

Facial Expressions of Emotions and Schizophrenia: A Review

by Manas K. Mandal, Rakesh Pandey, Akhouri B. Prasad

Abstract

It is generally agreed that schizophrenia patients show a markedly reduced ability to perceive and express facial emotions. Previous studies have shown, however, that such deficits are emotion-specific in schizophrenia and not generalized. Three kinds of studies were examined: decoding studies dealing with schizophrenia patients' ability to perceive universally recognized facial expressions of emotions, encoding studies dealing with schizophrenia patients' ability to express certain facial emotions, and studies of subjective reactions of patients' sensitivity toward universally recognized facial expressions of emotions. A review of these studies shows that schizophrenia patients, despite a general impairment of perception or expression of facial emotions, are highly sensitive to certain negative emotions of fear and anger. These observations are discussed in the light of hemispheric theory, which accounts for a generalized performance deficit, and social-cognitive theory, which accounts for an emotion-specific deficit in schizophrenia.

Key words: Facial emotions, decoding, encoding, subjective reactions.

Schizophrenia Bulletin, 24(1):399–412, 1998.

The general purpose of this review is to make a qualitative assessment of schizophrenia patients' ability to understand and express facial emotions. The studies in this direction provide valuable information in (a) assigning psychiatric patients to different treatment groups, (b) assessing changes during the treatment period (in a pre-post design), and (c) training psychotherapists to recognize specific features in patients' expressions and their understanding of others' expressions (Ekman and Friesen 1974). Facial information, especially emotional expression, may also help in understanding the pathophysiology

of disorder, in longitudinal monitoring, and in predicting relapse of psychiatric illness.

Two approaches were taken: encoding and decoding. In the encoding studies, patients' ability to express different facial emotions were examined. The decoding studies were conducted to examine patients' ability to understand others' facial expression of emotions (Harper et al. 1978). Both approaches were aimed at establishing a relationship between facial expressions of emotions and psychopathology of certain kinds, especially in schizophrenia. Studies on schizophrenia patients have more or less confirmed that they have a general impairment in the processing of emotions despite some understanding of the specific aspects of emotions. These findings led observers to characterize schizophrenia as flatness of affect; that view has been substantiated by all, ranging from Kraepelin (1919) to *DSM-IV* (American Psychiatric Association 1994).

In arriving at this conclusion, most theorists believe that emotional impairment in schizophrenia patients is secondary to their cognitive impairment. This assertion was based on a theoretical view that emotion is secondary to and dependent on cognition (Lazarus 1984). A second theoretical view on the relationship of emotion to cognition presumes that emotion is primary and independent of cognition (Zajonc 1984). In terms of the latter view, emotional impairment in schizophrenia may not be global, but instead specific to certain categories, since not all emotions engender similar reactions. Adherence to the former view, however, precludes a general reduction of emotion processing ability since schizophrenia is primarily a cognitive disorder.

The present review does not aim to examine the general impairment in emotion processing abilities in schizophrenia; instead it aims to examine emotion-specific

Reprint requests should be sent to Dr. M.K. Mandal, Dept. of Psychology, Banaras Hindu University, Varanasi-221005, India.

impairment at three levels of processing—decoding, encoding, and subjective reactions to facial expressions of others. Studies were selected through a search of a computerized database for psychiatry (MEDLARS: mesh-words—schizophrenia, emotion) in addition to databases for other psychological literature. The selection criterion for studies involved any that dealt with emotional processing in schizophrenia. Therefore, studies dealing with neurobiological changes, alteration of autonomic reactivity, general impairment of affectivity (such as inappropriate affect, affect-blunting), and reactivity to expressed emotion (EE) of schizophrenia patients' relatives were not used. With the studies selected for review, quantitative meta-analyses were not attempted, as such reviews may lump together studies (encoding and decoding) that differ in major ways (Green and Hall 1984).

While studies on schizophrenia subjects were conducted either on their ability to express (encoding) or to understand (decoding) facial emotions (such as happiness, sadness, fear, anger, surprise, and disgust), relatively few attempts were made to examine the possibility of dissociation between encoding and decoding abilities in schizophrenia. The findings on encoding and decoding abilities in schizophrenia have not been consistent across studies. Some of the major reasons for variations could be attributed to this inconsistency. One main cause for variation relates to *sample characteristics*, such as variation in the subtypes of schizophrenia (paranoid vs. nonparanoid), severity and prognosis of schizophrenia pathology (positive vs. negative symptoms), onset of disorder (early vs. late adulthood), and course of psychopathology (acute vs. chronic). A second variation deals with *stimulus characteristics* such as variations in the category of emotion (happiness, sadness, fear), hedonic valence of emotion (pleasant, unpleasant), and level of arousal (high vs. low). Third, *methodological issues* bring out variations in the encoding mode of facial expressions of emotions (spontaneous vs. posed) and the response format for decoding facial expressions of emotions (forced-choice vs. open-ended).

Controlling these variations, experimentally or statistically, does not seem feasible in a single study since such an attempt could create other methodological problems. Thus, the solution left is to make a qualitative review of all those studies (both encoding and decoding) that investigate one or more sources of variations and to look for common findings across studies. Another line of investigation that deals with subjective reactions (emotional awareness in terms of liking vs. disliking, approach vs. avoidance) to facial expressions of emotions in schizophrenia is also examined to substantiate the findings of encoding and decoding studies.

Decoding of Facial Expressions of Emotions

In general, schizophrenia is a pathology associated predominantly with cognitive disturbances, despite the presence of certain affective disturbances. The general consensus on this issue gave impetus to researchers to focus more on cognitive rather than on affective disturbances, which remained little explored in schizophrenia. There are two important reasons for this: First, a disturbance of emotion is difficult to rate (Lehmann 1980). Second, the behavioral approach of clinical psychologists in studying psychiatric illness involved normal persons (usually the psychiatrist/clinical psychologist) judging abnormal emotions of patients. With the advent of systematic and scientific methodology for studying expression and understanding facial emotions based on the pioneer works of Izard (1971) and Ekman (Ekman and Friesen 1975), the approach was modified. Patients were asked to judge normal persons' emotions (Cutting 1981). This modification in the approach generated empirical research dealing with schizophrenia patients' ability to decode others' facial expressions of emotions.

Sampling Variations. Most studies of decoding abilities have been conducted with a subsection of the schizophrenia population (usually the chronic patients) and a comparable group of controls (e.g., Walker 1981; Mandal and Palchoudhury 1985, 1989; Feinberg et al. 1986; Cramer et al. 1989; Archer et al. 1992). The general conclusion has been that schizophrenia patients are significantly inferior than normal controls in the ability to decode universally recognized facial expressions of emotions.

Few attempts have been made to compare the subtypes of schizophrenia. From the emotion decoding studies reviewed in the present article (table 1), four studies were found to have examined this aspect. Walker and associates (Walker et al. 1980) studied children, adolescents, and adults with schizophrenia and noted a generalized emotion decoding deficit across all age groups. Comparing acute, chronic, and remitted schizophrenia subjects with depressives and normal controls, subjects with acute schizophrenia were found to have greater emotion decoding impairment than others (Gessler et al. 1989). Paranoid schizophrenia subjects were more accurate than the nonparanoid subjects in judging facially displayed emotions (Kline et al. 1992; Lewis and Garver 1995).

Three studies used prognostic subtypes of schizophrenia (process type: Dougherty et al. 1974; negative symptom: Borod et al. 1993; Schneider et al. 1995). Findings indicated that schizophrenia patients with poor

Table 1. Facial expressions of emotions in schizophrenia: Decoding studies

| Study | Sample | Observation |
|--------------------------------|---|--|
| Dougherty et al. (1974) | Hospitalized schizophrenia patients, normal controls | Schizophrenia patients labeled shame and disgust poorly, but not joy |
| Muzekari and Bates (1977) | Chronic schizophrenia patients, normal controls | Schizophrenia patients labeled negative emotions poorly, but not positive ones |
| Walker et al. (1980) | Hospitalized schizophrenia patients (children, adolescents, adults), normal controls | Schizophrenia patients showed emotion decoding deficit across ages |
| Walker (1981) | Schizophrenia, anxious, depressed patients; normal controls (all children) | Schizophrenia patients showed emotion decoding deficit in general, especially for negative emotions |
| Novic et al. (1984) | Chronic schizophrenia patients, normal controls | Schizophrenia patients showed emotion decoding deficit, in general |
| Walker et al. (1984) | Schizophrenia patients, patients with affective disorder, normal controls | Schizophrenia patients showed emotion decoding deficit, in general |
| Mandal and Palchoudhury (1985) | Chronic schizophrenia patients, normal controls | Schizophrenia patients recognized fear and anger emotions poorly |
| Feinberg et al. (1986) | Schizophrenia and depressive patients, normal controls | Schizophrenia patients showed emotion decoding deficit, in general |
| Zuroff and Colussy (1986) | Schizophrenia depressive patients, normal controls | Both patient groups made more errors for negative emotions |
| Mandal and Rai (1987) | Schizophrenia and neurotic patients, normal controls | Schizophrenia patients were most inaccurate in negative emotions, but not in positive ones |
| Cramer et al. (1989) | Schizophrenia patients, normal controls | Schizophrenia patients were less sensitive to negative emotional scenes and produced more deviant responses |
| Gessler et al. (1989) | Acute, chronic, remitted schizophrenia patients; depressive patients; normal controls | Acute schizophrenia patients were more impaired in emotion labeling task |
| Mandal and Gewali (1989) | Schizophrenia patients, general medical patients, normal controls | Schizophrenia patients did not differ from general medical patients in identifying briefly exposed emotions; both patient groups were inferior to controls |
| Mandal and Palchoudhury (1989) | Schizophrenia and neurotic patients, normal controls | Schizophrenia patients showed deficit in identifying emotions from a whole face, but not from part of a face |
| Archer et al. (1992) | Schizophrenia and depressive patients, normal controls | Schizophrenia patients exhibited generalized performance deficit |
| Heimberg et al. (1992) | Schizophrenia patients, normal controls | Schizophrenia patients showed emotion discrimination deficit, in general |
| Joseph et al. (1992) | Remitted schizophrenia patients, normal controls | Schizophrenia patients did not show emotion identification deficit |

Table 1. Facial expressions of emotions in schizophrenia: Decoding studies—Continued

| Study | Sample | Observation |
|--------------------------|---|--|
| Kline et al. (1992) | Schizophrenia patients (paranoid and nonparanoid), normal controls | Paranoid schizophrenia patients were superior to nonparanoid patients in labeling positive emotions |
| Schneider et al. (1992b) | Schizophrenia and depressive patients, normal controls | Both patient groups were poor in decoding emotion expressions |
| Borod et al. (1993) | Negative symptom schizophrenia patients and right-brain-damaged patients, normal controls | Identification of negative (but not positive) affect was poor in both patient groups |
| Kerr and Neale (1993) | Unmedicated schizophrenia patients, normal controls | Schizophrenia patients showed generalized performance deficit |
| Hellewell et al. (1994) | Schizophrenia patients, normal controls | Schizophrenia patients showed general deficit in describing emotions portrayed by live subjects as well as on video frames |
| Burch (1995) | Schizophrenia and depressive patients, normal controls | Schizophrenia patients with high WIST were the most inaccurate on shame responses |
| Lewis and Garver (1995) | Paranoid and nonparanoid schizophrenia patients, personality disordered patients, normal controls | Paranoid schizophrenia patients were superior to the nonparanoid patients in emotion recognition |
| Schneider et al. (1995) | Schizophrenia patients, normal controls | Schizophrenia and depressive patients were impaired on emotion discrimination task compared with normal controls |
| Salem et al. (1996) | Schizophrenia patients, normal controls | Schizophrenia patients showed generalized emotion decoding deficit |

Note.—WIST = Whitaker Index of Schizophrenic Thinking (Whitaker 1973).

prognosis (process type or negative symptom) and/or chronic schizophrenia patients showed a pattern in the emotion decoding deficit, such as a greater deficit for negative emotions or little or no deficit for positive emotions (Dougherty et al. 1974; Muzekari and Bates 1977; Mandal and Palchoudhury 1985; Borod et al. 1993; see also Poreh et al. 1994).

Studies dealing with an unspecified schizophrenia sample revealed that the emotion decoding deficit is not specific to any category or dimension of emotion (Walker et al. 1984; Feinberg et al. 1986; Cramer et al. 1989; Heimberg et al. 1992). One study reported a generalized performance deficit in an unspecified schizophrenia sample using the split-field presentation technique (Schneider et al. 1992a).

Review of these studies indicated that the emotion decoding deficit is a consistent feature across different subtypes of schizophrenia (chronic, acute, nonparanoid, process type, negative symptom, and unspecified). It

would, however, be premature to conclude that the deficit is generalized and characteristic of schizophrenia pathology because the findings of differential nature of the deficit (Gessler et al. 1989; Joseph et al. 1992) and the deficit in terms of emotional valence (Dougherty et al. 1974; Mandal and Palchoudhury 1985; Borod et al. 1993) in schizophrenia do not clearly favor a generalized performance deficit hypothesis.

Stimulus Variations. In general, photographs of facial expressions were used to judge patients' ability to identify emotions. There were, however, certain variations. For example, Anstadt and Krause (1989) used primary affects in portraits and concluded that schizophrenia patients were more impaired in terms of the quality and diversity of the action unit (the cluster of muscles in an area of the face during expression) drawn in facial expressions. Partial facial photographs (upper, middle, and lower portions of the face) were also used, with the finding that

schizophrenia subjects' impairment was more evident with full facial photographs compared with facial expressions of emotions in part of the face (Mandal and Palchoudhury 1989). Cramer and associates (1989) asked their patients to detect the dominant characteristic of the entire photograph and perceive expressed emotions; the patients failed to perform the task.

There were other variations as well. Most studies used static photographs, and a few used videos or films (Cramer et al. 1989; Joseph et al. 1992). Hellewell and colleagues (1994) showed emotional states portrayed by live subjects as well as on video frames. Viewing conditions differed across studies. Most studies had free viewing conditions; others used the split-field presentation technique (Mandal and Gewali 1989; Schneider et al. 1992a). Studies also differed in categories of basic emotions. Some studies used Ekman's classification (Ekman and Friesen 1975), and others preferred Izard's classification (Izard 1971).

In spite of wide variations in stimulus materials, findings in general indicate an emotion-decoding deficit in schizophrenia. It is interesting, however, to observe that schizophrenia patients were not found inferior to general medical patients in their processing of affective information at an iconic (sensory) level (Mandal and Gewali 1989).

Methodological Variations. Methods for indexing decoding ability could be broadly classified into two categories: (1) Free-response format in which subjects were asked to interpret facial emotions (i.e., to assign meaning by giving facial expressions of emotion a specific label such as happy, sad, etc., or to classify these emotions in terms of similarity of affect content) according to their own subjective criteria (e.g., Dougherty et al. 1974; Muzekari and Bates 1977; Mandal and Palchoudhury 1985), and (2) Fixed-response format in which subjects indicated their understanding of a given facial expression of emotion by assigning a verbal label (or by differentiating or matching it with another facial expression of emotion different or similar to the given one) from a preexperimentally fixed set of emotional labels or expressions.

Most studies dealing with schizophrenia patients' ability to decode facial expressions of emotions used only the fixed-response format (Walker et al. 1980, 1984; Novic et al. 1984; Mandal and Palchoudhury 1985, 1989; Feinberg et al. 1986; Zuroff and Colussy 1986; Mandal 1987; Mandal and Rai 1987; Gessler et al. 1989; Mandal and Gewali 1989; Archer et al. 1992; Heimberg et al. 1992; Kline et al. 1992; Kerr and Neale 1993) with the number of correct responses as the dependent measure. Two studies had different response measures within the fixed-response format, such as time taken to select an

emotional label (Mandal and Rai 1987) and the number of trials taken to choose the correct label (Mandal and Gewali 1989). Some studies had both free- and fixed-response formats (e.g., Dougherty et al. 1974; Muzekari and Bates 1977; Mandal and Palchoudhury 1985).

Researchers using the free-response along with the fixed-response format demonstrated patterns in the decoding deficit of schizophrenia patients, such as a greater decoding deficit for negative emotions and little or no deficit for positive emotions (Dougherty et al. 1974; Muzekari and Bates 1977; Mandal and Palchoudhury 1985). Comparison of the two response formats showed an advantage for the free-response format in one study (Mandal and Palchoudhury 1985) and for the fixed-response format in another (Muzekari and Bates 1977). The difference in the advantage for any specific response format, however, did not reflect a real format difference but was inherent in the task-demand characteristics. Mandal and Palchoudhury (1985) observed an advantage in free-sorting of emotions, which involves only expressed facial emotional cues, over fixed emotional labeling, which involves connecting an emotional word to an expressed facial emotional cue. In contrast, Muzekari and Bates (1977) observed an advantage in fixed labeling over free-emotional labeling that involved retrieval and approximation of an emotional word.

Certain inconsistencies in findings may be accounted for by variations in task demand characteristics. For example, in drawing a conclusion about schizophrenia patients' performance deficit in decoding facial emotions, a variety of methods were used—perceptual discrimination task, recognition task, matching task, identification task, labeling task, and others. In the perceptual discrimination task, subjects give a same-different judgment for two simultaneously presented faces; in the recognition task, subjects are asked to judge whether what is seen in a "test" is the same as what is seen in a "target" (Hilliard 1973); the matching task requires subjects to select a face from a pool of distractors, specifically one seen earlier (Leehey and Cahn 1979); and the identification task asks subjects to recognize physical physiognomical cues in a face (Marzi and Berluchhi 1977). These task demand characteristics were reviewed by Sergent and Bindra (1981). Finally, verbal labeling tasks require subjects to associate a word denoting an emotion with an emotional expression.

Although no study has been conducted to examine the relative efficacy of these methods in schizophrenia, it is believed that the perceptual discrimination task or the recognition tasks are the simplest since patients can respond at a nominal level—"same-different," "yes-no." Because of a set of distractors, the matching task seems to be a little more difficult. The identification task requires

an altogether different strategy because the patient must be more analytical about the presence or absence of a physical cue. The perceptual strategy is considered important because there is evidence that "schizophrenic patients do not utilize the principle of gestalt grouping in perceptual task . . . instead they use a detailed analysis of the stimulus" (Archer et al. 1992, p. 60). Studies on hemispheric strategies reveal that gestalt grouping is primarily a right-hemispheric function and analytical processing a left-hemispheric one (Borod 1992). Adherence to a view that left-hemispheric strategies are dominant in schizophrenia, however, complicates the issue, since patients perform significantly worse in labeling (a left-hemispheric function) compared with matching (a right-hemispheric function) tasks (Mandal and Palchoudhury 1985).

Interpretation of Findings. Two theoretical views explain the schizophrenia patients' decoding deficit: one holds that patients have a generalized performance deficit and the other that patients have an emotion-specific deficit. The former view maintains that schizophrenia patients are inferior in decoding facial expressions of emotions because of a general perceptual deficit for understanding faces. The latter suggests that these patients have a difficulty specific to comprehending facial emotional cues (facial expressions of emotions) but not non-emotional facial cues (Borod et al. 1993).

The advocates of the emotion-specific impairment view in schizophrenia are relatively few. However, there is some evidence to support the theory that postulates an impairment for processing negative emotions in schizophrenia. Walker and associates (1980) showed that, although non-significant, "there was a trend towards greater schizophrenic deficit on the negative emotions" (p. 433). Patients studied were found to be less accurate in recognizing anger and disgust in facial expressions (Shannon 1970). Muzekari and Knudsen (1986) observed that schizophrenia patients' perception of expressions denoting fear, anger, and happiness were accompanied by incongruent verbal statements. The study by Mandal and Rai (1987) showed that patients were specifically impaired in recognizing facial expressions showing fear and disgust. The patients did not differ from control groups in recognizing happy expressions; that finding was corroborated by a study by Burch (1995).

In contrast to most studies, two studies specifically tested the hypothesis of a generalized performance deficit in schizophrenia. These studies (Archer et al. 1992; Kerr and Neale 1993) used multiple tasks. For example, Archer and colleagues used both face-recognition and emotion-recognition tasks, and patients' impairment in these tasks led to a hypothesis of a generalized performance deficit. The study, however, did not attempt to statistically sepa-

rate the face-processing ability from the emotion-recognition performance. This study revealed that in schizophrenia the deficit is specific to recognizing facial expressions of emotion and not to the ability to identify distinguishable features in a face such as age (Borod et al. 1993). Heimberg and associates (1992) also observed that the age-discrimination ability is superior to the emotion-discrimination ability in schizophrenia. It was also found that schizophrenia subjects were as accurate as normal subjects on the familiar face-recognition task, but were less accurate than normal subjects in the unfamiliar face-matching task (Archer et al. 1994).

Meta-Analysis. A meta-analysis of decoding studies examined the magnitude of differences among groups (schizophrenia subjects vs. normal controls) across studies. It was hypothesized that the extent of group difference, as identified by a *p*-value, would be higher for studies that documented a generalized rather than an emotion-specific deficit, because in the latter case the difference would be neutralized to some extent because of a nonsignificant group difference for positive emotions. The Stouffer method was used for the meta-analysis, in which the normal deviate (*Z*) associated with each *p*-value was calculated. This was followed by "add[ition] of all *Z*s (one per study) and divid[ing] the sum by *k* [the number of independent studies], where *k* [was] the number of independent studies, to find the new *Z* that test[ed] the overall result of the metaanalysis" (Rosenthal 1995, p. 186). For computation purposes, *Z* corresponding to *p* was assigned a negative sign for studies documenting a generalized deficit to designate the direction of the finding (see Rosenthal 1991).

Altogether, 12 studies were found for which statistical indices could be retrieved from the published reports; of these 12 studies, 6 fell into the category that documented a generalized deficit (Walker et al. 1980; Novic et al. 1984; Gessler et al. 1989; Mandal and Gewali 1989; Archer et al. 1992; Salem et al. 1996), and the rest documented an emotion-specific deficit (Muzekari and Bates 1977; Mandal and Palchoudhury 1985; Zuroff and Colussy 1986; Mandal and Rai 1987; Cramer et al. 1989; Schneider et al. 1995) for schizophrenia. In studies that considered more than two groups, the *p*-value obtained by the post-hoc test between schizophrenia patients and normal controls was used only for purposes of analysis. The distribution of *p*-values was clearly heterogeneous: $\Sigma (Z_1 - Z)^2$, $\chi^2 = 91.59$, $df = 11$, $p < 0.001$. The magnitude of the group difference for these two classes of studies (generalized vs. emotion-specific deficit) did not differ ($Z = 0.75$, $p = 0.23$, one-tailed). The finding thus leaves the possibility that the researchers, documenting a generalized deficit in schizophrenia, may not have examined

the group difference in terms of hedonic valence of emotion categories. In fact, most authors used the term “generalized” to indicate a deficit in terms of face processing as well as facial emotion perception rather than to indicate a deficit for all or specific categories of facial emotion in schizophrenia.

A meta-analysis was also done using the p -values for studies that documented a significant difference in perception between positive and negative emotions in schizophrenia patients. Since all studies had an unidirectional finding (i.e., the positive emotions were significantly better recognized than the negative ones), the p -values were combined to run a test of heterogeneity. Findings suggest that these p -values were clearly homogeneous ($\chi^2 = 1.69$, $df = 5$, $p > 0.05$).

Although these studies generally documented an emotional deficit in schizophrenia, it remains to be examined whether there was an emotional bias while responding to such stimuli, that is, a tendency to respond to an emotional category relative to the dominant mood state. For example, a schizophrenia patient with anhedonia may see sadness in facial expressions of emotions of all kinds. Such biases may be readily examined by analyzing the magnitude of an error score falling into an emotion category in a decoding study. Schneider and colleagues (1995) used a mood induction procedure and observed a strong happy bias in schizophrenia for the emotion discrimination task. They interpreted the finding: “The tendency to rate others as happy reflects the difficulty in empathy, understanding the distinction between access to one’s own emotional state and the ability to assess others” (Schneider et al. 1995, p. 73).

Encoding Facial Expressions of Emotions

Encoding studies in schizophrenia examined patients’ ability to facially express certain categories of emotions. These studies differed in sample characteristics, elicitation conditions, methodological issues, and interpretation of findings.

Sample Characteristics. Most studies drew samples from a pool of subjects with chronic schizophrenia (Gottheil et al. 1970, 1976; Martin et al. 1990; Steimer-Krause et al. 1990; Berenbaum 1992; Schneider et al. 1992b). These studies, however, differed in their use of psychiatric control or nonpatient control subjects (see table 2).

Elicitation Conditions. Variations in studies for obtaining samples of facial emotions expressed by schizophrenia

patients were documented. Rubenstein (1969) examined facial displays of emotion following electroconvulsive therapy in schizophrenia patients. In some cases, patients were recorded on film as they described past emotional experiences in their lives (Gottheil et al. 1970; Winkel-mayer et al. 1978). Modes of eliciting facial emotions also differed in some studies. Berenbaum (1992) studies posed expressions; others used mimetic expressions (Schneider et al. 1992b) or spontaneous expressions (Martin et al. 1990) of schizophrenia patients.

Methodological Issues. Schizophrenia patients’ expressions of facial emotions are usually evaluated by raters. Some studies distinguished between professional and non-professional raters (Gottheil et al. 1979; Schneider et al. 1992b) who judged facial emotions expressed by patients with schizophrenia. The congruence between (a) verbal measures and facial displays (Gottheil et al. 1970) and (b) facial and vocal channels of expression (Borod et al. 1989) was studied. With the introduction of an anatomically based facial coding system (such as the Facial Action Coding System by Ekman [1982]), facial action units during normal expressions of emotion have been studied in a number of investigations (Krause et al. 1989; Schneider et al. 1990).

Interpretation of Findings. Studies examining schizophrenia patients’ ability to facially communicate concentrate on two or three emotions rather than on all six universally recognized emotions: happiness, sadness, fear, anger, surprise, and disgust (Ekman and Oster 1979). Therefore, it is difficult to evaluate a generalized performance deficit in schizophrenia using data from encoding studies. There is a general consensus, however, that schizophrenia patients manifest less congruence between their verbal and facial affective messages (Gottheil et al. 1976), are less accurate in facial and vocal expressions of affective messages (Borod et al. 1989), and show reduced facial action responsivity across emotions (Schneider et al. 1990).

Some observations have been made on the emotion-specific performance deficit in schizophrenia. For example, patients display more negative than positive emotions (Martin et al. 1990), exhibit expressions of contempt more frequently than other emotions (Steimer-Krause et al. 1990), and show a lower proportion of joyful expressions (Schneider et al. 1992b; Walker et al. 1993). One study found that schizophrenia patients’ decreased facial affect is more prominent in the upper face. The lower face, in contrast, depicts an increase of voluntarily produced social signals (Steimer-Krause et al. 1990—cited in Gaebel 1992). These patients, therefore, were judged as “showing less authentic affect and fewer facial illustrators

Table 2. Facial expressions of emotions in schizophrenia: Encoding studies

| Study | Sample | Observation |
|------------------------------|--|---|
| Gottheil et al. (1970) | Hospitalized schizophrenia patients, normal controls | Schizophrenia patients manifested less congruence between their verbal and nonverbal emotional messages |
| Gottheil et al. (1976) | Schizophrenia patients, normal controls | Schizophrenia patients were less accurate in expressing emotions |
| Winkelmayer et al. (1978) | Hospitalized schizophrenia patients, normal controls | Schizophrenia patients' expressions of positive (but not negative) emotions were judged accurately across cultures |
| Borod et al. (1989) | Flat affect schizophrenia patients, right-brain-damaged patients, Parkinsonian patients, normal controls | Schizophrenia patients were less accurate than Parkinsonian patients and normals, but not less accurate than right-brain-damaged patients |
| Martin et al. (1990) | Schizophrenia patients and right-brain-damaged patients, normal controls | Both patient groups showed significant reduction in expressiveness and more negative than positive emotions |
| Schneider et al. (1990) | Schizophrenia and depressive patients, normal controls | Schizophrenia patients showed reduced facial action across emotions |
| Steimer-Krause et al. (1990) | Schizophrenia patients, psychosomatic patients, normal controls | Schizophrenia patients exhibited contempt expressions most frequently |
| Berenbaum (1992) | Schizophrenia and depressive patients, normal controls | Depressive patients exhibited more anger/contempt and less happiness; schizophrenia patients exhibited an opposite trend |
| Schneider et al. (1992b) | Schizophrenia and depressive patients, normal controls | Facial responsivity and happiness were less intense in both patient groups |
| Walker et al. (1993) | Schizophrenia patients and their healthy siblings | Preschizophrenia patients showed greater negative affect |
| Kring and Neale (1996) | Schizophrenia patients, normal controls | Schizophrenia patients were facially less expressive than controls while watching emotional films |

and regulators" (Gaebel 1992, p. 69). Neurobiologically, the upper face is less voluntarily controlled than the lower face because of its neural link with the motoric speech center (Rinn 1984).

We have a hemifacial hypothesis that has rarely been tested in schizophrenia: The left side of the face is more under unconscious control, revealing hidden emotional content, and the right side of the face is more under conscious control, revealing interpersonally meaningful expressions (Wolff 1943; see also Sackeim et al. 1978). This hypothesis has been tested on many occasions (Mandal et al. 1993; Asthana and Mandal 1997; see also Borod and Koff 1990) and has been found true, using a hemifacial composite of faces (right-right, left-left). A hemifacial composite photograph is prepared by vertically bisecting a photograph and reassembling it with the mirror image of the same hemiface to create left-left and right-right facial composites (Sackeim et al. 1978). We suggest that the hemifacial composite method may be

used to study facial expressions of emotions in schizophrenia—it would allow us to examine the patients' dominant mood state. This procedure would be neurobiologically significant as well, since an absence of a dominant mood state in a left-left facial composite implicates a lack of right hemispheric involvement during emotion processing. It also might be expected that the right-right facial composite would reveal certain emotional signals that are less affectively charged and are expressed without actually being experienced. Future encoding studies may be directed along this line.

Subjective Reactions to Facial Expressions of Emotions

There have been very few studies of schizophrenia patients' reaction to emotions expressed by others; most studies have concerned perceptual and expressive aspects

of emotion processing in schizophrenia patients themselves. There could be two reasons for this: First, these perceptual and expressive aspects are relatively easy to assess. Second, measuring subjective reactions is difficult in schizophrenia as these reactions are generally found to be "flat." Because of such limitations, patients' subjective reaction or sensitivity toward facial expressions of emotions has been indirectly assessed through certain variations and modifications in the decoding paradigm.

Some studies may be mentioned. In two studies, schizophrenia patients were asked to comment freely on photographs depicting facial expressions of universally recognized emotions (Pilowsky and Bassett 1980; Mandal 1988). These patients uttered a significantly greater number of words (Pilowsky and Bassett 1980) and had a significantly greater number of speech disruptions (Mandal 1988) than control groups when responding to photographs depicting fear and anger. In another study, schizophrenia patients were asked to judge similarities among six different facial emotions (Mandal 1986). Instead of examining patients' judgment on the experimentally preselected dimensions, the method took direct account of the dimensions operative for the judges (Harper et al. 1978). It was found that patients were highly sensitive to a distinction between aroused (fear, anger) and nonaroused emotions (happiness, sadness). Patients' proximal behavior (metric analysis of space) was examined to determine their sensitivity toward different facial emotions in interpersonal situations. Patients were asked to walk forward from a distance of 10 feet to a distance comfortable for possible interaction with facial expressions of six different emotions: happiness, sadness, fear, anger, surprise, and disgust. Patients demanded significantly greater proximal space than control groups to interact with facial expressions, especially the nonaroused emotions of happiness and sadness (Srivastava and Mandal 1990). In another study, patients, instead of being instructed to walk forward, were simply asked to select the emotion they preferred most and least to interact with from triads of six facial emotions. Most patients chose happy and sad faces to interact with, and largely rejected fearful and angry faces (Mandal and Palchoudhury 1986). Decoding studies that used response latency as the dependent measure also demonstrated that schizophrenia patients had the greatest response latency for recognizing fearful and angry expressions (Mandal and Rai 1987). These findings indicated that schizophrenia patients understand facial emotions subjectively (at least at a shallow level) but lack the ability either to identify them or to express them appropriately.

Overall, decoding studies, apart from indicating a generalized performance deficit in emotion recognition (Archer et al. 1992; Kerr and Neale 1993), have shown an

emotion-specific recognition deficit for negative emotions (Shannon 1970; Walker et al. 1980; Muzekari and Knudsen 1986) but not for pleasant emotions like happiness (Mandal and Rai 1987). Encoding studies have shown a general reduction of facial action responsivity in schizophrenia patients (Schneider et al. 1990, 1992b). Some studies, however, have documented that schizophrenia patients exhibited more negative emotions (Martin et al. 1990; Steimer-Krause et al. 1990) and fewer positive emotions like joyful expressions (Schneider et al. 1992b; Walker et al. 1993). Studies on subjective reactions to facial emotions have offered a clearer picture, indicating that schizophrenia patients are highly sensitive to a distinction between aroused and nonaroused emotions (Pilowsky and Bassett 1980; Mandal 1988) rather than pleasant versus unpleasant emotions (Mandal 1986). Patients preferred negative-nonaroused emotions (such as sadness) for interaction (Mandal and Palchoudhury 1986).

With this empirical evidence, two theories have been advanced to account for schizophrenia patients' deficiency in processing facial emotions. First, the hemispheric theory proposes that the performance deficiency may be due to abnormalities in the right hemisphere. Neuropsychological literature has shown that the right hemisphere is relatively superior to the left hemisphere in the perception of facial emotions (Bryden 1982; Mandal and Singh 1990; Borod 1992; Mandal et al. 1993), especially negative ones (Davidson et al. 1990; Mandal et al. 1991). The left side of the face, which is contralaterally connected with the motor fibers of the right hemisphere, is found to be more involved than the right side of the face (controlled by the left hemisphere) in expressing emotion (Sackeim et al. 1978; Borod and Koff 1990; Mandal et al. 1993). Patients with right-brain damage were also found to be impaired in understanding of facial expressions of emotions (Mandal et al. 1991; Borod 1992).

In one study, right-brain-damaged and schizophrenia patients were videotaped while talking about their pleasant and unpleasant experiences. Both patient groups were judged to be less expressive and display more negative than positive emotions, compared with controls (Martin et al. 1990). Schneider and his associates (1992a) studied the recognition advantage for emotional stimuli presented in left and right visual fields. A significant reduction in the decoding advantage among schizophrenia patients was attributed to an interhemispheric disconnection syndrome. An interhemispheric disconnection hypothesis (Nasrallah et al. 1982; Biswas et al. 1996) partially substantiates the theoretical view that emotional impairment in schizophrenia is secondary to cognitive impairment, since cognitive input for emotional stimuli (a left-hemisphere function) has little access to the right hemisphere. Many theorists also believe that schizophrenia is chiefly a left-hemi-

sphere disorder (see Gruzelier 1987). The assertion is based on the view that the left hemisphere is the primary site for cognition (Borod 1992). It is believed therefore that the cognitive impairment in schizophrenia affects the ability to process emotion (a right-hemisphere function) globally, resulting in a broad reduction in emotional sensitivity. In sum, the hemispheric/interhemispheric theories support a generalized performance deficit for emotion processing in schizophrenia.

A social-cognitive theory holds that schizophrenia patients develop a social-cognitive deficit to expressions of emotions because they want to withdraw from social interaction in an attempt to guard against exposure to arousing stimuli (Walker et al. 1980). Mednick (1958) suggested that schizophrenia individuals are automatically more aroused and want to avoid situations that may add to arousal (Buss and Lang 1965). Further, "if the avoidance continues over a period of time it may affect the patients' ability to recognize and interpret social cues" (Walker et al. 1980, p. 435). The social-cognitive theory offers support to an emotion-specific deficit hypothesis in schizophrenia. The theory explains the perceptual deficit for negative emotions, especially the aroused emotions of fear and anger.

Recent studies on EE have indicated that family factors, such as emotional overinvolvement or negative affective style displayed by close relatives of schizophrenia patients may precipitate the onset or determine the course of pathology in schizophrenia (see McGlashan and Hoffman 1995). This may be why schizophrenia patients are found to be more vulnerable toward negatively aroused affective situations, as proposed by neurodynamic theorists (see also McGlashan and Hoffman 1995). Studies done on the measures of subjective reactions also have documented that the negatively aroused emotions (fear, anger) induced greater sensitivity (Pilowsky and Bassett 1980; Mandal 1988), were judged as orthogonal to positive or negative nonaroused emotions (Mandal 1986), and were the least preferred for interaction (Mandal and Palchoudhury 1986).

Cognitive theorists attribute impairment of facial emotion recognition in schizophrenia either to a deficit at the structural encoding stage or to an attention deficit (see Archer et al. 1992). Although the theories demonstrate the possible source of the impairment in face recognition, they hardly describe why the impairment is emotion-specific. One reason in support of the view of cognitive theorists is that positive emotions, such as happiness, are more communicative rather than emotion-laden (Borod 1992) and are more often experienced compared to negative emotions. Thus, positive emotions may facilitate the cognitive schema for facial expressions in schizophrenia patients. Empirical evidence obtained from studies of sub-

jective reactions to facial emotions, however, nullifies this presumption because patients were found differentially sensitive to various expressions of emotion.

A social-cognitive theory, therefore, more appropriately explains the emotion-specific perceptual deficit in schizophrenia. The theory does not reject the assumption that schizophrenia patients manifest a broad reduction of emotional sensitivity. In fact, a general performance deficit was more evident for conditions in which patients were compared to control groups in overall performance. When the basal level of performance was kept statistically constant for both groups, interemotion comparisons indicated an emotion-specific deficit in schizophrenia patients.

The emotion-specific deficit may be generalized, depending on the state of schizophrenic illness. For example, negative-symptom schizophrenia is more associated with the over- or underactivation of the right hemisphere (Martin et al. 1990). Because the right hemisphere has been found to be superior for emotion processing, "it might not be surprising if those schizophrenics with disturbed affect showed behavioral signs of right hemisphere disorganization" (Martin et al. 1990, p. 289). Right-brain-damaged patients exhibit, at times, a dissociation between emotional experience and emotional expression (Gainotti 1983; Ross 1984). Such dissociation is also evident in patients, perception and expression of facial emotions. For example, negative emotions are poorly recognized although more frequently displayed by patients.

To examine such dissociation, it is essential to perform perceptual and expressive studies on the same group of patients. Very few attempts in this direction have been made. While one study (Gottheil et al. 1970) indicated a dissociation between facial and verbal channels of emotion processing in schizophrenia patients, it did not deal with the state of patients' pathology. It is possible that with an acute state of pathology such as the breakdown of perceptual filtering, the dissociation between perceptual and expressive aspects of emotion processing increases. It has been found that emotional functioning and recognition accuracy improve when patients suffering from psychosis like schizophrenia patients move from an acute to a remitted state (Cutting 1981; Gessler et al. 1989). It is also possible that schizophrenia patients remain sensitive to at least some facial expressions of emotions but maintain a dissociation between the expression and perception of emotion (depending on the subjective experience associated with it) as part of their strategy to cope with the environment. In such a case, the theoretical view that emotion is primary and independent of cognition (Zajonc 1984) is partially verified, because the differential emotional sensitivity remains intact despite a gross cognitive disorder in schizophrenia.

A recent study by Kring and Neale (1996) observed a disjunction between expressive and subjective emotional response in schizophrenia. Patients were found facially to be less expressive but exhibit greater skin conductance reactivity while viewing emotional film clips. The researchers concluded that "Professionals who make ratings of flat affect on the basis of an interview with a patient may be mistaken by assuming that diminished expressivity reflects diminished subjective emotion when, in fact, this may not be true" (Kring and Neale 1996, p. 256).

In sum, the controversy over the emotion-cognition relationship may be resolved empirically to some extent by research on schizophrenia patients. Such an endeavor would allow exploring emotion without much influence from cognition. In a normal human being, the two apparently distinct psychological processes of cognition and emotion are "inseparably interrelated" (Leventhal and Scherer 1987) and therefore are difficult to study.

References

- American Psychiatric Association. *DSM-IV: Diagnostic and Statistical Manual of Mental Disorders*. 4th ed. Washington, DC: The Association, 1994.
- Anstadt, T., and Krause, R. The expression of primary affects in portraits drawn by schizophrenics. *Psychiatry*, 52:13-24, 1989.
- Archer, J.; Hay, D.C.; and Young, A.W. Face processing in psychiatric conditions. *British Journal of Clinical Psychology*, 31:45-61, 1992.
- Archer, J.; Hay, D.C.; and Young, A.W. Movement, face processing and schizophrenia: Evidence of a differential deficit in expression analysis. *British Journal of Clinical Psychology*, 31:517-528, 1994.
- Asthana, H.S., and Mandal, M.K. Hemiregional variations in facial expression of emotions. *British Journal of Psychology*, 88(Pt. 3):519-525, 1997.
- Berenbaum, H. Posed facial expressions of emotion in schizophrenia and depression. *Psychological Medicine*, 22:929-937, 1992.
- Biswas, A.K.; Haque-Nizamie, S.; Pandey, R.; and Mandal, M.K. Bilateral transfer deficit in schizophrenia: A trait marker. *Psychiatry Research*, 64(2):115-120, 1996.
- Borod, J.C. Interhemispheric and intrahemispheric control of emotion: A focus on unilateral brain damage. *Journal of Consulting and Clinical Psychology*, 60:339-348, 1992.
- Borod, J.C.; Alpert, M.; Brozgold, A.; and Martin, C. A preliminary comparison of flat affect schizophrenics and brain-damaged patients on measures of affective processing. *Journal of Communication Disorder*, 22:93-104, 1989.
- Borod, J.C., and Koff, E. Lateralization for facial emotional behaviour: A methodological perspective. *International Journal of Psychology*, 25:157-177, 1990.
- Borod, J.C.; Martin, C.C.; Alpert, M.; Brozgold, A.; and Welkowitz, J. Perception of facial emotion in schizophrenics and right brain-damaged patients. *Journal of Nervous and Mental Disorders*, 181:494-502, 1993.
- Bryden, M.P. *Laterality: Hemispheric Specialization in the Intact Brain*. New York, NY: Academic Press, 1982.
- Burch, J.W. Typicality range deficit in schizophrenics' recognition of emotion in faces. *Journal of Clinical Psychology*, 51:140-150, 1995.
- Buss, A., and Lang, P. Psychological deficit in schizophrenia. *Journal of Abnormal Psychology*, 70:2-24, 1965.
- Cramer, P.; Weegmann, M.; and O'Neil, M. Schizophrenia and the perception of emotions: How accurately do schizophrenics judge the emotional states of others? *British Journal of Psychiatry*, 155:225-228, 1989.
- Cutting, J. Judgment of emotional expression in schizophrenics. *British Journal of Psychiatry*, 139:1-6, 1981.
- Davidson, R.J.; Ekman, P.; Saron, C.D.; Senulis, J.A.; and Friesen, W.V. Approach-withdrawal and cerebral asymmetry: Emotional expression and brain pathology I. *Journal of Personality and Social Psychology*, 58:330-341, 1990.
- Dougherty, P.E.; Bartlett, E.S.; and Izard, C.E. Responses of schizophrenics to expressions of fundamental emotions. *Journal of Clinical Psychology*, 30:243-246, 1974.
- Ekman, P. *Emotion in the Human Face*. New York, NY: Cambridge University Press, 1982.
- Ekman, P., and Friesen, W.V. Nonverbal behavior and psychopathology. In: Friedman, R.J., and Katz, M.M., eds. *The Psychology of Depression: Contemporary Theory and Research*. Washington, DC: Winston & Sons, 1974. pp. 203-232.
- Ekman, P., and Friesen, P. *Unmasking the Face*. Englewood Cliffs, NJ: Prentice Hall, 1975.
- Ekman, P., and Oster, H. Facial expressions of emotions. *Annual Review of Psychology*, 30:527-554, 1979.
- Feinberg, J.E.; Pifkin, A.; Schaffer, C.; and Walker, E. Facial discrimination and emotional recognition in schizophrenia and affective disorders. *Archives of General Psychiatry*, 43:276-279, 1986.
- Gaebel, W. Nonverbal behaviour dysfunction in schizophrenia: Vulnerability indicator, residual marker, or coping strategy? *British Journal of Psychiatry*, 161:65-74, 1992.

- Gainotti, G. Laterality of affect: The emotional behaviour of right and left brain-damaged patients. In: Myslobodsky, M.S., ed. *Hemis syndromes: Psychology, Neurology, Psychiatry*. New York, NY: Academic Press, 1983. pp. 175–189.
- Gessler, S.; Cutting, J.; Frith, C.D.; and Weinman, J. Schizophrenics' inability to judge facial emotion: A controlled study. *British Journal of Clinical Psychology*, 28(Pt. 1):19–29, 1989.
- Gottheil, E.; Exline, R.V.; and Winkelmayer, R. Judging emotions of normal and schizophrenic subjects. *American Journal of Psychiatry*, 136:1049–1054, 1979.
- Gottheil, E.; Paredes, A.; Exline, R.V.; and Winkelmayer, R. Communication of affect in schizophrenia. *Archives of General Psychiatry*, 22:439–444, 1970.
- Gottheil, E.; Thornton, C.C.; and Exline, R.V. Appropriate and background affect in facial displays of emotion comparison of schizophrenic and normal males. *Archives of General Psychiatry*, 33:565–568, 1976.
- Green, B.F., and Hall, J.A. Quantitative methods for literature review. *Annual Review of Psychology*, 35:37–53, 1984.
- Gruzelier, J.H. Cerebral laterality and schizophrenia. In: Glass, A., ed. *Individual Differences in Hemispheric Specialization*. New York, NY: Plenum Press, 1987. pp. 301–329.
- Harper, R.G.; Wiens, A.N.; and Matarazzo, J.D. *Non-verbal Communication: The State of Art*. New York, NY: John Wiley & Sons, 1978.
- Heimberg, C.; Gur, R.E.; Erwin, R.J.; Shtasel, D.L.; and Gur, R.C. Facial emotion discrimination: III. Behavioural findings in schizophrenia. *Psychiatry Research*, 42:253–265, 1992.
- Hellewell, J.; Connell, J.; and Deakin, J.F.W. Affect-judgment and facial recognition memory in schizophrenia. *Psychopathology*, 27:255–261, 1994.
- Hilliard, R.D. Hemispheric laterality effects on a facial recognition task in normal subjects. *Cortex*, 9:246–258, 1973.
- Izard, C.E. *The Face of Emotion*. New York, NY: Appleton-Century-Crofts, 1971.
- Joseph, P.L.; Sturgeon, D.A.; and Leff, J. The perception of emotion by schizophrenic patients. *British Journal of Psychiatry*, 161:603–609, 1992.
- Kerr, S.L., and Neale, J.M. Emotion perception in schizophrenia: Specific deficit or further evidence of generalized poor performance. *Journal of Abnormal Psychology*, 102:312–318, 1993.
- Kline, J.S.; Smith, J.E.; and Ellis, H.C. Paranoid and non-paranoid schizophrenic processing of facially displayed affect. *Journal of Psychiatric Research*, 26:169–182, 1992.
- Kraepelin, E. *Dementia Praecox and Paraphrenia*. Edinburgh, Scotland: E & S. Livingstone, 1919.
- Krause, R.; Steimer, E.; Sangeralt, C.; and Wagner, G. Facial expression of schizophrenic patients and their interaction partners. *Psychiatry*, 52:1–12, 1989.
- Kring, A.M., and Neale, J.M. Do schizophrenic patients show a disjunctive relationship among expressive, experiential, and psychophysiological components of emotion? *Journal of Abnormal Psychology*, 105:249–257, 1996.
- Lazarus, R.S. On the primacy of cognition. *American Psychologist*, 39:124–129, 1984.
- Leehey, S.C., and Cahn, A. Lateral asymmetries in the recognition of words, familiar and unfamiliar faces. *Neuropsychologia*, 17:619–627, 1979.
- Lehmann, H.E. Schizophrenia: Clinical features. In: Kaplan, H.I.; Fredman, A.M.; and Sadock, B.J., eds. *Comprehensive Textbook of Psychiatry*. Vol. 3. Baltimore, MD: Williams & Wilkins Company, 1980. pp. 1153–1191.
- Leventhal, H., and Scherer, K. The relationship of emotion to cognition: A functional approach to a semantic controversy. *Cognition and Emotion*, 1:3–28, 1987.
- Lewis, S.F., and Garver, D.L. Treatment and diagnostic subtype in facial affect recognition in schizophrenia. *Journal of Psychiatric Research*, 29:5–11, 1995.
- Mandal, M.K. Judgement of facial affect among depressives and schizophrenics. *British Journal of Clinical Psychology*, 25:87–92, 1986.
- Mandal, M.K. Decoding the facial emotions in terms of expressiveness by schizophrenics and depressives. *Psychiatry*, 50:371–376, 1987.
- Mandal, M.K. Affect related response in schizophrenia. *Pharmacopsychologia*, 28:183–187, 1988.
- Mandal, M.K.; Asthana, H.S.; and Tandon, S.C. Judgment of facial expression of emotion in unilateral brain-damaged patients. *Archives of Clinical Neuropsychology*, 8:171–183, 1993.
- Mandal, M.K., and Gewali, H. Identification of brief presentation of facial expressions of affects in schizophrenia. *International Journal of Psychology*, 24:605–616, 1989.
- Mandal, M.K., and Palchoudhury, S. Decoding of facial affect in schizophrenia. *Psychological Reports*, 56:651–652, 1985.
- Mandal, M.K., and Palchoudhury, S. Choice of facial affect and psychopathology. *Journal of Social Behaviour and Personality*, 1:299–302, 1986.
- Mandal, M.K., and Palchoudhury, S. Identifying the components of facial emotion and schizophrenia. *Psychopathology*, 22:295–300, 1989.

- Mandal, M.K., and Rai, A. Responses to facial emotion and psychopathology. *Psychiatry Research*, 20:317–323, 1987.
- Mandal, M.K., and Singh, S.K. Lateral asymmetry in identification and expression of facial emotions. *Cognition and Emotion*, 4:61–70, 1990.
- Mandal, M.K.; Tandon, S.C.; and Asthana, H.S. Right brain damage impairs recognition of negative emotions. *Cortex*, 27:247–254, 1991.
- Martin, C.C.; Borod, J.C.; Alpert, M.; Brozgold, A.; and Welkowitz, J. Spontaneous expression of facial emotion in schizophrenic and right brain damaged patients. *Journal of Communication Disorder*, 23:287–301, 1990.
- Marzi, C., and Berlucchi, G. Right visual field superiority for accuracy of recognition of famous faces in normals. *Neuropsychologia*, 15:751–756, 1977.
- McGlashan, T.H., and Hoffman, R.E. Schizophrenia: Psychodynamic to neurodynamic theories. In: Kaplan, H.I., and Sadock, B.J., eds. *Comprehensive Textbook of Psychiatry*, Vol. 1. Baltimore, MD: Williams and Wilkins Company, 1995. pp. 957–967.
- Mednick, S. A learning theory approach to research on schizophrenia. *Psychological Bulletin*, 55:316–327, 1958.
- Muzekari, L.H., and Bates, M.E. Judgment of emotion among chronic schizophrenics. *Journal of Clinical Psychology*, 32:662–666, 1977.
- Muzekari, L.H., and Knudsen, H. Effect of context on perception of emotion among psychiatric patients. *Perceptual and Motor Skills*, 62:79–84, 1986.
- Nasrallah, H.A.; Jacoby, C.G.; McCalley-Whitters, M.; and Kupoman, S. Cerebral-ventricular enlargement in subtypes of chronic schizophrenia. *Archives of General Psychiatry*, 39:774–777, 1982.
- Novic, J.; Daniel, L.; and Perline, R. Facial affect recognition in schizophrenia: Is there a differential deficit? *British Journal of Psychiatry*, 144:533–537, 1984.
- Pilowsky, I., and Bassett, D. Schizophrenia and the response to facial emotions. *Comprehensive Psychiatry*, 21:236–244, 1980.
- Poreh, A.M.; Chaplin, K.; Rosen, M.D.; and Youssef, I. Correlations between the MMPI and the Scale for the Assessment of Positive Symptoms and the Scale for the Assessment of Negative Symptoms in schizophrenic patients. *Journal of Personality Assessment*, 63:275–283, 1994.
- Rinn, W.E. The neuropsychology of facial expression: A review of the neurological and psychological mechanisms for producing facial expressions. *Psychological Bulletin*, 95:52–77, 1984.
- Rosenthal, R. *Meta-analytical Procedures for Social Research*. London, England: Sage, 1991.
- Rosenthal, R. Writing meta-reviews. *Psychological Bulletin*, 118:183–192, 1995.
- Ross, E. Right hemisphere's role in language, affective behaviour, and emotion. *Trends in Neurosciences*, 7:342–346, 1984.
- Rubenstein, L. Facial expressions: An objective method in the quantitative evaluation of emotional change. *Behaviour Research Methods and Instruments*, 1:305–306, 1969.
- Sackeim, H.A.; Gur, R.C.; and Saucy, M.C. Emotions are expressed more intensely on the left side of the face. *Science*, 202:434–436, 1978.
- Salem, J.E.; Kring, A.M.; and Kerr, S.L. More evidence for generalized poor performance in facial emotion perception in schizophrenics. *Journal of Abnormal Psychology*, 105:480–483, 1996.
- Schneider, F.; Gur, R.C.; Gur, R.E.; and Shtasel, D.L. Emotional processing in schizophrenia: Neurobehavioral probes in relation to psychopathology. *Schizophrenia Research*, 17:67–75, 1995.
- Schneider, F.; Heimann, H.; Himer, W.; Huss, D.; Mattes, R.; and Adams, B. Computer based analysis of facial action in schizophrenic and depressed patients. *European Analysis of Psychiatry and Clinical Neuroscience*, 40:67–76, 1990.
- Schneider, F.; Koch, J.D.; Mattes, R.; and Heimann, H. Recognition of emotions in facial expression of visual half-field images by schizophrenic and depressed patients. *Nervenarzt*, 63:545–550, 1992a.
- Schneider, F.; Mattes, R.; Adams, B.; and Heimann, H. Evaluation of mimetic expression of schizophrenic and depressed patients by the psychiatrist. *Weiner Klinische Wochenschrift*, 104:56–60, 1992b.
- Sergent, J.S., and Bindra, D. Differential hemispheric processing of faces: Methodological considerations and reinterpretation. *Psychological Bulletin*, 89:541–554, 1981.
- Shannon, A.M. "Differences Between Depressives and Schizophrenics in the Recognition of Facial Expression of Emotion." Unpublished doctoral dissertation, University of California, San Francisco, 1970.
- Srivastava, P., and Mandal, M.K. Proximal spacing to facial affect expressions in schizophrenia. *Comprehensive Psychiatry*, 31:119–124, 1990.
- Steimer-Krause, E.; Krause, R.; and Wagner, G. Interaction regulation used by schizophrenic and psychosomatic patients: Studies on facial behavior in dyadic interactions. *Psychiatry*, 53:209–228, 1990.

Walker, E.F. Emotion recognition in disturbed and normal children: A research note. *Journal of Child Psychology and Psychiatry*, 22:263–268, 1981.

Walker, E.F.; Grimes, K.E.; Davis, D.M.; and Smith, A.J. Childhood precursors of schizophrenia: Facial expressions of emotion. *American Journal of Psychiatry*, 150:1654–1660, 1993.

Walker, E.F.; Marwit, S.J.; and Emory, E. A cross-sectional study of emotion recognition in schizophrenics. *Journal of Abnormal Psychology*, 89:428–436, 1980.

Walker, E.F.; McGuire, M.; and Bettes, B. Recognition and identification of facial stimuli by schizophrenics and patients with affective disorders. *British Journal of Clinical Psychology*, 23:37–44, 1984.

Whitaker, L.C. *Whitaker Index of Schizophrenic Thinking*. Los Angeles, CA: Western Psychological Services, 1973.

Winkelmayer, R.; Exline, R.V.; Gottheil, E.; and Paredes, A. The relative accuracy of U.S., British, and Mexican raters in judging the emotional displays of schizophrenic and normal U.S. women. *Journal of Clinical Psychology*, 34:600–608, 1978.

Wolff, W. *The Expression of Personality*. New York, NY: Harper, 1943.

Zajonc, R.B. On the primacy of affect. *American Psychologist*, 39:117–123, 1984.

Zuroff, D.C., and Colussy, S.A. Emotion recognition in schizophrenic and depressed inpatients. *Journal of Clinical Psychology*, 48:411–417, 1986.

Acknowledgments

This research was supported by a University Grants Commission Major Project Grant (F.5-113/92, HRP) awarded to Dr. Mandal. The authors thank V. Tripathi and H.S. Asthana for their help in the preparation of this manuscript.

The Authors

Manas K. Mandal, Ph.D., is Senior Lecturer, Department of Psychology, Banaras Hindu University, Varanasi, India. Rakesh Pandey, Ph.D., is Senior Research Fellow and Akhouri B. Prasad, M.A., is Project Fellow, Department of Psychology, Banaras Hindu University, Varanasi, India.