those in the bottom level. The design of each study was reported in the synthesis table.

Table 1. Study Design Hierarchy (Khan, ter Riet, Popay, Nixon & Kleijnen,[40] pp. 5)

Level	**Description**
1	Experimental studies (e.g. randomised controlled trials [RCT] with concealed allocation)
2	Quasi-experimental studies (e.g. experimental study without randomisation)
3	Controlled observational studies 3a. Cohort studies 3b. Case control studies
4	Observational studies without control groups
5	Expert opinion based on pathophysiology, bench research or consensus

In addition, a published quality assessment tool was used to rate the quality of each study. This allows easier comparison of quality amongst the studies included in the review. The Downs and Black[41] checklist was chosen because it allows the assessment of quality in both randomized and non-randomised health care interventions. The final

item on the Downs and Black scale (Power, item 27) could not be completed for any of the papers reviewed in this study, as the question assumed that is was possible for the reviewer to define a 'clinically important difference', and use this to complete a power calculation. However, as none of the papers included in the review described what a clinically important difference might be, the power calculations could not be determined. Therefore, item 27 was replaced with the following question: '*Did the study use a power calculation to justify the number of participants used?*' Studies received a point if they reported a power calculation, and used it to determine the number of participants in each group. Otherwise, studies received a score of 0 on this item.

Each paper was awarded a score according to the checklist, which was reported in the synthesis table. The maximum score obtainable using the revised scale was 28. Five papers were randomly selected, and the quality of these papers was assessed a second time using the Downs and Black[41] checklist by an independent reviewer. Inter-rater reliability was assessed, and Cohen's Kappa was found to be 0.63, which is considered 'substantial agreement' by Landis and Koch.[42]

2.4. Data extraction

Figure 2 outlines the article selection process used in this review.

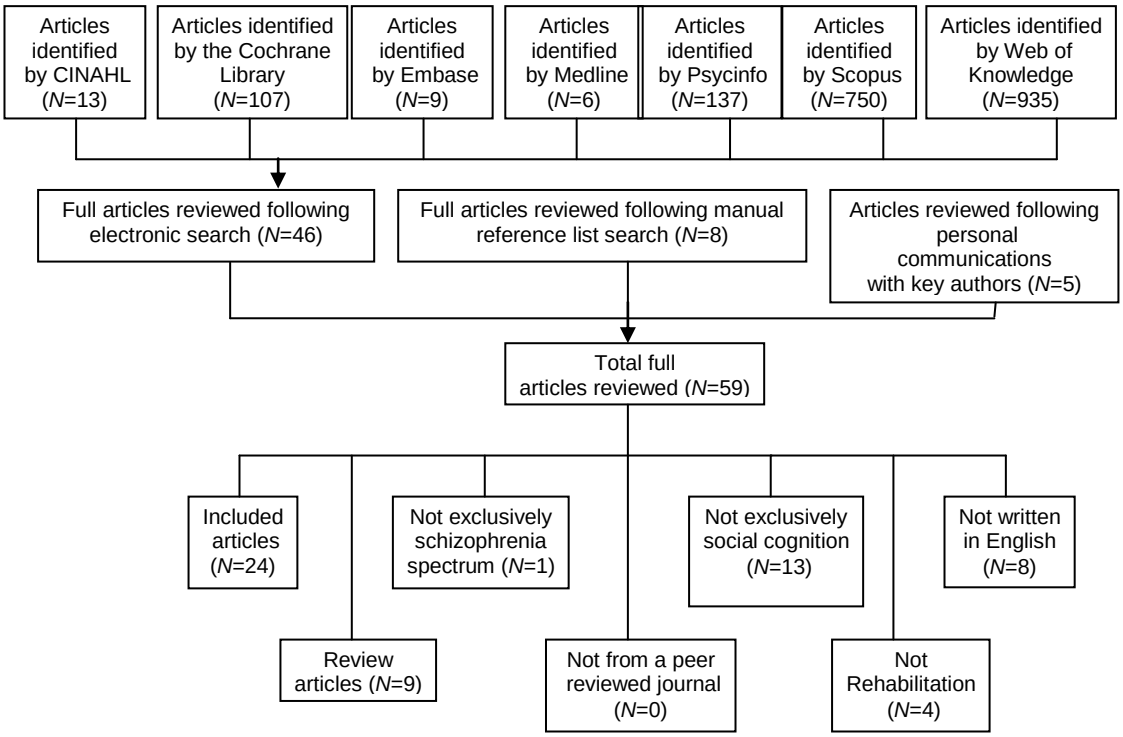

Fig. 2. A flowchart of the article selection process

After reviewing online titles and abstracts, the electronic search identified forty-six potentially eligible articles, and the manual reference search revealed a further eight. Following contact with key authors, five other potentially eligible articles were identified. Full copies of fifty-nine articles in total were assessed by the reviewer. Nine articles were review articles, or letters referring to a previously published study. One article was excluded due to inappropriate client group, and thirteen articles were excluded due to the inclusion of components other than social cognition. Four articles were found to be investigations into the nature of social cognitive deficits without attempts to rehabilitate those deficits, and were thus excluded. Eight studies were

excluded due to being written in a language other than English. Twenty-four articles met the inclusion criteria in total.

Included articles were reviewed using a standard data extraction sheet, to ensure unbiased extraction of data. Data extraction sheets were designed based on examples provided in the Centre for Reviews and Dissemination (CRD) report number 4,[43] but modified to make them appropriate for the present review (see Appendix E).

2.5. Data synthesis

Data synthesis in this review was qualitative, as the outcome measures and methodologies used in the review were too diverse to allow statistical methods of data synthesis to be conducted.

3. Results

A variety of different outcome measures were used by researchers to investigate the impact of social cognition rehabilitation. Appendix G outlines the different social cognition measures that were used in studies included within this review, and Appendix H outlines other outcome measures that were used.

3.1. Emotion perception

Eight studies were identified that investigated rehabilitation of emotion perception skills, making this area the most heavily researched aspect of social cognition rehabilitation reviewed, see Table 2. Several of the studies outlined formal intervention packages designed to target difficulties in emotion perception.[44,45,46,47,48] Others were more experimental studies, aimed at developing an understanding of why people with a

diagnosis of schizophrenia may experience difficulties in emotion perception.[49,50,51] The methodology rating scores ranged from nineteen[49] to nine,[44] indicating that there were flaws in the methodologies of all studies.

Table 2. Studies Investigating Emotion Perception Rehabilitation

Reference and Country	Characteristics of intervention group(s)	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Penn & Combs[51] USA	<u>Characteristics of entire sample</u> • *N*=40 (4 groups, *N*=10 in each group) • Mean age = 39.83 (*SD*= 0.06)% male = 58% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = Inpatient • Mean duration of illness = 17.13 years (*SD*=9.25)		RCT Quality score = 18	All groups completed the FEIT pretest. Group 1 – repeated the FEIT test. Group 2 – FEIT test, plus monetary reinforcement for each correct answer. Group 3 – FEIT test, but were instructed to mimic the facial expression in the stimuli prior to responding. Group 4 – repeated the FEIT test, plus facial expression mimicry and monetary reinforcement.	1. The Face Emotion Identification Test[52] (FEIT) 2. The Face emotion discrimination task[52] (FEDT)	Groups 2, 3 and 4 all performed significantly better than group 1 on the FEIT. At one week follow-up, only group 2 (monitory reinforcement) remained significantly better than repeated practice group. This may have been because scores in all groups including group one improved between post-test and follow up. The trends for improvement in the FEDT scores were not significant, suggesting that the intervention did not generalise to a facial expression discrimination task.	Not assessed.

Table 2. continued

Reference and Country	Characteristics of intervention group(s)	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Frommann, Streit & Wolwer[44] Germany	• *N*=16 • Mean age = 31.9 (*SD*=7.3) • % male = 81% • Diagnosis = schizophrenia • Clinical setting = no information • Mean duration of illness = no information	<u>Historic schizophrenic control group</u> • *N*=36 • Mean age = 35.9 (*SD*=8.8) • % male = 53% • Diagnosis = schizophrenia • Clinical setting = no information Mean duration of illness = no information <u>Historic healthy control group</u> • *N*=21 • Mean age = 34.2 (SD=10) • % male = 71%	Cohort study with historic controls Quality score = 9	<u>Intervention group</u> The training programme is called the Training of Affect Recognition (TAR). Participants worked in pairs, through 12 sessions (each lasting 45 minutes), using computer and desk work. They learned to identify and discriminate as well as verbalise the main facial signs of the 6 basic emotions. The knowledge was then expanded on by incorporating different affect intensities, and applied to wider social contexts. <u>Control groups</u> No intervention.	1. The PFA test of facial affect recognition (using stimuli from Ekman and Friesen[53]). This was administered to participants before and after training. The control groups were given a shortened version of the PFA test, with only 12 items rather than 24. This was only administered to participants once. 2. The Positive and Negative Symptom Scale[54] (PANSS) 3. The Brief Psychiatric Rating Scale[55] (BPRS)	Before training with the TAR, both clinical groups performed significantly worse than controls, and were not significantly different from each other. After training with the TAR, the intervention group performed significantly better than the historic schizophrenic control group. There was no difference between performance in the intervention group and the historic healthy control group. Within group comparisons are not reported.	PANSS scores were significantly better after training compared to before training in the intervention group. However, there was no significant correlation between performance on the PFA test and psychopathological status before or after training, as measured by the BPRS. Between group comparisons on the PANSS and BPRS are not reported.

Table 2. continued

Reference and Country	Characteristics of intervention group(s)	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Silver et al[47] Israel	• *N*=20 • Mean age = 38.1 (*SD*=11.2) • % male = 100% • Diagnosis = schizophrenia • Clinical setting = Inpatient • Mean duration of illness = 10.3 years (*SD*=11.3)	No control group used	Observational study without a control group Quality score not possible to determine due to lack of control group	Training involved computer based tasks designed for teaching autistic children about emotion. The tasks focussed on recognising core facial expressions, anticipating emotional responses, and anticipating pleasure or disappointment in other people. Training consisted of 3 sessions lasting 15 minutes each.	1. Identification of Facial Emotions[56] (PEAT) 2. Emotion Recognition 40[57] (ER40) 3. Differentiation of facial emotions[58] (EmDiff)	Post treatment scores were significantly better on the PEAT and ER40 than pre-treatment scores, indicating an improvement in emotion identification. There was no significant difference in EmDiff scores.	Not assessed.

Table 2. continued

Reference and Country	Characteristics of intervention group(s)	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Wolwer et al[48] Germany	• *N*=26 • Mean age = 31.5 (*SD*=6.9) • % male = 89% • Diagnosis= schizophrenia • Clinical setting = open wards or from an outpatient clinic • Mean duration of illness = no information	<u>Cognitive remediation control</u> • *N*=24 • Mean age = 36.7 (*SD*=11.4) • % male = 58% <u>Treatment as usual control</u> • *N*=25 • Mean age = 35.2 (*SD*=11.1) • % male = 84% Diagnosis, clinical setting and mean duration of illness the same in experimental and control groups	RCT Quality score = 13	<u>Intervention group</u> The TAR was used, as described earlier in the Frommann, Streit & Wolwer[44] study. <u>Cognitive remediation control</u> Participants completed computer tasks that focused on attention, memory and executive functioning. <u>Treatment as usual control</u> Participants had access to all usual treatment such as medication and psychoeducational therapy.	1. The PFA test of facial affect recognition (using stimuli from Ekman & Friesen[53]). 2. The Positive And Negative Symptom Scale[54] Various measures were additionally used to assess different aspects of neurocognition, such as attention, memory, and executive functioning.	The improvement that the intervention group demonstrated on the PFA test was significantly greater than the improvement demonstrated by either the cognitive remediation control of the treatment as usual control. In the cognitive remediation condition, a significantly larger improvement in the learning and memory scores was obtained compared to the treatment as usual control.	A negative relationship was identified between PFA score after training and amount of negative symptoms after training. However, common variance was only 7%. This meant that using clinical improvement as a covariate in the analysis of performance in facial affect recognition did not alter the results.

Table 2. continued

Reference and Country	Characteristics of intervention group(s)	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Combs et al[50] USA	• *N*=12 • Mean age = no information • % male = no information • Diagnosis= schizophrenia • Clinical setting = no information • Mean duration of illness = no information	• *N*=10 • Mean age = no information • % male = no information • Diagnosis= schizophrenia • Clinical setting = no information • Mean duration of illness = no information	RCT Quality score = 11	All participants completed the pre-test measures, and then were randomly assigned to a group. <u>Intervention group</u> Completed the FEIT a second time, but this time a cross appeared for the first 3 seconds of each item presentation, to draw attention to the eyes and mouth. <u>Control group</u> Completed the standard FEIT a second time.	1. The Face Emotion Identification Test[52] (FEIT) 2. The Bell-Lysaker Emotion Recognition Test[59] (BLERT)	The intervention group performed significantly better then the control group on the FEIT at post test, and also at one week follow up. They also performed significantly better than the control group on the BLERT at one week follow up.	Not assessed.

Table 2. continued

Reference and Country	Characteristics of intervention group(s)	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Russell, Chu & Phillips[45] Australia and UK	• *N*=20 • Mean age = 38.05 (*SD*=7.91) • % male = 45% • Diagnosis= schizophrenia • Clinical setting = Outpatient • Mean duration of illness = no information	• *N*=20 • Mean age = 34.35 (*SD*=9.21) • % male = 25% • Diagnosis= none – 'healthy' control group.	Cohort study. Quality score = 14	<u>Intervention group</u> Completed the METT. The participant was shown 4 pairs of emotions, and listened to distinctions between the two being explained. Next, there were 28 practice sessions where the participants label micro-expressions with feedback provided. The training is done in a single session, and is done on computer. <u>Control group</u> Participants were also administered the METT.	1. The METT incorporates a pre-and post test assessment as part of the computerised programme. This was used as an outcome measure. 2. An Emotion Matching Task (using stimuli from Ekman & Friesen[53])	In both measures, both groups improved significantly following training. In both measures, the clinical group performed significantly worse than the control group overall. There was no significant difference between performance on the METT in the intervention group post training and the control group pre-training.	Not assessed.

Table 2. continued

Reference and Country	Characteristics of intervention group(s)	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Russell et al[46] Australia	• *N*=26 • Mean age = 40 (*SD*=10) • % male = 65% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = Outpatient • Mean duration of illness = no information • Mean age of onset = 21.57 (*SD*=7.38)	• *N*=14 • Mean age = 44 (*SD*=9) • % male = 71% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = Outpatient • Mean duration of illness = no information • Mean age of onset = 23.57 (*SD*=7.19)	RCT Quality score = 17	<u>Intervention group</u> Administered the METT, as described above. <u>Control group</u> Participants had exactly the same procedure as those in the METT group, but the video was muted, and no feedback was given during the practice phase.	1. The Emotion Matching Task (using stimuli from Matsumoto & Ekman's Japanese and Caucasian Facial Expressions of Emotion.[60] Response accuracy recorded. 2. During the administration of the emotion matching task, visual scan paths were recorded.	The intervention group showed a significantly greater improvement on accuracy in the emotion matching task, compared to the control group. Participants in the intervention group looked at facial areas of interest significantly more than the control group at post-test, and their gaze entered and exited areas of interest significantly more than controls. However, there was no significant difference in time spent fixating on facial areas of interest.	Not assessed.

Table 2. continued

Reference and Country	Characteristics of intervention group(s)	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Combs et al[49] (2008) USA	<u>Characteristics of entire sample</u> • *N*=60 (3 groups, *N*=20 in each group) • Mean age = 38.7 (*SD*=13.7) • % male = 65% • Diagnosis= schizophrenia or schizoaffective disorder • Clinical setting = Inpatient • Mean duration of illness = 14.6 (*SD*=12.4)		RCT Quality score = 19	All participants completed the pre-test measures, and then were randomly assigned to a group. All groups were given a second trial of the FEIT as the 'intervention'. Group 1 received the FEIT just as they had before. Group 2 saw each FEIT item with a cross over the centre of each image, designed to draw attention to the eyes and mouth. They also received monetary reinforcement. Group 3 received monetary reinforcement only.	1. The Face Emotion Identification Test[52] (FEIT) 2. The Bell-Lysaker Emotion Recognition Test[59] (BLERT) 3. The Social Behaviour Scale[61] (SBS). Only data from the social mixing subscale was reported.	Group 2 showed significant improvements compared to the other groups on the FEIT at post test, and also at 1 week follow up. Group 2 also performed significantly better on the BLERT at 1 week follow up.	There was a trend showing people in group 2 to have better observer rated social mixing at follow-up. However, the difference was not statistically significant.

All of the studies reviewed found that it was possible to improve scores on emotion perception tasks using emotion perception remediation. Two studies[44,45] claimed that the results suggested that performance after intervention was equivalent to the performance of healthy control participants before training. However, these claims should be interpreted cautiously; in one paper the healthy control group was historic and thus difficult to compare to the intervention group,[44] and in the other paper the impact of a non-significant difference between healthy control at pre-test and intervention group at post-test must be tempered by the fact that no statistically significant difference was found between the groups even before the intervention group completed training.[45]

Three of the studies[49,50,51] found that gains were maintained over a 1 week follow up period. This provides preliminary evidence to suggest that the benefits of training can be maintained over short periods of time. However, more research is needed to establish how long gains can be maintained for.

There is some evidence to suggest that the effects of emotion perception training are generalizable to different measures of emotion perception. Four studies found that improvements in emotion perception could be identified using more than one measure of emotion perception.[45,47,49,50] However, the benefits may not extend to related areas of social cognition. Penn and Combs[51] found no improvement after intervention on a measure of facial emotion discrimination (deciding whether two faces are displaying the same or different emotions). They argued that this reflected a separate social cognitive skill, which was unlikely to be affected by emotion perception training. Similarly, Silver, Goodman, Knoll and Isakov[47] found no improvement on a test of emotion differentiation (determining if two faces differ in the intensity of emotion displayed). It

may therefore be that the effects of remediation are specific to the area that is the focus of the intervention.

Two studies[44,48] explored the relationship between emotion perception rehabilitation and psychopathology, as measured by instruments such as the Brief Psychiatric Rating Scale[55] (BPRS) and the Positive and Negative Symptom Scale[54] (PANSS). Frommann, Streit and Wolwer[44] found that psychopathology was significantly improved in the intervention group after rehabilitation. However, lack of concurrent control group means that this improvement could be due to other factors, such as increased social contact or reduced boredom, and this explanation is supported by the finding that there was no significant correlation between scores on the measure of emotion perception and scores on the BPRS. Wolwer et al[48] found that there was a negative correlation between score on an emotion perception task, and negative symptoms of psychosis. It seems that the evidence concerning the relationship between emotion perception and psychopathology is equivocal, and more research is needed.

Only one study[49] investigated the relationship between emotional perception rehabilitation and social functioning. They found no significant differences between groups on a measure of social functioning, although there was a trend for one intervention group to show better social mixing at one week follow up. Again, more research is needed to determine how rehabilitation effects social functioning, and what degree of improvement is likely to be clinically significant.

3.2. Social perception

Three studies were identified that investigated rehabilitation of general social perception skills, see Table 3. Two of these studies[62,63] assessed the Social Perception module of 'Integrated Psychological Therapy[30] (IPT), and the other study[64] trained participants using stimuli taken from a tool used to assess social perception. Methodology ratings ranged from fourteen[62,63] to eighteen,[64] indicating that again, there were methodological flaws present in the studies, and conclusions should be interpreted with caution.

Table 3. Studies Investigating Social Perception Rehabilitation

Reference and Country	Characteristics of intervention group(s)	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Corrigan, Hirschbeck & Wolfe[64] USA	• *N*=20 • Mean age = 35.9 (*SD*=10.9) • % male = 45% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = Inpatient and outpatient • Mean duration of illness = no information	• *N*= 20 • Mean age = 34.7 (*SD*=9.5) • % male = 45% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = inpatient and outpatient • Mean duration of illness = no information	RCT Quality score = 18	<u>Intervention group</u> Participants were shown videotaped vignettes of social situations (taken from the SCRT), and asked questions to encourage semantic elaboration, such as 'what did the actors say in this situation'. <u>Control group</u> Participants were shown the same vignettes, but were instructed only to attend to the video.	1. The Social Cue Recognition Test[65](SCRT). 2. The Cue Recognition Test[66] (CRT, Corrigan, Green & Toomey, 1992). 3. The Expanded Brief Psychiatric Rating Scale[67] (BPRS) Thinking disturbance and Withdrawal subtests	Immediately after training, the intervention group performed significantly better than the control group on both the SCRT and CRT after training. At 2 day follow up, the difference in SCRT was still significant, but the difference in CRT score had reduced to trends. No baseline measurements were conducted, so there can be no evidence to suggest that the differences were due to the training.	Between group scores on the BPRS were not calculated. There was a significant correlation between the BPRS withdrawal subscale and one subscale of the SCRT (sensitivity).

Table 3. continued

Reference and Country	Characteristics of intervention group(s)	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Garcia et al[62] Spain	• *N*=11 • Mean age = 40.45 (*SD*=7.10) • % male = 81% • Diagnosis = schizophrenia • Clinical setting = no information • Mean duration of illness = 21 years	• *N*=9 • Mean age =36.88 (*SD*=8.10) • % male = 56% • Diagnosis = schizophrenia • Clinical setting = no information • Mean duration of illness = 14.77 years	RCT Quality score = 14	<u>Intervention group</u> Participants were given the 'Social Perception' module of Integrated Psychological Therapy[30] (IPT). This involves viewing photographs of social situations, describing the details of the photos, and then interpreting the social situation. Participants received 18 and a half hours of this therapy, over 3 months <u>Control group</u> No information	1. The Social Perception Scale[68] (SPS) 2. The Disability Assessment Schedule[69] (DAS II), 3. The Expanded Brief Psychiatric Rating Scale[67] (BPRS, Lukoff, Nuechterlein and Ventura, 1986)	Immediately after training, the intervention group performed significantly better than the control group on all but one subscales of the SPS.	There was no significant difference between groups on measures of social functioning or on measures of psychopathology. Similarly, there was no within group difference for either group on measures of social functioning or psychopathology.

Table 3. continued

Reference and Country	Characteristics of intervention group(s)	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Fuentes et al[63] Spain	• *N*=10 • Mean age = • 40.40 (*SD* = 7.49) • % male = 80% • Diagnosis = Schizophrenia • Clinical setting = Outpatients • Mean duration of illness = 21.30 years	• *N*=8 • Mean age = 37.75 (*SD* = 8.21) • % male = 50% • Diagnosis = Schizophrenia • Clinical setting = Outpatients • Mean duration of illness = 15.38 years	RCT Quality score = 14	<u>Intervention group</u> Participants were given the 'Social Perception' module of IPT[30], as described above. Participants received 18 hours of therapy, over 3 months. <u>Control group</u> Treatment as usual	1. The Social Perception Scale[68] (SPS) 2. The Disability Assessment Schedule[69] (DAS II) to evaluate social functioning 3. The Expanded Brief Psychiatric Rating Scale[67] (BPRS) to evaluate psychopathology	Immediately after training, participants in the treatment group performed significantly better on all aspects of the SPS than controls. This significant difference was maintained at a 6 month follow up assessment.	There was no significant difference between groups on measures of social functioning or psychopathology immediately after training. This remained the case at 6 month follow up. Again, there was no within group differences for either group on measures of social functioning or psychopathology immediately after testing, or at 6 month follow up.

All three studies present evidence to suggest that social perception training can lead to an improvement on measures of social perception in people with a diagnosis of schizophrenia. In addition, the study by Fuentes, Garcia, Ruiz, Soler and Roder[63] indicates that the gains can be maintained for up to six months. This is encouraging evidence to support the potential that social perception rehabilitation may have.

However, the findings of all three studies are based on assessment using measurement tools very similar to the training that was provided. In the case of Corrigan, Hirschbeck and Wolfe,[64] assessment of social perception post training was done using the same instrument that was used during training (the Social Cue Recognition Test[65] SCRT). Although a different assessment tool was used in addition to the SCRT, no significant differences were identified using this measure two days after training. This casts doubt on the generalizability of the findings.

Similarly, both Garcia, Fuentes, Ruiz, Gallach, and Roder [62] and Fuentes et al[63] used an assessment tool specifically designed by the authors to replicate the conditions of the training module, and also used stimuli for assessment that were used in the training module. It is unclear whether an improvement would have been identified had a different measure of social perception been used.

In addition, no evidence has been found to indicate that social perception training has any effect on other aspects of client's life, such as psychopathology or social functioning. On the contrary, both Garcia et al[62] and Fuentes et al[63] found that training had no significant effect on these areas. This may be attributable to lack of experimental power due to small sample sizes, but it could also suggest that social

perception rehabilitation is insufficient to produce clinically significant gains in social functioning.

In summary, although evidence suggests that social perception training can improve scores on measures of social perception, there is currently no evidence to suggest that the effect is generalizable, or that training has a beneficial impact on everyday life for the client.

3.3. Theory of Mind and Attributional Style

Four studies were identified that investigated rehabilitation of theory of mind, attributional style and meta-cognitive skills, see Table 4. This field represents several rather disparate studies displaying very different takes on rehabilitation, and consequently different findings. Methodological ratings ranged from fourteen[70] to nineteen.[71] This suggests that although the study by Roncone et al[71] was comparatively well designed, other studies within this category should be interpreted with caution.

Table 4. Studies Investigating Theory of Mind, Attributional Style, and Meta-cognitive Skills

Reference and Country	Characteristics of intervention group	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Sarfati, Passerieux & Hardy-Bayle[70] France	• *N*=25 • Mean age = no information% male = 28% • Diagnosis = schizophrenia • Clinical setting = Inpatient • Mean duration of illness = no information	• *N*=25 • Mean age = no information% male = 28% • Diagnosis = none; 'healthy' control group	Cohort study. Quality score = 14	Participants completed the Character Intention Task (CIT). This involves seeing a cartoon of a character performing an action motivated by a recognisable intention, and determining the conclusion of the cartoon. There were 2 forms of this task; a pictorial form and a verbal form. Half the participants in both groups received 14 verbal items followed by 14 pictorial items, and half received 14 pictorial items followed by 14 verbal items.	1. CIT[73] accuracy score. People were divided into 3 groups: those who were good performers from the beginning, those who improved between the 2 sets, and those who stayed poor across both sets. Performance on the verbal and pictorial tasks in these 3 groups was compared. 2. The Positive And Negative Symptom Scale[54] (Kay, Opler & Lindenmayer, 1987) 3. The Scale for Thought, Language and Communication Disorders[73] (TLC)	10 participants in the schizophrenia group and 8 in the control group were defined as showing an improvement from the first subtest to the second, suggesting that their performance was 'remediable'. Within this group, performance was significantly better on the verbal subtest for both the schizophrenic and the control participants. The authors argue that this suggests that verbal strategies may help compensate for the theory of mind deficit for some people with a diagnosis of schizophrenia.	There was no significant correlation between performance groupings on the CIT and any of the measures of psychopathology.

Table 4. continued

Reference and Country	Characteristics of intervention group	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Roncone et al, 2004[71] Italy	• *N*=10 • Mean age = 33.9 • % male = 60% • Diagnosis = schizophrenia • Clinical setting = Inpatient • Mean duration of illness = 16.9 years (*SD*=8.05)	• *N*=10 • Mean age = 33.5 • % male = 70% • Diagnosis = schizophrenia • Clinical setting = Inpatient • Mean duration of illness = 11.1 years (*SD*=6.9)	RCT Quality score = 19	<u>Intervention group</u> Attended a weekly group for 22 weeks, focussing on metacognitive abilities. Topics included awareness of difficulties, recognising the beliefs of other people, and creation of motivation. <u>Control group</u> Treatment as usual.	1. First order Theory of Mind task[74] 2. Second order Theory of Mind task[75] 3. Perceptual recognition of emotion[76] 4. Accertamento Disabilita – an Italian version of the disability assessment schedule[77] 5. An Italian version of The Brief Psychiatric Rating Scale[78] Several tests of executive functioning were also included	At the end of training, the intervention group was significantly better than the control group on both measures of theory of mind. People in the intervention group were also significantly better at recognising sad and fearful faces post-training, as demonstrated by improved scores on the perceptual recognition of emotion task.	After the intervention, people in the intervention group performed significantly better than people in the control group on measures of social functioning. The intervention group also showed significantly reduced negative symptoms compared to the control group after the intervention. Additionally, they outperformed members of the control group on measures of executive functioning post-training.

Table 4. continued

Reference and Country	Characteristics of intervention group	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Kayser et al[79] France	• *N*=8 • Mean age = 32.4 (*SD*=9.4) • % male = 75% • Diagnosis = schizophrenia • Clinical setting = Outpatient • Mean duration of illness = no information	• *N*=6 • Mean age = 38.2 (*SD*=9.3) • % male = 83% • Diagnosis = schizophrenia • Clinical setting = Outpatient • Mean duration of illness = no information	RCT Quality score = 16	<u>Intervention group</u> Participants were shown video clips during 2 hour long sessions. The sessions involved one to one contact with a therapist. The behaviour, intentions and mental states of characters in these clips was discussed with the therapist. <u>Control group</u> No additional intervention aside from usual treatment	1. The non-verbal theory of mind task (Sarfati, Hardy-Bayle, Nadel, Chevalier, & Widlocher[72]) 2. The Brief Psychiatric Rating Scale[55] 3. The Positive And Negative Symptom Scale[54] 4. Schizophrenia Communication Disorder Rating Scale[80]	There were no significant differences between groups after the intervention. When differences within groups were investigated, the intervention group showed an improvement in Theory of Mind scores. There was no change between pre and post measures for the control group.	Within group analyses suggested that people in the intervention group showed a significant improvement in scores in the SCD after training. There was no difference for the BPRS and the PANSS. There was no difference in any measures in the control group.

Table 4. continued

Reference and Country	Characteristics of intervention group	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Moritz & Woodward[81] Germany	• *N*=20 • Mean age = 34.39 (*SD*=11.79) • % male = 70% • Diagnosis = schizophrenia • Clinical setting = Outpatient • Mean duration of illness = no information	• *N*=20 • Mean age = 34.39 (*SD*=11.79) • % male = 70% • Diagnosis = schizophrenia • Clinical setting = Outpatient • Mean duration of illness = no information	RCT Quality score = 15	<u>Metacognitive training (MCT) group.</u> MCT is a group intervention involving 8 sessions, which last about 45 to 60 minutes. Targets for sessions include attribution styles and self serving bias, jumping to conclusions, first order theory of mind, second order theory of mind, and overconfidence in errors. <u>CogPack group</u> A computerised cognitive remediation programme that covers a range of tasks including memory, logical thinking, and selective attention.	10 statements were given about the training, and participants were asked to rate their agreement with the statement on a 5 point likert scale.		Participants in the MCT group reported their training as more fun, and more applicable to everyday life. They reported being less likely to be bored, and more likely to recommend the training to others.

Two studies[71,81] attempted to devise a comprehensive meta-cognition rehabilitation programme that focussed on both theory of mind and attributional style. Although evidence can only be considered preliminary with such a small number of studies, the outcome of these studies seems positive. Roncone et al[71] found that treatment not only resulted in a significant improvement on measures assessing theory of mind, it also resulted in significant improvements in social functioning, psychopathology, and executive functioning. This implies that the effects of the training were not only statistically significant, but clinically relevant. If these findings could be replicated, a persuasive argument could be made for the importance of meta-cognitive rehabilitation in the treatment of schizophrenia. On a more modest scale, Moritz and Woodward[81] attempted only to assess participant opinion of their rehabilitation programme in this preliminary study. Nevertheless, participants rated the programme as significantly more fun, and more applicable to everyday life than a cognitive rehabilitation programme. Again, this hints at clinical relevance for meta-cognitive rehabilitation, although more research is needed.

The other two studies[70,79] focussed only on theory of mind, and the duration of rehabilitation was much shorter. Consequently, the effects of rehabilitation were much less dramatic. Sarfati, Passerieux and Hardy-Bayle[70] demonstrate that it is possible to remediate theory of mind in people with a diagnosis of schizophrenia, and suggest that verbalisation may be a helpful strategy to accomplish this. However, the design of the study falls short of evaluating the effectiveness of a rehabilitation programme for people with a diagnosis of schizophrenia, as people in the control group also improved. Kayser, Sarfati, Besche and Hardy-Bale[79] found that the intervention group showed an improvement in theory of mind and a reduction in levels of communication disorder.

However, no significant differences were identified between the intervention group and the control group, meaning that within subject differences must be interpreted with caution.

In summary, although only a few studies have been completed in this area and more research is needed, early findings seem to indicate that larger meta-cognitive programmes incorporating both theory of mind and attributional style may have good clinical effectiveness, whereas the usefulness of short duration interventions targeting purely theory of mind may be limited.

3.4. Social problem solving

Four studies were identified that investigated the effectiveness of social problem solving rehabilitation, see Table 5. These studies all followed a similar format; clients in the intervention group took part in a group program exploring the steps involved in social problem solving, and practicing the application of these steps. All but one of the studies[82] used the Assessment of Interpersonal Problem Solving Skills (AIPSS, Donahoe et al[83], 1990) to assess social problem solving ability. This tool assesses problem solving according to three subscales; receiving, processing and sending. 'Receiving' skills involve identifying and describing the problem, 'processing' skills involve identifying potential alternatives to the problem, weighing up the pros and cons of each, and selecting an appropriate solution, and 'sending' skills involve implementing the chosen solution. All studies used this model of social problem solving to some extent, although Jao and Lu[82] did not explicitly mention a 'sending' skill component. Methodology ratings within this category range from nine[84] to seventeen,[82] again implying that caution is needed when interpreting results.

Table 5. Studies Investigating Social Problem Solving Rehabilitation

Reference and Country	Characteristics of intervention group	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Jao & Lu[82] China	• *N*=10 • Mean age =35.4 years % male = no information • Diagnosis = schizophrenia • Clinical setting = Inpatient • Mean duration of illness = 21.2 years	• *N*=8 • Mean age =33 years % male = no information • Diagnosis = schizophrenia • Clinical setting = Inpatient • Mean duration of illness = 20.38 years	Quasi-experimental Quality score = 17	<u>Intervention group</u> Two 90 minute problem solving sessions a week, for 3 weeks. Participants learned to analyse social situations by applying a problem solving approach with 4 components; recognising problems, defining problems, thinking of alternative solutions to problems, and choosing a solution. These sessions were in place of participant's usual occupational therapy. <u>Control group</u> participants received their usual occupational therapy, which also consisted of two 90 minute sessions a week	1. The Means-Ends Problem-Solving Procedure[85] (MEPS) 2. The Culture-free self esteem inventories-second edition[86] (CFSEI-2)	Only within group analyses are reported. There was a significant improvement in the MEPS for the intervention group after training. There was no significant change in the performance on the MEPS for the control group.	The intervention group showed a significant decrease in self esteem as measured by the CFSEI-2. There was no significant change in the control group. There was no significant correlation between MEPS and CFSEI-2.

Table 5. continued

Reference and Country	Characteristics of intervention group	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Liberman, Eckman, & Marder[84] USA	<u>Characteristics for the entire sample</u> • social problem solving group *N*=38, supportive group therapy *N*=37 • Mean age = 38.7 (*SD* 8.8) • % male = 90% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = Outpatient • Mean duration of illness = 13.2 years (*SD*=8.9)		Unable to determine study design, as no information given about whether the assignment of participants to groups was random. Quality score = 9	<u>Social problem solving group</u> Participants received 4 months of weekly training, which involved being presented with a social problem, and watching a video which demonstrated good and poor solutions to the problem. Participants would then discuss the video, and role-play solutions to the problem. <u>Supportive therapy group</u> Participants met once a week for 4 months. They engaged in unstructured discussion about any problems they were experiencing.	1. The Assessment of Interpersonal Problem-Solving Skills[83] (AIPSS)	Both groups improved significantly between pre and post test on problem identification and ability to describe the problem ('receiving skills'). However, the social problem solving group performed significantly better than the supportive therapy group at post-treatment on measures of ability to generate solutions, select a solution, and role-play that solution.	Not assessed.

Table 5. continued

Reference and Country	Characteristics of intervention group	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Kern et al[87] USA	• *N*=29 • Mean age = 44.6 (*SD*=9.8) • % male = 69% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = Outpatient • Mean duration of illness = 17.9 years *(SD*= 9.6)	• *N*=31 • Mean age = 42.6 (*SD*=11.5) • % male = 74% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = Outpatient • Mean duration of illness = 15.7 years (*SD*= 10.0)	RCT Quality score = 15	<u>Intervention group</u> Errorless learning was used to train participants on 3 target areas; identifying the presence or absence of a problem (receiving skills), generating an appropriate solution (processing skills), and effectively enacting the solution (sending skills). <u>Control group</u> Participants practiced the Symptom Management module of the University of California, Los Angeles (UCLA) social and independent living skills series. The module has a strong problem solving emphasis, but does not involve social problem solving.	1. The Assessment of Interpersonal Problem-Solving Skills[83] (AIPSS)	Participants in the intervention group performed significantly better than those in the control group on all subtests of the AIPSS at post-test. At a 3 month follow-up, the difference between groups in 'receiving' skills (i.e. problem identification) was no longer significant. However, at 3 month follow up the intervention group remained significantly better on all other subtests of the AIPSS, namely 'processing' skills (generating and selecting solutions) and 'sending' skills (implementing the solutions).	Not assessed.

Table 5. continued

Reference and Country	Characteristics of intervention group	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Ucok et al[88] Turkey	• *N*=32 • Mean age = 28.12 (*SD*=5.87) • % male = 65.6% • Diagnosis = schizophrenia • Clinical setting = Inpatient • Mean duration of illness = 7 years (SD=4.14)	• *N*=31 • Mean age = 28.51 (*SD*=8.11)% male = 41.4% • Diagnosis = schizophrenia • Clinical setting = Inpatient • Mean duration of illness = 7.15 years (SD=5.51)	RCT Quality score = 16	<u>Intervention group</u> Sessions were once a week for 6 weeks, and lasted an hour each session. In each session a social problem was described, and steps in problem solving were reinforced. Next, either the therapist or the participants presented a couple of interpersonal problems, and discussed them with the group, using the steps. One or two solutions were then selected by the clients, and role-played. <u>Control group</u> Treatment as usual	1. The Assessment of Interpersonal Problem-Solving Skills[83] (AIPSS). However, the full AIPSS was not used; only 5 out of 13 vignettes were used. 2. Wisconsin Card Sorting Test[89] (WCST) 3. Continuous Performance Test[90] (CPT) 4. The digit span subscale of the Wechsler Adult Intelligence Scale[91] (WAIS-R)	Participants in the intervention group performed significantly better than the controls on all subscales of the AIPSS following the intervention. Scores on the WCST and the CPT were both found to be significant predictors of AIPSS score after training. This suggests that cognitive flexibility and ability to sustain attention may be factors that mediate ability to benefit from social problem solving training.	Not assessed.

In general, the evidence seems to suggest that social problem solving training results in improvements on measures of social problem solving ability. All studies show an improvement on at least some aspects of social problem solving ability. Jao and Lu[82] found that the intervention group improved significantly on a single measure of social problem solving, although the lack of between-group analysis means that findings should be interpreted with some degree of caution. All other studies in this subgroup did use between-group analyses, and still found significant improvements in the intervention group.

Two studies[84,87] suggest that training may not be as effective for 'receiving' skills as for other areas of social problem solving. Liberman, Eckman, and Marder[84] found that although the intervention group improved significantly in receiving skills, the control group also improved on this measure, so focussed training is no better at improving this aspect of social problem solving than supportive group therapy. Kern et al[87] found that although differences in receiving skills were identified after training, these differences were not maintained at three month follow up. In contrast, Ucok et al[88] did find a significant difference in receiving skills, but as a follow up assessment was not conducted in this study, evidence seems to suggest that the effects of remediation may be weakest for the 'receiving' skills aspect of social problem solving.

Despite this finding, all studies suggest that 'processing' skills are remediable, and three studies[84,87,88] suggest that 'sending' skills are remediable. Kern et al[87] found that the effects of intervention on both processing and sending skills are maintained at 3 month follow up. Thus, early evidence suggests that social problem solving training improves performance on social problem solving assessment tools. Ucok et al[88] suggest that

cognitive variables such as attention and cognitive flexibility may mediate remediation ability.

Only one study explored the effect that social problem solving training may have on variables other than social cognition and neurocognition. Jao & Lu[84] investigated the impact that training had on a measure of self esteem, and found that participants in the intervention group showed a significant drop in self esteem after training, unlike the control group, who showed no significant change. The authors suggest that the training may have increased self awareness and insight into deficits, leading to a reduction in self esteem. They argue that a longer training period would have lead to improved functioning, and thus improved self esteem. However, there is currently no evidence to suggest that this would be the case. More research on the effects of social problem solving training on social functioning is desperately needed.

3.5. Social knowledge rehabilitation

No studies were identified investigating social knowledge training in people with a diagnosis of schizophrenia, schizoaffective disorder, or schizophrenia spectrum disorders.

3.6. Disparate social cognitive rehabilitation

Five studies were identified that explored rehabilitation of multiple different domains of social cognition within a single training programme, see Table 6. Three studies[34,92,93] investigate the effectiveness of Social Cognition Interaction Training (SCIT). The SCIT attempts to remediate deficits in emotion perception, theory of mind and attribution biases, and to integrate this remediation by practicing the application of these

skills. One study[94] describes a package that incorporates aspects of the SCIT, but expands on it by also incorporating the computerized facial affect perception training exercises designed Wolwer and colleagues,[44,48] and uses different exercises to rehabilitate attribution biases and theory of mind. Another study[95] combines emotion and social perception with a social problem solving approach. Methodology ratings ranged from fifteen[34] to eighteen,[93] suggesting that whilst the standard of methodology within this category is more consistent, there were still notable flaws in the study designs.

Table 6. Studies Investigating Disparate Social Cognition Rehabilitation

Reference and Country	Characteristics of intervention group	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Penn et al[92] USA	• *N*=7 • Mean age = 43.6 (*SD*=10.3) • % male = 71% • Diagnosis = chronic psychotic illnesses • Clinical setting = Inpatient • Mean duration of illness = 12.6 years (*SD*=5.3)	No control group	Observational study without a control group Quality score not possible to determine without a control group.	Social Cognition Interaction Training (SCIT). The training is divided into 3 phases: 1 – Understanding emotion. The 'Emotional Trainer'[47] helps people link facial expressions to emotions. 2 – Social Cognitive Biases. Clients develop strategies to help them avoid 'jumping to conclusions'. 3 – Integration. Looks at applying newly learned social cognitive skills to everyday life. The programme is designed for 18 weekly sessions lasting an hour each. However, for this study, 5 weekly sessions were conducted over 3 months.	1. The Face Emotion Identification Test[52] (FEIT) 2. The Hinting Task[15] 3. Ambiguous Intentions Attributional Questionnaire[96], (AIHQ) 4. Brief Symptom Inventory[97]	There was a significant improvement in theory of mind after the intervention period. There were trends towards a reduction in aggressive attributional styles, but these were non-significant.	There were trends towards an improvement in psychopathology after the intervention period, but these trends were non-significant.

Table 6. continued

Reference and Country	Characteristics of intervention group	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Choi & Kwon[95] Korea	• *N*=17 • Mean age = 30.88 (*SD*= 6.15) • % male = 53% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = Inpatient • Mean duration of illness = 9.29 years (*SD*=4.86)	• *N*=17 • Mean age = 34.07 year (*SD*=7.53)% male = 59% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = Inpatient • Mean duration of illness = 13.08 years (*SD*=6.29)	RCT Quality score = 17	<u>Intervention group</u> Social Cognition Enhancement Training (SCET). 36 sessions were administered over a period of 6 months. The SCET is delivered in a group, and makes use of cartoons. Participants perceive social cues in the cartoon, arrange the cartoons in the right order based on contextual information, and then explain the social situation depicted in the cartoon. They then discuss how to solve problems in social situations similar to those depicted in the cartoon. <u>Control group</u> Standard rehabilitation programme.	1. Social behaviour sequencing task[98] (SBST) 2. Emotion Recognition Test[99] (ERT). Only the contextual recognition subscale was used. 3. Wechsler Intelligence Scale for Children[100] (WISC). Only the picture arrangement (PA) subscale was used.	Participants were assessed at baseline, 2 months, 4 months and 6 months. The intervention group performed significantly better than controls on the SBST at 2 months post treatment. However, this effect had disappeared and was non-significant by the 4 month and 6 month time points. There were no significant differences at any time points on the CR. The intervention group was significantly better than the control group at 4 months and 6 months on the PA.	Not assessed.

Table 6. continued

Reference and Country	Characteristics of intervention group	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Combs et al[34] USA	• *N*=18 • Mean age = 41.3 (*SD*=11.2) • % male = 67% • Diagnosis = schizophrenia spectrum diagnosis • Clinical setting = Inpatient • Mean duration of illness = 18.4 years (*SD*=8.4)	• *N*=10 • Mean age = 44.0 (*SD*=10.6) • % male = 90% • Diagnosis = schizophrenia spectrum diagnosis • Clinical setting = Inpatient • Mean duration of illness = 19.7 (*SD*=7.5).	Cohort study Quality score = 15	<u>Intervention group</u> SCIT was administered, as described above.[92] The group involved one hour long session a week for 18 weeks. <u>Control group</u> Participants took part in a coping skills group that focussed on symptom management, problem solving, and relapse prevention skills. The group involved one hour long session a week for 18 weeks.	1. The Face Emotion Identification Test[52] (FEIT) 2. The Face emotion discrimination task[52] (FEDT) 3. The Social Perception Scale[68] 4. The Hinting Task, Corcoran[15] 5. Ambiguous Intentions Attributional Questionnaire[96] 6. Need for Closure Scale[101] 7. Trail making test part B[102] 8. Social Functioning Scale[103] 9. Number of aggressive incidents on ward 10. The Positive And Negative Symptom Scale[54]	People in the intervention group performed significantly better than the control group at post-test on all measures of social cognition, including measures of emotion perception and discrimination, social perception, theory of mind and attributional style.	People in the intervention group performed significantly better than people in the control group on measures of social functioning. They also performed significantly less aggressive acts on the ward. There was no significant difference between groups in levels of psychopathology after the intervention.

Table 6. continued

Reference and Country	Characteristics of intervention group	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Horan et al[94] USA	• *N*=15 • Mean age = 50.7 (*SD*=5.8) • % male = 87% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = Outpatient • Mean duration of illness = no information. • Years since first psychiatric hospitalization= 20.23 (*SD*=12.3)	• *N*=16 • Mean age = 45.9 (*SD*=7.5) • % male = 100% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = Outpatient • Mean duration of illness = no information. • Years since first psychiatric hospitalization= 18.03 (*SD*=7.4)	RCT Quality score = 16	<u>Intervention group</u> The programme involved 2 phases, each lasting 6 sessions. The first phase was 'emotion and social perception' and involved learning about emotions, training using TAR techniques[48], and emotion mimicking. The second phase is 'social attribution and theory of mind'. This involves working on distinguishing fact from guesses, thinking about how to prevent 'jumping to conclusions' and learning how to check out evidence for beliefs <u>Control group</u> Participants took part in a skills training group, focussing on relapse prevention and illness self management.	1. The Face Emotion Identification Test[52] (FEIT) 2. Ambiguous Intentions Attributional Questionnaire[96] 3. The Half-Profile of Nonverbal Sensitivity[104] (PONS) 4. The Awareness of Social Inference Test[105] (TASIT) 5. MATRICS Consensus Cognitive battery[106] 6. The Expanded Brief Psychiatric Rating Scale[67] 7. Likert scales to rate satisfaction.	A significant improvement in the intervention group compared to the control group post training was only found on the facial affect identification task. There was no significant effect on the other social cognition measures.	Both groups reported similarly high levels of enjoyment/satisfaction, and perceived relevance to everyday life. In the symptoms domain (from the BPRS), there was a significant effect only for the domain of 'anergia', which is compromised of the items Disorientation, Blunted affect, Emotional withdrawal, and Motor retardation. This effect indicated a medium increase in symptomology within the intervention group, coupled with a medium decrease in the control group.

Table 6. continued

Reference and Country	Characteristics of intervention group	Characteristics of control group(s)	Study design and quality	Intervention procedures	Primary outcome measures	Main Findings	Findings in relation to social functioning, psychopathology, or client satisfaction
Roberts & Penn[93] USA	• *N*=14 • Mean age = 36.8 (*SD*=12.3) • % male = 55% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = Outpatient • Mean duration of illness = no information. • Years since first psychiatric hospitalization= no information	• *N*=11 • Mean age = 41.4 (*SD*=12.3) • % male = 64% • Diagnosis = schizophrenia or schizoaffective disorder • Clinical setting = Outpatient • Mean duration of illness = no information. • Years since first psychiatric hospitalization= no information	Quasi-experimental study. Quality score = 18	<u>Intervention group</u> SCIT was administered, as described above.[92] The intervention lasted for 20 weeks. No information is given regarding the duration of the sessions. Participants also received treatment as usual. <u>Control group</u> Participants received treatment as usual, which involved interventions such as medication management, case management and occupational therapy. No social cognitive therapy was administered.	1. The Face Emotion Identification Test[52] 2. The Bell-Lysaker Emotion Recognition Test[59] 3. The Awareness of Social Inference Test[105] 4. The Hinting Task[15] 5. Ambiguous Intentions Attributional Questionnaire, Ambiguous items[96] 6. The Social Skills Performance Assessment[107] (SSPA)	A significant improvement was found in the intervention group compared to the control group on the FEIT, suggesting improved facial affect identification. There were no statistically significant effects in the other social cognition measures.	A significant improvement was found in the intervention group compared to the control group on the SSPA, suggesting an improvement in social skill during a conversation role-play.

To date, the evidence for the effectiveness of these integrated social cognitive rehabilitation packages is somewhat disappointing. Choi and Kwon[95] found that the intervention group performed better than controls on a social behaviour sequencing task two months post-intervention, but this difference had disappeared by four months post-training. They did find that the intervention group was significantly better than controls on the picture arrangement subsection of the Wechsler Intelligence Scale for Children at six months, but this task is not generally considered to be a measure of social cognition, and it is not validated for adult use. Therefore the finding should be interpreted with extreme caution.

Three of the studies[92,93,94] found significant differences only in a single aspect of social cognition, despite training being emphasised at multiple domains. Penn et al[92] found significant improvements in theory of mind, but not in emotion perception or attribution bias, and both Horen et al[94] and Roberts and Penn[93] found significant improvements in emotion perception, but not theory of mind or attributional bias.

Combs et al[34] paint a more hopeful picture. Combs and colleagues improved the emotion perception module of the SCID by adding emotional mimicry into the training, following the findings of Penn et al.[92] They then tested the new procedure, and found that participants in the intervention group performed significantly better than participants in the control group on all measures of social cognition, including measures of emotion perception, social perception, theory of mind and attributional style. Thus, the programme had an effect on all areas that it aimed to remediate. This provides some evidence that more than one aspect of social cognition can be successfully remediated in one training program. However, this was the only study to produce this finding.

It is interesting to note that positive effects of training do not necessarily go hand in hand with longer duration of training. One study found little effects despite a training programme that lasted six months[95] another found effects on all aspects of social cognition, using a training program that lasted eighteen weeks[34].

Findings concerning the impact of training on psychopathology seem somewhat equivocal. Penn et al[92] found only non-significant trends towards an improvement in psychopathology in the intervention group. Similarly, Combs et al[34] found no change in psychopathology in the intervention group following training. However, Horan et al[94] found a significant increase in anergic symptoms in the intervention group (including experiences such as disorientation, blunted affect, emotional withdrawal and motor slowing), suggesting a deterioration of psychopathology.

Two studies investigated the effects of training on social functioning.[34,93] Combs et al[34] found that participants in the intervention group rated themselves as having significantly better social functioning than the control group following the intervention. This finding was supported by the finding that participants in the intervention group displayed significantly less aggressive behaviour on the ward following training than the control group. Roberts and Penn[93] found that participants in the intervention group improved significantly on a social skills measure, suggesting improved conversation skills, despite the fact that these skills were not explicitly targeted by the intervention. These findings suggest that disparate social cognition training can have a positive effect on social functioning, but as only two studies investigate this area, the evidence remains preliminary.

4. Discussion

The aim of this review was to examine the empirical support for the effectiveness of various different domains of social cognition rehabilitation. A range of experimental studies were identified, using very different intervention packages and assessment tools. There were significant flaws in the methodology of all papers reviewed, for example no studies reported power calculations, and all studies had a small sample size. This means that the findings of this review should be interpreted with caution, and considered preliminary at best. Bearing this in mind, the findings of the review are summarised below.

There was some evidence to suggest that emotion perception remediation resulted in improved scores on various assessments of emotion perception. Thus it seems that it is possible to remediate emotion perception deficits. Evidence suggests that the effects of this remediation can be maintained for at least one week. However, current evidence suggests that remediation has no impact on related aspects of social cognition such as emotion discrimination. Evidence regarding the relationship of the training to psychopathology is equivocal. In addition, only one study to date[50] has investigated the effect of rehabilitation on social functioning, and this found no significant effect. Thus, although there is clear evidence linking emotion perception deficits to poor social functioning[1] there is currently no evidence to suggest that emotion perception remediation has any positive clinical effects.

Research into social perception rehabilitation meets with similar findings. All studies demonstrated that social perception training led to improvements on measures of social perception.[62,63,64] Evidence suggests that these gains could be maintained for up to six

months. However, the measures used in all cases were very closely linked to the stimuli used in training. When a different measure was used, the gains no longer persisted at follow-up. In addition, two studies[62,62] found that social perception training had no effect on social functioning. Whilst this may be due to limitations in the studies conducted to date, currently there is no evidence to suggest that social perception remediation has any positive clinical effects.

Evidence for theory of mind and attributional style remediation is more positive. Whilst the effects of training were minimal for short term interventions focussed solely on theory of mind, the effects were greater for larger programmes that aimed to rehabilitate various aspects of meta-cognition, including both theory of mind and attributional bias. One study[71] found that treatment not only significantly improved performance on measures of theory of mind compared to controls, it also resulted in significant improvements to social functioning and psychopathology. Another study[81] found that metacognitive training was rated as significantly more applicable to everyday life than cognitive training by participants. Together, these studies are suggestive of positive clinical effects for meta-cognitive rehabilitation. However, only two studies demonstrate this finding, and more research is needed.

Studies investigating social problem solving suggest that whilst the effectiveness of remediating 'receiving' skills is equivocal, 'processing' and 'sending' skills to seem to be amenable to rehabilitation. There is some evidence that this benefit may be maintained at three month follow up.[87] However, only one study investigated a factor related to clinical relevance[82] and they found that the training actually had a detrimental effect on participant self esteem. This finding highlights the vital importance of

assessing measures of functioning and client wellbeing alongside social cognitive measures.

Evidence for the usefulness of multi-modal cognitive rehabilitation was mixed. One study found little positive effect,[95] three studies found that training improved one aspect of social cognition but not another[92,93,94] and one suggested that training improved all aspects of social cognition assessed, and also improved social functioning and reduced aggressive behaviours.[34] The difference was not due to duration of intervention period, as the Choi and Kwon[95] study was of longer duration than the Combs et al[34] study, and yet produced much less significant change.

Based on the findings of this review, the single most clinically relevant area for social cognition rehabilitation to focus on is meta-cognition, combining a focus on attributional style and theory of mind. It is unclear whether attributional style rehabilitation alone would have a similar effect, because no study was identified as having researched the effectiveness of pure attributional style remediation. Given this finding, it seems that meta-cognition is an important area in which to develop rehabilitation techniques. However, it must be remembered that the number of studies suggesting a clinically significant effect of rehabilitation is still very small and suffers from a number of methodological difficulties, and thus more research needs to be done before meta-cognitive rehabilitation can be considered best practice for schizophrenia.

There are several areas that could usefully be developed in future research. No studies were identified as investigating the impact of improving social knowledge in people with a diagnosis of schizophrenia. It may be that improving knowledge of social

situations would mediate improvement in social cognition research, and this area may merit further exploration.

'Schizophrenia' is a very diverse label, incorporating a large spectrum of very different psychotic experiences, as well as different levels of functioning, and different levels of cognitive ability. It may be that social cognition rehabilitation is beneficial for some people with a diagnosis of schizophrenia, and not for others. It would be interesting for future research to explore who benefits from social cognition rehabilitation by comparing groups. For example, there is some evidence to suggest that people experiencing different levels of symptom severity respond differently to social cognition training. Combs et al[34] and Roberts and Penn[93] both used the SCIT, but Combs et al[34] used an inpatient sample, whereas Roberts and Penn[93] used an outpatient sample. Combs et al[34] found that participants improved on all measures of social cognition, whereas Roberts and Penn[93] found that the improvement was limited to measures of emotion perception. They argue that this difference was due to ceiling effects; the outpatient sample were performing at 'normal' levels on tests of theory of mind and hostility before training began, so the measures were not sensitive enough to pick up any improvement. It might therefore be that inpatients benefit from a general approach, whereas outpatients benefit most from an emphasis on emotion perception. This question could be investigated by designing a study that directly compares inpatient and outpatient participants on the same rehabilitation programme. The findings of this research could help direct the design of rehabilitation programmes for specific settings.

An aspect of this line of enquiry is when to remediate. Deficits in social cognition have been identified early on in the development of psychosis.[108] It may be that remediation at an early stage could moderate later deficits in social functioning. However, no research has to date investigated the effects of social cognition rehabilitation in first episode psychosis. This would be an interesting area to explore in future research.

It is possible that disparate social cognitive approaches are more successful when the intervention is planned to follow a model. The model proposed by Couture, Penn and Roberts[1] and elaborated on in this review implies that social cognition occurs in steps; emotional and social perception, followed by meta-cognitive skills such as theory of mind and attributional style, followed by social problem solving skills, and finally leading to implementation of behaviour. Disparate social cognitive rehabilitation may be more successful if it follows this stepped process, allowing participants to develop a new skill, and use it in order to progress to the next level. For example, determining the motivation of another person may be easier if one has a clearer understanding of the emotions being displayed by that person. Similarly, developing solutions to solve social problems may be simpler if one can understand the perspective of the other person involved in the situation. Choi and Kwon[95] did not follow this stepped process, moving from emotion perception skills straight to social problem solving skills. This may have resulted in poorer performance. In contrast, both the SCIT[34] and the methodology proposed by Horan et al[94] progress from emotion and social perception to meta-cognitive skills. This may explain the more successful findings. No study has yet explicitly integrated social problem solving into a formal social cognition programme (although it could be argued that the 'integration' element of the SCIT[34] constitutes problem solving to some degree). It would be interesting to assess what effect such an

inclusion would have on the outcomes of social cognitive rehabilitation. The hypothesis that programmes will achieve better results by following a model driven stepped progression also requires evaluation.

There were several limitations to this review. In particular, the study reviews and rates the quality of each paper considered within this review, but discusses the findings of each paper equivalently in the results section, regardless of quality score. This was done in order to give the reader an overview of all findings within this area, given that the number of studies in the field is still quite low. However, it may have been more appropriate to provide greater emphasis to studies with higher quality ratings when attempting to collate the findings of the review. It will be important for future research to consider the best way of emphasising issues of quality in reviews of this kind, perhaps by implementing a minimum standard for the quality of papers included within the review.

Secondly, the review does not attempt to collate the findings of the literature using any quantitative techniques. Thus it was not possible to estimate overall effect sizes, or establish what sort of effect sizes in social cognitive rehabilitation might be clinically meaningful. Future research might consider the best way to implement a meta-analysis in an area representing such methodological diversity.

5. Conclusion

Social cognition is an umbrella term encompassing several different abilities. Reviews concerning social cognition should therefore consider each domain separately. Evidence suggests that all domains of social cognition can be improved by

rehabilitation. However, evidence for improvement is generally limited to a demonstration of improvement on social cognitive measures, without consideration of the impact on psychopathology or social functioning. This means that the clinical relevance of the rehabilitation cannot be established. There is some evidence to suggest that metacognition rehabilitation may have clinically relevant implications, and this is also true of rehabilitation programmes that target disparate aspects of social cognition in a single programme. However, the evidence must be regarded as preliminary due to small number of studies, and the methodological flaws identified within these studies. More research is needed to investigate the clinical implications of all aspects of social cognition rehabilitation.

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Part Two

The Relationship between Theory of Mind, Empathy, and Social Functioning in People with a Diagnosis of Schizophrenia.

This paper is written in the format ready for submission to the journal 'Schizophrenia Bulletin'. Please see Appendix B for the guidelines for authors.

Abstract

It has been suggested that people with a diagnosis of schizophrenia perform poorly on tests of affective theory of mind, but not cognitive theory of mind. It has also been suggested that they have deficits in cognitive empathy, but not emotional empathy. However, the relationship between theory of mind and empathy has rarely been explored, and findings are equivocal. It is suggested that affective theory of mind and cognitive empathy may represent the same construct, and a model is proposed outlining the relationship between subcomponents of theory of mind, empathy, and social functioning. This model was tested by assessing the ability of 22 people with a diagnosis of schizophrenia and 36 control participants on tests of cognitive and affective theory of mind, cognitive and affective empathy, and social functioning. Correlations between the measures were assessed, in order to identify patterns that might support the model. Results indicated that people in the clinical group did less well on a single affective theory of mind subtest, but there was no significant difference between groups on cognitive subtests. There was also no difference on measures of cognitive and emotional empathy, and correlational analyses did not confirm predicted dissociations between cognitive and affective theory of mind. Theory of Mind measures were found to correlate significantly with social functioning, which was found to discriminate between the clinical and control groups. It is concluded that there is insufficient evidence to support the model tested by this study, and an alternative model is presented.

Key words: SOCIAL COGNITION, SCHIZOPHRENIA SPECTRUM DISORDERS

1. Introduction

Social cognition is an area that is increasingly becoming of interest within the field of schizophrenia research. Deficits have been found in diverse social cognition tasks such as judgment of the direction of eye gaze, perception of emotional expressions on faces, and theory of minds tasks[1]. However, few studies have considered the role of empathy in social cognition deficits. This research aims to investigate the relationship between empathy and theory of mind amongst a population of people with a diagnosis of schizophrenia, and also to investigate how these constructs relate to social functioning within this population.

1.1. Theory of mind in people with a diagnosis of schizophrenia

Theory of mind can be defined as 'the ability to infer what another individual is thinking or feeling'[2] (pp. 499). Evidence suggests that people with a diagnosis of schizophrenia have a deficit in this area.[3,4] Whilst a few researchers have failed to find evidence of a theory of mind deficit in schizophrenia,[5,6] large effect sizes have been identified by two separate meta-analyses.[3,4] This supports the idea that people with a diagnosis of schizophrenia do have difficulty in this area. The deficit cannot be accounted for by general cognitive deficits[4] or difficulties with executive functioning,[7,8] and is apparent even in people who are in remission from schizophrenia.[3,4,9] The latter finding has led some to suggest that a deficit in theory of mind may be a trait marker for schizophrenia,[9] although this has been contested.[10,11,12]

One line of research suggests that theory of mind may not be a unitary concept. Abu-Akel and Abushua'leh[13] found that in a group of people with a diagnosis of paranoid schizophrenia, patients who were violent performed better than patients who were not

violent on high level theory of mind tasks, but worse on 'faux-pas' recognition tasks. Shamay-Tsoory, Shur, Barcai-Goodman, Medlovich, Harari, & Levkovitz[14] interpreted this to indicate that violent patients were particularly impaired on their ability to represent affective (emotional) mental states, because understanding a faux-pas requires an understanding that the person hearing the faux-pas will be insulted, whereas the other theory of mind tests involved in the experiment had no such emotional component.

Shamay-Tsoory et al[14] suggested that theory of mind could be divided into 'affective theory of mind', which involves predicting how a person might feel in a given situation, and 'cognitive theory of mind', which involves predicting how a person might think in a given situation. They suggested that in previous investigations into theory of mind in schizophrenia these two areas had been confounded, and they aimed to rectify this by devising a theory of mind task which investigates the two constructs separately. They administered this task to a group of people with a diagnosis of schizophrenia, and a control group. It was found that people with a diagnosis of schizophrenia were significantly more impaired than controls on tasks based on affective theory of mind, but there was no significant difference between the clinical and control groups on cognitive theory of mind tasks. Shamay-Tsoory et al[14] therefore suggested that people with a diagnosis of schizophrenia may show a deficit in emotional aspects of theory of mind, but not in cognitive aspects. This dissociation may be seen as evidence supporting the idea of cognitive and affective theory of mind as being two separable constructs.

1.2. A model of empathy

Whilst theory of mind has been subject to much research within the field of schizophrenia, the construct of empathy has received much less attention.

In order to apply a model of empathy to schizophrenia, it is important to first define what empathy is. Smith[15] argues that empathy is made up of two separable, complementary systems; cognitive empathy and emotional empathy. Smith[15] defines cognitive empathy as 'mental perspective taking' (pp 3). The construct involves an ability to represent mental states such as emotions in other people, and to predict what another person might be feeling in a given situation. It has been linked with Theory of Mind.[16]

Smith[15] defines emotional empathy as 'the vicarious sharing of emotion' (pp 3). It is thought to be an automatic autonomic response to expression of emotion in another person.

Smith[15] suggests that from an evolutionary perspective, the most beneficial way for the two systems to interact would be for both to be capable of operating independently, without the need for the other. However, they should be capable of integrating, as the two constructs would complement each other and facilitate social expertise. For example, emotional empathy might make one feel like helping someone, whilst cognitive empathy might enable one to determine what sort of help was most appropriate.

1.3. Empathy in people with a diagnosis of schizophrenia.

Although the literature into empathy in people with a diagnosis of schizophrenia is much more sparse than the research into theory of mind, evidence suggests that people with a diagnosis of schizophrenia do have a deficit in empathy.[17,18,19,20,21] For example, Bora, Gokcen and Vesnedaroglu[17] found that carer and relative ratings of empathy in people with a diagnosis of schizophrenia was significantly lower than carer and relative ratings of empathy in people without a diagnosis of schizophrenia.

Some studies have identified differential performance on different empathy subscales in people with a diagnosis of schizophrenia. Montag, Heinz, Kunz and Gallinat[20] administered the Interpersonal Reactivity Index (IRI)[22,23] to a group of people with a diagnosis of schizophrenia, and to a control group. The IRI contains four subscales; perspective taking, fantasy, empathic concern, and personal distress. The perspective taking subscale is thought to measure cognitive empathy, whilst the empathic concern subscale is thought to measure emotional empathy.[20] Montag et al[20] found that people with a diagnosis of schizophrenia scored significantly lower on the perspective taking subscale than controls, but there was no significant difference on the empathic concern subscale. Similarly, Shamay-Tsoory et al[14] found that people with a diagnosis of schizophrenia performed significantly worse on the perspective taking subscale of the IRI, but not on the empathic concern subscale.

Not all research observes this finding. Shamay-Tsoory, Shur, Harari and Levkovitz[21] administered the IRI,[22,23] and the Questionnaire Measure of Emotional Empathy[24] (QMEE) to a group of people with a diagnosis of schizophrenia, and to a control group. They found that people with a diagnosis of schizophrenia were impaired in both

cognitive and emotional empathy, in comparison to control groups. Henry, Bailey and Rendell[19] found that higher ratings of schizotypy correlated with poorer cognitive and affective empathy. Derntl et al[18] used a model of empathy involving three subtypes of empathy (emotional recognition, affective responsiveness and emotional perspective taking) and found deficits in all three areas, although the deficit was most pronounced in the emotional perspective taking task.

The findings of the research, then, appear equivocal, perhaps due to the wide variety of different methods of assessing empathy. Derntl et al[18] for example, used a purpose designed computer task to measure three different areas of empathy. However, this computer task did not show any significant correlations with the IRI[22,23] or the QMEE,[24] which may render the validity of the task questionable.

The most frequently used empathy measure in the literature has been the IRI.[22,23] However, even using the same instrument, findings are remarkably different. Montag et al[20] found a deficit in the perspective taking subscale (tapping cognitive empathy) but not in the empathic concern subscale (tapping emotional empathy) in people with a diagnosis of schizophrenia, Shamay-Tsoory et al[21] found a deficit in both perspective taking and empathic concern subscales, and Derntl et al[18] found no deficits in either the perspective taking or the empathic concern subscales of the IRI. The IRI is a self report tool, and it may be that these differences arise from poor reliability of self report measures in the field of empathy research, due to lack of self awareness.[17] However, differences could also have arisen from methodological variations in the studies, such as number of participants used. Clearly, more research is needed in order to gain a clearer picture of the nature of the empathy deficit in people with a diagnosis of schizophrenia.

1.4. The relationship between empathy and theory of mind

In describing the difference between cognitive and affective theory of mind, and cognitive and emotional empathy, it becomes clear that there are marked overlaps between the two constructs. In particular, the constructs of 'affective theory of mind' and 'cognitive empathy' seem remarkably similar. One possibility is that they represent the same construct. If this were the case, the relationship between empathy and theory of mind might be as outlined in Figure 1. To our knowledge, this study is the first to link theory of mind and empathy in this way, and to propose that affective theory of mind and cognitive empathy may represent the same construct.

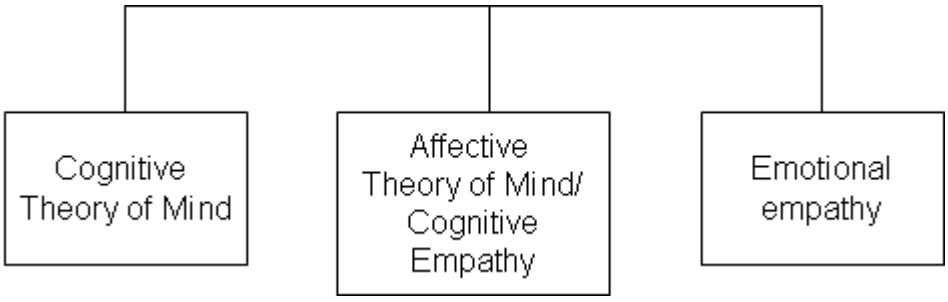

Fig. 1. Hypothesized relationship between components of Theory of Mind and Empathy

There is some evidence to support this position. In the study described above, Shamay-Tsoory et al[14] administered the IRI[22,23] to all participants. They found that there was a significant correlation between the fantasy subscale, which they argue measures cognitive empathy, and affective theory of mind. However, there was no correlation between any IRI subscales and cognitive theory of mind. This suggests that cognitive empathy may be more strongly related to affective theory of mind than cognitive theory of mind. The finding may be considered to be evidence to suggest that cognitive empathy and affective theory of mind represent the same construct; and indeed Shamay-

Tsoory et al[14] claim that their findings suggest that "affective 'theory of mind' may, in fact, be an empathic response" (pp. 19). However, the evidence is still very tentative, as the 'fantasy' subscale is not generally considered to tap exclusively cognitive empathy, because it shows stronger correlations with emotional empathy measures than cognitive empathy measures.[23] No correlation was found between 'perspective taking', the IRI subscale generally considered to represent cognitive empathy,[20] and affective theory of mind. In addition, Shamay-Tsoory et al[14] did not design their experiment to test the association between empathy and cognitive and affective theory of mind, rendering conclusions based on these correlations post hoc.

In clarifying the concept of affective theory of mind/cognitive empathy, it is important to use more than one measure, in order to investigate the convergent validity of the construct. One potentially relevant measure that could be used together with the task designed by Shamay-Tsoory and colleagues[14] is the 'Reading the Mind in the Eyes Test',[25] (also known as the 'Eyes test'). This was originally designed as a measure of theory of mind to discriminate high functioning autistic and Asperger's population groups from control groups. The test involves looking at a pair of eyes, and then predicting which emotion from a list of four the owner of the eyes might be feeling. The measure is unique amongst theory of mind measures in that it refers only to emotions, and not to intentions, beliefs, hidden meanings, or faux pas. It might reasonably be assumed that the test could therefore be considered a measure of affective theory of mind. Some evidence suggests that the Eyes test is related to cognitive empathy. Bora, Gokcen and Veznedaroglu[17] found significant correlations between the Eyes test and the Empathy Quotient[26] in a group of people with a diagnosis of schizophrenia. However, they did not differentiate between cognitive and emotional

aspects of empathy. More research is needed to investigate whether the Eyes test correlates differentially with cognitive and emotional empathy, and also to determine if it correlates differentially with cognitive and affective theory of mind.

1.5. The relationship between theory of mind and social functioning

People with a diagnosis of schizophrenia show a marked deficit in social functioning.[27] Evidence suggests that poor theory of mind may correlate with poor social functioning in people with a diagnosis of schizophrenia.[2,8,28] Although some researchers have not found a link between theory of mind and social functioning in schizophrenia,[5] other researchers suggest that the link may be present. Brune[8] found that theory of mind difficulties in people with a diagnosis of schizophrenia were related to severe social behavioural abnormalities, and Schenkel Spaulding and Silverstein[2] found that poorer performance on a test of theory of mind correlated with poor childhood social functioning. Couture, Penn and Roberts[28] reviewed the functional significance of social cognition in people with a diagnosis of schizophrenia. They concluded that there is 'some preliminary evidence to suggest that ToM [theory of mind] is related to social skill, community functioning and social behaviour in the milieu' (pp. S58). However, they note that it is difficult to be confident in these conclusions due to the paucity of research in this area, and they argue that replication is needed to confirm findings.

Several studies have investigated the relationship between social functioning and the 'Reading the Mind in the Eyes' test[25] specifically. Bora, Eryavuz, Kayahan, Sungu, and Veznedaroglu[29] assessed the relationship between social functioning and a variety of different psychological measures including theory of mind measures such as the 'Hinting task'[30] (a task measuring the ability to interpret the meaning of hints dropped

in conversation) and the 'Reading the Mind in the Eyes' test[25] in a population of outpatients with a diagnosis of schizophrenia. They found that there was a significant correlation between scores on the 'Reading the Mind in the Eyes' test[25] and social functioning, but not between scores on the 'Hinting task'[30] and social functioning. McGlade et al[31] identified the same finding. If the Hinting task[30] is assumed to represent a more 'cognitive' theory of mind task than the Eyes test, the evidence might suggest that affective theory of mind has a stronger relationship with social functioning than cognitive theory of mind. However, Bora et al[29] and McGlade et al[31] did not design their studies to investigate cognitive and affective theory of mind, and thereby conclusions must be considered tentative at best. In addition, Stewart, Corcoran and Drake[32] explored mental state references and emotional state references in the dialogue of people with a diagnosis of schizophrenia, and found that deficits in both areas were modestly related to deficits in social functioning. This suggests that both cognitive and affective theory of mind may be related to social functioning. More research is needed to clarify these findings.

1.6. The relationship between empathy and social functioning

Little research has been conducted into the relationship between social functioning deficits in people with a diagnosis of schizophrenia and empathy. Davis[23] reports that in an undergraduate population, the 'perspective taking' subscale of the IRI,[22,23] representing cognitive empathy, is associated with interpersonal functioning, whilst the 'empathic concern' subscale, representing emotional empathy, is not. However, Shamay-Tsoory et al[21] administered a measure of social functioning alongside their measures of empathy, and found that emotional empathy (as measured by the QMEE[24]) significantly correlated with social functioning, but cognitive empathy (as measured by

the IRI[22,23]) did not. Similarly, Henry, Bailey and Rendell[19] found that only negative schizotypy scores were associated with poor social functioning, and only emotional empathy was significantly associated with both negative schizotypy and poor social functioning. These results seem somewhat contradictory. Differences may result from the use of different empathy measures and social functioning measures, and also from differences within the population groups used, for example clinical or non-clinical community based samples.

1.7. Linking theory of mind, empathy, and social functioning

It is not evident, based on current research, whether there is a deficit in exclusively cognitive empathy in people with a diagnosis of schizophrenia, and which aspects of empathy are related to social functioning. However, in order to have a clear hypothesis, it is predicted in this study that deficits occur only in cognitive empathy, which is hypothesized to be the same construct as 'affective theory of mind'. This prediction is based on the findings of Montag et al,[20] which was considered an appropriate base for hypotheses, due to the comparatively large sample sizes used in the study.

If affective theory of mind and cognitive empathy represent the same construct, one hypothesis might be that the link between theory of mind, empathy and social functioning for people with a diagnosis of schizophrenia is as outlined in Figure 2.

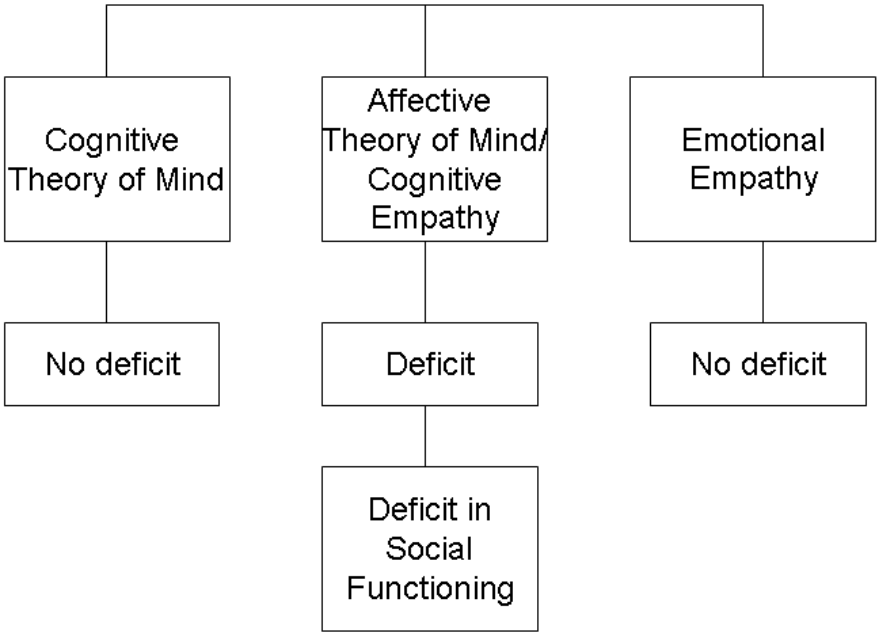

Fig. 2. Diagrammatical Representation of the Hypothesized Relationship Between Theory of Mind, Empathy, and Social Functioning in People with a Diagnosis of Schizophrenia.

If deficits exist exclusively in the affective theory of mind/cognitive empathy construct, then this construct alone will be associated with poor social functioning. This hypothesis is supported by some studies within the literature,[23,29,31] although not all.[19,21,32] It is important to recognize that at this stage there is no evidence to suggest that a deficit in one construct causes another; indeed both may be caused by some third factor.

1.8. Aims and hypotheses

This study aims to test the hypothesized relationships between theory of mind, empathy and social functioning, as described in Figure 2. To our knowledge, this paper is the first to present a model linking theory of mind, empathy and social functioning in this

way, and to test it empirically. The model will be investigated by looking at correlations between measures of cognitive and affective theory of mind as measured by Shamay-Tsoory et al[14], theory of mind as measured by the 'Reading the Mind in the Eyes' test[25] and measures of cognitive and emotional empathy.

In investigating the hypothesised model, one of the aims of the study is to replicate the findings of Shamay-Tsoory et al[14] that a distinction can be made between cognitive and affective theory of mind, and that people with a diagnosis of schizophrenia show a deficit in affective theory of mind, but not cognitive theory of mind.

The study also aims to determine how different aspects of theory of mind and empathy correlate with social functioning deficits in people with a diagnosis of schizophrenia, in order to determine which deficits seem to be linked to real life difficulties, and thus which deficits are of most clinical relevance.

The research questions are:

1. Do people with a diagnosis of schizophrenia show specific deficits in cognitive or affective theory of mind?
2. Do people with a diagnosis of schizophrenia show specific deficits in cognitive or emotional empathy?
3. How do measures of theory of mind and measures of empathy correlate with each other?
4. How do measures of theory of mind and measures of empathy correlate with a measure of social functioning?

The hypotheses are:

1. People with a diagnosis of schizophrenia will perform significantly worse than controls on tests of affective theory of mind but not on tests of cognitive theory of mind (replicating Shamay-Tsoory et al[14])
2. People with a diagnosis of schizophrenia will perform significantly worse than controls on tests of cognitive empathy, but not emotional empathy (replicating Montag et al[20])
3. There will be a positive correlation between affective theory of mind as measured by Shamay-Tsoory et al[14], the 'Reading the Mind in the Eyes' test[25], and cognitive empathy.
4. Affective theory of mind as measured by Shamay-Tsoory et al[14], the 'Reading the Mind in the Eyes' test[25], and cognitive empathy will all correlate positively with the measure of in social functioning.

2. Method

2.1. Participants

Twenty-three participants with a diagnosis of schizophrenia (N=17) or schizoaffective disorder (N=6) were recruited from community mental health teams, assertive outreach teams, acute inpatient units and rehabilitation units within the Hull, East Riding and York area. The sample included both inpatients and outpatients. Diagnosis was confirmed using subsections B and C of the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I[33]). Inclusion criteria were age between 18 and 65 (the age range for adult mental health services), ability to speak and read English, and a diagnosis of schizophrenia or schizoaffective disorder. Exclusion criteria were history

of neurological illness, brain injury or learning disability, major physical illness requiring constant care, and current substance dependency.

All participants were recruited via opportunity sampling. The majority of potential participants in the clinical group were identified with the assistance of staff who worked with the clients in the various different clinical settings that participants were recruited from. Once potential participants were identified, they were first approached by staff members, and given information about the study. If they showed an interest in participating, they were contacted by the researcher, further information was given, and a date for testing was arranged. Three participants were identified from a list of people with a diagnosis of schizophrenia who wished to be contacted about research. These people were contacted via letter, given information about the study, and invited to a testing session. The study was approved by York NHS Research Ethics Committee, and all participants gave full signed informed consent to participate. One participant was excluded, due to withdrawal of consent to participate during the course of the experiment.

Thirty-seven participants without a diagnosis of schizophrenia served as the control group. These people were also recruited opportunistically, through personal contacts. The same inclusion and exclusion criteria applied to the control group as to the clinical group, with the exception that participants were required not to have a diagnosis of any schizophrenia spectrum disorder, as identified by subsections B and C of the SCID-I (First et al, 1996). One participant was later excluded, due to subsequent diagnosis of schizoaffective disorder by a psychiatrist unconnected to the study.

All participants in the clinical group were taking antipsychotic medication; five people were taking typical antipsychotics, sixteen were taking atypical antipsychotics, and one person was taking a mixture of typical and atypical.

2.2. Measures

Theory of mind was measured using the Computerized Cognitive and Affective Theory of Mind Eye Gaze Task[14], and the 'Reading the Mind in the Eyes' Test Revised Version[25].

The Cognitive and Affective Theory of Mind Eye Gaze task was adapted from a French version of the task obtained by personal communication with the task authors,[14] and was translated to English for the purposes of the present study. The task is computerized, and involves the ability to gauge mental states based on written cues and eye gaze cues. It is made up of 87 trials, each showing a cartoon outline of a face in the centre of the screen, named Joe, and four coloured pictures of either objects or face/object pairings, one in each corner of the computer screen. A sentence is given at the top of the screen, for example 'Joe is thinking of _____', or 'Joe loves _____'. The task of the participant is to finish the sentence by choosing the correct object. The participant's decision is made based on the direction of the eye gaze, and also on Joe's expression. The keyboard has four keys that are clearly associated with each of the four corners of the computer screen, and the participant presses the key that corresponds to the corner where the correct object is. There are three conditions; 'cognitive', 'affective' and 'physical'. The cognitive and affective conditions involve mental inferences, whereas the physical condition requires a choice based on a physical attribute of the character (e.g. 'Joe is next to _____'). This serves as a control for errors

made due to attention and working memory deficits, and to ensure that the participant understands the task. Any participant that scored below 25% accuracy on the physical conditions was judged not to understand the tasks, and was excluded from the Cognitive and Affective task analyses. 25% was chosen as the cut-off, because it represents a chance score.

In the cognitive theory of mind conditions, both Joe's facial expression and the written cue are neutral. In the affective theory of mind conditions, both cues provided are affective. The task is split into 2 parts. The first part involves 'first order' theory of mind skills - predicting what another person (in this case Joe) is thinking or feeling. The sentences say things like 'Joe loves _____' or 'Joe is thinking about _____'. The second part involves 'second order' theory of mind skills - predicting what another person (in this case Joe) thinks that another person (in this case Joe's friend) is thinking or feeling. In this part of the task, the sentences say things like 'Joe loves the toy that _____ hates' and 'Joe is thinking about the toy that _____ wants'. In the second part of the task, some items have eye gaze cues, whilst others do not, making the task more difficult. See Figure 3 for examples of conditions.

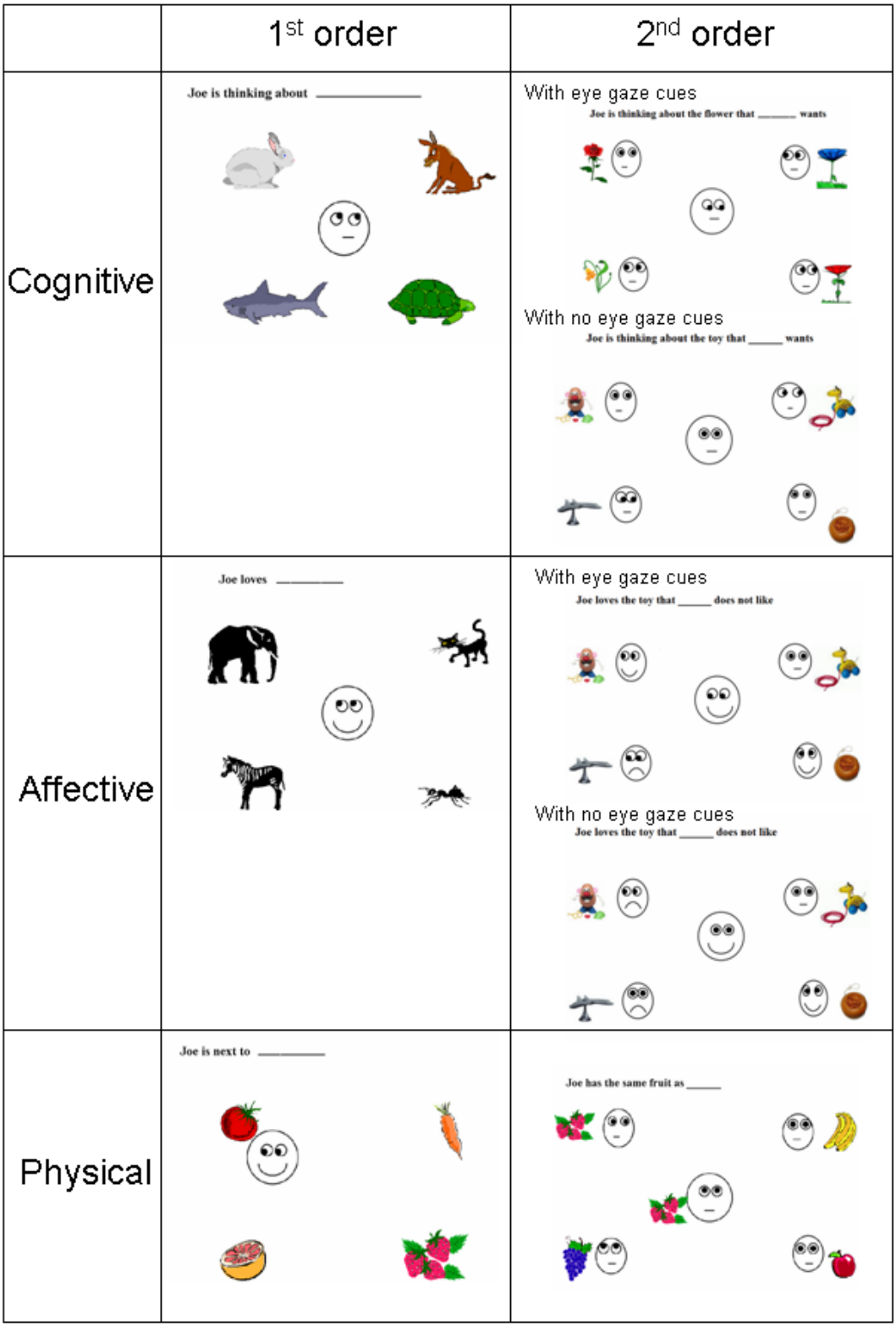

Fig. 3. Example of Conditions in Shamay-Tsoory et al's[14] Cognitive and Affective Eye Gaze Task

The design of the Cognitive and Affective Eye Gaze task means that outcome measures produce 8 subtask scores;

- First order affective theory of mind
- First order cognitive theory of mind
- First order physical task,
- Second order physical task
- Second order affective theory of mind with eye gaze cues
- Second order affective theory of mind without eye gaze cues
- Second order cognitive theory of mind with eye gaze cues,
- Second order cognitive theory of mind without eye gaze cues.

For each subtask, data is collected regarding accuracy (the percentage of items completed correctly) and reaction time. Whilst no reliability estimates have yet been established for this measure, it is nevertheless one of a very limited number of measures that directly compare cognitive and affective theory of mind.

The 'Reading the Mind in the Eyes' Test Revised version[25] requires participants to view a pair of eyes, with four potential emotions around the picture. The participant is required to select the emotion that they believe the owner of the eyes is most likely to be experiencing. There are thirty-six trials. These trials are shown as paper-based pictures in a folder. A glossary of all the emotional terms is available for the participant to check in case they are unsure of the meaning of any of the words. The mean score on this measure is 26.3 out of 36 in the general population (*SD* 3.6), and 21.9 amongst people with Asperger's syndrome (*SD* 6.6). Convergent and divergent validity for the

test has been established in that it correlates inversely with the Autism Questionnaire (r = -.53, p=.004), but does not correlate with IQ (r = .09, p=.77).

Empathy was measured using the 'perspective taking' and 'empathic concern' subscales of the **Interpersonal Reactivity Index**[22,23] **(IRI)**. This measure consists of four subscales, each with seven items. The subscales are:

- **Perspective taking**; measuring a tendency to adopt the point of view of others
- Fantasy scale; measuring the tendency to use ones imagination to understand the feelings and actions of fictional characters
- **Empathic concern**; measuring the tendency to have feelings for other people such as sympathy or concern
- Personal distress; measuring feelings of anxiety in tense interpersonal situations.

'Perspective taking' is thought to tap cognitive empathy, and 'empathic concern' is thought to tap emotional empathy.[20] Davis[22] reports that internal reliabilities for these scales range from .71 to .77, and test-retest reliabilities range from .62 to .71. Davis[23] has demonstrated that each of these scales has a unique pattern of convergent validity amongst several different measures of social cognition, suggesting that they each measure different constructs.

Social functioning was measured using the **Social Functioning Scale**.[34] This self report measure of social functioning consists of seven subscales:

- Social withdrawal
- Relationships
- Social activities

- Recreational activities
- Independence (competence)
- Independence (performance)
- Employment.

A total score can also be obtained from the subscales. This measure is appropriate for this study because norms have been measured for a schizophrenic population group.[34] Alpha-coefficient reliabilities for the various subscales range from 0.87 to 0.69, and inter-rater reliabilities range from 0.96 to 0.69. The alpha-coefficient reliability for the total SFS score is 0.80, and the inter-rater reliability is 0.94.

2.3. Procedure

For the majority of participants, testing was completed in one session, lasting approximately one hour and twenty minutes. However, for some participants in the clinical group, testing was completed over two sessions, as these participants found it difficult to concentrate for the full hour and twenty minutes.

Testing of the clinical sample was completed in the base of the team from which they were recruited, or in a quite room on the unit for inpatients. Testing of the control group was completed in a venue convenient for the participant. In all cases, testing was completed in a quiet environment, free from distractions.

Once full informed consent had been gained, participants were asked to complete a questionnaire collecting demographic information. Subsections B and C of the SCID-I was then completed, followed by the Computerized Cognitive and Affective Theory of

Mind Eye Gaze task.[14] Next, participants completed the Social Functioning Scale,[34] and then the 'Reading the Mind in the Eyes' test.[25] Finally, participants completed the IRI.[22,23] Participants were then debriefed, and given the opportunity to ask questions about the research. The ordering of these tests was designed to promote engagement by alternating questionnaires with non-questionnaire based tasks, and therefore the order of tasks remained the same for all participants. Participants were allowed to take as many breaks between tasks as they required. All test administration was completed by the researcher, who was not blind to participant group.

2.4. Data analysis

A power analysis was conducted to ascertain the sample size required to test the study hypotheses. A sample of fifty-two participants in each group was identified (although when power calculations were based on the Cognitive and Affective Eye Gaze task rather than the IRI, this figure was reduced to thirty-two). Whilst every effort was made to recruit the identified numbers, at the end of data collection only twenty-two participants had been recruited in the clinical group, and thirty-six in the control group.

It was planned to use parametric tests, in order to increase statistical power, and to allow variables thought to impact on the dependent variables to be controlled for statistically. MANCOVAs were planned to assess group differences in measures with more than one dependent variable, such as the Cognitive and Affective Eye Gaze task, and the IRI. In the Cognitive and Affective Eye Gaze task analyses, the dependent variables were:

- Second order affective, with no eye gaze cues
- Second order cognitive with no eye gaze cues
- Second order affective with eye gaze cues

- Second order cognitive with eye gaze cues
- First order affective
- First order cognitive

In the IRI task analyses, the dependent variables were 'perspective taking' and 'empathic concern'.

In all cases, the independent variable was group membership. If the MANCOVAs showed significant findings, it was planned to further explore the significance levels of individual dependent variables using individual ANOVAs, and Roy-Bargman Stepdown analyses. ANOVAs report significance of individual variables, but may provide inflated estimates of significance, as they do not take into account the correlations between dependent variables. The Roy-Bargman Stepdown analysis adjusts for these correlations, and thus provides a more reliable estimate of significance.

ANCOVAs were planned in order to assess group differences where there was only one dependent variable, namely the 'Reading the Mind in the Eyes' test[25] and the Social Functioning Scale Total Score.[34]

Correlational analyses were planned in order to assess relationships between variables. Given the high number of correlational analyses that were planned due to the large number of variables, it was decided that alpha would be set at 0.01 rather than 0.05 for the correlational analyses, in order to control for type 1 error (finding a significant result when in truth the results should have been non-significant).

Decisions regarding which variables to control for when looking at between group differences were made based on previous research. It was also considered necessary to maintain power by limiting the number of covariates where research indicated doubt as to their importance. Two independent systematic literature reviews of theory of mind deficits in people with a diagnosis of schizophrenia[3,4] have both found that age and gender had no impact on theory of mind deficits. Bora Yucel, & Pantelis[3] also found that education level had no impact on theory of mind abilities. In addition, Shamay-Tsoory et al[14] found no correlation between education level and subtests on the Cognitive and Affective Eye Gaze task. Thus, it was felt that there was no need to control statistically for differences in age, gender and education level in the theory of mind tests. However, as an additional safety mechanism to ensure integrity in results, it was decided to assess correlations between age and the theory of mind tests and control for age statistically if significant correlations were identified. The same safety mechanism could not be put in place for the variables 'gender' and 'education level', because data collection on these variables was dichotomous, and therefore correlations could not be established. Given the findings of the literature, it was decided that controlling for gender and educational level in the theory of mind tests would result in an unnecessary reduction in power, and therefore the variables were not controlled statistically.

No systematic literature reviews have been conducted regarding the impact of empathy deficits in people with a diagnosis of schizophrenia. It was therefore decided that any significant differences between the clinical and control groups in age, gender and education level would be controlled for statistically, as there was no clear evidence suggesting that these variables do not impact empathy in people with a diagnosis of

schizophrenia. Similarly, it was decided that significant differences in age, gender and education level would be controlled for statistically in the analysis of the Social Functioning Scale.[34]

3. Results

3.1. Demographic analyses

Table 1 outlines means and standard deviations for age and gender in the clinical and control groups. Education level, diagnosis and duration of illness were assessed using a categorical system, and therefore the frequencies in each category are described in Table 2. The control group was younger than the clinical group, and had a higher level of education. There were also more males in the clinical group than in the control group. These differences were found to be statistically significant; t tests and Chi square tests revealed that the groups were significantly different in age ($t(56) = -4.02$, $p=0.001$), gender ($\chi^2=10.18$, (1, $N=58$), $p=0.001$), and education level ($\chi^2=24.25$, (4, $N=58$), $p=0.001$).

Table 1. Demographic Information Regarding Age and Gender

	Clinical group (*N*=22)		Control group (*N*=36)	
	Mean	*SD*	Mean	*SD*
Age***	41.7	2.31	29.3	1.94
Male (%)***	82%		39%	

*** Significantly different between groups ($p < 0.001$)

Table 2. Frequencies for Education Level, Diagnosis, and Duration of Illness

	Frequency in each category	
	Clinical group (*N*=22)	Control group (*N*=36)
*Education level****		
No formal qualifications	7	0
GCSE level or equivalent	6	1
A level or equivalent	2	6
Undergraduate degree	6	22
Postgraduate qualification	1	7
Diagnosis		
Schizophrenia	16	
Schizoaffective Disorder	6	
Duration of illness		
less than 3 years	1	
3 to 5 years	5	
6 to 10 years	3	
11 to 15 years	3	
over 15 years	10	

*** Significantly different between groups ($p < 0.001$)

3.2. The relationship between age and theory of mind

Bivariate correlation coefficients were established between age, and all measures of theory of mind. There was a negative correlation between age and the 'Reading the Mind in the Eyes' test (r = -0.40), which was statistically significant (p=0.002). Several subscales of the Cognitive and Affective Eye Gaze task also showed statistically significant correlations with age, see Table 3. It was decided therefore to control for age statistically in all theory of mind analyses.

Table 3. Pearson Correlation Coefficients (and *p* values) of Age with the Subscales of the Cognitive and Affective Eye Gaze Task (*N*=57)

	Age	*p* value
Cognitive and Affective Eye Gaze task, reaction time (ms)		
Second order affective, with no eye gaze cues	0.27	0.042
Second order cognitive, with no eye gaze cues	0.27	0.045
Second order affective, with eye gaze cues	0.42*	0.001
Second order cognitive, with eye gaze cues	0.33	0.011
Second order physical	0.43*	0.001
First order affective	0.29	0.027
First order cognitive	0.41*	0.002
First order physical	0.43*	0.001
Cognitive and Affective Eye Gaze task, accuracy		
Second order affective, with no eye gaze cues	-0.24	0.071
Second order cognitive, with no eye gaze cues	-0.1	0.48
Second order affective, with eye gaze cues	-0.39*	0.003
Second order cognitive, with eye gaze cues	-0.38*	0.003
Second order physical	-0.06	0.68
First order affective	-0.34*	0.009
First order cognitive	-0.38*	0.004
First order physical	-0.17	0.2

* Significant correlation ($p<0.01$)

Variance and normality

In the statistical analysis of all theory of mind measures, Levene's test of equality of error variances was significant, indicating that the variance between groups was not equal. This violates the assumptions of parametric tests. The data in the Cognitive and Affective Eye Gaze task was not normally distributed, again violating parametric assumptions. However, Tabachnick and Fidell[35] state that Univariate *F* is robust to violation of assumptions so long as there are at least twenty degrees of freedom of error, and that even with an unequal *N*, a sample size of at least twenty in each group will ensure robustness (pp 251). Similarly, MANOVAs have been found to be robust to nonnormality so long overall *N* is greater than forty[36]. All analyses conducted in this study met these requirements, and therefore parametric tests were considered to be appropriate. Levene's test of equality of variance was not significant in the empathy

analyses or the analysis of the Social Functioning Scale, implying that the variance between groups was equal for this data.

3.3. Findings from the Cognitive and Affective Eye Gaze task

In analyzing the data for the Cognitive and Affective Eye Gaze task, both first and second order physical conditions (which served as a control to ensure that participants understood the task) were assessed to determine whether any clients scored below the 25% chance level. One participant did, and this person's data was subsequently excluded from the Cognitive and Affective Eye Gaze task analyses. The physical conditions were not entered into further analyses.

Group means and standard deviations for each subsection of the Cognitive and Affective Eye Gaze task are given in Table 4.

Table 4. Means and Standard Deviations for all Cognitive and Affective Eye Gaze Task Subsections.

	Clinical Group (*N* = 21)		Control Group (*N* - 36)	
	Mean	S.D.	Mean	S.D.
Cognitive and Affective eye gaze task, reaction time (ms)				
Second order affective theory of mind without eye gaze cues	14300	8850	7860	4090
Second order cognitive theory of mind without eye gaze cues	13200	9910	7810	3300
Second order affective theory of mind with eye gaze cues	9720	6070	4670	3280
Second order cognitive theory of mind with eye gaze cues	10200	6080	5340	2290
First order affective theory of mind	5440	5620	2280	1050
First order cognitive theory of mind	4490	3150	1900	586
Cognitive and Affective eye gaze task, accuracy				
Second order affective theory of mind without eye gaze cues	0.71	0.25	0.74	0.24
Second order cognitive theory of mind without eye gaze cues	0.7	0.33	0.67	0.34
Second order affective theory of mind with eye gaze cues	0.83	0.3	0.98	0.06
Second order cognitive theory of mind with eye gaze cues	0.8	0.25	0.93	0.13
First order affective theory of mind	0.86	0.23	0.99	0.04
First order cognitive theory of mind	0.86	0.27	0.98	0.07

A MANCOVA, with age as a covariate, was conducted in order to determine whether there were any significant group differences in accuracy. Results showed no significant effect of group ($F(6,49)=1.50$, $p=0.20$) or age ($F(6,49)=1.53$, $p>0.05$).

The MANCOVA analysis was repeated to determine whether there were any significant group differences in reaction time. Results showed a significant effect of group ($F(6,49)=2.93$, $p=0.016$). There was no significant effect of age ($F(6,49)=1.07$, $p=0.19$). Separate one way ANOVAs revealed that the effect of group was significant for all subsections, see Table 5.

To adjust for correlations between dependent variables, a Roy-Bargman Stepdown analysis was conducted. This revealed that when correlations were controlled, the only between-groups difference that remained significant was in the 'second order affective theory of mind without eye gaze cues' subtest. Thus, for second order conditions without eye gaze cues only, the findings suggest that people with a diagnosis of schizophrenia performed worse than controls on affective theory of mind conditions. There was no difference in cognitive theory of mind conditions. Hypothesis one (that people with a diagnosis of schizophrenia will perform significantly worse than controls on tests of affective theory of mind, but not on tests of cognitive theory of mind) seems therefore to be tentatively supported. This is however a conservative interpretation of the data. Given that the separate one way ANOVAs revealed a significant effect for all subsections, it may be that group differences were simply more statistically robust in the 'second order affective theory of mind without eye gaze cue' condition. The difference between cognitive and affective conditions on the second order theory of mind with no eye gaze cue subtests is demonstrated in Figure 4.

Table 5. Significance Values for Group Comparisons in Reaction Time on Each Subsection of the Cognitive and Affective Eye Gaze Task (*N*=57)

	Univariate analysis		Stepdown analysis	
Subsections of the Cognitive and Affective Eye Gaze task	*F*(1,54)	*p* value	*F*(1,54)	*p* value
Second order affective theory of mind without eye gaze cues	8.87	0.004	8.87	0.004
Second order cognitive theory of mind without eye gaze cues	4.08	0.048	0.0005	0.98
Second order affective theory of mind with eye gaze cues	7.05	0.01	0.52	0.47
Second order cognitive theory of mind with eye gaze cues	10.10	0.002	3.55	0.065
First order affective theory of mind	6.13	0.016	0.28	0.6
First order cognitive theory of mind	13	0.001	3.65	0.062

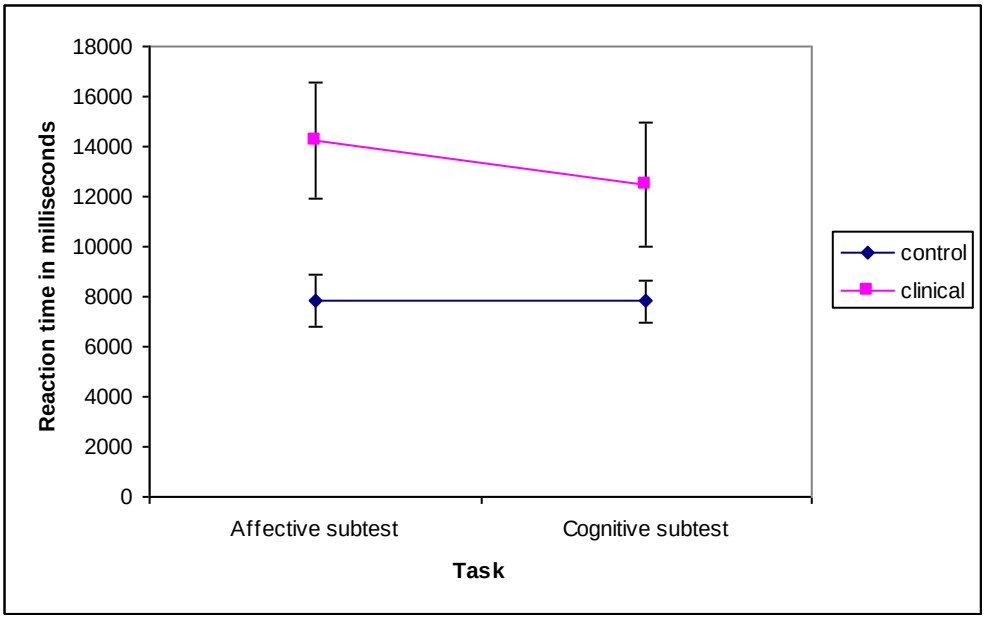

Fig. 4. Mean Scores (and 95% Confidence Intervals) Comparing Control and Clinical Groups on the Second Order Theory of Mind Tasks with No Eye Gaze Cues, from the Cognitive and Affective Eye Gaze Task (N=57).

3.4. Findings from the 'Reading the Mind in the Eyes' test

The mean score on the 'Reading the Mind in the Eyes' test for the thirty-six participants in the control group was 27.22 (*SD* 3.14). For the twenty-two participants in the clinical group, the mean score was 22.14 (*SD* 5.44). An ANCOVA was performed in order to determine whether this difference was statistically significant, controlling for age. After adjusting for age, there was a significant effect of group ($F(1,55)=10.9$, $p=0.002$), indicating that the clinical group had significantly lower scores on the 'Reading the Mind in the Eyes' test than controls.

3.5. Findings from the Interpersonal Reactivity Index (IRI)

Group means and standard deviations for the perspective taking and empathic concern subcomponents IRI are given in Table 6. A MANCOVA was conducted in order to compare scores on these subcomponents between groups, controlling for age, gender and education level. Results showed no significant group effect ($F(2,49)=0.6$, $p=0.55$). Thus, there was no support for hypothesis two, which predicted that people with a diagnosis of schizophrenia would show a deficit in the perspective taking subscale of the IRI, which reflects cognitive empathy. The results support previous research[17,18] which found no difference between groups in either cognitive or emotional empathy when using the IRI.

Table 6. Group Means and Standard Deviations for the Perspective Taking and Empathic Concern Subcomponents of the IRI

	Clinical Group (*N*=22)		Control Group (*N*=36)	
	Mean	S.D.	Mean	S.D.
Perspective Taking	20.3	5.5	19.4	3.9
Empathic concern	21.3	4.0	21.6	3.5

3.6. Findings from the Social Functioning Scale (SFS)

Mean SFS scores for both groups are given in Table 7. An ANCOVA was performed in order to determine whether there was a significant difference between groups in total SFS score, controlling for age, gender and education level. After adjusting for age, gender and education level, there was a significant effect of group ($F(1,42)=8.409$,

p=0.006), indicating that the clinical group had significantly lower total SFS scores than controls.

Table 7. Means and Standard Deviations for the Subcomponents of the SFS

	Clinical Group (*n* = 22)		Control Group (*n* - 36)	
	Mean	S.D.	Mean	S.D.
Withdrawal	11.6	2.85	14.6	1.89
Relationships	18.4	3.84	23.9	2.55
Social Activities	16.3	8.69	31.3	7.78
Recreational Activities	17.3	6.29	23.5	5.75
Independence (competence)	32.8	5.22	38.4	1.07
Independence (performance)	26.8	6.54	34.9	2.74
Employment	3.6	2.76	9.7	1.19
Total	126.8	22.84	176.2	14.1

3.7. Correlational Analyses

In order to test hypothesis three (there will be a positive correlation between affective theory of mind as measured by Shamay-Tsoory et al[14], the Reading the Mind in the Eyes test[25], and cognitive empathy) and four (affective theory of mind as measured by Shamay-Tsoory et al[14], the Reading the Mind in the Eyes test[25] and cognitive empathy will all correlate positively with the measure of social functioning), correlation coefficients were assessed between each of the subsections of the Cognitive and Affective Eye Gaze task, the 'Reading the Mind in the Eyes' test, the 'perspective taking' subsection of the IRI, and SFS total score. Tables 8 and 9 outline the correlations that were identified.

Table 8. Correlations (and *p* values) Between the Subsections of the Cognitive and Affective Eye Gaze Task (Measuring Cognitive and Affective Theory of Mind), the 'Reading the Mind in the Eyes' Test (Measuring Theory of Mind), the 'Perspective Taking' Subscale of the IRI (Measuring Cognitive Empathy), and SFS Total Score (Measuring Social Functioning) (*N*=57).

	Eyes test	Perspective Taking	SFS total
Cognitive and Affective eye gaze task, reaction time (ms)			
Second order affective, with no eye gaze cues	-0.304	0.025	-0.314
Second order cognitive, with no eye gaze cues	-0.237	-0.081	-0.321*
Second order affective, with eye gaze cues	-0.324	0.097	-0.375*
Second order cognitive, with eye gaze cues	-0.316	0.093	-0.349*
First order affective	-0.324	0.182	-0.266
First order cognitive	-0.454*	-0.314	-0.402*
Cognitive and Affective eye gaze task, accuracy			
Second order affective, with no eye gaze cues	0.207	0.109	0.031
Second order cognitive, with no eye gaze cues	0.243	-0.105	-0.14
Second order affective, with eye gaze cues	0.474*	-0.153	0.286
Second order cognitive, with eye gaze cues	0.433*	-0.202	0.286
First order affective	0.375*	-0.289	0.300
First order cognitive	0.350*	-0.313	0.286

*correlation significant ($p<0.01$)

Table 9. Correlations (and *p* values) Between the 'Reading the Mind in the Eyes' Test (Measuring Theory of Mind), the 'Perspective Taking' Subscale of the IRI (Measuring Cognitive Empathy), and SFS Total Score (Measuring Social Functioning) (*N*=58)

	Eyes test	Perspective Taking	SFS total
Eyes test	--	-0.074	0.41*
Perspective Taking		--	0.14
Empathic Concern			0.15

*correlation significant ($p<0.01$)

Table 8 shows that the 'Reading the Mind in the Eyes' test shows moderate correlations with many subsections of the Cognitive and Affective Eye Gaze task (particularly accuracy subscales), suggesting that quicker reaction time and higher scores on the Cognitive and Affective Eye Gaze task were associated with increased scores on the 'Reading the Mind in the Eyes' test, although this association was not evident for the subtests without eye gaze cues. The findings thus suggest that there is a relationship between the two measures, tentatively supporting the validity of the Cognitive and Affective Eye Gaze task as a test of theory of mind. However, the 'Reading the Mind in the Eyes' test correlated with both the cognitive and affective subcomponents of the Cognitive and Affective Eye Gaze task. Thus, the correlational analyses do not support a distinction between cognitive and affective theory of mind. In addition, the 'perspective taking' subsection of the IRI (which is thought to tap cognitive empathy) did not correlate with the 'Reading the Mind in the Eyes' test (see Table 9), or the Cognitive and Affective Eye Gaze task (see Table 8). Hypothesis three was therefore only partially supported.

Table 8 demonstrates that both the SFS total score subscale showed moderate correlations with many of the of the Cognitive and Affective Eye Gaze task reaction time subscale components, suggesting that the better the performance on the task, the better the social functioning rating. Similarly, Table 9 shows that there was a positive correlation between the 'Reading the Mind in the Eyes' test and SFS total, of moderate size. This suggests that tests of theory of mind tests do show a relationship to social functioning. However, the social functioning measures correlate with both cognitive and affective theory of mind subsections, again suggesting no distinction between

cognitive and affective theory of mind. Also, there was no correlation between SFS total and the 'perspective taking' subsection of the IRI. This suggests that no relationship between empathy and social functioning was identified. Hypothesis four, that affective theory of mind as measured by the Cognitive and Affective Eye Gaze task, the 'Reading the Mind in the Eyes' test and the perspective taking subscale of the IRI will correlate with the measure of social functioning, was thus only partially supported.

Summary. Although there were no group differences in the accuracy scores on the Cognitive and Affective Eye Gaze task, the clinical group did have significantly longer reaction times on the 'second order affective theory of mind with no eye gaze cues' subtest. There was no significant difference on the corresponding cognitive subtest. This tentatively supports the hypothesised distinction between cognitive and affective theory of mind, although the dissociation was only found in one pair of subtests. The clinical group also performed significantly worse on the 'Reading the Mind in the Eyes' test, which tested theory of mind, and the social functioning scale, testing self reported social functioning. These findings seem to support the hypothesised model (see Figure 2). In addition, the 'Reading the Mind in the Eyes' test showed significant correlations with several subsections of the Cognitive and Affective Eye Gaze task, tentatively supporting the validity of the Cognitive and Affective Eye Gaze Task as a measure of theory of mind. However, no group differences were identified on the IRI, measuring cognitive and emotional empathy. This goes against the hypothesised model. In addition, the 'perspective taking' subsection of the IRI did not correlate with either theory of mind tests or the social functioning scale. Both the Cognitive and Affective Eye Gaze task and the 'Reading the Mind in the Eyes' test showed significant

correlations with the Social Functioning Scale. However, the Social Functioning Scale correlated with both cognitive and affective theory of mind subtests. Similarly, the 'Reading the Mind in the Eyes' test correlated with both cognitive and affective subtests of the Cognitive and Affective Eye Gaze task. This contradicts the hypothesised model.

4. Discussion

The present study found little robust evidence to support the dissociation between 'cognitive' and 'affective' theory of mind. Results from the Cognitive and Affective Eye Gaze task demonstrate that people in the clinical group did perform worse than controls on one 'affective' subtest, but not the corresponding 'cognitive' subtest. This finding is similar to that of Shamey-Tsoory et al,[14] who found that people with a diagnosis of schizophrenia performed worse than controls on 'affective' theory of mind subtests, but not on 'cognitive' subtests. However, in the present study, the finding was only apparent in reaction time measurements, and only on second order theory of mind subtests that did not provide eye gaze cues. Explanations for why group differences were only noted in the subtests with no eye cues include lack of statistical power, or the impact of ceiling effects. In both the first order subtests and second order subtests with eye cues, a correct response could be determined by understanding that Joe was thinking about the object that he was looking at, and following his eye gaze (See Figure 3). In the second order conditions with eye gaze cues, there was little need to consider what the other characters in the stimulus were thinking, making the task easier. The subtests with no eye cues were more difficult, because the participant must establish what each of Joe's friends is thinking, as well as what Joe is thinking, before they come to a correct conclusion. Thus, it may be that difficulties in affective theory of mind only become apparent in people with a diagnosis of schizophrenia when the task is harder.

This argument fits with the finding that there was no significant difference in accuracy score. The present results suggest that people with a diagnosis of schizophrenia are not unable to perform tasks such as the Cognitive and Affective Eye Gaze task, and given enough time, they can produce accuracy scores similar to control groups. However, they may have difficulty with tasks relating to 'affective' theory of mind, and thus they may need more time to complete these items. Also, in real time, theory of mind cues may only be available for a short amount of time, leading to difficulty in social situations.

Figure 4 outlines the difference between 'cognitive' and 'affective' 'no eye gaze cue' subtest results in the clinical and control group. The graph seems to suggest that the clinical group had a poorer performance than the control group in both 'cognitive' and 'affective' subtests, with the difference in the 'affective' subtest being greater. However, following stepdown analyses, the difference was only significant in the 'affective' subtest. It may be that the data set is suffering from type 2 error (a finding of non-significant results when in truth the results are significant), perhaps caused by low power, possibly due to small sample size, or large heterogeneity within the clinical sample. Future research should attempt to replicate these findings, in order to determine whether a difference can be identified in the cognitive subtests when a less heterogeneous, or a larger, sample is used.

The present results demonstrate that people with a diagnosis of schizophrenia appear to have difficulty in the 'Reading the Mind in the Eyes' test.[25] This replicates previous findings.[10,31,37] The 'Reading the Mind in the Eyes' test correlated with many of the subsections of the Cognitive and Affective Eye Gaze task, particularly in the accuracy

subsections. The correlation sizes were not large, and thus do not provide clear evidence that the two tools were measuring the same construct, but the demonstration of a relationship between the tools provides at least some preliminary evidence to support the convergent validity of the Cognitive and Affective Eye Gaze task as a measure of theory of mind. Results were not significant for the 'no eye gaze cue' subsections, and also not significant for many of the reaction time subsections. This may be due to type 2 error, caused by small numbers of participants. When alpha was set at the less stringent 0.05 level, many of the reaction time correlations became significant.

The 'Reading the Mind in the Eyes' test did not correlate exclusively with the 'affective' subsections of the Cognitive and Affective Eye Gaze task as predicted; instead it showed similar strength correlations with both 'cognitive' and 'affective' subsections. This does not support the divergent validity of 'cognitive' and 'affective' theory of mind. Rather, it implies that both 'cognitive' and 'affective' subsections of the Cognitive and Affective Eye Gaze task tap an underlying theory of mind ability which the 'Reading the Mind in the Eyes' test also taps.

The present findings show that people with a diagnosis of schizophrenia report significantly lower levels of social functioning than the control group. This in itself is unsurprising, given that difficulty in social functioning is one of the key features of schizophrenia.[38] Of more interest are the correlations between self reported social functioning and the measures of theory of mind. The Social Functioning Scale correlated significantly with both the 'Reading the Mind in the Eyes' test, and many of the Cognitive and Affective Eye Gaze subsections. This suggests that poor theory of mind is related to poor social functioning, as reported by Couture, Penn & Roberts.[28]

However, once again, the SFS did not correlate exclusively with 'affective' subsections of the Cognitive and Affective Eye Gaze task; it correlated with both 'cognitive' and 'affective' subtasks to a similar degree. Again, there is no evidence for the divergent validity of 'cognitive' and 'affective' theory of mind, and more support for an underlying theory of mind ability that is related to social functioning.

This study found no difference in either cognitive or emotional empathy between the clinical and the control groups. This suggests that people with a diagnosis of schizophrenia do not report any difficulties in empathic abilities. The finding goes against the hypothesis that people with a diagnosis of schizophrenia would demonstrate difficulties in cognitive empathy, and also contradicts the hypothesis that 'affective' theory of mind and cognitive empathy reflect the same underlying construct. One possible explanation for the null findings concerning empathy may be that self report empathy measures were used. Bora, Gokcen and Veznedaroglu[17] asked people with a diagnosis of schizophrenia to complete the Empathy Quotient,[26] and also asked the relatives and spouses of the participants to rate them using the same measure. They found that there was no difference between participants in the clinical groups and a control group when self reported measures of empathy were analyzed. However, they did find a significant difference in empathy between clinical and control groups when relative/spouse ratings were considered. This deficit correlated significantly with the Reading the Mind in the Eyes test. It may therefore be that patterns of cognitive and emotional empathy in people with a diagnosis of schizophrenia cannot be reliably assessed using self report measures. The may account for the variability in findings observed within the literature regarding empathy difficulties in people with a diagnosis of schizophrenia.[18,20,21] Future research should explore the relationship between theory

of mind and cognitive and emotional empathy using relative/spouse rated measures. Additionally, non-questionnaire measures of empathy may be considered in future research. Blair and his colleagues[39] have used galvanic skin response (GSR) to distress cues as a measure of affective empathy in their work exploring empathy deficits in psychopathy. It may be that similar techniques could be employed in empathy research within the field of schizophrenia.

4.1. Conceptual Models

Regarding the dissociation between 'cognitive' and 'affective' theory of mind, the evidence presented in this study is contradictory. The findings from the Cognitive and Affective Eye Gaze task suggest that there is a dissociation, whilst the findings from the correlational analyses suggest otherwise. Two possible explanations for these findings seem evident; either type 2 error due to sample heterogeneity masked a difference between groups on the 'cognitive second order no eye gaze' subtest of the Cognitive and Affective Eye Gaze task, implying deficits in both 'cognitive' and 'affective' theory of mind, or differential correlation patterns between 'cognitive' and 'affective' theory of mind which would have supported the hypothesised model were masked by small sample size and heterogeneity within the data.

The present study cannot distinguish between these two alternatives. However, given the patterns displayed in Figure 4, the idea of a difference on both the 'cognitive' and 'affective' subtests that is masked by type 2 error is tentatively favoured. Thus, there is at present little evidence to support the model tested by this study. However, it does seem that people with a diagnosis of schizophrenia have greater difficulty with theory of mind tasks that have an emotional component, and this finding requires explanation.

Figure 5 presents an alternative model to account for the identified relationships between theory of mind, empathy and social functioning. The model is designed to account for the present findings of this study, and to fit them into the current literature.

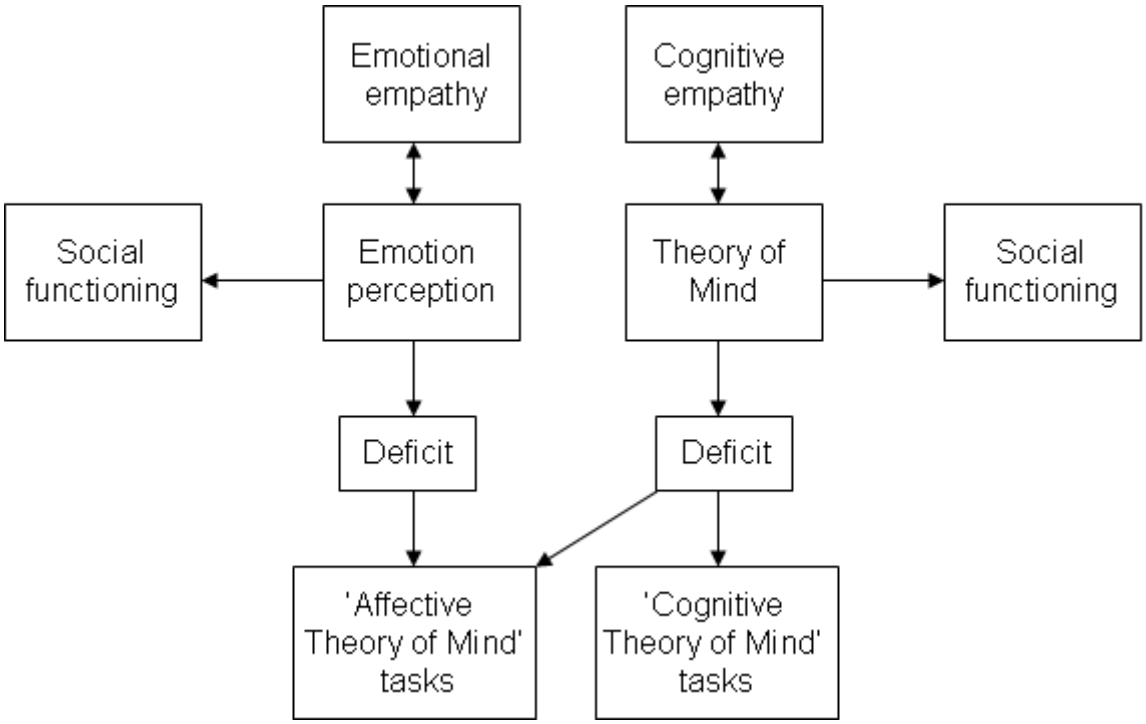

Fig. 5. Alternative Conceptual Model for the Relationship Between Theory of Mind, Empathy, Social Functioning, and Emotion Perception.

Rather than 'cognitive' and 'affective' theory of mind tasks reflecting separate concepts, it may be that what has been described as 'cognitive' theory of mind reflects a unitary theory of mind construct, whilst what has been described as 'affective' theory of mind reflects theory of mind combined with other social cognition skills, such as emotion perception. Evidence suggests that people with a diagnosis of schizophrenia have deficits in emotion perception in addition to deficits in theory of mind.[40,41,42] It may be that the combination of difficulties with theory of mind in addition to difficulties in

emotion perception means that tasks involving the prediction of emotions in other people are particularly hard for people with a diagnosis of schizophrenia. This may explain the pattern of difficulties found in some of the literature reviewed whereby theory of mind is divided into two separable constructs, whereas in fact theory of mind is a unitary construct, with emotion perception as a separate, but linked, deficit. In support of this argument, Badgaiyan[43] has argued that a deficit in social cognition skills such as the ability to recognize facial expression interferes with performance on theory of mind tasks in people with a diagnosis of schizophrenia. However, the model presented in Figure 5 must be considered purely speculative at this stage, and requires empirical testing by future research.

The model presented in Figure 5 argues that cognitive empathy may be related to theory of mind, whilst affective empathy may be more closely linked to emotion perception. Whilst the present study failed to identify any deficits in empathy for people with a diagnosis of schizophrenia, the findings of Bora, Gokcen and Veznedaroglu[17] suggest that this null finding may have been due to the use of a self report measure of empathy rather than a lack of deficit. Several researchers have argued that cognitive empathy and theory of mind represent the same construct.[15,16] Some researchers have also argued that there is a link between affective empathy and emotion perception. Atkinson[44] reviews various models describing the relationship between emotion perception and emotional contagion, the phenomenon referred to in this paper as 'emotional empathy'. However, other researchers have suggested that emotion perception is an aspect of empathy that is distinct from both cognitive and emotional empathy. Both Lee[45] and Derntl et al[18] describe three pronged models of empathy involving an emotional perception component, an affective responsiveness or vicarious

arousal component (i.e. emotional empathy), and a cognitive empathy component. The relationship between empathy components and emotional perception should be further explored in future research.

In investigating the relationships between theory of mind, empathy and emotion perception as outlined in Figure 5, it will be important for future research to continue to assess the relationship of these constructs with social functioning. This study identified a relationship between social functioning and measures of theory of mind. Couture, Penn and Roberts[28] have argued that both theory of mind and emotion perception are related to social functioning in schizophrenia, but this relationship must continue to be examined in social cognition research, in order to demonstrate that the research has implications for real world situations for people with a diagnosis of schizophrenia.

4.2. Limitations of the present study

There were several limitations to this study. Firstly, the clinical sample was very heterogeneous, which may have produced variability in the data which increased the level of type 2 error, masking significant differences in 'cognitive' theory of mind. This heterogeneity is inherent in psychosis research, as the diagnosis 'schizophrenia' encompasses people with a diverse range of symptoms and experiences. Indeed, Bentall[46] has argued that the very concept of 'schizophrenia' is not valid, and a more useful approach would be to try to develop an understanding of specific experiences of clients, such as unusual beliefs or voice hearing. Some researchers have found a link between theory of mind difficulties and negative symptoms of schizophrenia.[14,47] It may be that focusing social cognitive research on people who experience specific

symptoms, such as negative symptoms, would produce more homogenous results and thus reduce type 2 error.

Although the concept of 'schizophrenia' is naturally heterogeneous, there were aspects of this study design that may have led to increases in heterogeneity. Participants were recruited from both inpatient and outpatient settings, which may have increased variability due to differing levels of symptom severity. In particular, assessing social functioning in inpatients may have biased the results as inpatients may not have as much opportunity to engage in social activities as outpatients. However, it was considered that the difficulties that led to inpatient stay being necessitated probably represented a difficulty in social functioning in itself; reduced social functioning was considered to reflect a cause rather than purely a result of inpatient stay, and thus the risk of bias was considered acceptable.

In addition, the sample included people with a diagnosis of schizoaffective disorder as well as people with a diagnosis of schizophrenia. There is some evidence to suggest that people with a diagnosis of schizoaffective disorder may perform better than people with a diagnosis of schizophrenia on tests of Theory of Mind.[48] Whilst this finding would decrease rather than increase the likelihood of finding a difference between clinical and control groups and thus does not invalidate the present findings, it may have contributed to the variability which increased type 2 error.

A second difficulty with the present study was that there were significant differences between the clinical and the control group on demographic factors such as age, gender and educational level. Whilst systematic literature reviews confirm that these factors do

not impact significantly on theory of mind in schizophrenia,[3] there is no evidence as yet to suggest that they do not impact on empathy in schizophrenia, and as such it was necessary to control statistically for these variables. This reduced power in the current study. Future research should match clinical and control groups on these variables, to ensure a more powerful study design. Similarly, the power of the present study was reduced by the relatively small sample size in the clinical group. Future research should attempt to use larger sample sizes in order to improve power.

A final limitation of the present study was the use of theory of mind measures for which reliability coefficients have not yet been established. Lack of reliability coefficients limits the validity of a measure. However, Troisi[49] makes the point that many social cognition tasks have dubious validity, thus the problem seems to be apparent throughout the field of social cognition research. Future research should pay attention to establishing reliability and validity coefficients for all social cognition measures commonly in use.

This research investigates the correlation between various aspects of social cognition and social functioning. However, it is important to remember that correlation does not imply causality. Therefore it cannot be inferred that social cognition deficits cause difficulties in social functioning. On the contrary, given that schizophrenia typically develops in adolescence or early adulthood,[50] it may be that difficulty in social functioning, or some other factor connected to psychosis such as stigma, leads to social exclusion, resulting in reduced opportunities to learn and develop social cognitive skills at a critical stage in social development. This theory could be investigated by using

longitudinal research designs, exploring the impact of early social exclusion on later social cognitive skills.

4.3. Clinical Implications

Research in this area has important implications for clinical work with people with a diagnosis of schizophrenia. It is interesting to note that the mean score of the clinical group on the Reading the Mind in the Eyes test in this study (22.1, *SD* 5.44) is very similar to the mean score reported by Baron-Cohen et al[25] for people with a diagnosis of Asperger's Syndrome (21.9, *SD* 6.6). Future research may usefully compare performance of people with a diagnosis of schizophrenia with that of people with a diagnosis of Asperger's Syndrome, as similarities between the two clinical groups may suggest that interventions appropriate for people with Asperger's Syndrome are also appropriate for people with a diagnosis of schizophrenia. Indeed, some techniques for improving facial emotion perception in autistic children have already been applied to schizophrenia, with some success.[51] It may be that this research can be expanded by adapting theory of mind interventions designed for people with Asperger's Syndrome for an audience of people with psychosis.

Roncone et al[52] demonstrated that a social cognition rehabilitation programme focussing on metacognition and theory of mind could improve social functioning and symptomology outcomes for participants with a diagnosis of schizophrenia. It may be that rehabilitation programmes designed to target theory of mind, empathy and emotion perception may have even greater success. This study highlights the importance of covering emotional aspects of theory of mind in addition to purely cognitive aspects, as people with a diagnosis of schizophrenia appear to have even greater difficulty in these

areas than in theory of mind tasks that do not involve emotion. By developing a more precise understanding of the exact nature of social cognition deficits in schizophrenia and how they relate to social functioning, it may be possible to design ever more relevant and helpful rehabilitation packages to assist recovery in people with a diagnosis of schizophrenia.

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Part Three

Appendices

Appendix A - Reflective Statement

Conducting my doctoral research into social cognition in people with a diagnosis of schizophrenia has presented me with many challenges, and opportunities for learning and development. The purpose of this statement is to consider the process I underwent during the course of my research, to reflect on difficulties I experienced, and what I learned from these difficulties. I will first discuss the process of formulating my research ideas. Next, I will discuss several obstacles I met in the research process, and how I dealt with them. I will also discuss my selection of journal for submission. Finally, I will consider the many gains and learning points I have encountered through my research.

My current research idea stemmed from an interest in social cognition that I developed during my undergraduate degree in Psychology. During my undergraduate qualification I conducted a literature review on empathy in psychopathy, and thus became interested in the dissociation between cognitive and emotional empathy, and the clinical implications this might have. I was curious about whether there was a dissociation between cognitive and affective empathy in schizophrenia, in the same way as there appears to be in psychopathy and autism. When I reviewed the literature on empathy in schizophrenia, I found that very little work had been done in the area, which confirmed my desire to pursue this line of research for my doctoral research project.

Originally, I had planned to use behavioural measures to assess cognitive and emotional empathy. I had hoped to use theory of mind tasks to measure cognitive empathy, and galvanic skin response (GSR) to distress cues to measure emotional empathy.

Unfortunately, I came across two major difficulties in the design of this experiment. Firstly, when I enquired within the Psychology department about the possibility of using galvanic skin response technology, I discovered that researchers using such equipment are required to undergo extensive training, which would have been impossible for me to complete, given the time demands of the Clinical Psychology doctorate. Secondly, as I researched empathy and the related topic of theory of mind in psychosis, I began to develop awareness that theory of mind may not be a unitary construct. This shook my original assumption that theory of mind and cognitive empathy were equivalent, and I felt that I could not justify using theory of mind tests to measure cognitive empathy until I was certain that the concepts were equivalent. From reflecting on these difficulties, my current research project emerged.

For me, the journey to developing my final research project was therefore not straightforward; it involved dead ends, false starts, and backtracking. I have learned that research is not a simple case of having an idea and testing it; instead the process is more circular. An idea is formed, it is researched and developed, then it is evaluated and revised, and then the revised idea is researched, developed and evaluated. Understanding this will help me dedicate sufficient time to research design in the future. It is also heartening to consider research design as a circular process, in order to stop one feeling like no progress has been made when early ideas have to be rejected.

The most major obstacle that I experienced conducting my research was finding participants. Understanding that recruiting would be hard, I began contacting teams to discuss the research as early as January 2008. However, teams understandably wanted to wait until I had gained ethical approval before they considered my proposal, and thus

I was unable to begin involving teams in my research until June 2008. I originally thought that this would still leave plenty of time for recruitment, but I underestimated the time it would take to obtain approval from teams, and I also underestimated how few participants each team would be able to provide me with. I found that in order to arrange attendance at a team meeting to present my research proposal, I needed to identify and email the team leader, and follow the email up with several phone calls. In several places I also contacted the team psychologist to act as an advocate for me. Once I had contacted the team leader, I often had to wait a month or so for an appropriate meeting slot to become available. Then I had to wait for the team to make a decision regarding whether or not they wished to get involved in the research, and following this was a process by which I phoned the team on a regular basis in order to establish whether any potential participants had been identified and contacted.

Although I enlisted 14 teams in total, the majority of teams provided me with only one or two participants, with many teams being unable to find any potential participants at all. Consequently, the process required a very large time investment, with minimal return. Frustrating as this was, I feel that the process has provided me with many opportunities for learning. I have developed skills in contacting other professionals, and have learned the importance of being assertive. For me, assertiveness is not something that comes naturally, and initially I was worried about coming across as 'nagging'. However, I learned that the best strategy was to identify a team member who could be my link person during the initial meeting, and to agree a deadline with the team by which time I could contact the link person to find out whether the team was willing to get involved. I learned to overcome my fear of phoning my link person to find out whether participants had been identified, and found that rather than being a 'nag', I was

able to build up good working relationships with these people. I believe that these skills in team working will be very useful to me in my future career. In future research, I suspect that recruitment would be easier if it were done with the assistance of teams that I already had a working relationship with, and also had regular contact with. I have learned never to underestimate the difficulty of finding research participants, and in the future I will ensure that I am confident about being able to access participants before I undertake any research project.

Because recruiting participants to my clinical group required so much time and effort, I was unable to put a huge amount of time into recruiting my control group. This meant that my control group compromised mostly of students, leading to significant differences between groups in age and education level. Controlling for these variables statistically reduced the power of my experiment. In the future, I will ensure I dedicate sufficient time to recruiting a community based control sample, to minimise group differences on variables such as age, gender and education level.

A second flaw that I noticed in my research only when I came to analyse my data was the use of tick boxes in my demographic questionnaire. This meant that the data I collected was predominantly categorical rather than continuous, making it much less flexible in data analysis. In particular, I was unable to run correlational analyses between items such as 'education level' and 'duration of illness', and my outcome variables. This would have been useful data, and it would have been just as easy to collect continuous data as categorical for these variables. Therefore, in future, I will ensure that my data is continuous, if this is possible.

An important point for me to reflect on has been the necessity to exclude a participant from my control group due to a later diagnosis of schizoaffective disorder. In the design of my experiment, I anticipated the potential for uncovering psychotic symptoms in my control group. I made it clear in my ethics form that should such symptoms be uncovered, I would use my clinical skills to talk to the person about the experiences they were having, and contact the individual's G.P. I added a section into my consent form which enabled me to contact the participants G.P. should such symptoms be uncovered, and naturally covered this in my information leaflets. However, in actuality the participant in question gave no indication of having any psychotic symptoms when questioned during the SCID. It was about six months after testing that the participant contacted me to inform me that she had in fact had psychotic experiences in the past, and now that they were reoccurring, she had gone to her G.P., been referred to a psychiatrist, and been given a diagnosis of schizoaffective disorder. The reflection point seems to be that instruments such as the SCID are not infallible, and depend on the participant being in a position to give an honest answer. I do not believe that the participant in question was purposefully untruthful (indeed, she demonstrated great integrity by contacting me to let me know about her diagnosis), but denial is a powerful force and it would be easy to convince oneself that such experiences were too unimportant to mention, especially if one was afraid that their G.P. would be contacted should these experiences be discussed. Particularly when working with psychosis, the impact of stigma is enormous, and apparently impacts instruments such as the SCID. In the future, I will be more aware of the possibility that my control group may be experiencing mental health difficulties, and may be afraid to talk about them for fear of being labelled. I will be aware that this may impact on my assessment tools, and introduce a level of error into my results.

I decided to submit both of my papers to the journal 'Schizophrenia Bulletin' for several reasons. Firstly, I wanted to submit my papers to a highly respected journal that focussed specifically on schizophrenia. This would allow the articles to reach an audience of people with a specialised interest in psychosis, including many people who have psychotic experiences themselves. The two obvious journals that fell into this category were 'Schizophrenia Bulletin' and 'Schizophrenia Research'. Of the two, I selected 'Schizophrenia Bulletin' because it had a higher impact rating, and because it published a review paper that was influential to me in the design of my own systematic literature review paper.

Whilst the process of conducting my doctoral research has at times been challenging, I feel that I have gained some very valuable experiences through the course of the research. Aside from developing my skills in research design, implementation and analysis, I have had experience of working with clients and professionals in a wide variety of different settings, including community mental health teams, assertive outreach teams, acute inpatient units, and rehabilitation units. This has improved my knowledge of the different contexts that may be relevant when working with people who have a diagnosis of schizophrenia, and will be highly useful in my future career. I have also had the opportunity to hear the stories and experiences of participants, which has been a very powerful experience for me. In some instances, the stories were very sad, and it saddens me to realise how small the social networks of some service users are. However, other stories were positive, and inspired a real sense of hope. In particular, a few participants shared with me the process of their recovery, and how they made sense of their experiences and overcame their difficulties. Some people told me

about how their experiences were meaningful for them, or helped them understand their emotional state. These stories impressed on me the individuality of psychotic experience and recovery, and will have a lasting impact on my clinical work.

Appendix B – Author Guidelines for Schizophrenia Bulletin

Schizophrenia Bulletin - Information for Authors

Schizophrenia Bulletin is an international peer-reviewed journal that publishes original reports and reviews of clinical and experimental research relating to all aspects of schizophrenia. Each issue is based on one or more themes with articles about recent advances in the clinical and basic scientific aspects of that area. A guest editor will be responsible for planning and organizing the theme content and will typically invite contributions from leaders in the field. Themes for future issues will be published in advance. *Schizophrenia Bulletin* will consider unsolicited full-length manuscripts relating to any aspect of a future theme issue provided they have scientific merit and represent an important advance in knowledge. The *Bulletin* will also regularly publish an *At Issue* section containing unsolicited articles on theory or controversial topics including issues in ethics. Historical perspectives from patients and their families are also welcome.

EDITORIAL POLICIES

Manuscripts must be written in English and are accepted for consideration with an explicit understanding that the material has not been previously published in whole or substantial part and is not currently under consideration for publication by any other journal. All matters relating to the editorial policies of *Schizophrenia Bulletin* should be addressed in writing to Prof. William Carpenter, M.D., Editor-in Chief, *Schizophrenia Bulletin* Editorial Office, Maryland Psychiatric Research Center, PO Box 21247, Baltimore, MD 21228, USA. Manuscripts should be submitted at www.schizophreniabulletin.oxfordjournals.org as instructed below.

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Informed Consent and Ethics Committee Approval

Manuscripts reporting experiments on patients or healthy volunteers must record the fact that the subjects' consent was obtained and include a statement that the research was approved by the responsible ethical committee of the institution (e.g., an institutional review board) and was consistent with the principles outlined in an

internationally recognized standard for the ethical conduct of human research. Consent must be also recorded when photographs of patients are shown or other details given that could lead to the identification of the individuals. Authors may be required to provide tangible proof that the necessary permissions and consents have been obtained from study participants.

Laboratory Animals

Manuscripts reporting the results of experiments involving laboratory animals must be contain a statement indicating that the procedures used were in accordance with the guidelines published in the Institute of Laboratory Animals Resources Commission on Life Sciences' 1996 *Guide for the Care and Use of Laboratory Animals* (Washington, DC: National Academic Press; http://www.nap.edu/readingroom/books/labrats) or a similar internationally recognized standard. The species, sex, source, and genetic background of the animals as well as a detailed description of the experimental procedures, including any anesthetics and/or analgesics, must be provided in the Methods section of the manuscript.

Manuscripts containing data from human or animal experimentation may be rejected if the ethical aspects are open to question. The corresponding author will be held responsible for false statements or for failure to meet the aforementioned requirements.

Conflict of Interest

At the point of submission, *Schizophrenia Bulletin's* policy requires that each author reveal any financial interests or connections, direct or indirect, or other situations that might raise the question of bias in the work reported or the conclusions, implications, or opinions stated - including pertinent commercial or other sources of funding for the individual author(s) or for the associated department(s) or organization(s), personal relationships, or direct academic competition. When considering whether you should declare a conflicting interest or connection please consider the conflict of interest test: Is there any arrangement that would embarrass you or any of your co-authors if it was to emerge after publication and you had not declared it?

As an integral part of the online submission process, Corresponding authors are required to confirm whether they or their co-authors have any conflicts of interest to declare, and to provide details of these. If the Corresponding author is unable to confirm this information on behalf of all co-authors, the authors in question will then be required to submit a completed Conflict of Interest form to the Editorial Office. It is the Corresponding author’s responsibility to ensure that all authors adhere to this policy.

If the manuscript is published, Conflict of Interest information will be communicated in a statement in the published

Funding

Details of all funding sources for the work in question should be given in a separate section entitled 'Funding'. This should appear before the 'Acknowledgements' section.

The following rules should be followed:

- The sentence should begin: ‘This work was supported by …’
- The full official funding agency name should be given, i.e. ‘National Institutes of Health’, not ‘NIH’ (full RIN-approved list of UK funding agencies) Grant numbers should be given in brackets as follows: ‘[grant number xxxx]’
- Multiple grant numbers should be separated by a comma as follows: ‘[grant numbers xxxx, yyyy]’
- Agencies should be separated by a semi-colon (plus ‘and’ before the last funding agency)
- Where individuals need to be specified for certain sources of funding the following text should be added after the relevant agency or grant number 'to [author initials]'.

An example is given here: ‘This work was supported by the National Institutes of Health [AA123456 to C.S., BB765432 to M.H.]; and the Alcohol & Education Research Council [hfygr667789].

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Title Page

This page should consist of (i) the complete title of the manuscript, (ii) a running title not to exceed 50 characters including spaces, (iii) the full name of each author and the authors' institutional affiliations, (iv) name, complete address, telephone, fax, and e-mail address of the corresponding author, and (v) separate word counts of the abstract and text body.

Abstract

Provide a summary of no more than 250 words describing why and how the study, analysis, or review was done, a summary of the essential results, and what the authors

have concluded from the data. The abstract should not contain unexplained abbreviations. Up to six key words that do not appear as part of the title should be provided at the end of the abstract.

Main Text

Unsolicited original manuscripts reporting novel experimental findings should be comprised of these sections, in this order: Abstract, Introduction, Methods, Results, Discussion, Acknowledgments, References, and Figure Legends. Review articles must contain an abstract; however, the body of the text can be organized in a less structured format. Authors of review articles are encouraged to use section headers to improve the readability of their manuscript.

Number pages consecutively beginning with the title page. Spelling should conform to that used in *Merriam-Webster's Collegiate Dictionary,* eleventh edition. Clinical laboratory data may be expressed in conventional rather than Système International (SI) units.

Acknowledgments

These should be as brief as possible but include the names of sources of logistical support.

References

Each reference should be cited in consecutive numerical order using superscript arabic numerals, and reference style should follow the recommendations in the *American Medical Association Manual of Style*, 10th edition, with one exception: in the reference list, the name of all authors should be given unless there are more than 6, in which case the names of the first 3 authors are used, followed by "et al."

- Book: Talairach J, Tournoux P. *Co-planar stereotaxic atlas of the human brain*. New York, NY: Thieme Medical Publishers; 1998.
- Book chapter: Goldberg TE, David A, Gold JM. Neurocognitive deficits in schizophrenia. In: Hirsch SR, Weinberger DR, eds. *Schizophrenia*. Oxford, England: Blackwell Science; 2003:168-184.
- Journal article: Thaker GK, Carpenter WT. Advances in schizophrenia. *Nat Med* 2001;7:667-671.
- Journal article with more than 6 authors: Egan MF, Straub RE, Goldberg TE, et al. Variation in GRM3 affects cognition, prefrontal gluatamate, and risk for schizophrenia. *Proc Natl Acad Sci USA* 2004;101:12604-12609.
- Article published on Advance Access only: Gilad, Y. and Lancet, D. March 5, 2003. Population Differences in the Human Functional Olfactory Repertoire. *Mol Biol Evol* doi:10.1093/molbev/msg013.
- Article first published on Advance Access: Gilad, Y. and Lancet, D. 2003. Population Differences in the Human Functional Olfactory Repertoire *Mol Biol Evol* 2003;20:307-314. First published on March 5, 2003, doi:10.1093/molbev/msg013.

Journal names should be abbreviated in accordance with *Index Medicus* (www.nlm.nih.gov/tsd/serials/lji.html).

Manuscripts in which the references do not follow this format will be returned for retyping. References to meeting abstracts, material not yet accepted for publication, or personal communications are not acceptable as listed references and instead should be listed parenthetically in the text. It is the authors' responsibility for obtaining the necessary permissions from colleagues to include their work as a personal communication.

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Figures and Tables

Figures and tables must be referred to using arabic numbers in order of their appearance in the text (e.g., Figure 1, Figure 2, Table 1, Table 2, etc.).

Tables should be created with the table function of a word processing program; spreadsheets are not acceptable. Include only essential data, and format the table in a manner in which it should appear in the text. Each table must fit on a single manuscript page and have a short title that is self-explanatory without reference to the text. Footnotes can be used to explain any symbols or abbreviations appearing in the table. Do not duplicate data in tables and figures.

Please be aware that the figure requirements for initial online submission (peer review) and for reproduction in the journal are different. Initially, it is preferred to embed your figures within the word processing file or upload them separately as low-resolution images (.jpg, .tif, or .gif files). However, upon submission of a revised manuscript, you will be required to supply high-resolution .tif files for reproduction in the journal (1200 d.p.i. for line drawings and 300 d.p.i. for color and half-tone artwork). It is advisable to create high-resolution images first as these can be easily converted into low-resolution images for online submission. Figure legends should be typed separately from the figures in the main text document. Additional information on preparing your figures for publication can be located at http://cpc.cadmus.com/da.

Wherever possible figures should be submitted in their desired final size, to fit the width of a single (88 mm) or at most a double (180 mm) column width. All letters and numerals appearing in a particular figure should be of the same size and in proportion to the overall dimensions of the drawing. Letter labels used in figures should be in upper case in both the figure and the legend. The journal reserves the right to reduce the size of illustrative material.

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Appendix C – Items in the Downs and Black Quality Checklist

1. Is the hypothesis/aim/objective of the study clearly described?
2. Are the main outcomes to be measured clearly describes in the Introduction or Methods section?
3. Are the characteristics of the patients included in the study clearly described?
4. Are the interviews of interests clearly described?
5. Are the distributions of principal confounders in each group of subjects to be compared clearly described?
6. Are the main findings of the study clearly described?
7. Does the study provide estimates of the random variability in the data for the main outcomes?
8. Have all important adverse events that may be a consequence of the intervention been reported?
9. Have the characteristics of patients lost to follow-up been described?
10. Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where probability value is less than 0.001?
11. Were the subjects asked to participate in the study representative of the entire population from which they were recruited?
12. Were those subjects who were prepared to participate representative of the entire population from which they were recruited?
13. Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive?
14. Was an attempt made to blind study subjects to the intervention they have received?

15. Was an attempt made to blind those measuring the main outcomes of the intervention?
16. If any of the results of the study were based on “data dredging”, was this made clear?
17. In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case-control studies, is the time period between the intervention and outcome the same for case controls?
18. Were the statistical tests used to assess the main outcomes appropriate?
19. Was compliance with the intervention/s reliable?
20. Were the main outcome measures used accurate (valid and reliable)?
21. Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?
22. Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited over the same period of time?
23. Were study subjects randomised to intervention groups?
24. Was the randomised intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable?
25. Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?
26. Were losses of patients to follow-up taken into account?
27. Did the study have sufficient power to detect a clinically important effect were the probability value for a different being due to chance is less than 5%?

Appendix D – Quality Scoring of Papers

	Quality Checklist Item Number																											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**Total**
Penn & Combs[51]	1	1	1	1	2	1	1	0	1	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	1	1	0	18
Frommann, Streit & Wolwer[44]	1	0	0	1	1	1	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	9
Silver et al[47]																												No control group
Wolwer et al[48]	1	1	0	1	1	0	1	0	1	1	0	0	0	0	0	1	1	0	1	0	1	0	1	0	1	0	0	13
Combs et al[50]	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0	1	1	0	1	0	1	0	1	0	1	1	0	11
Russell et al[45]	1	1	0	1	1	1	1	0	1	1	0	0	0	0	0	1	1	1	1	0	0	0	0	0	1	1	0	14
Russell et al[46]	1	1	1	1	2	1	1	0	1	1	0	0	0	0	0	1	0	1	1	0	1	0	1	0	1	1	0	17
Combs et al[49]	1	1	1	1	2	1	1	0	1	1	0	0	0	0	0	1	1	1	1	1	1	0	1	0	1	1	0	19
Corrigan, Hirshbeck, Wolfe[64]	1	1	1	1	2	1	1	0	1	0	0	1	0	0	0	1	1	1	1	0	1	0	1	0	1	1	0	18
Garcia et al[62]	0	1	1	1	2	1	1	0	0	1	0	0	0	0	0	1	1	1	0	1	1	0	1	0	0	0	0	14
Fuentes et al[63]	1	1	1	0	2	0	0	0	1	1	0	0	0	0	0	1	1	0	1	1	1	0	1	0	1	0	0	14
Sarfati, Passerieux & Hardy-Bayle[70]	1	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	0	14

Appendix D continued

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**Total**
Roncone et al[71]	1	1	1	1	2	1	1	0	1	0	0	0	0	0	1	1	1	1	1	1	1	0	1	0	1	1	0	19
Keyser et al[79]	1	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	1	1	1	0	1	0	1	0	1	1	0	16
Moritz & Woodward[81]	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	1	1	1	1	0	1	0	1	0	1	1	0	15
Jao & Lu[82]	1	1	1	1	1	1	1	0	1	1	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	0	17
Liberman, Ekman & Marder[84]	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	1	1	0	0	1	1	0	0	0	1	0	0	9
Kern et al[87]	1	1	1	1	1	0	0	0	1	1	0	0	0	0	1	1	1	0	1	1	1	0	1	0	1	0	0	15
Ucok et al[88]	1	1	1	1	2	1	1	0	0	1	0	0	0	0	0	1	1	0	1	0	1	0	1	0	1	1	0	16
Penn et al[92]																												No control group
Choi & Kwon[95]	1	1	1	1	2	1	1	0	1	0	1	0	0	0	0	1	1	1	1	0	1	0	1	0	1	0	0	17
Combs et al[34]	1	1	0	1	1	1	1	0	1	0	0	0	0	0	1	1	1	0	1	1	1	0	0	0	1	1	0	15
Horan et al[94]	0	1	1	1	2	1	1	0	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	0	1	1	0	16
Rogers & Penn[93]	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	0	18

Appendix E – Data Extraction Sheet

General information

Date of data extraction

Identification features of the study

Author –

Article Title –

Source (eg Journal, Conference) Year / Volume / Pages / Country of Origin

Institutional Affiliation (first author) and/or contact address

Identification of the reviewer
Rose Starkie

Notes

Study characteristics

Verification of study eligibility:
Correct population –
Specifically social cognition rehab –

Population characteristics and care setting
1 Target population (describe) –
How diagnosis confirmed –

2 Inclusion criteria –
3 Exclusion criteria –
4 Recruitment procedures used (participation rates if available) –
5 Characteristics of participants at intervention commencement
Age –
Ethnicity –
Class – no information
Gender –
drinking information – no information
medication –
duration of illness –
care setting –
other information -
geographical region –
6 Number of participants in each condition
a) Condition A – social cognition group -
b) Condition B – control group -
7 Were intervention and control groups comparable?

Methodological quality of the study
1 Design of the Study
a) RCT
b) cohort study
c)
d)
2 Hierarchy score
3 Quality assessment score

Interventions
1 Focus of intervention –
2 Name of programme(s) –
3 Number of conditions (including control condition) -
4 Content of intervention package
a) Condition A –
b) Condition B
c) Condition C
d) Condition D
5 Specific theoretical model (eg social learning, Bandura) –6 Intervention site (eg school)
7 Duration of intervention (Total time = no sessions x length of time in mins)
a) Condition A
b) Condition B
c) Condition C
d) Condition D
8 Delivery mode of intervention (eg lecture, discussion group)
a) Condition A
b) Condition B
c) Condition C
d) Condition D
10 What mediating variables were investigated (if any)
11 Primary staff (eg teacher, counsellor)
a) Condition A
b) Condition B
c) Condition C
d) Condition D
12 Was special training provided for primary staff? (describe)

Outcomes, outcome measures
1 What was measured at baseline?
a)
b)
c)
d)
e)
2 What was measured after the intervention?
a)
b)
c)
d)

e)
3 Who carried out the measurement?
4 What was the measurement tool?
5 Was/were the tool(s) validated and how?
6 How was the validity of self reported behaviour maximised?
7 Time interval between first and second measurement:
Time interval between first and last measurement

Analysis
1 Statistical techniques used
2 Does technique adjust for confounding?
3 Unit of analysis
4 Attrition rate (overall rates) –
5 Was attrition adequately dealt with?
6 Number (or %) followed-up from each condition
a) Condition A
b) Condition B
c) Condition C
d) Condition D
7 Missing data
8 Survival data
9 Length of follow up data

Results
1 Cond A
mean(sd)
Cond B
mean(sd)
Cond C
mean(sd)
Cond D
mean(sd)

Var 1
pre-test
post-test
difference
N = n = n = n =

Var 2
pre-test
post-test
difference
N = n = n = n =

Var 3
pre-test
post-test
difference
N = n = n = n =

Var 4
pre-test
post-test
difference
N = n = n = n =
2 Quantitative results (eg estimates of effect size)
3 Effect of the intervention on other mediating variables
4 Qualitative results
5 Cost of intervention
6 Cost-effectiveness

Notes

Appendix F – Emails Sent to Researchers to Identify Articles for Review

Email conversation with Dr Fuentes

Dear Dr Fuentes,

My name is Rose Starkie, I'm a Trainee Clinical Psychologist in my final year of study at Hull university. As part of my doctoral thesis, i am currently conducting a systematic literature review exploring the effectiveness of different domains of social cognition rehabilitation for people with a diagnosis of schizophrenia. I understand that you have done a substantial amount of research into social perception rehabilitation for people with a diagnosis of schizophrenia. I am emailing to ask whether you have any 'in press' articles, or any documents that are not in the public domain that you might be willing to share, for the purposes of my review?

Thank you very much for your time and help.

Yours sincerely,

Rose Starkie
Trainee Clinical Psychologist

Dear Rose,
Thank you for you e-mail. It was very interesting for me to learn that there are people at Hull University working in the field of social cognition.

I am attaching one paper which are currently in press. They will shortly to be published in a special edition of "Rehabilitación Psicosocial".
Additionally I am sending you more papers, some of them are unfortunately only available
in Spanish.

I would very interested in reading your reviev when it is finished and hearing about any other of your research areas related with social cognition. Could you also tell me who is the Director of your thesis at Hull University?

Good luck with your thesis, and I hope we can keep in touch.
Regards
Inma Fuentes

Email conversation with Dr Moritz

Dear Dr Moritz,

My name is Rose Starkie, I'm a Trainee Clinical Psychologist in my final year of study at Hull university. As part of my doctoral thesis, i am currently conducting a systematic literature review exploring the effectiveness of different domains of social cognition rehabilitation for people with a diagnosis of schizophrenia. I understand that you have done a substantial amount of research into metacognitive training for people with a diagnosis of schizophrenia. I am emailing to ask whether you have any 'in press' articles, or any documents that are not in the public domain that you might be willing to share, for the purposes of my review?

Thank you very much for your time and help.

Yours sincerely,

Rose Starkie
Trainee Clinical Psychologist

thanks for your interest, we have nothing in press at the moment, kind regards, Steffen

Other emails that did not receive a reply:

Dear Dr Frommann,

My name is Rose Starkie, I'm a Trainee Clinical Psychologist in my final year of study at Hull university. As part of my doctoral thesis, i am currently conducting a systematic literature review exploring the effectiveness of different domains of social cognition rehabilitation for people with a diagnosis of schizophrenia. I understand that you have done a substantial amount of research investigating emotion perception rehabilitation in schizophrenia. I am emailing to ask whether you have any 'in press' articles, or any documents that are not in the public domain that you might be willing to share, for the purposes of my review?

Thank you very much for your time and help.

Yours sincerely,

Rose Starkie
Trainee Clinical Psychologist

Dear Dr Ucok,

My name is Rose Starkie, I'm a Trainee Clinical Psychologist in my final year of study at Hull university. As part of my doctoral thesis, i am currently conducting a systematic literature review exploring the effectiveness of different domains of social cognition rehabilitation for people with a diagnosis of schizophrenia. I understand that you have done some research into social problem solving remediation in people with a diagnosis of schizophrenia. I am emailing to ask whether you have any 'in press' articles, or any documents that are not in the public domain that you might be willing to share, for the purposes of my review?

Thank you very much for your time and help.

Yours sincerely,

Rose Starkie
Trainee Clinical Psychologist

Dear Dr Penn

My name is Rose Starkie, I'm a Trainee Clinical Psychologist in my final year of study at Hull university. As part of my doctoral thesis, i am currently conducting a systematic literature review exploring the effectiveness of different domains of social cognition rehabilitation for people with a diagnosis of schizophrenia. I understand that you have done a substantial amount of research into this area. I am emailing to ask whether you have any 'in press' articles, or any documents that are not in the public domain that you might be willing to share, for the purposes of my review?

Thank you very much for your time and help.

Yours sincerely,

Rose Starkie
Trainee Clinical Psychologist

Appendix G – Table of Social Cognition Measures included in Review

References linked to Part 1 Reference section.

Emotion perception outcome measures	*The Bell-Lysaker Emotion Recognition Test*[59] *(BLERT)* This is a 21 item videotaped presentation of 7 different emotional states: happiness, sadness, anger, fear, disgust, surprise, and no emotion. Each image is shown for 10 seconds. Participants circle the correct emotion on an answer sheet. *Differentiation of facial emotions*[58] *(EmDiff)* The participant is asked to determine if the emotional expression on a pair of faces differs in intensity. *The Emotion Matching Task (using stimuli from Ekman and Friesen*[53]*)* 50 photographs are presented of happy, sad, angry, disgust, and neutral faces. Participants are asked to match faces to one of two choices, on the basis of similar emotional expression. *The Emotion Matching Task (using stimuli from Matsumoto & Ekman's Japanese and Caucasian Facial Expressions of Emotion*[60] *JACFEE)* 14 colour images showing emotions such as fear, anger,

	happieness, sadness, disgust, contempt and surprise were used. Participants are asked to respond verbally with the correct emotion, and response accuracy is recorded. *Emotion Recognition 40*[57] *(ER40)* This uses 40 pictures, showing happy, sad, angry, fearful and no-emotion expressions. The participant is asked to select the appropriate emotion for each picture. *The Face emotion discrimination task*[52] *(FEDT)* The participant is required to decide whether 2 faces presented next to each other are expressing the same or different emotions *The Face Emotion Identification Test*[52] *(FEIT)* This measure is a 19 item presentation of 6 different emotional states – happiness, sadness, anger, surprise, afraid, and ashamed. Each image is shown for 15 seconds. The participant presses a button to select the emotional label that they feel is correct. *Identification of Facial Emotions*[56] *(PEAT)* This uses 40 back and white pictures depicting happy, sad and neutral faces. The participant is asked to rate the valence of expressions on a 7 point Likert scale ranging from very sad to very happy.

	PFA test of facial affect recognition (using stimuli from Ekman and Friesen[53]) A multiple choice labelling task containing 24 pictures of 6 basic emotions from the 'pictures of facial affect' set. *Perceptual recognition of emotion[76]* Participants are shown a series of cartoon drawings, representing sadness, fear, anger and happiness. Participants have to identify the correct emotion.
Social perception outcome measures	*The Cue Recognition Test[66] (CRT)* This has different vignettes to the SCRT but a very similar format, involving 8 videotaped vignettes, and a set of questions after each vignette. The dependent variable is a 'sensitivity' score, calculated from the correct response rate and false alarm rate in each group. *The Half-Profile of Nonverbal Sensitivity[104]* This assesses social perception, using videotaped scenes containing facial expressions, vocal intonations, and bodily gestures. The participant's task is to select which of two labels best describes a situation that would generate these social cues. *The Social Perception Scale[68]* Participants are shown 4 photographs, taken from the slides used in the Social Perception subsection of IPT (Brenner et al[30]).

	Subjects are asked: • 'What detail can you see in the photo?' This question is scored using a checklist which identifies all the items that can be seen in the photo. • 'What is happening in the photo?' This is scored using a 3 part Likert scale about the appropriateness of the interpretation. • 'What title can summarise the most relevant aspects of this photo?' This is scored using a 3 part Likert scale about the appropriateness of the title. *The Social Cue Recognition Test*[65] *(SCRT)* This involves a series of 8 videotaped vignettes portraying various different social encounters. The participant watches each vignette, and then answers true-false questions based on the vignette, designed to find out whether they picked up on various different social cues. The dependent variable is a 'sensitivity' score, calculated from the correct response rate and false alarm rate in each group.
Theory of Mind outcome measures	*The Awareness of Social Inference Test*[105] *(TASIT)* This is a videotaped measure containing 16 scenes, with two or three actors in each one. After each scene, the participant is asked to respond to questions about the character's intentions, whether their statements should be interpreted literally or not, and what their beliefs about the situation may have been, and what their

	emotional state may have been like. *Character Intention Task[73] (CIT)* This task involves seeing a cartoon of a character performing an action motivated by a recognisable intention, and determining the conclusion of the cartoon, based on your understanding of the characters intention. In the above version of the test, options are presented either in a verbal or a non-verbal format. Outcome measure is the accuracy score *First order theory of mind task[74]* Participants are read short stories which require them to make an inference about the world. *The Hinting Task[15]* The participant is given a series of vignettes involving two characters. One character drops a hint towards the end of the vignette. The participant is asked what the character in the story really means by what they have said. *Second order Theory of Mind[75]* Participants are read short stories which require participants to understand false beliefs about another person's beliefs. *The non-verbal theory of mind task[72]*

	This uses cartoons to assess the ability to attribute mental states to other people.
Attributional style outcome measures	*Ambiguous Intentions Attributional Questionnaire*[96] *(AIHQ)* The AIHQ involves scenarios with negative outcomes, that vary in intentionality. The task is to indicate why the person in the scenario acted the way they did, and what you would do about it. Responses are rated on a Likert scale. Subscales investigate hostile, blaming and aggressive attributional styles.
Problem solving measures	*The Assessment of Interpersonal Problem-Solving Skills*[83] *(AIPSS)* This tool measures social problem solving skills. It involves 13 videotaped vignettes, ten of which show a problem between 2 people (the other 3 are neutral scenes that do not involve a problem). The participant is instructed to put themselves in the shoes of the protagonist, and respond to a series of questions that correspond to problem-solving steps. The answers given to these questions are rated by the experimenter. Finally, the participant role-plays a selected solution to the problem. Participants receive scores on 'receiving skills' (identifying the problem) 'processing skills' (weighing up options to solve the problem and choosing one), and 'sending skills' (implementing the chosen solution). *The Means-Ends Problem-Solving Procedure*[85]

	This instrument involves 10 depicting interpersonal problems. Each vignette has a beginning, in which a problem is presented, followed by an ending in which the problem is resolved. The participant is to suggest a 'middle' to the vignette, to solve the problem. Responses are rated for 'means' (the cognitive or behavioural steps that the participant uses to solve the problem) 'obstacles' (recognition of things that may block the mean) and 'time' (understanding that some solutions take time, or need to be completed quickly).
Other social cognitive outcome measures	*Emotion Recognition Test*[99] This is a measure of ability to evaluate social stimuli accurately. Items involve a pictorial scene that portrays an emotion. The task is supposed to test how well how well the respondent captures the emotional connotation of stimuli presented in various formats. *Social behaviour sequencing task*[98] *(SBST)* This measure is based on the Schema component sequencing task by Corrigan, Wallace and Green (1992). It involves 6 sets of cards. Each set has 9 cards in which one action relates to a specific social situation. The cards are presented in a random mixed up order, and the task is to sort them out into the correct order.

Appendix H – Table of Other Measures used in Review

References linked to Part one Reference section

Accertamento Disabilita[77]	An Italian version of the disability assessment schedule.
The Brief Psychiatric Rating Scale[55]	A 16 item scale designed to assess psychotic symptoms such as emotional withdrawal, grandiosity and suspiciousness.
The Brief Psychiatric Rating Scale 4.0, Italian version[78]	Updated version of the Brief Psychiatric Rating Scale, translated into Italian.
Brief Symptom Inventory[97] (BSI)	Assesses psychopathology.
Continuous Performance Test[90] (CPT)	Assesses sustained attention.
The Culture-free self esteem inventories-second edition[86] (CFSEI-2)	A self report scale used to assess how a person perceives their own worth across a variety of specific domains. It involves 40 simple yes or no questions.
The Disability Assessment Schedule[69] (DAS II)	A measure of functional outcome, conducted through interview with the client or someone close to the client. Contains 10 subscales, and a total score can be calculated.
The Expanded Brief Psychiatric Rating	Assesses severity of psychotic symptoms,

Scale[67]	on 5 subscales; anxiety/depression, thought disorders, anergia, activation, and hostility.
Need for Closure Scale[101]	Assesses need for closure and tolerance of ambiguity.
Number of aggressive incidents on ward	Assesses levels of aggression.
MATRICS Consensus Cognitive battery[106]	A general cognition battery; includes tests of speed processing, attention/vigilance, working memory, verbal learning, visual learning, reasoning, problem solving.
The Positive And Negative Symptom Scale[54] (PANSS)	Assesses positive and negative symptoms of schizophrenia.
The Scale for Thought, Language and Communication Disorders[73] (TLC)	Assesses disorganisation symptoms of psychosis.
Schizophrenia Communication Disorder Rating Scale[80]	Assesses communication disorder in schizophrenia.
The Social Behaviour Scale[61] (SBS).	A semi-structured interview completed by the researcher based on staff observations of 21 social behaviours. The scale gives 4 factors (social mixing, inappropriate behaviours, reduced activity, and personal hygiene).
Social Functioning Scale[103]	Assesses social functioning.
The Social Skills Performance	Involves two short role plays on

Assessment[107] (SSPA)	predetermined topics. The participant is rated on factors such as interest/disinterest, speech fluency, clarity, focus, affect, social appropriateness, submissiveness versus persistence, negotiation ability, and overall conversation effectiveness.
Trail making test part B[102]	Assesses cognitive flexibility.
Wechsler Adult Intelligence Scale[91]	Assesses intelligence.
Wechsler Intelligence Scale for Children[100] (WISC)	Assesses intelligence levels in children.
Wisconsin Card Sorting Test[89] (WCST)	Assesses executive functioning.

Appendix I – Information sheet 1: Control

Information about the research (control group, part 1)

Social thinking and social functioning in schizophrenia

We would like to invite you to take part in a research study. Before you decide you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Talk to others about the study if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of this study?
This research looks at how people with a diagnosis of schizophrenia think in social situations, compared to people without a diagnosis of schizophrenia. It also looks at whether different ways of thinking in social situations are connected to real life social activity.

Why have I been invited?
You have been invited to take part because you do not have a diagnosis of schizophrenia. It is important for us to have a sample of people without a diagnosis of schizophrenia for comparison purposes.

Do I have to take part?
It is up to you to decide. We will describe the study and go through this information sheet, which we will then give to you. We will then ask you to sign a consent form to show that you have agreed to take part. You are free to withdraw at any time, without giving a reason.

What will I have to do?
This study is made up of 5 short activities, which will be conducted at a venue you may negotiate with the researcher. Some of these activities involve completing questionnaires or being asked questions by the researcher, some involve computerised tasks, and one involves looking at some pictures and answering some questions based on the pictures. It should take about one hour and twenty minutes to complete all of these activities put together.

Will my taking part be kept confidential?
All information you give us in this study will be considered strictly confidential. A number will be used rather than your name on all tasks and questionnaires, so none of the data will be identifiable as belonging to you. Your name and personal details will be stored on a sheet that will be kept separately from the research data, in a locked filing cabinet. After the study, questionnaire data will be kept in a locked filing cabinet. Only people directly connected to this research study will have access to the data.

Further information and contact details
If you require more detailed information, please ask us to provide it. Contact **Rose Starkie** on **01482 464170** or by email on R.A.Starkie@2006.hull.ac.uk

Appendix J – Information Sheet 1: Clinical

Information about the research (clinical group, part 1)

Social thinking and social functioning in schizophrenia

We would like to invite you to take part in a research study. Before you decide you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Talk to others about the study if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of this study?
This research looks at how people with a diagnosis of schizophrenia think in social situations, compared to people without a diagnosis of schizophrenia. It also looks at whether different ways of thinking in social situations are connected to real life social activity.

Why have I been invited?
You have been invited to take part in this study because you have a diagnosis of schizophrenia, and therefore can help us understand these issues. Your community mental health team or assertive outreach team has agreed to become involved in the research, and thought you might like to take part.

Do I have to take part?
It is up to you to decide. We will describe the study and go through this information sheet, which we will then give to you. We will then ask you to sign a consent form to show that you have agreed to take part. You are free to withdraw at any time, without giving a reason. This would not affect the standard of care you receive.

What will I have to do?
This study is made up of 5 short activities, which will be conducted in a private room at the base of the team who coordinates your care. You can reclaim any money you spend on public transport in order to get to the base. Some of these activities involve completing questionnaires or being asked questions by the researcher, some involve computerised tasks, and one involves looking at some pictures and answering some questions based on the pictures. It should take about one hour and twenty minutes to complete all of these activities put together. You will be able to take a break between activities if you choose.

Will my taking part be kept confidential?
All information you give us in this study will be considered strictly confidential. A number will be used rather than your name on all tasks and questionnaires, so none of the data will be identifiable as belonging to you. Your name and personal details will be stored on a sheet that will be kept separately from the research data, in a locked filing cabinet. After the study, questionnaire data will be kept in a locked filing cabinet. Only people directly connected to this research study will have access to the data.

Further information and contact details

If you require more detailed information, please ask us to provide it. Contact **Rose Starkie** on **01482 464170** or by email on R.A.Starkie@2006.hull.ac.uk

Appendix K – Information Sheet 2

Information about the research (part 2)

Social thinking and social functioning in schizophrenia

Involvement of the General Practitioner/Family Doctor (G.P.)
In most cases, it will not be necessary to inform your G.P. that you are taking part in this study. However, there is a small chance that the answers you give to some of the questions in part 1 of the study could suggest that you are suffering from a mental health problem that your G.P. may not know about. If this is the case, it will be our duty to inform your G.P of this. If you agree to take part in this research, you will be asked to sign a consent form as a record that you have given permission for us to contact your G.P. should we identify a new mental health problem. If you do give us information that suggests you might have a new mental health problem, you will be informed of this straight away. We will ask you not to continue with the rest of the tasks. You will be offered the chance to talk about the symptoms you are experiencing with the chief investigator, who is a Psychologist in Clinical Training.

Medication
We will need to know if you are taking any medication to help you manage the symptoms of schizophrenia (anti-psychotic medication). If you are, we will need to know what type of medication you are taking. With your permission, we will get this information from your community mental health team or assertive outreach team.

What will happen to the results of the research study?
We hope that the results of the study will be published in a scientific journal. This way, other scientists will be able to read the findings, and maybe use them to develop therapies for people with a diagnosis of schizophrenia that focus on social aspects of the disorder. You will not be identified in any published report.

Expenses and payments
You can reclaim any money you spend on public transport in order to get to the site where the research is being conducted.

Who is organising and funding this research?
This research is organised and funded by the University of Hull Clinical Psychology Department.

Who has reviewed this study?
All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee to protect your safety, rights, wellbeing and dignity. This study has been reviewed and given favourable opinion by York Research Ethics Committee.

Further information and contact details
If you require more detailed information, please ask us to provide it. Contact **Rose Starkie** on **01482 464170** or by email on R.A.Starkie@2006.hull.ac.uk

Appendix L – Consent to Contact Sheet

Participant Identification Code for this trial:

CONSENT FORM FOR CONTACTING PARTICIPANTS

Title of Project: **Social thinking and social functioning in schizophrenia**

Name of Researcher: **Ms Rose Starkie**

Researcher contact details: (Tel.) **01482 464170**
(Email) R.A.Starkie@2006.hull.ac.uk

1. I understand that by signing this form I am **NOT** consenting to take part in the study, I am consenting to being contacted by the above named researcher in order to learn more about participating in the study.

2. I understand that my involvement in this study is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.

3. I agree to being contacted by the above named researcher.

Preferred method of contact

_____

Phone number (if preferred method of contact is phone)

_____

Email address (if preferred method of contact is email):

_____

_____	_____	_____
Name of Participant	Date	Signature

_____	_____	_____
Name of Person taking consent	Date	Signature

Appendix M – Consent sheet

Participant Identification Code for this trial:

CONSENT FORM

Title of Project: **Social thinking and social functioning in schizophrenia**

Name of Researcher: **Ms Rose Starkie**

Researcher contact details: (Tel.) **01482 464170**
(Email) R.A.Starkie@2006.hull.ac.uk

1. I confirm that I have read and understand the information sheets part 1 and part 2 dated 18/04/08 (version 3) for the above study. I have had the opportunity to consider the information, ask questions, and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.

3. I agree that the researcher may access information regarding any anti-psychotic medication (medication to help manage the symptoms of schizophrenia) I may be taking from the team that co-ordinates my care.

4. I agree to my G.P. being informed should the information I provide in this study indicate that there is a chance that I may be suffering from a mental health problem that has not previously been identified.

5. I agree to take part in the above study.

_____	_____	_____
Name of Participant	Date	Signature
_____	_____	_____
Name of person taking consent	Date	Signature

Appendix N – Debriefing Sheet

Information about the research (debriefing sheet)

This study is looking into how people with a diagnosis of schizophrenia think and feel in social situations, compared to people who do not have a diagnosis of schizophrenia.

The first set of questions you were asked were designed to confirm whether or not you have a diagnosis of schizophrenia. This allows the researcher to put your data in the right group.

The computerized task was looking into the ability to predict how other people are thinking and feeling. Research suggests that people with a diagnosis of schizophrenia may be worse at predicting how other people are *feeling* than people without a diagnosis of schizophrenia, but there may be no difference in ability to predict what other people are *thinking*. This task was trying to find out whether this is true.

The third part of the experiment was looking into how often you engage in social activities. Research suggests that people with a diagnosis of schizophrenia tend to get involved in less social activities, but we don't really know why this is. This test was included in order to find out if there is a relationship between these measures of 'social thinking', and actual social activity in the real world. It is expected that lower scores on the tasks around predicting what other people are feeling will be related to less social activity.

The fourth part of the experiment was a second task around predicting what other people are feeling. This task was included to see whether the findings from this task match the findings from the computerised task. If they do, it allows people to be a bit more confident in the findings of the study.

The fifth part of the experiment was looking into the ability to predict what other people are feeling, and the ability to actually feel what other people are feeling yourself. Research suggests that people with a diagnosis of schizophrenia perform the same as people without such a diagnosis on tests of ability to actually feel what other people are feeling. This questionnaire was added to try to find out whether this is true.

If you have any further questions about this study, please feel free to contact **Rose Starkie** on

01482 464106 (tel)

or by email on R.A.Starkie@2006.hull.ac.uk

Thank you for taking part in this study!

Appendix O – Portfolio Thesis Word Count

Part One Word Count – 8,037 (excluding abstract, tables, figures, references, appendices and main headings)

Part Two Word Count – 10,324 (excluding abstract, tables, figures, references, appendices and main headings)

Appendix A Word Count – 1,915

Portfolio Thesis Word Count – 27,118 (excluding tables, figures, references, appendix B, appendix D and appendix P)

Appendix P – Ethics Documentation

Overleaf follows the documentation submitted to and received from York Research Ethics Committee, and also documentation received from both North Yorkshire Alliance Research and Development Unit, and Humber Mental Health Research and Development Department.

REMOVED FOR HARD BINDING