Startle Habituation in Individuals with Depression and/or Panic Disorder

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DISSERTATION

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This dissertation is dedicated to my family: my mom, dad, siblings, and husband, who have provided me endless support as I worked to earn this degree. Mom, Dad, and Jerry: thank you for always teaching me to march to the beat of my own drum and find my own path, even if it was a non-traditional one.

To my husband, Aaron: thank you for helping me keep my head up when times got tough, for the countless home-cooked meals ready for me when I came home after late nights at school, and for your never-ending love and support. I could not have done this without you.

Last but not least, thanks to Darwin - the most loyal friend anyone could have.

CHAPTER PAGE

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ACC	Anterior Cingulate Cortex
ASI	Anxiety Sensitivity Index
AS	Anxiety Sensitivity
BAI	Beck Anxiety Inventory
DSM	*Diagnostic and Statistical Manual of Mental Disorders*
ECI	Emotion Context Insensitivity
EMG	Electromyographic
GAD	Generalized Anxiety Disorder
GSR	Galvanic Skin Response
GTS	General Temperament Survey
HRSD	Hamilton Rating Scale for Depression
MDD	Major Depressive Disorder
NE	Negative Emotionality
NT	Negative Temperament
N	Neuroticism
OCD	Obsessive Compulsive Disorder
PD	Panic Disorder
PFC	Prefrontal Cortex
PTSD	Post Traumatic Stress Disorder
RDoC	Research Domain Criteria
SCID	Structured Clinical Interview for *DSM* Disorders

SUMMARY

Depression and anxiety, although traditionally classified as distinct psychological disorders, often co-occur and have been shown to have overlapping affective and behavioral characteristics (Watson, Clark, Lee & Harkness, 1994). Despite their commonalities, some studies have indicated that the two diagnostic constructs vary in their emotional responses to aversive events, as measured by the startle response. Specifically, anxious individuals often have a heightened startle response, whereas the association between depression and startle are more mixed, with some studies showing blunted startle in depressed individuals. One reason for these mixed findings may be because emotional responses to aversive events may change over time. For example, there may be different patterns of habituation of the startle response (Harris, 1943) in depression vs. anxiety. The present study examined the habituation of the startle response in a sample of depressed individuals without a history of anxiety (n = 40), individuals with panic disorder without a history of depression (n = *28*), those with comorbid depression and panic disorder (n = 56), and healthy controls (n = 65). Results indicate that depressed-only individuals habituate at quicker rates than control participants, but no other significant differences were found in rates of startle habituation between other diagnostic groups. Theoretical and clinical implications are discussed.

1. INTRODUCTION

Anxious and depressive disorders are highly comorbid conditions. Approximately 50-60% of individuals with a lifetime history of major depressive disorder (MDD) also report a lifetime history of one or more anxiety disorders (Clark, 1989) and individuals with a current anxiety disorder also report a lifetime history of depression at similarly high rates (Clark, 1989; Kessler, Nelson, McGonagle, & Liu, 1996). Consequently, because of this high comorbidity, researchers have raised questions about the reliability (Brown, De Nardo, Lehman, & Campbell, 2001) and validity (Watson, 2005) of the current diagnostic nomenclature for anxiety and depressive disorders (i.e., Diagnostic and Statistical Manual of Mental Disorders, 5th edition [DSM-5]; American Psychiatric Association, 2013), specifically whether the class of disorders truly represent separate forms of psychopathology.

1.1 Current Diagnostic Nomenclature

One hypothesis as to why this overlap exists is that current diagnostic nomenclature relies solely on self-reported symptoms (Cuthbert & Insel, 2010; Insel et al., 2010; Sanislow et al., 2010) as opposed to more objective measures that are thought to better reflect the core pathophysiology of psychological disorders. Research has shown the limitations of using these types of self-report measures (i.e., demand characteristics, etc.) This has led researchers to explore more mechanistic factors (i.e. genetic, neural, observable behavior) that may be associated with the phenomenology and development of mental disorders rather than relying exclusively on self-reported symptoms. Linking these basic biological and behavioral processes to normal and abnormal functioning is key to the development of reliable and valid phenotypes for psychiatric conditions that could aid in more appropriate diagnostic profiles and for potential targets of treatment (Sanislow et al., 2010).

In line with this theoretical shift away from the current categorical-based system, a recent initiative has been launched by the National Institute of Mental Health (Research Domain Criteria [RDoC] Project) that seeks to encourage scientists to work towards the development of transdiagnostic (i.e. neurobiology, genetics, psychophysiology, behavior) constructs that describe the core mechanisms underlying psychopathology as opposed to solely self-reported symptoms to classify disorders. Ideally, these RDoC constructs will help redefine the current diagnostic nomenclature by identifying core features of psychological disorders that are more valid than the current self-reported symptom-based categorical diagnoses. Further, studies under the RDoC initiative will ideally seek to examine features that are common and/or specific to particular psychopathological constructs in order to gain a better understanding of the pathophysiology (and discriminant validity) of these disorders.

1.2 Anxiety and Depression: Theories of Comorbidity

Many psychological theories have been postulated by researchers to try and explain the high rates of comorbidity between anxiety and depression. The most prominent initial theories outlined emotional factors thought to explain shared and unique variance in these two disorder classes. According to Clark and Watson's (1991) tripartite model, negative affectivity is theorized to be common to anxiety and depression, low positive emotionality unique to depression, and high anxious arousal unique to many anxiety disorders. Mineka, Watson, and Clark (1998) extended this theory and postulated that there may be distinguishing factors beyond anxious arousal that are unique to particular anxiety disorders. Supporting this further, studies have revealed that anxious arousal is most specific to Panic Disorder (PD) and not all anxiety disorders, whereas Major Depressive Disorder (MDD) and Generalized Anxiety Disorder (GAD)

are more associated with the aforementioned General Distress/Negative Affectivity factor than other anxiety disorders (Mineka et al., 1998).

More recently, Watson (2009) revised the model and labeled it the Quadripartite Model of Anxiety and Depression (Watson, 2009). This theory characterizes individual symptoms by their degree of subjective distress/negative affect (e.g., high vs. low) and specificity to depressive versus anxious, shifting away from traditional categorical diagnostic classes. More specifically, Watson (2009) describes four basic symptom profiles that may best characterize individuals experiencing anxiety and/or depression: 1) high distress symptoms with limited specificity (e.g., depressed mood); 2) high distress symptoms with greater specificity (e.g., intrusions in PTSD) 3) low distress symptoms with greater specificity (e.g., checking behaviors in OCD); and 4) low distress symptoms with limited specificity (e.g., appetite loss, insomnia).

1.3 **Affective Responding in Anxiety and Depression**

Despite many overlapping traits and characteristics in the depressive and anxious disorders, differences have emerged in affective responding between these two disorder classes. One class of responding that may differentiate the two is defensive responding to aversive stimuli. Evidence suggests that individuals with anxiety disorders have an increased tendency for heightened physiological responding to aversive stimuli (McTeague, Lang, Laplante, Bradley, 2011; McTeague & Lang, 2012). This pattern of heightened physiological responding in anxious individuals has been found in studies of contextual fear (Grillon & Morgan, 1999), cued fear (Grillon, 2002), and other fear-learning paradigms (Grillon, 2008; Lissek et al., 2005).

In contrast, the pattern of responding to aversive emotional stimuli in depression is unclear. For example, some research has suggested that individuals with depression exhibit a heightened and sustained response to negative stimuli (Grillon et al. 2013; Larson, Nitschke, &

Davidson, 2007). However, other studies have reported that individuals with depression have a blunted response to negative emotional stimuli (Dichter, Tomarken, Shelton, & Sutton, 2004; Allen, Trinder, & Brennan, 1999; Kaviani, Gray, Checkley, Wilson, & Kumari, 2004; Forbes, Miller, Cohn, Fox, & Kovacs, 2005). Additionally, studies examining event-related potentials (ERP's), resting sinus arrhythmia, and pupil dilation have all indicated that, relative to healthy controls, depressed individuals evidence heightened and more sustained affective responding immediately following the presentation of an unpleasant stimulus (Deldin, Deveney, Kim, Casas, & Best, 2001; Deveney & Deldin, 2004; Rottenberg, Kasch, Gross, & Gotlib, 2002; Siegle, Granholm, Ingram, & Matt, 2001; Siegle, Steinhauer, Carter, Ramel, & Thase, 2003).

1.3.1 **Initial Reactivity vs. Time Course of Responding**

The majority of the aforementioned studies have focused on responses to a single, aversive event (e.g., examining initial reactivity) or averaged responses across multiple events. There is a growing literature examining the 'pattern' (or course) of affective responding over time. Studies examining emotional responding over time (sometimes labeled affective chronometry) are critical, as reactivity and time course may play qualitatively different roles in the development and maintenance of the depressive and anxious disorders (Davidson, 1998; Davidson, Jackson, & Kalin, 2000). For instance, in anxiety disorders it is plausible to assume that heightened attention to threatening stimuli (initial reactivity) would play a critical role in the development of anxious symptoms, whereas the pattern of affective responding over time may be more related to the maintenance of anxious symptoms. As such, in order to further our understanding of these two important and distinct processes, studies should include separate examinations of initial affective reactivity and change in responding over time.

1.3.2 **Operationalizing the Time Course of Emotional Responding**

Unfortunately, the definition and measurement of the time course of emotional responding are fairly inconsistent in the literature. One way to examine the time course of responding is to measure the gradual decrease in physiological responding to a stimulus over time, often termed habituation (Harris, 1943; Herry et al., 2010). According to classic work by Groves and Thompson (1970), habituation often consists of two components– a gradual decrease in reactivity to a repeated stimulus over time, and in some cases, sensitization or the temporary enhancement in responding to an aversive stimulus. The presence of sensitization indicates that reductions in responding over time may not best be defined as a solely linear decrease, and often involve more complex underlying processes (i.e., perhaps a combination of linear and quadratic effects).

1.3.3 **Habituation in Anxiety and Depression**

Individuals with anxiety disorders have repeatedly been shown to display alterations in habituation of physiological responding to aversive events over time. In one of the first reports of this phenomena, Lader and Wing (1964) found that anxious individuals had slower rates of habituation of the galvanic skin response compared with healthy controls. A more recent study found deficits in habituation of the electrodermal response in rape victims with PTSD relative to non-PTSD rape victims (Rothbaum et al., 2001). Patients with panic disorder have also demonstrated deficits in habituation of skin conductance responses when presented with aversive auditory tones (Roth, Ehlers, Taylor, Margraf, & Agras, 1990). Lastly, deficits in habituation of the startle response have also been found to associate with Anxiety Sensitivity, a personality trait assessing an individual's fear of anxiety-related sensations (Taylor et al. 2007) and a known risk factor for the development of future anxiety disorders (Holloway & McNally, 1987; Keogh &

Mansoor, 2001; Keogh, Dillon, Georgiou, & Hunt, 2001; Lees, Mogg, & Bradley, 2003; Campbell et al., 2014).

Far fewer studies have examined habituation among individuals with depression. One study (Quednow, Kuhn, Stelzenmueller, Hoenig, Maier, & Wagner, 2004) showed attenuated habituation of the acoustic startle response among depressed individuals following two weeks of serotonergic anti-depressant use. Further, these researchers found that depressed individuals with the greatest baseline startle response (i.e., least habituation) had the largest benefit of antidepressant treatment. It is important to note that, in the aforementioned study, researchers did not control for baseline levels of anxiety, so it is unclear whether the reported differences in startle habituation were due to anxiety levels, medication effects, or changes in depressive symptoms. Lastly, Negative Temperament (NT), a personality dimension closely related to Neuroticism (Watson, Clark, & Harkness, 1994) that is related to both depressive (and anxious) disorders, has been associated with lower rates of physiological habituation (Coles, Gale & Kline, 1971; Norris, Larsen, & Cacioppo, 2007). Consequently, taking the complexity and inconsistency of the aforementioned literature into account, it remains unclear how individuals with depressive symptoms habituate their physiological responses to aversive stimuli.

1.3.4 **Startle Habituation**

Although studies examining habituation have often employed diverse measures, one widely used psychophysiological index is the startle response. Previous research has consistently demonstrated that startle is sensitive to internal affective states such that appetitive motivation states (e.g., happiness) inhibit the startle response while aversive motivation states (e.g., fear, anxiety) potentiate the startle response (Lang, 1995; Lang, Bradley, & Cuthbert, 1998). This 'affect modulation' of startle has been observed using numerous emotional stimuli/inductions,

including the passive viewing of pictures (Bradley, Lang, & Cuthbert, 1993), film clips (Jansen & Frijda, 1994), and during threat-of-shock (Grillon et al., 2008; Nelson & Shankman, 2011). Moreover, unlike other psychophysiological markers of affect (e.g., skin conductance), startle modulation is particularly sensitive to changes in the valence (i.e., positive vs. negative) of the individual's emotional state and not just their overall arousal (Lang, Bradley, & Cuthbert, 1990).

1.4 Aims and Hypotheses

As such, the primary aim of the present study was to determine whether patterns of baseline startle habituation differed between individuals with MDD and/or PD. The rationale behind why the present sample includes participants with early onset major depressive disorder and panic disorder, as opposed to other depressive and anxious disorders, stems from what is known about the qualitatively different symptoms of major depression and panic disorder. Phenotypic and genotypic studies suggest that internalizing psychopathologies can be characterized by two broad factors: 'anxious misery' (e.g., depression, and generalized anxiety disorder [GAD]) and 'fear' disorders (e.g., panic disorder, agoraphobia, and simple phobia) (Kendler et al., 2003; Krueger, 1999; Watson, 2005). Thus, given the interest in identifying biomarkers that distinguish depression and anxiety disorders, the present study focused on panic disorder (a 'fear' disorder) as opposed to disorders such as GAD (an 'anxious-misery' disorder) given the substantial overlap in etiology and symptom structure between depression and GAD.

Given the aforementioned high rates of comorbidity among the anxious and depressive disorders, identifying mechanisms that are common or specific to depression and anxiety will advance our understanding of the pathophysiology underlying these disorders. Taking into account evidence suggesting deficits in startle habituation among those with anxiety disorders, and panic disorder specifically, we hypothesized that individuals with panic disorder would have

less startle habituation than individuals without panic disorder. However, because the literature regarding startle and depression is more mixed, with some studies showing heightened physiological responding to aversive events, and others showing a "blunted" response, it is unclear how individuals with depression will respond compared to controls and/or individuals with panic disorder.

An additional aim of the present study is to determine whether there is an interactive effect of both disorders on startle habituation. More specifically, we will examine whether the pattern of startle response among individuals with comorbid depression and panic disorder differs from healthy controls and/or from individuals with either disorder (i.e., depression or panic disorder) alone. Because the depression literature regarding startle habituation is mixed, our hypothesis for this aim is unclear and will be guided by the presence or absence of a main effect of depression.

2. METHODS

2.1 Participants

Data was collected as part of a larger project examining startle reactivity among individuals with depression and/or panic disorder, using a threat-of-shock paradigm (see Shankman et al., 2013 for a detailed description). All interested participants were first screened over the phone to get an initial assessment of the inclusion/exclusion criteria. Participants were excluded from the study if they had a lifetime diagnosis of psychosis, bipolar disorder, or dementia; were unable to read or write English; had a history of head trauma with loss of consciousness; or were left-handed (as confirmed by the Edinburgh Inventory; range of laterality quotient: +20 to +100; Oldfield, 1971). Participants were recruited through clinics in the greater Chicago area and advertising in the community. If they were considered eligible for the study based on the phone screen, they were invited to the lab and provided written informed consent. Of note, final eligibility for the study was determined at the first lab visit.

2.2 Participant Diagnosis and Symptomatology Measures

All diagnoses were made via the Structured Clinical Interview for DSM-IV-TR (SCID; First, Spitzer, Gibbon, & Williams, 2002). Depression severity was determined via the 24-item Hamilton Depression Scale (HAM-D; Hamilton, 1960). Anxiety severity was determined via the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988). Twenty SCIDs were audio recorded and scored by a second rater blind to original diagnoses to determine reliability of diagnoses. Interrater reliability indicated perfect agreement for panic disorder and major depressive disorder diagnoses (kappas = 1.00).

The sample for the present study consists of four groups of participants: individuals with current panic disorder (i.e., PD only, n = 28), current MDD (i.e., MDD only, n = 40), current PD

and current MDD (i.e., comorbids, *n* = 58) and controls without a history of Axis I psychopathology (*n* = 65), for a total of 191 participants. Participants in the MDD-only group were required to have no current or past history of an anxiety disorder (PD, social phobia, etc.). Participants in the PD-only and comorbid groups were allowed to meet criteria for additional current and past anxiety disorders. PD-only participants also met criteria for social phobia (*n* = 2), specific phobia (*n* = 6), PTSD (*n* = 3), GAD (*n* = 7), and obsessive-compulsive disorder (*n* = 1). Comorbid participants also met criteria for social phobia (*n* = 20), specific phobia (*n* = 11), PTSD (*n* = 18), GAD (*n* = 1), and obsessive-compulsive disorder (*n* = 9). Comorbid (63.8%) and PD only (46.4%) participants did not differ in the rate of other lifetime anxiety disorders, $\chi^2(1, N = 86) = 2.34$, *ns*. Control participants were required to have no lifetime history of Axis I psychopathology, with the exception of a past diagnosis of alcohol or cannabis abuse (but not dependence; *n* = 4). Control participants were also required to have scores of less than 8 on both the 24-item Hamilton Rating Scale for Depression (HRSD; Hamilton, 1960) and Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988).

2.3 **Procedure**

Data collection took place during two sessions, separated by approximately 1-2 weeks. During Session 1, participants completed a diagnostic interview (the Structured Clinical Interview for DSM Disorders [SCID]) designed to capture categorical assessments of psychopathology (First, Spitzer, Gibbons, & Williams, 2002). Participants also completed an interview assessing depressive symptoms (HRSD; Hamilton, 1960).

Individuals that continued to meet eligibility for the study were invited to participate in Session 2. During this session, participants completed a series of tasks assessing reward and threat sensitivity, (as described in Shankman et. al, 2013). All participants completed the

baseline startle task prior to any other task. The startle eyeblink was recorded using two electrodes placed over the orbicularis oculi muscle underneath the right eye and collected with a bandpass filter of 10-200 Hz at a sampling-rate of 1000 Hz. Although the upper end of this frequency band is below the Blumenthal et al. recommendation of 500 Hz, the missing bandwidth (200-500 Hz) is not likely to effect the experimental manipulation or the reliability of the results (A. Van Boxtel and T. Blumenthal, personal communications, December 14, 2009). Following electrode placement, all participants sat in a sound-attenuated, electrically shielded booth. Participants were told to relax and focus on a fixation cross on a monitor approximately one meter in front of them while nine acoustic startle probes were administered through headphones. Startle tones were presented using PSYLAB (Contact Precision Instruments; London, UK) and physiological data was recorded using a PC-based acquisition system (Neuroscan 4.3). Of the 191 participants initially enrolled in the study, 1 was excluded because of equipment failure, 1 was excluded because the participant was deaf in one ear, 1 was excluded because the participant fell asleep during the experiment, resulting in a total of 188.

2.4 **Data Analysis**

Startle blinks were scored according to published guidelines (Blumenthal et al., 2005). Data was first rectified and then smoothed using a FIR filter with a band pass of 28-40 Hz. Blink response was defined as the peak amplitude of EMG activity within the 20-150-ms period following startle probe onset relative to baseline (average baseline EMG level for the 50-ms preceding the startle probe onset). Each peak is identified by software and examined by hand to ensure acceptability (e.g., not a double blink). Blinks were scored as non-responses if EMG activity during the 20-150-ms post-stimulus timeframe did not produce a blink peak that was visually differentiated from baseline activity. Blinks were scored as missing if the baseline

period was contaminated with noise, movement artifact, or if a spontaneous or voluntary blink began before minimal onset latency and thus interferes with the startle probe-elicited blink response. These definitions are in accordance with established guidelines (Blumenthal et al., 2005). Descriptive analyses indicated that individual blinks were significantly skewed (range = 1.1 to 2.9) and kurtotic (range = 0.8 to 31.5). Therefore, each individual blink was square-root transformed prior to analysis.

Random Coefficients Modeling (RCM; Hedeker & Gibbons, 2006) analyses were used to test the primary hypotheses. This analytic strategy tests not only for the presence of sample-wide (i.e., fixed) effects, but also subject-level (i.e., random) effects. Using RCM, one is also able to incorporate data from the entire series of blinks, rather than just the first and last blinks, 2) account for the influence an individual subject may have on his/her own future repeated observations, and 3) test for the presence of linear and quadratic effects (Hedeker & Gibbons, 2006).

All random coefficients models were run using the PROC MIXED procedure in SAS 9.2 (SAS Institute Inc., 2008). For these analyses, we first determined the variance-covariance structure that best described the data (see Hedeker & Gibbons, 2006) using tests of -2 log likelihood differences.

Following the determination of the most appropriate model for our data, we conducted a series of 2-level mixed effects models examining the slope of eyeblink responses across time, within individuals, to test whether there were group differences in the time course of defensive responding. Time was coded as the second the startle probe occurred relative to the start of the task (onset = 0 secs). Diagnosis was examined as two, 2-level factors, Depression Status (Present vs. Absent) and Panic Status (Present vs. Absent), instead of one 4-level factor in order

to examine main effects and interactions of MDD and PD on the variables of interest. Age and gender were included as covariates in all models. Age was grand-mean centered while gender was effects coded.

Any significant three-way interaction between the time variable and the two diagnostic variables (i.e., Depression Status and Panic Status) were followed up using mixed-effects models to detect changes in the startle response over time between two separate diagnostic groups (i.e., depressed only vs. controls; depressed only vs. panic only; depressed only vs. comorbid; panic only vs. controls; comorbids vs. controls). This allowed us to determine changes in habituation as a function of diagnostic status. Any resulting significant two-way time by diagnosis (Depression Status, Panic Status, or both) interaction was followed-up using a standard simple slopes approach (Holmbeck, 2002).

To determine whether there were group differences in initial defensive responding, we conducted analyses of variance (ANOVA) with each participant's estimated intercepts (i.e., time = 0) from our initial models. The use of estimated intercepts is preferable to using subjects' actual initial blink (i.e., blink 1 of the condition) given that the multilevel model uses all of the subjects data to estimate the intercept and is thus more reliable that a single blink. Between subjects effects were Depression Status, Panic Status, and the Depression Status x Panic Status interaction. Covariates included age and gender.

3. RESULTS

3.1 Clinical Characteristics

Demographic and clinical differences between the groups can be seen in Table 1. Of note, the groups did not differ on any major demographic variable including age, gender, race, or education level. As expected, individuals in the depressed only group reported elevated current depressive symptoms (i.e., Hamilton Rating Scale of Depression scores) relative to those without depression. Those in the panic only group reported elevated anxiety symptoms (i.e., Beck Anxiety Inventory scores) relative to those without a diagnosis of panic disorder. Comorbid individuals had elevated depressive symptoms relative to panic disorder patients and controls, and had elevated anxiety symptoms relative to depressed only participants and controls.

3.2 Initial Reactivity

Analyses of variance (ANOVA) did not yield main effects of PD, MDD, or a PD x MDD interaction for estimated intercepts, suggesting no group differences in initial reactivity (all *p's* > .05). When comparing control participants to all others in our sample, we also found no differences in initial reactivity ($p = .110$).

3.3 Random Coefficients Modeling: Overall Patterns of Startle Habituation

Analyses using random coefficients modeling revealed a significant negative linear effect of time ($b = -0.025$, $t = -6.67$, $p < .0001$), and a trend-level positive quadratic effect of time ($b = .00005$, $t = 1.89$, $p = .064$). Thus, on average, participants blink amplitudes decreased over time, but the rate of this decrease diminished over time. We also did not find any main effects for group (i.e., depression status: $b = -0.23$, $t = -0.46$, $p = 0.64$), although there was a trend for a main effect of panic status ($b = 0.93$, $t = 1.81$, $p = .07$), suggesting marginally higher overall startle responding for those with panic disorder compared to those without panic disorder. We

did not find a 2-way interaction between linear time and panic status (b = 0.0005, t = 0.22, p = 0.83), but a linear time by depression status interaction was at a trend level (b = 0.004, t = 1.84, p = 0.07). **.** However, this trend-level two way interaction was qualified by a significant 3-way linear time by depression status by panic status interaction (b = -0.01, t = -1.92, p = .05). Lastly, we did not find a relationship between negative emotionality and linear startle habituation (b = 0.0001, t = 1.02, p = 0.30).

3.3.1 **Three-Way Interaction Follow-Up: Pairwise Comparisons**

To follow up this significant three-way interaction, as described above, we conducted six separate pairwise mixed multilevel models to examine two-way interactions between each of our diagnostic groups and our linear time variable (e.g., panic only vs. control, panic only vs. depressed only, etc). As shown in Table 3, results indicated that the only significant 2-way interaction was Group x linear time between depressed only participants and our control group (b = .009, t = 2.57, p = .01). We did not find any significant two-way diagnostic group (i.e., depression status or panic status) by linear time interactions in any of our other pair-wise comparisons (all p's >.05).

To follow up the significant group by time interaction for the depressed-only vs. control group, simple slopes analyses were conducted to determine how the rate of habituation between the two groups differed over time. Results indicated that, while both groups displayed reduced startle reactivity over time during the baseline habituation period, individuals with depression (b = -0.03, t = -7.05, p < .0001) habituated more quickly than controls (b = -0.024, t = -5.76, p <.0001).

4. DISCUSSION

The present study sought to elucidate similarities and/or differences in baseline startle habituation among individuals with depression and/or panic disorder. Given the high comorbidity between depression and anxiety, it is crucial that research is conducted to identify constructs that can delineate these two conditions in order to further our understanding of these disorders and develop future targeted treatments. Furthermore, taking into consideration the problems with our current diagnostic nomenclature and sole reliance on self-reported symptoms to make diagnoses, it is of utmost importance that the field utilizes more objective measures (i.e., physiological measures such as the acoustic startle response) of these constructs.

We hypothesized that individuals with panic disorder would evidence higher overall startle magnitudes and reduced startle habituation across the baseline startle period compared with control subjects and depressed only subjects, given extant evidence that suggests individuals with anxiety exhibit exaggerated emotional responding (i.e., defensive responding; McTeague, Lang, Laplante, Bradley, 2011; McTeague & Lang, 2012) and, specifically, during baseline conditions. Our hypotheses regarding individuals with depression (and comorbid anxiety) were less clear, given the mixed literature indicating that those with depression have shown both heightened and blunted emotional responding.

Consistent with our initial hypotheses, we did find that individuals with a diagnosis of panic disorder had overall higher startle magnitudes than those without this diagnosis (although this effect was at trend). Interestingly, our results suggest that a current diagnosis of depression but not panic disorder is associated with increased habituation of the startle response over a baseline period, as indicated by a three-way depression status X panic status X linear time interaction. Specifically, we found that individuals with depression habituated at significantly

increased rates, but only when compared to our control group and not the other two diagnostic groups. We did not find that individuals with only a current diagnosis of panic disorder habituated at different rates than control participants, and we also did not find a difference in habituation rates between our comorbid group and any other group (i.e., depression only, panic only, controls). Lastly, we did not find any differences in initial reactivity.

There are several possible reasons for our finding that individuals with depression habituate over time at a steeper rate than control participants. First, these results may reflect that those with depression exhibited 'affective withdrawal' in the face of repeated aversive stimuli, akin to Seligman's theory of learned helplessness in depression (Seligman, 1975). This theory, drawing on both animal and human research, posits that, when a person concludes that events facing them are uncontrollable, that individual experiences deficits in cognition (i.e., expecting further uncontrollability), motivation (i.e., reduced/slowed initiation of responses), and emotion (i.e., depressed affect). Thus, taking this theory into consideration, it is plausible that individuals with depression would demonstrate accelerated startle habituation given their tendency to quickly withdraw from aversive stimuli.

A second (and related) explanation for these findings is that there is a growing body of research suggesting that individuals with depression have reduced emotional reactivity to both positive and negative stimuli (i.e., Emotion Context Insensitivity [ECI] hypothesis). A large meta-analysis of laboratory studies investigating this hypothesis among depressed individuals supported this theory (Bylsma, Morris, Rottenberg, 2008). However, mixed evidence has surfaced in more recent years, with some studies contradicting the ECI theory (Grillon et al., 2013), and others in support of it (Jin, Stedding, & Webb, 2015). Taking the ECI theory into consideration, it is plausible that individuals with depression may have disengaged from the

aversive stimuli in our study (i.e., the acoustic startle response) more quickly than control participants, resulting in steeper reductions over the course of our baseline startle task. However, future empirical research is needed to further evaluate this explanation.

A third reason for this effect could relate to the known differences in attentional processing between individuals with depression and anxiety. Although both populations (i.e., depression and anxiety) have shown heightened attention to threatening stimuli (Craske et al., 2009), the stage at which these individuals do so seems to differ. More specifically, those with anxiety have evidenced increased attention to threatening stimuli in the early, more unconscious stages of attention processing (Mogg and Bradley, 2002), whereas those with depression seem to show biases in later stages (Mathews and MacCleod, 2005). Consequently, it is plausible that this may help explain why individuals with a diagnosis of depression (but not panic disorder) show steeper reductions in startle during a brief, baseline startle period.

Related to the attention literature, it has been shown that individuals with depression evidence alterations in brain activity in regions associated with emotion regulation, such as the anterior cingulate cortex (ACC) and the prefrontal cortex. More specifically, the ACC region is often considered a "bridge" between attentional and emotional regions of the brain. As stated by Thayer & Lane (2000), the ACC is "a point of integration for visceral, attentional, and affective information that is critical for self-regulation and adaptability" (p. 211). The ACC is comprised of two subdivisions considered to have separate but related functions: the "affective" region, comprising the rostral and ventral areas of the ACC, and the "cognitive" region, involving the dorsal ACC (Devinsky, Morell, & Vogt, 1995; Vogt, Finch, & Olson, 1992; Vogt Nimchinsky, Vogt, & Hof, 1995). The affective portion of the ACC is thought to monitor visceral responses to stressful and/or emotional stimuli, social behavior, and emotional expression, whereas the

cognitive portion relates to processing of cognitively demanding information. Functional neuroimaging literature supports the distinction between these two separate ACC regions (Bush et al. 1998, 2000; Whalen et al. 1998).As referenced above, depressed individuals have repeatedly been found to have differences in ACC activation compared to those without depression. For instance, individuals in a current depressed state have demonstrated alterations in activation in the dorsal (e.g., "cognitive") ACC, whereas depressed individuals who respond to treatment as well as those who go into remission have shown increased activation in both subdivisions of the ACC (Bench et al. 1993, Buchsbaum et al. 1997, Mayberg et al. 1999).

In addition to the aforementioned studies related to ACC activation, recent neuroimaging studies have also revealed associations between activation of the prefrontal cortex and depressive symptoms. For instance, Heller and colleagues (2014) demonstrated that prefrontal cortex activation during an emotion regulation task was predictive of changes in depression severity during a 6 month antidepressant treatment, such that higher activation was associated with greater reductions in depression severity ratings (Heller et al., 2014). Another recent study found that depressed individuals who were more able to inhibit their response to positive stimuli (as measured by prefrontal cortex activity) had the greatest improvements in anhedonia during an 8-week treatment period (Light et al., 2011). Taking into consideration these findings, along with the previously mentioned research that implicates the ACC as integral to the modulation of the startle response (Pissiota, Frans, Michelgard, Appel, Langstrom, et al. 2003) it is plausible that alterations in neuronal activation typical of depressed individuals may help explain our finding of increased startle habituation in this population.

Although we found the aforementioned effect for depressed-only participants, we did not find differences in baseline startle habituation between any of our other groups. Given previous

research that has found blunted emotional responding among individuals with comorbid depression and anxiety, it is unclear why we did not find similar results. For instance, Forbes and colleagues (2005) looked at the relationship between startle blink reactivity among individuals with child-onset unipolar or bipolar depression versus those with no history of depression and found that those with major depressive disorder showed inhibited startle responding when viewing pleasant pictures, and non-significant startle potentiation when viewing unpleasant pictures. Notably, these findings remained even when participants had a comorbid anxiety disorder. Similarly, Lang et al. (2007) found that, among individuals with anxiety disorders, those with a comorbid depressive disorder displayed less fear potentiation than individuals without depression. The results from both of these studies suggest that the blunted physiological response to emotional stimuli present among those with depression may be enough to counteract the heightened emotional responding often found among those with anxiety disorders among individuals with both diagnoses. One key difference in these findings is that each of the previously mentioned studies of individuals with comorbid depression and anxiety (Forbes et al. 2005; Lang et al. 2007) examined startle reactivity during tasks designed to elicit emotional states, whereas the present study examined the startle response in relation to a 2.5-minute baseline period. Perhaps individuals with comorbid depression and anxiety only evidence emotional blunting during explicit emotion-modulated tasks and not to more implicit measures of emotional reactivity, such as baseline startle habituation.

It should be noted that prior definitions of the term "baseline startle response" in the literature have been inconsistent, with some operationalized as reaction to neutral stimuli or reactivity during intertrial intervals (Vaidyanathan et al., 2009). Further complicating matters is the fact that the way researchers have measured startle habituation in prior studies has varied

vastly, with some using the difference (or change) in responding from the first and last aversive stimulus (Ellwanger, Geyer, and Braff, 2003), others taking a proportion of change from the first to last stimulus (see Nelson, Shankman, Olino, & Klein, 2011), and others examining the slope or trajectory of responding (LaRowe et al., 2006). One prior study suggested that using a proportion of change score or an evaluation of slopes over time may be more robust measures of startle habituation than a simple change score, but that the latter may be a more nuanced measure given its ability to detect *patterns* of affective responding (Campbell et al., 2014). These patterns of responding are of particular relevance in relation to the anxious and depressive disorders, where the development and maintenance of psychological symptoms involve the way individuals respond to aversive events over time. Thus, it is crucial that future studies evaluating startle habituation consider examining the trajectory of responses over time.

Our lack of differences in initial reactivity between *any* of our groups is interesting, given our significant findings in other areas looking at patterns of responding over time. This contrast suggests that, during a baseline startle period, there may be meaningful differences in how the way certain people respond to aversive stimuli over time, despite a similar initial starting point. Perhaps these findings could be explained by the fact that this task was not an explicitly threatening task, and thus may not have been emotionally activating enough to elicit more pronounced effects. Researchers have found differences in how individuals with depression and anxiety respond depending on how "strong" or "weak" the experimental context or condition is. Lissek, Pine, & Grillon (2006) argue that the 'strength' of an experimental context/condition can depend on a variety of factors including the predictability and strength of experimental stimuli. Furthermore, Lissek and colleagues (2006) suggest that *weaker* experimental conditions may be necessary in order to detect patient versus control differences in anxiety, as strong situations tend

to illicit similar patterns of reactivity among *all* individuals (i.e., those with and without psychopathology).

While the current study had a number of strengths - including, most notably, the use of four separate groups allowing for an examination of the main and interactive effects of depression and anxiety, some limitations should be noted. First, the sample of panic disorder participants was by far the smallest of the 4 groups (n = 28), and may have thus limited our ability to detect differences in startle habituation. Second, the panic-only participants were allowed to have current other anxiety disorders, and thus these results may reflect startle habituation patterns of those with high levels of general anxiety rather than specifically panic disorder (and moreover, the combining of anxiety disorders may have masked any effects given the heterogeneity of anxiety conditions; Craske et al., 2009). Lastly, the present study took place in an experimental setting, which limits its generalizability to real-world situations (i.e., external validity).

While we know from theoretical and experimental studies how highly comorbid and related depression and anxiety are, the present study suggests that individuals with depression (but not anxiety disorders) may disengage more quickly from aversive external stimuli than those without this diagnosis. This finding is interesting given its specificity, as we did not find any differences in startle habituation in our comorbid or panic-only groups. This depression-specific effect is parallel to the type of withdrawal and learned helplessness that often characterizes the behavior of depressed individuals and this may serve in the development and maintenance of this disorder. It is unclear whether or not the pattern of heightened baseline startle habituation that we found is a product of depression or a premorbid marker of this psychological disorder. However, future longitudinal, prospective studies are needed to further evaluate this possibility, especially

considering the need for identifying core features of psychological disorders (i.e., RDoC constructs) that are more valid than the current self-reported symptom-based categorical diagnoses. Further, identification of these constructs would greatly aid our ability to make accurate diagnoses and appropriately guide future treatment development.

In conclusion, the present study revealed that individuals with current depression demonstrate increased rates of baseline startle habituation compared with control subjects. We did not find significant differences in rates of baseline startle among either of our other clinical populations (i.e., panic disorder only and comorbid participants). These findings shed light on a potential underlying mechanism - baseline startle habituation - that may help distinguish the highly comorbid diagnoses of depression and panic disorder.

Figure 1. Baseline startle habituation between participants with depression only and controls. Startle amplitude is square-root transformed.

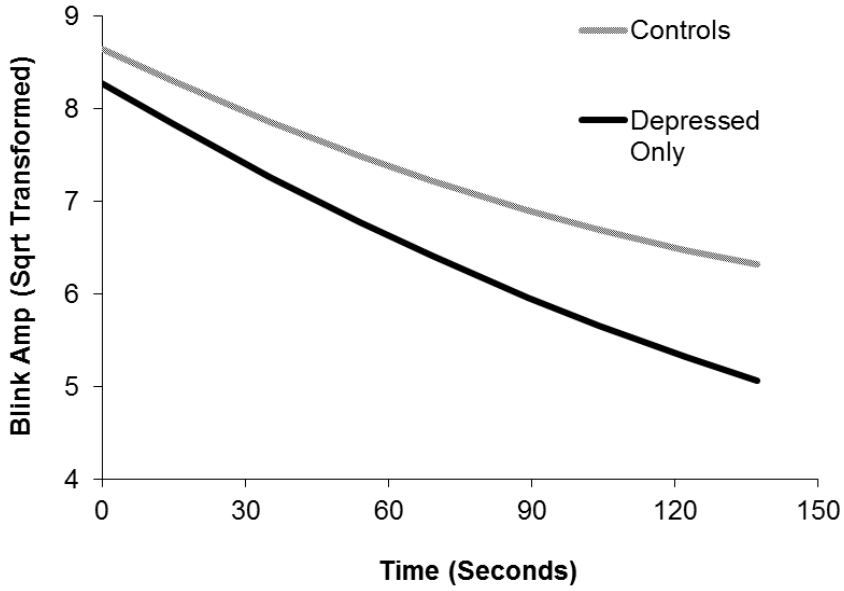

Table 1. Participant demographic and clinical characteristics.

	Panic (n = 28)	**Dep. Only (n = 40)**	**Comorbid (n = 56)**	**Control (n = 65)**
% Female	60.7_{a}	64.1_{a}	70.9_{a}	61_{a}
Age (M, SD)	$34.0\ (13.13)_{a}$	$30.8\ (12.12)_{a}$	$36.7\ (11.20)_{a}$	$31.5\ (12.75)_{a}$
% Cauc.	46.4_{a}	51.3_{a}	50.9_{a}	46.3_{a}
% Meds	28.6_{b}	$25.6_{b,c}$	41.8_{c}	1.2_{a}
GAF (SD)	$58.4\ (8.77)_{b}$	$53.3\ (7.5)_{c}$	$52.3\ (6.26)_{c}$	$87.9\ (7.48)_{a}$
GTS_NE	15.46_{b}	$17.62_{b,c}$	19.65_{c}	6.08_{a}
GTS_PE	17.46_{b}	9.7_{c}	$11.19_{b,c}$	20.01_{a}
BAI	$15.5_{b,c}$	14.27_{b}	20.2_{c}	3.34_{a}
HRSD	8.64_{b}	24.46_{c}	26.47_{c}	2.77_{a}

Note. Means or percentages with different subscripts across rows were significantly different in pairwise comparisons ($p < .05$, chi-square test for categorical variables and Tukey's honestly significant difference test for continuous variables).

Table 2. Omnibus analysis detecting a significant 3-way interaction between time, depression status, and panic status.

Variable	***b***	***t***	***p***
Intercept	8.63	12.01	<.0001
Time	-0.03	-6.67	<.0001
Age	-0.05	-2.45	0.01
Gender	0.75	1.60	0.11
Time x Time (quadratic effect)	0.00005	1.89	0.06
Panic	0.93	1.81	0.07
Time x Panic	0.0006	0.22	0.83
Depression	-0.23	-0.46	0.64
Time x Depression	0.005	1.84	0.07
Panic x Depression	-0.28	-0.27	0.78
Time x Depression x Panic	-0.01	-1.92	0.05

Table 3. Follow-up pair-wise comparisons to detect group x linear time interactions between separate groups of participants.

Group	**Interaction**	***b***	***t***	***p***
Depressed only vs. Comorbids	Time x Panic	-0.004	-1.33	0.18
Panic only vs. Controls	Time x Panic	0.006	1.41	0.16
Panic only vs. Comorbids	Time x Dep.	-0.001	-0.21	0.84
Comorbid vs. Controls	Time x Com.	0.005	1.72	0.09
Panic only vs. Depressed Only	Time x Dep.	0.003	0.76	0.45
Depressed only vs. Controls	Time x Dep.	0.009	2.57	0.01*

CITED LITERATURE

Allen, N. B., Trinder, J., and Brennan, C. Affective startle modulation in clinical depression: Preliminary findings. Biol. Psychiat. 46: 542-550, 1999.

Alloy, L. B., Kelley, K. A., Mineka, S., and Clements, C. M. Comorbidity of anxiety and depressive disorders: a helplessness-hopelessness perspective. In J.D. Maser (Ed.) and C.R. Cloninger (Ed.). Comorbidity of Mood and Anxiety Disorders. Arlington VA: American Psychiatric Association, 1990.

American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders (4th ed.). Washington, DC; Author, 1994.

Beck, A. T., Epstein, N., Brown, G., and Steer, R. A. An inventory for measuring clinical anxiety: psychometric properties. J. Consult. Clin. Psych. 56: 893-897, 1988.

Bench, C., Frith, C. D., Grasby, P. M., Friston, K. J., Paulesu, E., Frackowiak, R. S. J., and Dolan, R. J. Investigations of the functional anatomy of attention using the Stroop test. Neuropsychologia. 31:907-922, 1993.

Blumenthal, T. D., Cuthbert, B. N., Filion, D. L., Hackley, S., Lipp, O. V., and Boxtel, A. V. Committee report: Guidelines for human startle eyeblink electromyographic studies. Psychophysiology. 42: 1-15, 2005.

Brown, T. A., Di Nardo, P. A., Lehman, C. L., and Campbell, L. A. Reliability of DSM-IV anxiety and mood disorders: Implications for the classification of emotional disorders. J. Abnorm. Psychol. 110: 49-58, 2001.

Buchsbaum, M. S., Joseph, W., Siegel, B. V., Hackett, E., Trenary, M., Abel, L., and Reynolds, C. Effect of sertraline on regional metabolic rate in patients with affective disorder. Biol. Psychiat. 41:15-22, 1997.

Bush, G., Whalen, P. J., Rosen, B. R., Jenike, M. A., McInerney, S. C., and Rauch, S. L. The counting Stroop: an interference task specialized for functional neuroimaging—validation study with functional MRI. Hum. Brain Map. 6: 270-282, 1998.

Bush, G., Luu, P., and Posner, M. I. Cognitive and emotional influences in anterior cingulate cortex. Trends Cog. Sci. 4: 215-222, 2000.

Bylsma, L. M., Morris, B. H., and Rottenberg, J. A meta-analysis of emotional reactivity in major depressive disorder. Clin. Psychol. Rev. 28: 676-691, 2008.

Campbell, M. L., Gorka, S. M., McGowan, S. K., Nelson, B. D., Sarapas, C., Katz, A. C., Robison-Andrew, and E. J., Shankman, S. A. Does anxiety sensitivity correlate with startle habituation? An examination in two independent samples. Cognition Emotion. 28: 46-58, 2014.

Clark, L. A. The anxiety and depressive disorders: Descriptive psychopathology and differential diagnosis. In Kendall, P.C. (Ed); Watson, D. (Ed). Anxiety and depression: Distinctive and overlapping features: Personality, Psychopathology, and Psychotherapy. San Diego CA: Academic Press, 1989.

Clark, L. A., and Watson, D. Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications. J. Abnorm. Psychol. 100: 316-336, 1991.

Coles, M. G. H., Gale, A., and Kline, P. Personality and habituation of the orienting reaction: tonic and response measures of electrodermal activity. Psychophysiology. 8: 54-63, 1971.

Curran, S. M., Murray, C. M., Van Beck, M., Dougall, N., O'Carroll, R. E., Austin, M. P., ... and Goodwin, G. M. A single photon emission computerised tomography study of regional brain function in elderly patients with major depression and with Alzheimer-type dementia. Brit. J. Psychiat. 163: 155-165, 1993.

Cuthbert, B. N., and Insel, T. R. Toward new approaches to psychotic disorders: the NIMH Research Domain Criteria project. Schizophrenia Bull. 36: 1061-1062, 2010.

Davidson, R. J. (1998). Affective style and affective disorders: Perspectives from affective neuroscience. Cognition Emotion. 12, 307-330.

Davidson, R. J., Pizzagalli, D., Nitschke, J. B., and Putnam, K. Depression: perspectives from affective neuroscience. Annu. Rev. Psycho. 53: 545-574, 2002.

Davidson, R.J., Jackson, D.C., and Kalin, N.H. Emotion, plasticity, context, and regulation: perspectives from affective neuroscience. Psychol. Bull. 126: 890-909, 2000.

Deldin, P. J., Deveney, C. M., Kim, A. S., Casas, B. R. and Best, J. L. A slow wave investigation of working memory biases in mood disorders. J. Abnorm. Psychol. 110: 267-281, 2001.

Deveney, C. M. and Deldin, P. J. Memory of faces: a slow wave ERP study of major depression. Emotion. 4: 295-304, 2004.

Devinsky, O., Morrell, M. J., and Vogt, B. A. Contributions of anterior cingulate cortex to behaviour. Brain. 118: 279-306, 1995.

Dichter, G. S., Tomarken, A. J., Shelton, R. C., and Sutton, S. K. Early- and late- onset startle modulation in unipolar depression. Psychophysiology. 41: 433-440, 2004.

Ellwanger, J., Geyer, M. A., and Braff, D. L. The relationship of age to prepulse inhibition and habituation of the acoustic startle response. Biol. Psychol. 62: 175-195, 2003.

First, M. B., Spitzer, R. L., Gibbon, M., and Williams, J. B. Structured clinical interview for DSM-IV-TR axis I disorders, research version, patient edition. New York, NY: Biometrics Research, New York State Psychiatric Institute, 2002.

Forbes, E. E., Miller, A., Cohn, J. F., Fox, N. A., and Kovacs, M. Affect-modulated startle in adults with childhood-onset depression: relations to bipolar course and number of lifetime depressive episodes. Psychiat. Res. 134: 11-25, 2005.

Grillon, C. Startle reactivity and anxiety disorders: Aversive conditioning, context, and neurobiology. Biol. Psychiat. 52: 958-975, 2002.

Grillon, C. Models and mechanisms of anxiety: evidence from startle studies. Psychopharmacology. 199: 421-437, 2008.

Grillon, C., Lissek, S., Rabin, S., McDowell, D., Dvir, S. and Pine, D.S. Increased anxiety during anticipation of unpredictable but not predictable aversive stimuli as a psychophysiological marker of panic disorder. Am. J. Psychiat. 165: 898-904, 2008.

Grillon, C., and Morgan III, C. A. Fear-potentiated startle conditioning to explicit and contextual cues in Gulf War veterans with posttraumatic stress disorder. J. Abnorm. Psychol. 108: 134-142, 1999.

Grillon, C., Franco-Chaves, J. A., Mateus, C. F., Ionescu, D. F., and Zarate, C. A. Major depression is not associated with blunting of aversive responses; evidence for enhanced anxious anticipation. PloS One. 8, e70969, 2013.

Groves, P. M., and Thompson, R. F. Habituation: A dual-process theory. Psychol. Rev. 77: 419-450, 1970.

Hamilton, M. A rating scale for depression. J. Neurol. Neurosur. Ps. 23: 56-62, 1960.

Harris, J. D. Habituatory response decrement in the intact organism. Psychol. Bull. 40: 385-422, 1943.

Hedeker, D., and Gibbons, R.D. Longitudinal Data Analysis. Hoboken, NJ: John Wiley & Sons, Inc., 2006.

Heller, A. S., Johnstone, T., Light, S. N., Peterson, M. J., Kolden, G. G., Kalin, N. H., and Davidson, R. J. Relationships between changes in sustained fronto-striatal connectivity and positive affect in major depression resulting from antidepressant treatment. Am. J. Psychiat. 170: 197-206, 2013.

Herry, C., Ferraguti, F., Singewald, N., Letzkus, J.J., Ehrlich, I., and Lüthi, A. Neuronal circuits of fear extinction. Eur. J. Neurosci. 31: 599-612, 2010.

Holloway, W. and McNally, R. J. Effects of anxiety sensitivity on the response to hyperventilation. J. Abnorm. Psychol. 96: 330-334, 1987.

Insel, T., Cuthbert, B., Garvey, M., Heinssen, R., Pine, D.S., Quinn, K., Sanislow, C., and Wang, P. Research Domain Criteria (RDoC): Developing a valid diagnostic framework for research on mental disorders. Am. J. Psychiat. 167: 748-751, 2010.

Ito, H., Kawashima, R., Awata, S., Ono, S., Sato, K., Goto, R., and Fukuda, H. Hypoperfusion in the limbic system and prefrontal cortex in depression: SPECT with anatomic standardization technique. J. Nucl. Med. 37: 410-414, 1996.

Jansen, D.M., and Frijda, N.H. (1994). Modulation of the acoustic startle response by film-induced fear and sexual arousal. Psychophysiology. 31: 565-571, 1994.

Jin, A. B., Steding, L. H., and Webb, A. K. Reduced emotional and cardiovascular reactivity to emotionally evocative stimuli in major depressive disorder. Int. J. Psychophysiol. 97: 66-74, 2015.

Kaviani, H., Gray, J. A., Checkley, S. A., Raven, P. W., Wilson, G. D., and Kumari, V. Affective modulation of the startle response in depression: influence of the severity of depression, anhedonia, and anxiety. J. Affective Disorders. 83: 21-31, 2004.

Kendler, K. S., Prescott, C. A., Myers, J., and Neale, M. C. The structure of genetic and environmental risk factors for common psychiatric and substance use disorders in men and women. Arch. Gen. Psychiat. 60: 929-937, 2003.

Keogh, E., Dillon, C., Georgiou, G., and Hunt, C. Selective attentional biases for physical threat in physical anxiety sensitivity. J. Anxiety Disord. 15: 299-315, 2001.

Keogh, E., and Mansoor, L. Investigating the effects of anxiety sensitivity and coping on the perception of cold pressor pain in healthy women. Eur. J. Pain-London. 5: 11-25, 2001.

Kessler, R. C., Nelson, C. B., McGonagle, K. A., and Liu, J. Comorbidity of DSM-III—R major depressive disorder in the general population: Results from the US National Comorbidity Survey. Brit. J. Psychiat. 168: 17-30, 1996.

Klein, D. N. Classification of depressive disorders in the DSM-V: proposal for a two-dimension system. J. Abnorm. Psychol. 117: 552 - 560, 2008.

Krueger, R. F. The structure of common mental disorders. Arch. Gen. Psychiat. 56: 921-926, 1999.

Lang, P. J., Bradley, M. M., and Cuthbert, B. N. Emotion, attention, and the startle reflex. Psychol. Rev. 97: 377-398, 1998.

Larson, C. L., Nitschke, J. B., and Davidson, R. J. Common and distinct patterns of affective response in dimensions of anxiety and depression. Emotion. 7:182 - 191, 2007.

Lees, A., Mogg, K., and Bradley, B. P. Health anxiety, anxiety sensitivity, and attentional biases for pictorial and linguistic health-threat cues. Cognition Emotion. 19: 453-462, 2003.

Light, S. N., Heller, A. S., Johnstone, T., Kolden, G. G., Peterson, M. J., Kalin, N. H., and Davidson, R. J. Reduced right ventrolateral prefrontal cortex activity while inhibiting positive affect is associated with improvement in hedonic capacity after 8 weeks of antidepressant treatment in major depressive disorder. Biol. Psychiat. 70: 962-968, 2011.

Lissek, S., Pine, D. S., and Grillon, C. The strong situation: A potential impediment to studying the psychobiology and pharmacology of anxiety disorders. Biol. Psychol. 72: 265-270, 2006.

Lissek, S., Powers, A. S., McClure, E. B., Phelps, E. A., Woldehawariat, G., Grillon, C., and Pine, D. S. Classical fear conditioning in the anxiety disorders: a meta-analysis. Behav. Res. Ther. 43: 1391-1424, 2005.

MacLeod, C., Mathews, A. and Tata, P. Attentional bias in emotional disorders. J. Abnorm. Psychol. 95:15-20, 1986.

Mayberg, H. S. Frontal lobe dysfunction in secondary depression. J. Neuropsych. Clin. N. 6: 428-442, 1994.

Mayberg, H. S., Liotti, M., Brannan, S. K., McGinnis, S., Mahurin, R. K., Jerabek, P. A., ... and Fox, P. T. Reciprocal limbic-cortical function and negative mood: converging PET findings in depression and normal sadness. Am. J. Psychiat. 156: 675-682, 2014.

McTeague, L.M., Lang, P.J., Laplante, M-C, and Bradley, M.M. Aversive imagery in panic disorder: Agoraphobia severity, comorbidity and defensive physiology. Biol. Psychiat. 70: 415-424, 2011.

McTeague L.M., and Lang P.J. The anxiety spectrum and the reflex physiology of defense: from circumscribed fear to broad distress. Depress. Anxiety. 29: 264–281, 2012.

Mineka, S., Watson, D., and Clark, L. A. Comorbidity of anxiety and unipolar mood disorders. Annu. Rev. Psycho. 49: 377-412, 1998.

Mogg, K. and Bradley, B. P. Selective orienting of attention to masked threat faces in social anxiety. Behav. Res. Ther. 40: 1403-1414, 2002.

Nelson, B.D. and Shankman, S.A. Does intolerance of uncertainty predict anticipatory startle responses to uncertain threat? Int. J. Psychophysiol. 81: 107-115, 2011.

Norris, C. J., Larsen, J. T., & Cacioppo, J. T. Neuroticism is associated with larger and more prolonged electrodermal responses to emotionally evocative pictures. Psychophysiology. 44: 823-826, 2007.

Oldfield, R. C. The assessment and analysis of handedness: the Edinburgh inventory. Neuropsychologia. 9: 97-113, 1971.

Pissiota, A., Frans, Ö., Michelgård, Å., Appel, L., Långström, B., Flaten, M. A., and Fredrikson, M. Amygdala and anterior cingulate cortex activation during affective startle modulation: a PET study of fear. Eur. J. Neurosci. 18: 1325-1331, 2003.

Quednow, B. B., Kühn, K. U., Stelzenmueller, R., Hoenig, K., Maier, W., and Wagner, M. Effects of serotonergic and noradrenergic antidepressants on auditory startle response in patients with major depression. Psychopharmacology. 175: 399-406, 2004.

Rollman, G. B., and Harris, G. The detectability, discriminability, and perceived magnitude of painful electrical shock. Percept. Psychophys. 42: 257-268, 1987.

Roth, W. T., Ehlers, A., Taylor, C. B., Margraf, J., and Agras, W. S. Skin conductance habituation in panic disorder patients. Biol. Psychiat. 27: 1231-1243, 1990.

Rothbaum, B. O., Kozak, M. J., Foa, E. B., and Whitaker, D. J. Posttraumatic stress disorder in rape victims: Autonomic habituation to auditory stimuli. J. Trauma. Stress. 14: 283-293, 2001.

Rottenberg, J., Kasch, K. L., Gross, J. J., and Gotlib, I. H. Sadness and amusement reactivity differentially predict concurrent and prospective functioning in major depressive disorder. Emotion. 2: 135-146, 2002.

Sanislow, C. A., Pine, D. S., Quinn, K. J., Kozak, M. J., Garvey, M. A., Heinssen, R. K., ... and Cuthbert, B. N. Developing constructs for psychopathology research: research domain criteria. J. Abnorm. Psychol. 119: 631- 639, 2010.

Shankman, S. A., Nelson, B. D., Robison-Andrews, E. J., Sarapas, C. Campbell, M. L., Altman, S. E…., and Gorka, S. M. A psychophysiological investigation of threat and reward sensitivity in individuals with panic disorder and/or depression. J. Abnorm. Psychol. 122: 322-338, 2013.

Siegle, G. J., Granholm, E., Ingram, R. E., and Matt, G. E. Pupillary and reaction time measures of sustained processing of negative information in depression. Biol. Psychiat. 49: 624-636, 2001.

Siegle, G. J., Steinhauer, S. R., Carter, C. S., Ramel, W., and Thase, M. E. Do the seconds turn into hours? Relationships between sustained pupil dilation in response to emotional information and self-reported rumination. Cognitive Ther. Res. 27: 365-382, 2003.

Taylor, S., Zvolensky, M. J., Cox, B. J., Deacon, B., Heimberg, R. G., Ledley, D. R., Abramowitz, J. S., … and Bouvard, M. Robust dimensions of anxiety sensitivity: Development and initial validation of the Anxiety Sensitivity Index—3. Psychol. Assessment. 19: 176-188, 2007.

Thayer, J. F. and Lane, R. D. Claude Bernard and the heart–brain connection: Further elaboration of a model of neurovisceral integration. Neurosci. Biobehav. R. 33: 81-88, 2009.

Vaidyanathan, U., Patrick, C. J., & Bernat, E. M. Startle reflex potentiation during aversive picture viewing as an indicator of trait fear. Psychophysiology. 46:75-85, 2009.

Vogt, B. A., Finch, D. M., and Olson, C. R. Functional heterogeneity in cingulate cortex: the anterior executive and posterior evaluative regions. Cereb. Cortex. 2: 435-443, 1992.

Vogt, B. A., Nimchinsky, E. A., Vogt, L. J., and Hof, P. R. Human cingulate cortex: surface features, flat maps, and cytoarchitecture. J. Comp. Neurol. 359: 490-506, 1995.

Watson, D. Rethinking the mood and anxiety disorders: A quantitative hierarchical model for DSM-V. J. Abnorm. Psychol. 114: 522-536, 2005.

Watson, D. Differentiating the mood and anxiety disorders: A quadripartite model. Annu. Rev. Psychol. 5: 221-247, 2009.

Watson, D., Clark, L. A., and Harkness, A. R. Structures of personality and their relevance to psychopathology. J. Abnorm. Psychol. 103: 18 - 31, 1994.

Weissman, M. M., Wickramaratne, P., Adams, P., Wolk, S., Verdeli, H., and Olfson, M. Brief screening for family psychiatric history: The family history screen. Arch. Gen. Psychiat. 57: 675-682, 2000.

Whalen, P. J., Bush, G., McNally, R. J., Wilhelm, S., McInerney, S. C., Jenike, M. A., and Rauch, S. L. The emotional counting Stroop paradigm: a functional magnetic resonance imaging probe of the anterior cingulate affective division. Biol. Psychiat. 44: 1219-1228, 1998.

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Stewart Shankman, Ph.D.
Psychology
912 S. Wood Street, 4th Floor
M/C 285
Chicago, IL 60612
Phone: (312) 355-3812 / Fax: (312) 413-4122

RE: Protocol # 2005-0626
"Emotional Processing and Physiology"

Dear Dr. Shankman:

Members of Institutional Review Board (IRB) #3 have reviewed this amendment to your research and/or consent form under expedited procedures for minor changes to previously approved research allowed by Federal regulations [45 CFR 46.110(b)(2) and/or 21 CFR 56.110(b)(2)]. The amendment to your research was determined to be acceptable and may now be implemented.

Please note the following information about your approved amendment:

Amendment Approval Date: May 29, 2015
Amendment:

Summary: UIC Amendment #19 dated May 12, 2015 (received 5/13/15) involves a change in research personnel to remove Brady D. Nelson, Dr. Katarzyna Drozda, Jonathan Leigh. Appendix P was also updated to remove Jeffrey Bishop, James Stevenson, Alison DeLizza, Arshila Merchant, Allie Hodges, and Angelica Kladis, and to add Danelle Hee and Ryan Tardiff. The informant consent document was updated to change the time to complete questionnaire from 30 minutes to 1 hour. The PSY100 consent document was revised to remove inactive personnel from the contact information.

Approved Subject Enrollment #: 800
Performance Sites: UIC
Sponsor: NARSAD (Nat'l Alliance for Research on Schizophrenia and Depression), Office of Social Science Research (OSSR), NIMH - National Institute of Mental Health, Department of Psychology
Informed Consents:

a) Emotional processing-Group PSY100.NG, May 2015, Version #4, 05/27/2015
b) Emotional Processing, Informant, May 2015, Version #5, 05/27/2015

Please note the Review History of this submission:

Receipt Date	Submission Type	Review Process	Review Date	Review Action
05/13/2015	Amendment	Expedited	05/29/2015	Approved

Please be sure to:

→ Use only the IRB-approved and stamped consent document(s) and/or HIPAA Authorization form(s) enclosed with this letter when enrolling subjects.

→ Use your research protocol number (2005-0626) on any documents or correspondence with the IRB concerning your research protocol.

→ Review and comply with all requirements on the enclosure,
"UIC Investigator Responsibilities, Protection of Human Research Subjects"
(http://tigger.uic.edu/depts/ovcr/research/protocolreview/irb/policies/0924.pdf)

Please note that the UIC IRB #3 has the right to ask further questions, seek additional information, or monitor the conduct of your research and the consent process.

Please be aware that if the scope of work in the grant/project changes, the protocol must be amended and approved by the UIC IRB before the initiation of the change.

We wish you the best as you conduct your research. If you have any questions or need further help, please contact the OPRS at (312) 996-1711 or me at (312) 413-3788. Please send any correspondence about this protocol to OPRS at 203 AOB, M/C 672.

Sincerely,

Rachel Olech, B.A., CIP
Assistant Director, IRB # 3
Office for the Protection of Research Subjects

Enclosures:

1. **Informed Consent Documents:**
   a) Emotional processing-Group PSY100.NG, May 2015, Version #4, 05/27/2015
   b) Emotional Processing, Informant, May 2015, Version #5, 05/27/2015

cc: Michael E. Ragozzino, Psychology, M/C 285

VITA

MIRANDA (NELSON) CAMPBELL

Doctoral Student • University of Illinois, Department of Psychology
1007 West Harrison Ave, M/C 285 • Chicago, IL 60607
612.965.1678 • miranda.leih@gmail.com

EDUCATION

Ph.D., Clinical Psychology	**University of Illinois at Chicago, June 2015** *(APA Accredited)* *Chair*: Dr. Stewart Shankman
M.A., Clinical Psychology	**University of Illinois at Chicago, 2012**
B.A., Psychology **B.M.,Vocal Music**	**Augsburg College, Minneapolis, Minnesota, 2006**

HONORS AND AWARDS

2012	**Society for Research in Psychopathology Associate Member Committee**
2010 - 2013	**Student Travel Awards** (University of Illinois at Chicago; $2,000)
2006	**Cum Laude** (Augsburg College)
2006	**Departmental Honors in Psychology** (Augsburg College)

CLINICAL EXPERIENCE

2014 - 2015
Edward Hines, Jr. VA Hospital, Hines, Illinois
Clinical Psychology Intern, Rehabilitation and Neuropsychology Emphasis
(APA Accredited Internship Program)

Completed Rotations:
Psychology Service: Traumatic Brain Injury (TBI)/Polytrauma Outpatient Clinic;
June 2014 - December 2014
Supervisors: Rene Pichler-Mowry, Ph.D., HSPP

- Provide evidence-based mental health interventions to Veterans of various eras with comorbid medical and psychological conditions, including: Cognitive Behavioral Therapy (CBT), Cognitive Processing Therapy (CPT), Prolonged Exposure (PE), Acceptance and Commitment Therapy (ACT), Mindfulness-Oriented Recovery Enhancement (MORE), and Cognitive Behavioral Treatment for Insomnia (CBTi)
- Utilize biofeedback equipment in the treatment of chronic pain conditions
- Review findings from neuropsychological evaluations to guide treatment of Veterans with brain injury and associated cognitive impairment

- Provide didactic presentations to trainees, other providers, and Veterans/supporters on the treatment of chronic pain
- Conduct traumatic brain injury screenings for recently discharged Veterans
- Conduct mental health intakes through the Hines VA Telepsychiatry Service serving rural populations
- Co-facilitate an educational workshop for Veterans and their caregivers, spouses, parents, other supporters, and providers through the Family Empowerment Network (FEN)
- Supervise practicum students in the TBI/Polytrauma Psychology Clinic

Neuropsychology Service: TBI/Polytrauma Neuropsychology Clinic
June 2014 - December 2014
Supervisor: Amanda Urban, Ph.D.

- Provide comprehensive neuropsychological evaluations for Veterans, specializing in the TBI/Polytrauma population but also including assessment of Veterans with dementia and/or other neurological conditions
- Conduct clinical interviews, select test batteries, score and interpret test data, write integrated reports, and provide feedback to Veterans and family members
- Provide consultative services to other medical providers regarding the cognitive status and treatment recommendations for Veterans evaluated by neuropsychology service
- Present cases on a weekly basis to an interdisciplinary team of providers on the TBI/Polytrauma team to discuss treatment planning
- Provide education to community agencies about traumatic brain injury in Veterans

Upcoming Rotations: *Spinal Cord Injury Service, Inpatient Acute Medical Rehabilitation, Inpatient Psychiatry Service*

2013 - 2014
Edward Hines, Jr. VA Hospital, Hines, Illinois
Traumatic Brain Injury (TBI)/Polytrauma Psychology Service Practicum
Supervisor: Rene Pichler-Mowry, Ph.D., HSPP

- Provided individual psychotherapy services to Veterans with comorbid TBI and various medical and psychological conditions
- Served Veterans from various eras, including: Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), Operation New Dawn (OND), Persian Gulf War, Vietnam, and Desert Storm
- Led group psychotherapy services, including CBTi and Problem Solving Therapy
- Presented cases to an interdisciplinary team on a weekly basis to discuss best course of treatment
- Provided education and support to Veterans and families through the Family Empowerment Network (FEN)
- Consulted with various providers on a rehabilitation interdisciplinary team, such as speech and language pathologists, social workers, psychiatrists, and physiatrists

2012 - 2013
University of Illinois Medical Center, Neuropsychological Services
Adult Neuropsychology Practicum
Supervisor: Neil Pliskin, Ph.D., ABPP-CN

- Provided comprehensive neuropsychological assessment services to adults referred for evaluation due to a wide range of conditions (e.g., dementia, neurodegenerative disease, traumatic brain injury, and/or psychological disorders)
- Completed transplant evaluations (i.e., kidney transplant, deep brain stimulator for Parkinson's disease)
- Conducted clinical interviews, administered tests, interpreted data, prepared reports, and assisted in providing feedback to patients and family members
- Attended weekly didactics, case conferences, and presented cases for group discussion

2011- 2012
University of Illinois at Chicago Medical Center, Adult Inpatient Psychiatry Unit
Group Psychotherapy Clinician
Supervisor: Stewart Shankman, Ph.D.

- Provided group and individual psychotherapy services to psychiatric inpatients on a 37-bed unit serving a diverse, urban population with severe psychological disorders
- Sessions were held twice per week and utilized cognitive behavioral therapy techniques and psychoeducation
- Acted as a liaison between patients and other departments (i.e., psychiatry, social work, occupational therapy)
- Attended Grand Rounds and case conferences alongside other medical professionals
- Provided consultative services to providers regarding the mental health status of patients

2011- 2012
University of Illinois at Chicago, Office of Applied Psychological Services
Psychotherapy and Assessment Practicum
Supervisors: Drs. Gloria Balague, Nancy Steblay, Audrey Ruderman, & Amanda Lorenz

- Provided psychological assessments and empirically-supported psychological treatments (e.g., CBT, Dialectical Behavior Therapy [DBT]) to patients in a community-based clinic
- Treated a wide range of psychological disorders, such as: major depression, obsessive-compulsive disorder, borderline personality disorder, anorexia and bulimia, and substance use disorders

SPECIALIZED CLINICAL TRAINING/EXPERIENCE

- **Manualized Treatment Training:** Cognitive Processing Therapy (CPT) for Post-Traumatic Stress Disorder
- **Manualized Treatment Training:** Prolonged Exposure (PE) for Post-Traumatic Stress Disorder
- **Manualized Assessment Training:** Clinician-Administered PTSD Scale (CAPS)

SUPERVISORY EXPERIENCE

2014 - 2015
Edward Hines, Jr. VA Hospital, Hines, Illinois
Traumatic Brain Injury (TBI)/Polytrauma Psychology Outpatient Clinic

- Supervised practicum students in the TBI/Polytrauma Psychology Outpatient Clinic
- Met on a bi-weekly basis to discuss topics including professional development, patient issues, and personal development

2012 - 2013
The University of Illinois at Chicago, Department of Psychology

- Supervised 30 independent research projects for advanced undergraduate psychology majors taking an Applied Psychology Course
- Assisted students with project conceptualization, design, and development; supervised data collection, analysis, and report writing

INVITED TALKS

May 2014
Edward Hines Jr., VA Hospital, Hines, IL: Family Empowerment Network (FEN) Workshop
"On the Path to Wellness: Effective Pain Management"

December 2014
Illinois Department of Employment Services, Joliet, IL
"Traumatic Brain Injury in Veterans: An Overview"

PEER-REVIEWED PUBLICATIONS

Campbell, M.L., Gorka, S.M., McGowan, S.K., Nelson, B.D., Sarapas, C., Katz, A.C., Robison-Andrew, J.E., & Shankman, S.A. (2014). Does anxiety sensitivity correlate with startle habituation? An examination in two independent samples. *Cognition and Emotion, 28,* 46-58.

Sarapas, C., Shankman, S.A., Nelson, B.D., **Campbell, M.L**., Bishop, J.R., Robison-Andrew, E.J., Altman, S.E., Gorka, S.M., & Katz, A.C. (2014). Are individual differences in appetitive and defensive motivation related? A psychophysiological examination in two independent samples. *Cognition and Emotion, 28(4),* 636-655.

Altman, S.E., **Campbell, M.L.,** Nelson, B.D., Faust, J.P., & Shankman, S.A. (2013). The relation between symptoms of bulimia nervosa and obsessive-compulsive disorder: A startle investigation. *Journal of Abnormal Psychology*, *122(4),* 1132-1141.

Nelson, B.D., McGowan, S.K., Sarapas, C., Robison-Andrew, E.J., Altman, S.E., **Campbell, M.L.,** Gorka, S.M., Katz, A.C., & Shankman, S.A. (2013). Biomarkers of threat and reward sensitivity demonstrate unique associations with risk for psychopathology. *Journal of Abnormal Psychology*, *122(3)*, 662-671.

Gorka, S.M., McGowan, S.K., **Campbell, M.L**., Nelson, B.D., Sarapas, C., Bishop, J.R.,& Shankman, S.A. (2013). Associations between resting sinus arrhythmia and startle reduction in three independent samples. *Biological Psychology, 93(2)*, 334-341.

Gorka, S.M., Nelson, B.D., Sarapas, C., **Campbell, M.L.,** Lewis, G.F., Bishop, J.R., Porges, S.W., & Shankman, S.A. (2013). Relation between respiratory sinus arrhythmia and startle response during predictable and unpredictable threat. *Journal of Psychophysiology, 27(2),* 95-104.

Shankman, S.A., Nelson, B.D., Sarapas, C., Robison-Andrew, J.E., **Campbell, M.L.,** Altman, S.E., McGowan, S.K., Katz, A.C., & Gorka, S.M. (2013). A psychophysiological investigation of threat and reward sensitivity in individuals with panic disorder and/or major depressive disorder. *Journal of Abnormal Psychology, 122(2),* 322-338.

Shankman, S.A., **Campbell, M.L.,** Klein, D.N., Leon, A.C., Keller, M.B., Markowitz, J.C., Rothbaum, B.O., Thase, M.E., & Koscis, J.H. (2013). Dysfunctional attitudes as a moderator of pharmacotherapy and psychotherapy in chronic depression. *Journal of Psychiatric Research, 47(1),* 113-121.

Nelson, B.D., Sarapas, C., Robison-Andrew, E.J., Altman, S.E., **Campbell, M.L**., & Shankman, S.A. (2012). Frontal brain asymmetry in depression with comorbid anxiety: A neuropsychological investigation. *Journal of Abnormal Psychology, 121(3),* 579-591.

Shankman, S.A, Robison-Andrew, E.J., Nelson, B.D., Altman, S.E., & **Campbell, M.L.** (2011). Effects of predictability of shock timing and intensity on fearful and anxious responses. *International Journal of Psychophysiology, 80,* 112-118.

Wozniak, J.R., Mueller, B.A., Muetzel, R.L., Bell, C.J., Hoecker, H.L., **Nelson, M.L.,** … & Lim, K.O. (2010). Inter-hemispheric functional connectivity disruption in children with prenatal alcohol exposure. *Alcoholism: Clinical and Experimental Research, 35,* 849-861.

Wozniak, J.R., Muetzel, R.L., Mueller, B.A., McGee, C.L., Freerks, M.A., Ward, E.E., … & Lim, K.O. (2009). Microstructural corpus callosum anomalies in children with prenatal alcohol exposure: An extension of previous diffusion tensor imaging (DTI) findings. *Alcoholism: Clinical and Experimental Research, 33,* 1825-1835.

White, T., **Nelson, M.L**., & Lim, K.O. (2008). Diffusion tensor imaging in psychiatric disorders. *Topics in Magnetic Resonance Imaging, 19,* 97-109.

MANUSCRIPTS UNDER REVIEW

Sarapas, C., Katz, A.C., Bishop, J.R., Patel, S.R., Nelson, B.D., **Campbell, M.L.,** & Shankman, S.A. (submitted). Variation in serotonin transporter gene predicts startle response to cued but not contextual threat. *Biological Psychology.*

BOOK CHAPTERS

Shankman, S.A., Katz, A.C., Sarapas, C., **Campbell, M.L.,** & Gorka, S.M. (2014). The different components and facets of anhedonia and their associations with different psychopathologies. In M.S. Ritsner (Ed.), *Anhedonia: A Comprehensive Workbook*. Berlin: Springer.

CONFERENCE PRESENTATIONS

Shankman, S.A., Sarapas, C., Gorka, S.M., **Campbell, M.L.,** Katz, A.C., Liu, H., Lieberman, L., DeLizza, A.A., Hodges, A.M., & Huggins, A.A. (September, 2014). Family study of reward and threat sensitivity in internalizing psychopathology. In S. Morris (Chair), *The NIMH Research Domain Criteria initiative: Overview and exemplars.* Symposium conducted at the 28th annual meeting of the Society for Research in Psychopathology, Chicago, IL.

Shankman, S.A., Nelson, B. D., Sarapas, C., Robison-Andrew, E.J., **Campbell, M.L.,** Altman, S.E., McGowan, S.K., Katz, A.C., & Gorka, S.M. (November, 2013). Examining the specificity of reduced reward anticipation and heightened threat anticipation in depression and anxiety using psychophysiological indices of responding. In A. M. Ruscio (Chair), *Comorbidity of anxiety and depression: Moving beyond description to explain why and how comorbidity occurs.* Symposium conducted at the 47th annual meeting of the Association for Behavioral and Cognitive Therapies, Nashville, TN.

Shankman, S.A., Nelson, B.D., Sarapas, C., **Campbell, M.L.,** Gorka, S.M., Katz, A.C., & DeLizza, A.A. (September, 2013). *The discriminant validity of reward and threat anticipation in internalizing psychopathologies.* Paper presented at the 27th annual meeting of the Society for Research in Psychopathology, Oakland, CA.

Sarapas, C., Nelson, B.D., Gorka, S.M., **Campbell, M.L.,** Katz, A.C., DeLizza, AA., & Shankman, S.A. (September, 2013). *Association of executive function with family history of depression in two independent samples*. Poster presented at the 27th annual meeting of the Society for Research in Psychopathology, Oakland, CA.

Campbell, M.L., Sarapas, C., Nelson, B.D., Patel, S., Bishop, J., & Shankman, S.A. (September, 2012). *The relationship between a polymorphism in MAOA and sustained defensive responding.* Poster presented at the 26th annual meeting for the Society of Research in Psychopathology, Ann Arbor, MI.

Nelson, B.D., Robison-Andrew, E.J., Altman, S.E., **Campbell, M.L.,** Sarapas, C., Katz, A.C., Gorka, S.M., McGowan, S.K., & Shankman, S.A. (September, 2012). *Comparing reward sensitivity vs. DSM-defined major depressive disorder on how they predict family history of psychopathology.* Poster presented at the 26th annual meeting of the Society for Research in Psychopathology, Ann Arbor, MI.

Katz, A.C., Sarapas, C., Nelson, B.D., **Campbell, M.L**., Gorka, S.M., Patel, S., Bishop, J.R. & Shankman, S.A. (September, 2012). *The mediating effect of prefrontal asymmetry on the relationship between COMT SNP and trait consummatory positive affect.* Poster presented at the 52nd annual meeting of the Society for Psychophysiological Research, New Orleans, LA.

Nelson, B.D., Robison-Andrew, E.J., Altman, S.E., Sarapas, C., **Campbell, M.L**., Katz, A.C., Gorka, S.M., McGowan, S.K., & Shankman, S.A. (September, 2012). *Does heightened sensitivity to predictable vs. unpredictable threat index risk for panic disorder? A startle electromyography investigation.* Poster presented at the 52nd annual meeting of the Society for Psychophysiological Research, New Orleans, LA.

Gorka, S.M., Nelson, B.D., Sarapas, C., **Campbell, M.L.**, Katz, A., McGowan, S.K. & Shankman, S.A. (September, 2012). *Sensitivity to unpredictable threat in those with panic disorder and/or alcohol dependence*. Poster presented at the 52nd annual meeting of the Society for Psychophysiological Research, New Orleans, LA.

Sarapas, C., Bishop, J.R., Patel, S.R., Nelson, B.D., **Campbell, M.L**., & Shankman, S.A. (September, 2012). *Variation in serotonin transporter gene predicts startle response to cued but not contextual threat*. Poster presented at the 52nd annual meeting of the Society for Psychophysiological Research, New Orleans, LA.

Campbell, M.L., Nelson, B.D., McGowan, S.K., Robison-Andrew, E.J., Sarapas, C., Altman, S.E., Gorka, S.M., Katz, A.C., & Shankman, S.A. (September, 2011). *Startle habituation in individuals with depression and/or panic disorder.* Poster presented at the 25th annual meeting of the Society for Research in Psychopathology, Boston, MA.

Nelson, B.D., Sarapas, C., **Campbell, M.L**., Robison-Andrew, E.J., Altman, S.E., Katz, A.C., Gorka, S.M., McGowan, S.K., & Shankman, S.A. (September, 2011). *Comparing sensitivity to unpredictable threat versus DSM defined panic disorder on how they predict family history of panic disorder.* Poster presented at the 25th annual Society for Research in Psychopathology, Boston, MA.

Gorka, S.M., Nelson, B.D., Sarapas, C., **Campbell, M.L**., Robison-Andrew, E.J., Altman, S.E., & Shankman, S.A. (September, 2011). *Resting heart rate variability as a predictor of startle responses to predictable and unpredictable threat.* Poster presented at the 25th annual Society for Research in Psychopathology, Boston, MA.

Sarapas, C., Bishop, J.R, Nelson, B.D., **Campbell, M.L**., Robison-Andrew, E.J., Altman, S.E., Katz, A.C., Gorka, S.M., McGowan, S.K., & Shankman, S.A. (September, 2011). *Indirect genetic effects on internalizing symptoms through frontal EEG asymmetry.* Poster presented at the 25th annual meeting of the Society for Research in Psychopathology, Boston, MA.

Katz, A.C., Nelson, B.D., Robison-Andrew, E.J., Altman, S.E., **Campbell, M.L**., Sarapas, C., Gorka, S.M., & Shankman, S.A. (September, 2011). *The moderating effect of trait positive emotionality on EEG asymmetry recorded during a reward processing task.* Poster presented at the 25th annual meeting of the Society for Research in Psychopathology, Boston, MA.

Altman, S.E., **Nelson, M.L.,** Faust, J., & Shankman, S.A. (October, 2010). *Understanding the comorbidity of bulimia nervosa and obsessive compulsive disorder: A startle study of aversiveness sensitivity*. Poster presented at the 16th annual Eating Disorders Research Society meeting, Cambridge, MA.

Nelson, M.L., Shankman, S.A., Nelson, B.D., Robison-Andrews, E.J., Altman, S.E., &Sarapas, C. (October, 2010). *Personality correlates of startle habituation: An examination in three separate samples.* Poster presented at the 24th annual Society for Research in Psychopathology, Seattle, WA.

Nelson, B.D., Shankman, S.A., Sarapas, C., **Nelson, M.L.,** Altman, S.E., & Robison-Andrew, E.J. (October, 2010). *Are distinctive symptoms of anxiety and depression related to emotional responding while anticipating predictable vs. unpredictable threat?* Poster presented at the 24th annual Society for Research in Psychopathology, Seattle, WA.

Wozniak, J.R., Freerks, M.A., Mueller, B.A., Muetzel, R.L., Chang, P.-N., Ward, E., **Nelson, M.L.**, & Lim, K.O. (April, 2008). *Executive Functioning Correlates of Frontal White Matter Deficits in Children with Fetal Alcohol Spectrum Disorders*. Poster presented at the 41st annual meeting for the International Neuropsychological Society, Waikoloa, HI.

TEACHING ASSISTANTSHIPS

2009 - 2014
University of Illinois at Chicago, Department of Psychology
Courses: Introduction to Psychology, Theories of Personality, Abnormal Psychology, Applied Psychology, Clinical Interviewing, and Statistics

PROFESSIONAL MEMBERSHIPS

Association of Psychological Science
Society for Research in Psychopathology
American Psychological Association, Division 22 (Rehabilitation Psychology)
American Psychological Association, Division 40 (Clinical Neuropsychology)