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Facial expression and face orientation processing in schizophrenia

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ABSTRACT

Schizophrenia patients exhibit deficits in recognition and identification of facial emotional expressions, but it is unclear whether these deficits result from abnormal affective processing or an impaired ability to process complex visual stimuli such as faces. Participants comprised 16 outpatients with schizophrenia and 22 matched healthy control subjects who performed two computerized visual matching tasks (facial emotional expression and orientation). Accuracy and reaction time were recorded. Clinical symptoms were assessed in the patients using the Brief Psychiatric Rating Scale (BPRS), Scale for the Assessment of Positive Symptoms (SAPS), and Scale for the Assessment of Negative Symptoms (SANS). Social functioning as measured by the Zigler social competence scale was indexed in all participants. Patients with schizophrenia were less accurate than control participants on both facial emotion and orientation matching tasks, but there was no diagnosis-by-task interaction. Clinical symptoms of the patients were associated with deficits on emotion and orientation matching tasks. Worse social functioning was correlated with facial emotion matching errors across both groups. Patients with schizophrenia show general deficits in processing of faces, which is in turn associated with worse symptoms and reduced social functioning.

1. Introduction

Past research indicates that both vocal and facial emotion recognition is impaired in schizophrenia (Walker et al., 1984; Feinberg et al., 1986; Borod et al., 1993; Archer et al., 1994; Mandal et al., 1998; Edwards et al., 2001; Baudouin et al., 2002; Hooker and Park, 2002), and that this deficit is likely to be a trait-like feature of the illness (Kline et al., 1992; Schneider et al., 1995; Salem et al., 1996; Poole et al., 2000; Exner et al., 2004; Addington, et al., 2008). Schizophrenia patients (SZ) perform worse than healthy control subjects (CO) on tasks that require emotion identification or discrimination (Walker et al., 1980; Salem et al., 1996), but such deficits may stem from a generalized deficit in face processing. Indeed, evidence suggests that there is no specific deficit in emotion perception in schizophrenia (Kerr and Neale, 1993) but that they may have generalized deficits in processing of faces (Salem et al., 1996) and face processing deficits may be related to cognitive deficits in schizophrenia (Schneider et al., 1995; Bryson et al., 1997; Addington and Addington, 1998; Kohler et al., 2000).

The relationships among symptom severity, emotion processing, and face processing have been investigated but are not clearly understood. Some studies have found a relationship between increased positive symptoms and deficits in face processing (Schneider et al., 1995; Kohler et al., 2000; Baudouin et al., 2002; Martin et al., 2005); other studies have found a relationship between negative symptoms and deficits in face processing (Mueser et al., 1996; Kohler et al., 2000; Suslow et al., 2003b), and yet other studies have found no relationship between symptoms and face processing (Muzekari and Bates, 1977; Borod et al., 1993; Salem et al., 1996). Nevertheless, accurate processing of socially relevant stimuli such as faces seems to have important implications for social functioning in schizophrenia (Hooker and Park, 2002; Suslow et al., 2003a; Kim et al., 2005).

The goal of the present study was to extend previous findings of facial processing deficits of schizophrenia in relation to social functions using two simple matching tasks with no language or memory demands, which may introduce additional cognitive load. We hypothesize that SZ subjects will be impaired on both the emotion matching task and the orientation matching task compared with CO subjects. We further examined reaction time performance on these tasks in order to gauge whether or not there was additional cognitive loading.

2. Methods

2.1. Participants

Twenty-two healthy control participants (CO) (12 females) were recruited via advertisements. They were screened for history of psychiatric illness, head injury, epilepsy, and drug use. Sixteen (5 females) individuals who met the DSM-IV criteria (American Psychiatric Association, 2000) for schizophrenia or schizoaffective disorder (13 schizophrenia, 3 schizoaffective) were recruited from an outpatient clinic. All schizophrenic and schizoaffective subjects (SZ) were chronically ill (mean years of illness = 13.4, S.D. = 7.4). Exclusion criteria for SZ were multiple diagnoses, head injury,

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Table 1
Demographic information.

	Control subjects ($n=22$)	Schizophrenic subjects ($n=16$)
Education (years)	13.2 (1.9)[a]	12.8 (2.0)
Age	34.5 (11.2)	38.8 (10.2)
Full scale I.Q.[b]	95.4 (14.5)	100.0 (14.0)
BPRS	N/A	24.9 (13.6)
SANS	N/A	28.8 (18.6)
SAPS	N/A	25.9 (22.1)
SPQ	16.5 (8.0)	N/A
Global handedness score[c]	80.3 (35.7)	58.3 (56.7)
CPZ equivalent[d]	N/A	283.9 (98.3)
Illness duration	N/A	13.4 (7.4)
Zigler score[e]	5.0 (1.9)	2.2 (1.1)

[a] Mean (standard deviation).
[b] Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999).
[c] Global Handedness Questionnaire (Ransil and Schachter, 1994).
[d] Chlorpromazine dose equivalent (in milligrams per day; Woods, 2003).
[e] Zigler Score of Social Functioning (Zigler and Levine, 1981).

epilepsy, or current drug abuse. All SZ subjects were taking atypical antipsychotic drugs (risperidone, olanzapine or clozapine). Demographic information is presented in Table 1. All participants gave written informed consent as approved by the Vanderbilt University Institutional Review Board and were paid.

There were no group differences in age ($F(1,36)=1.41$, $P=$n.s.), education ($F(1,36)=0.41$, $P=$n.s.), estimated full-scale IQ ($F(1,34)=0.92$, $P=$n.s.) and handedness measured by the Global Handedness Questionnaire ($F(1,36)=1.96$, $P=$n.s.). IQ data were missing from two CO subjects, but since the education level was matched, it is unlikely that the two groups differed in general cognitive ability.

2.2. Materials and procedure

All tasks were performed on an iMac computer (screen size 28.75×21.25 cm). Subjects were seated 40 cm from the screen. Face stimuli were selected from the Karolinska Directed Emotional Faces (KDEF, Lundqvist et al., 1998), which provides standardized face stimuli for emotional expressions as well as orientation of faces. Calvo and Lundqvist (2008) conducted a study investigating valences and accuracy of identification using the KDEF stimuli. This study showed that happy faces were identified more accurately than other faces. However, fearful faces were identified less accurately than other faces. Please see www.psychonomic.org/archive for norms for each face and expression regarding identification accuracy, errors, and reaction times. Emotions used in the present study were neutral, happy, sad, fearful, and angry. All subjects had normal or corrected-to-normal vision. All subjects were given detailed instructions before beginning the experiment and were given practice trials.

2.2.1. Emotion matching

Subjects were asked to look at a fixation dot at the center of the screen. When they were ready to begin a trial, they clicked on the fixation dot with the mouse. The screen displayed a target face directly above the fixation dot and three different face stimuli below the fixation dot (see Fig. 1). Subjects were instructed to select one of the three response faces below the fixation point that best matched the target in its emotional expression. The identity of the target face differed from the identities of the response faces. Thus, on any given trial, there were faces of four different people on the screen. There were 20 trials.

2.2.2. Facial orientation matching

The procedure was identical to the one described above for the emotion-matching task, but in this case subjects were instructed to select one of the three response face stimuli that best matched the orientation of the target face above the fixation dot (see Fig. 2). There were 20 trials.

The order of task presentation was counterbalanced across subjects. For both matching tasks, accuracy and reaction times (RT) were recorded.

2.2.3. Clinical symptoms

The Brief Psychiatric Rating Scale (BPRS; Overall and Gorhman, 1962), the Scale for the Assessment of Positive Symptoms (SAPS; Andreasen, 1984), and the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1984) were used to assess symptoms.

2.2.4. Schizotypal personality in CO subjects

We used the Schizotypal Personality Questionnaire (SPQ) (Raine, 1991), a self-report questionnaire based on the DSM Axis II criteria for schizotypal personality disorder.

2.2.5. Social functioning

The Zigler social competence scale (Zigler and Levine, 1981) was used to estimate social functioning in all participants, using demographic information including age, employment, marital status and education.

2.3. Data analysis

Repeated measures analysis of variance (ANOVA) was used to compare the two groups on % correct responses and response times. Fisher's PLSD was used for the post-hoc analysis. Correlations were computed using the Pearson product-moment correlation. Cohen's d was used to calculate effect sizes.

3. Results

3.1. Accuracy

There was a main effect of diagnosis ($F(1,36)=10.10$; $P=0.003$, $r=0.89$). CO subjects (Mean = 92.50%; S.D. = 8.46) performed better overall than SZ subjects (Mean = 81.41%; S.D. = 20.25). A main effect for task was also found ($F(1,36)=8.82$; $P=0.005$, $r=0.84$). Subjects

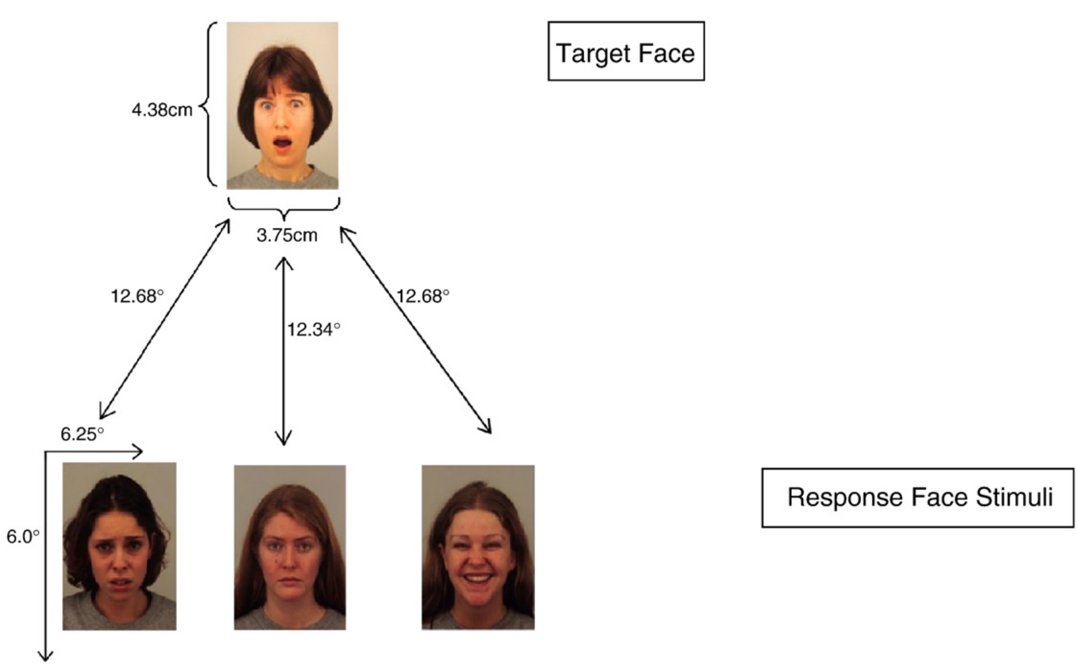

Fig. 1. Face emotion matching task.