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Spatial Affect Learning Restricted in Major Depression Relative to Anxiety Disorders and Healthy Controls

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Abstract

Detecting and learning the location of unpleasant or pleasant scenarios, or spatial affect learning, is an essential skill that safeguards well-being (Crawford & Cacioppo, 2002). Potentially altered by psychiatric illness, this skill has yet to be measured in adults with and without Major Depressive Disorder (MDD) and Anxiety Disorders (AD). This study enrolled 199 adults diagnosed with MDD and AD (n = 53), MDD (n = 47), AD (n = 54), and no disorders (n = 45). Measures included clinical interviews, self-reports, and a validated spatial affect task using affective pictures (IAPS; Lang, Bradley & Cuthbert, 2005). Participants with MDD showed impaired spatial affect learning of negative stimuli and irrelevant learning of pleasant pictures compared with nondepressed adults. Adults with MDD may use a 'GOOD is UP' heuristic reflected by their impaired learning of the opposite correlation (i.e., 'BAD is UP') and performance in the pleasant version of the task.

Keywords

spatial affect learning; major depression; anxiety disorder

Detecting and learning the constantly changing locations of resources and threats, characterized as spatial affective learning, is a critical skill to safeguard physical and emotional well-being (Crawford & Cacioppo, 2002). Research has indicated that individuals cognitively organize emotionally valenced information using spatial representations. Vertical space has been linked with valence (Meier & Robinson, 2004) where negative and positive stimuli are more likely to be placed on the vertical or x-dimension relative to the horizontal or y-dimension (Crawford, Margolies, Drake, & Murphy, 2006). Also, recall of

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positive life experiences have been linked with upward movement and negative experiences with downward movement (Casasanto & Dijkstra, 2010). Finally, data has shown that healthy participants place positive items consistently upwards compared with negative items, consistent with ‘GOOD is UP’ cognitive heuristic (Crawford et al., 2006; Huttenlocher, Hedges, Corrigan, & Crawford, 2004). These studies suggest that learning the association between valence and location in space is influenced by implicit heuristics that integrate these dimensions into one evaluation.

Spatial affect learning is a measurable function that can be reliably quantified. Crawford and Cacioppo (2002) developed and validated the spatial affect learning task to measure spatial affect learning using laboratory paradigms with college students. Unbeknownst to participants, pictures with varying affective valence, ranging from neutral to positive or neutral to negative, were selected from the International Affective Pictures System (IAPS; Lang, Bradley, & Cuthbert, 1990; Lang, Bradley, & Cuthbert, 2005; Lang, Greenwald, Bradley, & Hamm, 1993; CSEA-NIMH, 1999), and they were presented in locations on a computer monitor in a way that valence correlated with either the *x*- or *y*-dimension coordinates. In the unpleasant-neutral picture set, more unpleasant pictures appeared toward the top of the screen and more neutral pictures toward the bottom. No correlation ($r = .00$) existed with the second irrelevant and orthogonal dimension (e.g., left or right side of screen). After viewing a set of pictures that modeled the correlation between valence and spatial locations, participants assigned novel ‘test’ pictures (of a similar valence range) to locations where they believed those pictures would have appeared had they been presented as part of the training set. Training and test sets were matched in stimulus extremity, as well as stimulus features like luminance and spatial complexity. This approach evaluated two functions: (a) learning of the correlation between sets of neutral-unpleasant and neutral-pleasant pictures on a relevant dimension where the picture should be assigned; and, (b) disregard for the irrelevant dimension where the picture should not be assigned. Initial data using the spatial affective learning task has shown that college undergraduates were able to learn and reproduce mild to moderately strong correlations ($r = \pm.3, \pm.5$) between spatial location and valence (Crawford & Cacioppo, 2002). Notably, participants did not generate correlations between valenced stimuli and the irrelevant dimension of space and learned the location of unpleasant pictures better than the location of pleasant pictures.

The extent to which depression and anxiety illnesses alter spatial affect learning has yet to be studied, despite the potential to reveal differences and similarities in how adults with psychiatric illnesses respond to the location of affective cues. Anxious adults have exhibited decreased performance on spatial processing (Eysenck, Payne, & Derakshan, 2005), and individuals exhibiting negative affect and depressive symptoms have shown selective attention and a preference for lower regions of physical space (Meier & Robinson, 2006). Further, studies have shown that negative and positive vignettes presented before testing spatial affect learning altered placement of negative and positive stimuli (Crawford et al., 2006). With the burden of psychiatric illness and bias in affective information processing (Gollan et al., 2008), depressed individuals may demonstrate difficulty learning the location of positive and negative scenarios. However, negative affect may improve spatial affect learning based on data that showed that healthy participants who exhibited higher negativity bias (i.e., displayed the tendency to respond more strongly to unpleasant than to equally pleasant stimuli) learned the correlation between negative stimuli and location better compared with participants with a lower negativity bias (Norris et al., 2011). Moreover, adults with anxiety disorders may exhibit accurate spatial affect learning because of attunement to negative stimuli (Dijksterhuis & Aarts, 2003), though anxiety has modified spatial processing (Eysenck, Payne, Derakshan, 2010). Characterizing the extent to which psychiatric illness alters a person’s ability to detect and quickly learn the location of valenced stimuli may identify neurocognitive mechanisms.

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This study had two aims: The first aim was to characterize the mean level of spatial affect learning in adults with and without major depression and anxiety disorders. The second aim was to compare the extent to which groups with and without depression and anxiety disorders differed in spatial affective learning when viewing affective stimuli from the IAPS (Lang et al., 2005). We expected that participants with major depression would show attenuated learning in a spatial affective learning task of unpleasant pictures compared to participants without depression. Also, we expected that adults with anxiety disorders would show better spatial affect learning of unpleasant pictures than adults without anxiety disorders. Finally, we expected that both depressed and anxious participants would show decreased learning of spatial locations of pleasant pictures.

Method

Participants

Participants were right-handed males (n = 62) and females (n = 137) between 18-65 years. Of the 209 participants enrolled, 206 completed Visit 1 and 181 completed Visit 2. Participants who did not follow instructions in the spatial affect learning tasks were dropped from all analyses. Of 209 participants enrolled, nine participants (Healthy: n = 4, MDD: n = 2, Comorbid: n = 3) were excluded from the analyses given absence of variance among responses on the IAPS task (e.g., indicating lack of attention, choosing one type of keypress) and one participant had missing data, producing an analyzable sample of 199 for Visit 1 and 181 adults for Visit 2.

Measures

Measures included the Structured Clinical Interview for the DSM-IV Axis I Disorders, Outpatient Version (SCID; First, Spitzer, Gibbon, & Williams, 1995), the Structured Interview for DSM-IV Personality (SIDP-IV; Pfohl, Blum, & Zimmerman, 1995), the Hamilton Rating Scale for Depression – 17 item ($HRSD^{17}$, Hamilton, 1967), the Hamilton Anxiety Rating Scale (HARS; Hamilton, 1959). Self-reports included the Beck Depression Inventory, Second Edition, BDI-II (Beck, Steer, & Brown, 1996), and Beck Anxiety Inventory, BAI (Beck, Steer, & Brown, 1988). Cronbach alpha estimates for clinical groups for the above measures were 0.84 (HRSD) 0.74 (HARS), 0.92 (BDI-II), and 0.86 (BAI). Structured clinical interviews were conducted by clinical psychology doctoral students and supervised by first author.

The Spatial Affect Task (Crawford & Cacioppo, 2002) is a computer-based task that presents color pictures from the IAPS (Lang, Bradley, & Cuthbert, 1990, 2005; Lang, Greenwald, Bradley, & Hamm, 1993; CSEA-NIMH, 1999) to investigate the indirect learning of relationships between affect and spatial location. The spatial task was divided into two sessions to reduce practice effects, viewing a ‘pleasant version’ on a computer screen in Visit 1 and an ‘unpleasant’ version by wall projection in Visit 2. Although the method of stimuli presentation differed across sites (e.g., computer screen was used for training and testing at one site only), it did not pose methodological issues because we did not directly compare learning of the unpleasant and pleasant correlations. More specifically, pictures ranged from neutral to very unpleasant in Visit 1, and from neutral to very pleasant in Visit 2, and were chosen such that the valence means for the two sets were comparably distant from the neutral point of the valence scale. During the learning part of the task, participants saw 30 pictures flashed on the screen five times in one of 16 possible locations. Spatial distributions were constructed so that across each set there was a strong correlation (r = +/-.8) between normative valence ratings and the coordinates of one dimension of spatial location (Visit 1: y-coordinates, such that very unpleasant pictures tended to appear at the top of the screen, Visit 2: x-coordinates, such that very pleasant pictures tended to appear at the right of the screen). There was no correlation between valence and the irrelevant dimension of space on either version ($r = .00$). Each picture was displayed for 1.5 s and followed by a blank screen for 0.5 s. Participants were asked to think about how each picture made them feel. During the testing phase, participants predicted the spatial locations of 15 novel pictures. They were asked to imagine that due to a programming error the computer had forgotten to show this set of pictures and were asked where they thought each picture would have appeared had it been included. On each trial, each test pictures (ranging from neutral to very unpleasant in Visit 1 and from neutral to very pleasant in Visit 2) appeared in the lower left corner of the screen and participants were instructed to click on the location where they thought the picture would have appeared.[1]

Spatial affect learning is quantified as the correlation participants generate between normative valence ratings and the mouse click coordinates of the relevant dimension of space during the testing phase. First, we correlated normative valence ratings of the neutral to very unpleasant test pictures and the placement of the pictures at the top of the screen (*y*-coordinates) of participants' responses in Visit 1. Second, we correlated normative valence ratings of the neutral to very pleasant test pictures and the *x*-coordinates of participants' responses in Visit 2. In addition, to examine whether participants generated correlations in the irrelevant dimensions, we calculated correlations between valence ratings and the *x*-coordinates in Visit 1 and the *y*-coordinates in Visit 2. Each Pearson correlation underwent a Fisher transformation to approximate a normal distribution and to permit parametric statistics. Examination of residuals indicated that they were normally distributed. The origin for determining *x*- and *y*-coordinates is the upper left hand corner of the screen, and that normative valence ratings vary from 1 (*very unpleasant*) to 9 (*very pleasant*). Thus, both presented correlations are positive, with more unpleasant pictures appearing toward the top of the screen and more pleasant pictures toward the right of the screen.

Design and Procedure

Prospective volunteers responding to recruitment materials distributed on Craigslist and in the community, called our laboratory to seek more information. After completing an initial phone screen, participants were invited to the lab and were given written informed consent, a urine toxicology screen, self-report questionnaires and clinical interviews. Based on the assessment of active illness using clinician ratings, specifically, the SCID and HRSD[17], the participant was assigned to one of four following groups: The depressed group had Major Depressive Disorder with ≥ 14 on the HRSD[17] and ≥ 20 on the BDI-II, ≤ 10 on the HARS, and ≤ 15 BAI. The anxious group had anxiety disorder(s), with HRSD ≤ 13, BDI-II ≤ 19, HARS ≥ 10, BAI ≥ 15. Comorbid group had MDD and anxiety disorder(s) with HRSD ≥ 14, BDI-II ≥ 20, HARS ≥ 10, BAI ≥ 15. The healthy group had no psychopathology with HRSD ≤ 14, BDI-II ≤ 19, HARS ≤ 10, BAI ≤ 15. Participants were excluded if they endorsed any of the following conditions, including: medical illness, bipolar, schizophrenia and psychotic disorders, obsessive-compulsive disorder, substance abuse/dependence, borderline, schizotypal, antisocial disorders, and pregnancy, medication use, and animal phobia or philia (evoking a biased reaction to pictures). Once assigned to a group, the participants were asked to complete the negative version of the spatial affect task and were scheduled to visit a different laboratory one week later to complete a second urine toxicology screen, symptom questionnaires, and the positive version of the spatial affect task.

[1]The positive and negative test sets each contained 15 images not used in the training sets. IAPS numbers for stimuli in the negative test set: 1220, 2271, 2752, 3500, 7130, 9006, 9010, 9102, 9190, 9340, 9401, 9417, 9430, 9480, 9910 ($M_{\text{valence}} = 3.36$; $SD = 0.87$; $M_{\text{arousal}} = 4.68$; $SD = 0.31$). IAPS numbers for stimuli in the positive test set: 1121, 2352, 2485, 4608, 5260, 5628, 5990, 7100, 7233, 7450, 7550, 8080, 8170, 8250 and 8502 ($M_{\text{valence}} = 6.46$; $SD = 0.90$; $M_{\text{arousal}} = 4.92$; $SD = 1.19$).

Results

Tests of baseline differences in demographic and clinical characteristics were investigated using one sample t-tests or Analysis of Variance (ANOVA) for continuous variables and Chi-square tests of independence for categorical variables. In the presence of small or empty cells in the tests of categorical variables, the Chi-square test was replaced by Fisher's exact test. Also, we conducted ANOVAs to examine whether there were group differences in spatial affect learning by clinical diagnosis. Analyses were 2-tailed at the .05 level of significance. Significant interactions were probed using simple effects analyses (Tabachnik & Fidell, 2001). We made Bonferroni adjustments when comparing more than two groups in the same analysis.

Sample Characteristics

The total sample was 62 (31%) males and 137 (69%) females, with a mean age of 34 years (*SD* = 12.2y). Ethnicity breakdown was 62% Caucasian, 24% African American, 8% Hispanic, 4% Asian American, 0.5% Native American, and 2.5% mixed ethnicities. Chi-square analyses revealed no group differences on demographic characteristics, [$\chi^2_{gender} = 1.4$, $p > 0.05$; $\chi^2_{ethnicity} = 11.8$, $p > 0.05$; $\chi^2_{education} = 18.3$, $p > 0.05$; $\chi^2_{marital\ status} = 23.8$, $p > 0.05$]. Clinical groups were significantly less likely to be employed (11%) compared to the healthy group (2%) ($\chi^2_{unemployment} = 33.04$, $p = 0.004$).[2] Table 1 shows descriptive information.

Depressed and comorbid groups were did not differ significantly on the BDI-II at Visit 1 (Bonferroni Multiple Comparisons: mean difference = -2.2, p > .05) and on the HRSD[17] (Bonferroni Multiple Comparisons: mean difference = -1.07, $p > .05$). Also, the anxiety and comorbid groups did not differ significantly on BAI (Bonferroni Multiple Comparisons: mean difference = 1.4, $p > .05$). Post hoc analyses (Bonferroni Multiple Comparisons) indicated significant differences on the HARS across all sets of comparisons between clinical groups and healthy controls. As expected, significant differences on severity of depression and anxiety symptoms were evident across the four groups ($F_{HRSD\text{-}17}$ (3,198) = 327, $p < 0.05$; F_{HARS} (3,198) = 225, $p < 0.05$).

Self-reported symptoms of depression and anxiety were stable across Visits 1 and 2. Repeated measures analyses showed no significant interaction effect between BDI-II and group assignment from Visit 1 to Visit 2 ($F_{BDI \times Group} = 1.9$, $p > 0.05$). Additionally, there was no significant change on the BDI-II from Visit 1 to Visit 2 ($F = 33$, $p > 0.05$). Repeated measures assessing change on the BAI revealed a significant interaction effect, $F_{BAI \times group} = 11.9$, $p < 0.05$. Additionally, there was a main within-group effect ($F_{BAI} = 22.2$, $p < 0.05$). Planned comparisons (Bonferroni) revealed significant differences between anxious group and their depressed and healthy counterparts; mean difference anxious-depressed = 9.8, $p = 0.00$ (95% *CI*: 6.9, 12.1), mean difference anxious-healthy = 15.4, $p = 0.00$ (95% *CI*: 12.4; 16, 6).

Spatial Affect Learning for Negative Pictures

First, we examined whether participants learned the correlation between spatial location and unpleasant affective pictures. One-sample *t*-tests comparing the mean Fisher-transformed correlations to zero for each diagnostic group indicated that three of the four groups showed spatial learning of the relationship between unpleasant pictures and location. Specifically,

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[2]Participants who did not complete Visit 2 were no more depressed than participants who completed Visits 1 and 2 (HRSD, $t = -.40$, $p > 0.05$; BDI-II, t = -.40, p > 0.05), nor more anxious (HARS, $t = 1.7$, $p > 0.05$; BAI, $t = 1.9$, $p > 0.05$). Also, a chi-square analyses revealed no significant group differences between completers and noncompleters on demographic indices (i.e., sex, ethnicity, marital status, employment status).

healthy participants learned the spatial location of unpleasant pictures, $t(53) = 2.88$, $p = .006$, replicating prior research conducted on college students (Crawford & Cacioppo, 2002; Norris, Larsen, Crawford, & Cacioppo, 2011). Also, participants with anxiety disorders, $t(53) = 2.8$, $p = .006$, and with comorbid anxiety and depression, $t(52) = 2.4$, $p = .01$, demonstrated learning of the negative relevant correlation. In contrast, participants with major depression did not show spatial affect learning of the negative relevant correlation, $t(46) = .45$, $p = .65$. To determine whether there were group differences in learning of the negative correlation, we conducted a 2(depression: no, yes) × 2(anxiety: no, yes) ANOVA on the Fisher-transformed correlations between valence and location (*y*-coordinates) in Visit 1. The main effect for depression was significant, $F(1, 198) = 4.85$, $p = .029$, and mean scores indicated that participants with major depression ($M = 0.05$, $SD = 0.26$) displayed worse learning than participants without major depression ($M = 0.15$, $SD = 0.33$). No other effects were significant.

Next, we examined whether any of the four groups imputed a correlation in the irrelevant dimension of the unpleasant version. Results indicated that none of the groups imputed a correlation on the irrelevant dimension, as one sample t-tests comparing the mean Fisher-transformed correlations to zero were not significant, all *p*s > .05. For purposes of testing potential group differences, we conducted a 2(depression: no, yes) × 2(anxiety: no, yes) ANOVA on the Fisher-transformed correlations between valence and location (*y*-coordinates) in Visit 1, which indicated no significant effects. See Table 2.

Spatial Affect Learning for Positive Pictures

We examined whether participants in each group learned the location of pleasant stimuli. Participants in all four groups learned the positive correlation as each one sample t-test comparing the mean Fisher-transformed correlations to zero was significant: Major depression: $t(43) = 3.7$, $p = .0001$; Anxiety Disorders: $t(45) = 4.1$, $p < .001$; Comorbid: $t(47) = 6.1$, $p < .001$; and Healthy: $t(47) = 3.3$, $p = .002$. To determine whether there were group differences in learning of the positive correlation, we conducted a 2 (depression: no, yes) × 2 (anxiety: no, yes) ANOVA on the Fisher-transformed correlations between valence and *x*-coordinates in Visit 2. Results showed no significant effects.

Finally, we examined whether each of the four groups imputed a relationship in the irrelevant dimension of the pleasant version. Healthy participants and participants with anxiety disorders did not impute correlations in the irrelevant dimension of the positive task, as one-sample t-tests comparing Fisher transformed mean z-scored correlations to zero were not significant, Anxiety: $t(47) = -1.9$, $p = .052$; Healthy: $t(37) = 0.01$, $p = .98$. In contrast, participants with major depression placed pleasant images upwards relative to neutral pictures, as they incorrectly imputed a relationship between pleasant stimuli and the orthogonal, irrelevant dimension of space, Major Depression $t(42) = -2.7$, $p = .009$; Comorbid $t(44) = -4.0$, $p < .001$. A 2 (depression: no, yes) × 2 (anxiety: no, yes) ANOVA showed a significant main effect for major depression, $F(1, 173) = 6.84$, $p = .01$, such that participants with major depression ($M = -.18$, $SD = 0.36$) produced a stronger irrelevant correlation than participants without major depression ($M = 0.05$, $SD = 0.33$). No other effects were significant. Figure 1 shows spatial affect learning of unpleasant and pleasant pictures by group. See Table 2.

Discussion

Our results showed a significant spatial affect learning impairment among participants endorsing major depression compared to participants who were healthy or who were diagnosed with anxiety disorders. Relative to non-depressed participants, depressed participants displayed weaker learning of the location of unpleasant pictures. Adults with depression learned the location of pleasant pictures, though they also placed pleasant pictures in spurious locations. Finally, our results showed the participants in healthy and anxious groups were able to learn the correlation between affective pictures and their location accurately.

Spatial affect learning exhibited by the participants with and without anxiety disorders is consistent with previous research (Crawford et al., 2002; Crawford, Margolies, Drake, & Murphy, 2006). Notably, our data indicated that anxiety disorders did not alter spatial affect learning, which is inconsistent with prior studies showing that trait and state anxiety may differentially alter visuospatial processing, impairing cognitive performance on nonverbal tasks (Eysenck, Payne, Derakshan, 2010) and depending on trait anxiety, may differentially influence judgment on informational relevance (Gasper & Clore, 1998).

Depressed individuals may not have learned the association between unpleasant pictures and spatial location as they may have used the 'GOOD is UP' heuristic rather than the information in the task. If depressed participants routinely used the 'GOOD is UP' heuristic with both versions of the spatial affect task, then they would expect pleasant pictures to be placed at the top of the screen. However, both tasks challenge this heuristic: The unpleasant version is constructed with unpleasant pictures at the top of the screen and neutral pictures at the bottom of the screen. Depressed participants showed difficulty in incorporating the new learning strategy, and to the extent that they retained the 'GOOD is UP' strategy, they were likely to produce incorrect assignments of location with the unpleasant version. Likewise, the pleasant version is constructed with positive to the right, and to the extent depressed participants used the 'GOOD is UP' heuristic, they would exhibit the spurious assignment of the pleasant pictures to the irrelevant dimension (placing them up) when no correlation was presented. These findings are consistent with research showing that major depression is linked with perceptual deficits in simple pattern identification, facial pattern identification, and facial component discrimination tasks (Asthana, Mandal, Hitesh, & Haque-Nizami, 1998), though inconsistent with results from Meier and Robinson (2006) in which depressed patients showed selection attention bias downwards. Though negative mood state may increase an individual's use of reliance on heuristics used to assign stereotypes (Park & Banaji, 2000), our data indicates that depression has a specific effect on spatial affect learning. Finally, these results suggest that attenuated spatial affect learning of negative cues may be explained by essential features in major depression, including low emotional reactivity to valenced stimuli (Blysma, Morris, Rottenberg, 2008) in which adults with major depression show lower reactivity to pleasant stimuli than to unpleasant stimuli.

Clinically, our research suggests that healthy and anxious individuals showed flexible acquisition and application of new associations between valence and location, reflecting a skill that is likely to promote productive interactions with the environment. However, the impaired learning exhibited by depressed participants suggested an upward bias for pleasant stimuli compared to unpleasant stimuli, in the absence of explicit instructions (Crawford, et al., 2006). To the extent that the 'GOOD is UP' heuristic is consistent with their environment, depressed individuals may respond to unpleasant visual cues in ways that safeguards their health and function. However, in scenarios requiring flexibility of learning where things are located, depressed individuals may encounter increased difficulty or missed opportunities. Given the importance of learning the location of valenced stimuli, depressed individuals may benefit from instruction and practice in learning the location of negative scenarios to potentiate implicit processes.

Strengths and Limitations

Strengths include methods to reflect the theoretical framework of spatial affect learning, active and implicit task conditions that prompted participants to process evocative pictures showing pleasant and unpleasant content, a multi-method, clinical evaluation technique to characterize clinical groups, and participants who were untreated. Limitations included the different size of the image (computer screen in Visit 1 and a wall projection in Visit 2, though data indicate that the size of an image does not influence participant's responses (de Cesari & Codispoti, 2006). Also, there may have been practice effects from Visit 1 to 2, which could be constrained in future studies by counterbalancing the trials and using an object-location memory task to assess coordinate position memory. Finally, the task does not discern the extent to which positive affect and vertical axis and the negative affect and horizontal axis are specifically associated differently in psychopathology.

In sum, depressed individuals showed difficulty in learning the location of pleasant and unpleasant pictures, which may perpetuate or generate impairments in how depressed individuals navigate their environments. This study provides new data that characterizes the difficulties in spatial affect learning in an untreated sample of depressed adults and serves as first step towards developing intervention strategies that aim to reduce exposure to unpleasant scenarios often observed in depression.

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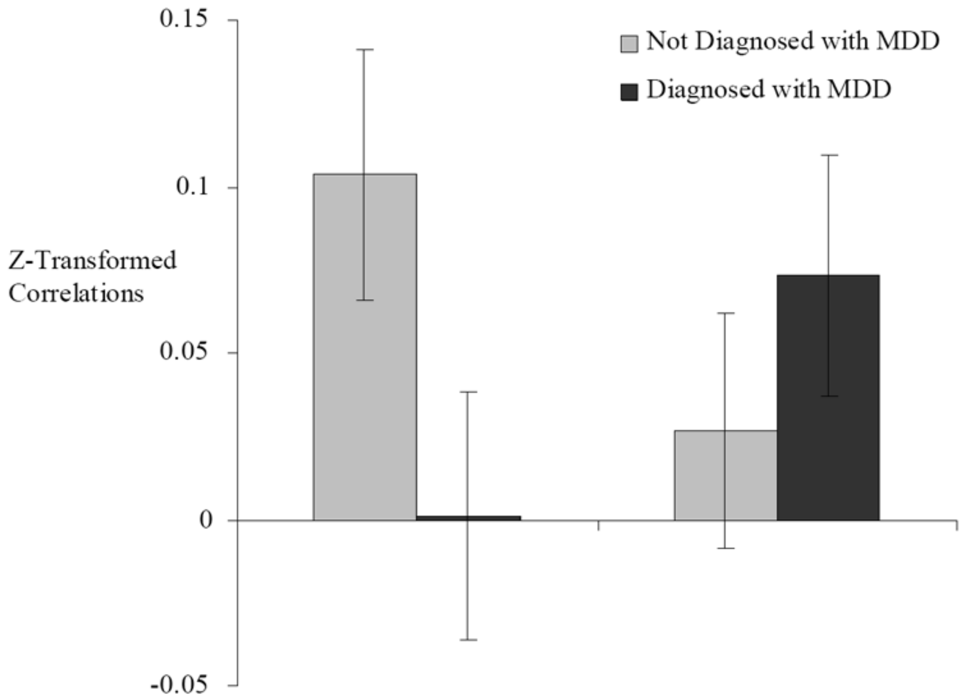

Figure 1.
Group effects on learning of pleasant and unpleasant pictures.
Not Diagnosed with MDD = No Depression Disorders (e.g., anxious or healthy group).
Diagnosed with MDD = Depression group or comorbid anxiety and depression group.

Table 1

Sociodemographic and Clinical Characteristics by Group (N = 199)

Sociodemographic	**Characteristics**	**Depressed (*n*=47)**	**Anxious (*n*=54)**	**Comorbid (*n*=53)**	**Healthy (*n*=45)**
		***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**
Race	Caucasian	28 (14.0%)	36 (18%)	30 (15 %)	30 (15%)
	African American	12 (6.0%)	9 (4.5%)	15 (7.5%)	11 (5.5%)
	Asian	0 (0%)	2 (1%)	2 (1%)	3 (1.5%)
	Native American	1 (0.5)	0 (0%)	0 (0%)	0 (0%)
	Hispanic	5 (2.5%)	6 (3 %)	4 (2%)	1 (0.5%)
	Other	1 (0.5)	1 (0.5%)	2 (1%)	1 (0.5)
Sex	Male	12 (6.0%)	16 (8%)	17 (8.5%)	17 (8.5%)
	Female	35 (17.5%)	38 (19%)	36 (18%)	29 (14.5%)
Age	(years)	37 (12.4%)	32 (10.8)	36 (12.7)	33 (12.5)
Marital Status					
	Never Married	33 (16.5%)	42 (21%)	34 (17%)	36 (18 %)
	Married	8 (4%)	6 (3%)	7 (3.5%)	7 (3.5%)
	Separated	0 (0%)	1 (0.5%)	3 (1.5%)	0 (0%)
	Divorced	6 (3%)	5 (2.5%)	5 (2.5%)	1 (0.5%)
	Widowed	0 (0%)	0 (0%)	2 (1%)	0 (0%)
Education	Partial High School	0 (0%)	0 (0%)	2 (1 %)	0 (0%)
	High School	2 (1.0%)	1(0.5%)	1 (1.5%)	3 (1.5%)
	Partial College	15 (7.5%)	20 (10 %)	24 (12%)	12 (6%)
	Completed College	22 (11%)	29 (14.5%)	20 (10%)	20 (10%)
	Graduate Training	8 (4%)	4 (2 %)	4 (2%)	11 (5.5%)
Employment	Unemployed	21 (10.5%)	15 (7.5%)	24 (12%)	5 (2.5%)
	Employed	21 (10.5%)	26 (13%)	20 (10%)	23 (11.5%)
	Full-time student	4 (2 %)	11 (5.5%)	8 (4%)	17 (8.5%)
	Disabled	0 (0%)	0 (0%)	1 (0.5%)	0 (0%)
	Retired	1 (0.5%)	0 (0%)	0 (0%)	1 (0.5%)
	Not working, not receiving public assistance	0 (0%)	2 (1%)	0 (0%)	0 (0 %)
		M(SD)	*M(SD)*	*M(SD)*	*M(SD)*

Sociodemographic	Characteristics	Depressed (*n*=47)	Anxious (*n*=54)	Comorbid (*n*=53)	Healthy (*n*=45)
		n **(%)**	***n*** **(%)**	***n*** **(%)**	***n*** **(%)**
Depression	HRSD-17	19.2 (3.9)	7.2 (3.9)	20.3 (4.1)	1.1 (1.7)
	BDI	26.9 (6.8)	7.9 (5.4)	29.1 (6.5)	1.4 (2.5)
Anxiety	HARS	7.4 (2.2)	17.4 (5.2)	19.9 (5.3)	1.2 (1.7)
	BAI	6.2 (4.0)	20.3 (7.6)	18.8 (6.9)	1.1 (1.4)
Visit 2	BDI	25.9 (5.5)	8.5 (7.4)	26.8 (8.7)	1.5 (2.7)
	BAI	7.0 (5.1)	12.4 (7.4)	15.5 (7.3)	0.8 (1.0)

HRSD-17 = Hamilton Rating Scale for Depression, 17 item; BDI = Beck Depression Inventory, HARS = Hamilton Anxiety Rating Scale; BAI = Beck Anxiety Inventory. *M* = Mean; *SD*= Standard Deviation.

Table 2

Means, Standard Deviations, and Standard Error of Spatial Affect Variables by Group

		Mean	S.D.	S.E.
Spatial Affect (Negative: Relevant Dimension)	MDD	.01	.25	.03
	Anxiety	.10	.27	.03
	Comorbid	.09	.27	.03
	Healthy	.19	.38	.05
Spatial Affect (Negative: Irrelevant dimension)	MDD	-.06	.26	.03
	Anxiety	-.04	.26	.03
	Comorbid	.02	.29	.04
	Healthy	-.02	.20	.03
Spatial Affect (Positive: Relevant Dimension)	MDD	.22	.39	.06
	Anxiety	.17	.29	.04
	Comorbid	.21	.22	.03
	Healthy	.17	.33	.05
Spatial Affect (Positive: Irrelevant Dimension)	MDD	-.16	.39	.06
	Anxiety	-.09	.32	.04
	Comorbid	-.20	.33	.04
	Healthy	.01	.33	.05

MDD = Major Depressive Disorder; S.D. = Standard Deviation; S.E. = Standard Error.