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# Social cognition in first-degree relatives of people with schizophrenia: A meta-analysis



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## ABSTRACT

Social cognition is affected in people with schizophrenia, but whether this is the case for healthy relatives of these patients is less clear. The presence of social cognition impairments in relatives would suggest a potential genetic role of social cognition in schizophrenia. To determine whether social cognition is affected in first-degree relatives of people with schizophrenia and examine the impact of potential moderator variables, a meta-analysis of studies investigating at least one domain of social cognition (mentalizing, emotional processing, social perception, social knowledge and/or attributional style) in adult first-degree relatives of patients with schizophrenia was performed. Our inclusion criteria were satisfied by 29 studies, of which 11 evaluated mentalizing, 20 emotional processing, and two social perception. Moderate mean effect sizes were obtained for these three components. Across all studies, effect sizes were significantly correlated with IQ and age differences between groups, calling for careful group matching for future studies. Overall, the results from this meta-analysis highlight that social cognition is globally affected in first-degree relatives of people with schizophrenia, suggesting that social cognition deficits in schizophrenia may be related to a genetic vulnerability for the disorder.

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## 1. Introduction

Social cognition refers to a large range of skills that allow us to perceive, interpret and process social stimuli, and that guide social interactions (Green et al., 2008; Achim et al., 2012). Among the multiple components of social cognition, two are more frequently studied: emotional processing and mentalizing (also referred to as theory of mind [ToM]). Emotional processing refers to our capacity to perceive and recognize emotional states. Mentalizing is a cognitive function that relates to our capacity to infer the mental state (beliefs, intentions, desires, emotions) of another person or character based on several pieces of information about the person and the context in which that person is presented (Frith and Frith, 1999; Achim et al., 2012). In addition to these two well-studied components, social cognition also includes social knowledge, which refers to our knowledge of theoretical social situations (e.g. the comprehension of social contexts, social rules, social goals or of what is expected in

different social situations), social perception, which refers to capacity to make inference about social situation (e.g. mood state, intimacy, reliability) from different cues, and attributional bias, defined as the tendency to attribute positive or negative events to internal or external causes (see Green et al., 2008, for a seminal description of these five social cognition domains).

Impaired social cognition performance has been repeatedly observed in schizophrenia, with well-documented deficits for emotional processing (Edwards et al., 2002) and mentalizing (Sprong et al., 2007). A few studies also observed deficits in attributional bias (Lee et al., 2004), social perception (Toomey et al., 2002) and social knowledge (Corrigan et al., 1996) associated with psychotic disorders. Social cognition deficits have a considerable importance in schizophrenia since they are associated with poorer social and community functioning (Couture et al., 2006; Fett et al., 2011). As social cognition deficits have also been observed in patients in remission (Sprong et al., 2007), these impairments have been hypothesized to represent a trait of the disease, possibly related to a genetic vulnerability associated with the pathology rather than a state-related aspect (Bora et al., 2009a).

Unaffected relatives of people with schizophrenia are a population of interest to evaluate the potential endophenotypic role of social cognition in schizophrenia as they share genetic information

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with those affected by the disorder (Braff et al., 2007). To date, studies investigating social cognition in unaffected relatives of patients with schizophrenia have shown inconsistent results. For instance, some studies have reported decreased performance on tests of social cognition in unaffected first-degree relatives in comparison with healthy controls (e.g., Janssen et al., 2003; Bediou et al., 2007; Alfimova et al., 2009), while others have found similar levels of performance (e.g., Kelemen et al., 2004; Loughland et al., 2004). This variability across studies could be explained at least in part by the characteristics of the study participants (relatives and/or control subjects) or by the experimental tasks used to measure social cognition (Edwards et al., 2002). Such methodological differences between studies make it difficult to draw clear conclusions on whether relatives of people with schizophrenia have difficulties in specific domains of social cognition. In addition, most studies restrict their focus to only one component of social cognition, thus failing to provide an integrated appreciation of the differences across all components. A better understanding of the potential social cognition deficits in unaffected relatives is important to identify whether all components of social cognition are similarly affected or if some processes may be more related to a genetic risk associated with the disease than others. Highlighting the domains of social cognition that are most impaired in unaffected relatives may allow us to eventually link these processes with candidate genes for schizophrenia.

An effective way to gather these varied results and generate a global portrait of the social cognition capacities reported in unaffected first-degree relatives of people with schizophrenia is through the use of meta-analytic techniques. Meta-analytic tools allow us to combine the results of different studies and also to contrast results from studies that have made different methodological choices. The goals of the current meta-analysis are (1) to determine if significant impairments in the different components of social cognition (mentalizing, emotional processing, social perception, social knowledge, and attributional bias) are observed in unaffected first-degree relatives of patients with schizophrenia, and (2) to evaluate the impact of different moderator variables on performance on social cognition tasks.

## 2. Method

### 2.1. Literature search

Articles included in the present meta-analysis were found through searches in MEDLINE, PSYCINFO and GOOGLE SCHOLAR dating between August 1985 and January 2011. Keywords used were “schizophrenia” or “psychotic disorder”, along with “social cognition”, “theory of mind”, “mentalizing”, “emotion perception”, “emotion recognition”, “emotion processing”, “social perception”, “social cue perception”, “social knowledge” or “attributional bias”, and along with “relative”, “sibling”, “parent” or “family member”, for a total of 80 keyword combinations. Additional articles were found by scrutinizing the reference lists of the articles retained in the analysis.

The inclusion criteria for a study to be included in the meta-analysis were as follows: (1) Inclusion of at least one group of adult first-degree relatives of patients with schizophrenia or related psychotic disorder (mean group age at least 18 years old). Adults were targeted since younger relatives are at high risk of developing schizophrenia and groups of teenaged relatives thus likely include an important proportion of subjects who are in a premorbid stage of the disease. (2) Inclusion of a healthy control group for comparison. (3) Administration of at least one social cognition test targeting mentalizing, emotional processing, social perception, social knowledge, and/or attributional bias and (4) Provision of enough data to calculate an effect size  $r$  of the between-group difference on at least one social cognition measure. Short reports were included, but abstracts were excluded.

### 2.2. Criteria used to classify the tasks in the corresponding social cognition domains

The task-classification criteria described below are based on the definition of the five social cognition domains presented by Green et al. (2008) but adapted to clarify the boundaries between the different constructs.

#### 2.2.1. Mentalizing

Tasks were classified in the mentalizing domain if the participants had to attribute mental states (e.g., intentions, beliefs, knowledge, desires, and emotions) to specific characters that typically express something (facial, bodily or verbal expression) in a given situation (*contextualized mentalizing*), though for some tasks the expressions themselves were complex enough not to necessitate explicit contextual information (*decontextualized mentalizing*). If only contextual information was presented without reference to a specific character that could express something, it was rather classified in the social knowledge domain. If emotional expressions were presented without a context or other expressive information, the test was included in the emotional processing domain.

#### 2.2.2. Emotional processing

The tasks classified in this domain require the participants to perceive and recognize emotional states based on the character's expressions (i.e., facial expression or prosody). The tasks typically asked participants either to label or name an emotion (*emotion identification*) or to discriminate emotional stimuli (*emotion differentiation*), such as positive versus negative facial expressions, or emotional versus neutral facial expressions (Kohler et al., 2010).

#### 2.2.3. Social knowledge

To be included in this domain, tasks had to investigate the ability to understand social rules and what is normally expected in different social situations.

#### 2.2.4. Social perception

To be included in the social perception domain, tasks had to evaluate the ability to match expressive behavior with prototypical social situations and/or to make social judgments that go beyond understanding or predicting a character's mental states (e.g. morality, veracity, and intimacy).

#### 2.2.5. Attributional bias

For this domain, the tasks had to measure the participant's tendencies to favor specific types of causal attributions over others to explain a character's behavior (e.g., internal versus external causes).

### 2.3. Data analysis and moderator variables of interest

We followed the meta-analytic procedure proposed by Rosenthal (Rosenthal, 1991; Rosenthal and DiMatteo, 2001; Rosnow and Rosenthal, 2003). Rosenthal's procedure is based on effect sizes  $r$  (ES $r$ ) and is more flexible than meta-analytic methods based on Cohen's  $d$  since ES $r$  can be calculated in the absence of information regarding the mean or standard deviation or from non-parametric statistics in the case of non-normally distributed data, which are often found, at least for some social cognition tests. Other than these considerations, ES $r$  and Cohen's  $d$  techniques are relatively equivalent, and ES $r$  and Cohen's  $d$  can be readily converted to one another (Rosenthal and DiMatteo, 2001).

For effect size combinations and comparisons, weighted statistics can sometimes be favored over unweighted statistics. When the tasks largely differ within a category, however, weighted ES $r$  may result in an emphasis on certain tasks over the others (i.e., on the tasks employed in one or a few bigger studies), which could bias the overall pattern of results across studies. Thus, we chose to put more emphasis on unweighted ES $r$  (each study is an observation) but also report weighted ES $r$  (each subject is an observation) for completeness.

The ES $r$  of the difference between groups of first-degree relatives and healthy subjects were calculated for each social cognition measures of each study. These effect sizes were then converted with a Fisher Z transformation ( $Z_r$ ). When several effect sizes were obtained from the same study (e.g., different subgroups or different measures of the same type, such as the false-belief task and hinting task from Janssen et al., 2003), these were pooled together to preserve the independence of the data entered into subsequent analyses. We then calculated the unweighted and weighted mean  $Z_r$  for all five domains of social cognition and converted these mean scores back into ES $r$  (and also transformed into Cohen's  $d$  for reference). A heterogeneity score was also calculated between the effect sizes of the studies included in each domain (Rosenthal, 1991, p. 73). Comparisons of effect sizes between categories (e.g., mentalizing vs. emotional processing vs. social perception) were performed using unweighted focused tests (Rosenthal, 1991, pp. 79–80). Similar tests were also used to identify the presence of outliers within a given domain, i.e., separately contrasting each study to all other studies within that domain.

We then investigated the impact of the potential moderator variables for which at least a few studies had provided the relevant information. For dichotomous variables, we compared the weighted mean  $Z_r$  of the studies included in each category using focused tests. This was applied to compare contextualized vs. decontextualized mentalizing, emotion identification vs. differentiation (see Table 1), and studies performed with parents vs. siblings. As there were not enough studies to do this last analysis separately for each domain of social cognition, we performed this analysis across all studies reporting information about the type of relatives.

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