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Actively paranoid patients with schizophrenia over attribute anger to neutral faces

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ABSTRACT

Previous investigations of the influence of paranoia on facial affect recognition in schizophrenia have been inconclusive as some studies demonstrate better performance for paranoid relative to non-paranoid patients and others show that paranoid patients display greater impairments. These studies have been limited by small sample sizes and inconsistencies in the criteria used to define groups. Here, we utilized an established emotion recognition task and a large sample to examine differential performance in emotion recognition ability between patients who were actively paranoid (AP) and those who were not actively paranoid (NAP). Accuracy and error patterns on the Penn Emotion Recognition test (ER40) were examined in 132 patients (64 NAP and 68 AP). Groups were defined based on the presence of paranoid ideation at the time of testing rather than diagnostic subtype. AP and NAP patients did not differ in overall task accuracy; however, an emotion by group interaction indicated that AP patients were significantly worse than NAP patients at correctly labeling neutral faces. A comparison of error patterns on neutral stimuli revealed that the groups differed only in misattributions of anger expressions, with AP patients being significantly more likely to misidentify a neutral expression as angry. The present findings suggest that paranoia is associated with a tendency to over attribute threat to ambiguous stimuli and also lend support to emerging hypotheses of amygdala hyperactivation as a potential neural mechanism for paranoid ideation.

1. Introduction

Emotion recognition impairments and their relationship to social and functional outcome are well established in schizophrenia (Couture et al., 2006; Kohler et al., 2009; Pinkham et al., 2007). It remains unclear however whether the degree of these impairments may differ between symptom based subgroups and specifically between patients who experience prominent paranoid symptoms and those who do not. Previous investigations of the influence of paranoia on facial affect recognition in schizophrenia have provided conflicting results. Some studies support an advantage for paranoid over non-paranoid patients (Chan et al., 2008; Davis and Gibson, 2000; Lewis and Garver, 1995; Phillips et al., 1999; Van't Wout et al., 2007), while others show the opposite pattern (An et al., 2006; Russell et al., 2007; Williams et al., 2007). Kline et al. (1992) note that this pattern may differ based on emotion, as their work showed that paranoid patients were more accurate for negative emotions but that groups did not differ in correctly labeling positive emotions.

These discrepancies may be partially explained by the fact that all of the above studies utilized relatively small samples (generally fewer than 20 individuals per group); however, methodological differences between studies also deserve consideration. Perhaps most importantly, many previous studies have defined the paranoid and non-paranoid

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subgroups based on diagnostic subtype rather than symptom ratings at the time of testing (An et al., 2006; Chan et al., 2008; Davis and Gibson, 2000; Lewis and Garver, 1995; Van't Wout et al., 2007). It is important to note that under DSM-IV-TR, patients do not require persecutory or paranoid delusions to be diagnosed with this subtype. Therefore, much of the previous work may not have examined paranoia per se. Additionally, the range of emotions studied and the tasks used to measure emotion recognition ability have varied widely between studies.

The potential role of paranoia in emotion recognition is also raised by several neuroimaging studies showing differences in amygdala functioning between individuals with prominent paranoid symptoms at the time of scanning and those without. The amygdala is thought to play a key role in emotion perception (Adolphs, 2002; Gur et al., 2002; Loughead et al., 2008; Vuilleumier and Pourtois, 2007) and has also been linked to the processing of threat (Ohman, 2005) and complex social judgments (Adolphs et al., 1998; Winston et al., 2002). fMRI studies indicate that paranoid patients generally show reduced amygdala activation as compared to non-paranoid patients (Phillips et al., 1999; Pinkham et al., 2008a,b; Russell et al., 2007; Williams et al., 2004, 2007), a finding that would seem to contradict behavioral reports of increased recognition accuracy for paranoid patients. Of note, however, each of these imaging studies has assigned individuals to groups based on clinical ratings of paranoia as opposed to diagnostic subtype, and these studies have largely used tasks of implicit emotion recognition (e.g. asking participants to identify the gender of an emotional face) rather than the explicit identification of emotion utilized in behavioral tasks. While differences in task demands may partially explain the unexpected result of reduced amygdala activation in paranoid patients, tasks of explicit emotion recognition administered after scanning do show greater impairments in paranoid patients (Russell et al., 2007; Williams et al., 2004, 2007), suggesting that reduced amygdala activation may indeed be related to poorer performance.

In an effort to complement the neuroimaging findings, and to address the discrepancies in previous behavioral studies, we utilized an established emotion recognition task and a large sample to assess facial affect recognition abilities in patients with schizophrenia who were actively paranoid and those who were not actively paranoid. Groups were defined based on the presence of paranoid ideation at the time of testing rather than diagnostic subtype. Based on the above-mentioned findings of reduced amygdala activation in paranoid patients, we hypothesized that actively paranoid patients would be impaired relative to patients who were not actively paranoid in emotion identification accuracy.

2. Method

2.1. Participants

Archival data from 132 individuals with schizophrenia were utilized for the present investigation. All individuals were volunteers at the Schizophrenia Research Center of the University of Pennsylvania Medical Center who had provided written informed consent to participate in studies that were approved by the University of Pennsylvania ethics review board. Diagnoses were confirmed with the Diagnostic Interview for Genetics Studies (DIGS; (Nurnberger et al., 1994) and medical history information. Only patients receiving a diagnosis of schizophrenia were included in the current sample.

Symptom severity at the time of testing was assessed with the Scale for Assessment of Negative Symptoms (SANS, 25 items; Andreasen, 1984a) and the Scale for Assessment of Positive Symptoms (SAPS, 34 items; Andreasen, 1984b). For both scales, interviewers specify the severity of symptoms by assigning a rating between 0 and 5, with higher ratings indicating greater severity. Ratings on the persecutory delusions item of the SAPS were used to divide patients into two groups: actively paranoid (AP) and not actively paranoid (NAP). Individuals scoring 2 or greater, indicating the presence of paranoid ideation, were included in the AP group (N = 68), and individuals scoring 0, indicating absence of paranoid ideation, constituted the NAP group (N = 64). No individuals received a score of 1, which would indicate questionable levels of paranoia. Groups did not significantly differ in gender ($\chi^2 = .004$, $p = .95$), ethnicity ($\chi^2 = 1.64$, $p = .44$), age ($t(130) = .64$, $p = .53$), education ($t(130) = 1.44$, $p = .15$) or parental education (maternal education: $t(121) = 1.16$, $p = .25$ and paternal education: $t(115) = 1.51$, $p = .14$). AP patients did show greater severity of negative ($t(130) = 2.22$, $p = .028$) and positive symptoms ($t(130) = 7.45$, $p < .001$) as indexed by the sum of SANS and SAPS global ratings. The difference in positive symptoms remained even when omitting global ratings on the delusion subscale ($t(130) = 4.67$, $p < .001$). Finally, mean Chlorpromazine equivalent dose (Woods, 2003) did not significantly differ between groups ($t(130) = .54$, $p = .59$). Participant demographic information is provided in Table 1.

Table 1
Participant demographic information.

	AP ($n = 68$) Mean (SD)	NAP ($n = 64$) Mean (SD)
Gender		
Male	45	42
Female	23	22
Ethnicity		
Caucasian	32	31
African American	33	28
Asian	2	5
Age	35.24 (10.49)	33.98 (12.06)
Education	12.69 (2.21)	13.28 (2.49)
Maternal education	13.00 (3.11)	13.61 (2.69)
Paternal education	12.95 (3.94)	14.02 (3.74)
SANS	7.62 (4.18)	5.94 (4.52)
SAPS	6.94 (3.35)	2.64 (3.28)
SAPS (omitting delusion subscale)	4.03 (2.72)	1.92 (2.46)
Chlorpromazine Equivalent	454.10 (418.68)	492.42 (404.02)

Abbreviations: AP = actively paranoid, NAP = not actively paranoid.
Note: ethnicity information was missing for one patient in the AP group. Maternal education was missing for 6 individuals in the AP group and 3 in the NAP group. Paternal education was missing for 9 and 6 individuals in the AP and NAP groups, respectively. SANS and SAPS scores are presented as the sum of the global scores with 0-20 as the range of possible scores on both scales.