Recognition Accuracy and Response Bias to Happy and Sad Facial Expressions in Patients With Major Depression

Simon A. Surguladze
King’s College London
Carl Senior
Aston University

Andrew W. Young
University of York
Gildas Brébion, Michael J. Travis, and Mary L. Phillips
King’s College London

Impaired facial expression recognition has been associated with features of major depression, which could underline some of the difficulties in social interactions in these patients. Patients with major depressive disorder and age- and gender-matched healthy volunteers judged the emotion of 100 facial stimuli displaying different intensities of sadness and happiness and neutral expressions presented for short (100 ms) and long (2,000 ms) durations. Compared with healthy volunteers, depressed patients demonstrated subtle impairments in discrimination accuracy and a predominant bias away from the identification as happy of mildly happy expressions. The authors suggest that, in depressed patients, the inability to accurately identify subtle changes in facial expression displayed by others in social situations may underlie the impaired interpersonal functioning.

Defining features of unipolar depression include depressed mood and anhedonia, which, with increasing severity of illness, can lead to a restriction of affective range and social dysfunction. The ability to recognize facial expressions displayed by others is highly developed in human and nonhuman primates and is observed across many cultures (Ekman & Friesen, 1971). In depressed patients, however, depressed mood has been associated with specific abnormalities in the identification of facial expressions (Cooley & Nowicki, 1989; Wexler, Levenson, Warrenburg, & Price, 1994), negative cognitions regarding the self, and dysfunctional appraisal of social events and situations (Beck, 1976). These abnormalities may lead to impaired interpersonal functioning (e.g., Gotlib & Asarnow, 1979).

Previous studies have examined the nature of the impairment in perception of facial expressions in depressed patients. Some investigators exploring discrimination accuracy of facial emotional stimuli in these patients have provided evidence for a generalized deficit in the recognition of all emotions (and even in the recognition of nonemotional stimuli). Deficits have been demonstrated, for example, in the recognition of faces expressing happiness (Jaeger, Borod, & Peselow, 1987), sadness and interest (Rubinow & Post, 1992), and fear, anger, surprise, disgust, happiness, sadness, and indifference (Persad & Polivy, 1993). In one study, however, impairments in performance of both visuospatial and affective tasks (identification of neutral, happy, sad, fearful, and angry expressions) were demonstrated in depressed patients (Ashana, Mandal, Khurana, & Haque-Nizamie, 1998), suggestive of a general visual perceptual rather than a specific emotion recognition deficit.

In another study, although depressed patients were not significantly impaired in tasks requiring matching pictures of emotional faces, they were impaired in verbal labeling of all emotional (anger, happiness, sadness, fear, disgust, surprise) and neutral (Feinberg, Rikfin, Schaffer, & Walker, 1986) faces. These findings were interpreted as evidence of a specific deficit in the expressive domain rather than a visual perceptual deficit in these patients.

Conversely, depressed patients compared with healthy volunteers have been reported to be significantly impaired in the recognition of both sad and happy, but not neutral, faces (Mikhailirova, Vladimirova, Iznak, Tsusulkovskaya, & Sushko, 1996). In this study, depressed patients retested in remission did not demonstrate this deficit in emotion processing, suggesting a state rather than trait deficit in emotion processing in depression.

Other studies have revealed emotion-specific abnormalities in depressed patients, with patients demonstrating negative perceptual bias (i.e., recognizing significantly more sadness in facial expressions than healthy volunteers; Bouhyus, Geerts, & Gordijn, 1999; R. C. Gur et al., 1992; Hale, 1998; Matthews & Antes, 1992). There have been additional reports in depressed patients of impaired recognition of positive facial expressions (Murphy et al., 1999; Süsslow, Junghanns, & Arolt, 2001), diminished emotional responses to pleasant pictorial stimuli (Sloan, Strauss, Quirk, & Sajatovic, 1997; Sloan, Strauss, & Wisner, 2001), and increased response times to happy compared with sad emotional words. Findings to date from studies examining emotion processing in depressed patients are, therefore, inconsistent, with evidence for and against the presence of a general visual perceptual deficit.
evidence for impaired identification of all categories of emotion, and evidence for impairments in the identification of specific emotions.

There are several potential explanations for the discrepant findings. First, there were differences in the types of patient populations recruited and examined in the studies. In some studies, patients were restricted to those with unipolar depression (e.g., Feinberg et al., 1986; Jaeger et al., 1987; Persad & Polivy, 1993), whereas in others, both unipolar and bipolar depressed patients were examined (R. C. Gur et al., 1992; Ruhrimow & Post, 1992). Second, there were differences across the studies in the types of stimuli used. In some of the studies, facial expressions from a standardized series (Ekman & Friesen, 1976) were used (Feinberg et al., 1986; Persad & Polivy, 1993), whereas other investigators used novel series of photographs (Asthana et al., 1998; R. C. Gur et al., 1992) or schematic faces (Boulouza et al., 1999; Suslow et al., 2001). Furthermore, different categories of emotional expression (negative or positive) have been used in the different studies. Third, the ability of depressed patients to identify facial expressions of milder intensity or those presented for shorter durations remains unexplored. In everyday life, humans process a wide range of emotional stimuli displayed by others, including signals less intense than prototypical facial expressions from standardized series or those displayed for brief rather than long durations.

Studies using event-related potentials and rapid presentation of facial expressions have demonstrated that healthy participants were able to discriminate between emotional and neutral facial expressions presented for durations as brief as 100 to 200 ms (Jungheofer, Bradley, Elbert, & Lang, 2001; Sato, Kochiyama, Yoshikawa, & Matsumura, 2001). It has been argued that the recognition of rapid presentations of emotional expressions might be impaired in depressed patients because of general slowing of cognitive processes (Cooley & Nowicki, 1989). The ability of depressed patients to identify rapid presentations of facial expressions remains unexamined, however.

Previous findings in healthy participants have also demonstrated that accuracy in recognition of facial expressions decreases as the intensity of emotional expression displayed in the face is reduced (e.g., Calder, Young, Rowland, & Perrett, 1997). It is possible that specific impairments in the identification of subtle changes in emotional expression, rather than in the identification of prototypical displays of emotion, may exist in depressed patients. As noted, intact matching of prototypical displays of emotion has been demonstrated in these patients (Feinberg et al., 1986). There is, therefore, a rationale for the examination of the ability of depressed patients to identify facial expressions presented for short durations or depicting milder intensities of emotion.

Finally, although there is evidence from previous studies for the presence of impaired recognition accuracy and a negative response bias to facial expressions in depressed patients, the nature of the relationship between these processes in depressed patients has not been examined.

We aimed to examine the recognition accuracy of and response bias toward positive and negative facial expressions in patients with unipolar depression and healthy volunteers. We chose happy and sad emotional expressions, reasoning that these emotional displays might be of particular relevance to the negative schemata demonstrated by depressed patients, in particular, the negative cognitions regarding the abilities of the self compared with others (Beck, 1976). It is, therefore, possible that depressed patients identify with displays of sadness, but not happiness, in others. We used happy, neutral, and sad facial expressions from a standardized series (Ekman & Friesen, 1976) presented at different durations and transformed with computer software (Facial Expressions of Emotion: Stimuli and Tests; Young, Perrett, Calder, Sprengelmeyer, & Ekman, 2002) to depict different intensities of emotion.

We were interested in examining measures of recognition accuracy and response bias. There are two commonly used approaches to derive these measures: signal-detection theory, with the discrimination measure d' and the bias measure C (e.g., Stanislaw & Todorov, 1999), and the two-high threshold (2HT) theory, with the discrimination accuracy measure Pr and the response bias measure Br (Corwin, 1994). The latter approach is especially useful when numbers of criteria items (targets) and distractors differ, as was the case in the current study. We, therefore, used the 2HT theory to compute measures of recognition or discrimination accuracy and response bias to happy and sad facial expressions in both groups. In this study, the discrimination accuracy measure represented the ability to discriminate among neutral, happy, and sad expressions. The response bias measure reflected the tendency of participants, when uncertain about the category to which a facial expression should belong, to categorize the expression as emotional (happy or sad) rather than neutral.

Findings from previous studies enabled us to make several predictions in depressed patients.

**Hypothesis 1:** We predicted a negative response bias toward facial expressions such that (a) depressed patients would demonstrate a smaller response bias to happy expressions (i.e., compared with healthy volunteers, they would less frequently identify happy and neutral faces as happy) and (b) depressed patients would have a greater response bias to sad expressions (i.e., compared with healthy volunteers, they would more frequently identify sad and neutral faces as sad).

**Hypothesis 2:** We predicted a reduced recognition accuracy of happy and sad facial expressions overall compared with healthy volunteers.

**Hypothesis 3:** We predicted a significantly greater negative response bias and impaired recognition accuracy in response to expressions presented for shorter rather than longer durations and those expressions depicting milder rather than more severe intensities of emotion.

**Hypothesis 4:** We predicted a significant positive correlation between the magnitude of the negative response bias and impairment in recognition accuracy and the severity of depression measured by standardized rating scales.

**Method**

**Participants**

Twenty-seven patients meeting Diagnostic and Statistical Manual of Mental Disorders (fourth edition; American Psychiatric Association, 1994) criteria for major depressive disorder were recruited from inpatient and outpatient services of the Bethlem Royal and Maidstone Hospitals. All patients had a chronic, recurrent depressive disorder, and none was tested in the first episode of illness. The mean duration of illness (since first
episode) in patients was 10.1 years (median duration of illness = 9 years). As a control group, 29 healthy volunteers without a history of depression were recruited from the local community and from a pool of employees at the Institute of Psychiatry. They were matched with patients for age, gender, and educational achievement (Table 1). Ethical approval was obtained from the Ethical Committee of the South London and Maudsley Trust and Institute of Psychiatry. All participants were right-handed (Oldfield, 1971). Patients were excluded from the study if they reported a history of mania, psychosis, alcoholism, or organic brain syndrome or if they scored less than 24 on the Mini-Mental State Exam (Folstein, Folstein, & McHugh, 1975). All participants completed the Recognition Memory Test–Faces (Warrington, 1984) as a measure of nonemotional face perception. Depressed patients did not differ significantly from controls in performance on this task, r(36.1) = 1.7, p > .05 (see Table 1).

All participants completed the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). Controls with a score higher than 9 on the BDI or with a history of depression were excluded from the study. The mean BDI score of the controls was significantly lower than that of the patients, t(33.5) = −12.2, p < .01. The Hamilton Depression Rating Scale (HAMD; Hamilton, 1960) was also completed for each patient (see Table 1). To ensure that the experimenter was unaware of the depression severity rating of patients during task performance, these ratings were calculated after patients participated in the task. All patients were taking some type of antidepressant medication: selective serotonin reuptake inhibitors (n = 9), serotonin and noradrenergic reuptake inhibitors (n = 8), monoamine oxidase inhibitors (n = 4), tricyclic antidepressants (n = 3), noradrenergic reuptake inhibitors (n = 2), mirtazapine (n = 1), lithium (n = 5), and other mood stabilizers, including carbamazepine and lamotrigine (n = 4).

Procedure

A facial expression recognition task was developed to present facial expressions at different intensities and for different durations. In this task, participants viewed randomized pictures on a computer screen of 10 facial identities from a standardized series (Young et al., 2002), each displaying expressions of happiness, sadness, or neutral expressions. Both happy and sad faces were presented within the same task to avoid task-dependent systematic errors and allow for a direct comparison of responses to happy and sad faces. Each emotional facial expression was morphed using computer software with the facial expression of the same individual to depict two different intensities (50% and 100%) of the emotion, and each was then presented twice during the task: for 100 ms and 2000 ms. In the same task, 10 neutral faces were presented at two durations each: 100 ms and 2000 ms. Participants, therefore, viewed 100 stimuli during the experiment: 10 facial identities, each displaying two emotions, happy and sad, at two different intensities of emotion and for two different durations. Each face was presented individually, with an interstimulus interval of 1,500 ms, during the first 500 ms of which was displayed a fixation cross. Participants were instructed that they would view either emotional (sad or happy) or neutral faces and were requested to label each facial expression as happy, sad, or neutral by moving a computer joystick accordingly in one of the three directions. Before testing, all participants performed a practice trial to ensure they were able to perform the task.

Statistical Analysis

Raw data were transformed into measures of accuracy and response bias according to the 2HT model (Corwin, 1994). Discrimination accuracy was computed for the two separate subsets of targets (i.e., either sad or happy faces [targets] vs. neutral faces [distractors]): Pr = (number of hits + 0.5/number of targets + 1) − (number of false alarms + 0.5/number of distractors + 1). Response bias was computed according to false-alarm scores (tendency to label a neutral face as happy or sad) in two separate subsets of sad or happy faces versus neutral faces (distractors): Br = (number of false alarms + 0.5/number of distractors + 1)/(1 − Pr). Discrimination accuracy and response bias values were, therefore, computed with regard to measures of recognition accuracy of neutral as well as emotional facial expressions. High accuracy values would indicate an ability to discriminate accurately among sad, happy, and neutral expressions. Higher response bias scores would indicate a tendency to misclassify neutral faces as emotional (either sad or happy).

Results

Response Accuracy

Because the data were not normally distributed, they were log-transformed. Log-transformed scores of response accuracy were entered in 2 × 2 × 2 repeated measures analysis of variance (ANOVA) with emotion (sad, happy), intensity (50% and 100%), and duration (100, 2000 ms) as within-subject factors and group (patients, controls) as the between-subject factor. There were several significant main effects: emotion, F(1, 42) = 176.1, p < .01; intensity, F(1, 42) = 197.7, p < .01; duration, F(1, 42) = 69.2, p < .01; and group, F(1, 42) = 26.2, p < .01. The degrees of freedom are smaller than expected (54) because of some missing data.

Comparison of the mean values for discrimination accuracy indicated that in both groups, these significant effects were the result of sad expressions being recognized less accurately than happy ones, expressions with higher intensity being recognized more accurately than those with lower intensity, and stimuli with longer durations being recognized more accurately than those with shorter durations. Patients were less accurate overall compared with controls.

Significant interactions were observed for the following: Emotion × Group, F(1, 42) = 7.9, p < .01; Duration × Group, F(1, 42) = 7.9, p < .01; Intensity × Duration, F(1, 42) = 33.1, p < .01; Emotion × Duration, F(1, 42) = 33.1, p < .01; Emotion × Intensity, F(1, 42) = 33.1, p < .01; Intensity × Group, F(1, 42) = 33.1, p < .01; and Duration × Intensity, F(1, 42) = 33.1, p < .01. These results are consistent with the hypothesis that patients with depression are less accurate at recognizing emotional expressions and are more affected by intensity and duration differences than controls.
42) = 19.8, p < .01; and Emotion × Duration × Group, F(1, 42) = 5.0, p < .05. Comparison of mean values revealed that the Emotion × Group interaction reflected the significantly greater impairment in patients in the discrimination of sad rather than happy expressions. To examine which of the duration conditions contributed most to the interaction of Emotion × Group, a post hoc ANOVA was performed for each presentation duration. A significant Emotion × Group interaction was observed for the 100 ms, F(1, 42) = 9.8, p < .01, but not for the 2,000 ms, F(1, 50) = 0.06, p = .80, presentation duration condition. In other words, the accuracy of facial emotion discrimination in patients did not differ from that of controls for facial expressions presented for 2,000 ms but did differ for facial expressions presented for 100 ms.

Because there was no additional interaction of Emotion × Group × Duration with intensity, mean measures of discrimination accuracy for both intensities (50% and 100%) of each emotional expression (sad and happy) were computed for the 100-ms condition in both groups. Between-group t tests of these mean measures revealed that patients were significantly impaired compared with controls in the discrimination of both happy and sad facial expressions at 100-ms duration but significantly more impaired in the discrimination of sad expressions, t(51) = 5.6, p < .01, and t(54) = 4.4, p < .01, for sad and happy expressions, respectively (Table 2).

Overall, therefore, depressed patients were less accurate compared with controls in the discrimination of happy and sad facial expressions of either intensity presented rapidly (100 ms). This impairment was more pronounced for sad expressions. Patients were not significantly different from controls in their ability to accurately discriminate happy and sad facial expressions of either intensity presented for longer (2,000 ms) durations.

Response Bias

Log-transformed measures of response bias were entered into a 2 × 2 × 2 repeated measures ANOVA with emotion (sad, happy), intensity (50%, 100%), and duration (100, 2,000 ms) as within-subject variables and group (patients, controls) as the between-subject variable. There were significant main effects of emotion, F(1, 54) = 10.3, p < .01; intensity, F(1, 54) = 158.6, p < .01; and group, F(1, 54) = 7.8, p < .01. Comparison of mean values for the response bias indicated that the main effect of emotion reflected the greater bias in both groups toward labeling neutral expressions as sad rather than happy. The main effect of intensity indicated the propensity for a greater bias in both groups toward labeling more intense expressions as emotional regardless of their valence (sad or happy). The main effect of group reflected a generally more conservative (smaller) response bias in patients compared with controls. In other words, patients had a greater than normal tendency to label any expression as neutral rather than emotional.

A significant Emotion × Intensity × Group interaction was observed, F(1, 54) = 10.3, p < .01. To further investigate this interaction, a post hoc ANOVA was performed for each intensity (50% and 100%) of facial expression. There was no significant Emotion × Group interaction for facial expressions of 100% intensity of either emotion, F(1, 54) = 0.1, p = .80. For facial expressions of 50% intensity of emotion, the Emotion × Group interaction was significant, F(1, 54) = 6.1, p < .05. Subsequently, separate analyses were performed for each presentation duration (100 ms and 2,000 ms) for both emotions presented at 50% intensity. There was a significant Group × Emotion interaction for the 2,000-ms condition, F(1, 54) = 8.6, p < .01, but not for the 100-ms condition, F(1, 54) = 1.1, p = .30. Thus, a significant interaction of Emotion × Group on response bias occurred for facial expressions of 50% intensity presented for 2,000 ms.

To explore this interaction further, we performed between-groups post hoc t tests. These demonstrated that controls had a greater bias toward happy expressions of 50% intensity presented for 2,000 ms compared with patients, t(54) = 3.8, p < .01. Because the response bias variable was computed from two measures (correct recognitions and false-positive responses), the greater response bias in controls reflected their tendency to more frequently label the neutral faces as happy as well as the tendency to more frequently label the happy expressions as happy. On the other hand, the smaller response bias in patients toward the happy expressions suggest a greater tendency of patients compared with controls to label these happy and neutral faces as neutral rather than happy. In the same condition (facial expressions of 50% intensity of emotion presented for 2,000 ms), there was no significant difference between groups in response bias toward sad expressions (Figure 1).

Table 2

Log-Transformed Data of Discrimination Accuracy Scores

<table>
<thead>
<tr>
<th>Condition</th>
<th>Patients</th>
<th></th>
<th>Controls</th>
<th></th>
<th>Significance of difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>100% happy, 100 ms</td>
<td>−0.53</td>
<td>0.49</td>
<td>−0.22</td>
<td>0.12</td>
<td>t(54) = 4.4, p &lt; .001a</td>
</tr>
<tr>
<td>50% happy, 100 ms</td>
<td>−0.91</td>
<td>0.53</td>
<td>−0.41</td>
<td>0.24</td>
<td>t(54) = 4.4, p &lt; .001a</td>
</tr>
<tr>
<td>50% sad, 100 ms</td>
<td>−1.75</td>
<td>0.59</td>
<td>−1.02</td>
<td>0.39</td>
<td>t(51) = 5.6, p &lt; .001a</td>
</tr>
<tr>
<td>100% sad, 100 ms</td>
<td>−1.18</td>
<td>0.65</td>
<td>−0.53</td>
<td>0.36</td>
<td>t(51) = 5.6, p &lt; .001a</td>
</tr>
<tr>
<td>100% happy, 2,000 ms</td>
<td>−0.33</td>
<td>0.49</td>
<td>−0.15</td>
<td>0.12</td>
<td>ns</td>
</tr>
<tr>
<td>50% happy, 2,000 ms</td>
<td>−0.55</td>
<td>0.49</td>
<td>−0.26</td>
<td>0.16</td>
<td>ns</td>
</tr>
<tr>
<td>50% sad, 2,000 ms</td>
<td>−1.16</td>
<td>0.56</td>
<td>−1.01</td>
<td>0.59</td>
<td>ns</td>
</tr>
<tr>
<td>100% sad, 2,000 ms</td>
<td>−0.57</td>
<td>0.37</td>
<td>−0.40</td>
<td>0.35</td>
<td>ns</td>
</tr>
</tbody>
</table>

*Between-group post hoc t tests after analysis of variance for main effects of emotion, intensity, duration, and diagnostic group. In these comparisons, the mean values for discrimination accuracy for happy and sad facial expressions of both intensities (50% and 100%) were used.
Correlations Between Response Accuracy and Bias Scores and Depression Severity Ratings

In patients, significant negative correlations were demonstrated between HAMD scores and discrimination accuracies for 50% intensity sad expressions presented for 100 ms (Spearman's $\rho = -.44$, $p < .05$) and for 50% intensity sad expressions presented for 2,000 ms ($\rho = -.48$, $p < .05$). There was no significant correlation between HAMD and response bias scores.

BDI measures correlated significantly and negatively with discrimination accuracy for 50% intensity sad faces at 2,000-ms duration (Spearman's $\rho = -.49$, $p < .05$). BDI also correlated negatively and significantly with response bias toward 100% happy faces presented at 100 ms (Spearman's $\rho = -.52$, $p < .01$).

Effect of Antidepressant Medication

To examine the possible effect of antidepressant medication on patients’ performance, all medications were coded in terms of dose by levels from 1 to 4, according to those proposed by Sackeim (2001). For example, venlafaxine at a dose less than 75 mg/day for 4 weeks or more is considered as Level 1; 75–224 mg/day, Level 2; 225–374 mg/day, Level 3; and more than 375 mg/day for 4 weeks, Level 4. Patients were, therefore, divided into subgroups with low (Levels 1 and 2) and high (Levels 3 and 4) medication levels. Accuracy and response bias were compared between these two subgroups of patients using independent-sample $t$ tests. Recognition accuracy in the high-dosage subgroup was significantly reduced in only one of the eight conditions: for sad faces of 50% intensity presented for 100 ms, $t(26) = 2.2, p < .01$. The high-dosage subgroup also had a significantly greater conservative response bias toward all sad faces ($p < .05$) but did not differ from the low subgroup in the response bias for happy faces. Thus, higher dosages of antidepressant medication in the depressed patients were associated with a bias away from labeling sad expressions as sad but not with a bias away from labeling happy expressions as happy.

Discussion

Our findings indicate impaired recognition accuracy and a conservative response bias particularly to happy emotional facial expressions in depressed patients. Depressed patients were not impaired in a recognition memory test for faces (Warrington, 1984), an indirect measure of the perception of nonemotional faces. Patients were significantly impaired in discrimination accuracy compared with controls for sad and, to a lesser extent, happy expressions presented for shorter (100 ms) durations, but did not significantly differ from controls in discrimination accuracy for facial expressions presented for 2,000 ms. Patients also demonstrated a significantly lower than normal tendency to label happy faces of 50% intensity and neutral faces presented at 2,000 ms as happy. These findings support those of previous studies demonstrating impaired facial expression recognition (Asthana et al., 1998; Jaeger et al., 1987; Mikhailova et al., 1996; Persad & Polivy, 1993; Rubinow & Post, 1992) and also those demonstrating abnormal bias in response to facial expressions (R. C. Gur et al., 1992; Matthews & Antes, 1992; Hale, 1998; Suslow et al., 2001) in depressed patients. These findings support our Hypothesis 1a, but not Hypothesis 1b, suggesting that a bias away from labeling facial expressions as happy is not associated with a bias toward labeling expressions as sad. The finding in depressed patients of an impaired discrimination for facial expressions presented for shorter durations also supports Hypothesis 2.

Importantly, we found, in patients compared with healthy volunteers, a discrimination impairment and an emotion-specific response bias. These two abnormalities were demonstrated in different conditions, however: Discrimination accuracy in patients was more impaired for facial expressions, particularly sad expressions, presented for short durations (100 ms), whereas abnormal response bias was demonstrated away from happy facial expressions of 50% intensity presented for longer durations (2,000 ms). Thus, response bias abnormalities were demonstrated by depressed patients in conditions in which discrimination accuracy was not impaired and vice versa. Happy expressions were more accurately recognized than sad expressions in both groups, however. These results suggest that discrimination accuracy impairments alone did not contribute to the abnormal response bias away from mildly happy expressions demonstrated by depressed patients. Our find-
tings further suggest that discrimination accuracy and response bias can be considered separate processes underlying facial expression recognition.

Depression has been associated with impairments in various aspects of interpersonal functioning, for example, interpersonal problem-solving performance (Gottlib & Asarnow, 1979), social competence (Fisher-Beckfield & McFall, 1982), and marital interactions (Gottlib & Whiffen, 1989). We suggest that abnormal processing of emotional expressions may underlie some of these difficulties. Furthermore, the emotion-specific bias demonstrated by depressed patients in our study may be responsible for the tendency of depressed patients to judge social interactions and appraise social situations more negatively or less positively.

Depressed patients demonstrated abnormalities in discrimination accuracy predominantly to expressions presented for shorter durations and abnormalities in response bias to happy expressions of milder intensity presented for longer durations, supporting Hypothesis 3. We did not find significant impairments in discrimination accuracy and response bias in depressed patients to prototypical expressions presented for longer durations, nor did we demonstrate between-group differences on these measures to milder expressions presented for shorter durations. Although the former stimuli may be relatively easy to identify, the latter stimuli may be difficult to categorize in both normal and depressed populations. Our findings indicate that the use of milder expressions and shorter presentation durations allows the detection of more subtle impairments in measures of recognition accuracy and response bias in depressed patients. The impaired social function and interaction apparent in depressed patients may, therefore, be associated with specific abnormalities in the identification of and bias toward these more subtle displays of facial emotion.

Further analyses revealed that depression severity was positively correlated with the magnitude of the discrimination accuracy impairment for sad facial expressions of 50% intensity and with the magnitude of the response bias away from labeling as happy facial expressions of 100% intensity happiness presented for 100 ms. These findings partially support Hypothesis 4 and suggest that the magnitude of the discrimination accuracy impairment for sad facial expressions and magnitude of the response bias away from labeling happy facial expressions as happy may be greater in more severely depressed patients. It is unlikely, however, that depression severity was the sole determinant of the magnitude of observed abnormalities in depressed patients because patients who were also impaired in the discrimination of higher intensity sad and happy facial expressions presented for shorter durations, and demonstrated a reduced response bias away from labeling happy facial expressions of milder intensity presented for longer durations.

Analysis of possible medication effects on discrimination accuracy and response bias revealed that patients taking higher doses of antidepressant medication were more impaired than those taking lower doses of medication only in the discrimination of sad faces of 50% intensity presented for 100 ms. Patients taking higher doses of antidepressant medication also demonstrated a tendency to identify sad but not happy faces as neutral. The main findings in our study of an impaired recognition accuracy in all depressed patients, specifically for happy and sad facial expressions presented at the shorter duration, and a tendency to identify happy but not sad faces as neutral are not, therefore, explained simply in terms of an effect of antidepressant medication dose. It is, therefore, unlikely that attentional impairments associated with medication are responsible for our findings.

In conclusion, we have demonstrated impaired recognition accuracy and response bias to emotional facial expressions in depressed patients and suggest that an inability to accurately identify and respond to the subtle changes in facial expression displayed by others in social situations may be associated with the social dysfunction apparent in these patients. We have also demonstrated the importance of using facial expressions of different intensities presented for different durations in the examination of the nature of abnormalities in facial expression recognition in clinical populations. Our findings add to the increasing number of studies examining abnormalities in attention to and recognition of facial expressions in clinical populations, including schizophrenia (e.g., Borod & Koff, 1989; Edwards, Pattison, Jackson, & Wales, 2001; R. E. Gur et al., 2002; Kerr & Neale, 1993; Horley et al., 2001; Whitaker, 2001) and psychopathy (Blair, Colledge, Murray, & Mitchell, 2001) and indicate the importance of investigating the relationship between emotion-processing abnormalities and specific symptoms of psychiatric disorders (Phillips et al., 2003). Future studies examining depressed patients at different stages of illness will help to clarify the extent to which these abnormalities in facial expression identification are state or trait features of the disorder.

References


Received September 20, 2002
Revision received April 25, 2003
Accepted May 5, 2003