Schizophrenia Research: Cognition 2 (2015) 12–19

Contents lists available at ScienceDirect

Schizophrenia Research: Cognition

journal homepage: http://www.schizrescognition.com/

Specificity of facial emotion recognition impairments in patients with multi-episode schizophrenia

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ARTICLE INFO

Article history:
Received 19 August 2014
Received in revised form 20 January 2015
Accepted 26 January 2015

Keywords:
Schizophrenia
Social cognition
Neurocognition
Emotion perception
Face recognition

ABSTRACT

Background: Patients with schizophrenia show impairments in social information processing, such as recognising facial emotions and face identity.
Goal: The aim of this study was to explore whether these impairments represent specific deficits or are part of a more general cognitive dysfunction.
Method: Forty-two patients with schizophrenia and 42 matched controls were compared on facial emotion and face identity recognition versus (non-social) abstract pattern recognition, using three tasks of the Amsterdam Neuropsychological Tasks (ANT) program.
Results: Patients were slower than controls in social information processing as well as in (non-social) abstract pattern recognition. Patients were also less accurate than controls in processing social information, but not in recognition of abstract patterns. Differences between patients and controls were most substantial for facial emotion recognition compared to both face identity recognition (speed) and non-social pattern recognition (speed and accuracy). Finally, differences between patients and controls were largest for the recognition of negative emotions.
Conclusion: Compared to controls patients with schizophrenia displayed more difficulties in processing of social information compared to non-social information. These results support the hypothesis that facial emotion recognition impairment is a relatively distinct entity within the domain of cognitive dysfunction in schizophrenia.

1. Introduction

For adequate social interaction a quick and proper apprehension of social information is required. Patients with schizophrenia experience problems in the processing of such information. It has been repeatedly demonstrated that patients have substantial problems with recognizing emotions in facial expressions of others (Kohler et al., 2010; Marwick and Hall, 2008), not only compared to healthy control subjects (Kohler et al., 2000; Turetsky et al., 2007; van't Wout et al., 2007) but also compared to patients with other psychiatric disorders (Addington and Addington, 1998; Weniger et al., 2004). Facial emotion recognition is part of the domain of social cognition, which further includes social perception and knowledge, theory of mind and attributional bias (Green et al., 2005; Penn et al., 2008).

Based on the differences between patients with schizophrenia and healthy controls on both social cognitive and neurocognitive tasks, there is growing evidence that impairments in social cognition should be considered an independent construct (Mehta et al., 2013; Penn et al., 2000; Pinkham, 2003; Sergi et al., 2007; Van Hooren et al., 2008) with suggestions for separate neural pathways (Phillips et al., 2003). On the other hand there appears to be an overlap between social cognitive and neurocognitive impairments (Addington and Addington, 1998; Kohler et al., 2000; Oerlemans et al., 2013; Poole et al., 2000; van Rijn et al., 2011), indicative of a more generalized cognitive deficit.

Social cognition appears to explain more variance in functional outcome parameters such as community functioning, compared to neurocognition (Fett et al., 2011). Some authors have proposed that social cognition may act as a mediator in the relation between neurocognition and functional outcome in patients with schizophrenia (Addington et al., 2006; Barbato et al., 2013; Sergi et al., 2007).

Within the domain of social information processing there is a debate on the specificity of facial emotion recognition in relation to the recognition of facial identity. While in some studies no differential deficits between these abilities were found (Addington and Addington, 1998; Pomarol-Clotet et al., 2010; Sachs et al., 2004), other studies have shown specific deficits in facial affect recognition in patients with schizophrenia (Kosmidis et al., 2007; Kucharska-Pietura et al., 2005; Penn et al., 2000; Poole et al., 2000; Schneider et al., 2006).

More detailed studies suggest that patients with schizophrenia specifically experience problems with recognising negative emotions,

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http://dx.doi.org/10.1016/j.scog.2015.01.001
2215-0013/

including fear, sadness, anger and disgust (Edwards et al., 2001; Kohler, 2003; Brüne, 2005; Hall et al., 2008). Imaging studies on healthy subjects show that amygdala activation has been associated with the recognition of negative emotions, especially fear (Fusar-Poli et al., 2009; Phan et al., 2002). Structural abnormalities found in the amygdala (Wright et al., 2000) as well as functional abnormalities in relation to emotion recognition (Gur, 2002; Holt et al., 2006) in patients with schizophrenia suggest a pathogenetic role of the amygdala in schizophrenia. These findings are in line with the hypothesis of a distinctive impairment in the recognition of (negative) emotions in patients with schizophrenia (Aleman and Kahn, 2005; Amminger et al., 2012).

In the current study we aimed to further explore the relation between facial emotion recognition, facial identity recognition and neurocognitive functioning. We therefore compared patients with schizophrenia and matched controls on recognition of facial emotions and face identity, specifically contrasting results with those on (non-social) abstract pattern recognition. For that purpose we have used the Amsterdam Neuropsychological Tasks (ANT; de Sonneville, 2014), which allows for directly contrasting facial emotion recognition with identification of more basic social patterns (face identity) and non-social patterns (abstract figures), as the paradigms used in these tasks are similar and differ only on the degree to which they call on social information processing (high on emotion recognition, intermediate on face recognition and low on abstract pattern recognition).

The ANT examines accuracy as well as the speed of performance on tasks (such as pattern and emotion recognition), which may help to understand the strategy that respondents used in these processes. There are suggestions that patients with schizophrenia require more visual information, and therefore more time, to correctly identify emotional expression in faces, compared to controls (Clark et al., 2013; Lee et al., 2011). Furthermore there are indications that problems with face identity recognition in patients with schizophrenia may be the result of impairments in configural processing and an over-reliance on featural processing (Joshua and Rossell, 2009; Shin et al., 2008). Therefore we hypothesized that differences in emotion recognition between patients with schizophrenia and healthy controls may be more prominent in speed of performance than in accuracy of the emotion recognition task.

2. Method

2.1. Subjects

We performed a cross-sectional study including 42 individuals (mean age 38.4 ± 9.4 years), diagnosed with schizophrenia or schizoaffective disorder according to the Structured Clinical Interview for DSM-IV Disorders (SCID; First et al., 1996) and 42 controls, matched on sex, age and level of education.

Patients were selected from inpatient and outpatient facilities for the treatment of psychotic disorders of three mental healthcare institutions in the greater Amsterdam area. All patients experienced two or more psychotic episodes and had experienced a psychotic relapse or a clinical deterioration in the past year, resulting in hospitalisation and/or a detoriation on the Clinical Global Impression scale, severity of illness (CGI-S; Guy, 1976). At the time of inclusion in the study, antipsychotic treatment was resumed with at least minimal symptomatic improvement, defined as a score of 3 (minimal improved) or better on the Clinical Global Impression scale for Improvement (CGI-I; Guy, 1976). Exclusion criteria were: presence of an organic disease that is known as an etiological factor in psychotic illnesses; intellectual dysfunction (IQ < 70). The control group was recruited among hospital facility crew and firemen; controls and patients were carefully matched on level of education, age and gender.

Exclusion criteria for controls were a psychiatric history and a Symptoms Checklist (SCL-90) score of higher than 170 for male or higher than 204 for female subjects (Arrindell and Ettema, 2003).

All assessments were performed by trained psychologists and psychiatrists. Informed consent was obtained in all cases. The study was approved by the Medical Ethical Committee of the Academic Medical Center, Amsterdam.

2.2. Instruments

2.2.1. Amsterdam Neuropsychological Tasks (ANT)

The ANT is a computerized neuropsychological test battery, which is developed to evaluate basal processes underlying the execution of complex cognitive processes in a standardized and systematic manor (De Sonneville, 1999) and has proved to be a reliable and valid instrument with satisfactory test-retest reliability, construct, criterion, and discriminant validity of the tasks used in the study. (De Sonneville, 2005, 2014; Günther et al., 2005; Rowbotham et al., 2009). The ANT consists of 38 tasks investigating functions of attention, memory, executive functioning and social cognition. Tasks will be briefly described, for detailed descriptions including examples of signals and timing between signals, see e.g. De Sonneville et al. (2002). Four tasks were administered for the purpose of this study, namely Identification of Facial Emotions (IFE), Face Recognition (FR), Feature Identification (FI) and Baseline Speed (BS).

3. Identification of Facial Emotions (IFE)

This task examines the ability to identify facial emotions, by asking the subject to judge whether a face on a picture shows a specific (target) expression ('yes'-key) or a different expression ('no'-key). The signal consists of one photo of a face that may show any of the following eight expressions: happiness, sadness, anger, fear, disgust, surprise, shame, and contempt. The total stimulus set consists of 32 pictures from four different persons, each showing the eight emotions. The original task consists of eight parts of 40 trials. In this study five parts are administered with the target emotions happiness, sadness, anger, fear and disgust, respectively (see Fig. 1).

3.1. Face Recognition (FR)

This task examines speed and accuracy in recognising unfamiliar faces. The signal consists of four photos of human faces 'en face', with a neutral expression, taken from a set of 40 pictures of boys, girls, adult men and women. Preceding each signal, a probe (the to-be-recognised face) is presented for 2.5 seconds. Gender and age category of probe and signal always match, i.e. when the probe is a girl's face, the signal contains the pictures of four girls of the same age, and so forth. The subject should press the 'yes'-key when the probe is present in the signal, and the 'no'-key when this is not the case. In half the signals the probe is present (target condition) and in the other half it is not present (non-target condition) (See Fig. 2).

4. Feature Identification (FI)

Feature Identification is a pattern recognition task designed to examine speed and accuracy of processing non-social abstract visuospatial patterns processing. The signal consists of four visuospatial patterns, each pattern being a 3x3 matrix of red and white coloured squares. The subject is asked to decide whether a specific pattern is present in the signal. The task consists of a random mix of 40 target trials and 40 non-target trials with two possible modes of signal presentation. In the similar condition, the target signal contains the target pattern and three distracters that look relatively similar to the target pattern, and the non-target signal contains four similar looking distracters. In the dissimilar condition the distracters are relatively different from the target signal. In the similar condition, pattern recognition depends on detailed (featural) processing (controlled information processing), in the dissimilar condition the target pattern can be identified as a 'gestalt'