Facial emotion processing in schizophrenia: No evidence for a deficit specific to negative emotions in a differential deficit design

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Abstract

People with schizophrenia perform poorly when recognising facial expressions of emotion, particularly negative emotions such as fear. This finding has been taken as evidence of a "negative emotion specific deficit", putatively associated with a dysfunction in the limbic system, particularly the amygdala. An alternative explanation is that greater difficulty in recognising negative emotions may reflect a priori differences in task difficulty. The present study uses a differential deficit design to test the above argument. Facial emotion recognition accuracy for seven emotion categories was compared across three groups. Eighteen schizophrenia patients and one group of healthy age- and gender-matched controls viewed identical sets of stimuli. A second group of 18 age- and gender-matched controls viewed a degraded version of the same stimuli. The level of stimulus degradation was chosen so as to equate overall level of accuracy to the schizophrenia patients. Both the schizophrenia group and the degraded image control group showed reduced overall recognition accuracy and reduced recognition accuracy for fearful and sad facial stimuli compared with the intact-image control group. There were no differences in recognition accuracy for any emotion category between the schizophrenia group and the degraded image control group. These findings argue against a negative emotion specific deficit in schizophrenia.
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1. Introduction

1.1. Facial emotion recognition deficits in schizophrenia

A deficit in the ability to recognise facial expressions of emotion has been consistently reported in

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patients with schizophrenia (Walker et al., 1984; Feinberg et al., 1986; Archer et al., 1992; Schneider et al., 1995; Salem et al., 1996; Addington and Addington, 1998; Kee et al., 1998; Kohler et al., 2003). This deficit appears to be, at least partly, related to a more general problem in cognitive functions including the categorisation, discrimination and identification of facial stimuli, as well as deficits in other cognitive processes such as working memory and attention (Addington and Addington, 1998; Kee et al., 1998). Previous studies report an association between performance on facial expression recognition tasks and clinical measures of symptomatology, particularly negative symptoms (Heimberg et al., 1992; Schneider et al., 1995; Addington and Addington, 1998). It has been frequently found that patients with schizophrenia are more adversely affected in recognition of negative facial expressions, particularly fear, than positive or neutral expressions (Archer et al., 1992; Schneider et al., 1995; Bryson et al., 1997; Kohler et al., 2003).

1.2. Possible explanations for reduced recognition of negative emotions

This finding has led to the hypothesis of a negative emotion specific deficit in schizophrenia that arises as a result of either a cognitively mediated avoidance of negative stimuli leading to reduced acuity for processing such information (the social-cognitive view, Mandal et al., 1998), or aberrant neural processing in brain regions specifically subserving the recognition of negative emotions (Phillips et al., 1999; Kohler et al., 2003). A number of recent neuroimaging studies have tried to differentiate between these alternatives (e.g., Phillips et al., 1999; Gur et al., 2002; Kosaka et al., 2002). Patients with schizophrenia show reduced amygdala activation to negative emotions such as fear. This finding has been interpreted as supporting the notion that a) the amygdala is specifically involved in the recognition of negative emotions and b) amygdala dysfunction underlies the negative emotion specific deficit found in schizophrenia patients.

We have argued previously (Johnston et al., 2001, 2003) that the alleged negative emotion specific deficit reported in schizophrenia may, in fact, be an artefact arising as a result of the psychometric properties of the stimulus materials. Facial emotional expression stimuli typically include representations of Ekman's eight universal emotional expressions that consist of one positive emotion (happiness), five negative emotions (sadness, fear, anger, disgust, and contempt) as well as surprise and a neutral expression. It is argued that the overlap of structural configuration in feature space may be greater among negative expressions of emotion than between negative and positive or between negative and neutral expressions. This may result in a priori differences in the relative discriminability of negative and positive emotion categories. Such differences in stimulus discriminability may not be apparent in healthy subjects due to ceiling effects. However, they may surface in schizophrenia, as a generalised perceptual deficit could result not only in overall poorer performance but also in greater performance decline for the more difficult negative expressions of emotion relative to positive and neutral expressions of emotion.

Johnston et al. (2001) examined the behaviour of a neural network model that was capable of discriminating seven categories of facial expression of emotion (happiness, surprise, fear, disgust, anger, sadness and neutral) based on measures describing relationships between important facial features. The discrimination performance of this neural network model was then compromised by a random "lesioning" of synaptic connections. This lesioning had a disproportionate effect on the model's ability to correctly classify negative emotions, whilst classification of happy faces remained largely intact and the classification of neutral and surprised faces was only mildly affected. Johnston et al. (2003) showed that facial emotion recognition performance was disrupted in healthy subjects when the quality of the images had been degrading by blurring. Emotion recognition accuracy was compared for intact images and two levels of stimulus degradation. Increasing stimulus degradation resulted in different degrees of decline in recognition accuracy for different emotions. Specifically, increasing degradation resulted in greater decline in recognition accuracy for negative emotions than for happy, surprised or neutral faces. In both studies, there was a consistent pattern of erroneous categorisation that was characterised by reciprocal miscategorisation of disgust and anger, fear and surprise, and sadness and neutral. Johnston et al. concluded that negative and positive emotions differ in