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How Do Depressed and Healthy Adults Interpret Nuanced Facial Expressions?

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Abstract

This study investigates the discrimination accuracy of emotional stimuli in subjects with major depression compared with healthy controls using photographs of facial expressions of varying emotional intensities. The sample included 88 unmedicated male and female subjects, aged 18–56 years, with major depressive disorder ($n = 44$) or no psychiatric illness ($n = 44$), who judged the emotion of 200 facial pictures displaying an expression between 10% (90% neutral) and 80% (nuanced) emotion. Stimuli were presented in 10% increments to generate a range of intensities, each presented for a 500-ms duration. Compared with healthy volunteers, depressed subjects showed very good recognition accuracy for sad faces but impaired recognition accuracy for other emotions (e.g., harsh, surprise, and sad expressions) of subtle emotional intensity. Recognition accuracy improved for both groups as a function of increased intensity on all emotions. Finally, as depressive symptoms increased, recognition accuracy increased for sad faces, but decreased for surprised faces. Moreover, depressed subjects showed an impaired ability to accurately identify subtle facial expressions, indicating that depressive symptoms influence accuracy of emotional recognition.

Keywords

recognition accuracy; facial expressions; information processing; major depression

Accurate recognition of facial expressions is a critical skill for adaptive social cognition, particularly given the extent to which human facial expressions convey intention and emotion (Ekman & Friesen, 1976). An impaired ability to recognize emotional stimuli may lead to misinterpretation of emotional cues that would normally guide behavior, thereby generating changes in mood and functioning. Inaccurate recognition may also represent

important preclinical deficits, specifically, observing communication of social stimuli that convey emotions. Though no task that tests recognition of facial expression can be distilled to one single process, nor isolated into specific emotional perceptual processes, accuracy recognition serves as a window for identifying such processes, and its role in potentiating symptoms and behavioral disturbance.

Though depression clearly evokes pervasive changes in mood, behavior, and functioning, the extent to which it is associated with an interpretation bias toward negative stimuli is uneven across studies (cf. Gotlib, Krasnoperova, Yue, & Joorman, 2004; Joorman, Teachman, & Gotlib, 2009). On the one hand, clinically depressed subjects show an impaired ability to accurately recognize facial expressions conveying happiness (Jaeger, Borod, & Peselow, 1987); sadness (Surguladze et al., 2004); interest (Rubinow & Post, 1992); and fear, anger, surprise, and disgust (Persad & Polivy, 1993). In this regard, reduced “recognition accuracy” may be exclusively linked with a specific emotion: Depressed patients in remission, for example, show significant inaccurate recognition of sad and happy facial expressions, though no errors when recognizing neutral faces (Mikhailova, Vladimirova, Iznak, Tsusulkovskaya, & Sushko, 1996).

And yet, other studies suggest an enhanced processing of negative content by individuals who are currently depressed (Lawson, MacLeod, & Hammond, 2002). For example, negative mood is found to be associated with selective attention to negative stimuli and greater accessibility to negative memories (Mathews & MacLeod, 2005). Such responses may reflect preferential processing of mood-congruent stimuli—such as a depressed person attending to sad stimuli— or an impairment of attention to positive stimuli (Crawford & Cacioppo, 2002), for example, impaired recognition of positive facial expressions (Murphy et al., 1999; Suslow, Junghanns, & Arolt, 2001).

Subtle emotional expressions convey less information, requiring greater attention by the perceiver to accurately determine its valence and relevance. Differentiating mild expressions of sadness from disgust, for example, may require greater vigilance from the perceiver. Data suggest that attention to specific facial features assists individuals to identify emotional expression (Whalen et al., 2001). Depressed subjects were able to recognize emotional expressions but showed difficulty in accurately identifying facial expressions of milder emotional intensity (Feinberg, Rifkin, Schaffer, & Walker, 1986; Young, Rowland, Calder, & Etcoff, 1997). Potentially, this may reflect deficits of attentional focus on key parts of the face, deficits in emotional perceptual processing of valence that produce recognition errors, or an attenuated response to arousal conveyed by emotional stimuli because of symptoms of depression. Depressed subjects view emotional content as less valent and less arousing compared with healthy controls (Gur, Erwin, Gur, & Zwi, 1992; Hale, 1998), though characterization of behavioral responses associated with emotional perceptual processes of healthy and depressed adults when they both review a common set of social stimuli (facial expression) of varied emotional valence (i.e., negative vs. positive) and of “subtle emotional intensity” has yet to be characterized.

In the present study, we investigated the discrimination accuracy of emotional stimuli of unmedicated subjects diagnosed with major depression compared with healthy controls using Ekman and Friesen’s (1976; see also Gollan, Payne, McCloskey, & Coccaro, 2008) standardized set of facial expressions. We examined the extent to which there are group differences in recognition accuracy of positive and negative facial expressions. The stimuli set include six basic emotions (including happiness, surprise, disgust, sadness, fear, and anger), using both male and female faces who were showing very little emotion (10% emotion, 90% neutral) to very strong emotions (80% of the emotion, 20% neutral expression). These morphed expressions are standardized. We hypothesized that depressed

individuals would demonstrate increased recognition accuracy of relevant facial expressions (i.e., negative/sad emotions) even when the stimuli showed attenuated emotional intensity. Also, we hypothesized that symptom severity would be positively correlated with accuracy in identifying sad facial expressions among depressed subjects.

Method

Subjects

The sample included 88 subjects, 33 men and 55 women (mean age = 29.51; $SD = 9.96$), recruited through the University of Chicago, its medical center, and surrounding Chicago neighborhoods. Subjects were predominately Caucasian (50%) or African American (39%) and were relatively well educated (90% had some college education). All subjects were unmedicated. The depressed sample ($n = 44$; 19 men, 25 women) were diagnosed with current unipolar major depression using the Structured Clinical Interview for the DSM-IV, outpatient version (SCID; First, Spitzer, Gibbon, & Williams, 1995), with concurrent Beck Depression Inventory II (BDI-II; Beck, Steer, & Brown, 1996) scores of ≥ 20 , and Hamilton Rating Scale for Depression-17 item (HRSD¹⁷; Hamilton, 1967) scores of ≥ 13 . Depressed subjects showed moderate to severe depressive symptoms with HRSD¹⁷ scores ranging from 13 to 31 ($M = 19.52$, $SD = 4.39$). The average age of onset for the first depressive episode for these subjects was 17.10 years ($SD = 7.40$), with subjects averaging 1.67 ($SD = 0.48$) lifetime depressive episodes.

Healthy subjects ($n = 44$; 14 men, 30 women) had no lifetime or current diagnosis of *DSM-IV* Axis I or Axis II conditions, with BDI-II scores < 5 . All subjects, aged 18–56 years, passed an onsite urine toxicology screen. General exclusion criteria for both groups were as follows: diagnoses of lifetime or current bipolar disorder; psychosis; organic brain disorder; primary diagnosis of another Axis I or Axis II disorder; substance abuse/dependence in the last 6 months; antisocial, borderline, or schizotypal personality disorder; imminent suicide risk; current use of medications; general medical condition associated with depression (e.g., hypothyroidism); or pregnancy.

Procedure

Prospective volunteers contacted the project coordinator, who obtained verbal consent to conduct an eligibility screen by phone. Once passed, volunteers came to the laboratory to provide informed consent and complete the clinical interview as well as self-reports and the computer-administered affective information-processing task.

Measures

Independent evaluators trained in the conduct of interview protocols and other assessment devices conducted all of the evaluations in this study. These interviewers were blind to screening information throughout the study and were supervised weekly to monitor blinding and prevent rater drift. Evaluators were clinical psychology doctoral graduate students, all of whom had completed their master's thesis, watched the SCID training tapes (Spitzer, Williams, Gibbon, & First, 1989), observed expert evaluators conducting SCIDs, corated these interviews, and then, for reliability testing, completed reliability testing by reviewing three common SCID interviews. Reliability data are described in the next paragraph.

The SCID (First et al., 1995) is a semistructured interview reviewing lifetime and current *DSM-IV* Axis I psychiatric disorders, assisting with the determination of inclusion or exclusion criteria and psychiatric diagnoses. Composed of modules with questions carefully designed to map onto each specific *DSM-IV* diagnostic criterion, the SCID also collects data on the number and duration of each major depressive episode, symptom profile,

severity, and the number and duration of full remission intervals. The SCID has adequate interrater reliability, with kappa values for modules reported to be between 0.70 and 1.00 (First et al., 1995). Our own reliability checks yielded kappa coefficients of 0.83 for the mood and 0.93 for the anxiety modules of the SCID.

The *Structured Interview for DSM-IV Personality Disorders* (SIDP; Pfohl, Blum, & Zimmerman, 1995) is a clinical interview that measures Axis II domains of functioning (work style, close relationships, social relations, emotions, self-perception) to assess consistent patterns of behavior and cognition. Specifically, all subjects were screened with this measure and did not meet criteria for a specific personality disorder. Estimates of interrater reliability for the SIDP are reported to be adequate-to-strong, with intra-class correlation coefficients (ICCs) as high as 0.88 – 0.99 (Damen, De Jong, & Van der Kroft, 2004).

The BDI-II (Beck et al., 1996) is a 21-item self-report measure designed to evaluate the severity of depressive symptoms in the past 2 weeks. Each item offers a series of self-evaluative statements ranging from 0 (*no presence of the symptom*) to 3 (*severe form of the symptom*). The BDI-II has demonstrated reliability ($\alpha = .91$) and validity (Beck et al., 1996).

The *HDRS*¹⁷ (Hamilton, 1967) is a 17-item, clinician-rated measure of depression designed to measure severity of symptoms experienced in the past week. Interrater reliability coefficients have been reported as $\alpha = .84$ (Schwab, Bialow, Clemmons, & Holzer, 1967), and scores on the BDI-II are highly correlated with those on the HDRS¹⁷ ($r = .71$), demonstrating convergent validity (Beck et al., 1996).

The Beck Anxiety Scale (Beck & Steer, 1988) is a 21-item self-report inventory measuring the severity of anxiety symptoms including physiologic hyperarousal and cognitive anxiety.

The *Pictures of Morph Facial Affect* (Ekman & Friesen, 1976) is a computer-administered task designed to measure perceptual processing of facial emotions using standardized affectively evocative photographs of facial expressions portraying degrees of emotional intensity. This task features six basic emotions (happiness, surprise, disgust, sadness, fear, anger), morphed to produce an expression between 10% (90% neutral) and 80% of the emotion. Four sets of emotional intensity conditions reflecting specific gradients of emotional intensity were generated (i.e., 10%–20%, 30%–40%, 50%–60%, 70%–80%). Ten-percent increments were used, as opposed to 20% increments, to generate a more challenging task.

For each intensity gradient (eight total) of each emotional expression (six total), subjects were shown four adult face pictures (two male and two female), for a total of 192 facial pictures. In addition, subjects were shown eight pure (100%) neutral facial pictures (four male and four female) interspersed among the other pictures. In all, subjects saw 200 facial pictures. Each face was presented for 500 ms, after which subjects identified the emotional expression by pressing one of six colored keyboard keys that listed each of the six emotions (i.e., happiness, surprise, disgust, sadness, fear, anger). In keeping with the research, the fearful faces were included in the “harsh” faces category because fearful faces were subjectively rated to be “very critical/harsh” by both subjects with clinical and healthy volunteers (Stein, Goldin, Sareen, Zorrilla, & Brown, 2002), and facial displays of fear are potent signals of threat and are linked with amygdala activation (Adolphs, 2002; Gamer & Büschel, 2009). Additionally, facial expressions representing disgust in the harsh category were included on the basis of research that has demonstrated activation of a network of brain regions, including the amygdala, when subjects are exposed to contempt and disgust facial expressions (Aleman & Swart, 2008). Similarly, Whalen and colleagues (2001) demonstrated amygdala activation among subjects who viewed angry facial expression. On

the basis of research that has shown amygdala activation in the presence of fear, angry, and disgust facial expressions, these emotions were examined under one “harsh emotional expression” category. The proportion of correctly identified harsh faces were computed by calculating the average correct identification of anger, disgust, and fear expressions.

Analyses

Analyses conducted were two-tailed at the .05 level of significance. Significant within-subjects effects were tested using the Greenhouse–Geisser correction when violations of sphericity were detected. All uncorrected significant findings remained significant after correction; therefore, the degrees of freedom from the uncorrected analyses are reported. Post hoc mean comparisons were performed using Bonferroni corrected (.05/number of contrasts) *t* tests for within-subjects factors (Keppel, 1991). Significant interactions were probed using simple effects analyses as specified by Tabachnick and Fidell (2001). Effect sizes were provided using generalized eta squared (η^2) for analyses of variance and Cohen's *d* (*d*) for *t* tests (Cohen, 1988).

Results

Table 1 shows that the depressed and control groups did not differ with respect to age ($p = .14$), gender ($p = .27$), racial composition ($p = .60$), or number of children ($p = .58$). Marital status was significantly different between the two groups ($p < .05$). Post hoc 2×2 chi-squares showed that the control group had a greater proportion of married relative to divorced/separated individuals than did the depressed group ($p = .007$). Control subjects were also more likely to be college graduates ($p < .001$). Not surprisingly, depressed subjects reported more depressive symptoms, anxiety, and psychosocial impairment than their control subject counterparts (all $p < .001$). Correlation analyses revealed a significant relationship between education (college education vs. none) and accuracy of interpretation for only two of the facial expression categories, including sad, $r(88) = -.29$, $p < .01$, and happy faces, $r(88) = .38$, $p < .001$.

Group Effect on Emotion-Processing Accuracy

A 2 (group) $\times 4$ (emotion type) $\times 4$ (emotion intensity) mixed design analysis of variance (ANOVA) on accuracy scores (see Table 2 for means) revealed a significant Group $\times$ Emotion interaction, $F(3, 258) = 4.51$, $p = .004$, $\eta^2 = .05$. Simple-group effects for each emotion type showed that depressed subjects were more accurate in identifying sad faces than were controls ($p < .05$). There was also a nonsignificant trend for control subjects to be more accurate in identifying surprised facial expressions than depressed subjects ($p < .07$).

There was a main effect of emotion, $F(3, 258) = 145.74$, $p < .001$, $\eta^2 = .62$. Specifically, there was reduced accuracy for harsh and surprise expressions, whereas there was a main group effect for sad expressions. There was also a main effect of intensity, $F(3, 258) = 1095.57$, $p < .001$, $\eta^2 = .93$. These main effects were limited by an Intensity $\times$ Emotion interaction, $F(9, 774) = 83.87$, $p < .001$, $\eta^2 = .49$. Simple effects revealed a highly significant effect of intensity for happy, $F(3, 774) = 264.88$, $p < .001$; surprised, $F(3, 774) = 260.00$, $p < .001$; and harsh, $F(3, 774) = 125.33$, $p < .001$, expressions. The simple effect of intensity for sad faces approached significance, $F(3, 774) = 3.04$, $p = .05$. Post hoc analyses showed that accuracy for happy, surprise, and harsh expressions significantly improved with each increase in intensity (all $ps < .05$). Accuracy for sad faces did not differ as a function of intensity (all $ps > .05$). No other main effects or interactions were significant (all $ps > .10$).

Because an a priori hypothesis was that depressed subjects would be more accurate than controls in identifying sad faces, we compared the depressed and control groups at lower

(10%–40%) and higher (50%–80%) levels of sad intensity. The Group $\times$ Intensity interaction for sad faces was not significant, $F(1, 86) = 0.89$, $p = .35$, $\eta^2 = .01$. However, exploratory analyses (see Figure 1) showed that depressed subjects were better than control subjects at recognizing sad faces at lower intensities, $t(86) = 2.03$, $p < .05$, $d = 0.44$, whereas the two groups did not significantly differ for higher intensity faces, $t(86) = 1.23$, $p = .22$, $d = 0.26$. In other words, depressed individuals exhibit higher rates of recognition accuracy of low-intensity sad facial stimuli (10%–40% sadness intensity) when compared with their healthy counterparts. Conversely, group differences in recognition accuracy of more intensely sad facial expressions (50%–80% sadness intensity) are less salient. As compared with healthy subjects, depressed subjects showed significantly greater recognition accuracy for facial expressions of sadness at lower ranges of emotional intensity, with accuracy rates of 61% and 63%, respectively.

Group Effect on Misidentification of Faces

We used a series of t tests to examine the effect of group on proportion of emotional facial expressions misidentified as sad, happy, surprise, or harsh (e.g., surprise expression identified as harsh). Results in Figure 1 showed that depressed subjects misidentified emotional facial expressions as sad more often than controls, $t(86) = 2.25$, $p < .05$, $d = 0.49$. Depressed and control groups did not differ in their tendency to misidentify emotional faces as happy, $t(86) = 1.58$, $p = .12$, $d = 0.34$; surprise, $t(86) = 0.44$, $p = .66$, $d = 0.09$; or harsh, $t(86) = .56$, $p = .58$, $d = 0.13$.

Effects of Depression Symptom Severity on Facial Emotion Processing

Within the depressed group, we examined the relationship between accurate identification of facial emotion and severity of depressive symptoms (HRSD¹⁷ score). Depressive severity was marginally positively correlated with identification of sad faces, $r(44) = .29$, $p = .05$. At a trend level, depressive severity was negatively correlated with identification of surprise faces, $r(44) = -.25$, $p = .09$. Depressive symptoms were unrelated to accurately identifying happy, $r(44) = -.06$, $p = .67$, or harsh, $r(44) = -.07$, $p = .62$, faces. Despite the association between depression severity and accuracy identifying sad faces, depression severity was not associated with the tendency to identify neutral faces as sad, $r(44) = .05$, $p = .72$, or the tendency to misidentify faces as sad, $r(44) = .10$, $p = .51$. Depression severity was similarly uncorrelated to neutral faces or misidentification responses of happy and harsh (all r s $> .10$, $p > .58$). However, depression severity was inversely correlated with identification of neutral faces as surprise, $r(44) = -.33$, $p = .03$.

We also examined group differences in recognition accuracy of facial expressions while controlling for anxiety levels using Beck Anxiety Inventory (Beck & Steer, 1993) scores as a covariate. Findings from this analysis of covariance (ANCOVA) analysis suggested that there were no group differences between healthy and depressed individuals in accurately recognizing sad, happy, and harsh facial stimuli.¹ Conversely, there was a significant main effect of group and anxiety levels in accurately recognizing surprise facial stimuli. We also examined group differences in anxiety levels using BAI estimates and found statistically significant group mean differences in BAI estimates between depressed and healthy subjects.

¹We conducted separate ANCOVA analyses to assess for group differences in recognition accuracy for each of the emotions (anger, disgust, fear) comprising the harsh category while controlling for anxiety levels. Findings revealed no group effect in recognition accuracy for each of these emotions.

Discussion

In the present study, we investigated the effect of major depression on discrimination accuracy of emotional stimuli of varying emotional intensity. We found group differences for accuracy of recognition of sad facial expressions, despite no group differences for other emotions classified as negative (harsh) or positive (surprise, happy). Consistent with our hypothesis, depressed subjects were more accurate in identifying sad facial expressions than healthy volunteers. This finding may be interpreted as evidence of an emotion-specific magnification of sad stimuli for depressed individuals. Although healthy and depressed subjects demonstrate different perceptual processing of sad facial expressions, this perceptual difference does not extend to identification of other types of facial expressions. This finding is consistent with research suggesting that depressed individuals may be primed to better identify sad facial expressions given the congruency of the emotional information with depressive disorder (Rusting, 1998), cognitive specificity of disorders in terms of selectively processing depressive information (Ingram, Kendall, Smith, Donnell, & Ronan, 1987), and the tendency to perceive sad stimuli as more important (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001).

All subjects showed reduced recognition accuracy for harsh and surprise facial expressions. These emotions are harder to identify than others (e.g., identifying sad is harder than happy), and there appears to be a similar attenuation of recognition accuracy for healthy and depressed individuals when intensity of the valence is modulated. These findings are consistent with a set of studies showing impaired discrimination accuracy for specific emotions (Mikhailova et al., 1996; Murphy et al., 1999; Suslow et al., 2001). Likewise, our results indicate that both healthy and depressed individuals have normative difficulties with identifying categories of emotion because they are naturally difficult to evaluate. If depressed individuals show no differences in identifying categories of emotions compared with healthy subjects, we have learned that depressed individuals identify presentation of facial expressions normatively.

Our data show a main effect for intensity, in which all subjects showed poor recognition accuracy of facial expressions conveying low emotional intensity. Interestingly, as shown in Table 2 for all subjects, recognition accuracy increased as a function of the increase in emotional intensity in all categories (happy, surprise, and harsh) except sad. All subjects showed difficulties in identifying facial expressions conveying subtle emotional intensities (representing 10%–20% intensity of the emotional expression) compared with moderate emotional intensities (30%–40%, 50%–60%) and higher emotional intensities (70%–80%). This suggests that accuracy of recognition of facial expression decreases as the saliency of the emotional stimuli is reduced. We found evidence, however, of differing trends in recognition accuracy for sad faces between depressed and healthy subjects. As compared with healthy subjects, depressed subjects showed significantly greater recognition accuracy for facial expressions of sadness at lower ranges of emotional intensity (10%–40%), with minimal change in accuracy of recognition as emotional intensity increased (50%–80%), with accuracy rates of 61% and 63%, respectively. This supports our hypothesis that the response bias among depressed subjects for sad facial expressions would be more pronounced at the lower ranges of emotional intensity. Absence of a monotonic increase of accuracy suggests that depressed individuals convey sensitivity to sad stimuli even when presented at low, practically imperceptible, levels. Sensitivity to subtle facial expressions of sadness may be explained by a negativity bias toward neutral information as observed by other researchers (Baumeister et al., 2001), albeit not all (Feinberg et al., 1986), suggesting that research on intergroup and intragroup variability of recognition accuracy of emotional stimuli across varying intensity levels for depressed individuals is needed. These data begin

to clarify the nature of the relationship between emotional perceptual processes of social stimuli at low, mild, and high emotional intensities of depressed subjects.

Further analyses revealed that depressed subjects misidentified other emotional facial expressions as sad more often than control subjects. Consistent with previous research, this suggests misclassification of other emotional faces as sad (Persad & Polivy, 1993). Finally, severity of depressive symptoms was marginally positively correlated with recognition accuracy of sad facial expressions, though unrelated to recognition accuracy in identifying happy or harsh facial expressions. Depression severity was not associated with the tendency to *misidentify* other emotional faces as sad. Also, depression severity was similarly unrelated to misidentification of responses of happy and harsh. Depression severity, however, was inversely correlated with identification of neutral faces as surprise. These findings suggest that symptom severity does not strongly influence recognition accuracy of facial stimuli among depressed individuals.

We focused solely on individuals who presented with *DSM-IV* major depressive disorder and with a moderate severity of symptoms (BDI-II enrollment criteria). We used Ekman's prototypical facial expressions (Ekman & Friesen, 1976) to evoke behavioral responses, as opposed to schematic faces (Suslow et al., 2001) and categories of emotion (Surguladze et al., 2004), which are less affectively loaded. Also, we outlined a standard intensity and duration of stimuli sufficient to evoke behavioral ratings. Finally, we excluded subjects using medications, based on the data that psychotropic medications influence accuracy of recognition (Harmer, Grayson, & Goodwin, 2002; Surguladze et al., 2004; Yoon, Joorman, & Gotlib, 2008). Additional strengths of the study included our use of standardized measurements of clinical status (SCID, HRSD¹⁷), a computer-administered task measuring interpretative bias, and urinalysis for all subjects before testing to ensure that performance on the morphed faces task was unhampered by potential effects of medication or substance use. Such approaches may be useful in parsing out to what extent irregularities in recognition accuracy are directly linked with symptom set and reflect state or trait characteristics that potentially change with time and treatment. In summary, results in subjects with depression indicate gross recognition accuracy across all emotion, expression-specific deficits, and discrete impairment in recognition of subtle expressions except for sad facial expressions.

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Figure 1.
Proportion of faces misidentified as sad, happy, surprised, or harsh as a function of group. *
 $p < .05$.

Table 1

Demographic and Clinical Variables as a Function of Diagnostic Group (N = 88)

Variable	Control (n = 44)	Depressed (n = 44)	<i>t/</i> ²
Mean age (SD)	31.07 (8.55)	27.95 (11.08)	3.14 ^a
Gender (%)			1.21 ^a
Male	14 (32%)	19 (43%)	
Female	30 (68%)	25 (57%)	
Race (%)			1.88 ^a
Caucasian	21 (48%)	23 (52%)	
African American	16 (36%)	18 (41%)	
Asian	4 (9%)	2 (5%)	
Other	3 (7%)	1 (2%)	
Marital status (%)			7.40 ^{a*}
Single	33 (75%)	35 (80%)	
Married	10 (23%)	3 (7%)	
Separated/divorced	1 (2%)	6 (14%)	
Children (SD)	0.48 (.98)	0.61 (1.26)	0.57 ^a
Education (%)			14.85 ^{a***}
Not college grad	15 (31%)	33 (75%)	
College grad	29 (66%)	11 (25%)	
Mean BDI-II (SD)	1.84 (3.53)	30.20 (7.87)	21.82 ^{a***}
Mean BAI (SD)	23.05 (4.33)	33.30 (14.91)	4.09 ^{b***}
Mean GAF score (SD)	82.64 (4.89)	30.64 (32.068)	10.63 ^{a***}

Note. BDI-II = Beck Depression Inventory, second edition; BAI = Beck Anxiety Inventory; GAF = Global Assessment of Functioning.

^a *df* = 86.

^b *df* = 80.

* *p* < .05.

*** *p* < .001.

Table 2Mean Accuracy (and Standard Deviations) as a Function of Emotion $\times$ Intensity $\times$ Group

Variable	Depressed ($n = 44$)	Control ($n = 44$)	Total ($N = 88$)
Sad			
10–20%	.58 (.25)	.50 (.26)	.54 (.26)
30–40%	.64 (.21)	.53 (.22)	.59 (.23)
50–60%	.63 (.20)	.58 (.21)	.61 (.21)
70–80%	.64 (.19)	.59 (.21)	.62 (.21)
Overall ^a	.62 (.16)	.55 (.17)	.59 (.19)
Harsh			
10–20%	.11 (.07)	.12 (.06)	.11 (.07)
30–40%	.26 (.17)	.28 (.12)	.27 (.12)
50–60%	.48 (.13)	.51 (.15)	.49 (.16)
70–80%	.62 (.16)	.62 (.16)	.62 (.16)
Overall	.36 (.09)	.38 (.10)	.37 (.09)
Surprise ^b			
10–20%	.05 (.08)	.03 (.06)	.04 (.07)
30–40%	.19 (.17)	.27 (.17)	.23 (.17)
50–60%	.65 (.21)	.71 (.23)	.68 (.22)
70–80%	.78 (.16)	.83 (.20)	.81 (.18)
Overall	.42 (.09)	.46 (.12)	.44 (.11)
Happy ^b			
10–20%	.26 (.22)	.36 (.28)	.31 (.26)
30–40%	.63 (.21)	.66 (.24)	.65 (.22)
50–60%	.89 (.17)	.90 (.10)	.90 (.14)
70–80%	.98 (.05)	.99 (.02)	.99 (.04)
Overall	.69 (.12)	.73 (.14)	.71 (.13)

^aSimple effect of control versus depressed for sad faces ($p < .05$).^bSimple effect of intensity for surprise and happy faces ($p < .05$).