Recognition of Facial Expressions of Emotion: The Effects of Anxiety, Depression, and Fear of Negative Evaluation

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Abstract

Anxiety is a debilitating disorder that can cause those suffering from it social dysfunction. This research focuses on how anxiety is associated with recognition of emotion on faces, as that may be a contributing factor to the social woes of those suffering from anxiety, both general and social. However, depression and fear of negative evaluation may also be associated with difficulty in recognizing emotions. In this study, 48 college students were presented with 60 facial expressions of emotion for either 500ms or 2s and asked to identify the emotion that was portrayed by choosing from a list of 6 possible choices: anger, disgust, fear, happiness, neutral, and sadness. Participants then completed measures of depressive and anxious (general and social) symptoms and fear of negative evaluation. Partial correlations were used to analyze the data. It was found that when depression and sex were controlled for, higher fear of negative evaluation and high social anxiety scores were correlated with better accuracy in identifying happy facial expressions. Additionally, higher general anxiety scores were marginally correlated with lower accuracy in identifying facial expressions of disgust. The correlations between general and social anxiety and recognition of expressions of disgust and happiness approached marginal significance or were marginally significant, respectively, when depression, fear of negative evaluation, and sex were controlled.

Keywords: anxiety, depression, fear of negative evaluation, social anxiety, emotion recognition
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Anxiety disorders can be extremely debilitating. Sudhir, Sharma, Mariamma, and Subbakrishna (2012) found that patients suffering from anxiety disorders have significantly lower qualities of life than people without anxiety disorders; this lower quality was evident throughout physical, social, psychological, and environmental aspects of life. Moreover, those suffering from generalized anxiety disorder have reported more impairment at work, lower self-esteem, and lower satisfaction of goals and values than those not suffering from the disorder (Henning, Turk, Mennin, Fresco, & Haimberg, 2007). Anxiety, specifically social anxiety, is associated with paranoid symptoms such as thinking that others regard you as dumb (Schutters et al., 2012). These types of negative cognitions could be what cause anxiety to be so debilitating.

In order to treat anxiety, it would be helpful to know what factors perpetuate or inhibit the paranoid cognitions that make anxiety so debilitating. One factor that could affect such cognitions is how one interprets social cues, including emotional expressions on the faces of others. If anxious people interpret facial expressions negatively, then paranoid cognitions are confirmed and likely increased, but if facial expressions are interpreted positively or as neutral, the paranoid cognitions would hopefully decrease. A great deal of research has been done in the area of recognizing emotions with regards to general anxiety and social anxiety. However, mixed results have limited the utility of prior studies in understanding the exact relation between anxiety and facial recognition of emotion. Both general and social anxiety have been found to affect the recognition of facial expressions of emotion in multiple ways, including decreased accuracy (Montagne et al., 2006), increased accuracy (Surcinelli, Codispoti, Montebarooci, Rossi, & Baldara, 2006), and negative response biases (Bell et al., 2011; Bouhuys, Geerts, & Mersch, 1997).
A negative response bias occurs when one type of participant is more likely to classify neutral expressions as negative – angry, sad, etc. – than another. People with social phobia have been found to have a negative response bias when identifying facial expressions of emotion of various intensities when presented for 500ms (Bell et al., 2011). However, they were not different overall from the control group in terms of accuracy (Bell et al., 2011). Bell et al. (2011) found that when participants who met the criteria for social phobia in the *Diagnostic and Statistical Manual of Mental Disorders 4th edition* (DSM-IV; American Psychiatric Association, 1994) misclassified facial expressions of emotion, they were more likely to misclassify expressions as angry; however, they did not misclassify expressions more often than the control group. Despite a lack of difference in accuracy, this finding is important because a negative response bias could have a negative impact on the course of one’s anxiety. For example, this negative response bias has also been found in experimental settings beyond facial recognition tasks. Those with high social anxiety felt that a person they were told was interacting with them live over a video feed had a lower acceptance of them, when in fact this was a prerecorded video (Pozo, Carver, Weflens, & Scheir, 1991).

On the other hand, research by Montagne et al. (2006) found that people diagnosed with social anxiety disorder were less sensitive to negative emotions than the control group. In Montagne et al.’s experiment, the six emotions used were: happiness, sadness, surprise, anger, disgust, and fear. Ekman (1972) determined that these six emotions have universal facial expressions. The emotions were then grouped into positive (happy and surprise) and negative emotions (sadness, anger, disgust, and fear). Each expression was morphed with a neutral expression from the same actor to produce nine levels of emotional intensity (20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100%). The faces were then shown in succession to one another to produce video clips of a neutral expression to a progressively more intense expression; each video was 500ms to 2s long depending on the final intensity level. The experimenters found the sensitivity level of each participant by determining at which intensity level
consistently correct responses were given; having a lower sensitivity level meant that a higher intensity level was needed for consistently correct responses. Thus, Montagne et al. (2006) found that those with social anxiety disorder were less accurate at identifying low-intensity expressions of negative emotions.

De Ruiter and Brosschot (as cited in Montagne et al., 2006) explained results such as these in terms of a two-stage process in which patients with social anxiety tend to shift their attention away from a feared stimulus (i.e., a negative facial expression) after processing. This disengagement causes a person with social anxiety to not consciously recognize negative expressions (Montagne et al., 2006). On the other hand, it could also be that the inability to accurately recognize negative facial expressions is an underlying cause of social anxiety disorder; this deficit in recognition may lead to a lack of self-confidence or interactions that are inappropriate to the situation which may then lead to social anxiety (Montagne et al., 2006).

In terms of general anxiety, there also has been a large variability in the findings in terms of accuracy of identifying emotions. When facial expressions of emotion are shown for 10s, people with high trait anxiety have been found to be more accurate in recognizing fearful emotional expressions on faces (Surcinelli, et al., 2006). This increased accuracy was not due to a negative response bias; this means that people with high trait anxiety were actually more sensitive and therefore more likely to recognize negative expressions (Surcinelli, et al., 2006). However, it has also been found that when the faces are shown for an average of 2s there is no effect of trait anxiety on accuracy or speed of recognition of emotions on faces (Cooper, Rowe, & Penton-Voak, 2008). In addition, McClure, Pope, Hoberman, Pine, and Leibenluft (2003) found that young adolescents diagnosed with DSM-IV (1994) anxiety disorders were no more or less accurate at identifying facial expressions of emotion when presented for an unspecified period of time.

Due to inconsistent findings, it is still not clear exactly how anxiety (both general and social) influences the recognition of facial expressions of emotion. Despite all of these competing accounts of
anxiety’s effect on facial recognition of emotion, Demenescu, Kortekaas, DenBoer, and Aleman (2010) concluded in a recent meta-analysis that overall, anxiety has been shown to be associated with an impairment in recognizing facial expressions of emotion. However, it was noted that this is a difficult conclusion to make because of the variety of evidence pointing in different directions. One problem with this meta-analysis is that a combination of studies of clinical anxiety, such as social phobia, and studies of non-clinical anxiety, such as high-trait anxiety, were used in the analysis. This could affect the results because different types and severity levels of anxiety could affect recognition of emotions on faces differently. For example, one might expect that people with social anxiety, who are concerned about others’ negative reactions to them, are more sensitive (and perhaps inaccurate) when presented with negative or neutral facial expressions than are those with other types of anxiety, such as a specific phobia. Thus, making a general conclusion about the effects of anxiety on recognition of facial expression of emotion is difficult.

In addition to differing types of anxiety, two other potential factors to take into account in the relation between anxiety and emotion recognition are depression and personality. Anxiety disorders are highly comorbid with major depression (e.g., Pini et al., 1997; Regier, Rae, Narrow, Kaelber, & Schatzberg, 1998). Also, people within any class of disorder have a variety of different personality traits. If certain personality traits and mood disorders have been found to have an effect on the ability to recognize emotions on faces, then they could impact the relation between anxiety and facial recognition of emotion.

As with anxiety, the research on the effect of depression on recognition of facial expressions of emotions is not conclusive. Some research has found that those with depression are significantly less accurate in perceiving facial expressions of emotion than those without a mood disorder (Mikhailova, Vladimirov, Iznak, Tsusulkovskaya, & Sushko, 1996; Rubinow & Post, 1991). Other research indicates that depression is related to a tendency for a negative bias in recognition of emotions (Bouhuys, Geerts,
& Mersch, 1997). In addition to these two different findings, others have found that depression has no
effect on recognition of emotion on faces (Gaebel & Wölwer, 1992). These varying results mirror the
diverse findings regarding the relation between anxiety and facial recognition of emotion. Yet, it was
concluded in a recent meta-analysis that there is a moderate overall impairment of recognition of
emotions in faces (both positive and negative) associated with major depressive disorder (Demenescu et
al., 2010). Although it is not completely clear as to what depression’s effect is, it is apparent that
depression has some effect on recognition of emotions on faces.

Despite the high level of comorbidity between depression and anxiety, few studies to date have
controlled for and/or looked at level of depression when examining the impact of anxiety on recognition
of facial emotions. One such study that controlled for levels of depression found that more anxiety is
associated with a negative response bias to perceive negative emotion (Bouhuys et al., 1997). Montagne
et al. (2006), as discussed before, found that those with high social anxiety were less accurate at
identifying negative emotional facial expressions, and concluded that depression was not likely to be a
contributing factor because neither group had participants with clinical levels of depression. However,
while not clinically significant, depressive symptoms were higher in the social anxiety group than in the
control group, but level of depression was not controlled for in the analyses. Given that very few studies
have examined the impact of depression and anxiety on recognition of facial expressions, one purpose
of the present study was to further investigate the relationship between anxiety and facial recognition
after controlling for depression.

Personality characteristics have been shown to affect the recognition of facial expressions of
emotions in multiple ways. For example, more socially oriented females have been found to be better
at recognition of emotions on faces than females who were less socially oriented (Toner & Gates, 1985).
On the other hand, individuals with avoidant personality disorder are less likely to recognize fear in faces
(Rosenthal et al., 2011). In addition, a recent meta-analysis concluded that individuals with borderline
personality disorder (BPD) are overall less accurate in recognizing emotions, although with BPD there tends to be a negative response bias and therefore an increase in accuracy of recognition of negative emotions (Domes, Schulze, & Herpertz, 2009). Gardner, Qualter, Stylianou, and Robinson (2010) examined two different traits (effortful control and rejection sensitivity) that may affect the recognition errors related to BPD. They found that effortful control, combined with BPD, was helpful in predicting accuracy of recognizing negative emotions such as anger and that rejection sensitivity was not a helpful predictor in the recognition of neutral expressions.

One trait related to personality that would be important to take into account is fear of negative evaluation. This is because people who are concerned about being evaluated negatively by others may be more sensitive to social cues, such as facial expressions, that suggest an unfavorable evaluation. Winton, Clark, and Edelmann (1995) found that people with high fear of negative evaluation were more accurate at identifying negative facial expressions and poorer at identifying neutral expressions than were people with low social anxiety. This experiment used slides of negative and neutral emotions shown for 60ms. The negative emotions used were anger, sadness, disgust, contempt, and fear. The participants were instructed to rate each slide on a nine-point scale ranging from negative to positive. Winton et al. (1995) found that the response pattern for participants with high fear of negative evaluation was due to a negative response bias, as opposed to increased sensitivity to negative emotions. The subjects in the high fear of negative evaluation group also scored higher than the control group on social anxiety and depression, two other variables that have been shown to be related to accuracy of identifying facial expressions of emotion.

In addition to not controlling for these factors described above, previous studies have grouped participants into those with high anxiety and those with low anxiety, or those diagnosed with anxiety or not diagnosed. This study instead looked at college students on a continuum of anxiety, depression, and fear of negative evaluation instead of grouping them. Looking at these traits and disorders continuously
may show a relationship when grouping them into high and low may not. In addition, previous studies have had many methodological variances, such as different presentation times. In order to try to control for this, there were two sets of faces presented for different times in order to attempt to control for some of the changes in method.

Time of presentation is also an important part of the method to consider when taking into account the two-stage process of De Ruiter and Brosschot (1995) mentioned earlier. This process describes socially anxious participants when reacting to a feared stimulus: first, there is an attentional shift towards the stimulus, and second, the stimulus is avoided (as cited in Montagne et al., 2006). If the exposure time is too long, this shifts of attention away from an aversive stimulus, such as an angry or disgusted facial expression, may lead those with social anxiety to not consciously process the expression correctly, when in fact they correctly recognized the expression initially, albeit unconsciously.

Thus, the main purpose of this study was to examine if continuous measures of anxiety and social anxiety were correlated with the accuracy of recognizing facial expressions of emotion, especially negative emotions, while controlling for depression and fear of negative evaluation. Another aim of this study was to determine if time of presentation affected accuracy of recognizing facial expressions of emotion, specifically if a longer presentation time causes those with high social anxiety to less accurately identify negative expressions. The shorter presentation time was 500ms and the longer presentation time was 2s. Those times were used because three prior studies had used one or both of those presentation times (Bell et al., 2011; Cooper et al., 2008; Montagne et al., 2006).

Method

Participants

There were 48 participants in this study (12 males, 25%). Participants were students at Wittenberg University who were 18 to 22 years old ($M = 19.5; SD = 1.29$). There were 43 Caucasian (89.6%) and 5 African American (10.4%) participants. Thirty-five participants (73%) received extra credit
for a psychology course in return for participation in this study. Eight of the participants (16.7%) reported having been diagnosed with an anxiety disorder. Four of those participants were also diagnosed with a mood disorder and one was also diagnosed with a social anxiety disorder.

Stimuli

Each face was approximately 4 inches tall and presented for either 500ms or 2s. Faces of 60 white actors (30 male, 50%) were presented. Each actor portrayed either a neutral expression or one of five emotions: happiness, sadness, fear, disgust, and anger. The faces were collected from a database file of facial expressions that have been shown to accurately portray these emotions (Kanade, Cohn, & Tian, 2000). For the expressions of the five emotions, pictures were chosen that represented a partial expression of that emotion (approximately 50% intensity). This was done by choosing an image of the actors halfway through the process of making the expressions. Overall, 60 faces were shown to each participant.

There were two sets of faces, set A and set B, each with the same number of actors portraying each emotion. Half of the participants, group 1, viewed the faces in set A for 500ms and set B for 2s and the other half of the participants, group 2, viewed the faces in set A for 2s and set B for 500ms. Half of group 1 and half of group 2 viewed set A first, the other half of the groups viewed set B first. The variation in order was to control for any practice effects of labeling facial expressions.

Apparatus

The stimuli were presented on individual Windows computers with a mouse and full keyboard. The monitors were 20” measured diagonally. The background for the stimuli took up the whole screen. The program used to present the faces to the participants was SuperLab.

Procedure

The experiment began with participants arriving at a small computer lab in the university’s psychology building. After giving consent for participation in the experiment, each participant filled out a
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demographic form and was given written instructions of the procedure of the experiment (verbal clarification was also provided). Then, participants were logged into the SuperLab program using their participant number. The experiment began by clicking “Run.” The first two faces were sample trials in order to get participants acclimated to the speed of presentation. If participants had any questions after the two sample trials, they were told to ask the experimenter. Otherwise, they could continue on with the experiment. Overall, there were 10 faces presented that were representing each emotion and 10 representing a neutral expression.

First, the number of the trial (N) was presented for 1s. Then, a face was presented for 500ms or 2s depending on the trial. After the face disappeared, “Please respond to item N” appeared on the screen. At this time, participants had been instructed to circle a response on the answer sheet that they believed best represented which emotion had been portrayed by the face. If the actor was portraying a neutral expression, the participant was to circle “NEUTRAL.” If the actor was portraying an emotion, the participant was to circle the corresponding name (e.g., “SADNESS”). Once the participant had circled the emotion that they believed to be correct, they were to press the ‘n’ key to move to the next trial. After the key was pressed, the number of the next trial (N+1) was presented, and the experiment continued following this order until all of the trials were completed. The data sheet was collected after the completion of the last trial.

After the last trial was completed, participants were given four brief psychological assessments to assess their levels of depression, general anxiety, social anxiety, and fear of negative evaluation. The assessments were given on the same computer via Survey Monkey and were presented in a random order determined by Survey Monkey.

**Depression.** The Beck Depression Inventory Second Edition (BDI-II; Beck, Steer, & Brown, 1996) was utilized to assess each participant’s level of depression. The BDI-II is a 21-question assessment with each item requiring a response rated on a 4-point Likert scale (0-3) which differs slightly in wording for
each question. Each question addresses a different DSM-IV (APA, 1994) criterion for depression. For example, “Sadness”: 0 = I do not feel sad. 1 = I feel sad much of the time. 2 = I am sad all the time. 3 = I am so sad or unhappy that I can’t stand it. The BDI-II has been shown to be reliable in outpatient and nonclinical populations and has exhibited strong test-retest reliability over the course of one week (Arbisi, 2001). The BDI-II is highly correlated with the Hamilton Psychiatric Rating Scale for Depression-Revised in outpatient populations as well (Arbisi, 2001). For this experiment, the question which asked about suicidal thoughts or wishes was removed from the list of questions in order to not overly distress the participants. The internal consistency reliability of the 20-item version used in the present study was high, Cronbach’s $\alpha = .92$.

**Anxiety.** The Beck Anxiety Inventory (BAI; Beck & Steer, 1993) was used to assess the participants’ levels of general anxiety. The BAI is a 21-question assessment that asks respondents to indicate how much each symptom of anxiety (e.g. “Nervous,” “Fear of losing control,” “Heart pounding or racing”) has bothered them in the past week. The response was on a 4-point Likert scale (1-4) with 1 labeled *Not at all* and 4 labeled *Severely*. The BAI has demonstrated high internal consistency and has high test-retest reliability over the course of one week (Dowd, 1998). In the current sample, the internal consistency reliability was high as well, Cronbach’s $\alpha = .87$. One item on the scale had a low correlation with the total score (“Fear of dying,” $r = .05$), however this item was kept in the analysis because the BAI is an established scale and it didn’t have a strong impact on the internal consistency.

**Social anxiety.** The Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987) was used to assess the participants’ levels of social anxiety. The LSAS is a 24-item questionnaire in which participants are asked to rate their fear or anxiety and avoidance of particular social situations (e.g. eating in public places, working while being observed) within the past week on a 4-point Likert scale with, for fear or anxiety, 0 labeled *None* and 3 labeled *Severe*, and, for avoidance, 0 being *Never* (0%) and 3 being *Usually* (67-100%). Eleven of the items have to do with social interaction and the remaining 13 items are related to
performance situations. Prior research indicates the scores on the LSAS are internally consistent and demonstrate both convergent and discriminant validity (Heimberg et al., 1999). The self-report version of the LSAS was found to distinguish participants with social anxiety from nonanxious participants (Rytwinski et al., 2009). The LSAS demonstrated a high level of internal consistency reliability in the present sample, Cronbach’s $\alpha = .95$.

**Fear of negative evaluation.** A brief version of the Fear of Negative Evaluation Scale (Brief-FNE) was used to assess the participants’ levels of fear of negative evaluation (Leary, 1983). This brief version of the FNE Scale contains 12 items from the original 30-item FNE by Watson and Friend (as cited in Leary, 1983) that correlated at least .50 with the scale total. The original and Brief-FNE scales were highly correlated (Leary, 1983). The Brief-FNE is internally consistent and has high four-week test-retest reliability (Leary, 1983). Leary (1983) concluded that the Brief-FNE will serve research needs quite well in that it has the advantage of taking less time while not diverging from the results that the longer version would provide. The Brief-FNE had high internal consistency in this study, Cronbach’s $\alpha = .91$.

After completion of the assessments, participants were thanked and given a debriefing form. The experiment took approximately 30 minutes to complete.

**Results**

First, distributions and correlations of all the measures were examined. All variables, individual item responses, and total scores were normally distributed. While the total scores on the symptomology measures were normally distributed, they were sometimes different from the normal range of scores among college students. In the current study, the average score on the BDI-II was 15.35 ($SD = 10.48$), but the average score on the BDI-II for college students has been found to be 9.3 ($SD = 8.1$) (Whisman, Judd, Whiteford, & Gelhorn, 2012). The average score on the BAI in the current study was 34.06 ($SD = 9.05$), but the average score on the BAI for college students has been found to be 11.48 ($SD = 7.24$) (Armstrong & Khawaja, 2002). The average score on the Brief-FNE for the current sample ($M = 37.25, SD = 10.02$)
was very close to the average of the normative college student sample \((M = 35.7, SD = 8.1)\) (Leary, 1983). In the current study, the average LSAS score was 41.94 \((SD = 23.63)\), and the average score for college students is 34.7 \((SD = 20.4)\) (Russell & Shaw, 2006). As expected, the psychological measures were significantly correlated, but not highly enough that two measures would be considered as measuring the same construct (see Table 1). The BDI-II and LSAS were the most highly correlated, \(r = .65, p < .001\). The BAI and Brief-FNE had the lowest correlation, \(r = .33, p = .02\). The rest of the correlations fell between these two values. The accuracies of recognizing individual facial expressions of emotion, except happiness, were positively correlated with overall accuracy of recognizing facial expressions of emotion (see Table 2). None of the accuracies of recognizing individual facial expressions of emotion were significantly correlated with each other.

A paired samples t-test was run to determine if there was a difference in accuracy depending on the length of the presentation of the face. The number of faces presented for 500ms incorrectly labeled \((M = 5.54, SD = 2.23)\) was not significantly different from the number of incorrectly labeled faces presented for 2s \((M = 5.38, SD = 3.16)\), \(t = 0.35, p = .73\). Correlations between scores on the psychological measures and the difference in accuracy of faces presented for 500ms and faces presented for 2s were also examined. In order to do this, first the total number of faces presented for 2s that were missed was subtracted from the total number of faces presented for 500ms that were missed. The only significant correlation was with level of fear of negative evaluation, \(r = .37, p = .01\). Participants with greater fear of negative evaluation incorrectly labeled faces more often when they were presented for 500ms than when they were presented for 2s than did participants with less fear of negative evaluation.

Next, correlations were run to determine if there was a correlation between scores on the psychological measures and the difference in accuracy between lengths of presentation for individual emotions (see Table 3). Level of depression and the difference in accuracy between lengths of
presentation for sad expressions were negatively correlated, $r = -.31, p = .03$. Participants with higher levels of depression missed more expressions of sadness when they were presented for a longer period of time. Level of anxiety and difference in accuracy between lengths of presentation for expressions of disgust were positively correlated, $r = .24, p = .10$ (marginally significant). Participants with more anxiety incorrectly labeled expressions of disgust more often when the faces were presented for a shorter period of time. Fear of negative evaluation was correlated with difference in accuracy between lengths of presentation for happy ($r = .45, p = .001$) and neutral ($r = .30, p = .04$) expressions. Participants who were more fearful of negative evaluation were less accurate in labeling happy and neutral expressions when they were presented for a shorter period of time. Level of social anxiety was correlated with difference in accuracy between lengths of presentation for happiness, $r = .25, p = .08$ (marginally significant). Participants with higher levels of social anxiety made more errors in recognizing happy expressions when they were presented for a shorter period of time. The differences found in this analysis show that the time of exposure is important in regards to accuracy of recognizing certain facial expressions. While time is important, the following correlations and t-tests were run without regard to time in order to get a look at general accuracy for different groups and levels of symptomology.

The correlation between the total number of facial expressions wrongly identified and the Brief-FNE was approaching marginal significance ($r = -.23, p = .11$) and was not significantly correlated with any other psychological measures. Participants with greater fear of negative evaluation appeared to more accurately judge the facial expressions of emotion. The number of facial expressions of disgust that were wrongly identified was marginally significantly correlated with the BAI ($r = .26, p = .07$) and the number of facial expressions of fear that were wrongly identified was marginally significantly correlated with the Brief-FNE ($r = -.27, p = .06$). Participants with higher general anxiety less accurately judged the facial expressions of disgust and participants with greater fear of negative evaluation more accurately judged facial expressions of fear. The number of facial expressions of happiness that were wrongly
identified was significantly correlated with the Brief-FNE ($r = -.30, p = .04$) and the LSAS ($r = -.30, p = .04$). Participants with greater fear of negative evaluation and participants with higher social anxiety were more accurate at recognizing facial expressions of happiness. The rest of the correlations were not significant (see Table 4).

The significant correlations of happiness accuracy with fear of negative evaluation and social anxiety were interesting because very few expressions of happiness were misidentified. Therefore, this correlation may be the result of a single outlier. When looking at the distribution of scores, it was clear that an outlier might be causing this correlation (see Figure 1 & Figure 2). When the outlier was deleted, the correlation between expressions of happiness missed, fear of negative evaluation, and social anxiety was run again. The number of facial expressions of happiness that were wrongly identified was still significantly correlated with the LSAS ($r = -.30, p = .04$) but was now only marginally correlated with the Brief-FNE ($r = -.28, p = .06$). Since the outlier only slightly impacted the correlations, it was kept for the remaining analyses.

The significant correlations of level of fear of negative evaluation with overall accuracy and accuracy of expressions of fear could possibly be explained by a negative response bias; if the participants with high fear of negative evaluation were more prone to identify expressions as negative, they would be more likely to correctly label negative expressions. However, when a correlation was run with the number of neutral expressions identified as negative and the scores on the symptomology measures, so significant relationships were found, meaning that there was not a negative response bias (see Table 5).

Next, an independent samples t-test was run to examine sex differences. Males missed more facial expressions of disgust ($M = 3.75, SD = 2.42$) than did females ($M = 2.31, SD = 1.45$), $t = 2.50, p = .02$. Males also missed more fearful expressions ($M = 3.25, SD = 2.22$) than did females ($M = 1.75, SD = 1.84$). Overall, males incorrectly labeled more faces ($M = 14.17, SD = 5.13$) than did females ($M = 9.83, SD = 1.84$).
3.49), \( t = 3.30, p = .002 \). There was one sex difference in the symptomology measures; males scored significantly lower on the Brief-FNE \((M = 31.08, SD = 6.76)\) than did females \((M = 39.31, SD = 10.15), t = -2.61, p = .01; that is, males reported less fear of negative evaluation than did females. While those were the only significant sex differences found, men consistently missed more faces of each emotion than women, and therefore, in the partial correlations that followed, sex was always controlled.

A partial correlation was then run controlling for the BDI-II and sex. None of the nonsignificant correlations became significant and the Brief-FNE was no longer marginally correlated with the total number of faces incorrectly labeled \((r = -.14, p = .35)\) or the number of facial expressions of fear incorrectly labeled \((r = -.19, p = .22)\). When sex and level of depression were controlled for, participants with greater fear of negative evaluation no longer more accurately judged all facial expressions nor fearful expressions. However, the number of happy expressions incorrectly labeled was still significantly correlated with the Brief-FNE \((r = -.34, p = .02)\) and the LSAS \((r = -.37, p = .01)\), indicating that participants with greater fear of negative evaluation and participants with higher social anxiety still more accurately perceived expressions of happiness even when depression was controlled. The correlation of the BAI and number of expressions of disgust that were missed was now only approaching marginal significance, \( r = .23, p = .12 \). When sex and level of depression were controlled for, participants with higher social anxiety still less accurately identified facial expressions of disgust. This finding is consistent with the hypothesis that anxiety, particularly social anxiety, has an impact on recognizing negative facial expressions.

A second partial correlation was run controlling for the BDI-II, Brief-FNE, and sex. Again, none of the nonsignificant correlations became significant, and now the correlation between the BAI and the number of disgust expressions wrongly identified was only approaching marginal significance, \( r = .24, p = .11 \). When amount of fear of negative evaluation was controlled for in addition to sex and level of depression, participants with higher anxiety still less accurately identified facial expressions of disgust.
The LSAS was also still marginally negatively correlated with the number of expressions of happiness missed, $r = -.26, p = .08$. When amount of fear of negative evaluation was controlled for in addition to sex and level of depression, participants with higher social anxiety still more accurately labeled happy expressions.

**Discussion**

The findings of this study are consistent with the hypothesis that anxiety and social anxiety are correlated with the accuracy of recognizing facial expressions of emotion even while controlling for depression and fear of negative evaluation as well as sex. When levels of depression and fear of negative evaluation (and sex) were controlled for, higher levels of anxiety were correlated with mislabeling more expressions of disgust and higher levels of social anxiety were correlated with mislabeling fewer expressions of happiness. The second part of the hypothesis that time of presentation would have an effect on accuracy was also supported, but not in the direction in which it was predicted. Participants with higher levels of fear of negative evaluation, anxiety, and social anxiety were less accurate at identifying facial expressions that were presented for a short period of time. Specifically, when facial expressions were presented for 500ms, greater fear of negative evaluation was correlated with less accuracy overall and less accuracy for neutral and happy expressions, higher levels of anxiety were correlated with less accuracy for expressions of disgust, and higher levels of social anxiety were also correlated with less accuracy for happy expressions. The only correlation in the predicted direction was for participants with higher levels of depression, which was not a symptomology specified in the hypothesis. Higher levels of depression were correlated with less accuracy for expressions of sadness when they were presented for a longer period of time.

The fact that participants with high levels of general anxiety were found to mislabel more expressions of disgust is somewhat supported by the meta-analysis by Demenescu et al. (2010), which found overall decreased accuracy for those with anxiety. This decreased accuracy for the negative
emotion of disgust for those with higher levels of anxiety could be explained using the same reasoning that Montagne et al. (2006) used when describing their finding of decreased sensitivity to negative emotions in those with social anxiety. People with anxiety might become anxious when presented with a negative expression, especially one as rejecting as disgust, and this may cause them to disengage after processing in order to decrease the anxiety.

Participants with higher levels of social anxiety being more accurate at identifying facial expressions of happiness was not found in previous research, but can be explained using some of the same reasoning. Montagne et al. (2006) explained that those with social anxiety may disengage negative expressions after processing; the opposite may be true for positive expressions. An expression of happiness could reassure someone with social anxiety, and therefore when presented with a happy face, the person with social anxiety will be likely to engage that face after processing and recognize it as a happy expression.

Even though higher levels of social anxiety were correlated with higher accuracy when identifying facial expressions of happiness, they were also correlated with lower accuracy when identifying happy expressions when the expressions were presented for a shorter period of time. This interesting conflict could be explained by reasoning that even if participants with social anxiety were likely to engage happy expressions, and therefore identify them correctly, it took these same participants longer to process the expressions as happy. The DSM-IV-TR (APA, 2000) describes social anxiety as including a fear of scrutiny by others; because of this fear, those with social anxiety may be expecting to see negative facial expressions and it takes longer to process an expression that is different from what one is expecting, causing an inaccuracy of identifying happy expressions presented for a short period of time.

The above explanation could also be used to explain the correlation of greater fear of negative evaluation with inaccuracy in identifying neutral and happy expressions when presented for a short
period of time. Both general anxiety and fear of negative evaluation contain cognitive components that could cause someone to expect to see negative expressions. On the other hand, the correlation of higher levels of anxiety with inaccuracy in identifying expressions of disgust when presented for a short period of time goes against this idea.

The two-stage process of De Ruiter and Brosschot (as cited in Montagne et al., 2006) could explain the fact that higher levels of depression are correlated with less accuracy for recognizing expressions of sadness when they were presented for a longer period of time. Although the process was created to describe the engagement process of those with social anxiety with negative stimuli, the same idea could apply to those with high levels of depression; when presented with a negative expression, after processing the expression, a person with depression would disengage the expression because it causes them sadness and therefore would cause that person to label the expression incorrectly.

One limitation of the present study was its small sample size. When looking at so many variables – depression, anxiety, social anxiety, fear of negative evaluation, and individual facial expressions – it would be beneficial to have a much larger sample size in order to have participants along every part of the various continuums. It would also be beneficial to present more than 10 expressions per emotion. Another limitation would be self-report bias on the symptomology measures. The scores were higher than the norm for college students on the BDI and the BAI, so participants may have been “faking bad,” or just happened to be more distressed than is typical for college students; either way it limits the generalizability of the results, and in the former case, perhaps their validity.

An additional complication is the presence of participants who have been diagnosed with anxiety disorders. The effect of anxiety and depression on accuracy of recognizing facial expressions of emotion may be different at the clinical level, so results could have been affected. Thus one direction for future research is comparing the differences between the effects of trait anxiety and clinical anxiety on accuracy. Knowing if there is a difference would be helpful when creating treatments for those two
populations. The current study was also limited by the small number of male participants. It would be interesting and helpful for future research to study a diverse enough population where it could be seen if there is an interaction between gender and anxiety in terms of accuracy when judging facial expressions of emotion. Men were found to overall miss identify more facial expressions, so there is a possibility of an interaction of anxiety and sex.

The current study is important for two main reasons. One, this study showed that even when depression and the personality trait of fear of negative evaluation are controlled for, both general and social anxiety have an impact on accuracy of recognition of emotions. Second, this study showed that time of exposure to an emotional expression can have an effect of accuracy of recognition of specific emotions.
References


facial expressions in anxiety and major depression. *PLoS ONE*. 5(12), e15058. doi: 10.1371/journal.pone.0015058


Measurements Yearbook online database.


### Table 1. Means, Standard Deviations, and Correlations of Symptomology Measures

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>BDI-II</th>
<th>BAI</th>
<th>Brief-FNE</th>
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<td>BDI-II</td>
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<td>9.05</td>
<td>.53***</td>
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<td>.33*</td>
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<td>.47**</td>
<td>.55***</td>
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*Note.* $n = 48$.  * $p < .05$. ** $p < .01$. *** $p < .001$. 

Table 2. Means, Standard Deviations, and Correlations of Facial Expression Recognition Measures

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Total Missed</th>
<th>Angry Missed</th>
<th>Disgust Missed</th>
<th>Fear Missed</th>
<th>Happiness Missed</th>
<th>Neutral Missed</th>
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<td>.04</td>
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<td>.25</td>
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Note. n = 48. * p < .05. ** p < .01. *** p < .001.
Table 3. Correlations of Symptomology Measures and Differences in Accuracy Based on Time

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<th>Brief-FNE</th>
<th>LSAS</th>
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Table 4. Correlations of Symptomology Measures and Emotion Recognition Measures

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Table 5.  *Correlations of Symptomology Measures and Neutral Expressions Identified as Negative*

<table>
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<tr>
<td>Sig. (2-tailed)</td>
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<td>BAI Total</td>
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Figure 1. Scatterplot representing the relationship between participants’ scores on the Brief-FNE and their accuracy in recognizing happy facial expressions with a line of best fit. The data point highlighted in red is the outlier.
Figure 2. Social Anxiety and Happiness Accuracy

*Figure 2. Scatterplot representing the relationship between participants’ scores on the LSAS and their accuracy in recognizing happy facial expressions with a line of best fit. The data point highlighted in red is the outlier.*