Differentiating Generalized Anxiety Disorder from Major Depressive Disorder by Examining Reward Sensitivity in a Laboratory Setting

Honors Research Thesis

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Abstract

Generalized anxiety disorder (GAD) and major depressive disorder (MDD) are frequently co-occurring disorders (e.g., Kessler et al., 2005). Based on the current diagnostic criteria (American Psychiatric Association, 2013), there is a large overlap in symptoms and thus the two disorders are closely associated. However, there is growing evidence that suggests the importance of separating GAD from MDD, given their different patterns of emotion regulation (e.g., Mennin & Fresco, 2014). This may be examined through differential responses to rewards and punishments; however, there has been no systematic examination of reactivity to reward and punishment in laboratory settings in relation to GAD and MDD. This study examines sensitivity to reward and sensitivity to punishment via self-report measures (subjective) and physiological reactivity. Participants were presented with a food stimulus (popcorn) and a series of four videos (two disgust, two craving) in a randomized order. They were instructed to either eat or save popcorn. The crave-eat (reward) block provided the highest reward, followed by crave-save (frustrative non-reward), disgust-save (relief), and finally, the disgust-eat block (punishment). Participants reported the extent to which they experienced anxiety, disgust and craving, and we recorded heart rate variability (HRV; which reflects physiological flexibility) and cardiac impedance (pre-ejection period, which reflects sensitivity to rewards) throughout each of the blocks. I found 1) high levels of GAD symptoms were associated with elevated anxiety in all contexts 2) high levels of MDD symptoms were associated with increased anxiety in all contexts. This study yielded no differences in craving or disgust based on GAD or MDD symptom levels and yielded no differences for HRV or PEP measures based on film clip or GAD or MDD symptom levels. Also, these findings did not lend support to context insensitivity theories for GAD or MDD. Future studies should examine these effects in a larger, clinical sample.

Differentiating Generalized Anxiety Disorder from Major Depressive Disorder by Examining Reward Sensitivity in a Laboratory Setting

Generalized anxiety disorder (GAD) and major depressive disorder (MDD) are two highly comorbid conditions (e.g., Kessler et al., 2005). For example, in the US National Comorbidity Replication Survey, the two disorders had a correlation of .62 (Kessler, Chiu, Demler & Walters, 2005). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychological Association, 2013), GAD is characterized by excessive worry, restlessness, irritability, fatigue, difficulties concentrating, difficulties sleeping, and muscle tension lasting six months or more. MDD is characterized by depressed mood, loss of interest in pleasurable activities, fatigue, agitation (or slowing down), difficulties concentrating, sleep dysregulation, feelings of worthlessness, appetite/weight dysregulation, and thoughts of suicide lasting for at least two weeks. By solely relying on the current DSM diagnostic criteria, it is easy to see that there is large overlap in symptoms and thus, it is not surprising that the two disorders are so closely associated. In fact, in the past, it has been suggested that due to the considerable degree of symptom overlap, GAD may be more accurately thought of as a symptom of mood disorders (e.g., Kessler et al., 2005). However, looking beyond the symptoms outlined in the current DSM, GAD and MDD can be differentiated. There is growing evidence that suggests separating GAD from MDD given their different patterns of emotion regulation (e.g., Mennin & Fresco, 2014). This is particularly evident when looking at emotional reactivity associated with the approach and avoidance systems.

Individuals' motivation to approach or avoid emotion-eliciting situations may constitute a dimension with which to functionally differentiate GAD and MDD. Under approach motivation, positive affect increases pursuit of something desired, which is a function of the behavioral

approach system (BAS). This can be indexed by sensitivity to rewarding stimuli. However, under avoidance motivation, negative affect leads to moving away from something unpleasant (Carver, 2006), which is controlled by the behavioral inhibition system (BIS) (Beauchaine, 2001). This reflects sensitivity to punishing stimuli.

GAD has been associated with increased worry and increased levels of negative affect (e.g., Youngstrom & Izard, 2008). The uncontrollable worry present in GAD may lead someone to avoid a situation for fear of the potential consequence. Conversely, MDD has been linked to blunted sensitivity to reward and heightened sensitivity to punishment (e.g., Youngstrom & Izard, 2008). For example, a depressed person might not engage in previously pleasurable activities because they no longer find them enjoyable or they may avoid situations (e.g., going to a party) because they might believe that they will not be able to relax and have fun. More recently, however, a differing theory has been developed regarding these relationships in MDD. Rottenberg and colleagues' (2005) emotion context insensitivity work suggests that MDD might be characterized by blunted reactivity to both reward and punishment (e.g., due to loss of interest or energy, there is no increase in avoiding a potentially punishing situation). However, there has been no systematic examination of reactivity to punishment and reward in laboratory settings in relation to GAD and MDD.

To help fill this gap in our knowledge, I studied these processes for my thesis. I utilized a multi-method approach in line with the National Institute of Mental Health's Research Domain Criteria (RDoC) initiative, which emphasizes the importance of assessing dysfunction in psychopathology across multiple units of analyses (e.g., subjective and physiological; Insel et al., 2010). To do so, I examined sensitivity to reward and sensitivity to punishment via self-report measures (subjective) and physiological measures and how these differ in participants with

symptoms of GAD and/or MDD. I also examined responses in the context of frustrative non-reward, which involves the absence of a reward where it is expected (Amsel, 1958), and relief, in which one does not have to engage in a punishing activity.

I ran two sets of models (one set entering GAD symptoms as a predictor, the other set entering MDD symptoms as a predictor) to examine self-reported anxiety, disgust, and craving to film clips. For these models, I predicted a main effect of film clip such that more anxiety, as well as more disgust would be reported in the context of punishment than in the context of reward, with frustrative non-reward and relief falling in between. I expected a main effect of GAD such that those participants with higher GAD would report more anxiety and disgust across film clips. I expected that these main effects would be qualified by an interaction between film clip and symptoms of GAD such that those participants with high GAD would exhibit no modulation between film clips (i.e., high anxiety and disgust across all blocks; context insensitivity), but that those with low GAD would exhibit modulation between film clips (i.e., higher anxiety and disgust for punishment than reward; context sensitivity).

I expected a main effect of MDD such that those participants with high MDD would exhibit blunted levels of both anxiety and disgust. I also predicted an interaction between film clip and symptoms of MDD such that those participants with high MDD would show no modulation between film clips (i.e., blunted reactivity during all blocks; context insensitivity), but that those with low MDD would exhibit modulation (i.e., higher anxiety and disgust for punishment than reward; context sensitivity).

I expected to see the opposite pattern of subjective responses for craving. I predicted a main effect of film clip, such that participants would report the highest levels of craving in the reward condition and lowest in the punishment condition, with frustrative non-reward and relief

falling in between. I predicted a main effect of GAD such that those participants with higher GAD would report less craving. I expected that these main effects would be qualified by an interaction between film clip and symptoms of GAD such that those participants with high GAD would exhibit no modulation between film clips (i.e., less craving across all blocks; context insensitivity), but that those with low GAD would exhibit modulation between film clips (i.e., lower craving for punishment than reward; context sensitivity).

I predicted a main effect of MDD such that those participants with high MDD would exhibit blunted levels of craving. I also predicted a similar pattern for the interaction between film clip and symptoms of MDD such that those participants with high MDD would show no modulation between film clip (i.e., blunted reactivity during all blocks; context insensitivity), but that those with low MDD would exhibit modulation (i.e., lower craving for punishment than reward; context sensitivity).

In addition to examining subjective emotional responses, I also utilized two sets of models entering GAD or MDD to predict psychophysiological responses. Respiratory sinus arrhythmia (RSA) and pre-ejection period (PEP) are used as physiological markers of emotional reactivity. RSA measures the extent to which the time between heartbeats changes with the breathing cycle (Rottenberg et al., 2005). It is an index of the parasympathetic nervous system, and it reflects flexible physiological responding (Thayer et al., 2012; Beauchaine, 2001). Changes in RSA that result from engagement with the environment capture vagal reactivity. A decrease in RSA in response to a stimulus is known as vagal withdrawal. This occurs when the inhibition of energy by the parasympathetic nervous system is diminished due to increased attention, exercise, or response to negative emotions (Rottenberg et al., 2005). This ability to withdraw parasympathetic activity is adaptive, important for flexible behavior, and associated

with decreased psychopathology (Rottenberg et al., 2005). In one study, greater vagal withdrawal when viewing a sad film was correlated with recovery from depression 6 months later (Rottenberg et al., 2005).

For RSA reactivity, I predicted a main effect of film clip such that that there would be the most RSA reactivity for the punishment condition and the least RSA reactivity for the reward condition, with frustrative non-reward and relief falling in between, as RSA reactivity has been associated with reactivity to negative emotions. I predicted a main effect of GAD such that those participants with higher GAD would report more RSA reactivity (e.g. decreased parasympathetic activation). I predicted an interaction between film clip and symptoms of GAD such that those participants with high GAD would exhibit no modulation between film clips (e.g. greater RSA reactivity across all blocks), but those with low GAD would exhibit modulation between film clips (e.g. greater RSA reactivity for punishment than reward).

I predicted a main effect of MDD such that those participants with high MDD would exhibit less RSA reactivity. I also predicted an interaction between film clip and symptoms of MDD such that those participants with high MDD would show no modulation between film clip (e.g. less RSA reactivity during all blocks), but those with low MDD would exhibit modulation (e.g. more RSA reactivity for punishment than reward).

PEP, on the other hand, is a reflection of sympathetic nervous system activity. This system, known as "fight or flight," speeds up the heart in response to environmental challenges (Thayer et al., 2012). PEP is the amount of time between depolarization of the left ventricle and when blood is ejected into the aorta (Beauchaine, 2012). It is associated with the behavioral approach system, which serves to maximize rewards and minimize punishments when responding to a situation (Beauchaine, 2001). These behaviors require energy to be spent and the

heart to work harder, and are indicated by shorter PEP (Beauchaine, 2001; Beauchaine, 2012). However, PEP shortening (i.e., how much PEP changes from a resting baseline, also known as PEP reactivity) typically only occurs under conditions with rewards (Beauchaine, 2012).

For PEP reactivity, I predicted that participants would experience the most reactivity in the reward condition and lowest in the punishment condition, with frustrative non-reward and relief falling in between. I predicted a main effect of GAD such that those participants with higher GAD would experience greater reactivity (i.e., more sympathetic activation). I also predicted an interaction between film clip and symptoms of GAD such that those participants with high GAD would exhibit no modulation between film clips (e.g. greater reactivity across all blocks), but that those with low GAD would exhibit modulation between film clips (e.g. less reactivity for punishment than reward).

I predicted a main effect of MDD such that those participants with high MDD would exhibit blunted reactivity (i.e., less sympathetic activation). I also predicted an interaction between film clip and symptoms of MDD such that those participants with high MDD would show no modulation between film clip (e.g. blunted reactivity during all blocks), but that those with low MDD would exhibit modulation (e.g. less reactivity for punishment than reward).

Method

Participants

Participants (N=68) were recruited through the Department of Psychology's Research Experience Program (REP). Research assistants, including myself, administered the study protocol and collected the data under the supervision of graduate students and Dr. Aldao. The mean age was 20.1 years (*SD*= 3.06), and the sample was 37.9% female. Participants were 79.5% White, 9% Black/African-American, 3.8% Asian, 2.6% Native Hawaiian/Pacific Islander,

and 5.1% identifying with another race. The study was run in Dr. Aldao's Psychopathology and Affective Sciences Lab. The Ohio State University Institutional Review Board approved all procedures and measures for this study and participants provided informed consent before participating.

Self-Report Questionnaires

Generalized Anxiety Disorder Questionnaire (GADQ; Newman et al., 2002**)**. The GADQ is valid as a preliminary screening tool for use before a structured interview or, as in the case in the present study, symptom criteria for experimental studies on non-clinical populations (Newman et al., 2002). It includes a checklist of whether the person has experienced excessive and uncontrollable worry for at least 6 months, and symptoms such as restlessness, irritability, fatigue, difficulties concentrating, difficulties sleeping, and muscle tension lasting six months or more (Newman et al., 2002; American Psychological Association, 2013). Kappa agreement with a structured interview is .67 (Newman et al., 2002). Participants scoring 5.7 and up are classified as high in GAD symptoms. 43 participants (63.2%) in this sample scored below 5.7 and 23 participants (33.8%) scored 5.7 or higher. Two participants had missing data (2.9%).

Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). This 20-item scale is valid for the general population for measuring symptoms of depression, such as depressed mood, feelings of guilt and worthlessness, feelings of helplessness and hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance over the past week (Radloff, 1977). It correlates moderately (r=.49) with interviewer ratings (Radloff, 1977). Participants scoring 16 and up are classified as high in MDD symptoms. 42 participants (61.8%) in this sample scored below 16 and 26 participants (38.2%) scored 16 or higher. Internal consistency was .904.

Experimental Task

Participants were presented with a food stimulus (popcorn) and a series of four videos in a randomized order. In this 2 (disgust vs. crave) x 2 (eat vs. save) within-subjects design, participants were shown disgusting and appealing videos and instructed to eat or save popcorn. The crave-eat (reward) block provided the highest reward, followed by crave-save (frustrative non-reward), disgust-save (relief), and finally, the disgust-eat block, which represented punishment.

Film Clips. The craving film clips consisted of segments from various food-travel TV and YouTube shows that included descriptions of various desserts. The disgusting film clips were from the TV show Fear Factor and they included people eating bugs and rotten things. Each of the four film clips lasted 270 seconds.

Emotion Ratings. Participants reported the extent to which they experienced anxiety, disgust, and craving using visual analog scales (VAS) from 0-100 at two points during each video, and at the completion of each video. I averaged all of the ratings during each block to calculate subjective emotional experiences.

Psychophysiology Recording. We recorded electrocardiography and cardiac impedance at rest and continually throughout each of the blocks. In order to model physiological reactivity, I calculated respiratory sinus arrhythmia (RSA) and pre-ejection period (PEP). Specifically, I examined RSA reactivity and PEP reactivity, as indexed by the changes in RSA and PEP from baseline to the film clip blocks. Decreases in RSA are associated with greater parasympathetic activation and regulation of changing environment conditions (Rottenberg et al, 2005). Shorter PEP is associated with heightened sympathetic reactivity and has been linked to greater reward reactivity (Beauchaine, 2001, 2012).

Results

For the main analyses, I used generalized estimating equations (GEE), which is an extension of the general linear model that allows for analyzing nested data (e.g., Ghisletta & Spini, 2004; Liang & Zeger, 1986). GEE produces unstandardized coefficients, so, I report unstandardized betas (*b***)** and standard errors (*se*). For the main effects of the continuous variables, I report *Wald's* χ^2*, b, and se*. For the main effects and interactions that consist of and/or contain categorical variables, I only report the *Wald's* χ^2. To avoid issues of multicollinearity due to comorbidity between diagnoses (GAD and MDD are moderately correlated in this sample, $r = .466$), I did not enter both GAD and MDD into the same models as predictors. The mean GADQ was 4.605 ($SD = 2.7856$) and the mean CES-D score was 13.577 (SD=8.858), indicating that participants on average had subclinical GAD or MDD symptoms.

Predicting Self-Reported Anxiety with Film Clip and GADQ. When predicting self-reported anxiety with film clip and GADQ scores, I found a non-significant effect of film clip, *Wald's* $\chi^2 = 5.613$, $p = .132$, and a significant effect of GADQ, *Wald's* $\chi^2 = 4.085$, $b = 2.553$, $se = 1.1286$, $p = .043$, such that higher GAD symptoms were associated with greater anxiety. The two-way interaction was non-significant, *Wald's* $\chi^2 = 3.620$, $p = .305$. As such, results indicate that higher GADQ scores are associated with higher anxiety during all of the film clips. This does not support context insensitivity theories, as those with higher GAD symptoms displayed the same pattern of responding across film clips as those with lower GAD symptoms.

Predicting Self-Reported Anxiety with Film Clip and CES-D. When predicting self-reported anxiety with film clip and CES-D scores, I found a significant effect of film clip, *Wald's* $\chi^2 = 12.713$, $p = .005$, such that more anxiety was reported during disgust film clips than craving film clips. I also found a significant effect of CES-D score, *Wald's* $\chi^2 = 17.374$, $b = 1.221$, $se =$

.3056 $p < .001$, such that more anxiety was reported by participants who scored higher on the CES-D. The two-way interaction was significant, *Wald's* $\chi^2 = 16.612$, $p = .001$. In order to test this interaction, I broke down the sample into high CES-D and low CES-D classifying participants scoring 16 and up as high in MDD symptoms and participants scoring below 16 as low in MDD symptoms. 26 participants were in the high MDD group and 42 participants were in the low MDD group. When broken down based on high or low CES-D score, I found a main effect of film clip that was driven by the comparisons between the reward block and the punishment block (for low MDD, mean difference = -16.4647, $p < .001$; for high MDD, mean difference = -23.3269, $p < .001$), the reward block and the relief block (for low MDD, mean difference = -17.8622, $p < .001$; for high MDD, mean difference = -24.2821, $p < .001$), the frustrative non-reward block and the punishment block (for low MDD, mean difference = -15.0673, $p < .001$; for high MDD, mean difference = -24.9295, $p < .001$), and the frustrative non-reward block and the relief block (for low MDD, mean difference = -16.4647, $p < .001$; for high MDD, mean difference = -25.8846, $p < .001$). Thus, both the high CES-D group and the low CES-D group reported more anxiety during the disgust videos than the craving videos. These results suggest that those with higher MDD symptoms are modulating between film clip in the same way as those with lower MDD symptoms, which reflects failure to support context insensitivity theories.

Predicting Self-Reported Disgust with Film Clip and GADQ. When predicting self-reported disgust with film clip and GADQ scores, I found a significant effect of film clip, *Wald's* $\chi^2 = 60.838$, $p < .001$, such that more disgust was reported during disgust film clips than craving film clips. There was a non-significant effect of GADQ score, *Wald's* $\chi^2 = .266$, $b = .848$, $se = 1.3650$, $p = .606$. The two-way interaction was not significant, *Wald's* $\chi^2 = 1.969$, $p = .579$. As

such, results indicate that more disgust was reported during disgust clips than craving clips, regardless of GAD symptoms. These results suggest that those with higher GAD symptoms are modulating between film clips in the same way as those with lower GAD, which reflects failure to find support for context insensitivity.

Predicting Self-Reported Disgust with Film Clip and CES-D. When predicting self-reported disgust with film clip and CES-D scores, I found a significant effect of film clip, *Wald's* $\chi^2 = 116.738$, $p < .001$, such that more disgust was reported during disgust film clips than craving film clips. There was a non-significant effect of CES-D score, *Wald's* $\chi^2 = 1.288$, $b = .307$, $se = .3375$, $p = .256$. The two-way interaction was non-significant, *Wald's* $\chi^2 = 1.635$, $p = .651$. As such, results indicate that more disgust was reported during disgust clips than craving clips, regardless of depression levels. These results suggest that those with higher MDD symptoms are modulating between film clips in the same way as those with lower MDD, which reflects failure to find support for context insensitivity.

Predicting Self-Reported Craving with Film Clip and GADQ. When predicting self-reported craving with film clip and GADQ scores, I found a significant effect of film clip, *Wald's* $\chi^2 = 23.225$, $p < .001$, such that more craving was reported during craving film clips than disgust film clips. I found a non-significant effect of GADQ score, *Wald's* $\chi^2 = .484$, $b = -1.519$, $se = .8265$, $p = .487$. The two-way interaction was non-significant, *Wald's* $\chi^2 = 3.476$, $p = .324$. As such, results indicate that more craving was reported during craving clips than disgust clips, regardless of GAD symptoms. These results suggest that those with higher GAD symptoms are modulating between film clips in the same way as those with lower GAD, which reflects failure to find support for context insensitivity.

Predicting Self-Reported Craving with Film Clip and CES-D. When predicting self-reported craving with film clip and CES-D scores, I found a significant effect of film clip, *Wald's* χ^2 = 64.797, *b* =, *p* < .001, such that more disgust was reported during disgust film clips than craving film clips. There was a non-significant effect of CES-D score, *Wald's* χ^2 = 2.967, *b* = -.366, *se* = .2904, *p* = .085. The two-way interaction was non-significant, *Wald's* χ^2 = 3.452, *p* = .327. As such, results indicate that more craving was reported during craving clips than disgust clips, regardless of depression levels. These results suggest that those with higher MDD symptoms are modulating between film clips in the same way as those with lower MDD, which reflects failure to find support for context insensitivity.

Predicting RSA Reactivity with Film Clip and GADQ. When predicting RSA reactivity with film clip and GADQ scores, I found a non-significant effect of film clip, *Wald's* χ^2 = 2.879, *p* = .411, a non-significant effect of GADQ score, *Wald's* χ^2 = 1.927, *b* = -.062, *se* = .0425, *p* = .165, and a non-significant interaction, *Wald's* χ^2 = 1.026, *p* = .795.

Predicting RSA Reactivity with Film Clip and CES-D. When predicting RSA reactivity with film clip and CES-D scores, I found a non-significant effect of film clip, *Wald's* χ^2 = 2.635, *p* = .451, and a non-significant effect of CES-D score, *Wald's* χ^2 = 3.616, *b* = -.013, *se* = .0096, *p* = .057, and a non-significant interaction, *Wald's* χ^2 = .103, *p* = .991.

Predicting PEP Change with Film Clip and GADQ. When predicting PEP change with film clip and GADQ scores, I found a non-significant effect of film clip, *Wald's* χ^2 = .715, *p* = .870, and a non-significant effect of GADQ score, *Wald's* χ^2 = .752, *b* = -.773, *se* = .8158, *p* = .386, and a non-significant interaction, *Wald's* χ^2 = 3.002, *p* = .391.

Predicting PEP Change with Film Clip and CES-D. When predicting PEP change with film clip and CES-D scores, I found a non-significant effect of film clip, *Wald's* χ^2 = 3.866, *p* =

.276, and a non-significant effect of CES-D score, *Wald's* χ^2 = 1.015, *b* = .028, *se* = .1417, *p* = .314, and a non-significant interaction, *Wald's* χ^2 = 1.907, *p* = .592.

Discussion

A potential way to differentiate GAD and MDD is through emotional reactivity to reward and punishment. Previously, GAD has been linked to increased reactivity to punishment and MDD has been linked to blunted reactivity to reward and punishment (e.g., Rottenberg et al., 2005; Youngstrom & Izard, 2008). GAD has been associated with an over reactive avoidance system and increased levels of negative affect (e.g., Mennin & Fresco, 2014; Youngstrom & Izard, 2008). On the other hand, depression has been associated with similar levels of sadness in response to happy, sad, and neutral film clips and images, indicating an inability to respond to stimulus valence (Rottenberg et al. 2005). Depressed participants have also demonstrated less happiness than non-depressed individuals in response to all types of stimuli (Rottenberg et al., 2005). This thesis constituted the first laboratory assessment of differences in these responses in people reporting symptoms of both GAD and MDD, and provides a more integrative way of examining these responses by studying parasympathetic and sympathetic activity to assess physiological responses in addition to subjective reactivity.

Participants endorsing elevated GAD symptoms reported more anxiety during all blocks than those endorsing few GAD symptoms. This may suggest that GAD is associated not only with increased negative reactivity to punishing stimuli (avoidance), which would support previous findings (e.g., Youngstrom & Izard, 2008), but also with increased negative reactivity to rewarding stimuli (i.e., craving film clips). However, individuals with higher GAD are responding in similar patterns as those with lower GAD symptoms, so context insensitivity theories are not supported. In other words, both high and low GAD participants did not modulate

anxiety across the film clips, which confounded our determination of contextually appropriate reactions.

Participants endorsing higher depressive symptoms also reported more anxiety in all contexts compared to those with lower MDD symptoms. It is surprising that those with higher MDD symptoms reported more anxiety given that previous studies have found that individuals with MDD symptoms displayed blunted responses to both rewarding and punishing stimuli. In fact, these results partially support a context-sensitivity hypothesis, as those with high and low MDD symptoms displayed similar patterns of responding. This may suggest that those with higher MDD symptoms are responding in a way that is contextually congruent, just at higher levels of anxiety than participants with lower MDD. These results could suggest that GAD and MDD function similarly in that symptoms of both disorders are characterized by increased negative reactivity to disgusting and appealing stimuli. This could suggest that depression, which is traditionally characterized by low approach, is also characterized by high avoidance, which would make sense given the higher reports of subjective anxiety.

Alternately, these findings may be driven by the fact that the CES-D could be reflecting the MDD traits that are shared with GAD. In this sample, depression and anxiety symptoms were moderately correlated. This could explain the elevated, instead of blunted, reactivity to the disgust clips. These findings may suggest that depression is perhaps more nuanced than originally thought, at least when it comes to anxiety responses.

In both models, more craving was reported during the craving film clips than the disgust film clips, as expected. Neither GAD symptoms nor MDD symptoms predicted craving during the video clips. These findings may suggest that those with higher GAD symptoms and those with higher MDD symptoms are experiencing positive emotions in a way that is contextually

congruent (i.e. context sensitivity). However, this finding is most likely due to the limited range and severity of the symptoms in this non-clinical sample. The average GADQ score of 4.605 in our sample is lower than the clinical cut-off score of 5.6. Similarly, depression symptoms did not significantly predict self-reported craving. As with GAD, this is most likely due to having a non-clinical sample, particularly because MDD is associated with low positive affect. The average CESD score was 13.557, which is lower than the clinical cut-off score of 16. Finally, in both models, more disgust was reported during the disgust clips than during the craving clips. GAD or MDD symptoms did not predict self-reported disgust. This is most likely a result of the limited range and severity of GAD and MDD symptoms, as described above.

This study, which was the first to assess physiological reactivity in addition to subjective reactivity, unfortunately did not show any differences in vagal reactivity or PEP reactivity according to symptom severity. This could be because the number of participants that were able to be included in the analysis was not large enough to capture the small physiological differences. As such, an important next step would consist of studying these effects in a larger sample. In addition, the task might not have been intense enough to generate strong physiological responses. One option for continued examination of these physiological effects is to increase the intensity of the videos by showing more disgusting or appealing clips.

Another venue for future work is to examine these effects in a larger, clinical sample. The use of a non-clinical sample of undergraduates limited the range of symptoms, and thus lowered the power to detect differences. With a wider range of symptoms, the differences between anxiety and depressive disorders would be more pronounced. Future studies could include individuals with a clinical diagnosis of GAD and/or MDD. To some extent, it is possible that a

study done with such a clinical sample might not require a more intense task to detect differences.

Another limitation that could be addressed in future research is the representation of reward and punishment. While the results show that the film clips were effective in eliciting anxiety, craving and disgust, it did not make a difference whether the participants were instructed to eat popcorn or not. This may imply that the video stimulus was much more effective in eliciting emotional responses than the food stimulus. If participants did not find eating popcorn during the disgust video as something threatening they might not be as inclined to avoid it. Also, participants who did not like the popcorn might not have interpreted the instruction to eat as a reward, which could have decreased approach and potentially increased avoidance. Future studies could address this issue by instituting other means of reward, including food and non-food stimuli, and in varying intensities (utilizing more desirable or disgusting foods).

Concluding Remarks

This study found that individuals displaying elevated GAD symptoms and individuals displaying elevated MDD symptoms reported more anxiety across film contexts, suggesting that both disorders are characterized by increased negative affect. However, this was restricted to the emotion of anxiety. Moreover, the patterns above were only found regarding subjective reactivity, not physiological reactivity. One of the strengths of this study is that it utilized multiple levels of analysis by including physiological measures. Another strength is that it assessed multiple forms of psychopathology by examining symptoms of anxiety and depression. I did not find support for context insensitivity theories for those with elevated GAD and I found partial support for negative (anxiety) responses in those with high MDD. Positive responses (craving) did not vary based on GAD or MDD symptoms levels. These findings may shed light

on the complex ways that GAD and MDD influence emotional responses and could eventually help guide the treatment and prevention of these disorders.

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Table 1: GEE models predicting subjective and physiological reactivity with film clip and GAD (*Wald's* χ^2)

	Anxiety	Craving	Disgust	RSA withdrawal	PEP reactivity
Main effect of film clip	5.613	23.225**	60.838**	2.879	.715
Main effect of GAD	4.085*	.484	.266	1.927	.752
Film clip * GAD	3.620	.3476	1.969	1.026	3.002

*$p < .05$, **$p < .01$

Table 2: GEE models predicting subjective and physiological reactivity with film clip and MDD (*Wald's* χ^2)

	Anxiety	Craving	Disgust	RSA withdrawal	PEP reactivity
Main effect of film clip	12.713**	64.797**	116.738**	2.635	3.866
Main effect of MDD	17.374**	2.967	1.228	3.616	1.015
Film clip * MDD	16.612**	3.452	1.635	.103	1.907

*$p < .05$, ** $p < .01$