Journal of Abnormal Psychology
2006, Vol. 115, No. 4, 705–714

0021-843X/06/$12.00 DOI: 10.1037/0021-843X.115.4.705

Is This Happiness I See? Biases in the Identification of Emotional Facial Expressions in Depression and Social Phobia

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The present study was designed to examine the operation of depression-specific biases in the identification or labeling of facial expression of emotions. Participants diagnosed with major depression and social phobia and control participants were presented with faces that expressed increasing degrees of emotional intensity, slowly changing from a neutral to a full-intensity happy, sad, or angry expression. The authors assessed individual differences in the intensity of facial expression of emotion that was required for the participants to accurately identify the emotion being expressed. The depressed participants required significantly greater intensity of emotion than did the social phobic and the control participants to correctly identify happy expressions and less intensity to identify sad than angry expressions. In contrast, social phobic participants needed less intensity to correctly identify the angry expressions than did the depressed and control participants and less intensity to identify angry than sad expressions. Implications of these results for interpersonal functioning in depression and social phobia are discussed.

Keywords: depression, anxiety, bias, faces, emotion

Results from a growing number of studies suggest that interpersonal factors and deficits in social skills play an important role in the development and maintenance of depression (Hammen, 1997; Joiner, 2002). Biased processing of emotional information, specifically the misinterpretation of social cues, may underlie these impairments. Gotlib and Hammen (1992), for example, suggested that depressed individuals' readiness to attend to negative aspects of their social surroundings contributes to the decreased levels of social support they experience. Perhaps not surprisingly, the majority of studies in this area have examined responses to one specific class of social stimulus—human faces expressing emotions. Facial expressions of emotion are powerful stimuli that represent salient features of the social environment (e.g., Ekman & Friesen, 1976a; Hansen & Hansen, 1994). Individuals use facial expressions to avoid conflict, to monitor emotional reactions of their interaction partners and adjust their behavior accordingly, and to determine the attitudes of other people (Hess, Kappas, & Scherer, 1988; Salovey & Mayer, 1990). Thus, the ability to accurately identify others' emotional facial expressions is of considerable importance in social interactions. Indeed, several investigators have delineated adverse interpersonal consequences of not being able to identify facial emotional expressions accurately (Carton, Kessler, & Pape, 1999; Persad & Polivy, 1993). Given the negative biases that characterize depressed individuals' processing of emotional stimuli (cf. Gotlib & Krasnoperova, 1998), it is likely that individual differences in the correct identification or labeling of emotional facial expressions contribute to interpersonal problems in depression and therefore may represent an important factor in the maintenance of this disorder.

In a typical experiment, pictures of real or schematic faces are presented, and participants are asked to categorize and/or to judge the intensity of the emotional expression. Although the results of some of these studies have suggested that depression is associated with a deficit in perception of emotional facial expressions (e.g., Surguladze et al., 2004), findings from other studies have suggested that depression is characterized primarily by a bias in labeling emotional expressions. Indeed, Feinberg, Rifkin, Schaffer, and Walker (1986) reported that depressed participants were not impaired on a task requiring the matching of pictures of emotional faces but did exhibit impairment in the verbal labeling of all emotional expressions. It is important to note that regardless of the presence or absence of perceptual anomalies, depression-associated difficulties in the labeling of emotional expressions have been found to be associated with interpersonal difficulties, persistence of depressive symptoms, and relapse after remission of the depressive episode. For example, Persad and Polivy (1993) found not only that depressed participants made more errors than did nondepressed controls in labeling facial expressions, but further, that they reported higher levels of distress and fear when they were confronted with these faces. Using schematic faces, Bouhuys and her colleagues (e.g., Bouhuys, Geerts, & Gordijn, 1999a; 1999b; Geerts & Bouhuys, 1998) found that the tendency to label ambiguous angry faces as sad was related to the persistence of a depressive episode 6 weeks after intake, as well as to relapse 6 months after termination of treatment. Similarly, Hale (1998) reported that the judgment of the emotion of sadness in schematic

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This research was supported by German Research Foundation Grants JO/399-1 and JO/399-2 awarded to Jutta Joormann and by National Institute of Mental Health Grant MH59259 awarded to Ian H. Gotlib. We thank Danielle Keenan-Miller for her help with the data collection.

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faces was the best predictor of the persistence of depression at both 13-week and 6-month follow-up assessments.

The results of these studies suggest that individual differences in the identification or labeling of facial expressions of emotion predict the course of a depressive episode, recovery from depression, and recurrence of depressive episodes. It is not clear, however, whether depression is associated with a general deficit in emotion identification or with a bias in the identification of specific emotional expressions. Whereas some investigators have found that depressed individuals are characterized by deficits in the processing of all emotional (and neutral) facial expressions (e.g., Carton et al., 1999; Cooley & Nowicki, 1989; Mikhailova, Vladimirova, Iznak, & Tsusulkovskaya, 1996), other researchers have failed to corroborate this finding (e.g., Ridout, Astell, Reid, Glen, & O'Carroll, 2003; Walker, McGuire, & Bettes, 1984). Numerous investigators have found depression to be associated with negative biases in the processing of specific types of emotional faces (Hale, 1998; Persad & Polivy, 1993; Rubinow & Post, 1992). For example, Gur, Erwin, Gur, and Zwil (1992) reported that although depressed participants were not impaired in their overall performance on an emotion identification task, they tended to label neutral faces as sad and happy faces as neutral (see also Murphy et al., 1999, and Suslow, Junghanns, & Arolt, 2001). Mandal (1987) reported similar results: Although depressed participants did not differ from controls in their identification of happy faces, they exhibited a negative bias in evaluating the emotional expressiveness of sad faces. In sum, therefore, investigators have variously found depressed participants to be characterized by a general deficit in emotion identification, by a bias that is specific to the emotion of sadness, and/or by difficulties in the identification of positive facial expressions.

There are a number of possible explanations for these inconsistent findings. In particular, it is important to recognize that the designs of these studies are, in many ways, problematic. For example, in most of these investigations, participants were presented with rather artificial social stimuli. Several researchers have used schematic faces as stimuli (Bouhuys et al., 1999a; Suslow et al., 2001) rather than photographs of real faces. Moreover, although some investigators have used photographs of faces from standardized sets (Persad & Polivy, 1993), others have used novel pictures (Gur et al., 1992), making it difficult to compare results across studies. Perhaps the most significant limitation of these investigations, however, is the fact that in everyday life people process a wide range of emotional stimuli, including signals that are far less intense than the prototypical facial expressions contained in standardized picture sets. It is likely, therefore, that responses concerning the identification or the intensity of the emotions portrayed in these prototypical faces provide a limited understanding of the processing of social cues in depression.

In this context, assessing the early identification or labeling of traces of emotion and of subtle changes in facial expressions is likely to yield important information with respect to understanding depression-associated deficits in interpersonal functioning. The operation of biases in the identification of emotions that are just beginning to form in facial expressions may have particularly adverse consequences, given that individuals use others' facial expressions as important cues by which to regulate their own behavior (Salovey & Mayer, 1990). Surguladze et al. (2004) recently examined the ability of depressed and nondepressed participants to identify both happy and sad facial expressions of full emotional intensity and faces that were morphed to express 50% emotional intensity. The authors found that, compared with the nondepressed participants, the depressed participants were impaired in their discrimination accuracy for sad faces presented for short durations and were less likely to correctly identify mildly happy expressions. Specifically, Surguladze et al. found that at 2-s presentations, the depressed participants were less likely than were their nondepressed counterparts to label the 50% happy faces as happy. Whereas the use of 50% intensity faces in this study represents an improvement over previous investigations of facial expression identification in depression, it does not permit the assessment of biases for less intense (and likely more frequently seen) expressions of emotions; more important, it does not allow the examination of individual differences in response to subtle changes in emotional expressions. Thus, the primary goal of the present study was to use a methodology with greater sensitivity and ecological validity than has typified previous research to assess biases among depressed individuals in identification or labeling of emotional facial expressions. More specifically, we used real faces that change slowly from a neutral expression to a full emotional expression to examine whether depressed participants are biased in their identification of faces expressing varying degrees of emotional intensity.

Another explanation for the inconsistent findings of previous studies involves differences among these investigations in the composition of their participant samples. This is particularly important because it is not clear whether biases in the identification of facial expressions are specific to depression, whether they characterize individuals diagnosed with other forms of psychopathology, or whether they are a consequence of the high rates of comorbidity between depression and other disorders, such as social phobia (SP; Kessler, Chiu, Demler, & Walters, 2005; Stein, McQuaid, Laffaye, & McCahill, 1999). Whereas some investigators included only participants diagnosed with major depressive disorder (MDD; e.g., Persad & Polivy, 1993), other researchers used dysphoric participants (e.g., Carton et al., 1999) or included participants with bipolar disorder (e.g., Gur et al., 1992). Moreover, previous studies did not exclude MDD participants with comorbid anxiety disorders; in fact, not a single study has systematically compared the perception of emotional faces in participants with major depression with that of participants with anxiety disorders.

In this context, it is noteworthy that models of SP and findings from studies investigating the general propositions of these models strongly suggest that SP is associated with biases in the identification of facial expressions of emotion (Rapee & Heimberg, 1997). For example, in an early study, Winton, Clark, and Edelmann (1995) reported that participants who endorsed high levels of social anxiety exhibited a clear tendency to identify faces as negative but did not show an enhanced ability to discriminate among different specific emotional states in others. Given these findings, therefore, it is critical to test explicitly both the diagnostic and the stimulus specificity of depression-associated biases. According to Beck's (1976) content-specificity hypothesis, depressed and anxious individuals should demonstrate biases only for stimuli that are consistent with the cognitive schemata that underlie these disorders: sadness and loss for depression; anger and social threat for anxiety. Thus, the second goal of the present study was to examine the content specificity and diagnostic specificity of biases

in the identification of emotional facial expressions by examining participants diagnosed with MDD and participants diagnosed with SP as they processed the emergence of sad, angry, and happy facial expressions.

In sum, the present study was designed to examine the identification of different types and intensities of emotional faces by MDD and SP participants. We assessed the responses of carefully diagnosed MDD individuals and SP participants, as well as a group of never-disordered participants, to sad and socially threatening (i.e., angry) faces and happy faces of varying intensity. None of the MDD or SP participants had comorbid diagnoses of SP or MDD. We used a morphed-faces task modeled after that used by Niedenthal and her colleagues (Niedenthal, Brauer, Robin, & Innes-Ker, 2002; Niedenthal, Halberstadt, Margolin, & Innes-Ker, 2000) to assess individual differences in the identification or labeling of emotional expressions. In this task, participants watch a series of computerized movies of faces whose expressions change gradually from neutral to a full emotion. For each movie, participants are asked to press a key on the computer keyboard as soon as they detect an emotion they can identify and are then asked to identify the emotion they detected. A significant advantage of this procedure over those used in previous studies in which static schematic faces or photographs were used is that the emotional expressions change gradually over the course of the movies, more realistically reflecting interpersonal situations that are likely to be actually experienced. We tested four hypotheses in this study.

> *Hypothesis 1*: Diagnostic specificity (between-groups comparisons): (a) MDD participants will identify sad expressions earlier and happy expressions later in the emotion development sequence than will participants with SP and never-disordered controls, (b) participants with SP will identify angry expressions earlier in the sequence than will MDD or never-disordered control participants.
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> *Hypothesis 2:* Content specificity (within-group comparisons) (c) participants with MDD will identify sad emotional expressions earlier in the sequence than they will angry expressions; and (d) participants with SP will identify angry expressions earlier in the sequence than they will sad expressions.

We should note that we did not include within-group comparisons of happy faces in our content-specificity hypotheses both because we consider happy faces to be part of the sadness and/or loss schema and because happy faces were the only positive emotion presented and would, therefore, likely be identified earlier in the sequence by all participants than would the sad and angry faces.

Method

Overview

Individuals diagnosed with MDD or SP and never-disordered control participants watched movies of computer-morphed faces that changed slowly from a neutral to a fully emotional expression. The movies were composed of sequences of 70 photographs of the same face that expressed gradually increasing degrees of anger, sadness, fear, and happiness. Participants were asked to press a key as soon as they detected an emotional expression that they could identify. Pressing the key stopped the movie and opened a rating screen that asked participants to identify the face as expressing happiness, sadness, fear, or anger. The computer recorded the identification rating and the emotional intensity of the face that was displayed at the moment of the key press.

Participants

Participants were recruited from a variety of sources. Clinical participants were solicited from two outpatient psychiatry clinics in a university teaching hospital, as well as through advertisements posted in numerous locations within the local community (e.g., Internet bulletin boards, university kiosks, supermarkets). Healthy controls were recruited from the community through advertisements posted in the same locations. Participants' responses to a telephone interview provided initial selection information. This phone screen established that participants were fluent in English and were between 18 and 60 years of age. Participants were excluded for severe head trauma and learning disabilities, as well as for current panic disorder, psychotic symptoms, bipolar disorder, and alcohol or substance abuse within the past six months. This telephone interview was also used to identify individuals who were likely to meet criteria for one of three groups: (a) MDD individuals; (b) individuals with diagnosable SP; and (c) never-disordered healthy control participants. Those identified individuals were invited to come to the laboratory for a more extensive interview.

Trained interviewers administered the Structured Clinical Interview for the *DSM–IV* (SCID; First, Spitzer, Gibbon, & Williams, 1996) to these individuals during their first session in the study. The SCID has demonstrated good reliability for the majority of the disorders covered in the interview (Skre, Onstad, Torgersen, & Kringlen, 1991; Williams et al., 1992). All interviewers had extensive training in the use of the SCID, as well as previous experience in administering structured clinical interviews with psychiatric patients prior to beginning the current study. In previous studies, our team of interviewers achieved excellent interrater reliability. The kappa coefficients were .93 for the MDD diagnosis, 1.0 for the SP diagnosis, and .92 for the nonpsychiatric control diagnosis (i.e., the absence of current or lifetime psychiatric diagnoses, according to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., *DSM–IV*; American Psychiatric Association, 1994) criteria. Although this represents excellent reliability, we should note that the interviewers used the "skip out" strategy of the SCID, which may have reduced the opportunities for the independent raters to disagree with the diagnoses (Gotlib, Kasch, et al., 2004; Gotlib, Krasnoperova, Yue, & Joormann, 2004).

Participants were included in the MDD group if they met the *DSM–IV* criteria for MDD but did not meet current or lifetime criteria for SP. Participants were included in the SP group if they met DSM-IV criteria for SP but did not meet criteria for current or lifetime MDD. We included only participants who reported anxiety and significant impairment in at least three different social situations and would thus be considered generalized subtypes. The never-disordered control group consisted of individuals with no current diagnosis and no history of any Axis I disorder. Participants also completed the Beck Depression Inventory-II (BDI; Beck, Steer, & Brown, 1996), a 21-item self-report measure of the severity of depressive symptoms. The acceptable reliability and validity of the BDI has been well documented (Beck, Steer, & Garbin, 1988). Finally, participants completed the trait form of the State–Trait Anxiety Inventory (STAI-T; Spielberger, Gorsuch, & Lushene, 1970). The STAI-T is a 20-item inventory that assesses trait anxiety. Participants were scheduled for a second session of computer tasks, usually within 2 weeks after the interview.

Seventy-six individuals (23 diagnosed with MDD, 27 diagnosed with SP, and 26 never-disordered controls) participated in this study. Data from 2 MDD, 1 SP, and 1 control participant were excluded because in over half of the trials these participants did not respond until the 80% emotion face was presented, leading to valence scores that were well beyond two standard deviations both of the full sample and of their respective diag-

nostic groups. Thus, for the purposes of data analysis, the final sample consisted of 72 participants: 21 diagnosed with MDD (18 women and 3 men), 26 diagnosed with SP (16 women and 10 men), and 25 never-disordered controls (17 women and 8 men).

Stimuli

Stimuli were faces taken from the Facial Expressions of Emotions–Stimuli and Tests series set (Young, Perrett, Calder, Sprengelmeyer, & Ekman, 2002), in which faces from Ekman and Friesen's (1976b) series of facial affect have been morphed from a neutral expression to a fully emotive expression in 10% intervals. We selected a male and a female face from the morphed series and included the sad, angry, happy, and fearful versions of each of these faces. Although we did not have specific hypotheses for the fearful expressions, we included this category to make the identification task more difficult. Faces of the same two actors expressing disgust were used for practice trials with the participants. Using these pictures as raw material, we used Morph Studio: Morph Editor software Version 1.0 (Ulead, 2000) to further refine the morphed pictures: We created intermediate images between the 10% intervals for a total of 50 unique faces, changing in 2% steps from neutral to full emotion. An example of one of these sequences is presented in Figure 1.

Using E-Prime software Version 1.1 (Psychology Software Tools, 2000), we presented each face for 500 ms, which created the impression of an animated clip of the development of an emotional facial expression. The black-and-white faces were 18. 5 × 13 cm in size and were presented in the middle of the screen with a black background. These movies were presented on a high-resolution 17-in. monitor.

Design

Each of the sequences (male and female actor expressing angry, happy, fear, and sad emotion) was presented 5 times, for a total of 40 sequence presentations. To avoid having a perfect correlation between time and expression intensity and to increase the difficulty of the task, we sometimes repeated faces within the sequences so that the appearance of the next face in the emotion sequence was jittered. For example, in some sequences the face with 12% emotion was repeated three times before the 14% emotion face was presented, but in other sequences 12% was followed immediately by 14%; in no case did the sequences move backward. Thus, each sequence consisted of 50 unique-emotion faces but 70 face presentations. The presentation of the sequences was randomized across participants. For each sequence, participants were instructed to watch the face change from neutral to an emotion and to press the space bar as soon as they saw an emotion they could identify. After the participants pressed the space bar, the sequence stopped, and they were presented with a rating screen asking them to identify the emotion as happy, sad, fearful, or angry. The intensity of the emotion being expressed on the face when the participants pressed the space bar was recorded, as was their identification of the emotion.

Procedure

Participants were tested individually within 2 weeks after their initial diagnostic interview. They were told that the experiment was designed to assess identification of emotional expressions. After responding to practice trials to familiarize themselves with the procedure and the stimuli, participants were shown the 40 morphed sequences of the faces in random order. The entire task took about 20 min.

Results

Participant Characteristics

The three groups of participants did not differ significantly in age, MDD: $M = 33.8$, $SD = 10.70$; SP: $M = 30.23$, $SD = 8.68$; control participants: $M = 31.64$, $SD = 8.67$; $F(2, 70) < 1$; or education, 86% of the MDD, 58% of the SP, and 76% of control participants were college graduates, $\chi^2(2, N = 72) = 4.82$, $p > .05$. As expected, the three groups of participants differed significantly in their BDI scores, $F(2, 62) = 59.76$, $p < .001$. The MDD group had significantly higher BDI scores ($M = 30.44$, $SD = 10.63$) than did both SP ($M = 11.37$, $SD = 8.28$) and control ($M = 2.8$, $SD = 4.25$) participants, both ps $< .05$; the SP participants, in turn, had higher BDI scores than did the control participants, $p < .05$. The three groups of participants also differed significantly in their STAI-T scores, $F(2, 61) = 52.72$, $p < .001$. Follow-up tests indicated that the MDD ($M = 53.68$, $SD = 9.17$) and the SP ($M = 48.95$, $SD = 7.78$) participants had higher scores than did the control participants ($M = 32.83$, $SD = 4.38$), both ps $< .05$, but did not differ significantly from each other, $p > .05$. One MDD participant was diagnosed with a comorbid condition (dysthymia), 6 SP participants were diagnosed with 1 comorbid condition (generalized anxiety disorder, posttraumatic stress disorder, obsessive–compulsive disorder, and dysthymia), and 1 SP participant was diagnosed with two comorbid conditions (binge-eating disorder and specific phobia). Eleven participants in the MDD group and 6 participants in the SP group were taking psychotropic medication, almost exclusively SSRIs.

Emotion Identification Error Rates

Because we were testing specific hypotheses about the happy, angry, and sad faces and included the fearful faces only to increase the difficulty of the discrimination task, we excluded the fearful

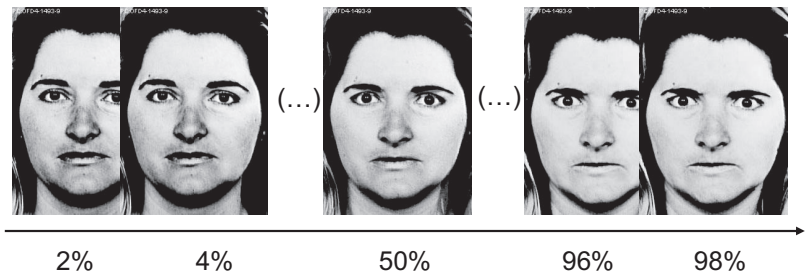

Figure 1. Examples of emotional faces used in the morphing task.

faces from our data analysis.[1] The mean percentages of correct identifications of the happy, angry, and sad faces are presented in Figure 2. Although our predictions concerned group differences in the intensity of emotion required to make a correct identification, we analyzed the percentage of correct identifications to ensure that any group differences in required intensity are not due to differences in accuracy. This analysis allows us to investigate the possibility that group differences in emotion identification are due to a group-specific general response bias. If one of the groups was characterized by a general response bias (e.g., the participants are concerned about making errors and wait to respond until they are absolutely sure that they have correctly identified the face), we would have expected this group to need more intense expressions to respond and to be more accurate than the other participants in their expression identification. Thus, to ensure that group differences were not due to differences in such a response bias, it was important to analyze group differences in both intensity and accuracy. As is apparent in Figure 2, overall identification accuracy was high. A two-way Group (MDD, SP, control) × Expression type (happy, angry, sad) repeated-measures analysis of variance conducted on the percentage of correct responses yielded a significant main effect for expression type, $F(2, 138) = 49.18$, $p < .001$; neither the main effect for group, $F(2, 69) < 1$, nor the interaction of group and expression type, $F(4, 138) = 2.04$, $p > .05$, was significant. Paired t tests conducted to examine the main effect for expression type indicated that mean accuracy rates differed significantly for the happy, sad, and angry faces, all ps $< .001$. Participants were more accurate in identifying happy than angry and sad faces and more accurate in identifying sad than angry faces.

Emotion Intensity Analyses

Both the diagnostic specificity and the content specificity hypotheses predicted a significant interaction of group and expression type for the identification of facial expressions of emotion. Because we were examining the degree of intensity of the emotional facial expression required for the correct identification of the presented emotion, we restricted our analyses to trials in which the facial expressions were identified correctly. Mean intensity scores of the three groups of participants for the happy, angry, and sad expressions are presented in Figure 3.[2]

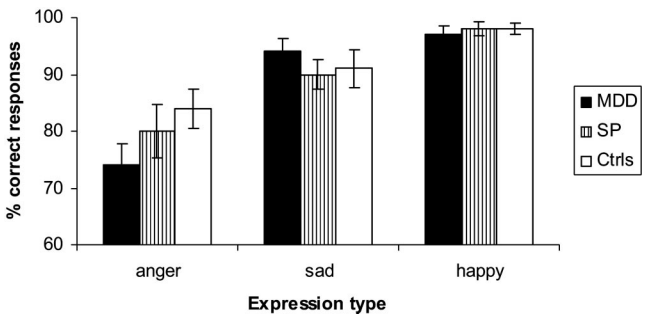

Figure 2. Mean percentage of correct emotion identifications of facial expressions made by participants diagnosed with major depressive disorder (MDD), participants diagnosed with social phobia (SP), and control participants (Ctrls) as a function of valence of facial expression. Error bars represent one standard error.

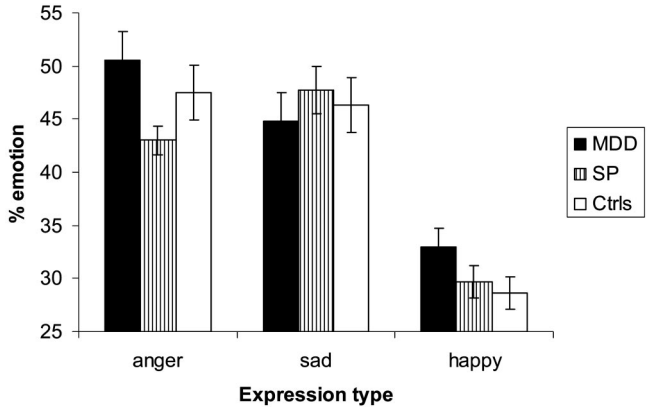

Figure 3. Mean emotional intensity of correctly identified facial expressions at time of key press made by participants diagnosed with major depressive disorder (MDD), participants diagnosed with social phobia (SP), and control participants (Ctrls) as a function of valence of facial expression. Error bars represent one standard error.

The intensity scores of the facial expression at the time of the key press were analyzed by a two-way Group (MDD, SP, control) × Expression type (happy, angry, sad) repeated-measures analysis of variance. This analysis yielded a significant main effect for expression type, $F(2, 138) = 125.41$, $p < .001$, which was qualified by the predicted significant interaction of group and expression type, $F(4, 138) = 3.66$, $p < .01$;[3] the main effect for group was not significant, $F(2, 69) < 1$. Follow-up analyses were conducted to investigate whether the obtained two-way interaction supported the stated hypotheses.

The diagnostic specificity hypotheses predicted that MDD participants would identify the sad faces earlier in the emotion development sequence and the happy faces later in the sequence than would participants with SP and control participants and that the SP participants would identify angry faces sooner in the emotion development sequence than would the MDD and never-disordered control participants. To examine these hypotheses, we conducted follow-up tests comparing MDD participants' intensity scores for happy and sad faces to those of the SP and control participants, and SP participants' intensity scores for the angry faces to those of the MDD and control participants.

In conducting these analyses, we again wanted to minimize the possibility that the obtained results could be due to differences in accuracy. It was important, therefore, to ensure that the group differences in intensity scores were not affected by group differences in error rates. Although we included only correct responses in these analyses and although there was no main effect of group

[1] The inclusion of the fear faces did not change the results of the overall analysis of variance. No group differences in error rates were found for the fear faces, $F(2, 71) < 1$.

[2] The inclusion of the fear faces did not change the results of the overall analysis of variance. No group differences in emotion intensity were found for the identification of the fear faces, $F(2, 71) = 1.44$, $p > .05$.

[3] We obtain similar results if we include overall error rate as a covariate: The interaction of group and valence remains significant, $F(4, 136) = 3.67$, $p < .01$.

and no interaction of group and emotional expression in the analysis of the error rates, it is nevertheless possible that group differences in error rates would confound the analyses of intensity scores if intensity scores and error rates were correlated. Therefore, we adopted a conservative approach to analyzing the emotion expression intensities by including error rates as a covariate. With this approach, our analyses yielded information about individual differences in the intensities of emotion required for the correct identification of the faces that is not explained by differences in error rates. Because we wanted to examine whether group differences in the intensities required to correctly identify a specific emotion (happiness, for example) could be explained by individual differences in the accuracy of identification of faces expressing that emotion (i.e., happy faces), we did not use the overall error rate as the covariate but, rather, the specific error rates for each emotion separately. Therefore, following up on the significant interaction of Group × Emotional Expression described above, we conducted separate analyses of covariance on the happy, sad, and angry faces, using the percentage of correct responses within each of these emotion categories as a covariate. The results of these analyses indicated that although the MDD participants did not differ from the SP and control participants in the intensity of emotion required to identify sad faces, $F(1, 69) < 1$, they required a more intense emotional expression to identify happy faces than did the SP and control participants, $F(1, 69) = 4.46$, $p < .04$. The analyses also indicated that the SP participants required significantly less intensity to identify angry facial expressions than did the MDD and control participants, $F(1, 69) = 4.95$, $p < .03$. Thus, whereas MDD participants required more intensity in a facial expression to correctly identify happiness, SP participants required a less intense facial expression to correctly identify anger.[4]

The content specificity hypothesis predicted that whereas MDD participants would require less intensity to identify sad than angry faces, SP participants would require less intensity to identify angry than sad faces. Paired *t* tests conducted within each of the three groups supported these hypotheses. Control participants were not characterized by different intensity scores for sad versus angry faces, $t(24) < 1$. In contrast, and as predicted, MDD participants required significantly less intense expressions to identify sad than angry faces, $t(20) = 3.23$, $p < .01$, and SP participants required significantly less intense expressions to identify angry than sad faces, $t(25) = 2.03$, $p < .05$.

Discussion

The present study was designed to examine the operation of depression-associated and anxiety-associated biases in the identification or labeling of facial expressions of emotion with a task in which faces are presented with increasing degrees of emotional intensity. The findings largely supported our hypotheses. With respect to diagnostic specificity, although MDD participants did not differ from non-MDD and SP participants in the intensity required to identify sad facial expressions of emotions, they required significantly greater intensity to correctly identify or label happy expressions than did both SP and control participants (Hypothesis 1a). Moreover, as predicted, SP participants required significantly less intense expressions to correctly identify angry faces than did both MDD and non-MDD participants (Hypothesis 1b). Thus, we obtained evidence for diagnostic specificity of biases in the identification of emotional faces for both MDD and SP participants. Similarly, with respect to content specificity, we found that MDD participants required less intense expressions to correctly identify sad than angry faces, whereas SP participants required less intensity to correctly identify angry than sad faces (Hypotheses 2a and 2b); non-MDD control participants did not exhibit differential identification of the two negative facial expressions. Thus, we also obtained evidence for content specificity in the identification of emotional information by MDD and SP participants. Considered collectively, therefore, the present results indicate that depression and SP are associated with specific biases in the identification or labeling of facial expressions of emotion. Interestingly, depressed individuals do not identify sad emotional expressions at a lower intensity than do nondepressed individuals; rather, this depressive bias is better conceptualized as a specific bias in the identification of positive facial expressions.

This study is the first to use movies of computer-morphed faces to examine biases in participants diagnosed with MDD or SP. In previous studies on emotion identification, participants were typically asked to categorize and/or judge the intensity of different emotional expressions, and individual differences in identification accuracy or in intensity ratings were assessed (e.g., Hale, 1998; Persad & Polivy, 1993). In the present study, participants were presented with faces that expressed increasing degrees of emotional intensity and were required to indicate when they were able to identify the emotion that was emerging. We believe that this type of task allows for a more ecologically valid assessment of identification biases than do tasks that present participants either with prototypical full-intensity emotional facial expressions from standardized picture sets or with schematic faces. In everyday life, people are confronted with information comprising a wide range of emotional intensity, and it is likely that individual differences in correctly labeling low-intensity emotional expressions and subtle changes in facial expressions of emotion are stronger predictors of interpersonal functioning than is accurate identification of a high-intensity emotional expression. Our results indicate that MDD participants require more intense happy facial expressions in order to correctly label a face as happy than did SP and control participants. In contrast, SP participants correctly identified angry expressions at a lower emotional intensity than did MDD and control participants. These results are consistent with findings from the only other study conducted to date in which emotion identification was assessed for different intensities of facial expressions in depressed participants. Surguladze et al. (2004) presented depressed individuals with 50% and 100% intensities of happy and sad facial expressions and found that depressed participants were less likely than were controls to label the 50% intensity faces as happy. The present study extends this finding by assessing the correct identification or labeling of emotion in gradually changing facial ex-

[4] To limit the number of follow-up tests conducted, we compared the MDD participants with all other participants (i.e., to control and SP participants combined). It is important to note, however, that single-effects follow-up tests yielded no significant differences in any group comparison for the sad faces, all ts < 1. For the happy faces, the SP and control participants did not differ significantly, $t(49) < 1$, but the MDD participants differed from the other two groups, both ps $< .05$. For the angry faces, the SP participants differed significantly from the other two groups, both ps $< .05$, who did not differ significantly from each other, $t(44) < 1$.

pressions. This procedure permits the assessment not only of whether depressed participants can identify subtle expressions of emotions but, further, of whether depressed participants are sensitive to subtle changes in emotional expressions. Taken together, these results suggest that whereas depression is associated with specific biases in the identification of subtle happy facial expressions, SP is associated with specific biases in the identification of subtle angry facial expressions. It should be noted, however, that this task cannot differentiate between group differences in the perception or detection of the onset of an emotion and group differences in the response criterion used to identify and label an emotion. Future studies are needed to clarify whether the obtained results were due to perceptual deficits or due to differences in the level of subjective certainty required to make an identification of a particular emotion. This and other limitations of the morphed faces task are discussed in greater detail below.

The present results underscore the utility in clinical research of presenting a sequence of computer-morphed faces in order to assess responses to expressions of emotions. A similar task was recently described by Niedenthal et al. (2000, 2002). In contrast to the present procedure, Niedenthal et al. (2000) asked participants to play the movies at their own speed using a sliding bar that allowed them to go back and forth between neutral and fully emotional faces. And perhaps more important, Niedenthal et al. (2000) required participants to indicate the offset, rather than the onset, of emotional expressions. Although the assessment of individual differences in the perception of the offset of emotion is an important topic for investigation, in Niedenthal's task it was difficult to exclude demand characteristics and general response bias explanations. Only in an onset version of this task, as used in the present study, can participants be asked to identify the emotion they report detecting. Nevertheless, Niedenthal et al. (2000) did find evidence of mood-congruent biases: Participants' reported perceptions of facial expressions of emotion were affected by their induced emotional state. Compared with participants in a sad mood state, those in a happy mood state reported happy expressions as lingering longer as the initially happy faces morphed into neutral faces. Considered collectively, these results indicate that this type of facial expression morphing task can be used effectively to assess individual differences in the identification of emotional faces.

Despite the fact that our task differed in a number of ways from those used in previous studies examining biases in the identification of emotional facial expressions in depression, our results can nevertheless be integrated with findings from these investigations. For example, consistent with findings from other studies (e.g., Ridout et al., 2003; Walker et al., 1984), the present results do not support the hypothesis that depression is characterized by a general deficit in emotion identification or labeling. Rather, the present findings underscore the importance of differentiating emotional expressions: Although MDD participants in the present study correctly identified angry and sad faces as early in the expressive sequence as did control participants, they took longer than did the SP or the control participants to identify happy faces. Although the present results do not support previous findings that suggest that depression is characterized by fast and accurate identification of sad facial expressions (e.g., Gur et al., 1992), they do add to a growing literature that indicates that depression is characterized primarily by difficulties in the identification of positive affect, perhaps even more so than by biases in the identification of negative affect (e.g., Deveney & Deldin, 2004; Gilboa-Schechtman, Erhard-Weiss, & Jeczemien, 2002; Surguladze et al., 2004). For example, Suslow et al. (2001) found that whereas depressed and control participants did not differ in their latencies to detect sad faces in a display of schematic faces, depressed participants were significantly slower than were controls to detect happy faces. In an emotion discrimination task, Gur et al. (1992) found that the tendency to misinterpret happy faces as neutral best discriminated depressed patients from controls. Similarly, Gilboa-Schechtman et al. (2002) found that depression is associated with decreased memory for happy facial expressions, and Deldin, Deveney, Kim, Casas, and Best (2001) found evidence for decreased N200 event-related brain potential in response to positive faces in depression, suggesting decreases in resource allocation to the encoding of these mood-incongruent facial stimuli.

From a more theoretical perspective, it is noteworthy that these findings of problematic responses among depressed but not anxious individuals to positive facial expressions are consistent with the tripartite model of depression and anxiety, in which depression, but not anxiety, is posited to be characterized by low levels of positive affect (Clark & Watson, 1991; Watson, Clark, et al., 1995; Watson, Weber, et al., 1995). Interestingly, recent reformulations of the tripartite model posit that both depression and SP differ from other anxiety disorders by being characterized by low positive affect (Brown, Campbell, Lehman, Grisham, & Mancill, 2001; Brown, Chorpita, & Barlow, 1998; Mineka, Watson, & Clark, 1998). In the present study, however, only depression was characterized by a bias in the identification of happy expressions. This pattern of results might reflect important differences between the experience of affect and the identification of affect in others. It will be important in future research examining biased processing of information in depression and SP that both the experience and the identification of positive affect be assessed.

Our results further suggest that SP is associated with early identification of angry facial expressions. The results of studies using emotional faces to examine attentional biases in SP are mixed. Whereas some investigators have found evidence of enhanced vigilance for angry faces (e.g., Mogg, Philippot, & Bradley, 2004), other researchers have reported that participants with SP avoid attending to angry faces (e.g., Chen, Ehlers, A., Clark, & Mansell, 2002; Mansell, Clark, Ehlers, & Chen, 1999). It is important to emphasize here that the present study was designed to assess biases in the identification of subtle emotional expressions rather than attentional biases to or away from full-intensity facial expressions of emotion. Our results are consistent with findings from previous studies examining the identification of emotion in SP participants. For example, Winton et al. (1995) found socially anxious individuals to exhibit a bias toward identifying briefly presented negative and neutral faces as negative, and Gilboa-Schechtman, Foa, and Amir (1999) found that patients with SP were faster to detect angry faces than happy faces in an array of neutral faces.

Although the morphed-faces task allows us to assess novel aspects of the identification of facial expressions of emotion in psychological disorders, we should note that there are limitations of this task. First, because this task assesses participants' subjective judgments of the onset of emotions in gradually changing expressions, participants are free to respond at any point in the

emotion development sequence. Because participants are not forced to make a judgment at a specific point, the task cannot differentiate between group differences in the perception or detection of the onset of an emotion and group differences in the response criterion used to identify and label an emotion. For example, MDD participants might detect the onset of an emotion at the same point as non-MDD participants but might require more intense expressions before they are sufficiently confident of their detection to identify the emotion. If our results, however, had been due to the MDD participants using a more conservative response criterion for all emotions than the participants in the other groups, we would have expected them both to require more intense emotional expressions for identification and to make fewer identification errors in general. Neither of these conditions was met. Not only were there no significant group effects or interactions in the accuracy data, but, furthermore, there was a trend for MDD participants to require *less* intensity than did the other participants to identify the sad faces. We also restricted our analyses to intensity ratings of correct responses, and we used individual differences in accuracy as a covariate. Given this analytic strategy, we are confident that the obtained results are not due to a general difference in response criterion among MDD, SP, and control participants.

Although a general response bias explanation does not appear to be tenable, it is possible that these results are due to group differences in the response criterion for particular emotional expressions. For example, the MDD participants might exhibit a more conservative response criterion only for happy faces; that is, they might need more confidence in their perception of the happy expressions before responding, requiring a greater intensity of the emotional expression to be confident enough to label it as happy. Even if such a response-criterion explanation is viable in understanding the obtained findings, however, stimulus-specific and diagnosis-specific differences in the correct identification of subtle expressions of emotions are nevertheless of considerable theoretical interest for understanding the identification of social stimuli in SP and depression. Previous studies investigating the identification of facial expression of emotion in depression have provided support for both differences in perception of emotional expressions (Surguladze et al., 2004; Suslow et al., 2001) and difficulties in identifying and labeling specific emotions (e.g., Bouhuys et al., 1999a; Suslow et al., 2001). Indeed, anomalies in the accurate and timely identification and labeling of facial expressions of emotions are likely to have negative consequences for social reinforcement, for the perception of other people's attitudes, and for the regulation of behavior in social interactions (Geerts & Bouhuys, 1998; Hale, 1998; Persad & Polivy, 1993). Consequently, biases in the labeling of facial expressions have been associated with persistent depressive episodes (Bouhuys et al., 1999a) and relapse (Hale, 1998). In sum, we believe that there are two viable explanations for our depression-associated findings: Either MDD participants do not perceive the onset of happy expressions as early in the developmental sequence as the other participants do, or the MDD participants do detect the onset of happy expressions as early as do non-MDD participants but delay their identification response until they are more confident in their accuracy. Future research is needed to differentiate these two mechanisms. Nevertheless, given the social importance of correctly detecting and identifying emotional expressions and the inherently ambiguous nature of emotional expressions particularly when they are of low intensity, it is likely that difficulties in either of these mechanisms have detrimental consequences for social interactions.

A second limitation of the morphed-faces task is that we included only one positive emotion, a facial expression of happiness. Consequently, happiness judgments in this task were easier to make for all participants than were judgments of other emotions. Although this aspect of the design makes it difficult to compare directly the intensities that were required to identify happy faces with the intensities required to identify the other expressions, it is important to note that these specific comparisons were not the focus of this study. In fact, we did not compare happy expressions to negative expressions in testing either the diagnostic- or the content-specificity hypotheses. We compared intensities of the three participant groups separately for each emotion to test the diagnostic-specificity hypotheses, and we compared intensities of angry and sad faces to test the content-specificity hypotheses.

A third limitation involves the rate of presentation of the stimuli. Sato and Yoshikawa (2004) recently demonstrated that higher rates of presentation (100 frames/s for happy faces and 25 frames/s for sad faces) were rated as the most natural. Moreover, findings reported by Kamachi et al. (2001) suggest that the speed of presentation affects the perception of the onset of different emotions. In the present study we presented the morphed faces at a rate of 2 frames per s to allow time for the participants to respond, and it is possible that we sacrificed naturalness in order to permit participants to interrupt the sequence. Future research might investigate more systematically the role of presentation times in the perceived onset of different emotions.

A fourth limitation is that the same faces were presented several times, which might lead to familiarity with the presented clips. It is important to note, however, that we did not find an effect of the repeated viewing of the clips on either accuracy or valence intensity judgments when comparing responses to the first and second halves of the task. Moreover, because we jittered the progression of emotion intensity in each sequence, participants never saw exactly the same dynamic clip twice. Finally, because the MDD participants in our study reported slightly higher STAI scores than did the SP participants, it is possible that the MDD group was characterized by greater impairment than was the SP group. It is important to point out, however, that this potential group difference in impairment does not explain the significant interaction of group and facial expression obtained in this study.

In conclusion, the present results indicate that MDD and SP participants exhibit specific biases in their identification of emotional facial expressions. As we described earlier, facial expressions of emotion provide important information that guides our behavior in social interactions. Individuals use facial expressions of others as cues to regulate their own behavior, as indicators of success during attempts to regulate the emotions of others, and as important reflections of the attitudes of others. For individuals diagnosed with SP, their demonstrated tendency to correctly identify or label faces expressing even a low intensity of emotion as angry might thus contribute to their anxiety and lead to avoidance behavior in interpersonal situations (Clark & Wells, 1995; Juster & Heimberg, 1998). Similarly, for depressed persons, the demonstrated delay in correctly identifying or labeling faces as happy might lead to decreased perceptions of social reinforcement and positive attitudes in their communication partners, in turn impair-

ing their regulation of social behavior (Hess et al., 1988; Salovey & Mayer, 1990). In particular, this bias might lead depressed persons, relative to nondepressed individuals, to judge social interactions as less positive, to perceive their interaction partners as less well-meaning, and to appraise social situations as less positive (Fisher-Beckfield & McFall, 1982; Gotlib & Asarnow, 1979). In general, therefore, the relative inability of depressed individuals to accurately identify or label and respond to subtle changes in positive facial expressions displayed by their interaction partners may contribute to their widely documented interpersonal difficulties and impairments in various aspects of social functioning (e.g., Gotlib & Hammen, 1992).

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Received March 8, 2005
Revision received June 1, 2006
Accepted June 5, 2006 ■