



## A differential neural response to threatening and non-threatening negative facial expressions in paranoid and non-paranoid schizophrenics

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### Abstract

Several studies have demonstrated impaired facial expression recognition in schizophrenia. Few have examined the neural basis for this; none have compared the neural correlates of facial expression perception in different schizophrenic patient subgroups. We compared neural responses to facial expressions in 10 right-handed schizophrenic patients (five paranoid and five non-paranoid) and five normal volunteers using functional Magnetic Resonance Imaging (fMRI). In three 5-min experiments, subjects viewed alternating 30-s blocks of black-and-white facial expressions of either fear, anger or disgust contrasted with expressions of mild happiness. After scanning, subjects categorised each expression. All patients were less accurate in identifying expressions, and showed less activation to these stimuli than normals. Non-paranoids performed poorly in the identification task and failed to activate neural regions that are normally linked with perception of these stimuli. They categorised disgust as either anger or fear more frequently than paranoids, and demonstrated in response to disgust expressions activation in the amygdala, a region associated with perception of fearful faces. Paranoids were more accurate in recognising expressions, and demonstrated greater activation than non-paranoids to most stimuli. We provide the first evidence for a distinction between two schizophrenic patient subgroups on the basis of recognition of and neural response to different negative facial expressions. © 1999 Elsevier Science Ireland Ltd. All rights reserved.

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## 1. Introduction

Faces convey a wealth of personal information, such as identity, expression, age and sex (Bruce and Young, 1986). The ability to recognise the different aspects of each face is crucial for adaptation in the social milieu. Patients with schizophrenia often perform poorly in social situations, appearing to misinterpret social cues and exhibiting poor social skills. Furthermore, delusions often emerge as misinterpretations of social interactions and events, frequently revolving around a person's relationship to others and role in society rather than neutral or impersonal themes (Brennan and Hemsley, 1984; Bentall et al., 1991, 1994). For this reason, perception of facial stimuli and, in particular, perception of facial emotional expressions have been studied frequently in this patient group.

Whilst some studies have provided evidence for a generalised performance deficit in facial processing, rather than a specific emotion recognition deficit in schizophrenia (Archer et al., 1992; Kerr and Neale, 1993; Mueser et al., 1997), many have demonstrated poor judgement of facial emotion in schizophrenic patients (Novic et al., 1984; Feinberg et al., 1986; Gessler et al., 1989; Gaebel and Woelwer, 1992). A recent study tested patients' ability to recognise an affect state from audio-visual presentation of facial expression, voice tone and upper body movement cues (Bell et al., 1997). Although schizophrenic patients were generally impaired compared with normal and patient controls, they demonstrated a differential impairment in negative affect recognition. Attempts to differentiate the performance on facial expression recognition tasks of different subgroups of schizophrenic patients have provided evidence for the superior ability of paranoid compared with non-paranoid patients in the labelling of negative affects (Kline et al., 1992).

Other recent studies have investigated perception and encoding of facial expressions and postures in the same group of schizophrenic patients (Flack et al., 1997, 1998). These patients failed to respond normally to postures expected to induce anger and disgust.

Taken together, these findings suggest that there is a generalised deficit in facial perception in schizophrenia, but that the deficit may be particularly apparent for negative expressions of emotion and in non-paranoid patients.

Although paranoid patients (those with persecutory delusions) might be generally superior to non-paranoid patients in the recognition of negative facial expressions, it is possible that the paranoid individuals have difficulty with specific negative emotions. Given the persecutory content of their delusions, threat-related expressions are of particular relevance. Some studies have shown increased attention to threatening stimuli in this group (Bentall and Kaney, 1989; Kaney et al., 1992; Bentall et al., 1995; Bentall and Kaney, 1996), while studies of on-line visual appraisal using visual scan paths have suggested avoidance of overtly threatening scenes (Phillips et al., 1999). Paranoid patients may have difficulty in the correct labelling of threat-related negative emotions (fear, anger) displayed by others for any of several reasons, including:

1. identification of threat where none exists;
2. avoidance of thorough appraisal of threat; and
3. a deficit in the ability to correctly label negative emotions.

On the other hand, schizophrenic patients without a history of persecutory delusions, but with other symptoms (e.g. passivity experiences or negative symptoms) may have a more generalised cognitive or perceptual deficit in the processing of all facial expressions.

Fear and anger are both basic emotions experienced when an individual is under threat (Darwin, 1872/1998, 3rd. edition). Disgust is another negative emotion usually experienced in a food-related context, and is thought to prevent the ingestion of harmful, waste products (Roizin and Fallon, 1987; Phillips et al., 1998a). The three basic emotions of fear, anger and disgust are characterised by a specific facial expression and an associated behavioural response (Ekman and Friesen, 1976).

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