An Intact Social Cognitive Process in Schizophrenia: Situational Context Effects on Perception of Facial Affect

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Background: Impaired facial affect recognition is the most consistent social cognitive finding in schizophrenia. Although social situations provide powerful constraints on our perception, little is known about how situational context modulates facial affect recognition in schizophrenia. *Methods:* Study 1 was a single-site study with 34 schizophrenia patients and 22 healthy controls. Study 2 was a 2-site study with 68 schizophrenia patients and 28 controls. Both studies administered a Situational Context Facial Affect Recognition Task with 2 conditions: a situational context condition and a no-context condition. For the situational context condition, a briefly shown face was preceded by a sentence describing either a fear- or surprise-inducing event. In the no-context condition, a face was presented without a sentence. For both conditions, subjects rated how fearful or surprised the face appeared on a 9-point Likert scale. *Results:* For the situational context condition of study 1, both patients and controls rated faces as more afraid when they were paired with fear-inducing sentences and as more surprised when they were paired with surprise-inducing sentences. The degree of modulation was comparable across groups. For the no-context condition, patients rated faces comparably to controls. The findings of study 2 replicated those from study 1. *Conclusions:* Despite previous abnormalities in other types of context paradigms, this study found intact situational context processing in schizophrenia, suggesting that patients benefit from situational context when interpreting ambiguous facial expression. This area of relative social cognitive strength in schizophrenia has implications for social cognitive training programs.

Key words: schizophrenia/contextual modulation/facial affect processing/social cognition

Introduction

Human facial emotional expression is probably the most common social information we encounter in everyday life, and evaluating facial emotion expression is a fundamental social cognitive process necessary for adaptive social behavior. Not surprisingly, facial affect perception is the most extensively studied area of social cognition in schizophrenia. The lion's share of the work on the perception of facial affect in schizophrenia has utilized static face stimuli (ie, still photographs) in isolation that portray stereotypical emotional expressions (eg, Ekman faces). Across studies, schizophrenia patients consistently show deficits in identifying emotional expressions of faces using such stimuli.[1–4] However, these studies have overlooked important characteristics of faces as we encounter them in natural settings; faces are often ambiguous and typically exist with other available social information. Such information provides a contextual frame that can change the meaning of facial expressions or disambiguate vague facial expressions.[5–7] Although context modulation of facial affect processing is critical for effective social information processing and adaptive social behavior, it has rarely been studied in schizophrenia. This study was designed to investigate the integrity of situational context modulation of facial affect processing in schizophrenia.

When faces are preceded by sentences describing situational information (eg, fearful face paired with sad situation), healthy individuals tend to interpret emotions of faces based on situation rather than facial information alone.[5] This effect of context modulation of facial expression appears to vary with the degree of congruence between the facial expression and the situational context; the effect is larger when the face expresses an emotion similar to the emotion suggested by the situational

context.[8] Studies with electrophysiology showed that contextual modulation of facial affect processing occurs early during the visual processing of information,[8–10] but it remains to be determined whether this context-face integration occurs in a relatively automatic[11] or more effortful way.[5,12]

Context is a multifaceted construct,[13,14] and much of the focus of context processing in schizophrenia has involved a family of specialized versions of the continuous performance test (eg, AX-CPT or a dot expectancy test). During the AX-CPT, individuals are asked to detect a letter "X" only when it is preceded by a letter "A"; the letter "A" serves as goal-relevant contextual information. Schizophrenia patients consistently show impaired performance on such tasks because they fail to maintain the contextual information.[15,16] These findings indicate schizophrenia patients show impairments on a measure of context that is relatively effortful, requires cognitive control, and uses nonsocial stimuli; however, they failed to address the question as to whether patients show impairment on context tasks with social stimuli.

Only a few studies have been conducted on context processing and facial affect perception in schizophrenia, and they have yielded inconsistent findings. Two studies examined situational context by providing a sentence that was incompatible with a prototypical emotional expression on a face[17,18] and found reduced context modulation in schizophrenia. The paradigms from these studies employed verbal context and required subjects to resolve the conflict between faces and sentences (eg, demand on cognitive control). In contrast, when judging the valence of ambiguous faces (eg, positive or negative) that were presented with emotional context provided by pictures, a recent study[19] showed that schizophrenia patients were as sensitive to emotional context (ie, emotional pictures) as controls. This finding suggests intact emotional context processing in schizophrenia when context was provided visually and there was no conflict to resolve. There are at least 2 possible explanations for these inconsistent findings. Perhaps schizophrenia patients have more difficulty with verbal context than visual context when judging emotional expression of faces. Alternatively, schizophrenia patients may have more difficulty when cognitive control demand or more effortful processing is required (eg, contextual information is not congruent with face stimuli).

The goal of this study was to examine the effect of situational context on facial affect processing in schizophrenia. By modifying an existing situational context task,[7] we created a Situational Context Facial Affect Recognition Task that utilized verbal situational context and minimized the demand of effortful processing. If schizophrenia patients have difficulty with verbal situational context, we would expect to see impairment on our task. Alternatively, if schizophrenia patients have less difficulty with modulation on tasks that do not require extensive cognitive control, we might observe relatively intact performance. In this task, situational context was provided as either a fear- or surprise-inducing sentences (ie, verbal modality) before a face was presented briefly. We minimized the demand of effortful processing by asking subjects to rate the emotional expression of ambiguous facial expressions, namely surprised faces. Surprise faces are considered to be more ambiguous than other prototypical facial expressions.[7,20] In addition to surprise faces, we also included neutral faces to explore whether contextual modulation was uniform across facial expressions. Participants were asked to rate the degree to which each face appeared to be afraid or surprised using a continuous 1–9 rating scale. Participants also completed the ratings of the same faces using the same scale without situational context. Study 1 was a single-site study, and study 2 was a 2-site study with larger and independent samples that aimed to replicate the findings of study 1.

Methods

Participants—Study 1

Thirty-five patients with schizophrenia and 22 healthy controls participated. Schizophrenia patients were recruited from outpatient clinics at the Veterans Affairs Greater Los Angeles Healthcare System (VAGLAHS) and University of California, Los Angeles (UCLA) and from local board and care facilities in the Los Angeles (LA) area. Healthy control participants were recruited through flyers posted in the local community and website postings.

All participants received the Structured Clinical Interview for *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*, (SCID) Axis I Disorders[21] to confirm their diagnostic eligibility. Exclusion criteria for patients included: (1) substance abuse or dependence in the last 6 months based on the SCID,[21] (2) current major depressive episode, (3) IQ < 70 based on review of medical records, (4) history of loss of consciousness for more than 1 hour due to head trauma, (5) an identifiable neurological disorder, or (6) insufficient fluency in English to understand the procedures based on clinician's judgment. Controls were excluded if they had: (1) history of schizophrenia or other psychotic disorder, bipolar disorder, recurrent depression, substance dependence, or any substance abuse in the last 6 months based on the SCID,[21] (2) current major depressive episode, (3) any of the following Axis II disorders: avoidant, paranoid, schizoid, or schizotypal, based on the SCID for Axis II disorders,[22] (4) schizophrenia or other psychotic disorder in a first-degree relative based on self-report, (5) any significant neurological disorder or head injury, or (6) insufficient fluency in English based on clinician's judgment.

Schizophrenia patients and healthy controls were comparable in terms of age and parental education but not personal education (see table 1 for demographic information).

Table 1. Demographics of Schizophrenia Patients and Healthy Controls

	Schizophrenia Patients	Healthy Controls
Study 1		
Age	46.4 (11.8)	44.2 (8.5)
Personal education (y)*	13.0 (1.2)	14.8 (1.7)
Parental education (y)	13.2 (2.0)	14.1 (2.6)
Gender (F/M)	8/27	5/18
Age of onset	22.1 (6.0)	NA
Number of hospitalization	3.1 (2.1)	NA
BPRS		
Total	39.7 (7.6)	NA
Positive symptom	1.74 (.63)	NA
Negative symptom	1.82 (.81)	NA
Agitation/Mania	1.21 (.27)	NA
Depression/Anxiety	1.85 (.56)	NA
Study 2		
Age	43.8 (11.7)	42.5 (8.6)
Personal education (y)*	12.9 (1.7)	15.6 (1.4)
Parental education (y)	13.5 (3.1)	13.8 (2.5)
Gender (F/M)	13/55	8/20
Age of onset	22.5 (7.21)	NA
Number of hospitalization	5.0 (3.1)	NA
BPRS		
Total	38.9 (8.7)	NA
Positive symptom	1.8 (.7)	NA
Negative symptom	1.7 (.7)	NA
Agitation/Mania	1.1 (.3)	NA
Depression/Anxiety	1.8 (.8)	NA

Note: BPRS, Brief Psychiatric Rating Scale.
* Significant group difference (p < .05).

All of the patients were taking antipsychotic medications at the time of testing (ie, aripiprazole, clozapine, fluphenazine, loxapine, olanzapine, risperidone, quetiapine, trazadone, or ziprasidone). All participants had normal or corrected to normal vision of at least 20/30. The expanded 24-item version of the Brief Psychiatric Rating Scale[23] was used to characterize clinical symptoms for patients and clinical symptoms were divided into 4 factors[24]: positive symptom consisting of grandiosity, suspiciousness, hallucinations, unusual thought content, bizarre behavior, disorientation and conceptual disorganization; agitation/mania consisting of uncooperativeness, tensions, excitement, distractibility, motor hyperactivity, and mannerisms; negative symptoms consisting of blunted affect, emotional withdrawal, and motor retardation; and depression/anxiety consisting of anxiety, depression, suicidality, and guilt. All participants were evaluated for the capacity to give informed consent and provided written informed consent after all procedures were fully explained, according to procedures approved by the Institutional Review Board (IRB) at the VA Greater Los Angeles Healthcare System.

Participants—Study 2

Sixty-eight patients with schizophrenia (34 from LA and 34 from Chapel Hill sites) and 28 healthy controls

(15 from LA and 13 from Chapel Hill sites) participated in study 2. Patients were recruited from outpatient clinics at the VAGLAHS and UCLA; the University of North Carolina (UNC) at Chapel Hill, Schizophrenia Treatment and Evaluation Program; and community mental health facilities in the LA and Chapel Hill area. Healthy controls were recruited through flyers posted in the local community and website postings. Exclusion/inclusion criteria for patients and controls and symptom ratings methods for patients were the same as those described for study 1, unless otherwise noted.

All of the patients were taking antipsychotic medications at the time of testing (ie, aripiprazole, clozapine, fluphenazine, haloperidololanzapine, paliperidone, perphenazine, risperidone, quetiapine, trazadone, or ziprasidone). Schizophrenia patients and healthy controls were comparable in terms of age and parental education but not personal education (see table 1). All participants were evaluated for the capacity to give informed consent and provided written informed consent after all procedures were fully explained, according to procedures approved by the IRBs at the VAGLHAS and UNC-Chapel Hill.

Experimental Paradigm

The Situational Context Facial Affect Recognition Task consisted of 2 conditions: a situational context condition and a no-context condition. For the situational context condition, there were face stimuli with 1 of 2 facial expressions (surprised or neutral) and 2 types of sentence frames (describing situations that would normally elicit either fear or surprise). Face stimuli were preceded by either fear- or surprise-inducing sentences, and subjects were asked to rate how afraid or surprised the faces looked using a 9-point rating scale (1: very afraid, 5: neither, and 9: very surprised). For the no-context condition, there were 3 types of face stimuli: surprised, fearful, and neutral. The face stimuli were presented without a sentence frame, and subjects were asked to rate how afraid or surprised the faces looked using the same 9-point scale.

Sentence Stimuli. The sentence stimuli were created by investigators on this project and were designed to provide situational context. The sentence stimuli were derived from ratings obtained from 32 college students (mean age = 22.6 [SD = 3.3]) from California State University at Channel Islands. These students read a total of 56 sentences describing a particular situation and provided ratings on a continuum of how afraid or surprised someone in that situation would feel using a 9-point scale (1: very afraid, 5: neither, and 9: very surprised). Based on the average ratings from these students, we selected 17 fear-inducing and 17 surprise-inducing sentences matched for word counts (fear-inducing sentences: mean rating = 2.2, and mean word count = 14.2;

surprise-inducing sentences: mean rating = 7.4, and mean word count = 14.7). For each sentence, we created 2 versions (ie, the protagonist was female or male), resulting in 34 fear-inducing and 34 surprise-inducing sentences (see online supplementary method for examples of sentence stimuli).

Face Stimuli. All face stimuli were selected from the Karolinska Directed Emotional Faces (http://www.emotionlab.se/resources/kdef).[25,26] We first selected 48 surprised and 48 fearful facial expressions from 48 individuals (24 females and 24 males). That is, one surprised face and one fearful face were selected for a given individual. In addition, we selected 20 neutral faces from an additional 20 individuals (10 females and 10 males) to explore whether contextual modulation can be observed across facial expressions. According to a recent study[27] that measured perceived intensity and arousal for the Karolinska faces using a 9-point scale with 272 healthy individuals, mean intensity ratings (1 "not at all" to 9 "completely") for surprise and fearful faces are 5.89 (SD = 0.93) and 5.39 (SD = 0.80). Mean arousal ratings (1 "calm" to 9 "aroused") for surprise and fearful faces are 3.51 (SD = 0.50) and 3.58 (SD = 0.36).

Procedure. The task was administered in a fixed order with a block of situational context trials first and a block of no-context trials second. For the situational context trials, face stimuli included 48 surprised and 20 neutral expressions, and sentences included 34 fear-inducing and 34 surprise-inducing sentences. We created 2 versions of the situational context trials to counterbalance the pairing between faces and types of sentences. For stimulus set A, the first half of faces (24 surprised and 10 neutral) was paired with fear-inducing sentences, and the other half was paired with surprise-inducing sentences. For stimulus set B, the pairing was reversed. The 2 versions of the stimulus sets were counterbalanced across subjects. Within each set, trials were presented in a random order. For each trial of the context block (figure 1), a fixation point was presented for 200 msec. After the fixation, a sentence was shown on the screen, and the experimenter read the sentence to the subject. The sentences were read to each participant to minimize potential influence of any subtle differences in reading ability. When the sentence disappeared, a face was presented for 250 msec, followed by the 9-point rating scale (1: very afraid, 5: neither, and 9: very surprised). Participants were asked to rate how afraid or surprised each face appeared.

The no-context block of trials included 48 surprise, 20 neutral, and 48 fearful facial expressions. For each trial of the no-context block, after a fixation point of 200 msec, a face stimulus was presented for 250 msec, followed by the same 9-point rating scale; participants were asked to rate how afraid or surprised each face appeared.
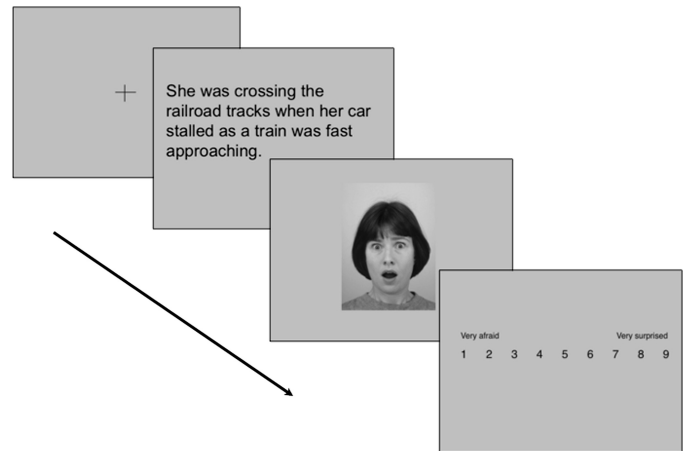

Fig. 1. A schematic diagram of a single trial of a situational context condition. After a fixation point was presented for 200 msec, a sentence (either fear- or surprise-inducing sentences) was shown on the screen and an experimenter read the sentence to the subject. When the sentence disappeared, a face (either surprised or neutral) was presented for 250 msec, followed by a 9-point rating scale (1: very afraid, 5: neither, and 9: very surprised). Subjects were asked to rate how afraid or surprised a face appeared.

There was one procedural difference between study 1 and study 2. Only for study 1, at the end of the Situational Context Facial Affect Recognition Task, participants also read the full list of 68 sentences and were asked to rate how afraid or surprised someone in each situation would feel using the same 9-point rating scale.

Results

Study 1

Figure 2A shows the ratings of face stimuli for the situational context condition. To determine whether schizophrenia patients showed differential effect of situational context on facial affect, a 2 × 2 × 2 repeated measures ANOVA was performed with the type of sentence and type of face stimuli as within-subject factors and group as a between-subject factor. We found a significant main effect of type of face ($F_{1,55} = 13.16$, $P < .01$), a significant main effect of sentence type ($F_{1,55} = 111.62$, $P < .0001$), and a significant interaction between sentences and faces ($F_{1,55} = 114.55$, $P < .0001$). Neither a main effect of group nor any interaction-involving group was significant. Across groups, surprised faces were rated more surprised than neutral faces. Across groups, participants rated faces as more afraid when they were paired with fear-inducing sentences and more surprised when they were paired with surprise-inducing sentences. This modulation of the perception by the sentences was much stronger for surprise faces than neutral faces in both groups. When further examining the degree of modulation across groups, we found comparable effect sizes of context modulation (effect size of modulation for surprised faces with fear-inducing sentences vs
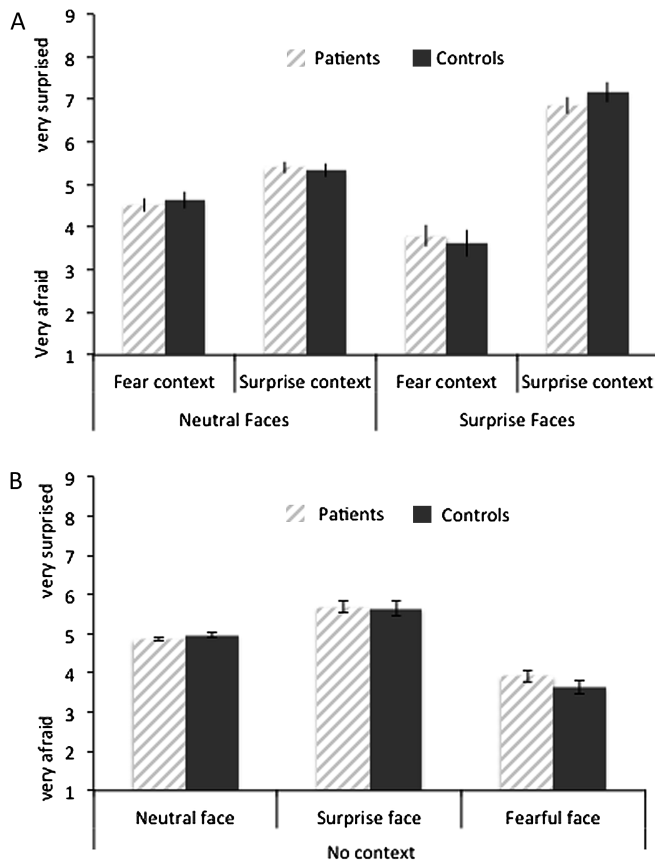
Fig. 2. Performance of schizophrenia patients and healthy controls in study 1. (A) Ratings of the face stimuli for the situational context condition. Both schizophrenia patients and controls rated faces as more fearful when they were paired with fear-inducing sentences and more surprised when they were paired with surprise-inducing sentences. This degree of context modulation was comparable across groups. (B) Ratings of the face stimuli for the no-context condition. When there was no context, both schizophrenia patients and controls rated fearful faces as more afraid and surprise faces as more surprised relative to neutral faces. Values represent the mean ratings (SE).

Fig. 3. Performance of schizophrenia patients and healthy controls in study 2. (A) Ratings of the face stimuli for the situational context condition. Similar to study 1, contextual modulation of facial affect processing was comparable across groups. (B) Ratings of the face stimuli for the no-context condition. When there was no context, both schizophrenia patients and controls rated fearful faces as more afraid and surprise faces as more surprised relative to neutral faces. Values represent the mean ratings (SE).

surprise-inducing sentences = 2.07 and 3.36 for patients and controls, respectively; effect size of modulation for neutral faces with fear-inducing sentences vs surprise-inducing sentences = 1.00 and 0.87 for patients and controls, respectively).

Results from the no-context condition are shown in figure 2B. A 3 × 2 repeated measures ANOVA was performed with type of face stimuli as a within-subject factor and group as a between-subject factor. A main effect of type of face was significant ($F_{2,110} = 107.01$, $P < .0001$). Neither a main effect of group nor a face by group interaction was significant. Both schizophrenia patients and controls rated fearful faces as more afraid and surprise faces as more surprised relative to neutral faces.

Finally, the patient and control groups provided similar mean ratings for the sentence frames: both rated situations described in fear-inducing sentences as more afraid (patients mean rating = 3.1 [SD = 1.6] and controls mean rating = 2.5
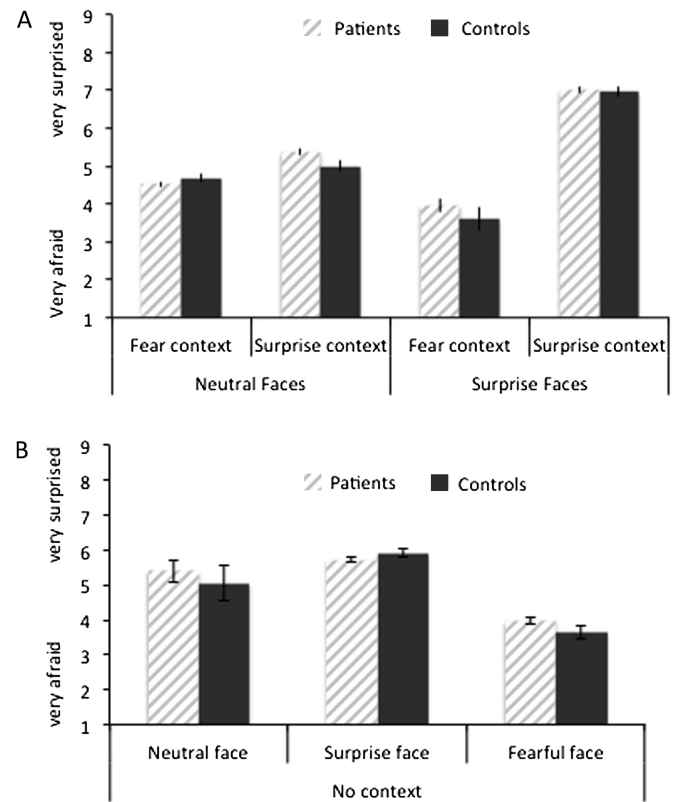
[SD = 1.1]) and situations described surprise-inducing sentences as more surprised (7.0 [SD = 1.1] and 7.3 [SD = 0.6] for patients and controls, respectively). Only a main effect of type of sentence frame ($F_{1,48} = 216.88$, $P < .0001$) was significant. Neither a main effect of group nor a group by sentence interaction was significant.

Study 2

The results from study 2 were highly similar to those from study 1. Figure 3A shows the ratings of face stimuli on the situational context condition. A 2 × 2 ×2 repeated measures ANOVA showed a significant main effect of type of face ($F_{1,94} = 19.88$, $P < .001$), a significant main effect of sentence type ($F_{1,94} = 164.82$, $P < .0001$), and a significant interaction between sentences and faces ($F_{1,94} = 151.01$, $P < .0001$). Neither a main effect of group nor any interactions involving group was significant. Across groups, ratings for surprised faces were higher than ratings for neutral faces. Across groups, subjects rated faces as more afraid when they were paired with fear-inducing sentences and more surprised when they were paired

with surprise-inducing sentences. This modulation of the sentences was much stronger for surprise faces than neutral faces in both groups. Similar to study 1, both groups showed comparable effect sizes of modulation for surprised faces with fear-inducing sentences vs surprise-inducing sentences (d = 2.37 and 2.82 for patients and controls, respectively) and neutral faces with fear-inducing sentences vs surprise-inducing sentences (d = 1.06 and 0.89 for patients and controls, respectively). Results from the no-context condition are shown in figure 3B. A 3 × 2 repeated measures ANOVA found a significant main effect of type of face ($F_{2,186}$ = 30.78, P < .0001). Neither a main effect of group nor a face by group interaction was significant. Both schizophrenia patients and controls rated fearful faces as more afraid and surprise faces as more surprised relative to neutral faces.

Discussion

Using a Situational Facial Affect Recognition Task, study 1 showed that the degree of context modulation with situational context was highly comparable across schizophrenia patients and controls. The findings of study 1 suggest that schizophrenia patients are as sensitive to verbal situational context as controls are when perceiving somewhat ambiguous facial expressions. With relatively small sample sizes, it is possible that study 1 was statistically underpowered to detect any subtle group difference, should they exist. Hence, we conducted study 2 with independent larger samples from 2 sites. The results of study 2 were remarkably similar to the findings of study 1. The conclusion from these 2 studies is that schizophrenia patients are capable of benefiting from situational context when evaluating ambiguous emotional expressions of faces.

Whereas facial affect processing has been studied extensively in schizophrenia, the influence of situational context on facial affect perception has been largely overlooked. As mentioned in the introduction, 2 studies reported less contextual modulation of schizophrenia patients relative to controls when prototypical emotion expressions of faces (ie, type of emotion) were presented with verbal situational context information that was incompatible to facial information.[17,18] The experimental paradigm of the current study was intended to minimize effortful cognitive demand by using ambiguous facial expressions that were not incompatible with situational context information, which was critically different from previous studies. A recent study also found intact context modulation in schizophrenia when asking participants to rate the valence of ambiguous facial emotion with emotion-inducing photos.[19] These studies suggest that the level of effortful processing might be a critical factor to determine the extent of contextual modulation of facial affect recognition in schizophrenia. In other words, schizophrenia patients

may show intact situational context modulation when a task involves minimum cognitive controls, such as judging ambiguous facial expressions rather than prototypical facial expressions.

The finding of intact situational context processing appears to be at odds with previous findings of impaired context processing in schizophrenia. Context is clearly a complex construct,[13,14] and previous studies on context processing have primarily focused on goal-relevant context that relied heavily on cognitive control or conflict resolution.[15,16] This study focused on situational context, which provides a social contextual frame to disambiguate emotions of faces and which did not demand cognitive control. The term context has also been used in studies of perceptual organization in schizophrenia. Schizophrenia patients exhibit impairments utilizing perceptual organization, especially when the paradigms require more top-down processing.[28,29] Looking across studies, schizophrenia patients may show different levels of impairment on context processing as a function of processing load. In other words, schizophrenia patients may show intact context processing when the paradigm requires minimal load but show impaired context processing otherwise. Further examination of this possibility by manipulating levels of processing demand will be informative in determining a more complete picture of context processing in schizophrenia.

Contextual modulation of facial affect processing has been observed at the neural level in healthy individuals. For example, the N170 amplitude (an event-related potential related to facial processing) was larger when a fearful facial expression was paired with a fearful scene compared with a happy or neutral scene.[10] When the faces were paired with emotionally salient contexts compared with emotionally neutral contexts, increased neural activation (measured by functional magnetic resonance imaging [fMRI]) were observed in the bilateral temporal pole, anterior cingulate cortices, and amygdala.[30] In addition, a study whose experimental paradigm was modified for the current study employed fMRI to study neural activations when a surprise face was paired with negative vs positive situational context.[7] This study showed that context information modulated amygdala activation, and the dorsomedial prefrontal cortex was associated with this contextual modulation of amygdala activation. It remains to be determined whether schizophrenia patients utilize neural systems similar to those in controls when using situational context information to disambiguate emotional expressions of faces.

The lack of group difference in the no-context condition would have been considered surprising if this had been found in an emotional identification task; facial affect recognition is one of the most consistently documented impairments in schizophrenia.[4] However, the no-context condition of this study involved a rating response for ambiguous faces on a single dimension (ie, surprise to fear) instead of categorizing or labeling

prototypical facial expressions that is typically done in identification tasks. A previous study with a dimensional rating scale for ambiguous faces[19] also found the performance of patients comparable to controls. It is possible that patients may have more difficulties with labeling prototypical facial expressions than rating dimensions of ambiguous expressions. Another possibility is that the groups did not differ in their ratings of surprise and neutral faces in the no-context condition because faces were seen previously in the context condition. This explanation is less likely because we did not see rating differences for fearful faces in the no-context condition, and those faces were introduced for the first time in the no-context condition.

Schizophrenia patients have shown impairments across several areas of social cognition.[31,32] Due to its close association with adaptive social behaviors, impaired social cognition has recently become a promising target of psychosocial and pharmacological treatments that aim to improve functional outcome of schizophrenia patients.[33–35] Furthermore, the experimental paradigm of this study was recommended by the Cognitive Neuroscience of Treatment Research to Improve Cognition in Schizophrenia Initiative for clinical trials in schizophrenia.[36] The current study, however, found intact situational context processing of facial affect processing in schizophrenia, suggesting that it is not a likely candidate for clinical trials of cognition enhancements in schizophrenia. In contrast, the current finding indicates that certain areas of social cognition may be preserved in schizophrenia. Very few areas of intact social cognition have as of yet been identified. The current study provides guidance for where the researchers should focus to identify a profile of intact vs impaired social cognitive processes to build a complete picture of social cognition in schizophrenia. Identifying intact social cognitive processes could also be potentially important for developing or modifying existing training methods used in rehabilitation programs. That is, schizophrenia patients may benefit more when psychosocial rehabilitation programs provide richer situational factors to facilitate social interactions or social learning.

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Supplementary Material

Supplementary material is available at http://schizophreniabulletin.oxfordjournals.org.

Acknowledgments

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