Startle Habituation in Individuals with Depression and/or Panic Disorder

BY

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DISSERTATION

Submitted as partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Psychology
in the Graduate College of the
University of Illinois at Chicago, 2015

Chicago, Illinois

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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.
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<tr>
<td>ACC</td>
<td>Anterior Cingulate Cortex</td>
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<td>ASI</td>
<td>Anxiety Sensitivity Index</td>
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<td>AS</td>
<td>Anxiety Sensitivity</td>
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<td>BAI</td>
<td>Beck Anxiety Inventory</td>
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<td>DSM</td>
<td><em>Diagnostic and Statistical Manual of Mental Disorders</em></td>
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<td>ECI</td>
<td>Emotion Context Insensitivity</td>
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<td>EMG</td>
<td>Electromyographic</td>
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<td>HRSD</td>
<td>Hamilton Rating Scale for Depression</td>
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<td>MDD</td>
<td>Major Depressive Disorder</td>
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<td>NE</td>
<td>Negative Emotionality</td>
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<td>NT</td>
<td>Negative Temperament</td>
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<td>N</td>
<td>Neuroticism</td>
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<td>OCD</td>
<td>Obsessive Compulsive Disorder</td>
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<td>Panic Disorder</td>
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<td>PTSD</td>
<td>Post Traumatic Stress Disorder</td>
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<td>RDoC</td>
<td>Research Domain Criteria</td>
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<td>SCID</td>
<td>Structured Clinical Interview for <em>DSM</em> Disorders</td>
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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 &
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 Habitation

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.

<table>
<thead>
<tr>
<th></th>
<th>Panic (n = 28)</th>
<th>Dep. Only (n = 40)</th>
<th>Comorbid (n = 56)</th>
<th>Control (n = 65)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Female</td>
<td>60.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>64.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>70.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>61&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Age (M, SD)</td>
<td>34.0 (13.13)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>30.8 (12.12)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>36.7 (11.20)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>31.5 (12.75)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>% Cauc.</td>
<td>46.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>51.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>50.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>46.3&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>% Meds</td>
<td>28.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>25.6&lt;sup&gt;b,c&lt;/sup&gt;</td>
<td>41.8&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.2&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>GAF (SD)</td>
<td>58.4 (8.77)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>53.3 (7.5)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>52.3 (6.26)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>87.9 (7.48)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>GTS_NE</td>
<td>15.46&lt;sup&gt;b&lt;/sup&gt;</td>
<td>17.62&lt;sup&gt;b,c&lt;/sup&gt;</td>
<td>19.65&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6.08&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>GTS_PE</td>
<td>17.46&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9.7&lt;sup&gt;c&lt;/sup&gt;</td>
<td>11.19&lt;sup&gt;b,c&lt;/sup&gt;</td>
<td>20.01&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>BAI</td>
<td>15.5&lt;sup&gt;b,c&lt;/sup&gt;</td>
<td>14.27&lt;sup&gt;b&lt;/sup&gt;</td>
<td>20.2&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.34&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>HRSD</td>
<td>8.64&lt;sup&gt;b&lt;/sup&gt;</td>
<td>24.46&lt;sup&gt;c&lt;/sup&gt;</td>
<td>26.47&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.77&lt;sup&gt;a&lt;/sup&gt;</td>
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</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Variable</th>
<th>$b$</th>
<th>$t$</th>
<th>$p$</th>
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<tr>
<td>Intercept</td>
<td>8.63</td>
<td>12.01</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Time</td>
<td>-0.03</td>
<td>-6.67</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Age</td>
<td>-0.05</td>
<td>-2.45</td>
<td>0.01</td>
</tr>
<tr>
<td>Gender</td>
<td>0.75</td>
<td>1.60</td>
<td>0.11</td>
</tr>
<tr>
<td>Time x Time (quadratic effect)</td>
<td>0.00005</td>
<td>1.89</td>
<td>0.06</td>
</tr>
<tr>
<td>Panic</td>
<td>0.93</td>
<td>1.81</td>
<td>0.07</td>
</tr>
<tr>
<td>Time x Panic</td>
<td>0.0006</td>
<td>0.22</td>
<td>0.83</td>
</tr>
<tr>
<td>Depression</td>
<td>-0.23</td>
<td>-0.46</td>
<td>0.64</td>
</tr>
<tr>
<td>Time x Depression</td>
<td>0.005</td>
<td>1.84</td>
<td>0.07</td>
</tr>
<tr>
<td>Panic x Depression</td>
<td>-0.28</td>
<td>-0.27</td>
<td>0.78</td>
</tr>
<tr>
<td>Time x Depression x Panic</td>
<td>-0.01</td>
<td>-1.92</td>
<td>0.05</td>
</tr>
</tbody>
</table>
Table 3. Follow-up pair-wise comparisons to detect group x linear time interactions between separate groups of participants.

<table>
<thead>
<tr>
<th>Group</th>
<th>Interaction</th>
<th>b</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depressed only vs. Comorbids</td>
<td>Time x Panic</td>
<td>-0.004</td>
<td>-1.33</td>
<td>0.18</td>
</tr>
<tr>
<td>Panic only vs. Controls</td>
<td>Time x Panic</td>
<td>0.006</td>
<td>1.41</td>
<td>0.16</td>
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<tr>
<td>Panic only vs. Comorbids</td>
<td>Time x Dep.</td>
<td>-0.001</td>
<td>-0.21</td>
<td>0.84</td>
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<tr>
<td>Comorbid vs. Controls</td>
<td>Time x Com.</td>
<td>0.005</td>
<td>1.72</td>
<td>0.09</td>
</tr>
<tr>
<td>Panic only vs. Depressed Only</td>
<td>Time x Dep.</td>
<td>0.003</td>
<td>0.76</td>
<td>0.45</td>
</tr>
<tr>
<td>Depressed only vs. Controls</td>
<td>Time x Dep.</td>
<td>0.009</td>
<td>2.57</td>
<td>0.01*</td>
</tr>
</tbody>
</table>
CITED LITERATURE


Approval Notice
Amendment to Research Protocol and/or Consent Document – Expedited Review
UIC Amendment #19

June 1, 2015

Stewart Shankman, Ph.D.
Psychology
912 S. Wood Street, 4th Floor
M/C 285
Chicago, IL 60612
Phone: (312) 355-3612 / 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 Danielle 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:

Phone: 312-996-1711 http://www.uic.edu/depts/ovcr/cprs/ FAX: 312-413-2929
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:

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<th>Submission Type</th>
<th>Review Process</th>
<th>Review Date</th>
<th>Review Action</th>
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<td>05/13/2015</td>
<td>Amendment</td>
<td>Expedited</td>
<td>05/29/2015</td>
<td>Approved</td>
</tr>
</tbody>
</table>

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://tiger.uchicago.edu/depts/ovc/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 Otech, 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
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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 Augsburg College, Minneapolis, Minnesota, 2006
B.M., Vocal Music

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


MANUSCRIPTS UNDER REVIEW


BOOK CHAPTERS


CONFERENCE PRESENTATIONS


**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)