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Do Schizophrenic Patients Show a Disjunctive Relationship Among Expressive, Experiential, and Psychophysiological Components of Emotion?

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Recent research has found a discrepancy between schizophrenic patients' outward expression of emotion and their reported emotional experience. In this study, which attempts to replicate and extend the findings of previous studies, participants with and without schizophrenia viewed emotional film clips while their facial expressions were videotaped and skin conductance was recorded. Participants also reported their subjective experience of emotion following each film. Those with schizophrenia were less facially expressive than controls during the emotional films and reported experiencing as much positive and negative emotion, replicating previous findings. Additionally, schizophrenic patients exhibited greater skin conductance reactivity to all films than controls. These findings suggest a disjunction among emotional response domains for schizophrenic patients; alternative explanations for the findings are considered as well as suggestions for future research.

Historically, affective features of schizophrenia were considered an integral part of the disorder. For example, Bleuler (1911/1950) considered affective disturbance to be a fundamental symptom of schizophrenia, whereas hallucinations and delusions were regarded as accessory symptoms. In describing affective symptomatology, Bleuler noted a discrepancy between schizophrenic patients' outward display and their reports of emotional experience. That is, individuals with schizophrenia often reported experiencing strong emotions, but observers could note no visible signs of emotion. Recent case reports of schizophrenic patients have noted a similar disjunction between outward signs of emotion and reports of internal experience. For example, Bouricius (1989) presented the history of a schizophrenic man who evidenced many negative symptoms, including flat affect, but who wrote vivid accounts of emotional experiences in his diaries.

Recent empirical studies of emotion in schizophrenia have been centered on the symptom of flat affect, which is defined primarily by diminished expression of emotion. Although not universal among schizophrenic patients, flat affect has been shown to be temporally stable (e.g., Pfhol & Winokur, 1982), related to chronicity (e.g., Knight, Roff, Barnett, & Moss, 1979), more common in schizophrenia than in depression (e.g., Andreasen, 1979), and prognostically significant (e.g., Carpenter, Bartko, Strauss, & Hawk, 1978; Fenton & McGlashan, 1991; Knight & Roff, 1985). Flat affect is most often assessed through clinical rating scales such as the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1979) that emphasize limited outward expression across multiple channels (face, voice, gestures) and across both positive and negative emotions. These ratings are typically made in the context of a clinical interview, and thus they may be assessing expressivity more related to social communication or interpersonal style than emotion. Indeed, Dworkin (1992) noted that many currently available rating scales for affective deficits in schizophrenia and the context in which these ratings are made (interview in an interpersonal situation) make the differentiation of affective deficits from social skills deficits nearly impossible.

Although clinical ratings of flat affect focus primarily on diminished expressivity, the term *flat affect* itself is too broad, because it implies that all domains of emotional response are flat. Indeed, affect or emotion[1] is best conceptualized as having at least three components: behavioral or expressive, experiential or subjective, and physiological (e.g., Lang, 1984; Lang, Rice, & Sternbach, 1972). Most contemporary emotion researchers

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[1] For the present article, the terms *affect* and *emotion* are used interchangeably. However, some researchers (e.g., Alpert & Rosen, 1990) have argued that the two terms represent conceptually distinct constructs. In this scheme, they have suggested that *affect* refers to the expression of feelings, whereas *emotion* refers to the subjective experience of emotion.

argue that it is the combination of these indicators that comprises emotion and that any one indicator is not sufficient to describe emotion. To date, empirical investigations of emotion in schizophrenia have only looked at either one or two of these components.

For example, Krause, Steimer, Sanger-Alt, and Wagner (1989) reported that medicated schizophrenic patients were less facially expressive during a social interaction than a nonpatient control group. Berenbaum and Oltmanns (1992) studied both the expressive and experiential domains and found that blunted schizophrenic patients (who were taking medication) were less expressive in response to emotional films than a nonpatient control group, yet they did not differ from them in their reported emotional experience. Similarly, Dworkin et al. (1993) found that medicated schizophrenic patients were less facially expressive in response to cartoons but reported normal levels of emotional experience. In a study using unmedicated patients, Kring, Kerr, Smith, and Neale (1993) assessed facial expression and reported subjective experience in response to emotional films. Compared to nonschizophrenic individuals, those with schizophrenia showed fewer positive expressions in response to a happy film and fewer negative expressions in response to sad and fear films. However, they reported experiencing similar, and in some cases greater levels of emotion. In sum, recent studies of emotion in schizophrenia support the descriptive writings of Bleuler (1911/1950): The outward displays of emotion by schizophrenic patients do not match their reports of their own emotions.

Although these studies have been informative with respect to understanding emotion in schizophrenia, no investigation has systematically examined all three components of emotion. The present study was designed to replicate and extend the findings of Kring et al. (1993). In addition to assessing expressivity and subjective experience, we also measured electrodermal activity (skin conductance) in response to emotional stimuli. Skin conductance is perhaps the most widely used measure in psychophysiology for a number of reasons. First, it is a reliable, peripheral indicator of sympathetic nervous system activity that is relatively easy to measure unobtrusively (see Dawson, Schell, & Filion, 1990, for a review). Second, skin conductance is sensitive to changes in psychological state, and in particular to changes in emotion (e.g., Averill, 1969; Geen & Rakosky, 1973; Greenwald, Cook, & Lang, 1989; Lang, Greenwald, Bradley, & Hamm, 1993; Levenson, Ekman, & Friesen, 1990). This is not surprising when one considers the relationship between emotion and the autonomic nervous system (ANS) activity. One of the primary functions of the ANS is to provide the body the support to deal with behavioral demands. Similarly, a primary purpose of emotion is to respond to behavioral demands that may, in some circumstances, require mobilization for action (e.g., the response to a disgusting taste is to expel the substance from the mouth).

Given this relationship, some researchers have argued that discrete emotions such as disgust or sadness should reflect specific autonomic activity (e.g., Ekman, Levenson, & Friesen, 1983; Levenson et al., 1990). For example, Levensen et al. (1990) found that skin conductance discriminated negative emotions (fear, disgust, sadness, anger) from positive emotions (happiness, surprise) during a directed facial action task. In contrast, other researchers have shown that skin conductance is more sensitive to the arousal or activation dimension of emotion (e.g., Bradley, Cuthbert, & Lang, 1990; Greenwald et al., 1989; Lang et al., 1993; Winton, Putnam, & Krauss, 1984). That is, increases in reports of arousal vary directly with changes in skin conductance, regardless of the valence (positive or negative) of the stimuli. Thus, the literature strongly supports the relationship between skin conductance and emotional reactivity despite the existence of differing theoretical positions regarding the nature of this relationship (i.e., discrete emotions vs. emotion dimensions).

In our previous study (Kring et al., 1993), we suggested that schizophrenic patients experience emotion, but the outward display of the emotion is inhibited. Although this finding replicates other research (e.g., Berenbaum & Oltmanns, 1992; Dworkin et al., 1993), demand characteristics may have influenced the self-reports of experienced emotion. Adding a measure of the physiological component of emotion, which is not under conscious control, allows for a more comprehensive evaluation of a component of emotion that is not as easily influenced by demand characteristics. In the present study, further support for the inhibition hypothesis would be obtained if schizophrenic and nonschizophrenic individuals demonstrate similar levels of skin conductance reactivity in addition to similar reports of experienced emotion and decreased levels of expressivity. That is, schizophrenic patients may experience emotion both subjectively and physiologically while keeping any outward signs of these experiences concealed. In contrast, lowered skin conductance reactivity in conjunction with reports of strong emotion and diminished expressivity might call into question the validity of the self-reports of schizophrenic patients. As in our previous study, only patients who were not on medication participated in the study to avoid confusing diminished expressivity with medication side effects (Blanchard & Neale, 1992). Additionally, the anticholinergic properties of these medications can attenuate electrodermal response (Zahn, Frith, & Steinhauer, 1991).

Method

Participants

Twenty-three male schizophrenic patients selected from the research units at Mt. Sinai Medical Center and the Bronx Veterans Administration Hospital and 20 nonschizophrenic male controls (with no personal or family history of psychiatric illness) recruited from the nonprofessional staff at the State University of New York at Stony Brook participated in the study.[2] For most patients (n = 20), diagnoses on the basis of the *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev.; American Psychiatric Association, 1987) were derived from a standard research protocol (Keefe et al., 1987), which included an interview using the Schedule for Affective Disorders (SADS; Endicott &

[2] The control group in the present study is the same as the control group presented in Kring et al. (1993). In addition, portions of data from two of the patients in the present study were presented in the earlier study. Removing the 2 patients from the sample did not change the results of any of the analyses in the present study. They were included because, unlike the other patients from the earlier study, these two also had physiological data.

Spitzer, 1978) conducted by trained interviewers. To confirm hospital diagnoses, John M. Neale reviewed the chart for those patients who had not yet completed the standard diagnostic work-up ($n = 3$). Any participant with a history of head trauma, severe alcohol or drug abuse, or known neurological disease was excluded from the study. In addition, any patients with tardive dyskinesia were excluded so as not to confuse uncontrollable facial movements with facial expression of emotion.

The groups did not differ in age, $t(41) = .54$, *ns* (schizophrenic patients' mean age = 39.09, $SD = 8.75$; control group members' mean age = 37.25, $SD = 13.36$); education, $t(41) = 1.31$, *ns* (schizophrenic patients' mean years of education = 12.17, $SD = 3.86$; control group members' mean years of education = 12.75, $SD = 1.45$); or race, $\chi^2(2, N = 43) = .66$, *ns*. Most of the sample was Caucasian ($n = 15$ for both groups); 17% ($n = 4$) of the schizophrenic patients and 10% ($n = 2$) of the control group members were African American; and 17% ($n = 4$) of the schizophrenic patients and 15% ($n = 3$) of the control group members were Hispanic. Although the two groups did not significantly differ with respect to marital status, $\chi^2(3, N = 43) = 10.95$, *ns*, more of the schizophrenic patients were single ($n = 17$), whereas more of the control group members were either married or divorced ($n = 7$ and $n = 5$, respectively). The schizophrenic patients had been hospitalized an average of 8.05 times ($SD = 8.86$) for an average of 35.40 months ($SD = 59.92$).

Because affective flattening can be confused with side effects of neuroleptic medication (e.g., akinesia; Van Putten & Marder, 1987), all patients had been off medication for at least 2 weeks prior to testing ($M = 18.60$ days, $SD = 4.73$). Serum neuroleptic levels were analyzed to confirm drug-free status. Patients taking depot neuroleptics were excluded because these medications often lead to the maintenance of plasma drug levels for several months following their discontinuation (Wistedt, Wiles, & Kolakowska, 1981).

Apparatus

Stimuli. Although all laboratory inductions of emotion are somewhat artificial in nature, film clips have been successfully used with psychiatric populations (e.g., Berenbaum & Oltmanns, 1992; Kring et al., 1993). For the present study, participants viewed film clips from contemporary movies chosen to elicit different emotions. They were randomly assigned to view one of two stimulus tapes that consisted of three different film clips representing both positive (happy) and negative (sad, fear) emotions. These particular film clips have been used in other studies of emotion in schizophrenia (Blanchard, Bellack, & Mueser, 1994; Blanchard, Kring, & Neale, 1994; Kring et al., 1993); they include scenes of slapstick comedy, children with a dying parent, a man being swarmed with cockroaches, and a man nearly falling off the ledge of a tall building. Two different tapes were used to ensure that responses were not specific to the films but rather to the emotion domain represented by the films. Length of the emotional clips ranged from 285 to 360 s. One of two different neutral clips (180 s long) depicting nature scenes was shown at the end of the three emotional segments. One of the nature scenes depicted baby birds being fed by their mother and various birds singing; the other depicted macaque monkeys bathing in hot springs and ducks protecting their young. The film clips were shown to all participants in the same order (sad, fear, happy, neutral) using a videocassette recorder and a 13-in. (33-cm) color television. Participants were seated approximately 5 ft. (1.5 m) from the television.

Psychophysiological recording. Skin conductance during a 10-min baseline period and during each film was recorded using a Coulbourn Instruments polygraph linked to an IBM compatible computer. Following standardization recommendations (Fowles et al., 1981), participants first washed their hands with soap and water. Separate adhesive collars were attached to two Beckman 16 mm Ag/AgCl cup electrodes that were filled with a 0.05 M NaCl electrolyte and then were attached to the hypothenar eminence of the nondominant palm. Recording was accomplished at a sampling rate of 100 samples/s using a Coulbourn Instruments constant-voltage skin conductance coupler (S71-23) applying a constant voltage of 0.5 V across electrodes. Data were digitized and stored on-line for later analyses.

Self-report of emotional experience. To assess experienced emotion during the films, we had participants complete the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) after watching each film. The PANAS is a 20-item mood adjective checklist designed to measure Positive Affect (PA) and Negative Affect (NA) factors. These two factors have been reliably produced in several studies of affect (e.g., Diener & Emmons, 1984; Russell, 1980; Watson & Tellegen, 1985; Zevon & Tellegen, 1982). To fill out the PANAS, participants were instructed to use a 5-point Likert scale (1 = *very slightly or not at all*; 5 = *extremely*) to indicate "to what extent you feel this way right now, that is, at the present moment" for each adjective. In addition to the 20 adjectives on the PANAS, two additional adjectives were added (happy and sad) to ensure adequate coverage of the emotion domains represented by the film clips.

Procedure

Testing was conducted as part of a larger study examining multiple contributors to affective flattening. For the present study, participants were tested individually in a session lasting approximately 2 to 2½ hr. Following electrode placement, a 10-min baseline period was started during which participants were encouraged to relax while electrodermal activity was monitored and recorded.

Participants were then given instructions for viewing the films. As in our previous study (Kring et al., 1993), participants were told that we were assessing those characteristics of movies that allow people to become involved in the story. Participants were instructed to allow themselves to get into the story as much as possible. This line of instruction was intended to get them to attend to the film without revealing the true nature of the study in order to reduce demand characteristics. While viewing each film clip, participants were knowingly videotaped,[3] and skin conductance was continuously recorded. The videotaping procedure was made as unobtrusive as possible by covering any external lights on the camera and by covertly beginning the recording with a remote control switch.

Following each film clip, participants completed the PANAS. In between film clips, participants completed a neuropsychological test, which served as a distractor to eliminate any carryover effects from the previous film clip. Following a brief review of the instructions, the next film clip was presented.

As in our previous study (Kring et al., 1993), videotapes of the participants were coded using the Facial Expression Coding System (FACES: Kring & Sloan, 1991; Kring & Tomarken, 1994). Unlike systems based on a discrete emotions theory (e.g., Ekman & Friesen, 1976, 1978), FACES reflects an alternative perspective focusing on more global dimensions of emotion (e.g., valence and intensity).[4] Using this

[3] Hospital rules did not allow for unobtrusive videotaping or for the experimenter to leave the room while the patients viewed the films. Thus, this same procedure was used for the normal control group. The presence of another may have influenced expressive behavior; however, we have little reason to believe that schizophrenic and control participants were differentially affected by the presence of another. In a similar study, Oltmanns, Strauss, Heinrichs, and Driesen (1988) found a facilitation effect for both schizophrenic and control participants even though the former were less expressive.

[4] Despite being derived from different theoretical models, Kring and Tomarken (1994) found a high degree of correspondence between FACES and EMFACS.

system, coders rate the frequency, mean intensity, and mean duration of both positive and negative facial expressions. Thus, coding with FACES yielded 24 variables per participant (six variables for each of the four films): positive frequency, positive mean intensity, positive mean duration, negative frequency, negative mean intensity, and negative mean duration. Coding was conducted by undergraduate and graduate students trained to use FACES. Adherence checks were made periodically throughout the study to ensure that coders were remaining consistent. Coders were blind to the hypotheses of the study and to the nature and names of the film clips. Two coders rated all of the normal participants' videotapes and approximately two thirds of the patients' tapes; one coder rated the remaining patients' tapes.

Results

Preliminary Analyses

Missing data. Operator errors resulted in missing psychophysiological data on the fear and neutral films for 1 patient; the neutral film for another patient; the happy and neutral films for 1 control; and all films for another control. One patient's videotape of facial expressions during the neutral film was inadvertently erased. One patient did not fill out five items on the PANAS following the sad film; thus, no total PA or NA scores were computed for that film for that participant.

Data reduction—psychophysiology. Because movement and baseline adjustments during recording can produce artifact in the physiological data, gross movement and adjustments to the skin conductance level were marked for later deletion as the data were being collected. During data reduction, ±2 s of data around each event mark were deleted.

The number of nonspecific skin conductance responses (NS-SCRs)[5] for each condition (baseline and film) were computed. An *NS-SCR* was defined as a response with a minimum amplitude of 0.05 μS (Dawson et al., 1990). The frequency of NS-SCRs was divided by the total time of that condition to yield an index of NS-SCRs per minute. Finally, reactivity scores were computed by subtracting the frequency of NS-SCRs during baseline from the frequency of NS-SCRs during each film.

FACES rater agreement. Two-thirds of the patients' and all of the controls' videotaped facial responses to the four films were coded by two raters. Intraclass correlations (ICCs) were computed (separately for schizophrenic and control participants) for pairs of raters for the 24 FACES variables (positive frequency, intensity, and duration; negative frequency, intensity, and duration for four films) following the recommendations of Shrout and Fleiss (1979): ICC(2,1). These correlations ranged from .45 to .99 for schizophrenic patients (mean ICC = .93) and from .22 to .99 for controls (mean ICC = .87).[6] Because the overall agreement was high, a mean across raters was computed for use in later analyses.

Manipulation check. Although previous studies using these stimuli with psychiatric patients have demonstrated their effectiveness (e.g., Kring et al., 1993), target emotions for each film were examined to insure that the films had their intended effect. Descriptive statistics for these adjectives are presented in Table 1. Because the distributions of these ratings were significantly skewed, square root transformations were performed. Paired *t* tests were then conducted separately for schizophrenic and control participants comparing the target emotion for each film with the other films. Both schizophrenic and control participants reported feeling more of the target emotion during the target film (e.g., happiness following the positive film) than during the nontarget films (negative or neutral), with one exception. Although the schizophrenic participants reported experiencing more "happy" during the positive film than the neutral film, this difference was not significant.

Emotional Expressiveness

Descriptive statistics for the congruent FACES variables (i.e., the number of positive expressions to the positive film, the number of negative expressions to the negative films, and the number of both positive and negative expressions to the neutral film) are shown in Table 2. Similar to previous studies using FACES (Blanchard, Kring, & Neale, 1994; Kring et al., 1993), the frequency, intensity, and duration ratings were significantly correlated for both patients and controls. To reduce the number of dependent variables in the analyses, expressiveness during the films was assessed using just the frequency ratings.[7] To first determine whether stimulus tape affected expressivity, we conducted a 2 (group: schizophrenic vs. control) × 2 (stimulus tape: A vs. B) multivariate analysis of variance (MANOVA) for the frequency of expressions during the films. The multivariate, omnibus *F* was nonsignificant for both the Group × Stimulus Tape interaction and the stimulus tape main effect. Additionally, all univariate *F*s were nonsignificant, indicating that participants' expressiveness did not depend on whether they viewed stimulus tape A or B. Stimulus tape was therefore not included in the remaining analyses of facial expressiveness.

Congruent frequency ratings were entered into a 2 (group: schizophrenic vs. control) × 3 (film type: negative, positive, neutral) repeated measures MANOVA.[8] The group main effect was significant, $F(1, 40) = 30.7$, $p < .001$, as was the Group × Film Type interaction, $F(2, 39) = 18.51$, $p < .001$. Specifically, the schizophrenic patients displayed fewer expressions than controls during the negative films, $F(1, 41) = 5.34$, $p < .03$, and the positive film, $F(1, 40) = 28.61$, $p < .001$, but not during the

[5] Event-related skin conductance responses are usually defined by minimum amplitude and a latency window of 1 to 3 s. In the present study, no specific "stimuli" were identified. Participants viewed films that contain various potential stimuli. Thus, skin conductance responses during the film were considered nonspecific in that they were not clearly tied to an identifiable stimulus.

[6] Limited variance on the FACES variables for the neutral film for both schizophrenic and control participants resulted in low ICCs. In fact, none of the patients exhibited any negative expressions during the neutral film. Seventeen out of 20 of the controls showed no positive expressions, and 18 out of 20 showed no negative expressions during the neutral film. Ostensibly, this was the intended effect for the neutral film. However, some types of analyses are unwarranted (e.g., correlations) given the severe range restriction.

[7] Analyses were also conducted using the duration and intensity variables, and the results were the same as the results from the analysis using frequency.

[8] Because one third of the patients' videotapes were coded by only one rater, the expressions analyses were also conducted using only the coder who rated both schizophrenic and control participants. Results of these analyses did not differ from those reported above.

Table 1
Scores for Target Self-Report Adjectives

	Negative films				Positive film				Neutral film			
	Sz		Con		Sz		Con		Sz		Con	
Adjective	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Negative	2.37	1.16	2.40	0.92	1.85	1.04	1.07	0.24	1.76	1.13	1.05	0.15
Positive	1.85	0.79	1.85	0.81	3.04	1.58	3.65	1.18	2.57	1.56	2.30	1.17

Note. *Positive adjective* = the happy item; *negative adjectives* = sad and fear combined. Values range from 1 to 5. Sz = Schizophrenia group; Con = control group.

neutral film, $F(1, 40) = .68$, *ns*. The film type main effect was also significant, $F(2, 39) = 43.71$, $p < .001$. Both schizophrenic and control participants displayed more positive expressions during the positive film than negative expressions during the negative films, $F(1, 40) = 51.66$, $p < .001$, and more negative expressions during the negative films than all expressions during the neutral film, $F(1, 40) = 15.55$, $p < .001$.

A parallel analysis using the frequency of incongruent expressions (i.e., number of positive expressions to the negative films, number of negative expressions to the positive film, all expressions to the neutral film) was also conducted, and neither the group main effect nor the Group × Film Type interaction were significant. Thus, schizophrenic and control participants differed only on expressivity congruent with the valence of the films.

Emotional Experience

Descriptive statistics for the PANAS subscales are shown in Table 3. It is important to point out that the reliabilities (alpha; Cronbach, 1951) were equally high for both groups, indicating that the PANAS demonstrated high internal consistency for both schizophrenic and control participants.

Minimal stimulus tape differences were found for PA but not NA. Specifically, schizophrenic patients reported experiencing more PA during the positive film on tape A ($M = 32.54$, $SD = 9.32$) than during the positive film on tape B ($M = 24.33$, $SD = 10.40$) compared to controls, who reported experiencing slightly more PA during the positive film on tape B ($M = 29.78$, $SD = 6.38$) than during the positive film on tape A ($M = 25.00$, $SD = 8.00$). Stimulus tape was therefore included in further analyses of PA, but not NA.

To assess whether schizophrenic and control participants differed in experienced PA, we conducted a 2 (group: schizophrenic vs. control) × 2 (stimulus tape: A vs. B) × 3 (film type: negative, positive, neutral) repeated measures MANOVA. Neither the Group × Film Type interaction, $F(2, 38) = 1.94$, *ns*, nor the group main effect, $F(1, 39) = 0.88$, *ns*, were significant. However, the film type main effect was significant, $F(2, 38) = 4.66$, $p < .02$. Univariate follow-up tests indicated that both groups reported experiencing more PA during the positive film than during the negative films, $F(1, 39) = 5.47$, $p < .03$, and more PA during the positive film than during the neutral film, $F(1, 41) = 7.23$, $p < .01$. The Film Type × Stimulus Tape interaction was not significant.

For NA, both the group main effect and the Group × Film Type interaction reached significance, $F(1, 41) = 7.32$, $p < .01$, and $F(2, 40) = 4.36$, $p < .02$, respectively. Follow-up analyses revealed that schizophrenic patients reported significantly more NA during the positive film, $F(1, 41) = 10.08$, $p < .01$, and neutral film, $F(1, 41) = 11.88$, $p < .001$, compared to controls. Similar to the findings for PA, there was a significant main effect for film type, $F(2, 40) = 20.70$, $p < .001$. Univariate follow-up tests indicated that both groups reported significantly more NA during the negative films than during the positive film, $F(1, 41)$

Table 2
Scores for FACES Expression Variables

	Negative films				Positive film				Neutral film			
	Sz		Con		Sz		Con		Sz		Con	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Frequency	0.46	0.78	1.20	1.30	2.13	3.21	8.60	5.08	0.11	0.30	0.23	0.55
Intensity	0.26	0.37	0.56	0.48	0.73	0.91	1.28	0.43	0.07	0.19	0.09	0.20
Duration	1.73	3.25	4.15	4.82	9.57	15.67	51.33	38.45	0.30	0.85	0.43	0.95

Note. Values are congruent with film type for positive and negative films (e.g., frequency for negative films is the number of negative expressions; frequency for positive film is the number of positive expressions). Values for the neutral films are the sum of positive and negative frequency and duration, and the mean of positive and negative intensity. Intensity values range from 1 (low) to 4 (very high). Duration values represent the total duration of expressions (in seconds). FACES = Facial Expression Coding System; Sz = Schizophrenia group; Con = control group.

Table 3
Descriptive Statistics for Emotional Experience (PANAS) Variables

	PANAS Scale											
	Positive Affect						Negative Affect					
	Schizophrenia group			Control group			Schizophrenia group			Control group		
Film	*M*	*SD*	α	*M*	*SD*	α	*M*	*SD*	α	*M*	*SD*	α
Negative	25.27	9.10	.89	24.48	6.27	.88	19.70	8.03	.91	18.08	4.66	.82
Positive	28.34	10.91	.89	27.15	7.53	.87	17.21	8.14	.88	11.25	2.20	.74
Neutral	26.70	9.34	.82	21.20	8.85	.95	16.83	7.89	.84	10.70	0.92	.16

Note. PANAS = Positive and Negative Affect Schedule.

= 39.47, $p < .001$, and more NA during the negative films than during the neutral film, $F(1, 41) = 33.06$, $p < .001$.

Skin Conductance

The number of NS-SCRs per minute was computed for baseline and each of the films.[9] To assess reactivity to the films, we then computed reactivity scores by subtracting baseline values from the film values[10] (see Table 4). No differences related to stimulus tape (A or B) were found; thus, this variable was not included in any further analyses. Reactivity scores were entered into a 2 (group: schizophrenic vs. control) × 3 (film type: negative, positive, neutral) repeated measures MANOVA. The group main effect, $F(1, 34) = 6.55$, $p < .02$, was significant; however, neither the Group × Film Type interaction nor the film type main effect reached significance. Schizophrenic patients evidenced higher skin conductance reactivity (i.e., greater change from baseline to film) to the films than the controls.

Additional Analyses

The skin conductance results from the neutral film are somewhat puzzling and require further discussion and analysis. Both schizophrenic and control participants displayed very little positive and negative expressiveness during the neutral film, and both groups reported experiencing less of the target emotion and less PA and NA during the neutral film than during the emotional films. With respect to skin conductance, schizophrenic patients demonstrated higher reactivity than controls to all films, including the neutral film. One possible interpretation of the skin conductance finding is that the neutral film was as arousing as the emotional films for the schizophrenic patients.

Table 4
Skin Conductance Reactivity Scores

	Group			
	Schizophrenia		Control	
Film type	*M*	*SD*	*M*	*SD*
Negative	0.943	1.497	0.138	0.861
Positive	0.499	1.370	0.133	0.604
Neutral	0.832	1.427	0.048	0.685

A number of researchers have argued that self-reported emotion can be represented in a circular structure (circumplex) comprised of two bipolar dimensions (e.g., Russell, 1980; Watson & Tellegen, 1985). One representation of the circumplex (e.g., Larsen & Diener, 1992; Russell, 1980) focuses on two dimensions that reflect the overall valence of emotion (pleasure–displeasure) and the arousal or activation of emotion (calm–arousal), respectively. The representation from which the PANAS was developed, however, reflects a different focus, namely, on dimensions labelled Positive and Negative, which are a combination of valence and activation. Independent examination of valence and activation is difficult with the PANAS because most items reflect both activation and valence (e.g., "excited" is an activated pleasant item; "nervous" is an activated unpleasant item). This distinction between valence and activation is potentially important, however, for understanding the relationship among the various components of emotion. With respect to skin conductance and dimensions of emotion,

[9] Two schizophrenic patients' NS-SCR data were greater than three standard deviations from the mean, making them univariate outliers. Because these 2 patients' data were so deviant from the rest and given the small sample size, it seemed prudent to eliminate them from these initial analyses. Notably, analyses conducted including these 2 patients did not differ from the analyses reported in the Results.

[10] Psychophysiological reactivity or change is typically measured either by delta (Δ; difference between response to task and response during baseline) or residualized change. Neither is without problems. Residualized change scores are difficult to interpret and are sample specific. Delta has been criticized for its low reliability and the often-found negative correlation between change and baseline (i.e., the law of initial values; Wilder, 1967). However, Llabre, Spitzer, Saab, Ironson, and Schneiderman (1991) have shown that the reliability of delta is a function of the ratio of baseline variance to task variance (λ). That is, the lower the variance ratio, the higher the reliability of delta. Similarly, the law of initial values (LIV) can be assessed on the basis of a test of the equality of variances (initial and task; Geenen & Van de Vijver, 1993). For the present study, LIV, as assessed by Geenen and Van de Vijver's recommendations, did not hold for any of the relationships between baseline and film with one exception (neutral film and baseline for controls). In addition, reliabilities of delta were not significantly lower than reliabilities of residualized change scores. Thus, to make interpretation of the data clearer, delta was used as the reactivity measure.

a number of studies have shown that skin conductance is related to the activation dimension of emotion, not valence (e.g., Lang et al., 1993; Winton et al., 1984). In other words, skin conductance is linearly related to valence–independent arousal.

Only one PANAS item, "active," represents the activation dimension independent of valence. To further explore the hypothesis that the neutral film may have been more activating for schizophrenic patients, we conducted within-subject t tests comparing active from the neutral film to the other films. Schizophrenic patients reported experiencing as much active during the neutral film ($M = 2.57$) as during the other films ($M = 2.73$), $t(21) = 0.60$, ns. By contrast, controls reported experiencing less active during the neutral film ($M = 1.95$) than during the other films ($M = 2.50$), $t(19) = 2.24$, $p < .04$. In addition, the active item from the neutral film was significantly correlated with skin conductance reactivity to the neutral film for schizophrenic patients, $r(18) = .44$, $p < .04$, but not for controls, $r(18) = .22$, ns. It must be noted that these additional analyses were conducted post hoc in an attempt to understand schizophrenic patients' responses to the neutral film and that they are based on only one self-report item. Thus, conclusions that are based on them must remain tentative.

Discussion

One purpose of the present investigation was to replicate previous studies of emotion in schizophrenia. Unmedicated schizophrenic patients in the present study reported experiencing as much emotion during positive and negative films than controls, and in some cases, they reported experiencing more than controls. These findings, in combination with the schizophrenic patients' reduced expressiveness, replicate the findings of our earlier study (Kring et al., 1993) and provide additional support for the inhibition hypothesis. That is, although schizophrenic patients differed from controls in the amount of outwardly expressed emotions, they did not differ in the amount of reported experienced emotion. Additionally, these effects were consistent across both positive and negative films. Stated differently, schizophrenic patients reported feeling positive emotion during a positive film and negative emotion during the negative films, despite showing relatively little facial expression in response to these films.

In some ways, the self-report findings are surprising because they do not coincide with findings of anhedonia in schizophrenia (e.g., J. P. Chapman & Chapman, 1985; L. J. Chapman, Chapman, & Raulin, 1976; Mishlove & Chapman, 1985). Yet, other studies of emotion in schizophrenia have also found that schizophrenic patients report experiencing positive emotion in response to positive emotional stimuli (Berenbaum & Oltmanns, 1992; Dworkin et al., 1993). Typically, anhedonia is conceptualized as a trait disturbance in the ability to experience pleasure and is measured by empirically derived self-report scales (e.g., Scale for Physical Anhedonia; L. J. Chapman et al., 1976). More recent studies of anhedonia that have examined the relationship between scores on these scales and emotional processing, however, have not consistently found a deficit in experienced emotion (e.g., Berenbaum, Snowhite, & Oltmanns, 1987; Fitzgibbons & Simons, 1992). It seems clear that anhedonia is best understood within an emotional processing framework that includes measures of all emotion response systems.

A second purpose of the present study was to go beyond previous studies of emotion in schizophrenia by assessing a physiological component of emotion. We had hypothesized that further support for the inhibition hypothesis would be obtained if, compared to controls, the schizophrenic patients evidenced similar levels of electrodermal reactivity combined with similar self-reports of experienced emotion and diminished expressiveness. In contrast, if the schizophrenic patients demonstrated lower electrodermal reactivity than controls in combination with similar self-reports of experienced emotion and diminished expressiveness, the validity of their self-reports would be questionable. The second hypothesis was not supported: Schizophrenic patients in the present study did not demonstrate lower skin conductance reactivity than controls. However, the first hypothesis was only tentatively supported: Compared to controls, schizophrenic patients evidenced greater skin conductance reactivity to the positive and negative films. Yet, they also showed greater reactivity than controls to the neutral film. Thus, in addition to reporting comparable levels of experienced emotion yet being less expressive, the schizophrenic patients were more electrodermally aroused than controls.

That the schizophrenic patients demonstrated higher skin conductance reactivity to the neutral film in addition to the emotional films makes interpretation of the data less straightforward. One interpretation of this finding is that the schizophrenic patients were not electrodermally aroused by the emotional content of the stimuli per se, but rather were aroused by some other aspect of the films. However, this is a complicated issue. First, arousal or activation is considered a fundamental dimension of emotion (e.g., Larsen & Diener, 1992; Russell, 1980). Thus, finding that schizophrenic patients were aroused by the films does not necessarily mean that their arousal was nonemotional. It is interesting that their self-report of activation did not differ across film types, suggesting that all the films elicited activation. It remains unclear, however, why the neutral film would elicit activation in the schizophrenic patients. Although there is a large body of literature supporting the notion that affective states can be represented by two bipolar dimensions that reflect valence and activation among controls (e.g., Larsen & Diener, 1992; Russell, 1980), no research to our knowledge has examined these fundamental dimensions of emotion in patients with schizophrenia.

Another explanation for the finding is that the neutral film was not "emotionally" neutral. Indeed, other emotion researchers have used films containing outdoor or nature scenes to elicit positive emotion (Gross & Levenson, 1995; J. J. Gross, personal communication, January 14, 1995). However, the neutral film appeared to be relatively neutral in valence for both controls and schizophrenic patients (i.e., self-reports of positive and negative adjectives were lower for the neutral film than the emotional films), and both schizophrenic and control participants exhibited very little facial expression in response to the neutral film. It did not appear to be neutral with respect to activation, at least for the schizophrenic patients. Researchers should consider carefully the selection of film stimuli, particularly neutral stimuli. Two groups of emotion researchers have now developed relatively standardized film clips (Gross & Levenson, 1995;

Phillippot, 1993). Gross and Levenson's (1995) neutral stimuli consist of filmed video test signals and were chosen so that any effects caused by simply watching a film could be tested.

Finally, schizophrenic patients may have been responding to the visual and auditory stimuli associated with film viewing. This possibility cannot be entirely ruled out. That is, their heightened reactivity could reflect information processing or detection of nonemotional changes in the film clips. Related to this notion, the schizophrenic patients' heightened electrodermal reactivity may indicate autonomic hyperreactivity. Indeed, laboratories have documented that a subgroup of schizophrenic patients appear to be autonomic hyperresponders (e.g., Dawson & Nuechterlein, 1984; Öhman, 1981). This designation is typically made using a skin conductance orienting response (SCOR) paradigm whereby hyperresponders demonstrate high levels of tonic arousal, a high rate of nonspecific responses, and a slower rate of habituation. No direct tests of the relationship between the SCOR and specific components of emotion (expressivity, subjective experience, and psychophysiological activity) among schizophrenic patients have been conducted. Although the schizophrenic patients and controls in the present study did not differ in the number of skin conductance responses evidenced during the resting baseline, it remains unclear how the schizophrenic patients would have responded in an orienting paradigm. Future work ought to compare skin conductance reactivity to emotional stimuli with reactivity during the SCOR task.

In summary, the results of the present study provide further support for a disjunction between the expressive and subjective experience response systems of emotion in schizophrenia. One implication of this finding for our understanding of schizophrenia is that the flat affect typical of some patients with schizophrenia misrepresents the underlying emotional experience. Professionals who make ratings of flat affect on the basis of an interview with a patient may mistakenly assume that diminished expressivity reflects diminished subjective experience of emotion when, in fact, this may not be true.

A number of research directions are suggested by the current study. For example, future work should continue to examine these components of emotion in addition to the physiological component. Our results are inconclusive with respect to the physiological domain of emotion. We chose to measure skin conductance because it is relatively easy to assess and because it is solely innervated by fibers from the sympathetic nervous system. Other indicators of sympathetic activity (e.g., finger pulse amplitude, pulse transmission time to the finger) would provide a more comprehensive assessment. Additionally, including an assessment of heart rate (e.g., beats per minute) would be useful because heart rate has been shown to be sensitive to changes in emotional valence (e.g., Lang et al., 1993). Finally, research examining the fundamental dimensions of emotion (valence and activation) in schizophrenia is needed.

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