

Nonverbal Behavior in Schizophrenia

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In the outspoken forms of schizophrenia, the emotional deterioration stands in the forefront of the clinical picture. . . . Many schizophrenics . . . sit about the institutions to which they are confined with expressionless faces, hunched-up, the image of indifference.

Bleuler (1911/1950)

Historically, emotional disturbances in schizophrenia were considered prominent features of the disorder, as evidenced in the above quote by Bleuler (1911/1950). It is noteworthy that the nonverbal behavior component of emotion (facial expression, postures) was the focus of these early clinical descriptions. Indeed, theorists wrote often about an apparent mismatch between schizophrenia patients' nonverbal emotion displays and their subjective experience of emotion. The writings of Bleuler, Kraepelin (1919/1971), and others provided descriptions of schizophrenia patients who reported experiencing strong emotions, but who did not readily display those feelings outwardly. Despite the theoretical and clinical importance of these observations, systematic research into the nature of emotional disturbances was not conducted until fairly recently.

In this chapter, we examine the nature of nonverbal emotion disturbances in schizophrenia, beginning with a consideration of theoretical approaches to the study of emotion and schizophrenia and the research paradigms that have arisen from these approaches. It is our contention that greater progress toward understanding the nature of emotional disturbances in schizophrenia has been made from studies based in the theoretical and methodological traditions of basic emotion research. We review a number of schizophrenia studies that have employed paradigms from the basic emotion literature and then present some new data that demonstrate that

schizophrenia patients exhibit very subtle nonverbal facial expressions not outwardly observable. We conclude by summarizing what we do and do not know about emotion disturbances in schizophrenia, note treatment and assessment implications, and suggest a number of directions for additional research.

Theoretical and Methodological Approaches to Studying Emotion in Schizophrenia

Many early theories of emotion disturbance in schizophrenia were based on clinical observations with schizophrenia patients, and they were derived to account for the diverse symptom picture comprising the illness, not just the emotional features of schizophrenia. Recognizing the varied number of schizophrenia symptoms, Bleuler (1911/1950) posited that schizophrenia symptoms could be categorized as either fundamental (i.e., pathognomonic) or accessory. In Bleuler's theory, there were four fundamental symptoms, one of which was affective disturbance. Bleuler, who coined the term *schizophrenia* to reflect the "splitting of associative threads" that occurs in schizophrenia, suggested that this associative disturbance was a direct reflection of the disease process, whereas other symptoms, including affective symptoms, reflected the disease process interacting with an individual patient's environment. Moreover, Bleuler's ideas about schizophrenia were heavily influenced by psychoanalytic theory. For example, he suggested that this line of theorizing could account for the content of delusions and hallucinations.

Also grounded in psychoanalytic theory, Rado (1956) conjectured that the primary emotion disturbance in schizophrenia was a failure to experience positive emotions, which he referred to as the "welfare emotions." As a consequence of this pleasure deficit, Rado argued that schizophrenia patients would experience negative emotions (the "emergency emotions") more strongly.

More recent theories in psychiatry have attempted to integrate psychological and biological factors to account for the overt signs and symptoms of the disorder. For example, Carpenter and colleagues (e.g., Carpenter, Buchanan, Kirkpatrick, Tamminga, & Wood, 1993; Carpenter, Heinrichs, & Wagman, 1988) argued that schizophrenia patients who have negative symptoms that are both enduring and primary represent a distinct etiologic subtype referred to as the deficit syndrome. Furthermore, these investigators hypothesized that dysfunction involving frontal cortex and limbic structures might account for deficit symptomatology (e.g., Buchanan et al., 1994; Tamminga et al., 1992). Interestingly, the essence of deficit symptoms is based on Kraepelin's (1919/1971) notion of an avolitional process, described as "emotional dullness, failure of mental activities, loss of mastery over volition, of endeavor, and of ability for independent action" (p. 74);

thus, not surprisingly, a number of the deficit symptoms involve emotional features (e.g., diminished emotional range, curbing of interests, and restricted affect).

The development of more recent theories of schizophrenia has been complemented with the development of more reliable methods for symptom assessment, such as the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1983) and the Schedule for the Deficit Syndrome (SDS; Kirkpatrick, Buchanan, McKinney, Alphas, & Carpenter, 1989; for a review, see Earnst & Kring, 1997). These scales were developed so that a trained observer could interview a patient and then rate the degree to which the patient manifested a number of different symptoms, including emotional symptoms. For example, the SANS includes an Affective Flattening subscale. Patients who are rated as having flat affect may speak in a monotonic voice, use few expressive gestures, have poor eye contact, and show few changes in facial expression.

The development of these rating scales contributed to a resurgence of interest in emotional features of schizophrenia because they provided investigators with much-needed, reliable measures of emotion-related symptoms. Using these scales, evidence indicates that flat affect is a fairly common symptom of schizophrenia, although there is considerable cross-cultural variability (Jenkins, 1994). Among Euro-American schizophrenia patients, flat affect is relatively stable across time (Kring & Earnst, 1999; Pffhol & Winokur, 1982; but see Keefe et al., 1991), related to a poor prognosis (Carpenter, Bartko, Strauss, & Hawk, 1978; Fenton & McGlashan, 1991; Knight & Roff, 1985), and more common in schizophrenia than in depression (Andreasen, 1979).

Although the use of these rating scales has contributed to the understanding of the symptom flat affect (among others), the scales are not without limitations. First, the clinical interview on which symptom ratings are made may not actually elicit emotion from the participants. Questions are typically centered on the patient's illness experience, and while this may be emotion eliciting for some patients, it may be quite benign for others. Thus, ratings of expressive behavior may be constrained by the interview (Kring, Alpert, Neale, & Harvey, 1994). In addition, these scales typically assess only one component of emotion: The Affective Flattening subscale assesses the expressive component of emotion. However, emotion is best construed as having multiple components. An approach that assesses multiple emotion components, therefore, will provide a more complete evaluation of emotional responding among schizophrenia patients.

Because many psychiatric theories are developed to account for the diversity of schizophrenia symptoms, emotion does not often claim center stage in these accounts. Yet, a long and fruitful theoretical tradition on basic emotion function can inform studies of emotion dysfunction in schizophrenia. From the emotion literature, many theorists consider emotions to be responses that have developed over the course of human evolution to

enable individuals to deal with problems, situations, and events in the environment (e.g., Buck, 1994; Ekman, 1992; Izard, 1993a, 1993b; Keltner & Kring, 1998; Kring & Bachorowski, 1999; Lang, Bradley, & Cuthbert, 1990). Emerging from these functional accounts, an emotion response is defined by a constellation of components, including a cognitive or appraisal component, a behavioral or expressive component, an experiential component, and a physiological component.

Methods for studying emotion that have originated from the basic emotion tradition typically involve the presentation of emotion-eliciting stimuli, such as emotional film clips, emotional slides, imagery, or social interaction. Facial expressions are often videotaped and later coded, and self-reports of emotional experience following the presentation of the emotionally evocative stimuli are gathered. Some investigators include psychophysiological measures, such as heart rate or skin conductance (SC), to assess the physiological component of emotion. These studies are usually done in laboratory settings; however, other, more naturalistic, approaches include daily assessments of emotional expression and experience over longer periods of time (e.g., Feldman-Barrett, 1997, 1998).

Findings from Empirical Studies of Emotion Disturbances in Schizophrenia

Using paradigms from basic emotion research, studies have found that, compared to nonpatient controls, schizophrenia patients are less facially expressive of both positive and negative emotions, yet they report experiencing as much positive and negative emotion while viewing emotion-eliciting films or pictures (Berenbaum & Oltmanns, 1992; Dworkin et al., 1993; Dworkin, Clark, Amador, & Gorman, 1996; Kring & Earnst, 1999; Kring, Kerr, Smith, & Neale, 1993; Kring & Neale, 1996). In paradigms involving a social interaction, schizophrenia patients are also less expressive than nonpatient controls (e.g., Krause, Steimer, Sanger-Alt, & Wagner, 1989; Mattes, Schneider, Heimann, & Birbaumer, 1995) and other patient groups (e.g., those with Parkinson's disease, depression, alcohol abuse) that have features similar to negative symptoms (Davison, Frith, Harrison-Read, & Johnstone, 1996; Gaebel & Wolwer, 1992; Pitman, Kolb, Orr, & Singh, 1987). Yet, despite their diminished expressive behavior, schizophrenia patients reported experiencing more negative emotion in these social interactions (Krause, Steimer-Krause, & Hufnagel, 1992). In addition, schizophrenia patients may show greater skin conductance reactivity to emotional film clips than nonpatients (Kring and Neale, 1996; but see also Kring, Germans, Triesch, & Putnam, 2003). Thus, studies that have incorporated methods from basic emotion have been able, for the first time, to confirm empirically the early clinical descriptions of Bleuler, Kraepelin, and others and indicate

that schizophrenia patients manifest a disjunction among emotion response components.

These findings raise additional questions, however, with respect to nonverbal behavior in schizophrenia. First, it remains unclear whether schizophrenia patients are actually expressing (i.e., contracting the facial musculature), but at an intensity level that is undetectable by observers. Recent evidence indicates that schizophrenia patients do indeed manifest unobservable (covert) facial activity in a manner consistent with the valence of emotional stimuli, which suggests that the expressive component of emotion is not completely deficient among schizophrenia patients (Earnst et al., 1996; Kring, Kerr, & Earnst, 1999; Mattes et al., 1995). Second, the extent to which this subtle, unobservable facial activity among schizophrenia patients is related to other components of emotion is not known. However, understanding the relationships among emotion response components will help elucidate the nature of a possible disjunction among these components in schizophrenia.

Facial Expressions: Observable and Unobservable

Facial expressions are observable to the extent that facial muscle contraction leads to movement of various skin and connective tissue (e.g., lines, folds, wrinkles on the skin; movement of mouth, eyebrows, etc.). However, if facial muscle movement is sufficiently weak or if the muscle contractions discontinue before the corresponding connective tissues move, the muscle activity will not translate into an observable expression. Yet, this type of unobservable facial muscle activity can and does occur without these corresponding movements of skin and connective tissue.

Surface electromyographic (EMG) recording of facial muscle activity is a noninvasive method for measuring such unobservable facial muscle activity, and there are several important advantages to using EMG recording as a measure of facial behavior (Fridlund, 1988; Fridlund & Izard, 1983). For example, EMG recording allows for the detection of changes in the facial musculature that are too small to be observed. In addition, EMG is a more precise measure of facial muscle movement. Third, muscle movement is immediately detectable. EMG assessments of facial activity are not without disadvantages, however. The placement of electrodes on the face may interfere with spontaneous expressive behavior and may make an individual more aware of his or her facial behavior. To avoid this last problem, researchers typically give instructions to participants to divert attention from the face (e.g., "We are measuring unconscious brain waves"). In studies in which continuous emotional stimuli are presented, as in the case of film studies, EMG activity is most typically averaged over the entire film period and thus is not directly tied to particular moments of time in the film. In other words, an average of EMG activity across the film

period is typically the dependent variable in analyses rather than the discrete events that are accumulated when assessing observable facial expressions.

Converging evidence from several studies using EMG in nonpatient populations indicates that EMG activity over the brow region (corrugator supercillii) increases and EMG activity over the cheek region (zygomaticus major) decreases during the presentation of unpleasant stimuli. In contrast, EMG activity over the cheek region increases and activity over the brow region decreases during the presentation of pleasant stimuli (e.g., Brown & Schwartz, 1980; Cacioppo, Bush, & Tassinari, 1992; Cacioppo, Petty, Losch, & Kim, 1986; Dimberg, 1982; Fridlund, 1991; Kring et al., 1999). This same pattern of findings has also been demonstrated with depressed patients (e.g., Schwartz, Fair, Salt, Mandel, & Klerman, 1976; Teasdale & Bancroft, 1977). In addition, corrugator activity is associated with reports of unpleasant emotion, and zygomatic activity is associated with reports of pleasant emotion (e.g., Fridlund & Izard, 1983; Greenwald, Cook, & Lang, 1989; Lang, Greenwald, Bradley, & Hamm, 1993; McCanne & Anderson, 1987).

Only recently have researchers included EMG assessments in studies of schizophrenia. For example, Kring et al. (1999) found that schizophrenia patients demonstrated greater zygomatic activity in response to pictures of positive facial expressions than to pictures of negative facial expressions and greater corrugator activity in response to pictures of negative facial expressions than to pictures of positive facial expressions. Interestingly, schizophrenia patients' EMG activity was greater than that of nonpatient controls. Mattes et al. (1995) found that schizophrenia patients exhibited more zygomatic activity during a happy film and a discussion of pleasant events than during a sad film and discussion of sad events, and they exhibited more corrugator activity during a sad film and discussion of sad events than during the happy film and discussion of pleasant events. Although patients exhibited slightly more corrugator activity than controls during the sad discussion, this difference was not significant. In addition, patients did not differ from controls in their corrugator activity during the sad film, and they exhibited less zygomatic activity than controls during the happy film and pleasant discussion.

Taken together, these findings suggest that, although schizophrenia patients' observable expressive behavior distinguishes them from nonpatient controls, more subtle and unobservable facial activity may be similar to or even greater than controls. This is particularly interesting in light of the findings that schizophrenia patients do not differ from controls in their self-reports of emotional experience. That is, their diminished observable expressivity cannot be readily accounted for by comparable diminished reports of experienced emotion. Rather, schizophrenia patients may have a different threshold for displaying observable expressions (Ekman, 1992).

Investigating Unobservable Facial Activity in Schizophrenia: New Findings

We recently completed a longitudinal investigation of emotional responding in schizophrenia (Kring & Earnst, 1999). Our primary aim in that study was to investigate which effects, if any, neuroleptic medication might have on emotional responding in schizophrenia and to assess the extent to which emotional responding in schizophrenia is stable across time. To address those questions, we implemented a counterbalanced crossover design (Spohn & Strauss, 1989) by which all participants were tested on two occasions, approximately 5 months apart. For the schizophrenia patients, the different testing occasions also represented a change in their medication status. About half of the patients were off medication at the first testing and then were retested while on medication, and the other half of the patients were on medication at the first testing and then retested while off medication. Nonpatient controls were tested at two times, with the amount of time between testing occasions equivalent to the time between testing occasions for patients (for more detail on the study design, see Kring & Earnst, 1999).

A secondary aim of that study was to determine if schizophrenia patients manifested subtle, unobservable facial movement in response to emotionally evocative stimuli to illuminate the boundaries of expressive behavior among schizophrenia patients. In particular, we were interested to see if schizophrenia patients exhibited EMG activity that was consistent with the valence of emotional films. Based on the few previous studies that assessed EMG activity in response to emotional stimuli among schizophrenia patients, we expected that their responses would vary in a reliable fashion depending on the valence of the film that they were watching. That is, we expected that schizophrenia patients would exhibit greater zygomatic activity in response to positive film clips and greater corrugator activity in response to negative film clips. We were also interested in ascertaining whether schizophrenia patients would differ from nonpatients in their EMG activity. Based on the studies reviewed above, we expected that schizophrenia patients would show very similar levels of EMG activity across the films. Finally, we were interested to see if EMG activity among schizophrenia patients would be associated with the observable expressive, experiential, and physiological components of emotion.

Overview of Sample, Methods, and Prior Results

Our participants were 15 male patients with diagnoses of either schizophrenia ($n = 13$) or schizoaffective disorder ($n = 2$) and 15 nonpatient controls with no personal or family history of psychopathology who were recruited from the community. The patient and nonpatient groups did not significantly differ in age, years of education, or racial composition.

For each testing occasion, we unobtrusively videotaped participants as they first viewed a neutral film clip, followed by two positive then two negative film clips or the reverse order (negative before positive). After each film, participants answered three brief questions about the film clip to assess attention and understanding. They then completed a self-report emotional experience measure that included adjectives to assess the valence (pleasant, unpleasant) and activation (high, low) dimensions of emotion (Larsen & Diener, 1992; Russell, 1980). EMG activity (zygomatic and corrugator) and skin conductance activity were recorded during a 10-min resting baseline period as well as continuously throughout the film clips.

Although the findings relevant to our primary questions about medication effects and stability of emotional responding have been published elsewhere (Kring & Earnst, 1999), we briefly reiterate the results here to provide a context for interpreting the EMG findings. Replicating prior studies of emotional responding in schizophrenia, we found that schizophrenia patients showed fewer positive and negative facial expressions than nonpatients in response to emotional film clips, yet did not differ substantially in their reports of experienced emotions. More specifically, patients and controls did not differ in their reports of pleasant, high, and low activation emotions; however, patients reported experiencing more unpleasant emotion across all film clips. With respect to medication effects, our findings indicated that schizophrenia patients' observable expressive behavior and reports of experienced emotion were stable across changes in both medication status and time. In other words, medication did not strongly affect observable facial expression or experienced emotion. The findings (both new and already published) regarding group differences are summarized in Table 11.1. That medication was not associated with a dampening of expressive behavior suggested to us that schizophrenia patients' diminished expressive behavior could not be understood solely as a side effect of their medication.

Table 11.1 Summary of Group Differences in Emotional Responding

No Differences	Controls > Patients	Patients > Controls
Zygomatic activity	Positive and negative facial expressions	Corrugator activity
Self-report: Pleasant, high activation, and low activation emotion		Self-report: Unpleasant emotion

New Findings

In this chapter, we present new findings from the longitudinal study relevant to our secondary aim of examining subtle manifestations of facial activity. Consistent with our expectations, the zygomatic activity of both schizophrenia patients and controls varied according to the valence of the film clip. That is, the zygomatic activity of both schizophrenia patients and nonpatient controls was greater in response to the positive films than to the negative and neutral films. Similarly, both schizophrenia patients and nonpatient controls exhibited greater corrugator activity in response to the negative films than to the positive or neutral films (see Figs. 11.1 and 11.2). Also consistent with our predictions, schizophrenia patients did not differ from nonpatients in the amount of zygomatic activity exhibited in response to the emotional films. Contrary to our expectations, however, schizophrenia patients exhibited greater corrugator activity than controls across all films.

Descriptive statistics for skin conductance reactivity scores are shown in Table 11.2. Reactivity scores were computed by subtracting the number of skin conductance responses during baseline from the number of skin conductance responses during each film. Importantly, schizophrenia patients did not significantly differ from controls in the number of skin conductance responses during the baseline period. The reactivity of schizophrenia patients and controls did differ, however, according to film type. Specifically, patients tended to have greater reactivity than controls to the neutral film, but not to the positive and negative films. In addition, controls had less

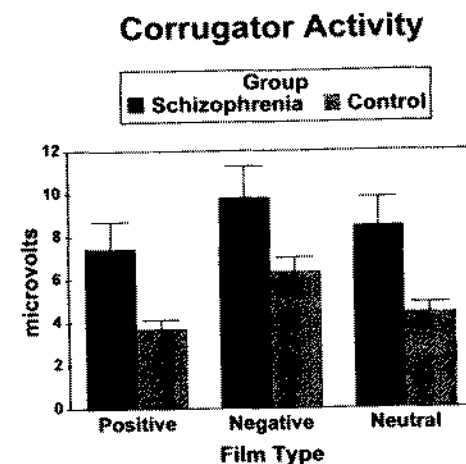


Fig. 11.1 Corrugator activity in schizophrenia patients and controls in response to emotional films.

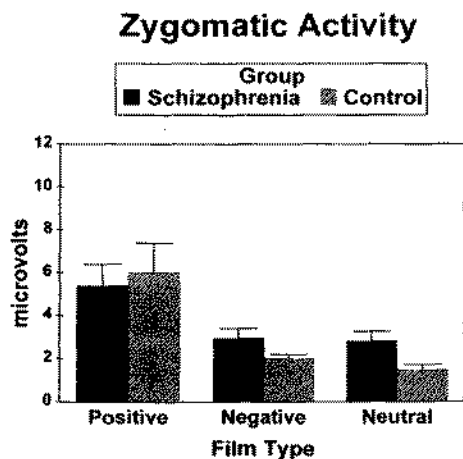


Fig. 11.2 Zygomatic activity of schizophrenia patients and controls in response to emotional films.

skin conductance reactivity to the neutral film than to the positive and negative films, but these differences were not significant for schizophrenia patients. It should be noted, however, that this relationship may reflect nothing more than the fact that the neutral film was always the first film clip presented. The film clip situation may have been more novel for patients than controls, thereby contributing to their increased skin conductance reactivity.

As shown in Table 11.3, there is much correspondence among observable facial expression, EMG, self-report, and skin conductance reactivity among nonpatient controls. That is, both observable expressive behavior and EMG activity were significantly positively correlated with self-report of emotional experience and skin conductance reactivity. In contrast, there

Table 11.2 Skin Conductance Reactivity Scores

Film	Group			
	Schizophrenia		Control	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Positive	0.30	0.94	0.65	0.99
Negative	0.23	1.02	0.32	1.00
Neutral	0.18	1.05	-0.26	0.63

Table 11.3 Correlations Among Emotion Components

	1	2	3	4	5	6	7	8	9	10
1. Obsv-Pos	—	.79**	.78**	.80**	.48*	.11	.47*	.38	.44*	—
2. Obsv-Neg	.15	—	—	.80**	.41*	.41*	.38	.70**	.44*	.47*
3. Zyg-Pos	.81**	—	—	—	.73**	.49*	.70**	.65*	.74**	.44*
4. Corr-Neg	.33	.33	—	—	.59*	.59*	.87**	.65*	.91**	.74**
5. Pleasant-Pos	.39	.36	.44*	.07	—	.87**	.87**	.59*	.91**	.70**
6. Unpleasant-Neg	.20	.19	.49*	.07	.79**	—	.59*	.60*	.60*	.70**
7. HiAct-Pos	.08	.19	.41*	-.08	.25	.25	—	.25	.66	.66
8. HiAct-Neg	.08	.19	.41*	-.08	.25	.25	—	.25	.66	.66
9. SCR-Pos	.08	.19	.41*	-.08	.25	.25	.31	—	.24	.24
10. SCR-Neg	-.37	-.37	-.52*	-.52*	.23	.23	.24	.24	—	—

is relatively little correspondence among these components for schizophrenia patients, substantiating findings of a disjunction between emotion response components. Neither observable expressive behavior nor corrugator activity was significantly related to self-reported emotional experience and skin conductance reactivity. Of note, zygomatic activity was related to observable expressive behavior, self-report, and skin conductance reactivity, a finding that is consistent with the findings for controls.

Discussion and Implications

These findings provide preliminary answers to the questions pertinent to the secondary aim of our study. Schizophrenia patients do manifest expressive behavior, albeit at an unobservable level, in response to emotionally evocative material. Although contraction of the facial muscles is part of both observable and unobservable facial activity, the magnitude of the corrugator and zygomatic responses obtained in this study suggests that, on average, the facial behavior assessed via EMG was subtle and likely not observable. In addition, we conducted analyses using observable facial expressions as a covariate in an attempt to statistically isolate EMG activity that was not related to observable facial activity; results from these analyses were virtually identical to those reported above.

Cacioppo and colleagues posited the "motor recruitment hypothesis" to conceptualize the relationship between unobservable and observable facial behavior (Cacioppo, Petty, & Marshall-Goodell, 1984; Cacioppo, Petty, & Tassinari, 1989; Tassinari & Cacioppo, 1992). More specifically, they argued that, at low levels of emotional intensity, facial behavior varies by valence (positive and negative) and as such is ideally measured using EMG. At higher levels of emotional intensity, however, facial behavior becomes observable and is further differentiated into specific emotions (e.g., disgust display, smile). Although both patients and controls exhibited valence-specific EMG activity, controls also displayed more observable expressions (although discrete emotional expressions were not measured in this study, it is likely that the observable behavior could be distinguished into more specific emotion displays). This raises the interesting possibility that schizophrenia patients have a different intensity threshold for producing observable displays. In other words, schizophrenia patients may require stimuli of even greater intensity before their expressive behavior becomes observable. On the other hand, schizophrenia patients' expressive behavior may be unrelated to the intensity of the stimulus and may instead reflect a component of a concomitant neuromotor dysfunction (e.g., Dworkin et al., 1996).

Although schizophrenia patients displayed less observable expressive behavior than controls, they exhibited comparable zygomatic activity and even greater amounts of corrugator activity. These findings were somewhat surprising, although they have been replicated in other studies (Kring et al., 1999; Mattes et al., 1995). Separate consideration of the findings regarding

zygomatic and corrugator activity is warranted since the findings differed, at least with respect to group differences.

Why might patients differ from controls in their observable positive facial behavior, but not in their zygomatic activity? Indeed, for both patients and controls, observable positive facial expressions were correlated with zygomatic activity, suggesting that greater muscle activity is associated with greater observable facial displays. Thus, it seems somewhat paradoxical that patients and controls differed in their observable displays but not in their unobservable displays given the observed positive correlation between these two measures of expressive behavior.

Measurement considerations are certainly plausible to account for the apparent discrepancy between observable positive facial behavior and zygomatic activity. Recall that our measure of zygomatic activity was an average of activity across the entire film clip. By contrast, our measure of observable displays was based on discrete events during the film period. That is, coders rated observable changes in the face from a neutral to nonneutral display and recorded the valence, intensity, and duration of those changes (Kring & Sloan, 1991). It may be the case that zygomatic activity is differentially distributed across the film periods for patients and controls. Although it is probable that most of the positive observable displays involved contraction of the zygomatic muscle, the schizophrenia patients likely had additional contractions either that were not of sufficient intensity to be observable or that dissipated before the attendant skin and connective tissues were moved.

With respect to corrugator activity, schizophrenia patients exhibited greater activity than controls in response to the films. This finding is consistent with other recent studies that assessed EMG or frowning among schizophrenia patients (Davison et al., 1996; Kring et al., 1999; Mattes et al., 1995). Why do patients exhibit greater corrugator activity (i.e., frown) than controls? It might be tempting to conclude that this activity has little to do with emotional expression; however, patients' corrugator activity varied according to the film type in the expected manner. In other words, they displayed greater corrugator activity in response to the negative films than to either the positive or neutral films. Nonetheless, a number of previous studies demonstrated that corrugator activity often reflects processes not directly linked to emotion expressive behavior. For example, Smith and colleagues (Pope & Smith, 1994; Smith, 1989) demonstrated that corrugator activity reflects not only unpleasant emotion, but also "anticipated effort." Cacioppo, Petty, and Morris (1985) suggested that the frown also indicates concentration or puzzlement. According to these views, watching the films may have required more actual (or perceived) effort for patients than for controls. If this is the case, it remains unclear what part of this experimental situation (viewing films) was more effortful for the patients.

In prior studies, we (Kring et al., 1993; Kring & Neale, 1996) speculated that schizophrenic patients might be actively inhibiting or suppressing

their facial expressions. Active inhibition likely requires effortful processing and would thus be consistent with elevated corrugator activity. However, that the schizophrenic patients' skin conductance reactivity was similar in response to both emotional and nonemotional (neutral) films does not favor an inhibition hypothesis. Indeed, although there is some disagreement in the literature as to whether suppressing expressive behavior corresponds to an increase (e.g., Gross & Levenson, 1993, 1997) or decrease (e.g., Zuckerman, Klorman, Larrance, & Spiegel, 1981) in skin conductance response, what seems clear is that the psychophysiological effects of emotional suppression are specific to emotional stimuli.

Alternatively, the patients may have been rather puzzled by the experimental situation. If this is the case, this puzzlement only manifested itself during the films as the patients and controls did not significantly differ in their baseline corrugator activity. Nonetheless, that the schizophrenia patients' corrugator activity reflects more than emotional responding is supported by the weak and nonsignificant correlations between corrugator activity and self-reports of emotional experience and skin conductance reactivity. In contrast, zygomatic activity was related to emotion self-reports and skin conductance reactivity for both patients and controls. Thus, these findings provide further support for a disjunction among emotion response components among schizophrenia patients, particularly for negative emotion expressive behavior.

Conclusions and Future Directions

Empirical investigations into the nature of emotional disturbances in schizophrenia have confirmed what early theorists observed. Adopting methods from basic emotion research has allowed investigators to study multiple components of emotional response in emotionally evocative situations. These studies revealed that schizophrenia patients display fewer observable facial expressions than nonpatients, yet they report experiencing similar, and in some instances greater, amounts of experienced emotion. Using a more sensitive measure of expressive behavior has led to a number of interesting discoveries. First, schizophrenia patients manifested subtle, unobservable displays in response to emotional stimuli. Second, schizophrenia patients' EMG activity was similar to or greater than the displays of nonpatients. Third, the zygomatic activity of schizophrenia patients was associated with observer ratings of positive facial expression, self-reports of pleasant emotions, and skin conductance reactivity. In contrast, patients' corrugator activity was not significantly related to other components of emotional response.

Despite this progress in our understanding of emotional features in schizophrenia, a number of unanswered questions remain. First, it remains unclear whether the observed emotion deficits in schizophrenia are ante-

cedent to, concomitant with, or a consequence of the disorder. If these disturbances pre-date the onset of schizophrenia or persist beyond symptomatic remission, claims about their causal importance can be more clearly made. Moreover, positioning these disturbances in the temporal sequence of the disorder has important treatment and assessment implications. Unfortunately, very few studies have addressed this important issue (Kring, 1999, 2001).

However, indirect evidence suggests that at least some of the observed emotion disturbances may pre-date the onset of schizophrenia. For example, Walker and colleagues (Walker, Grimes, Davis, & Smith, 1993) coded facial expressions from home movies and found that preschizophrenic girls displayed fewer joy expressions, and that both preschizophrenic boys and girls displayed more negative facial expressions compared to their healthy siblings (Walker et al., 1993). Studying childhood records of adults who developed schizophrenia, Knight and Roff (1983, 1985) found evidence that affective disturbances appeared in childhood and persisted into adulthood. Although the findings from these studies are interesting, it remains unclear whether this pattern of emotional behavior was related to the onset of schizophrenia and if the pattern was specific to schizophrenia since these studies were retrospective and had fairly limited samples (e.g., patients seen in clinics as children or who had home movies are not necessarily representative of all schizophrenia patients).

However, findings from high-risk studies also suggest that emotional disturbances may pre-date the onset of the illness. High-risk studies identify a group of children at risk for developing schizophrenia (typically, high risk is defined as having a biological parent with schizophrenia) and then follow them from childhood through the period of risk (Neale & Oltmanns, 1980). Teacher ratings from the Copenhagen high-risk study indicated that boys and girls who were later diagnosed with schizophrenia were more emotionally labile, socially withdrawn, socially anxious, and relatively unexpressive than children who did not develop schizophrenia (Olin, John, & Mednick, 1995; Olin & Mednick, 1996). Findings from the New York High-Risk Project indicated that flat affect was greater among adolescents at risk for developing schizophrenia than among adolescents at risk for developing affective disorders (Dworkin et al., 1991).

Although there is indirect evidence that at least some type of emotion disturbance in schizophrenia may pre-date the onset of the disorder, many of the observed emotion disturbances in schizophrenia are perhaps most accurately construed as concomitants of the disorder. Indeed, most of the research on emotion in schizophrenia has been cross sectional and has included patients with at least some degree of residual symptoms.

With respect to whether emotion disturbances in schizophrenia can be construed as consequences of the disorder, there is some evidence that emotional disturbances in schizophrenia are fairly stable. For example, results from our longitudinal study (Kring & Earnst, 1999) indicated that di-

minated emotional expression was stable across 5 months. However, our study did not specifically include assessments during and following a symptomatic episode. In sum, additional research is needed to elucidate whether emotional disturbances in schizophrenia are an antecedent to or a consequence of the illness or both.

An additional unanswered question is whether these findings of emotion disturbances will be observed among women with schizophrenia. Almost none of the studies above included women patients in their sample. Studies that did include women did not look for gender differences. Yet, research from basic emotion suggests that there are substantial gender differences in expressive behavior (e.g., Brody & Hall, 1993; Kring & Gordon, 1998). In a study of adult schizophrenia patients' childhood movies, Walker et al. (1993) found that preschizophrenic girls displayed fewer expressions of joy from infancy to adolescence compared to their healthy siblings, but displayed more negative expressions in adolescence. Although the basic emotion literature suggests fewer differences between men and women in other components of emotion response, it is nonetheless important to examine gender in studies of emotion and schizophrenia, particularly given that there are a number of gender differences in schizophrenia (for a review, see Salem & Kring, 1998).

A third important question is whether these findings will replicate across cultures. There is evidence to suggest that negative symptoms, including flat affect, may not be as prevalent in other cultures. For example, Ramirez, Johnson, and Opler (1992) found that Puerto Rican schizophrenia patients manifested fewer negative symptoms, including flat affect and anhedonia, than Anglo American patients. Dassori, Miller, and Saldana (1995) found that Mexican American schizophrenia patients exhibited more withdrawal than Anglo American patients, but these groups did not differ on other measures of negative symptoms. Perhaps more important, however, the meaning of these symptoms across cultures may vary dramatically. Jenkins (1988) found that various manifestations of mental illness (including schizophrenia, but also including depression and anxiety) were characterized as *nervios* rather than (or in addition to) mental illness by Mexican American families. When these family members were given the opportunity to describe what *nervios* was like, their descriptions were categorized in emotional terms: easily angered, anxious, and sad or depressed. This finding suggests that emotional features of schizophrenia may be among the more salient characteristics of the disorder among Mexican Americans (yet these features are not necessarily considered part of a mental illness).

Implications for Assessment and Treatment

The adoption of paradigms and methods from the emotion research literature has allowed us to study more precisely schizophrenia patients' pattern of emotional responding, and the findings generated from these studies

have important treatment and assessment implications. Schizophrenia patients' emotional responding is stable across time and does not appear to be strongly affected by more typical neuroleptic medications (Kring & Earnst, 1999). What remains to be seen, however, is whether some of the newer, "atypical" medications might have an impact on emotional responding, particularly flat affect. Recent research on the atypical neuroleptics, such as clozapine, suggests that these agents may be more effective in treating negative symptoms, including flat affect (e.g., Kane, Honigfeld, Singer, & Meltzer, 1988; Meltzer, 1991; Miller, Perry, Cadoret, & Andreasen, 1994; Umbricht & Kane, 1995).

One of the more effective forms of psychosocial interventions for schizophrenia involves social skills training (Benton & Schroeder, 1990; Corrigan, 1991; Dilk & Bond, 1996). Certainly, expressive behavior is an important part of socially skilled behavior. However, recent evidence suggests that the emotional deficits in schizophrenia are distinct from social skills deficits (Salem & Kring, 1999), and thus interventions aimed at improving social skills may not necessarily change expressive behavior. These interventions could be strengthened by including components that specifically target emotional disturbances (e.g., expressing emotion at the right time in the appropriate contexts; interpreting emotions in others) as well as the performance of socially skilled behavior. Moreover, researchers and clinicians could augment their outcome assessment procedures to include measures of both emotional and social functioning.

The findings reviewed above also have important implications for the assessment of emotional features in schizophrenia. In particular, laboratory-based measures of emotional responding can provide important information that is not easily accessed with clinical rating scales. For example, ratings of flat affect might be misinterpreted to mean that a schizophrenia patient is without feeling. Indeed, studies that rely solely on clinical rating scales that typically assess only one component of emotion may fail to capture the essence of the emotional disturbance adequately in schizophrenia, which appears to be the lack of coordinated engagement of emotion response components. For those who work with schizophrenia patients clinically, it will be important to ascertain how schizophrenia patients feel in different situations even if they do not show many outward signs of emotion.

Although the experimental control offered by a laboratory manipulation of emotion answers important questions, its generalizability is limited. However, results from these laboratory studies can suggest a number of hypotheses that can then be tested in a more ecologically valid (but less well controlled) setting. For example, examining emotional response tendencies in contexts such as social interaction with family members is a direction that deserves further empirical attention. In addition, psychologists would do well to adapt methods, such as ethnographies and narrative analyses, used by other disciplines (including anthropology, linguistics,

and sociology) to capture more adequately the subjective experience of emotion in daily life among schizophrenia patients (Corin, 1990; Jenkins, 1994; Kleinman, 1995). A combination of laboratory and field methods would be an ideal marriage, for example, to study the social consequences of diminished emotional expression and inability to describe one's feelings to others (Keltner & Kring, 1998). In addition, narrative analyses would provide useful information on the contexts in which patients are likely to experience diminished pleasure and positive emotion. Such a methodological approach can also provide important information about the meaning of emotional symptoms both within and across cultures (Jenkins, 1997).

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