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Do the siblings of schizophrenia patients demonstrate affect perception deficits?

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Abstract

Affect perception deficits have been extensively documented in schizophrenia and are associated with the social dysfunction that is characteristic of this disorder. The two previous studies examined facial affect perception in genetically at-risk samples and yielded mixed results. The current study was designed to provide a rigorous test of affect perception abilities among schizophrenia patients ($n=58$), their biological siblings without psychosis ($n=51$), and nonpsychiatric controls ($n=49$). Participants completed three measures of affect perception, including facial, vocal, and combined modality. Schizophrenia patients performed significantly worse than controls on two of the three affect perception tests as well as a composite index based on all three tests. The performance of the sibling group fell between the patient and control groups on each of the affect perception tests. However, group differences achieved statistical significance only for the composite index with the siblings performing significantly worse than controls and significantly better than the schizophrenia group. These findings demonstrate that subtle deficits in affect perception are detectable in the unaffected siblings of schizophrenia patients when multiple measures of different types of affect perception abilities are used in combination.

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1. Introduction

Impairment in social functioning has been recognized as one of the hallmarks of schizophrenia (Bellack et al., 1989), resulting in fractured family relationships, peer conflict, and isolation. Considerable attention has focused on aspects of social

cognition (including perception of emotion) as potential determinants of social dysfunction in schizophrenia (Green, 2001; Penn et al., 1997). Research studies over the past two decades have consistently indicated that schizophrenia patients are less accurate than nonpatient controls in their ability to perceive emotions across various modalities of expression. Affect perception deficits have been most extensively documented in paradigms that require subjects to identify or discriminate between emotions displayed in still photographs of faces (see Mandal et al., 1998 for a comprehensive review of methods and stimuli in this area). Similar deficits are found in studies of

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emotional vocalizations (Kerr and Neale, 1993; Salem et al., 1996), emotional displays in videotaped monologues (Bryson et al., 1997), and affective cues displayed during videotaped social interactions (Bellack et al., 1996). It is likely that such deficits could lead to inappropriate social responses, decreased social skills, and a decreased sense of social efficacy.

The nature and functional significance of affect perception deficits in schizophrenia have been examined through several lines of investigation. Affect perception deficits cannot be explained by antipsychotic medication side effects as they are detectable in unmedicated patients (Kerr and Neale, 1993; Salem et al., 1996). These deficits appear to be unaffected by traditional antipsychotics (Gaebel and Wolwer, 1992) and may be improved by atypical antipsychotics (Kee et al., 1998a). Although affect perception deficits may be more pronounced during periods of acute psychotic symptom exacerbations, they are evident during periods of clinical remission (Gessler et al., 1989) and may be more severe in schizophrenia patients than patients diagnosed with non-schizophrenia psychiatric disorders (Archer and Andrew, 1992). Preliminary evidence suggests affect perception deficits are found in first-episode patients (Edwards et al., 2001) and are relatively stable over time (Addington and Addington, 1998; Streit et al., 1997). Finally, affect perception deficits appear to have functional significance, as they have been linked to various indices of poor social competence and social functioning (Ihnen et al., 1998; Kee et al., *in press*; Mueser et al., 1996; Penn et al., 1996; Poole et al., 2000).

The underlying cause of poor performance on affect perception tests has been a matter of debate (see Mandal et al., 1998). According to one perspective, poor performance on affect perception tasks merely reflects a generalized performance deficit, such that schizophrenia patients perform about as poorly on affect perception tasks as they do on any given neurocognitive task (e.g., Johnston et al., 2001; Salem et al., 1996; Silver and Shlomo, 2001). Similarly, Mueser et al. (1997) suggested that patients demonstrated a more general deficit in perceiving faces rather than a specific deficit in recognizing facial expressions of emotion. An opposing perspective is that poor performance on affect perception tasks in schizophrenic patients in fact reflects an emotion-

specific deficit (e.g., Borod et al., 1993; Bryson et al., 1997; Penn et al., 1997; Penn and Comb, 2000; Silver et al., 2002).

Recent studies examining the relationship between affect perception and basic neurocognitive abilities suggest that an alternative conceptualization may be more fruitful. Affect perception deficits may be particularly linked to some nonsocial/neurocognitive processes, and may also tap distinctive, nonredundant social cognitive abilities that contribute to clinical features (e.g., social dysfunction) of schizophrenia (see Penn et al., 1997). For example, we previously reported that affect perception deficits are associated with visual scanning deficits, but less strongly associated with vigilance and working memory (e.g., Kee et al., 1998b). Data from several other laboratories have shown similar patterns of association (Addington and Addington, 1998; Bryson et al., 1997; Schneider et al., 1995).

In the current study, we sought to test whether affect perception deficits are potential markers of vulnerability to schizophrenia by examining whether such deficits exist in the unaffected biological relatives of individuals with schizophrenia, who are at heightened risk for developing this disorder (Gottesman, 1991). This approach avoids many confounds typically associated with patient samples such as medication side effects, severe neurocognitive deficits, and relationships to clinical symptoms of the illness. The unaffected biological relatives of individuals with schizophrenia have previously been shown to exhibit subtle deficits in nonsocial cognitive and perceptual processes similar to those found in schizophrenia patients, including early visual scanning deficits (e.g., Green et al., 1997; Nuechterlein et al., 1998; Saoud et al., 2000), which suggests that such deficits are part of the predisposition to this disorder. As mentioned earlier, these particular types of deficits are closely related to impairments in perception of emotion. If siblings also show subtle deficits in affect perception, it would suggest that certain social cognitive deficits might be indicators of vulnerability to schizophrenia.

The performance of first-degree relatives of schizophrenic patients on affect perception tasks has been examined in two studies, which both focused on facial affect perception. McCown et al. (1988) examined performance on a task requiring subjects to

identify emotions expressed on slides of faces selected from Ekman and Friesen's (1976) Basic Affect Recognition Test. The relatives include parents of 50 individuals with schizophrenia and parents of 25 medical surgery patients. The parents of schizophrenia patients performed significantly worse than control parents on the task, although the magnitude of this effect was modest (0.19). Because the psychiatric status of parents in both groups was not provided, there is no information on the degree to which performance was independent of clinical feature of illness. More recently, Toomey et al. (1999) examined the performance of a relatively small sample of 21 nonpsychotic first-degree relatives (parents, siblings, or offspring) of schizophrenia patients and 19 demographically matched nonpsychiatric controls on tests of face identification, facial emotion identification, and a measure of social perception (the Profile of Nonverbal Sensitivity Test, PONS; Rosenthal et al., 1979). While no group differences were found across the face identification and facial emotion identification tasks, the relatives of schizophrenic patients performed worse than controls on the measure of social perception.

The current study was designed to rigorously test affect perception abilities in carefully diagnosed schizophrenia patients, siblings without schizophrenia spectrum disorders, and nonpsychiatric controls. Participants completed validated tests of affect perception previously found to discriminate schizophrenic patients from controls, which assessed facial, vocal as well as combined facial and vocal affect perception. Our primary interest was to test whether siblings of schizophrenia patients demonstrated affect perception deficits across facial and vocal modalities.

2. Methods

2.1. Subjects

Subjects included 58 schizophrenia outpatients, 54 siblings who shared both biological parents with the schizophrenia probands, and 49 nonpatient controls. Schizophrenia patients, recruited from the outpatient clinics of the Greater Los Angeles VA Healthcare System, and their siblings were participating in a larger

study of early visual processes in schizophrenia (M.F. Green, PI). Control subjects were recruited through newspaper advertisements and flyers posted in the UCLA and VA Medical Centers and in the local community.

Patients met criteria for schizophrenia based on the Structured Clinical Interview for DSM-IV (SCID; First et al., 1996a). All patients were receiving anti-psychotic medications at clinically determined dosages ($n = 39$ for atypical; $n = 19$ for conventional). For these patients, the average length of illness since first symptoms was 16.51 years (S.D. = 8.89). Psychiatric symptoms were assessed in the patient group using the 24-item Brief Psychiatric Rating Scale (BPRS; Ventura et al., 1993 [item range 1–7]).

Of the 54 siblings assessed, three were diagnosed with schizophrenia, schizoaffective, or delusional disorder and five were diagnosed with other nonpsychotic schizophrenia spectrum disorders (i.e., avoidant, paranoid, schizotypal, schizoid, or borderline personality disorder). The three siblings with psychotic disorders were excluded. Analyses were conducted on both siblings with and without nonpsychotic spectrum disorders.

Nonpatient control subjects were screened with the SCID and SCID-II (First et al., 1996b) and were excluded if they met criteria for any psychotic disorder, bipolar mood disorder, recurrent depression, substance dependence, or personality disorder such as avoidant, paranoid, schizotypal, schizoid, and borderline. Control subjects were also excluded if there was any evidence (according to subject report) for a history of psychotic disorder among their first-degree relatives. Additional exclusion criteria for all patients, siblings, and controls included: age less than 18 or over 55 years, active substance use disorder in the past six months, identifiable neurological disorder, mental retardation, or seizure disorder. Information used to determine these criteria were mainly derived from direct interviews with the subjects. For a few patients, medical chart reviews were included as supplementary to interviews after they gave informed consent. Diagnostic interviewers were trained to a minimum Kappa of 0.75 for rating psychotic and mood symptoms by the Diagnostic and Psychopathology Unit of the UCLA Clinical Research Center for the Study of Schizophrenia (R.P. Liberman, PI).

2.2. Procedures

Subjects were tested on three measures of affect perception in the order presented below. For each test the dependent measure was the total number of correct responses.

2.3. Measures

2.3.1. Facial Emotion Identification Test

The Facial Emotion Identification Test (FEIT; Kerr and Neale, 1993) consists of 19 black and white still photographs depicting differing facial emotions presented on videotape. After each photograph, the subjects were asked to circle on an answer sheet which one of six emotions (i.e., happy, angry, afraid, sad, surprised, and ashamed) best described the emotion of the photograph. Definitions of these six emotions were presented in written form and read aloud to the subjects before testing. Internal consistency (as measured by Cronbach's alpha) was examined separately for the three groups. The values were as follows: schizophrenia group, $\alpha=0.49$; siblings, $\alpha=0.51$; and controls, $\alpha=0.50$.

2.3.2. Voice Emotion Identification Test

For the Voice Emotion Identification Test (VEIT; Kerr and Neale, 1993), subjects were presented a series of 21 sentences of neutral content on audiotape (e.g., "Fish can jump out of the water;" "He tossed the bread to the pigeons"). Each sentence was spoken aloud in such a manner as to convey one of the same six emotions used in the Facial Emotion Identification Test. The subjects listened to each sentence and then circled on an answer sheet which of the six emotions best described the speaker's tone of voice. Cronbach's alphas were as follows: schizophrenia group, $\alpha=0.55$; siblings, $\alpha=0.63$; and controls, $\alpha=0.56$.

2.3.3. Videotape Affect Perception Test

The Videotape Affect Perception Test (VAPT; Bellack et al., 1996) includes 30 brief scenes from movies and television. At the start of each scene, the subjects were told to attend to a particular character. After viewing each scene, the subjects then selected one of six emotions that best characterized this actor/actress. For this test, Cronbach's alphas were as follows:

schizophrenia group, $\alpha=0.55$; siblings, $\alpha=0.81$; and controls, $\alpha=0.61$.

2.3.4. Composite affect perception index

As in previous research (Kee et al., 1998b), a composite affect perception index was calculated based on the three affect perception measures. Because the scales differed in length, scores on each scale were standardized and a mean standardized score was computed for each subject. Cronbach's alphas were as follows: schizophrenia group, $\alpha=0.65$; siblings, $\alpha=0.84$; and controls, $\alpha=0.69$. Two of the siblings did not complete the VEIT, and one patient, four siblings, and two controls did not complete the VAPT. A composite index was not calculated for these subjects.

3. Results

3.1. Demographic characteristics

Descriptive demographic data for schizophrenia patients, siblings, and controls are presented in Table 1. The groups differed in age, $F(2,157)=5.12$, $p<0.01$, with the schizophrenic group older than siblings and controls, who did not differ from each

Table 1
Demographic data

	Schizophrenia	Siblings	Controls
<i>n</i>	58	51	49
Age (mean, S.D.)	43.24 (9.65)	38.64 (10.74)	36.38 (8.99)
Sex (%male)	95	43	49
Education (mean, S.D.)	13.12 (1.75)	13.98 (2.10)	13.43 (1.17)
Education, father (mean, S.D.)	11.55 (3.37)	11.35 (3.31)	12.67 (2.06)
Education, mother (mean, S.D.)	12.00 (2.96)	11.90 (2.89)	12.74 (2.66)
Ethnicity (<i>n</i>)			
Caucasian	17	13	19
African-American	31	22	17
Hispanic	7	7	7
Asian	1	3	4
Other	2	6	2
Marital status (<i>n</i>)			
Currently married	7	19	16
Never married	34	17	23
Divorced/separated	17	15	10

other. The groups differed in education level, $F(2,157)=3.38$, $p<0.05$, with schizophrenia having less education than siblings and controls, who did not differ from each other. Thus, the sibling and control groups, which were the focus of this study, did not differ from each other in terms of age, education, ethnicity, or marital status.

The patient group had mild levels of symptoms on three BPRS subscales, which included a measure of positive symptoms (sum of hallucinations and unusual thought content; mean=7.10, S.D.=3.41), the conceptual disorganization item (mean=1.71, S.D.=1.15), and an index of negative symptoms (sum of blunted affect, emotional withdrawal, and motor retardation; mean=6.73, S.D.=3.23) as well as the BPRS total score (sum of the 24 items; mean=49.02, S.D.=10.35).

There were significant differences in sex composition across the three groups, $\chi^2=37.43$, $p<0.001$, with the schizophrenia group having a higher proportion of males than siblings or controls. Because of the small number of female probands, it was not possible to meaningfully examine sex effects within the schizophrenia group on the affect perception tasks. Thus, preliminary analyses of sex effects were conducted only within the sibling and control groups. A 2 (group) \times 2 (sex) repeated-measures analysis of variance (ANOVA) across the individual affect perception tests and the composite index indicated that neither the main effect of sex nor the group \times sex interaction was statistically significant ($p>0.05$). Because no sex effects were evident, males and females were combined within each group in the subsequent analyses.

3.2. Group differences

Group differences on the affect perception measures were examined using a series of one-way ANOVAs and then follow-up t -tests for significant group effects. In all analyses, p levels less than 0.05 (two-tailed) were considered statistically significant. We first examined group differences among the schizophrenia patients, siblings including those with nonpsychotic schizophrenia spectrum disorders ($n=51$), and controls. Descriptive data are presented in Table 2. For the FEIT, the group effect was significant, $F(2,157)=6.17$, $p<0.005$, with the schizophrenic group performing worse than controls ($p<0.001$) and siblings ($p<0.05$), who did not differ from each other. For the VEIT, the group effect was nonsignificant, $F(2,155)=2.38$, $p=0.10$. For the VAPT, the group effect was significant, $F(2,150)=5.80$, $p<0.005$, with the schizophrenia group performing worse than controls ($p<0.001$). The siblings did not differ from the control or schizophrenia groups. On the composite index, there was a significant group effect, $F(2,157)=9.88$, $p<0.001$, with the schizophrenia group performing worse than both siblings and controls ($p<0.001$). Additionally, siblings performed worse than the control group ($p<0.05$) and better than the schizophrenia group ($p<0.05$). To cross check whether differences among groups on the composite index could be due to the presence of axis II disorders in the sibling group, we analyzed group differences separately for the siblings excluding those with nonpsychotic schizophrenia spectrum disorders. The results were essentially the same.

Table 2
Group means on emotion perception tasks

Measures	Schizophrenia	Siblings 1	Siblings 2	Controls
Face Emotion	12.43 (2.51)	13.41 (2.52)	13.33 (2.53)	14.10 (2.39)
Identification Test	[11.77 to 13.09]	[12.70 to 14.12]	[12.57 to 14.08]	[13.42 to 14.79]
Voice Emotion	10.91 (2.92)	11.55 (2.74)	11.48 (2.86)	12.10 (2.78)
Identification Test	[10.15 to 11.68]	[10.76 to 12.34]	[10.61 to 12.65]	[11.30 to 12.90]
Videotaped Affect	19.39 (3.52)	20.83 (4.77)	21.00 (4.93)	21.74 (3.42)
Perception Test	[18.45 to 20.34]	[19.43 to 22.23]	[18.45 to 20.34]	[21.01 to 23.00]
Composite POE index	-0.27 (0.65)	0.02 (0.70)	0.01 (0.71)	0.30 (0.63)
	[-0.45 to -0.10]	[-0.18 to 0.21]	[-0.21 to 0.22]	[0.11 to 0.48]

Standard deviations appear in parentheses; 95% confidence intervals appear in brackets. Siblings 1=Sibling group including those with nonpsychotic schizophrenia spectrum disorders ($n=51$). Siblings 2=Sibling group excluding those with nonpsychotic schizophrenia spectrum disorders ($n=46$).

Although the mean differences between the sibling and control groups did not differ at a statistically significant level across the individual affect perception tests, the scores in the sibling group were consistently lower than the controls. The effect sizes between the sibling group excluding those with schizophrenia spectrum disorders ($n=46$) and controls were small to medium (Cohen, 1988): FEIT ($d=0.31$), VEIT ($d=0.22$), VAPT ($d=0.18$), and composite index ($d=0.45$).

4. Discussion

The purpose of this study was to determine whether affect perception deficits are detectable among unaffected biological siblings of individuals with schizophrenia. We were able to replicate previously reported affect perception deficits in schizophrenic patients as compared to nonpatient controls on two out of three affect perception measures, the FEIT and VAPT, as well as a composite index based on all three affect perception measures. The affect perception scores in the sibling group demonstrated the anticipated pattern of falling between those of the control and schizophrenia groups, but did not differ significantly from the control group on the individual affect perception tests. For the composite affect perception index, however, siblings performed significantly worse than controls and significantly better than the schizophrenia group, and these differences held when the analyses were limited to siblings without any schizophrenia spectrum disorder. Thus, subtle deficits in affect perception appear to be detectable in the unaffected biological siblings of schizophrenia patients when multiple measures of different types of affect perception abilities are used in combination.

As noted above, the two previous studies of affect perception among biological relatives of schizophrenia patients (McCown et al., 1988; Toomey et al., 1999) yielded mixed results and had some methodological limitations. Inconsistencies across these studies of affect perception in relatives of schizophrenia patients could be associated with several methodological factors, including the use of a time limit presentation for test stimuli in the study by McCown et al. (1988), but not Toomey et al. (1999), and mixtures of different types of first-degree relatives. The current

study was characterized by several methodological strengths, including the use of nonpatient controls who were well matched to the siblings of schizophrenia patients on key demographic criteria prior to inclusion, a more comprehensive assessment of facial, vocal, and combined facial/vocal affective cue perception, and extensive screening of siblings for schizophrenia-related psychopathology.

Although the mean scores of the siblings were consistently lower than controls on the individual affect perception tests, the effect sizes were small for the individual measures and medium for the composite index, which is consistent with the two previous studies in this area. McCown et al. (1988) found that although relatives of schizophrenia patients performed significantly worse than controls on a facial affect perception test, the effect size of this group difference was small (0.19). Toomey et al. (1999) did not find significant differences between relatives of schizophrenia patients and controls on two facial affect perception tests, but the effect sizes of these group differences were approximately 0.30 and 0.45. Overall, these results across studies suggest modest mean differences in affect perception abilities between biological relatives of schizophrenia patients and controls. The tests with the largest effect sizes (both the PONS in the study by Toomey et al., 1999 and the composite score in this study) use auditory and visual cues. Hence, it may be that combined assessment of affect perception abilities across multiple modalities are required to achieve the sensitivity necessary to detect differences in the performance of relatives of schizophrenia patients.

Several methodological issues warrant consideration in the interpretation of our results. The psychometric properties of commonly used affect perception measures are often found to be less than optimal (Mueser et al., 1996; Penn and Comb, 2000). In the current study, the internal consistencies for the individual measures used were also relatively low, which may have limited their ability to detect subtle deficits among the relatives of schizophrenia patients. Questions have also been raised about whether viewing still pictures of faces or listening to tape-recorded voices (as in the VEIT or FEIT) adequately captures the complexity of affect perception abilities that are necessary for successful social interactions (Mueser et al., 1997). Although the ecological validity for the

facial emotion stimuli is still uncertain (see Russell, 1994), research with various nonclinical populations, including children from economically disadvantaged families (Izard et al., 2001) and married couples (Noller and Ruzzene, 1991), has demonstrated associations with indices of functional outcome.

Although our assessment of affect perception was relatively comprehensive, other aspects of affect perception were not explored in the current study. It is possible that the ability to discriminate among different emotions (rather than identify) might be useful in detecting subtle deficits. Characteristics of the schizophrenia probands in this study may also have influenced our results. The probands were almost exclusively male, which precluded examination of potential differences in affect perception among the siblings of male versus female schizophrenia patients. Finally, this study was not designed to examine whether affect perception deficits are more evident among the relatives of probands in certain schizophrenia subgroups, which has been suggested as possibly relevant to performance (e.g., Bellack et al., 1996).

In summary, subtle affect perception deficits were evident on a composite score in the unaffected siblings of individuals with schizophrenia as compared to nonpatient controls. The effect sizes of these impairments appear to be fairly small, suggesting that relatively large sample sizes would be required to detect them. However, another consideration is that the reliabilities of the affect perception tests examined are less than optimal, and it is noteworthy that we found the significant difference on the measure with the best internal consistency ($\alpha=0.84$ for the composite index, compared to 0.51–0.81 for the individual measures for the siblings). Assuming that differences between siblings and controls in affect perception ability do exist, these differences could reflect an indirect influence of subtle deficits in basic cognitive and perceptual tasks that have been reported for siblings of patients in other studies (Green et al., 1997; Kremen et al., 1994; Saoud et al., 2000). Alternatively, such deficits in social cognition may be direct indicators of vulnerability factors. An important next step will be to determine the replicability of the current results using more representative samples of schizophrenia probands and more refined measures of affect perception.

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