Attribution Biases in Schizophrenia: Relationship to Clinical and Functional Impairments

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Background: Patients with schizophrenia exhibit impairment in their ability to accurately recognize facial emotions in others, and the severity of this emotion perception deficit has been associated with poorer functioning. However, the mechanisms underlying facial emotion perception deficits are poorly understood. There is evidence to suggest that patients, particularly those with certain positive symptoms, may misinterpret other people’s facial expressions as having an overly negative valence. The present study examined the degree to which attribution biases in facial emotion perception are associated with psychiatric symptomatology and social and occupational impairments.

Sampling and Methods: The error profiles from a facial emotion perception test were analyzed and compared for 67 schizophrenic state hospital inpatients and 21 nonpsychiatric controls. Attribution bias scores were separately computed for each of six types of emotion. Results: The error profiles were remarkably similar for patients as a group and controls. Within the patient group, severity of positive symptoms was associated with more ‘fear’ misperceptions. Patients with relatively high levels of ‘anger’ misperceptions tended to have more severe disorganization and negative symptoms and more pronounced functional impairments. Interestingly, patients who erroneously reported seeing relatively high levels of ‘shame’ and ‘happiness’ showed better functioning and less severe symptoms.

Conclusions: Attribution biases appear to play a role in contributing to functional impairments in patients with schizophrenia. The lack of an isomorphic attribution bias across patients highlights the importance of considering schizophrenia heterogeneity when attempting to understand and treat social cognitive deficits.

Introduction

Patients with schizophrenia have shown marked social cognitive deficits, particularly in their ability to accurately recognize facial emotions [1]. Moreover, the severity of these deficits has been associated with poorer functioning across a number of social and occupational domains [2, 3]. However, the underlying mechanism by which emotion perception deficits occur is largely unclear. Based mostly on evidence that emotion perception deficits are modestly correlated with impaired neuropsychological performance [4, 5], some researchers have pro-
posed that emotion perception deficits reflect impairment in basic neurocognitive processes [5, 6]. There is reason to suspect that, at least for some patients, emotion perception deficits are also driven by higher-order cognitive disruptions, notably attribution biases. Attribution biases are motivational and cognitive perceptual biases that color an individual’s perception of their environment [7]. With regard to schizophrenia, it may be the case that patients erroneously interpret others as having an overly negative emotional valence and this attribution bias interferes with their ability to effectively function in social and occupational settings. The present study examined the degree to which attribution biases in facial emotion perception are related to severity of schizophrenia symptoms and functional impairments. Understanding the underpinnings of emotion perception deficits in this manner is particularly timely given current efforts to develop social cognition rehabilitation programs for use with schizophrenia patients [8].

There is good reason to think that attribution biases are important for understanding emotion perception deficits in schizophrenia. First, an attribution bias towards seeing facial emotions as overly negative in valence has been observed in other psychiatric disorders, including depression [9], body dysmorphic disorder [10], conduct disorder [11] and bipolar disorder [12]. Second, the application of attribution theory to schizophrenia research has been helpful for understanding certain schizophrenic processes, notably paranoia and delusions of persecution [13, 14], hallucinations [15, 16] and depression [17]. Finally, support for an attribution bias in facial emotion perception in patients with schizophrenia has been found. Kohler et al. [18] reported that patients, compared to nonpsychiatric controls, incorrectly endorsed seeing significantly more negative emotions (‘disgust’, and to a lesser extent ‘fear’) in neutral-valenced facial expressions. However, patients and controls did not differ in the error profiles of nonneutral faces, suggesting that this attribution bias may be limited to neutral stimuli, at least for patients as a group. In the present study, we compared the error profiles from a facial emotion perception test between patients and healthy controls with the expectation that patients would erroneously report seeing negatively valenced emotions, particularly anger and fear, more so than controls. A related goal of this study involved determining the extent to which these attribution biases were associated with ‘real world’ social and occupational dysfunctions.

When discussing schizophrenia, it is important to acknowledge the considerable heterogeneity across patients in most aspects of the disorder. Given the improbability that an isomorphic attribution bias is present in all or even most patients, it seems more plausible that attribution biases for different ‘types’ of emotions would manifest in patients with different types of symptom presentations. Based on evidence that patients with paranoid psychotic processes have relatively global attribution biases compared to nonparanoid patients [13], a reasonable supposition would be that attribution biases for negative emotions might be more pronounced in patients with prominent positive symptoms. In an examination of this issue, Peer et al. [19] found that ‘disgust’ misperceptions from a facial emotion perception test were associated with more severe paranoid symptoms. A secondary aim of the present project was to examine the relationship between symptoms and attribution biases for five common emotion types. In particular, we were interested in determining whether patients with positive symptoms would evidence attribution biases for ‘anger’- and ‘fear’-based emotions.

Methods

This study was part of a larger investigation into the emotional, physiological, and neuropsychological correlates of social functioning. Approval from all relevant human subjects review boards was obtained, and all subjects gave written voluntary informed consent prior to participating in the study. A fuller description of the methodology is provided elsewhere [20, 21]. The descriptive and clinical data for the patient group are presented in Table 1.

Participants

The patient group consisted of 67 individuals who met the DSM-IV [22] criteria for schizophrenia or schizoaffective disorder based on information obtained from the Schedule for Affective Disorders and Schizophrenia (SADS) [23]. These patients were recruited from an inpatient psychiatric state hospital, and the majority of the patients were hospitalized under a forensic status (i.e., forensic evaluation, restoration of competency to stand trial, or being found not guilty by reason of insanity by a court of law). Patients were excluded if they had a Global Assessment of Functioning (GAF) score [22] below 30, evidence of mental retardation, history of organic disorder or significant head trauma (requiring overnight hospitalization), DSM-IV current alcohol or drug abuse, or a significant history of alcohol or drug abuse or dependence suggestive of substance-related organic damage.

The control group consisted of 21 university support staff and community volunteers. The control group was matched to the patient group in age, gender, and parental Socioeconomic Index [24]. Exclusion criteria included meeting DSM-IV criteria for any current psychotic or substance use disorder, or having a history suggestive of the possibility of organic damage, as above.
Table 1. Spearman’s correlations between the attribution bias scores and the functioning and symptom severity scores for patients (n = 67)

<table>
<thead>
<tr>
<th>Functioning measures</th>
<th>Attribution bias categories³</th>
<th>happiness</th>
<th>anger</th>
<th>fear</th>
<th>sadness</th>
<th>shame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social functioning</td>
<td></td>
<td>0.31*</td>
<td>–0.30*</td>
<td>–0.16</td>
<td>0.05</td>
<td>0.00</td>
</tr>
<tr>
<td>Global functioning</td>
<td></td>
<td>0.18</td>
<td>–0.42**</td>
<td>–0.07</td>
<td>–0.01</td>
<td>0.31*</td>
</tr>
<tr>
<td>Symptom measures²</td>
<td></td>
<td>0.12</td>
<td>0.11</td>
<td>0.31*</td>
<td>–0.10</td>
<td>–0.29*</td>
</tr>
<tr>
<td>Core positive symptoms</td>
<td></td>
<td>0.03</td>
<td>0.28*</td>
<td>–0.03</td>
<td>0.01</td>
<td>–0.37**</td>
</tr>
<tr>
<td>Disorganization symptoms</td>
<td></td>
<td>–0.11</td>
<td>0.30*</td>
<td>0.16</td>
<td>0.00</td>
<td>–0.15</td>
</tr>
<tr>
<td>Negative symptoms</td>
<td></td>
<td>–0.03</td>
<td>0.07</td>
<td>0.25*</td>
<td>0.03</td>
<td>–0.01</td>
</tr>
</tbody>
</table>

Significant r values are in italics. * p < 0.05, ** p < 0.01.

³ Higher scores reflect better functioning.
² Higher scores reflect more severe symptomatology.
³ Higher scores reflect a more severe attribution bias.

Procedures

Attribution biases were measured using the Facial Emotion Identification Test (FEIT) [25]. Patients were presented with 19 black-and-white still photographs of individuals’ faces and then asked to identify the primary emotion from six different emotions. These emotions included: happiness, anger, fear, sadness, surprise and shame [26]. Using the procedures outlined in Peer et al. [19], attribution bias scores were computed for each of the emotion categories as a proportion between the number of times that specific category was erroneously selected and the total number of errors. For example, the ‘fear’ bias score was computed by dividing the number of incorrect ‘fear’ responses by the total number of errors. As noted by Hogg and Craig [27], proportion scores violate the homogeneity of variance assumption for parametric statistical analysis. To compensate for this, we employed the following arcsine transformation suggested in Hogg and Craig [27]: arcsin(SQRT)((y + 3/8)/(n + 3/4)), where y = the number of errors of interest reported for each subject and n = the total number of errors. Furthermore, for reasons explicated below, we used non-parametric statistics for all analyses examining attribution bias scores.

Functioning

Social and occupational functioning was measured using the Social Functioning Scale (SFS) [28]. The SFS is a 79-item questionnaire that assesses seven distinct yet highly correlated domains of social behavior including: social engagement, interpersonal behavior, independence-performance, recreational activities, prosocial behavior, independence-competence, and employment/occupation. A global social functioning score was computed by summing the seven individual t-score-transformed subscale scores (norms in Birchwood [28]). The SFS has been shown to have acceptable alpha coefficients (0.80), sensitivity and construct validity in patients with schizophrenia and nonpsychiatric controls [28]. Higher SFS scores reflect better social functioning.

General functioning was measured using the GAF [22]. Ratings were made by one of three graduate-level researchers who demonstrated adequate reliability based on independent reviews of 10 videotaped SADS interviews (intraclass correlation coefficient values = 0.83). The GAF was not administered to controls in the present study. Higher GAF scores reflect better overall functioning.

Global intellectual functioning (IQ) was estimated using the Shipley Institute of Living Scale [29]. This scale has been found to be highly correlated with full-scale WAIS-R IQ scores [28].

Symptom Severity

The Scale for the Assessment of Positive Symptoms (SAPS) [30] and the Scale for the Assessment of Negative Symptoms (SANS) [31] were used to measure patients’ symptom severity. Three symptom domain scores were computed for the present study, which included a core positive (i.e., SAPS global hallucination and delusion items), core disorganization (i.e., SAPS global bizarre behavior and formal thought disorder items), and negative (i.e., SANS global items, except the inattention score) factors. We also computed a ‘depression-anxiety’ factor (i.e., anxiety, guilt, suicidality and depression items), identified in a recent factor analytic study [32] of the expanded 24-item Brief Psychiatric Rating Scale [33]. Ratings were made by one of three graduate-level researchers who demonstrated adequate reliability based on independent reviews of 10 videotaped SADS interviews (intraclass correlation coefficient values for each of the individual factor scores were >0.70). Higher scores reflect more severe symptoms.

Analyses

The analyses were conducted in three steps. First, we compared the patients and controls on demographic variables. Second, we compared patients and controls in accuracy on the emotion perception test with the expectation that patients would perform worse. As part of these analyses, we computed and compared
Results

Patients versus Controls: Descriptive and Demographic Variables

Means and standard deviations were separately computed and compared between patients and nonpatient controls for age (41.29 ± 8.55 and 39.38 ± 10.97 years, respectively), education (11.94 ± 1.96 and 14.24 ± 1.45 years, respectively), IQ (80.61 ± 10.63 and 101.38 ± 11.47, respectively), gender composition (27 and 33% male, respectively), ethnic composition (33 and 57% Caucasian, respectively) and social functioning (106.96 ± 7.65 and 122.83 ± 3.85, respectively) variables. Controls had significantly higher levels of education and better intellectual, social and general functioning than patients, but the two groups did not differ in any other respect. Regarding patient clinical characteristics, patients were relatively stable (core positive syndrome = 3.49 ± 2.66, disorganization syndrome = 2.77 ± 2.29, negative syndrome = 4.58 ± 3.54 and anxiety factor = 8.35 ± 2.12) and were functionally impaired (GAF score = 41.29 ± 8.25). Eighty-eight percent of the patients were being prescribed atypical antipsychotic medications, 42% mood stabilizers and 9% antidepressant medications.

Patients versus Controls: Emotion Perception Accuracy and Attribution Bias Scores

A t test comparing patients and controls in FEIT accuracy suggested that patients produced significantly more errors (mean = 8.84, SD = 3.23) than controls (mean = 5.71, SD = 2.26) [t(86) = 4.12, p < 0.001]. Thus, consistent with prior research [1], patients showed a deficit in emotion recognition ability.

Means, standard deviations and ranges for the attribution bias scores were computed. Across both groups, ‘happiness’ misperception scores ranged from 0 to 0.50 (means ± SD = 0.13 ± 0.12 and 0.06 ± 0.13 for patients and controls, respectively), ‘anger’ misperception scores ranged from 0 to 0.57 (means ± SD = 0.13 ± 0.15 and 0.17 ± 0.16 for patients and controls, respectively), ‘fear’ misperception scores ranged from 0 to 0.29 (means ± SD = 0.08 ± 0.08 and 0.11 ± 0.10 for patients and controls, respectively), ‘sadness’ misperception scores ranged from 0 to 0.50 (means ± SD = 0.17 ± 0.13 and 0.17 ± 0.16 for patients and controls, respectively), ‘surprise’ misperception scores ranged from 0 to 1.00 (means ± SD = 0.31 ± 0.19 and 0.32 ± 0.18 for patients and controls, respectively), and ‘shame’ misperception scores ranged from 0 to 0.50 (means ± SD = 0.19 ± 0.14 and 0.17 ± 0.15 for patients and controls, respectively). We had concerns about these distributions because there were a large number of ‘zero’ values for some of the categories (percent of zero scores ranged from 12 to 46%). Therefore, nonparametric statistics were used for all analyses examining the attribution bias scores. A Mann-Whitney U test, computed to compare the two groups on attribution bias scores, suggested that the groups significantly differed only on the ‘happiness’ (Z = –2.57, p < 0.01) categories (all other p values >0.10). Thus, in contrast to our predictions, patients, as a group, did not demonstrate attribution biases towards negative emotions.

Patient Group Analyses: the Relationship between Attribution Biases, Symptom Severity and Functional Impairment

Spearman rank correlations were computed between the attribution biases, symptom severity and functional impairment scores (table 1). Given that ‘surprise’ is neither inherently positively nor negatively emotionally valenced, we excluded this variable to reduce the overall number of analyses. There were three main findings. First, severity of ‘anger’ misperceptions was significantly associated with poorer overall social and global functioning. ‘Anger’ misperceptions were not significantly associated with core positive symptoms as expected, but were significantly associated with more severe disorganization and negative symptoms. Second, ‘fear’-based misperceptions tended to occur in individuals with pronounced core positive symptoms and depressive/anxious symptoms but were not significantly associated with functioning. Third, ‘happiness’ and ‘shame’ misperceptions were significantly associated with better clinical and functional state in some respects. Patients who tended to erroneously report seeing ‘happiness’ tended to have better social functioning and those who erroneously reported seeing ‘shame’ tended to have better overall functioning and less severe core positive and disorganization symptoms.
Discussion

To our knowledge, this study is one of the first to examine the relationship between functioning ability, symptom severity and attribution biases in facial emotion perception in patients with schizophrenia. For the most part, as in Kohler et al. [18], patients as a group did not differ from controls in these attribution biases (when evaluating emotionally expressive faces) raising doubts about whether there is an isomorphic attribution bias that characterizes schizophrenia patients as a group. However, within the patient group, attribution biases for emotion showed important clinical and functional correlates. In general, these findings suggest that certain types of attribution biases, particularly for anger-, fear- and shame-based emotions, are important for understanding schizophrenia pathology across the heterogeneous manifestations of the disorder. Several findings from this study bear further discussion.

Evidence from this study suggests that patients who misinterpret others’ faces as having an angry emotional valence tend to have poorer functioning than other patients. ‘Anger’ misperceptions were not associated significantly with core positive symptoms as hypothesized but were associated with more severe disorganization and negative symptoms. When attempting to explain this, it is important to note that patients with disorganization symptoms have shown lower levels of hemispheric specialization than other patients [34], and there is growing evidence for a right hemispheric dominance for emotion processing, particularly for ‘anger’-based emotions [35]. Thus, disorganization symptoms and ‘anger’-based attribution biases may reflect abnormal right hemispheric functioning. An alternate explanation concerns the fact that a majority of patients in this sample were hospitalized for forensic reasons, and some of the patients probably had maladaptive personality traits (e.g. antisocial traits) that may have interfered with functioning. Thus, it could be the case that, as has been noted in adolescents with conduct disorder [11], personality traits contributed to an ‘angry’ attribution bias. Finally, it is possible that increased ‘anger’ misperceptions reflected a more global angry disposition related to a severe illness state. In support of this view, a link between increased self-reported feelings of anger and increased chronicity of illness has been reported [36]. While far from conclusive, the idea that disorganization and negative symptoms may be related to attribution biases and these biases may be associated with functional impairment is relatively novel and intriguing for the generation of future hypotheses.

Individuals with ‘fear’, ‘anger’ and ‘shame’/’happiness’ misperceptions each showed a relatively distinct pattern of clinical correlates suggesting that different types of attribution biases are related to different pathological processes. While these results should be interpreted cautiously, it may be the case that certain types of attribution styles demarcate coherent schizophrenia subtypes, each with relatively specific symptom and functional correlates. In other words, there may be something fundamentally different about patients who erroneously see ‘anger’ in others’ faces versus patients that erroneously see ‘shame’ or ‘fear’. If true, this finding would be important in its implications for our understanding of schizophrenia heterogeneity. From a treatment perspective, the present findings are also important for developing cognitive-behavioral interventions aimed at reducing the impact of maladaptive attribution and cognitive distortions on patients’ functioning. Understanding how patients process information from their environment may be very informative for designing efficacious, individually tailored treatments. While clearly in its early stages of validation, the facial emotion perception test appears to hold promise as a measure of attribution biases in schizophrenia.

It is also important to consider the potential contribution that methodological issues made to the present findings. First, as noted by Kohler et al. [18], there are limitations with using the FEIT, including restricted stimulus set and limited use of ethnicity and age representation across the facial stimuli. Moreover, the use of photographic stills has limited ecological validity for understanding ‘real-life’ emotion perception occurring in dyadic interactions across multiple sensory domains. Our use of FEIT stimuli was also a limitation in that it did not allow for a more sophisticated examination of whether attribution biases occurred at the ‘encoding’ versus ‘decoding’ stages of processing [37, 38]. Second, the patient group was primarily comprised of chronic patients who may be considered atypical in some respects. In particular, antisocial characteristics, illicit drug abuse and florid psychosis were probably much more pronounced in this sample than patients as a whole. As we lacked information on these characteristics, we were unable to determine their effect on the present findings. Third, no attempt to control for type II errors was made due to the exploratory nature of this study, so it is possible that these significant findings could be spurious. Fourth, the control sample was relatively small compared to the patient group and we were unable to examine the relationship between attribution biases and functional impairments in nonpatient controls. Given that emotional biases ap-
appear to have functional consequences for individuals who are not schizophrenic [9], it may be the case that these biases reflect a more general marker of pathology rather than a pathognomonic sign of schizophrenia. Fifth, the study was ill-equipped to examine the role of basic cognitive processes (e.g., attention, memory) in facial emotion recognition ability. Finally, this study was cross-sectional in design and it would be important to examine the covariance between symptoms, functioning and attribution biases over time using a longitudinal design. An important next step in this line of research would be to replicate the present study in a sample of stable outpatients using a more comprehensive facial emotion perception test.

The present findings have relevance for efforts to develop remediation interventions that address deficits in social cognition and emotion perception. Namely, successful remediation strategies may benefit by taking into account the extent to which attribution biases are related to patients’ impaired facial emotion perception ability. Moreover, attribution biases may vary considerably across patients and may reflect different underlying pathophysiological processes. Further research is needed to clarify the role that attribution biases play in schizophrenia pathology across the heterogeneous manifestations of the disorder.

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