



## Do we recognize facial expressions of emotions from persons with schizophrenia?

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### ABSTRACT

**Objectives:** Impaired facial emotion expression is central to schizophrenia. Extensive work has quantified these differences, but it remains unclear how patient expressions are perceived by their healthy peers and other non-trained individuals. This study examined how static facial expressions of posed and evoked emotions of patients and controls are recognized by naïve observers.

**Methods:** Facial photographs of 6 persons with stable schizophrenia and 6 matched healthy controls expressing five universal emotions (happy, sad, anger, fear, and disgust) and neutral were selected from a previous data set. Untrained raters ( $N=420$ ) viewed each photo and identified the expressed emotion. Repeated measures ANOVAs were used to assess differences in accuracy and error patterns between patient and control expressions.

**Results:** Expressions from healthy individuals were more accurately identified than those from schizophrenia patients across all conditions, except for posed sadness and evoked neutral faces, in which groups did not differ, and posed fear, in which patient expressions were more accurately identified than control expressions. Analysis of incorrect responses revealed misidentifications as neutral were most common across both groups but significantly more likely among patients.

**Conclusion:** Present findings demonstrate that patient expressions of emotion are poorly perceived by naïve observers and support the concept of affective flattening in schizophrenia. These results highlight the real world implications of impairments in emotion expression and may shed light on potential mechanisms of impaired social functioning in schizophrenia.

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### 1. Introduction

Impaired facial expressions of emotion represent an area of behavioral dysfunction that is central to the illness of schizophrenia and indicates both current functioning and future outcome (Gur et al., 2006). Much of our knowledge on affective flattening in schizophrenia has been based on clinical rating scales of global affect during psychiatric interviews, but

the reliability of ratings of affective flattening and other negative symptoms can be problematic (Andreasen, 1997). Over the past 20 years, efforts beyond global ratings of facial expressions by a single trained or experienced rater have attempted to apply standardized procedures to examine specific face regions based on facial muscles, and quantify the degree and time course of emotional expressions. Several groups have utilized paradigms based on the Facial Action Coding System (Ekman and Friesen, 1978) to demonstrate generalized and emotion specific deficits in posed and evoked facial expressions. Findings suggested that patients do not engage the same facial muscles as controls (Aghevli et al., 2003; Berenbaum and Oltmanns, 1992; Blanchard et al., 1994; Gaebel and Wolwer, 2004; Kohler et al., 2008b; Kring et al., 1993;

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Schneider et al., 1990), and that they make facial expressions less frequently than controls (Treméau et al., 2005), and for shorter duration (Treméau et al., 2005; Kohler et al., 2008a). Alternatively, more subtle expressions have been quantitatively analyzed through electromyographic activity in specific facial muscles, with mixed findings. When exposed to emotionally evoking stimuli and interviews, patients show less zygomatic activity in the lower face during happy interviews and more movements than controls during sad interviews (Mattes et al., 1995). Other EMG findings however suggest patient facial movements are similar to healthy subjects when viewing positively and negatively valenced static images (Kring et al., 1999). More recently, Putnam and Kring (2007) instructed trained, reliable raters to identify emotions in posed expressions and reported that patients less accurately portrayed surprise and sadness, but not disgust, fear, happiness, or anger.

Despite the extensive work devoted to quantifying how patient expressions differ from those of healthy individuals, comparatively little attention has been given to understanding how patient expressions are perceived by untrained healthy persons. While scientifically less rigorous, this approach may have greater ecological validity in revealing how emotion expressions of persons with schizophrenia are recognized in the community and may also have greater relevance with respect to possible effects on interpersonal engagement and social functioning. Gottheil et al. (1970) displayed participants' evoked emotional video clips to untrained raters, finding that controls' "affective themes" were more correctly identified than patients', but only significantly in anger. Similarly, Gottheil et al. (1976) instructed untrained judges to match emotional and neutral images from patients and controls with corresponding emotion words. Patients had less identifiable expressions of anger and sadness, but differences were not found across all emotions.

Consistent with these findings, Winkelmayr et al. (1978) found that happy was best recognized and sad and angry faces had the lowest recognition rates. Braun et al. (1991), utilized a similar matching paradigm, expanded the stimuli to include the five universal emotions and surprise, and found an overall deficit in patient facial expressions but not in any particular emotion. Conversely, Flack et al. (1997) found emotional expressions of depressed persons, schizophrenia patients, and controls to be equally recognizable by naïve undergraduate raters. Due to these mixed findings, further examination of how the general population interprets facial expressions of persons with schizophrenia may provide valuable new insight into the extent of emotion expression impairments and their potential impact on social functioning.

The present study expanded on Gottheil's original model and utilized a computerized test of facial expressions of emotion from schizophrenia patients and matched controls. Posed and evoked emotion expressions of five universal emotions were collected in a standardized, empirically validated procedure that has previously been described in detail (Kohler et al., 2008b). These photos were displayed to a large group of untrained observers who identified the emotion expressed on each face. Based on the work reviewed above, we hypothesized that in comparison with controls (1) patients' expressions would be more poorly recognized, particularly in the evoked condition, which is more sponta-

neous and under less volitional control, (2) based on Gottheil et al.'s findings (1976), when separated by emotion, patients' expressions of sadness and anger would be less accurately recognized, and (3) consistent with the presence of flat affect in schizophrenia, patients' expressions would be more likely misidentified as neutral.

## 2. Methods

### 2.1. Face (photographic) stimuli collection

Stimuli were photos of healthy individuals and individuals with schizophrenia who displayed each of five emotional expressions (i.e. happiness, sadness, anger, fear, or disgust) or a neutral expression. Stimulus individuals were selected for inclusion from the larger group of 12 patients and 12 controls utilized in Kohler et al. (2008b). Of these 24 individuals, 16 participants consented to the use of their facial photographs in future task development. All patients met DSM-IV criteria for schizophrenia, and diagnoses were confirmed with the Diagnostic Interview for Genetic Studies (Nurnberger et al., 1994). Patient and control individuals were matched one-to-one on gender, age, ethnicity, and where possible, parental education (parental education was unavailable for one control individual). To maintain matched groups, facial stimuli were limited to 6 pairs of control and patient stimuli participants. All patients were clinically stable outpatients with chronic schizophrenia and mild to moderate levels of negative symptoms and mild to moderate delusions. One individual showed marked hallucinations. Characteristics of stimuli groups are presented in Table 1.

The procedure for collecting evoked and posed facial expressions is detailed in Kohler et al. (2008b). Briefly, participants were prompted to express happiness, anger, fear, disgust, and sadness while being photographed. Participants were first photographed in a posed condition in which they were simply instructed to signal the target emotion on their face. Following the posed condition, participants were photographed during an evoked condition in which autobiographical vignettes were utilized to aid the participant in experiencing the target emotion. Mild, moderate, and extreme intensities of the emotions were collected with neutral faces at the beginning and end of each intensity sequence. At the end of each emotional condition, participants completed the Emotion Experience Rating Scale (EERS), an 11-point (0 to 10), self-report rating scale of the degree to which they felt the target emotion at each intensity.

To assess the possibility of selection bias in the patient and control sub-samples utilized here, we conducted logistic regression analyses, using generalized estimating equations (GEE) methodology, to compare facial action units (AUs) displayed during each emotion between included and non-included stimulus individuals. Consistent with Kohler et al. (2008b), the presence of frequent and infrequent AUs for each emotion were examined separately. Only minimal differences were found between included and non-included individuals in each group. Specifically, included patients had fewer common AUs for happy expressions ( $OR = .33$ ,  $p = .036$ ) and fewer uncommon AUs for anger ( $OR = .35$ ,  $p = .047$ ) than non-included patients. Among controls, included individuals were more likely to have common AUs

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