The Relation Between Symptoms of Bulimia Nervosa and OCD:

A Startle Study of Aversiveness Sensitivity

BY

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THESIS

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, 2011

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ACKNOWLEDGEMENTS

I would like to thank my advisor and chair of my dissertation committee, Stew Shankman, for his unwavering support throughout my entire time as one of his mentees. I would not have been able to accomplish this study or been successful with other graduate school pursuits were it not for his guidance and encouragement. I would also like to especially thank Eunice Chen, a dissertation committee member and my clinical supervisor at the University of Chicago. Her positive encouragements and the clinical and research opportunities that were provided in her Eating Disorders clinic led me to continue my interest and research in eating disorders, and for this, I will be forever grateful. I would also like to thank the other committee members, Evi Behar, Audrey Ruderman, and Larry Grimm, for their support and suggestions during this study.
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I. INTRODUCTION

Comorbidity among mental disorders has important diagnostic, clinical, and research implications, and raises questions about the validity of diagnostic categories and the true nature of comorbidity. Understanding how comorbidity occurs and clarifying the relationship between separate disorders may provide possible answers to questions about diagnostic boundaries, mechanisms of psychopathology and common etiology. Additionally, the presence of comorbidity often affects treatment outcome (Cumella, Kally, & Wall, 2007), and therefore understanding how and why comorbidity occurs is essential to development of more targeted treatments.

Recently, research efforts have been directed towards investigating the comorbidity of eating disorders and obsessive compulsive disorder (Altman & Shankman, 2009; Hudson, Pope, Yurgelun-Todd, Jonas, & Frankenburg, 1987; Lilenfeld et al., 1998). The DSM-IV (APA, 1994) categorizes three disorders under the umbrella of ‘Eating Disorders’ - Anorexia Nervosa (AN), Bulimia Nervosa (BN), and Eating Disorder-Not Otherwise Specified (EDNOS), and lists a fourth condition in the appendix, binge eating disorder (BED). The eating disorders (EDs) are heterogeneous in symptom manifestation, but all have common dysfunctional thoughts and behaviors associated with food and body image on varying dimensions.

Bulimia Nervosa (BN) is characterized by episodes of eating abnormally large amounts of food within a 2-hour period, along with a feeling of loss of control over eating. To counteract the potential consequences of the binge, individuals with BN often engage in a compensatory action such as purging (self-induced vomiting, laxative/diuretic use), and/or excessive exercising. Individuals with BN typically have body image concerns, as well as recurring thoughts about food.
Obsessive Compulsive Disorder (OCD) is categorized in the DSM-IV as an anxiety disorder. Hallmarks of the disease include obsessions, defined as recurrent, intrusive unwanted thoughts and images, and compulsions, which are performed in an effort to reduce the obsession-related anxiety (APA, 1994). Individuals with OCD often have disparate obsessions and compulsions, such as fear of contamination/excessive handwashing or aggressive urges/excessive checking.

Although BN and OCD seem disparate and are classified in separate sections of the DSM-IV, further examination reveals similar emotional, cognitive, and behavioral characteristics and relationships. For example, regulation of anxiety plays a critical role in the development and maintenance of both BN and OCD (Bulik, 1995; Bulik, Sullivan, Fear, & Joyce, 1997; Godart, Flament, Perdereau, & Jeamment, 2002; Tynes, White, & Steketee, 1990). BN and OCD are both characterized by anxiety and repetitive thoughts and preoccupations (e.g. BN: food/body image/weight preoccupation; OCD: obsessive preoccupation with symmetry, contamination, etc) (Buree, Papageorgis & Hare, 1990; Rachman, 1997). For both BN and OCD, this is then followed by compensatory motor behaviors. For BN this compensatory behavior could be binging/purging, laxative/diuretic use or compulsive exercise. For OCD, this compensatory behavior could be handwashing, checking, or another other compulsion aimed at reducing the anxiety (Rachman & Hodgson, 1980; Schupak-Neuberg & Nemeroff, 1993).

Researchers and clinicians have long hypothesized a relation between eating disorders and OCD (Hudson et al., 1987; Lilenfeld et al., 1998). In a systematic review of epidemiological, family, and longitudinal studies (Altman & Shankman, 2009), we reported a link between OCD and BN. Epidemiological studies suggested that BN and OCD co-occur
frequently and this high comorbidity rate is not due to chance or a sampling bias (Angst et al., 2004; Hudson et al., 2007). Longitudinal and family studies also supported that BN and OCD may share a common underlying etiology (Bellodi et al., 2001; Bulik, Sullivan, Fear, & Joyce, 1997; Godart et al., 2000; 2003; Kaye et al., 2004; Milos et al., 2002; Speranza et al., 2001; Thornton & Russell, 1997; Wentz, Gillberg, Anckarsa, Gillberg, & Rastam, 2009). However, the exact nature of this shared etiology has yet to be elucidated. The present study seeks to examine whether common emotional processes and mechanisms explain the relation between OCD and BN. Specifically, this study will focus on sensitivity to aversiveness.

A. Lang’s Theory of Sensitivity to Aversiveness

One theory that may help in the understanding of the emotional mechanisms of OCD and BN is Lang’s theory of emotional and motivational processes (1995). Under this theory, emotions are described as “action dispositions” in which two underlying motivational systems, the appetitive system and the aversive system, influence an individual’s behavior (Lang, Bradley, & Cuthbert, 1990; Lang, 1995). This theory postulates that all affects are primitively associated with a set of behaviors which either lead the organism to approach the stimuli (appetitive system) or to avoid and withdrawal from the stimuli (aversive system).

The aversive system is activated when an individual experiences fear or anxiety when faced with unpleasant, threatening stimuli, and this leads the individual to withdrawal and escape (Lang, 1995). In BN, food and weight could potentially be aversive stimuli to the individual; hence, when faced with a food that is generally a binge food (and potentially evoking fear of weight gain), the aversive system should be intensely activated in the individual. Accordingly, for an OCD individual with contamination fears, when faced with a dirty toilet or other contaminated stimuli, the aversive system should be intensely activated in that individual.
Indicators of aversiveness sensitivity have been suggested to play an etiological role in OCD and BN. For example, the personality construct harm avoidance is the tendency to be highly sensitive to aversive and punishing stimuli (Cloninger, 1986). Compared to healthy controls, harm avoidance has been shown to be significantly elevated in individuals with OCD and their relatives (Bejerot et al., 1998; Ettelt et al., 2008 Lyoo et al., 2001; Richter et al., 1996), suggesting that it is a risk factor for OCD. High harm avoidance has been shown to be characteristic across the Eating Disorder pathologies, and specifically, individuals with BN have significantly higher harm avoidance than controls (Alvarez-Moya et al, 2007; Kaye et al., 2004; Monteleone et al., 2008).

Another indicator of aversiveness sensitivity, neuroticism was identified as a risk factor for the development of BN. Cervera et al. (2003) followed a sample of adolescent girls over 18 months who were originally free from eating disorder diagnoses, and results indicated that those higher in neuroticism had a 3.3 fold increase in odds of developing a diagnosable eating disorder. Neuroticism is also elevated in individuals with OCD and their relatives compared to controls and their healthy relatives (Fullana et al., 2004; Samuels et al., 2000), suggesting that it is also a risk factor for OCD. Thus, it may be that comorbidity between OCD and BN may be due to a shared elevated sensitivity to aversiveness.

B. Startle Reflex and its Relation to the Aversive System and Harm Avoidance

i. General aversiveness sensitivity.

As stated above, the aversive system is activated when an individual is faced with aversive stimuli. Specifically, when the aversive system has been activated, defensive reflexes, such as startle, are increased (Lang, Bradley, & Cuthbert, 1990). Startle is a component of a defensive responding and occurs following the presentation of an abrupt sensory event (e.g., loud
noise). The pathway mediating the startle reflex is very quick as it only has synapses at the ventral cochlear nucleus, the dorsal nucleus of the lateral lemniscus, and the caudal pontine reticular nucleus (PnC). The output of this circuit is thought to activate spinal interneurons and spinal motor neurons (Koch, 1999). One of the ways to measure startle response is to measure electromyographic (EMG) activity generated by the obicularis oculi muscle, (i.e., the muscle that closes the eye) (Lang, Bradley, & Cuthbert, 1990).

One of the most robust findings in the startle literature is that, compared to a neutral state, when an individual is in a heightened state of aversiveness, the eyeblink startle response is significantly potentiated (increased) when an abrupt sensory event occurs (i.e., the fear-potentiated startle response; Lang, 1995). Fear-potentiated startle studies have used various methodological approaches to induce aversive states, ranging from presenting individuals with an aversive stimuli (e.g., aversive picture, shock, airblasts to the throat, darkness, or giving a speech) to threatening individuals with aversive stimuli (Bradley, Codispoti, Cuthbert, & Lang, 2001; Cornwell et al., 2006; Grillon et al., 1997; Jovanovic et al., 2005). The fear-potentiated startle response has therefore been proposed to be a physiological indicator of the sensitivity of the aversive system (Lang, Bradley, & Cuthbert, 1990; Lang, 1995). In support of this, individuals with high harm avoidance and neuroticism have shown significantly higher fear-potentiated startle than controls to aversive pictures (Cook et al, 1991; Corr et al., 1995; 1997; Wilson, Kumari, Gray, & Corr, 2000).

Given that individuals with high sensitivity to aversiveness show potentiated startle responses to aversive pictures, one would expect that OCD individuals and BN individuals would respond to aversive stimuli differently than controls. However, few studies have investigated this question. While presented with aversive pictures (e.g., a pointed gun, attack),
BN individuals and controls have exhibited comparable fear-potentiated startle responses (Drobes et al., 2001; Freiderich et al. 2006; Mauler et al., 2006). There are even fewer emotion modulated startle studies in the OCD literature. Kumari, Kaviani, Raven, Gray, and Checkley (2001) investigated startle response during film clips with varying affective tones (positive, neutral, negative) in 10 patients with OCD and 10 healthy controls. Results showed that OCD patients had higher startle responses during all film clips, regardless of the affective valence. This suggests that individuals with OCD exhibit an abnormal baseline startle, but not an abnormal potentiation to aversive stimuli. Though not an emotion modulated startle experiment, Buhlman et al (2007) measured startle response to acoustic noise in OCD patients compared to controls when they were relaxed and found a trend for OCD patients to have a larger eyeblink startle response compared to controls.

Although the limited data suggest that individuals who are experiencing BN or OCD have not shown fear-potentiated startle to aversive pictures, those with characteristics of both disorders may have a double risk of increased harm avoidance and neuroticism, and this may increase the possibility of having an increased general aversiveness sensitivity that would be supported by fear-potentiated startle during general threat pictures.

ii. Sensitivity to disorder-specific aversiveness.

Although the few startle studies for BN and OCD do not support that individuals with these conditions exhibit a general hypersensitivity to aversiveness, Grillon and Baas (2003) suggest that startle studies would benefit from using aversive stimuli that are directly relevant to the disorder (or symptom) of interest. For example, individuals with spider phobias have exhibited potentiated startle to pictures of spiders compared to controls, but did not differ when faced with general aversive pictures, such as threatening dogs or weapons (Hamm et al., 1997).
Furthermore, McTeague et al. (2009) examined disorder specificity in social phobia using disorder-relevant narrative imagery scripts. Individuals with social phobia exhibited potentiated startle in response to social threat imagery scripts, such as public speaking failure and social confrontation, compared to controls; but, there were no differences between groups during general threat imagery scripts, which included physical attack by animal or human. However, a study with panic disorder and PTSD patients using a similar imagery script methodology failed to find startle potentiation for disorder-specific aversiveness (Cuthbert et al., 2003). Thus, in order to assess aversiveness sensitivity using startle, it may be important to tailor the stimuli to certain disorders, but not for others. Furthermore, Vaidyanathan et al. (2009) suggest that different patterns of startle reactivity may help elucidate distinct neurobiological processes in internalizing disorders. The authors suggest that comorbidity may be understood by co-morbid disorders encompassing unique processes to each disorder, yet common processes shared by both disorders.

Disorder-specific aversive stimuli for individuals with BN and OCD may potentially trigger higher startle responses and thus reflect higher aversiveness sensitivity for their respective disorder cues. For example, if a high caloric food is an aversive stimulus to BN individuals, the startle reflex may be potentiated when the individual is presented with foods that are high calorie/fat, or pictures of those foods. Similarly, if contaminated objects are aversive stimuli for OCD individuals, the startle reflex may be potentiated when the individual is presented with a dirty toilet, or pictures of a dirty toilet or other contaminated objects.

**1. Startle response to food cues.**

There have been few studies that have examined the startle reflex in response to pictures of food in individuals with bulimic behaviors and they have yielded conflicting findings. Drobos
et al. (2001) investigated individuals’ startle response to food pictures in female undergraduates characterized as Restrainers (i.e. high on a restraint subscale and low on a binge-purge subscale), Binge-purgers (i.e. high on binge-purge subscale, low on restraint subscale), and controls. Controls and Restrainers showed no differences in startle reflex during food cues; however, Binge-purgers showed potentiated startle in response to food cues, consistent with food being aversive stimuli to those individuals. Similar results were found by Mauler, Hamm, Weihe, and Tuschen-Caffier (2006) in patients diagnosed with BN. Conflicting results, however, have been reported by Friederich et al. (2006) who examined the startle reflex in response to food, positive, aversive, and neutral cues. During food cues, BN individuals showed an attenuated, rather than potentiated, response which was significantly different from controls; however, BN and controls did not differ in response to aversive cues. Taken together, these studies support that BN individuals do not have a general aversiveness sensitivity, but may have a specific aversiveness to disorder-specific cues.

2. Response to contamination cues.

Although there are no studies examining startle in OCD individuals in response to disorder-specific cues, there have been a few studies that have investigated response to contamination cues in OCD individuals using other methodologies. In an fMRI study, Shapira et al. (2003) showed disgust-inducing pictures of contaminated objects (e.g. feces, vomit, dirty toilets), along with general affective pictures (threat and neutral), to controls and OCD individuals with preoccupations of contamination. Results showed higher activation in the insular, basal ganglia and parahippocampal regions during contamination pictures in OCD individuals compared to controls, whereas there were no differences in activation found between the two groups during the negative and neutral pictures. Similarly, Phillips et al. (2000) found
that OCD individuals with washing compulsions showed differential activation in the visual regions and insula during the washing-relevant pictures compared to individuals with checking compulsions or controls. Together, these results lend support to a disorder-specific, and potentially symptom-specific, aversive response to pictures of clinically-relevant cues for OCD individuals.

C. The Current Study

i. Primary goals/hypotheses of the current study.

Although the majority of studies have examined diagnostic comorbidity in patient populations, Hasler et al. (2005) examined dimensional symptoms in OCD patients and reported that EDs are only associated with contamination obsessions and cleaning rituals and not other clusters of OC symptoms. Other studies have also reported this finding, particularly in those with binge/purge behaviors, but also found high co-occurrence of aggressive and symmetry symptoms in EDs (Halmi et al., 2003; Matsunaga et al., 1999). In short, instead of relying on DSM diagnoses, it may be more useful to examine more specific OC and BN dimensions in order to examine comorbidity more comprehensively. In this study, startle response was evaluated during disorder-specific (e.g., food cues, contamination cues) and non-specific aversive pictures (e.g., threat) in a college-aged population of females with a wide-spectrum of eating behaviors and contamination fears.

1. Primary hypotheses.

It was hypothesized that in individuals with elevated levels of disordered eating characteristics (e.g. weight/shape concerns), startle response during food pictures would be higher than during contamination pictures, negative pictures, and neutral pictures.
For those with BN Symptoms:

Food > Contamination = Negative > Neutral

It is hypothesized that in individuals with elevated contamination fears, startle response during contamination pictures would be higher than during food pictures, negative pictures, and neutral pictures.

For those with OCD Symptoms:

Contamination > Negative > Neutral >= Food

It is hypothesized that in individuals with co-occurring elevated contamination fears and elevated eating disorder characteristics, startle response during general threat pictures would generate the highest potentiation than during the food pictures, contamination pictures, and neutral pictures.

For those with co-occurring OCD and BN symptoms:

Negative > Contamination = Food > Neutral

ii. Secondary aims.

It is particularly important for studies of emotional responsivity in psychopathology to examine the temporal dynamics of the emotional response, or “affective chronometry” as this is likely to play a key role in understanding psychopathology (Davidson, 1998). For example, it may be useful to look for group differences in anticipation of and recovery from aversive stimuli (whether disorder specific or not). Studies have found that anticipation of aversive stimuli results in potentiated startle response in not only anxious individuals, but also controls (Larson, Nitschke, & Davidson, 2007; Nitschke et al., 2002). Anxious individuals also show a trend for a slower recovery following aversive stimuli offset (Larson et al., 2007).
The temporal dynamics of responding may be particularly important for studies of BN and OCD. Purging and compulsions are done in an effort to reduce the anxiety from the obsessional images/thoughts of the individuals. Therefore it may be that the arousal induced by the food and contamination pictures may linger longer for BN and OCD, respectively, after picture offset. Szechtman and Woody (2005) hypothesized a theoretical model in which they suggest that OCD individuals may have a prolonged recovery period after being confronted with an aversive stimulus due to their inability to terminate their thoughts and action. In the present study, this deficit may be reflected by a potentiated startle during recovery time after presentation of contaminated pictures in those with OCD symptoms. Alternatively, it may be that groups show abnormalities during the anticipation period (i.e., before the picture onset). Examining these potential differences may give clues to deficits in emotion regulation of aversive stimuli, and may also help understanding the mechanism of maintenance of the disorders.

1. Secondary hypotheses.

It is hypothesized that following food cues, individuals with elevated disordered eating characteristics will have higher startles compared to those with lower disordered eating behaviors and concerns.

For those with BN Symptoms:

Food > Contamination = Negative > Neutral

Similarly, it is expected that following contamination cues, individuals with elevated contamination preoccupations will have higher startles compared to individuals with lower contamination preoccupations.
For those with OCD Symptoms:

Contamination > Negative > Neutral >= Food

Though there are no specific *a priori* hypotheses for the anticipation periods, differences will be explored during the anticipation of food and contamination cues.
II. METHODS

A. Participants

A total of 125 female undergraduates were enrolled in the study. Participants were recruited from the University of Illinois at Chicago Introduction to Psychology Subject Pool during the fall and spring semesters of the 2009-2010 academic year. Individuals with BN are 3 times as likely to be female (Hudson et al., 2007), and OCD occurs in slightly more females than males (1.44:1) (Torres et al., 2006); therefore, only female participants were recruited. During the Psychology Subject Pool Mass Testing, the Bulimia subscale of the Eating Disorder Inventory (EDI) and the Contamination Fears subscale of The Schedule of Compulsions, Obsessions, and Pathological Impulses (SCOPI) were administered to approximately 900 students (see Measure section below). The EDI-Bulimia subscale was given as a screener because of the limited space guidelines for mass testing. The EDE is the preferred measure and was highly correlated with the EDI. Because binge-purge behaviors and contamination fears are fairly low frequency behaviors in the general population (Hudson et al., 2007; Ruscio, Stein, Chiu & Kessler, 2010), we oversampled those who scored high on the EDI-Bulimia and the SCOPI-Contamination subscales in order for bulimic behaviors and contamination fears to be normally distributed in the present sample.

B. Measures

i. Primary predictors.

1. Eating Disorders Examination-Questionnaire (EDE-Q).

The EDE-Q (Fairburn & Beglin, 1994) is a 36-item self-report measure derived from the well-known eating disorders interview, the EDE (Fairburn & Cooper, 1993). The EDE-Q is

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1 Statistics from mass testing questionnaires were: EDI-Bulimia M = 13.48, Median = 12.00, SD = 4.54, Skewness = 1.08, and Kurtosis = 1.15. SCOPI M = 38.31, Median = 39.00, SD = 7.89, Skewness = -0.16, Kurtosis = -0.12.
scored the same way as the EDE and provides a similarly comprehensive assessment of the specific psychopathology of eating-disordered behavior as the full semi-structured diagnostic interview. The EDE is regarded as the instrument of choice for assessment and diagnosis of DSM-IV eating disorders (Garner, 2002) and studies of the validity of the EDE-Q have demonstrated a high level of agreement between the EDE-Q and EDE in assessing the core attitudinal features of eating disorder psychopathology in the general population (Fairburn & Beglin, 1994), and in clinical samples of bulimia nervosa (BN) patients (Carter, Aime, & Mills, 2001). Acceptable internal consistency and test–retest reliability have also been demonstrated (Luce & Crowther, 1999; see Appendix 1 for measure). Two predictor variables from the EDE-Q were used in the main analyses - the weight concern and shape concern subscales as weight/shape concerns has been found to be the most consistently found risk factor for the development of BN (Jacobi et al., 2010.)

2. The Schedule of Compulsions, Obsessions, and Pathological Impulses (SCOPI).

The SCOPI (Watson & Wu, 2005) is a 47-item factor-analytically derived self-report scale which assesses behaviors related to OCD. All items are rated on a 5-point scale (1 = strongly disagree, 5 = strongly agree). In addition to providing a total score, the SCOPI yields 3 core subscales: checking, cleanliness, and pathological impulses that make up the total score. The scales show high internal consistency and test-retest reliability. They also show good convergent validity with other OCD measures (e.g. OCI-R and Y-BOCS) and adequate discriminant validity in that the scales differentiated OCD individuals from non-OCD individuals.

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2. We explored the association with other EDE subscales (Restraint, Eating Concerns, and Global scores) and found that they were not associated with startle potentiation during food pictures (all p’s > .18).
in samples of students, adults, and general psychiatric outpatients (Watson & Wu, 2005; see Appendix 2 for measure).

**ii. Demographics and other measures.**

Participants completed questions regarding demographic information. Because food deprivation has been shown to influence startle response (see Drobes et al., 2001; Mauler et al., 2006), participants indicated the time since they last ate by choosing one of the following options: 0-1 hours ago; 2-4 hours ago; 4-6 hours ago; 6-12 hours ago; or 12+ hours ago. This variable was used as a covariate in all analyses. In addition, participants also completed measures of personality, depressive and anxious symptoms, perfectionism and impulsivity. In future studies, we will examine these as potential moderators. These measures are described below.

**1. The Eating Disorder Inventory-3 (EDI-3).**

The EDI is a self-report questionnaire used to assess the presence of symptoms of eating disorders. The original questionnaire consisted of 64 questions, divided into eight subscales. The EDI-3 was developed to improve and expand earlier versions and includes three subscales of eating disorder symptoms. The subscales showed satisfactory internal consistency and good discriminant validity (Clausen, Rosenvinge, Friborg, & Rokkedal, 2011). The Bulimia subscale was used during mass testing to screen for participants.

**2. The Eysenck Personality Questionnaire-Revised (EPQ-R).**

The EPQ-R is a revised version of the original EPQ (Eysenck & Eysenck, 1975) and consists of 100 true-false items designed to measure broad personality domains (Eysenck, Eysenck, & Barrett, 1985). The scale consists of four subscales, Extraversion, Neuroticism, Psychoticism, and Lie scales, and reliabilities of these scales range from .78 to .90 (Eysenck,
Eysenck & Barrett, 1985). The Neuroticism subscale was used as an index of aversiveness sensitivity (see Appendix 3 for measure).

3. The Inventory of Depression and Anxiety Symptoms (IDAS).

The IDAS (Watson et al., 2007) is a factor-analytically-derived scale assessing specific symptom dimensions of major depression and related anxiety disorders. The scales are internally consistent and show excellent convergent validity and good discriminant validity. Major Depressive Disorder has been found to be highly co-morbid with BN (O’Brien & Vincent, 2003) and OCD (Overbeek et al., 2002), therefore it was important to assess depression symptomatology in the sample (see Appendix 4 for measure).


The FMPS is a 35-item scale assessing perfectionism, or the tendency to hold and pursue high expectations/standards (Frost et al., 1990). The FMPS has shown high reliability, internal consistency and construct validity (Frost et al., 1990). Perfectionism has been argued as a core personality trait in individuals with EDs and OCD (see Appendix 5 for measure).

5. UPPS-P Impulsive Behavior Scale (UPPS-P).

The UPPS-P is a factor-analytically derived 57-item scale assessing facets of impulsivity, and includes five subscales: Urgency, Lack of Perseverance, Lack of Premeditation, and Sensation Seeking, and Positive Urgency being the most recent subscale addition due to recent research by Cyders et al. (2007). The items are rated on a 4-point scale (1=agree strongly to 4=disagree strongly). Whiteside and Lynam (2001) reported high internal consistency, as well as good divergent and external validity of the UPPS, and Cyders et al (2007) report high internal consistency and divergent validity of the Positive Urgency scale. Impulsivity has been argued to be a core trait in individuals with BN and OCD (see Appendix 6 for measure).
C. Procedure

i. Physiological and acoustic materials.

Stimuli were regulated by Contact Precision Instruments (London, UK) and startle data were recorded using a PC-based acquisition system (Neuroscan 4.3). Startle response were operationalized as the eyeblink response elicited by a 50ms, 103db bursts of white noise presented binaurally through headphones. The startle eyeblink were recorded using two electrodes placed over the obicularis oculi muscle underneath the right eye and collected with a bandpass of DC-500 Hz at a sampling-rate of 1000 Hz. A ground electrode was placed along the midline of the forehead.

ii. Disorder-specific stimuli.

Forty colored slides were selected from the International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 2008). The picture set included ten pictures each of explicit food content, contamination content, aversive personal threat content and neutral content based on normative valence and arousal ratings for women (Lang et al., 2008). The food pictures included candy, ice cream and other high-calorie, high density foods that were previously rated as highly appetitive by individuals without disordered eating behaviors and half were also used in a previous startle study (Drobes et al, 2001). IAPS numbers of food slides are: 7200, 7220, 7230, 7340, 7350, 7402, 7405, 7410, 7430, 7451, 7461, 7470. The contamination pictures included dirty toilets and other contamination pictures rated high on disgust (Shapira et al., 2003). IAPS numbers of contamination slides are: 2730, 9290, 9291, 9300, 9301, 9302, 9340, 9341, 9390, and 9395. The general aversive personal threat pictures are: 1050, 1120, 1300, 1525, 1932, 6230, 6242, 6250, 6510, 6560 and include pictures of animal attack and pointed guns.
Following the experimental portion of the session, participants rated all 40 International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 2008) pictures on arousal, valence and control on a manikin scale used by Lang et al. The script for the instructions can be found in the Appendix 7. The range for the three categories ranged from 0 to 8 in each case. For valence ratings, 0 was “completely happy” and 8 was “completely unhappy”. For arousal ratings, 0 was “completely aroused” and 8 was “not at all aroused.” For control ratings, 0 was “completely controlled” and 8 was “completely dominant.”

iii. Experimental sessions.

Participants were asked to have a meal 2-3 hours before the experiment in order to avoid any confound with deprivation (see Drobes et al., 2001; Mauler et al., 2006). Participants were instructed to avoid eating, smoking or drinking caffeine-containing beverages in the hour before the experiment. Approximately 50% of the sample indicated that they last ate 2-4 hours before the experimental session; however, because 18% of the sample ate within the hour before the session and the remaining 32% ate more than 4 hours prior to the session, the variable for “time since last eaten,” as described above, was used as a covariate (referred to as “Deprivation Time” in the remainder of the manuscript).

Following electrode placement, all participants were seated in a sound-attenuated booth approximately 1.5 m in front of a computer screen. Participants were first presented with a 3-minute baseline period during which heart rate was recorded and no startle probes were presented (data not presented). Next, participants were given another 2.5-minute baseline period during which they were presented with 9 startle stimuli to habituate participants to the startle probe.
Pictures were presented in two blocks of 20 pictures, with each block separated by approximately 5 minutes. There were five pictures of each valence in each block. Pictures were presented in a quasi-random order, with the constraint that no more than two pictures of a given valence were presented consecutively. Immediately before each picture, participants were presented with a 4-second anticipation text that indicated the category of the coming picture. Participants were told that the text was to prepare them for the category of the upcoming stimulus picture. The text for the food pictures was the word “FOOD,” the text for contamination pictures was the word “DIRTY,” the text for aversive pictures was the word “THREAT,” and the text for neutral pictures was the word “NEUTRAL.” Each picture was on the screen for 5 seconds, followed by a blank screen for 12-18s (mean interstimulus interval was 15s). Acoustic startle probes were presented during 7 trials of each valence during the following probe times: during the warning stimulus (1 to 2s before the picture onset), during the picture (2 to 4s post–picture onset) and once during the intertrial interval (between 1.5 and 6s after picture offset). A total of 84 probes were delivered during the course of the experiment. Seven probes were delivered during anticipation periods of pictures for each condition (neutral, food, contamination, threat), seven during presentation of pictures of each condition, and seven during the period following pictures of each condition for a total of 21 during affective category (see Figure 1.)
Figure 1

Timeline of Startle

NEUTRAL +

[-------------4s-----------------6s-----------------12-18s--------------------------]

FOOD +

[-------------4s-----------------6s-----------------12-18s--------------------------]

DIRTY +

[-------------4s-----------------6s-----------------12-18s--------------------------]

THREAT +

[-------------4s-----------------6s-----------------12-18s--------------------------]

뇌 indicates white noise probe approximate timing
After each block, participants rated their anxiety and happiness levels during the anticipation, presentation and recovery periods of the picture cues of each category. They were asked to rate on a 7-point Likert scale, where higher values represented higher levels of anxiety or happiness (see Appendix 8). Following the second block, electrodes were removed and participants went into a separate room where they were shown the 40 pictures again and asked to rate each picture on arousal, valence, and controls as described above. Finally, after the rating task, participants completed the self-report questionnaires listed in the measures section.

D. Analyses

Peak blink response was measured during the 20 to 100-ms window following presentation of the startle probe. Data were rectified and smoothed using an FIR filter (low pass cutoff of 40 Hz) and then baseline corrected using the 50-ms preceding stimulus onset. Each blink was analyzed for its conformity as per established guidelines (Blumenthal et al., 2005). Participants were excluded from analyses if they elicited fewer than 3 of 7 blinks within a condition, resulting in the final sample being 117 of 125 participants with complete data. Due to a technical error, 107 participants only received 83 startle probes instead of 84. All analyses were run with these 107 participants only, and these analyses revealed the same pattern of results as the entire sample; therefore, results from the 117 participants are revealed below.

Correlations of the subscales and global score of the EDE-Q were run to explore any significant associations with potentiation during the food pictures. Because the EDE-Q subscales of weight concerns and shape concerns were highly correlated ($r = .92$), the subscales were Z-scored and then averaged to make a composite body image variable (Body Image). Correlations were run to examine the relationships between the predictors (Body Image and Contamination Fears) and dependent variables (startle and self-report ratings of pictures.)
Analyses revealed that BMI was not significantly correlated with any of the dependent variables (all $p > .10$), therefore it was not used as a covariate in the analyses.

First, we examined zero-order correlations to determine whether Body Image and Contamination Fears were correlated with the startle response during neutral pictures for each startle response period (e.g. in anticipation, during and in recovery phases) (see Tables 1, 2, & 3). As these were nonsignificant, it allowed us to use as dependent variables difference scores between the affective conditions (e.g. Food, Contamination, and Threat) and the neutral conditions (i.e., the potentiation of startle to the affective conditions).

### Table I

**Zero-Order Correlations of Predictors and Startle Response During Picture Presentation**

<table>
<thead>
<tr>
<th></th>
<th>Deprivation Time</th>
<th>Body Image Concerns</th>
<th>Contamination Fears</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral Pic</td>
<td>.25**</td>
<td>.01</td>
<td>-.13</td>
</tr>
<tr>
<td>Food minus Neutral</td>
<td>-.20*</td>
<td>.18*</td>
<td>-.08</td>
</tr>
<tr>
<td>Contamination minus Neutral</td>
<td>-.17</td>
<td>.08</td>
<td>.17 (t)</td>
</tr>
<tr>
<td>Threat minus Neutral</td>
<td>-.11</td>
<td>.00</td>
<td>.11</td>
</tr>
</tbody>
</table>

Note: (t) trend. *$p < .05$.  **$p < .01$.  


Table II

Zero-Order Correlations of Predictors and Startle Response in Anticipation of Cue and Startle Response After Presentation

<table>
<thead>
<tr>
<th>In Anticipation</th>
<th>Deprivation Time</th>
<th>Body Image Composite</th>
<th>Contamination Fears</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral</td>
<td>-.04</td>
<td>.03</td>
<td>-.26**</td>
</tr>
<tr>
<td>Food minus Neutral</td>
<td>.03</td>
<td>-.04</td>
<td>.13</td>
</tr>
<tr>
<td>Contamination minus Neutral</td>
<td>.02</td>
<td>.05</td>
<td>.19*</td>
</tr>
<tr>
<td>Threat minus Neutral</td>
<td>.07</td>
<td>-.10</td>
<td>.22*</td>
</tr>
<tr>
<td>Recovery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutral</td>
<td>-.20*</td>
<td>-.04</td>
<td>.10</td>
</tr>
<tr>
<td>Food minus Neutral</td>
<td>.03</td>
<td>-.02</td>
<td>-.01</td>
</tr>
<tr>
<td>Contamination minus Neutral</td>
<td>.13</td>
<td>-.02</td>
<td>.00</td>
</tr>
<tr>
<td>Threat minus Neutral</td>
<td>.15</td>
<td>-.07</td>
<td>.07</td>
</tr>
</tbody>
</table>

Note: *p < .05. **p < .01.
### Table III

*Zero-Order Correlations of Picture Ratings*

<table>
<thead>
<tr>
<th></th>
<th>Deprivation Time</th>
<th>Body Image Composite</th>
<th>Contamination Fears</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral Arousal</td>
<td>-.09</td>
<td>.01</td>
<td>-.07</td>
</tr>
<tr>
<td>Food Arousal</td>
<td>-.07</td>
<td>-.11</td>
<td>.01</td>
</tr>
<tr>
<td>Contamination Arousal</td>
<td>.04</td>
<td>.08</td>
<td>-.27**</td>
</tr>
<tr>
<td>Threat Arousal</td>
<td>.05</td>
<td>.01</td>
<td>-.20*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutral Valence</td>
<td>-.07</td>
<td>-.10</td>
<td>-.09</td>
</tr>
<tr>
<td>Food Valence</td>
<td>-.07</td>
<td>.13</td>
<td>-.10</td>
</tr>
<tr>
<td>Contamination Valence</td>
<td>.04</td>
<td>-.05</td>
<td>.30**</td>
</tr>
<tr>
<td>Threat Valence</td>
<td>.08</td>
<td>.00</td>
<td>.31**</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutral Control</td>
<td>-.12</td>
<td>-.12</td>
<td>-.09</td>
</tr>
<tr>
<td>Food Control</td>
<td>.01</td>
<td>.20*</td>
<td>.15</td>
</tr>
<tr>
<td>Contamination Control</td>
<td>.06</td>
<td>.02</td>
<td>-.20*</td>
</tr>
<tr>
<td>Threat Control</td>
<td>.09</td>
<td>.00</td>
<td>-.17</td>
</tr>
</tbody>
</table>
To test the primary hypotheses, hierarchical multiple regression analyses were used to evaluate the relationship between the predictor variables (Body Image; Contamination Fears) and the interaction of BN symptoms and OCD symptoms on startle response, after controlling for relevant covariates (Deprivation Time). Continuous variables were centered to reduce non-essential multicollinearity (Aiken & West, 1991). Due to our interest in the disorder-specificity of predictors on disorder-specific cues, when results revealed a significant interaction, the significant disorder-specific predictor was used as the main predictor, and the comorbid predictor was used as the moderator (e.g. Body Image moderator when predicting Contamination Pictures, Contamination moderator when predicting Food Pictures). To test the secondary hypotheses, data analyses was similar to the primary hypotheses analyses, except that the DVs were startle response in anticipation to the picture stimuli and startle response following the picture stimuli.
III. RESULTS

A. Descriptive Statistics

The ethnic background of the sample was heterogeneous: 36.8% were White, 9.4% were Black, 23.9% were Latino, 22.2% were Asian/Island Pacific and 7.7% were Other. Participants varied in the amount of time elapsed since they last ate: 0-1 hrs ago (17.9%), 2-4 hrs ago (49.6%), 4-6 hrs ago (13.7%), 6-12 hrs ago (12.8%) and 12+ hrs ago (6.0%). The descriptive statistics for the sample are presented in Table 4. Consistent with our goal to oversample those with body image and contamination concerns, the EDE-Q and SCOPI variables were reasonably normally distributed as neither the skewness nor kurtosis values exceeded an absolute value of one, and means were higher than the general female population. Histograms for each variable were also examined and appeared to have normal distributions. Behavioral variables from the EDE-Q were highly correlated with Body Image concerns: Body Image concerns were highly correlated with loss of control eating episodes \(r = .53, p < .01\), eating episodes done in secret \(r = .46, p < .01\), binge episodes \(r = .37, p < .01\), laxative use \(r = .25, p < .01\), diuretic use \(r = .19, p < .05\) and excessive exercising \(r = .45, p < .01\) during the 28 days prior to the experimental session. Neuroticism was highly correlated with Body Image concerns \(r = .58, p < .01\); however it was not significantly correlated with Contamination Fears \(r = .04, ns\).
Table IV

Sample Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>S.D.</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>19.97</td>
<td>2.91</td>
<td>18.1-43.4</td>
</tr>
<tr>
<td>BMI</td>
<td>23.60</td>
<td>5.38</td>
<td>16.9-43.9</td>
</tr>
<tr>
<td>EDE-Q Weight Concern</td>
<td>2.35</td>
<td>2.20</td>
<td>0.0-6.0</td>
</tr>
<tr>
<td>EDE-Q Shape Concern</td>
<td>2.69</td>
<td>1.80</td>
<td>0.0-6.0</td>
</tr>
<tr>
<td>EDE-Q Restraint</td>
<td>1.47</td>
<td>1.41</td>
<td>0.0-5.8</td>
</tr>
<tr>
<td>EDE-Q Eating Concern</td>
<td>1.08</td>
<td>1.28</td>
<td>0.0-5.0</td>
</tr>
<tr>
<td>SCOPI Contamination Fears</td>
<td>35.00</td>
<td>9.07</td>
<td>13.0-57.0</td>
</tr>
<tr>
<td>SCOPI Total</td>
<td>92.36</td>
<td>23.25</td>
<td>49.0-151.0</td>
</tr>
</tbody>
</table>

B. Effects of Predictors on Startle Response

i. Primary hypotheses results.

For all analyses with startle response as the dependent variable, hierarchical regression was employed. In Step 1, the covariate variable Deprivation Time was entered. Step 2 included main effects of Body Image and Contamination Fears (both centered) and the interaction of the two variables

1. Startle potentiation during food pictures.

It was expected that as body image concerns increased, startle response during food pictures would show increased potentiation. The overall model explained 10% of the variance in startle response, $R^2 = .10$, $F(4,116) = 3.08$, $p < .05$. Results of Step 1 indicated a significant effect for Deprivation Time, such that as Deprivation Time decreased (i.e., the more recently they ate), startle potentiation increased, $\beta = -0.23$, $t (116) = -2.52$, $p < .05$. In Step 2, Deprivation Time continued to significantly predict startle response, and Body Image also significantly predicted startle, such that as body image concerns increased, startle potentiation increased, $\beta =
Contamination Fears and the interaction term did not significantly predict startle response during food pictures.

2. Startle potentiation during contamination pictures.

It was expected that as contamination fears increased, startle response during contamination pictures would show increased potentiation. The overall model explained 13% of the variance in startle response, $R^2 = .13$, $F(4,116) = 4.09$, $p < .01$. Results of Step 1 indicated a trend effect for Deprivation Time, such that as Deprivation Time decreased (i.e., the more recently they ate), startle potentiation increased, ($\beta = -0.17$, $t (116) = -1.86$, $p = .07$). This effect of Deprivation Time became significant in Step 2 ($\beta = -0.25$, $t (116) = -2.73$, $p < .01$). More importantly, in Step 2, there was also a main effect for Contamination Fears ($\beta = .19$, $t (116) = 2.06$, $p < .05$) predicting startle potentiation during contamination pictures. Specifically, as contamination concerns increased, potentiation during contamination pictures increased.

However, this main effect was qualified by an interaction of Contamination Fears and Body Image ($\beta = .23$, $t (114) = 2.49$, $p < .05$). To follow up this interaction, analyses of simple slopes (Aiken & West, 1991; Holmbeck, 2002) were conducted to enhance interpretation of the significant interaction. New moderator variables were created, using values 1 SD below and above the mean to create ‘high body image’ and ‘low body image’ variables. Then, new interaction terms were created by multiplying the new high and low body image variables with the centered contamination fears. Results indicated that for participants with lower body image concerns, contamination fears were not significantly associated with potentiated startle to contamination pictures, $\beta = -0.02$, $t (116) = -0.16$, ns. However, for participants with higher body image concerns, contamination fears were associated with higher potentiation to contamination pictures, $\beta = .39$, $t (116) = 3.34$, $p < .01$. See Figure 2.
Figure 2

*Body Image concerns moderates the effect of Contamination Fears on startle potentiation during presentation of contamination pictures.*

Note: Cont = Contamination; BI = Body Image
3. **Startle potentiation during general threat pictures.**

It was expected that the interaction of body image concerns and contamination concerns would predict increased potentiation during threat pictures. The overall model approached significance, $R^2 = .07$, $F(4,116) = 1.99$, $p = .10$. Deprivation Time, Body Image, and Contamination Fears did not produce significant main effects on startle response during threat pictures. However, there was a significant interaction of Body Image and Contamination Fears on startle response ($\beta = .21$, $t(116) = 2.16$, $p < .05$). To follow up this interaction, post-hoc analyses of simple slopes were conducted to enhance interpretation of the significant interaction, as reported above. These results paralleled the contamination picture results. Specifically, results indicated that for participants with lower body image concerns, contamination fears were not significantly associated with potentiated startle to general threat pictures, $\beta = -0.07$, $t(116) = -0.54$, $ns$. However, for participants with higher body image concerns, higher contamination fears were associated with larger potentiation to general threat pictures, $\beta = .30$, $t(116) = 2.45$, $p < .05$. See Figure 3.
Figure 3

Body Image concerns moderates the effect of Contamination Fears on startle potentiation during presentation of contamination pictures.

Note: Cont = Contamination; BI = Body Image
ii. Secondary hypotheses results.

1. Startle potentiation in anticipation of food pictures.

The overall model did not reach significance, $R^2 = .02, F(4,116) = 0.52, ns$. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on startle response during the anticipation of food pictures.

2. Startle potentiation in anticipation of contamination pictures.

The overall model did not reach significance, $R^2 = .04, F(4,116) = 1.14, ns$. However, similar to the picture analyses, the regression analysis revealed that there was a main effect for Contamination Fears ($\beta = .19, t (116) = 2.04, p < .05$) predicting startle potentiation during the anticipation of contamination pictures. Specifically, as contamination concerns increased, startle potentiation increased as participants anticipated viewing contamination pictures. Deprivation Time, Body Image, and the interaction term did not predict startle response during the anticipation of contamination pictures.


The overall model did not reach significance, $R^2 = .06, F(4,116) = 1.88, ns$. The regression analysis revealed that Contamination Fears ($\beta = .20, t (116) = 2.18, p < .05$) significantly predicted startle potentiation during the anticipation of threat pictures, such that as contamination concerns increased, startle potentiation in anticipation of threat pictures increased. Deprivation Time, Body Image, and the interaction term did not predict startle response during the anticipation of threat pictures.

4. Startle potentiation during recovery from food, contamination and threat pictures.
None of the overall models reached significance for the recovery period after Food, Contamination or Threat pictures, nor were there any significant main effects or interactions.

A summary of the all of the reported startle response results can be found in the appendix in Table 5.

Table 5

Summary of Results

<table>
<thead>
<tr>
<th>Predictor/Interaction Variable</th>
<th>Time period</th>
<th>Effect on DVs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher Body Image Concerns</td>
<td>Anticipatory</td>
<td>↓ happiness in anticipation of Food pics (T2)</td>
</tr>
<tr>
<td></td>
<td>Presentation</td>
<td>↑ startle during Food Pics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>↓ happiness during Food pics (T2)</td>
</tr>
<tr>
<td></td>
<td>Recovery</td>
<td>None</td>
</tr>
<tr>
<td>Higher Contamination Fears</td>
<td>Anticipatory</td>
<td>↑ startle in anticipation of contamination pics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>↑ startle in anticipation of threat pics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>↓ happiness in anticipation of threat pics (T1)</td>
</tr>
<tr>
<td></td>
<td>Presentation</td>
<td>↑ startle during contamination pics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>↑ anxiety during contamination pics (T2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>↓ happiness during threat pics (T2)</td>
</tr>
<tr>
<td></td>
<td>Recovery</td>
<td>None</td>
</tr>
<tr>
<td>Higher Body Image/Higher Contamination Fears</td>
<td>Anticipatory</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Presentation</td>
<td>↑ startle during contamination pics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>↑ startle during threat pics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>↑ anxiety during threat pics (T1/T2)</td>
</tr>
<tr>
<td></td>
<td>Recovery</td>
<td>↓ anxiety during recovery from threat pics (T2)</td>
</tr>
<tr>
<td>Lower Body Image/Higher Contamination Fears</td>
<td>Anticipatory</td>
<td>↑ anxiety in anticipation of contamination pics (T1/T2)</td>
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<td></td>
<td>Presentation</td>
<td>↑ anxiety during contamination pics (T1/T2)</td>
</tr>
<tr>
<td></td>
<td>Recovery</td>
<td>None</td>
</tr>
</tbody>
</table>

Note: T1 = Time 1, T2 = Time 2
C. Anxiety and Happiness Ratings Reported During Experimental Session

A repeated-measures mixed ANOVA was used to examine any potential effects of condition, time (block 1 vs. block 2), Body Image or Contamination Fears on ratings. Results revealed no Time x Condition interaction, indicating that that the effect of condition was the same at both time assessment points. However, results revealed a Condition x Time x Contamination Fears three-way interaction, indicating that the relative change of the conditions across time varies by level of Contamination Fears. Therefore, I examined the effects of Body Image and Contamination Fears at each time point separately.

i. Time 1.

For all analyses, hierarchical regression was employed. In Step 1, the covariate variable Deprivation Time was entered. Step 2 included main effects of Body Image and Contamination Fears (both centered) and the interaction of the two variables.

1. Anxiety during picture.

a. Anxiety ratings during food pictures.

The overall model did not reach significance, $R^2 = .04$, $F(4,116) = 1.21$, $ns$. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on anxiety during food pictures.

b. Anxiety ratings during contamination pictures.

The overall model explained 9% of the variance in anxiety, $R^2 = .13$, $F(4,116) = 2.67$, $p < .05$. The regression analysis revealed no significant main effects of Deprivation Time, Body Image or Contamination Fears. However, there was a significant interaction of Body Image and Contamination Fears ($\beta = -.20$, $t(116) = -2.19$, $p < .05$), which significantly predicted the first block of anxiety ratings during the contamination pictures. To follow up this interaction, post-
hoc analyses of simple slopes were conducted to enhance interpretation of the significant interaction, as reported above. Results indicated that for participants with lower body image concerns, contamination fears were significantly associated with higher anxiety during contamination pictures, $\beta = .27$, $t (116) = 2.09$, $p < .05$. However, for participants with higher body image concerns, higher contamination fears were not associated with anxiety during contamination pictures, $\beta = -.08$, $t (116) = -.63$, $ns$. See Figure 4.

Figure 4

Body Image concerns moderates the effect of Contamination Fears on anxiety ratings during contamination pictures-Time 1

Note: Cont = Contamination; BI = Body Image
c. Anxiety ratings during threat pictures.

The overall model did not reach significance, $R^2 = .01, F(4,116) = .32, ns$. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on anxiety during threat pictures.

2. Happiness during picture.

a. Happiness ratings during food pictures.

The overall model did not reach significance, $R^2 = .02, F(4,116) = .69, ns$. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on happiness during food pictures.

b. Happiness ratings during contamination pictures.

The overall model did not reach significance, $R^2 = .04, F(4,116) = 1.01, ns$. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on happiness during contamination pictures.

c. Happiness ratings during threat pictures.

The overall model explained 11% of the variance in happiness, $R^2 = .11, F(4,116) = 3.34, p < .05$. The regression analysis revealed no significant main effects of Deprivation Time, Body Image or Contamination Fears. However, there was a significant interaction of Body Image and Contamination Fears ($\beta = -.28, t (116) = -3.07, p < .01$), which significantly predicted happiness during the threat pictures of the first block. To follow up this interaction, post-hoc analyses of simple slopes indicated that for participants with lower body image concerns, contamination fears were not significantly associated with happiness during threat pictures, $\beta = .11, t (116) = .84, ns$. However, for participants with higher body image concerns, higher
contamination fears were associated with decreased happiness during threat pictures, $\beta = -.40$, $t(116) = -3.41$, $p < .01$.

3. **Anxiety before picture.**

   a. **Anxiety ratings in anticipation of food pictures.**

      The overall model did not reach significance, $R^2 = .03$, $F(4,116) = .90$, ns. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on anxiety in anticipation of food pictures.

   b. **Anxiety ratings in anticipation of contamination pictures.**

      The overall model explained 9% of the variance in anxiety, $R^2 = .13$, $F(4,116) = 2.85$, $p < .05$. The regression analysis revealed no significant main effects of Deprivation Time, Body Image or Contamination Fears. However, there was a significant interaction of Body Image and Contamination Fears ($\beta = -.19$, $t(116) = -2.06$, $p < .05$), which significantly predicted anxiety in anticipation of the contamination pictures during the first block. To follow up this interaction, post-hoc analyses of simple slopes indicated that for participants with higher body image concerns, contamination fears were not significantly associated with anxiety in anticipation of contamination pictures, $\beta = -0.08$, $t(116) = -0.63$, ns. However, for participants with higher body image concerns, lower contamination fears were associated with higher anxiety in anticipation of contamination pictures, $\beta = .27$, $t(116) = 2.09$, $p < .05$.

   c. **Anxiety ratings in anticipation of threat pictures.**

      The overall model did not reach significance, $R^2 = .04$, $F(4,116) = 1.07$, ns. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on anxiety in anticipation of threat pictures.
4. **Happiness before picture.**

   a. *Happiness ratings in anticipation of food pictures.*

      The overall model did not reach significance, $R^2 = .03$, $F(4,116) = .86$, *ns*. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on happiness in anticipation of food pictures.

   b. *Happiness ratings in anticipation of contamination pictures.*

      The overall model did not reach significance, $R^2 = .03$, $F(4,116) = 1.00$, *ns*. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on happiness in anticipation of contamination pictures.

   c. *Happiness ratings in anticipation of threat pictures.*

      The overall model did not reach significance, $R^2 = .06$, $F(4,116) = 1.06$, *ns*. However, there was a main effect of Contamination Fears on happiness ($\beta = -.20$, $t(116) = -2.13$, $p < .05$), such that as Contamination Fears increased, ratings of happiness in anticipation of threat pictures during the first block decreased. The regression analysis revealed no significant main effects of Deprivation Time or Body Image or interactions.

5. **Anxiety after picture.**

   None of the overall models reached significance for the recovery period after Food, Contamination or Threat pictures, nor were there any significant main effects or interactions of anxiety during the period after the picture was presented.

6. **Happiness after picture.**

   None of the overall models reached significance for the recovery period after Food, Contamination or Threat pictures, nor were there any significant main effects or interactions of anxiety during the period after the picture was presented.
ii. Time 2.

1. Anxiety during picture.

   a. Anxiety ratings during food pictures.

   The overall model did not reach significance, $R^2 = .04$, $F(4,116) = 1.00$, $ns$. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on anxiety during food pictures.

   b. Anxiety ratings during contamination pictures.

   The overall model explained 17% of the variance in anxiety, $R^2 = .17$, $F(4,116) = 5.55$, $p < .01$. The regression analysis revealed no significant main effects of Deprivation Time or Body Image. However, there was a main effect of Contamination Fears on anxiety ($\beta = .29$, $t(116) = 3.24$, $p < .01$), such that as Contamination Fears increased, ratings of anxiety during the second block of contamination pictures also increased. There was also a significant interaction of Body Image and Contamination Fears ($\beta = -.25$, $t(116) = 2.85$, $p < .01$) which significantly predicted anxiety during the contamination pictures. To follow up this interaction, post-hoc analyses of simple slopes indicated that for participants with lower body image concerns, contamination fears were significantly associated with higher anxiety during contamination pictures, $\beta = .51$, $t(116) = 4.14$, $p < .01$. However, for participants with higher body image concerns, contamination fears were not associated with anxiety during contamination pictures, $\beta = .06$, $t(116) = .50$, $ns$.

   c. Anxiety ratings during threat pictures.

   The overall model did not reach significance, $R^2 = .01$, $F(4,116) = .32$, $ns$. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on anxiety during threat pictures.
2. **Happiness during picture.**

   a. **Happiness ratings during food pictures.**

      The overall model approached significance, \( R^2 = .07, F(4,116) = 2.17, p = .08 \). The regression analysis revealed no significant main effects of Deprivation Time or Contamination Fears of happiness during food pictures. However, there was a main effect of Body Image on happiness (\( \beta = -.25, t (116) = -2.69, p < .01 \)), such that as Body Image concerns increased, ratings of happiness during food pictures of the second block decreased.

   b. **Happiness ratings during contamination pictures.**

      The overall model did not reach significance, \( R^2 = .03, F(4,116) = .78, ns \). The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on happiness during contamination pictures.

   c. **Happiness ratings during threat pictures.**

      The overall model explained 13% of the variance in anxiety, \( R^2 = .13, F(4,116) = 4.07, p < .01 \). The regression analysis revealed no significant main effects of Deprivation Time or Body Image. However, there was a main effect of Contamination Fears on happiness (\( \beta = -.29, t (116) = -3.18, p < .01 \)), such that as Contamination Fears increased, ratings of happiness during the second block of threat pictures decreased. There was also a significant interaction of Body Image and Contamination fears (\( \beta = -.18, t (116) = 2.00, p < .05 \)) which significantly predicted anxiety during the threat pictures. To follow up this interaction, post-hoc analyses of simple slopes indicated that for participants with lower body image concerns, contamination fears were not significantly associated with happiness during the second block of threat pictures, \( \beta = -.07, t (116) = -.82, ns \). However, for participants with higher body image concerns, higher
contamination fears were associated with decreased happiness during the second block of threat pictures, $\beta = -.45$, $t (116) = -3.87$, $p < .01$.

3. **Anxiety before picture.**

   a. **Anxiety ratings in anticipation of food pictures.**

   The overall model did not reach significance, $R^2 = .02$, $F(4,116) = .62$, *ns*. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on anxiety in anticipation food pictures.

   b. **Anxiety ratings in anticipation of contamination pictures.**

   The overall model explained 11% of the variance in anxiety, $R^2 = .11$, $F(4,116) = 3.38$, $p < .05$. The regression analysis revealed no significant main effects of Deprivation Time, Body Image or Contamination Fears. However, there was a significant interaction of Body Image and Contamination Fears ($\beta = -.25$, $t (116) = -2.69$, $p < .01$), which significantly predicted anxiety in anticipation of the contamination pictures during the second block. To follow up this interaction, post-hoc analyses of simple slopes indicated that for participants with higher body image concerns, contamination fears were not significantly associated with anxiety in anticipation of the second block of contamination pictures, $\beta = -.05$, $t (116) = -0.45$, *ns*. However, for participants with lower body image concerns, higher contamination fears were associated with higher anxiety in anticipation of contamination pictures, $\beta = .39$, $t (116) = 3.07$, $p < .01$.

   c. **Anxiety ratings in anticipation of threat pictures.**

   The overall model did not reach significance, $R^2 = .05$, $F(4,116) = 1.40$, *ns*. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on anxiety in anticipation of threat pictures.
4. **Happiness before picture.**

   a. **Happiness ratings in anticipation of food pictures.**

   The overall model approached significance, $R^2 = .07$, $F(4,116) = 2.22$, $p = .07$. The regression analysis revealed no significant predictors or interactions of Deprivation Time and Contamination Fears on happiness in anticipation of food pictures. However, there was a main effect of Body Image on happiness ($\beta = -.25$, $t (116) = -2.68$, $p < .01$), such that as Body Image concerns increased, happiness in anticipation of food pictures during the second block decreased.

   b. **Happiness ratings in anticipation of contamination pictures.**

   The overall model did not reach significance, $R^2 = .04$, $F(4,116) = 1.04$, ns. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on happiness in anticipation of contamination pictures.

   c. **Happiness ratings in anticipation of threat pictures.**

   The overall model did not reach significance, $R^2 = .03$, $F(4,116) = .96$, ns. The regression analysis revealed no significant main effects of Deprivation Time, Contamination Fears or Body Image or interactions.

5. **Anxiety after picture.**

   a. **Anxiety ratings after food pictures.**

   The overall model did not reach significance, $R^2 = .05$, $F(4,116) = 1.40$, ns. The regression analysis revealed no significant predictors or interactions of Deprivation Time, Body Image and Contamination Fears on anxiety after presentation of food pictures.
b. Anxiety ratings after contamination pictures.

The overall model did not reach significance, $R^2 = .08$, $F(4,116) = 2.00$, $ns$. The regression analysis revealed no significant main effects or interactions of Deprivation Time, Body Image or Contamination Fears.

c. Anxiety ratings after threat pictures.

The overall model explained 8% of the variance in anxiety, $R^2 = .08$, $F(4,116) = 2.52$, $p < .05$. The regression analysis revealed no significant main effects of Deprivation Time, Body Image or Contamination Fears. However, there was a significant interaction of Body Image and Contamination Fears ($\beta = -.24$, $t (116) = -2.55$, $p < .05$) which significantly predicted anxiety after the threat pictures during the second block. To follow up this interaction, post-hoc analyses of simple indicated that for participants with lower body image concerns, contamination fears were not significantly associated with anxiety after presentation of threat pictures, $\beta = .19$, $t (116) = 1.44$, $ns$. However, for participants with higher body image concerns, higher contamination fears were associated with lower anxiety after presentation of the second block of threat pictures, $\beta = -.24$, $t (116) = -2.03$, $p < .05$.

6. Happiness after picture.

None of the overall models reached significance for the recovery period after Food, Contamination or Threat pictures, nor were there any significant main effects or interactions of anxiety during the period after the picture was presented.

D. IAPS Picture Ratings Reported After Experimental Session

For all analyses with picture ratings (arousal, valence, control) as the dependent variable, hierarchical regression was employed. As in the case for the startle response analyses, in Step 1,
the covariate variable Deprivation Time was entered. Step 2 included main effects of Body Image and Contamination Fears (both centered) and the interaction of the two variables.

i. Food picture ratings.

a. Valence ratings of food pictures.

The overall model approached significance, $R^2 = .07$, $F(4,115) = 2.05$, $p = .09$. Deprivation Time and Contamination fears did not produce significant main effects on valence ratings for food pictures. However, there was a trend for Body Image on valence ratings, ($\beta = .15, t(115) = 1.79, p < .10$), such that as body image concerns increased, participants rated food pictures as less positive (more unhappy). There was also a significant interaction of Body Image and Contamination Fears on valence ratings of food ($\beta = .20, t(115) = 2.09, p < .05$). To follow up this interaction, similar to the startle analyses, post-hoc analyses of simple slopes were conducted to enhance interpretation of the significant interaction. For this analysis, Contamination fears was entered as the moderator, therefore, new moderator variables were created, using values 1 SD below and above the mean to create ‘high contamination fears” and ‘low contamination fears’ variables. Then, new interaction terms were created by multiplying the new high and low contamination fears variables with Body Image. Results indicated that for participants with lower contamination fears, body image concerns were not significantly associated with valence ratings of food pictures, $\beta = -0.02, t (116) = -0.20, ns$. However, for participants with higher contamination fears, higher body image concerns were associated with rating food pictures less positive (more unhappy), $\beta = .33, t (116) = 2.51, p < .01$. 


b. Arousal ratings of food pictures.

The overall model did not reach significance, $R^2 = .02, F(4,115) = 0.49, \text{ns.}$ Regression revealed no significant predictors or interactions of Body Image and Contamination Fears on arousal ratings for food pictures.

c. Control ratings of food pictures.

The overall model did not reach significance, $R^2 = .06, F(4,115) = 1.86, \text{ns.}$ Deprivation Time and Contamination fears did not produce significant main effects on valence ratings for food pictures. However, there was a main effect for Body Image on control ratings, ($\beta = -0.19, t (115) = -2.01, p < .05$), such that as body image concerns increased, participants rated food pictures as more controlling (feeling less in control).

ii. Contamination picture ratings.

1. Valence ratings of contamination pictures.

The overall model explained 10% of the variance in arousal ratings of contamination pictures, $R^2 = .10, F(4,115) = 2.91, p < .05$. Results of Step 1 indicated Deprivation Time did not significantly predict ratings. In Step 2, there was a main effect for Contamination Fears ($\beta = 0.31, t (115) = 3.33, p < .01$) predicting valence ratings of contamination pictures, such that as contamination concerns increased, participants rated contamination pictures as more unhappy/negative.

2. Arousal ratings of contamination pictures.

The overall model explained 11% of the variance in arousal ratings of contamination pictures, $R^2 = .11, F(4,116) = 3.51, p < .05$. Results of Step 1 indicated Deprivation Time did not significantly predict ratings. In Step 2, there was a main effect for Contamination Fears ($\beta = -0.29, t (116) = -3.17, p < .01$) predicting arousal ratings of contamination pictures, such that
as contamination concerns increased, participants rated contamination pictures as more arousing. However, this main effect was qualified by an interaction of Contamination Fears and Body Image ($\beta = .18$, $t (116) = 1.99$, $p = .05$). To follow up this interaction, post-hoc analyses of simple slopes were conducted to enhance interpretation of the significant interaction. Body Image was entered as the moderator in this analysis. Results indicated that for participants with higher body image concerns, contamination fears were not significantly associated with arousal ratings of contamination pictures, $\beta = -0.12$, $t (116) = -1.05$, $ns$. However, for participants with lower body image concerns, higher contamination fears were associated with contamination pictures rated more arousing, $\beta = -0.45$, $t (116) = -3.54$, $p < .01$.

3. Control ratings of contamination pictures.

The overall model explained 9% of the variance in arousal ratings of contamination pictures, $R^2 = .09$, $F(4,115) = 2.61$, $p < .05$. Results of Step 1 indicated Deprivation Time did not significantly predict ratings. In Step 2, there was a main effect for Contamination Fears ($\beta = -0.23$, $t (115) = 2.51$, $p < .05$) on control ratings of contamination pictures, such that as contamination concerns increased, participants rated contamination pictures as more controlling (feeling less in control). However, this main effect was qualified by an interaction of contamination fears and Body Image ($\beta = .20$, $t (115) = 2.13$, $p < .05$). To follow up this interaction, post-hoc analyses of simple slopes were conducted to enhance interpretation of the significant interaction. Body Image was entered as the moderator in this analysis. Results indicated that for participants with higher body image concerns, contamination fears were not significantly associated with control ratings of contamination pictures, $\beta = -0.05$, $t (116) = -0.44$, $ns$. However, for participants with lower body image concerns, higher contamination fears were
associated with rating contamination pictures as more controlling (feeling less in control), $\beta = -0.41$, $t (116) = -3.15, p < .01$.

iii. Threat picture ratings.

1. Valence ratings of threat pictures.

The overall model explained 10% of the variance in arousal ratings of threat pictures, $R^2 = .10$, $F(4,115) = 2.95, p < .05$. Results of Step 1 indicated Deprivation Time did not significantly predict ratings. In Step 2, there was a main effect for Contamination Fears ($\beta = 0.30$, $t (115) = 3.31, p < .01$) predicting valence ratings of threat pictures, such that as contamination concerns increased, participants rated threat pictures as more unhappy/negative.

2. Arousal ratings of threat pictures.

The overall model did not reach significance, $R^2 = .06$, $F(4,115) = 1.66, ns$. Results of Step 1 indicated Deprivation Time did not significantly predict ratings. In Step 2, there was a main effect for Contamination Fears ($\beta = -0.22$, $t (115) = -2.38, p < .05$) on arousal ratings of threat pictures, such that as contamination concerns increased, participants rated threat pictures as more arousing.

3. Control ratings of threat pictures.

The overall model did not reach significance, $R^2 = .06$, $F(4,115) = 1.66, ns$. In Step 2, there was a main effect for Contamination Fears ($\beta = -0.20$, $t (115) = -2.12, p < .05$) on control ratings of threat pictures, such that as contamination concerns increased, participants rated threat pictures as more controlling (feeling less in control).
IV. DISCUSSION

Epidemiological evidence supports that bulimia nervosa and obsessive compulsive disorder co-occur at higher levels than chance, and results from longitudinal and family studies suggest that a shared underlying liability may account for their comorbidity (Altman & Shankman, 2009). The present study sought to elucidate a potential specific underlying liability that may account for this relation; therefore, we examined whether aversiveness sensitivity, both general and disorder-specific processes, revealed similar underlying emotional processes in these disorders. Specifically, we examined whether startle response potentiated during disorder-specific cues and general threat cues in those who had increased BN symptoms and increased OCD symptoms. In addition, we examined the interactive effect of high levels of BN symptoms and OCD symptoms on startle response. To our knowledge, this is the first investigation of startle response examining the independent and interactive effects of these two psychopathologies.

A. Disorder-specific aversiveness sensitivity

i. Disorder-specific effects for food cues.

Individuals with increased BN symptoms (e.g. weight and shape concerns) showed potentiated startle during presentation of food pictures. This replicates previous studies that showed greater potentiated startle during presentation of food pictures in individuals with binge-purge behaviors and in clinical sample of BN patients (Drobes et al., 2001; Mauler et al., 2006). However, Friederich et al. (2006) found that BN patients had attenuated startle in the presence of food cues. This conflicting result may be due to the lower level of hunger of the BN participants in the Frederich et al. study, as increased hunger has been shown to potentiate startle during food
cues and decreased hunger has been shown to attenuate startle to food cues in BN patients (Mauler et al., 2006).

Consistent with the startle results, we found that increased BN symptoms were associated with decreased happiness in anticipation and during food picture presentations, as well as overall less positive ratings of food pictures and feeling less in control in the presence of food pictures.

In our sample, increased weight and shape concern was related to episodes of binge eating, loss of control, eating in secret and compensatory behaviors, such as laxative and diuretic use and excessive exercise, suggesting good construct validity. Weight concern is the most consistently found risk factor for the development of BN (Jacobi et al., 2004; Jacobi et al., 2010). For example, a longitudinal study examining risk factors for eating disorders followed 1103 girls initially assessed between sixth and ninth grade over 3 years (Taylor et al., 2003). High scores on the weight concerns factor predicted eating disorder development; specifically, results showed that 8% of girls originally scoring in the top quartile on the weight concerns factor developed binge-purge behaviors compared to 1.2% who originally scored in the bottom three quartiles. Results from the current study may elucidate the underlying emotional process in the development and maintenance of BN.

1. **Aversive or reward system dysfunction, or both?**

Our results suggest that high-caloric food may be aversive stimuli to those who have increased concerns about weight and shape. Previous studies found an attenuated response to food cues in controls (e.g. Drobes et al, 2004; Mauler et al., 2006). Collectively, data from our study and previous studies support food being an appetitive stimulus in the general population, but aversive in those with body image concerns. Although results from this study suggest that the aversive system is activated during food presentation, one might wonder why such stimuli
would trigger an appetitive motivation response to consume large quantities (i.e., binge). That is, as food is often considered a natural reward that activates the appetitive system, one might hypothesize that binge eating is due to a dysfunction (overactivity) in the appetitive system. However, studies from the substance use disorder literature have proposed a more nuanced discussion of the appetitive system. Researchers in the alcohol/substance addiction literature have hypothesized three plausible ways in which dopamine mediates reward: 1) by influencing the hedonic value of a reward (‘liking’) 2) by influencing the Pavlovian conditioning of a reward (‘wanting’) or 3) by influencing reward learning (Berridge, 2009). Furthermore, recent interest in the role of the appetitive system in binge eating and eating disorders has led to studies investigating the role of dopamine in natural rewards such as eating. Earlier theories of the role of dopamine in eating suggest that a dysfunction in the hedonic ‘liking’ pathways leads an individual to overeat due to an increased reward pleasure state. However, more recent theories and animal studies suggest separate ‘wanting’ dopaminergic pathways that are distinct from the ‘liking’ hedonic pathways, and may be activated even if the individual would not find the experience pleasurable, a process which has been termed “incentive salience” (Robinson & Berridge, 2000). Incentive salience ‘wants’ are separate from cognitive wants or desires, and can lead to urges to engage in ‘rewards’ that are not cognitively liked (Berridge, 2009). That is, the role of the reward system in those who compulsively eat in the presence of a food cue may be understood as a dysfunction in dopamine pathways that increase the urge to overeat (‘wanting’) even though the individual may not find the experience pleasurable (‘liking’).

In a study utilizing ecological momentary assessment to understand the patterns of negative and positive affect preceding and following binge and purge episodes, Smyth et al. (2007) found that engaging in binge/purge behaviors resulted in self-reported decreased negative
affect and increased positive affect in an attempt to regulate emotion. Thus, their results support that it is quite possible that food has been conditioned in individuals who binge/purge as negative and positive reinforcers over time, leading to the ‘wanting’ of food to relieve them of negative emotions and increase their positive emotions. Although our sample found food aversive, decreased feelings of being in control were also associated with the food stimuli, which may suggest that those with higher weight concerns also have conflicting urges of wanting the same foods that invoke fear.

Several pre-clinical studies have shown that stress, restriction of food, and sporadic access to highly palatable foods led to binge eating in animal models (Avena, 2007; Avena, Rada, and Hoebel, 2008). Individuals with BN often have high restraint periods followed by binges. Additionally, the homeostatic hunger influences the motivating power of a food cue (Zhang et al, 2009). Therefore, hunger may also influence the degree to which food activates “wanting” in BN individuals. Gray (1994) suggested that emotions and their disorders can be reflected by: “over or underactivity in [either the reward or aversive systems]; dysfunction in one system; combinations of over or underactivity and/or dysfunction in more than one system; or dysfunctional interactions between more than one system” (p.43). Our study found that body image concern cognitions led to potentiation of startle in response to food cues, while controlling for any differences in hunger. Potentially, although the aversive system is overactivated in the presence of food when body image concerns are present (cognitive component), the reward system may also be activated due to conditioned dopaminergic pathways of food (behavioral component) from the undulating states of hunger and binging, perhaps reflecting either overactivity in both systems or dysfunctional interactions between the two systems. To elucidate this issue, future studies are needed which utilize physiological measures of both systems and
their interactions in the presence of food cues, and examine whether cognitions and behaviors reflect different motivational systems.

ii. Disorder-specific effects for contamination cues.

We also examined the effect of contamination fears on startle in response to disorder-specific pictures, and to our knowledge, this is the first experiment to examine startle in response to contamination cues. The results supported our primary hypotheses that those who have elevated contamination fears showed potentiated startle, as well as self-reported increased anxiety, during presentation of contamination pictures. In addition, participants with increased contamination fears also rated contamination pictures as more negative, more arousing, and feeling less in control. These findings provide strong evidence that in individuals with OCD symptoms, the aversive system becomes activated during the presentation of contamination pictures. These results also lend support to findings from neuroimaging studies which have shown increased activation in fear and disgust-related areas of the brain when those with OCD symptoms are presented with disorder-specific cues (see Cisler et al., 2009 for review). Future studies are needed to replicate these results and to examine these disorder-specific responses in OCD patients.

iii. Theoretical implications of disorder-specific results.

Recently there has been an interest in the triple-vulnerability theory as an etiological model of various emotional disorders (Barlow, 2002; Suarez, Bennet, Goldstein, and Barlow, 2009.) The model suggests that similar biological or psychological factors and their interaction may generate anxiety and mood disorders, and this model may also apply to BN and OCD. This model suggests three “diatheses” of emotional disorders: the first being one of a generalized biological propensity to experience clinically significant negative mood; second that a
psychological vulnerability emerges from childhood through dysfunctional parenting styles or ineffective coping from an unexpected stressful event; and third, a specific psychological vulnerability which develops out of a learning focus for anxiety where certain situations, objects or internal somatic states are perceived as threats, even though objectively they are not dangerous. These early learning experiences can be as obvious as watching a parent’s fearful response of certain situation, or a more subtle cue, such as heightened attention from the caregivers to a potential danger.

In relation to the present study, it may be that individuals with increased BN symptoms and OCD symptoms have learned through early experiences that these objects are perceived as threatening, and that together they commonly share an increased physiological aversiveness to threatening situations/objects. Jacobi et al. (2011) found that the combination of high weight concerns and exposure to critical comments about shape/weight indicated very high risk of development of an ED in women. Thus, it may be that exposure to weight and shape concerns during childhood in individuals who have the propensity for increased aversion during threatening situations may be at higher risk for development of an eating disorder.

B. General aversiveness sensitivity

i. Results of increased body image and contamination fears.

Contrary to our hypotheses, those with only increased body image concerns or contamination fears did not show potentiation during general threat pictures. Although increased contamination fears were significantly correlated with self-reported ratings of threat pictures as more arousing, less positive, and a trend for feeling less in control, we did not find that contamination fears led to increased potentiation during threat pictures, nor were they correlated with increased neuroticism. Conversely, increased body image fears were associated with
increased neuroticism; however, increased body image concerns were not associated with valence, arousal or control ratings of threatening pictures. Although previous studies have shown potentiation during threatening stimuli in those with increased harm avoidance, it is unclear why our sample did not show the same pattern with increased neuroticism, nor why our sample did not show increased neuroticism with increased contamination fears.

ii. Results of comorbid body image and contamination fears.

Contamination fears and body image concerns did not independently predict startle potentiation during general threat cues; however, when contamination fears and body image concerns co-occurred, we found an interaction of body image concerns and contamination fears on startle potentiation during contamination pictures and general threat cues, suggesting a disorder-specific and heightened general aversiveness sensitivity for those with symptoms of both BN and OCD. Increased potentiation during threat pictures reflects an abnormality in the aversive system during threatening situations for these individuals. Individuals high in harm avoidance and fearfulness have also shown potentiated startle response during presentation of threat cues (Corr 1995, 1997; Vaidyanthan et al., 2009). Our results suggest that there may be an increased general fear process occurring in individuals with comorbid conditions, compared to those who only experience the symptoms individually.

C. Comorbidity of BN/OCD characteristics

i. Models of comorbidity.

Models attempting to explain the causes of comorbidity have been posited by many researchers. Klein and Riso (1993) provided one of the most comprehensive examinations of models of comorbidity and outlined patterns of results for epidemiological, longitudinal, and family studies that would denote one particular model as providing a better fit of the data than
another. In our systematic review (i.e. Altman & Shankman, 2009) wherein we used Klein and Riso’s models to interpret patterns of data from epidemiological, longitudinal, and family studies, results indicated that ED/OCD comorbidity does not occur by chance or sampling bias issues and suggested that several models were supported including multiformity, alternate expression, and that OCD is a risk factor for the development of eating disorders. Although there are some methodological limitations to the types of studies that were available for review, the varying models which were supported all encompass a common factor in that comorbidity arises in some process due to a common underlying liability.

Neale and Kendler (1995) further refined the Klein and Riso models into versions of the continuous liability threshold model, which suggests that disorders arise if an individual crosses a particular threshold of a genetic and/or environmental liability for a disorder. For example, if an individual is above the threshold for a liability to BN, then they would phenotypically have manifest characteristics of BN, and if they are below the threshold or asymptomatic, they would not show manifest characteristics of BN. Additionally, Rhee et al. (2005) suggest that researchers have tested models of comorbidity by attempting to answer two questions regarding underlying deficits of disorders: 1) Does a significant double dissociation exist between Disorder A and Disorder B (i.e. does Disorder A show unique deficits not manifest in Disorder B and does Disorder B show unique deficits not manifest in Disorder A?; and 2) What does the pattern of deficits look like in the comorbid condition, (i.e. Disorder AB)? Although Neale and Kendler recommend that their models are examined in relatives (e.g. family and twin studies), we can tentatively use these patterns to address the results of the present study if it is assumed that the response to food and contamination cues (i.e. disorder-specific aversiveness sensitivity) are liabilities specific to BN and OCD, respectively.
The pattern of results from the current study suggests that those with “pure” BN characteristics (e.g. ONLY body image concerns) show a liability to food cues only, those with “pure” OCD characteristics (e.g. ONLY contamination fears) only show a liability to contamination cues, and those with comorbid BN/OCD characteristics show a liability to contamination cues and threat cues. Thus, Disorder A (“pure” BN) shows a unique liability (or crosses the threshold of food aversiveness sensitivity) that is not shared with Disorder B (“pure” OCD) or Disorder AB (Comorbid BN/OCD); Disorder B shows a unique liability (or crosses the threshold of contamination aversiveness sensitivity) that is not shared with Disorder A but is shared with Disorder AB. Accordingly, this would potentially support Klein and Riso’s (1993) and Neale and Kendler’s (1995) multiformity models, which assume that the comorbid condition is actually an atypical form of OCD, despite having phenomenological features of BN.

Although this may tentatively explain the pattern of results with the disorder-specific liabilities, it does not explain why those with comorbid BN and OCD concerns were the only individuals to show potentiation during general threat pictures. Neale and Kendler (1995) and Klein and Riso (1993) also present a variant model of multiformity in which there is an “extreme” case of multiformity where the comorbid disorder manifests when it crosses both the threshold of one of the pure disorders but then additionally crosses a second threshold. Those with the pure disorder do not cross the second threshold. In regards to the current study’s data, potentially, the response to the general threat pictures could represent this second threshold. Therefore, the comorbid condition could be a more extreme/atypical form of OCD, in that startle potentiation during the contamination pictures is the first threshold crossed, and then the second threshold crossed is the potentiation during the general threat pictures leading to the manifestation of the comorbid condition.
Although these are potential tentative explanations to the pattern of results in the current study, it is important that these liability models are tested in familial or twin studies of BN and OCD patients. Rhee et al. (2005) used simulated data to validate whether Neale and Kendler’s patterns of liability deficits were able to distinguish, in general, which model(s) of comorbidity were supported. Though some models are distinguishable from others using very high numbered samples (e.g. N = 10,000), it was much more difficult to differentiate the models when examining smaller numbered samples. They concluded that in particular, it is very difficult, if not impossible, to distinguish multiformity, extreme multiformity, and the three independent disorders models (Rhee et al., 2005).

Results from this study tentatively lend support to our results from our systematic review that OCD/BN comorbidity can be understood as a multiformity of OCD, but we are careful not to suggest that our data definitively refute any of the models. However, there has been controversy over the categorization of obsessive-compulsive disorder and eating disorders in the current diagnostic system. Our data would suggest that BN has unique underlying deficits that are not shared with OCD and that OCD/BN may be a multiform of OCD, and therefore would support that BN should remain in a separate category and not included in the obsessive-compulsive spectrum disorders category.

D. Anticipation of stimuli

Interestingly, contamination fears predicted increased startle in the anticipation of general threat cues, in addition to the contamination cues. This may indicate that those with OCD symptoms have differences in aversive system activation during the anticipation of disorder specific and general threat aversive situations. This activation of the aversive system during anticipation may cause increased attention to upcoming threatening stimuli for these individuals.
Individuals with OCD symptoms also rated general threat cues as more arousing, less positive and feeling less in control, which would suggest that they perceive the general threat cues as aversive, even though they did not show potentiated startle during the general threat pictures. This could suggest that, in individuals with OCD symptoms, the aversive system is overactivated while anticipating future threat regardless of its content (disorder specific or general); however, when directly faced with the threatening stimuli, the overactivation is sustained only when the content is disorder-specific. Many previous studies have examined the startle response in anticipation of threatening stimuli and have found potentiated startle during anticipation periods, suggesting that startle during anticipation is modulated by emotional arousal (Sabatinelli, Bradley, & Lang, 2001). One might posit that this is why these individuals engage in compensatory behaviors to reduce their sustained arousal from anticipation of the contamination to presentation of contaminating objects.

The results, however, did not support our secondary hypotheses that those with heightened OCD symptoms would show potentiation during the period following presentation of contaminated pictures, suggesting that an inability or dysfunction in recovery does not occur. Rather, we found that individuals with OCD symptoms showed potentiation during the anticipatory period before the contamination pictures, as well as during the anticipatory period before the general threat pictures. This suggests that the aversive system is activated in those with heightened contamination fears when presented with a contaminated object, but also in anticipation of situations in which contamination may be present. Although it appears the aversive system does not remain activated during the recovery period, there is a sustained activation during the anticipation and presentation periods, and this may lead to an inability of the aversive system to continue to be activated into the recovery period. Alternatively, it may be
that the average latency that the startle probes occurred following picture offset (4.5 s) was too lengthy to record any lingering effects of the stimuli on the aversive system. Future studies should examine the post-stimuli period in a more fine-grained method to determine when activation dissipates.

Also, the results did not support our secondary hypotheses that individuals with body image concerns would show potentiation following presentation of food pictures; however, they did show potentiation after the presentation of general threat pictures. This may potentially suggest that individuals with body concerns have difficulty regulating negative affect or have an extended recovery from negative affect. The dual pathway model of bulimia suggests that binging and purging are done in an effort to regulate negative affect (Stice, 1994). If those with body image concerns have difficulty with recovering from negative affect, it is possible that these individuals experience negative affect longer because of an inability of the aversive system to recover as quickly as those without body image concerns, leading them to engage in binge/purge behaviors in an effort to reduce negative affect.

In sum, the data suggest that those with BN symptoms find being presented with food aversive. It also suggests that they tend to continue to experience effects from general threat situations longer than during the other potential threats. Thus, they show disorder-specific aversiveness sensitivity when presented with disorder-specific cues, and they may tend to have more difficulty with regulation of (or recovery from) negative affect after being presented with general threat cues. It is peculiar that this pattern does not occur after disorder-specific cues. It could possibly be explained in that these individuals’ aversive systems are activated immediately in the presence of food cues because of conditioned responses to food; however, when faced with general threat, their activation systems show delayed activation. Thus, they may have difficulty
identifying why they are experiencing arousal after the threatening stimuli is no longer present, and thus have difficulty managing their emotion dysregulation.

Individuals with OCD symptoms find anticipation of contamination and general threat and presentation of contaminated objects aversive. However, during the presentation of contamination and general threat objects, this is qualified by an interaction of contamination and weight/shape concern, such that those with co-occurring OCD symptoms and high BN symptoms find contamination pictures and threatening pictures aversive. Thus those with increased OCD symptoms show both disorder-specific and general aversiveness sensitivity during periods of anticipation of contamination and general threat. Those with comorbid OCD and BN symptoms fears show disorder specific and general aversiveness sensitivity during presentation of contamination and general threat.

E. Applications to treatment

Treatment studies have often relied on self report for outcome measures for success of treatment. For example, treatment studies for OCD have generally used the Y-BOCS, OCI-R, SCOPI and other OCD self report measures to determine treatment gains and the EDE-Q, EDI, and other self-reports have been used for BN studies. However, there is increasing interest in identifying more objective indicators of change and therapy processes. Previous studies of those with specific phobias have utilized the startle response as an indicator of treatment success by assessing startle prior to treatment and post-treatment, and results indicated that startle potentiation reduced after completion of treatment (de Jong et al., 1991; 1993; Vrana et al., 1992). Indeed, it would be a natural progression to use startle response to measure success of treatments for eating disorders and OCD.
Consistent with our results, it would behoove researchers to personalize the stimuli for each participant. For example, because OCD subtypes are disparate, studies would need to use stimuli corresponding to the person-specific subtypes and fears. Also, for eating disorders, foods that are typically binge foods for that particular person could be used as the stimuli. Furthermore, if weight/shape concerns and contamination fears are risk factors for the development of clinically diagnostic disorders, one might use startle response as an indicator of those at-risk for the development of eating disorders, and as outcome for any preventative treatment programs as well.

Furthermore, our results suggest that those with high body image concerns view food as aversive. Current evidence-based treatments for bulimia nervosa include Cognitive Behavior Therapy (Fairburn, Marcus & Wilson, 1993), Interpersonal Therapy (Fairburn, 1997), and Dialectical Behavioral Therapy (Linehan, 1993). CBT for Eating Disorders has a component of therapy dedicated to addressing weight and shape related thoughts and attitudes. Given that our results suggest that food is aversive to those with body and shape concerns, it will be important to address this potential aversive relationship to food during therapy.

F. Limitations

Though our sample included individuals with a wide spectrum of body image concerns and contamination fears, results may not be able to be generalized to those with clinical diagnostic eating disorders and OCD as participants were not formally diagnosed with DSM psychopathologies. However, the SCOPI and EDE-Q both have shown good discriminant validity in differentiating patients from controls (Mond et al., 2003; Watson & Wu, 2005). Future studies should address the current study’s objectives in a clinical sample. Furthermore, the sample was exclusively comprised of college-aged females, thus results cannot be
generalized to men and younger samples. Although men with eating disorders are more concerned with muscularity than thinness, studies have shown that men are just as concerned with body image as women are (Edwards & Launder, 2000), and negative affect also precedes binges in men (Womble et al., 2001). Future studies should therefore examine startle response in the presence of food cues in men.

We did not assess disgust in our participants during the experimental condition or in response to the pictures after the session was over. There is a growing interest in the anxiety literature about the specificity of fear versus disgust in relation to contamination-related OCD (see Cisler, Olatunji, & Lohr, 2009 for review). We did not specifically ask participants to rate pictures or their experiences in terms of disgust (we only asked them to rate arousal/anxiety, valence/happiness and control), and therefore are unable to elucidate any differences in disgust versus fear in terms of their physiological or self-reported experiences. Women have been found to have larger startle in response to disgust versus fear, and the levator labii superioris muscle (i.e., muscle that elevates the upper lip) appears to have better specificity in measuring disgust via EMG (Yartz and Hawk, 2002). Future studies should specifically include measures of fear and disgust in order to understand the specific contributions of these two emotions in disorder-specific aversiveness sensitivity.

Although 27.4% of our sample admitted to binge eating in the past 28 days, only 8% had engaged in binge eating more than 5 days. Purging behaviors were even less common; only 3.4% of our sample engaged in vomiting, 6.0% used laxatives and 1.7% used diuretics in the last 28 days to control weight or compensate for calorie intake. Therefore, we were unable to determine the relation between bulimic behaviors and startle response. Future studies should
enroll participants with these behaviors to determine the relationship between the behaviors and startle response during presentation of eating disorder cues.

Another limitation of the study is that initially we had planned to identify specific groups, e.g. high body image/low contamination fears, high contamination fears/low body image fears, high body image/high contamination fears, and low body image/low contamination fears. Due to the instability of the responses from participants at mass testing and experimental session, we decided to analyze the data on dimensional indices. While we cannot predict responses of categorical groups of behaviors/cognitions, we were still able to determine dimensional predictors of startle response. A taxometric study of nonbehavioral eating disorder indicators (body image, personality factors, EDI subscales) revealed no latent taxons, supporting a dimensional conceptualization of eating disorders (Tylka & Subich, 2003). Although taxometric statistical procedures have not yet been applied to OCD, conceptualizations of OCD have included dimensional models (Taylor, 2007).

G. Conclusions

In summary, the results of the current study provide support for disorder-specific and general aversiveness sensitivity in individuals experiencing body image concerns and contamination fears. Body image concerns predicted increased disorder-specific aversiveness sensitivity during presentation of food cues, contamination concerns predicted increased disorder-specific aversiveness sensitivity in anticipation of and during presentation of contamination cues, and the co-occurrence of body image and contamination concerns predicted increased general aversiveness sensitivity. Results suggest that those with elevated BN symptoms and elevated OCD symptoms find disorder-specific stimuli aversive, and that comorbid conditions may reflect a vulnerability to higher aversiveness sensitivity.
REFERENCES


APPENDICES

Appendix 1. The Eating Disorders Examination-Questionnaire.

EATING DISORDERS EXAMINATION QUESTIONNAIRE

Instructions

The following questions are concerned with the PAST FOUR WEEKS ONLY (28 days). Please read each question carefully and circle the appropriate number on the right. Please answer all the questions.

<table>
<thead>
<tr>
<th>ON HOW MANY DAYS OUT</th>
<th>No days</th>
<th>1-5 days</th>
<th>6-12 days</th>
<th>13-15 days</th>
<th>16-22 days</th>
<th>23-27 days</th>
<th>every day</th>
</tr>
</thead>
</table>

1…Have you been consciously trying to restrict the amount of food you eat to influence shape or weight? 0 1 2 3 4 5 6

2…Have you gone for long periods of time (8 hours or more) without eating anything in order to influence your shape or weight? 0 1 2 3 4 5 6

3…Have you attempted to avoid eating any foods which you like in order to influence your shape or weight? 0 1 2 3 4 5 6

4…Have you attempted to follow definite rules regarding your eating in order to influence your shape or weight: for example, a calorie limit, a set amount of food, or rules about what or when you should eat? 0 1 2 3 4 5 6

5…Has thinking about food or its calorie content interfered significantly with your ability to concentrate on things you are interested in: for
example, read, watch TV, or follow a conversation?  

<table>
<thead>
<tr>
<th>ON HOW MANY DAYS OUT OF THE PAST 28 DAYS….</th>
<th>No days</th>
<th>1-5 days</th>
<th>6-12 days</th>
<th>13-15 days</th>
<th>16-22 days</th>
<th>23-27 days</th>
<th>every day</th>
</tr>
</thead>
<tbody>
<tr>
<td>6…Have you had a definite fear that you might not be able to either resist eating or stop eating?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7…Have you experienced a sense of loss of control over eating?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>8…Have you had any episodes of binge eating?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>9…Have you eaten in secret? (Do not count binges.)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>10…Have you had a definite desire for your stomach to be flat?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>11…Have you had a definite desire for your stomach to feel empty?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>12…Has thinking about shape or weight interfered with your ability to concentrate on things you are interested in: for example, read, watch TV, or follow a conversation?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>13…Have you had a definite fear that you might gain weight or become fat?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>14…Have you felt fat?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
15... Have you had a strong desire to lose weight?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>OVER THE PAST FOUR WEEKS (28 DAYS).....</td>
<td></td>
<td></td>
<td></td>
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</table>

16... On what proportion of the times that you have eaten have you felt guilty because of your shape or weight? (Do not count binges)

- 0 – None of the times
- 1 – A few of the times
- 2 – Less than half of the times
- 3 – Half of the times
- 4 – More than half of the times
- 5 – Most of the times
- 6 – Every time

17... Have there been times when you have eaten what other people would regard as an unusually large amount of food? (Please circle)

- 0 – No
- 1 – Yes

18... How many such episodes have you had over the past four weeks?

....................

19... During how many of these episodes of overeating did you have a sense of having lost control?

....................

20... Have you had other episodes of eating in which you have had a sense of having lost control but have not eaten an unusually large amount of food? (Please circle)

- 0 – No
- 1 – Yes

21... How many such episodes have you had over that past four weeks?

....................

22... Over that past four weeks have you made yourself sick (vomit) as a means of controlling your shape or weight or to counteract the effects of eating? (Please circle)

- 0 – No
- 1 – Yes

23... How many such episodes have you had over that past four weeks?

[ ] [ ]

24... Have you taken laxatives as a means of controlling your shape or weight or to
counteract the effects of eating? (Please circle)  
0 – No  
1 – Yes

25… How many such episodes have you had over that past four weeks?  
[ ] [ ]

OVER THE PAST FOUR WEEKS (28 DAYS)…..

26… Have you taken diuretics (water tablets) as a means of controlling your shape or weight or to counteract the effects of eating? (Please circle)  
0 – No  
1 – Yes

27… How many such episodes have you had over that past four weeks?  
[ ] [ ]

28… Have you vigorously exercised as a means of controlling your weight, altering your shape or amount of fat, or burning off calories? (Please circle)  
0 – No  
1 – Yes

29… How many such episodes have you had over that past four weeks?  
[ ] [ ]

<table>
<thead>
<tr>
<th>OVER THE PAST FOUR WEEKS (28 DAYS)…..</th>
<th>NOT AT ALL</th>
<th>SLIGHTLY</th>
<th>MODERATELY</th>
<th>MARKEDLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>30…Has your weight influenced how you think about (judge) yourself as a person?</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31…Has your shape influenced how you think about (judge) yourself as a person?</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32…How much would it distress you if you had to weigh yourself once a week for the next four weeks?</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33…How dissatisfied have you felt about your weight?</td>
<td>0 1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>34…How dissatisfied have you felt about your shape?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35…How thin have you wanted to be?</td>
<td></td>
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**OVER THE PAST FOUR WEEKS (28 DAYS)…..**

<table>
<thead>
<tr>
<th></th>
<th>NOT AT ALL</th>
<th>SLIGHTLY</th>
<th>MODERATELY</th>
<th>MARKEDLY</th>
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<tr>
<td>36…How concerned have you been about other people seeing you eat? (Only circle 4, 5, or 6 if you have avoided some occasions.)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>37…How uncomfortable have you felt seeing your body: for example, in the mirror, in shop window reflections, while undressing or taking a bath or shower? (Only circle 4, 5, or 6 if you have avoided some occasions.)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>38…How uncomfortable have you felt about others seeing your body: for example, in communal changing rooms, when swimming or wearing tight clothes? (Only circle 4, 5, or 6 if you have avoided some occasions.)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
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Have the past four weeks been representative of the past year? (Please circle)  **Yes / No**

If no, how has the past year differed from the past four weeks?

..................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................
Appendix 2. The Schedule of Obsessions, Compulsions and Pathological Impulses.

**SCOPI**

Read each statement carefully, then mark the appropriate response in the space in front of that item. Use the following scale to record your responses:

1 = *strongly disagree*; the statement is definitely false  
2 = *disagree*; the statement is mostly false  
3 = *neutral* or *cannot decide*; the statement is about equally true and false  
4 = *agree*; the statement is mostly true  
5 = *strongly agree*; the statement is definitely true

___ 1. Even when I do something very carefully, I worry that it is not quite right.  
___ 2. I worry a lot about germs.  
___ 3. I like to follow a particular order as I dress myself each day.  
___ 4. I sometimes am troubled by unpleasant thoughts that occur over and over again.  
___ 5. I occasionally get a sudden impulse to do something violent or destructive.  
___ 6. I often worry that the food I am eating may be contaminated with germs.  
___ 7. I often follow the same, fixed order in performing everyday tasks.  
___ 8. I spend a lot of time checking things over and over again.  
___ 9. Cleanliness is very important to me.  
___ 10. I like to collect things.  
___ 11. Occasionally I will have a sudden urge to steal something.  
___ 12. I sometimes count things over and over again.  
___ 13. Whenever my clothes get dirty, I like to change them right away.
<p>| | | | | | |</p>
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<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>strongly disagree</td>
<td>disagree</td>
<td>neutral/</td>
<td>agree</td>
<td>strongly agree</td>
<td></td>
</tr>
<tr>
<td>cannot decide</td>
<td></td>
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1. I sometimes find myself rearranging things to make sure that everything is in the proper order.

2. I sometimes have to check things (e.g., whether the door is locked) several times because I'm just not sure whether I have already done it.

3. I sometimes avoid using public restrooms because I am worried about getting germs.

4. I have a number of different rituals (e.g., sorting or touching things in a particular way) that I follow in my everyday life.

5. I sometimes will check to see if I have done something (e.g., whether I have turned off my car lights) even though I'm pretty sure I already have done it.

6. I worry about getting germs through contact with animals.

7. I find it difficult to throw things away, even when I know I don’t need them.

8. After I have left my home, I often worry that I have failed to do something.

9. I sometimes avoid contact with people because I am worried about getting germs.

10. I find that I am fascinated by fire.

11. I like to do things in a particular order when I am getting ready for bed.

12. When I handle money, I count and recount it several times.

13. I find it difficult to touch something that I know has been touched by strangers.

14. I have trouble throwing things away because I worry that I might need them later.

15. I often am plagued by the nagging doubt that I’ve failed to do something important.

16. People should wash their hands frequently to eliminate contamination from germs.

17. I sometimes feel the need to break things for no reason.
SCOPI (cont.)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>strongly disagree</td>
<td>disagree</td>
<td>neutral/</td>
<td>agree</td>
<td>strongly agree</td>
</tr>
<tr>
<td></td>
<td>cannot decide</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

31. I sometimes find that I cannot get rid of unpleasant thoughts that have popped into my mind.

32. Cleanliness is important in maintaining good health.

33. I have little rituals that I follow even though I know they are silly.

34. While driving, I sometimes have the impulse to do something crazy.

35. I sometimes will return home to make sure that I've locked doors and turned off lights and appliances.

36. I don't like wearing clothes that are dirty.

37. I have wondered what it would be like to tear off my clothes in public.

38. I sometimes find that I have to go back to check whether or not I've done something.

39. I collect items that others would consider junk.

40. Before putting a letter in the mail, I sometimes will check the address several times to make sure it is right.

41. If I don't do certain tasks in a specific order, I feel uncomfortable.

42. As I watch a car or train approaching, I sometimes imagine throwing myself in front of it.

43. My hands feel dirty after touching money.

44. There are certain routine tasks that I always perform in exactly the same way.

45. No matter how many times I check something over, I can't help wondering whether I have done everything correctly.

46. I keep many items I do not need.

47. I sometimes feel a sudden urge to play with fire.
**SCOPI Scale Composition**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obsessive Checking (14 items)</td>
<td>1, 4, 8, 12, 15, 18, 21, 25, 28, 31, 35, 38, 40, 45</td>
</tr>
<tr>
<td>Obsessive Cleanliness (12 items)</td>
<td>2, 6, 9, 13, 16, 19, 22, 26, 29, 32, 36, 43</td>
</tr>
<tr>
<td>Compulsive Rituals (8 items)</td>
<td>3, 7, 14, 17, 24, 33, 41, 44</td>
</tr>
<tr>
<td>Hoarding (5 items)</td>
<td>10, 20, 27, 39, 46</td>
</tr>
<tr>
<td>Pathological Impulses (8 items)</td>
<td>5, 11, 23, 30, 34, 37, 42, 47</td>
</tr>
</tbody>
</table>

**NOTE:** One can compute a total OCD score by summing responses to the Obsessive Checking, Obsessive Cleanliness, and Compulsive Rituals scales.
Appendix 3. The Eysenck Personality Questionnaire.

EPQ R

Instructions: Please answer each question by putting a circle around the ‘YES’ or the ‘NO’ following the question. There are no right or wrong answers, and no trick questions. Work quickly and do not think too long about the exact meaning of the questions.

PLEASE REMEMBER TO ANSWER EACH QUESTION

1. Do you have many different hobbies? ........................................... YES NO
2. Do you stop to think things over before doing anything? ........... YES NO
3. Does your mood often go up and down? .................................... YES NO
4. Have you ever taken the praise for something you knew someone else had really done? ................................................................. YES NO
5. Do you take much notice of what people think? ......................... YES NO
6. Are you a talkative person? ........................................................... YES NO
7. Would being in debt worry you? .................................................... YES NO
8. Do you ever feel ‘just miserable’ for no reason? ......................... YES NO
9. Do you give money or charities? .................................................... YES NO
10. Were you ever greedy by helping yourself to more than your share of anything? ................................................................. YES NO
11. Are you rather ‘lucky’? ................................................................. YES NO
12. Would it upset you a lot to see a child or an animal suffer? ....... YES NO
13. Do you often worry about things you would not have done or said? ................................................................. YES NO
14. Do you dislike people who don’t know how to behave themselves? ................................................................. YES NO
15. If you say you will do something, do you always keep your promise no matter how inconvenient it might be? ......................... YES NO
16. Can you usually let yourself go and enjoy yourself at a lively party? ................................................................. YES NO
17. Are you an irritable person? ........................................................... YES NO
18. Should people always respect the law? .......................................... YES NO
19. Have you ever blamed someone else for doing something you knew was really your fault? ................................................................. YES NO
20. Do you enjoy meeting new people? .............................................. YES NO
21. Are good manners very important? .............................................. YES NO
22. Are your feelings easily hurt? ........................................................... YES NO
23. Are all your habits good and desirable ones? ......................... YES NO
24. Do you tend to keep in the background on social occasions? ....... YES NO
25. Would you take drugs which may have strange or dangerous effects? ................................................................. YES NO
26. Do you often feel ‘fed-up’? ............................................................. YES NO
27. Have you ever taken anything (even a pin or button) that belonged to someone else? ................................................................. YES NO
28. Do you like going out a lot? ............................................................. YES NO
29. Do you prefer to go your own way rather than act by the rules? ....... YES NO
Appendix 4. The Inventory of Depression and Anxiety Symptoms.

Below is a list of feelings, sensations, problems, and experiences that people sometimes have. Read each item to determine how well it describes your recent feelings and experiences. Then select the option that best describes how much you have felt or experienced things this way during the past two weeks, including today. Use this scale when answering:

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Not at all</td>
<td>A little bit</td>
<td>Moderately</td>
<td>Quite a bit</td>
<td>Extremely</td>
</tr>
</tbody>
</table>

**1.** I was proud of myself
**2.** I felt exhausted
**3.** I felt depressed
**4.** I felt inadequate
**5.** I slept less than usual
**6.** I felt fidgety, restless
**7.** I had thoughts of suicide
**8.** I slept more than usual
**9.** I hurt myself purposely
**10.** I slept very poorly
**11.** I blamed myself for things
**12.** I had trouble falling asleep
**13.** I felt discouraged about things
**14.** I thought about my own death
**15.** I thought about hurting myself
**16.** I did not have much of an appetite
**17.** I felt like eating less than usual
**18.** I thought a lot about food
**19.** I did not feel much like eating
**20.** I ate when I wasn’t hungry
**21.** I felt optimistic
**22.** I ate more than usual
**23.** I felt that I had accomplished a lot
**24.** I looked forward to things with enjoyment
**25.** I was furious
**26.** I felt hopeful about the future
**27.** I felt that I had a lot to look forward to
**28.** I felt like breaking things
**29.** I had disturbing thoughts of something bad that happened to me
**30.** Little things made me mad
**31.** I felt enraged
**32.** I had nightmares that reminded me of something bad that happened
**33.** I lost my temper and yelled at people
**34.** I felt like I had a lot of interesting things to do
**35.** I felt like I had a lot of energy
**36.** I had memories of something scary that happened
**37.** I felt self-conscious knowing that others were watching me
**38.** I felt a pain in my chest
**39.** I was worried about embarrassing myself socially
**40.** I felt dizzy or light headed
**41.** I cut or burned myself on purpose
42. I had little interest in my usual hobbies or activities
43. I thought that the world would be better off without me
44. I felt much worse in the morning than later in the day
45. I felt drowsy, sleepy
46. I woke up early and could not get back to sleep
47. I had trouble concentrating
48. I had trouble making up my mind
49. I talked more slowly than usual
50. I had trouble waking up in the morning
51. I found myself worrying all the time
52. I woke up frequently during the night
53. It took a lot of effort for me to get going
54. I woke up much earlier than usual
55. I was trembling or shaking
56. I became anxious in a crowded public setting
57. I felt faint
58. I found it difficult to make eye contact with people
59. My heart was racing or pounding
60. I got upset thinking about something bad that happened
61. I found it difficult to talk with people I did not know well
62. I had a very dry mouth
63. I was short of breath
64. I felt like I was choking

Composition of the IDAS Scales

General Depression
#2, #3, #4, #6, #7, #10, #11, #12, #13, #15, #16, #17, #24*, 35*, #42, #47, #48,
#49, #51, #53 *reverse-keyed item

Dysphoria
#3, #4, #6, #11, #13, #42, #47, #48, #49, #51

Lassitude
#2, #8, #44, #45, #50, #53

Insomnia
#5, #10, #12, #46, #52, #54

Suicidality
#7, #9, #14, #15, #41, #43

Appetite Loss
#16, #17, #19

Appetite Gain
#18, #20, #22

Ill Temper
#25, #28, #30, #31, #33

Well-Being
#1, #21, #23, #24, #26, #27, #34, #35

Social Anxiety
#37, #39, #56, #58, #61

Panic
#38, #40, #55, #57, #59, #62, #63, #64

Traumatic Intrusions
#29, #32, #36, #60
Appendix 5. The Frost Multidimensional Perfectionism Scale.

**FMPS**

Please select the option that best reflects your opinion, using the rating system below.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neither Agree or Disagree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

1 My parents set very high standards for me.  
2 Organization is very important to me.  
3 As a child, I was punished for doing things less than perfectly.  
4 If I do not set the highest standards for myself, I am likely to end up a second-rate person.  
5 My parents never try to understand my mistakes.  
6 It is important to me that I be thoroughly competent in what I do.  
7 I am a neat person.  
8 I try to be an organized person.  
9 If I fail at school, I am a failure as a person.  
10 I should be upset if I make a mistake.  
11 My parents want me to be the best at everything.  
12 I set higher goals than most people.  
13 If someone does a task at school better than I do, then I feel as if I failed the whole task.  
14 If I fail partly, it is as bad as being a complete failure.  
15 Only outstanding performance is good enough in my family.  
16. I am very good at focusing my efforts on attaining a goal.  
17 Even when I do something very carefully, I often feel that it is not quite right.  
18. I hate being less than the best at things.  
19 I have extremely high goals.  
20 My parents expect excellence from me.  
21 People will probably think less of me if I make a mistake.  
22 I never feel that I can meet my parents’ expectations.  
23 If I do not do as well as other people, it means I am an inferior being.  
24 Other people seem to accept lower standards from themselves than I do.
25 If I do not do well all the time, people will not respect me.

26 My parents have always had higher expectations for my future than I have.

27 I try to be a neat person.

28 I usually have doubts about the simple everyday things that I do.

29 Neatness is very important to me.

30 I expect higher performance in my daily tasks than most people.

31 I am an organized person.

32 I tend to get behind in my work because I repeat things over and over.

33 It takes me a long time to do something “right.

34 The fewer mistakes I make, the more people will like me.

35 I never feel that I can meet my parents’ standards.
Appendix 6. The UPPS-P Impulsivity Scale.

Below are a number of statements that describe ways in which people act and think. For each statement, please indicate how much you agree or disagree with the statement. If you Agree Strongly circle 1, if you Agree Somewhat circle 2, if you Disagree somewhat circle 3, and if you Disagree Strongly circle 4. Be sure to indicate your agreement or disagreement for every statement below. Also, there are questions on the following pages.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Disagree</th>
<th>Agree Strongly</th>
<th>Agree Some</th>
<th>Agree Some</th>
<th>Agree Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I have a reserved and cautious attitude toward life.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>2. I have trouble controlling my impulses.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>3. I generally seek new and exciting experiences and sensations.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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</tr>
<tr>
<td>4. I generally like to see things through to the end.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5. When I am very happy, I can’t seem to stop myself from doing things that can have bad consequences.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>6. My thinking is usually careful and purposeful.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>7. I have trouble resisting my cravings (for food, cigarettes, etc.).</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
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<tr>
<td>8. I’ll try anything once.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>9. I tend to give up easily.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>10. When I am in great mood, I tend to get into situations that could cause me problems.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>11. I am not one of those people who blurt out things without thinking.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>12. I often get involved in things I later wish I could get out of.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>13. I like sports and games in which you have to choose your next move very quickly.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>14. Unfinished tasks really bother me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>15. When I am very happy, I tend to do things that may cause problems in my life.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>16. I like to stop and think things over before I do them.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>17. When I feel bad, I will often do things I later regret in order to make myself feel better now.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>18. I would enjoy water skiing.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>19. Once I get going on something I hate to stop.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>20. I tend to lose control when I am in a great mood.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>21. I don't like to start a project until I know exactly how to proceed.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Please go to the next page
|   | 22. Sometimes when I feel bad, I can’t seem to stop what I am doing even though it is making me feel worse. | 1 | 2 | 3 | 4 |
|   | 23. I quite enjoy taking risks. | 1 | 2 | 3 | 4 |
|   | 24. I concentrate easily. | 1 | 2 | 3 | 4 |
|   | 25. When I am really ecstatic, I tend to get out of control. | 1 | 2 | 3 | 4 |
|   | 26. I would enjoy parachute jumping. | 1 | 2 | 3 | 4 |
|   | 27. I finish what I start. | 1 | 2 | 3 | 4 |
|   | 28. I tend to value and follow a rational, "sensible" approach to things. | 1 | 2 | 3 | 4 |
|   | 29. When I am upset I often act without thinking. | 1 | 2 | 3 | 4 |
|   | 30. Others would say I make bad choices when I am extremely happy about something. | 1 | 2 | 3 | 4 |
|   | 31. I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional. | 1 | 2 | 3 | 4 |
|   | 32. I am able to pace myself so as to get things done on time. | 1 | 2 | 3 | 4 |
|   | 33. I usually make up my mind through careful reasoning. | 1 | 2 | 3 | 4 |
|   | 34. When I feel rejected, I will often say things that I later regret. | 1 | 2 | 3 | 4 |
|   | 35. Others are shocked or worried about the things I do when I am feeling very excited. | 1 | 2 | 3 | 4 |
|   | 36. I would like to learn to fly an airplane. | 1 | 2 | 3 | 4 |
|   | 37. I am a person who always gets the job done. | 1 | 2 | 3 | 4 |
|   | 38. I am a cautious person. | 1 | 2 | 3 | 4 |
|   | 39. It is hard for me to resist acting on my feelings. | 1 | 2 | 3 | 4 |
|   | 40. When I get really happy about something, I tend to do things that can have bad consequences. | 1 | 2 | 3 | 4 |
|   | 41. I sometimes like doing things that are a bit frightening. | 1 | 2 | 3 | 4 |
|   | 42. I almost always finish projects that I start. | 1 | 2 | 3 | 4 |
|   | 43. Before I get into a new situation I like to find out what to expect from it. | 1 | 2 | 3 | 4 |
|   | 44. I often make matters worse because I act without thinking when I am upset. | 1 | 2 | 3 | 4 |
|   | 45. When overjoyed, I feel like I can’t stop myself from going overboard. | 1 | 2 | 3 | 4 |

Please go to the next page
<table>
<thead>
<tr>
<th></th>
<th>Agree Strongly</th>
<th>Agree Some</th>
<th>Disagree Some</th>
<th>Disagree Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>46. I would enjoy the sensation of skiing very fast down a high mountain slope.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>47. Sometimes there are so many little things to be done that I just ignore them all.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>48. I usually think carefully before doing anything.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>49. Before making up my mind, I consider all the advantages and disadvantages.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>50. When I am really excited, I tend not to think of the consequences of my actions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>51. In the heat of an argument, I will often say things that I later regret.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>52. I would like to go scuba diving.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>53. I tend to act without thinking when I am really excited.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>54. I always keep my feelings under control.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>55. When I am really happy, I often find myself in situations that I normally wouldn’t be comfortable with.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>56. I would enjoy fast driving.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>57. When I am very happy, I feel like it is ok to give in to cravings or overindulge.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>58. Sometimes I do impulsive things that I later regret.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>59. I am surprised at the things I do while in a great mood.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Scoring Instructions

This is a revised version of the UPPS Impulsive Behavior scale (Whiteside & Lynam, 2001). This version, UPPS+P, assesses an additional personality pathway to impulsive behavior, Positive Urgency (Cyders & Smith, 2007), in addition to the four pathways assessed in the original version of the scale-- Urgency (now Negative Urgency), (lack of) Premeditation, (lack of) Perseverance, and Sensation Seeking. The scale uses a 1 (agree strongly) to 4 (disagree strongly) response format. Because the items from different scales run in different directions, it is important to make sure that the correct items are reverse-scored. We suggest making all of the scales run in the direction such that higher scores indicate more impulsive behavior. Therefore, we include the scoring key for, (Negative) Urgency, (lack of) Premeditation, (lack of) Perseverance, Sensation Seeking, and Positive Urgency. For each scale, calculate the mean of the available items; this puts the scales on the same metric. We recommend requiring that a participant have at least 70% of the items before a score is calculated.

(Negative) Urgency (all items except 1 are reversed)
items 2 (R), 67(R), 12 (R), 17 (R), 22 (R), 29 (R), 34 (R), 39 (R), 44 (R), 51 (R), 54, 58 (R)

(lack of) Premeditation (no items are reversed)
items 1, 6, 11, 16, 21, 28, 33, 38, 43, 48, 49.

(lack of) Perseverance (two items are reversed)
items 4, 9 (R), 14, 19, 24, 27, 32, 37, 42, 47 (R)

Sensation Seeking (all items are reversed)
items 3 (R), 8 (R), 13 (R), 18 (R), 23 (R), 26 (R), 31 (R), 36 (R), 41 (R), 46 (R), 52 (R), 56 (R)

Positive Urgency (all items are reversed)
items 5 (R), 10 (R), 15 (R), 20 (R), 25 (R), 30 (R), 35 (R), 40 (R), 45 (R), 50 (R), 53 (R), 55 (R), 57 (R), 59 (R)

(R) indicates the item needs to be reverse scored such 1=4, 2=3, 3=2, and 4=1.
Appendix 7.

Script for IAPS Picture Ratings.

In this study, we are interested in how people respond to pictures that represent a lot of different events that occur in life. For about the next 10-15 minutes, you will be rating the pictures you saw in the other room. There are no right or wrong answers, so simply respond as honestly as you can.

Now let me explain your involvement in more detail.
If you'll look at the sheet in front of you, you will see 3 sets of 5 figures, each arranged along a continuum. We call this set of figures SAM, and you will be using these figures to rate how you felt while viewing each picture. You will make all 3 ratings for each picture that you observe.

SAM shows three different kinds of feelings: Happy vs. Unhappy, Excited vs. Calm, and Controlled vs. In-control.

You can see that each SAM figure varies along each scale. The first SAM scale is the happy/unhappy scale, which ranges from a smile to a frown. At one extreme of the happy vs. unhappy scale, you feel happy, pleased, satisfied, contented, hopeful. If you felt completely happy while viewing the picture, you can indicate this by marking an “X” on the figure at the left, like this (demonstrate with SAM).

The other end of the scale is when you felt completely unhappy, annoyed, unsatisfied, melancholic, despairing, bored. You can indicate feeling completely unhappy by marking an “X” on the figure at the right, like this (demonstrate with SAM). The figures also allow you to describe intermediate feelings of pleasure, by placing an "X" over any of the other pictures. If you felt completely neutral, neither happy nor unhappy, place an "X" over the figure in the middle. If, in your judgment, your feeling of pleasure or displeasure falls between two of the pictures, then mark an “X” on the space between the figures, like this (demonstrate with SAM). This permits you to make more finely graded ratings of how you feel in reaction to the pictures.

The excited vs. calm dimension is the second type of feeling displayed here. At one extreme of the scale you feel stimulated, excited, frenzied, jittery, wide-awake, aroused. If you felt completely aroused while viewing the picture, mark an “X” on the figure at the left of the row, like this (demonstrate with SAM). On the other hand, at the other end of the scale, you felt completely relaxed, calm, sluggish, dull, sleepy, unaroused. You can indicate you felt completely calm by marking an “X” on the figure at the right of the row, like this (demonstrate with SAM). As with the happy/unhappy scale, you can represent intermediate levels by bubbling in any of the other figures. If you are not at all excited nor at all calm, mark an “X” on the figure in the middle of the row. Again, if you wish to make a more finely tuned rating of how excited or calm you feel, mark an “X” on the spaces between the pictures, like this. (demonstrate with SAM).

The last scale of feeling that you will rate is the dimension of controlled vs. in-control. At one end of the scale you have feelings characterized as completely controlled, influenced, cared-for, awed, submissive, guided. Please indicate feeling controlled by marking an “X” on the figure at the left, like this (demonstrate with SAM). At the other extreme of this scale, you felt completely...
controlling, influential, in control, important, dominant, autonomous. You can indicate that you felt *dominant* by marking an “X” on the figure at the right of the row, like this (demonstrate with SAM). Note that when the figure is large, you feel important and influential, and that it will be very small when you feel controlled and guided. If you feel neither in control nor controlled mark an “X” on the middle picture. Remember you can also represent your feelings by marking an “X” on the spaces between pictures. (demonstrate with SAM).

Some of the pictures may prompt emotional experiences; others may seem relatively neutral. Your rating of each picture should reflect your immediate personal experience, and no more. Please rate each one *AS YOU ACTUALLY FELT WHILE YOU WATCHED THE PICTURE*. There are no right or wrong answers; so *rate every picture on all three dimensions*.

After each set of 10 pictures, you will be asked to rate how you felt during the pictures as a whole category. There are different adjectives listed, so please fill out each one.
Appendix 8.

Happiness and Anxiety Ratings During Anticipation of, Presentation of and Following Cues

**FOOD TRIALS**

*When the text FOOD was on the screen, how did you feel?*

<table>
<thead>
<tr>
<th>Not at all happy</th>
<th>Moderately happy</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1------------------2------------------3------------------4------------------5------------------6------------------7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Not at all nervous/anxious</th>
<th>Moderately nervous/anxious</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1------------------2------------------3------------------4------------------5------------------6------------------7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*When the food PICTURE was on the screen, how did you feel?*

<table>
<thead>
<tr>
<th>Not at all happy</th>
<th>Moderately happy</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1------------------2------------------3------------------4------------------5------------------6------------------7</td>
<td></td>
<td></td>
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</tbody>
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<tr>
<th>Not at all nervous/anxious</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1------------------2------------------3------------------4------------------5------------------6------------------7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*AFTER the food picture (when the + was on the screen), how did you feel?*

<table>
<thead>
<tr>
<th>Not at all happy</th>
<th>Moderately happy</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1------------------2------------------3------------------4------------------5------------------6------------------7</td>
<td></td>
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</thead>
<tbody>
<tr>
<td>1------------------2------------------3------------------4------------------5------------------6------------------7</td>
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**THREAT TRIALS**

*When the text THREAT was on the screen, how did you feel?*

<table>
<thead>
<tr>
<th>Not at all happy</th>
<th>Moderately happy</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1------------------2------------------3------------------4------------------5------------------6------------------7</td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Not at all nervous/anxious</th>
<th>Moderately nervous/anxious</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1------------------2------------------3------------------4------------------5------------------6------------------7</td>
<td></td>
<td></td>
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</tbody>
</table>
When the threatening PICTURE was on the screen, how did you feel?

Not at all happy       Moderately happy       Extremely

1------------------ 2------------------ 3------------------ 4------------------ 5------------------ 6------------------ 7

Not at all nervous/anxious       Moderately nervous/anxious       Extremely

1------------------ 2------------------ 3------------------ 4------------------ 5------------------ 6------------------ 7

AFTER the threatening picture (when the + was on the screen), how did you feel?

Not at all happy       Moderately happy       Extremely

1------------------ 2------------------ 3------------------ 4------------------ 5------------------ 6------------------ 7

Not at all nervous/anxious       Moderately nervous/anxious       Extremely

1------------------ 2------------------ 3------------------ 4------------------ 5------------------ 6------------------ 7

DIRTY TRIALS

When the text DIRTY was on the screen, how did you feel?

Not at all happy       Moderately happy       Extremely

1------------------ 2------------------ 3------------------ 4------------------ 5------------------ 6------------------ 7

Not at all nervous/anxious       Moderately nervous/anxious       Extremely

1------------------ 2------------------ 3------------------ 4------------------ 5------------------ 6------------------ 7

When the dirty PICTURE was on the screen, how did you feel?

Not at all happy       Moderately happy       Extremely

1------------------ 2------------------ 3------------------ 4------------------ 5------------------ 6------------------ 7

Not at all nervous/anxious       Moderately nervous/anxious       Extremely

1------------------ 2------------------ 3------------------ 4------------------ 5------------------ 6------------------ 7

AFTER the dirty picture (when the + was on the screen), how did you feel?

Not at all happy       Moderately happy       Extremely

1------------------ 2------------------ 3------------------ 4------------------ 5------------------ 6------------------ 7

Not at all nervous/anxious       Moderately nervous/anxious       Extremely

1------------------ 2------------------ 3------------------ 4------------------ 5------------------ 6------------------ 7
**NEUTRAL TRIALS**

When the text NEUTRAL was on the screen, how did you feel?

<table>
<thead>
<tr>
<th>Not at all happy</th>
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</thead>
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When the neutral PICTURE was on the screen, how did you feel?

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<td>5-----------------------------</td>
</tr>
<tr>
<td></td>
<td>6-----------------------------</td>
<td>7-----------------------------</td>
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</tbody>
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AFTER the neutral picture (when the + was on the screen), how did you feel?

<table>
<thead>
<tr>
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<th>Moderately nervous/anxious</th>
<th>Extremely nervous/anxious</th>
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<tr>
<td></td>
<td>6-----------------------------</td>
<td>7-----------------------------</td>
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</tbody>
</table>

How hungry are you RIGHT NOW?

<table>
<thead>
<tr>
<th>Not at all hungry</th>
<th>Moderately hungry</th>
<th>Extremely hungry</th>
</tr>
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<tbody>
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</table>
Approval Notice
Initial Review (Response To Modifications)

August 24, 2009

Sarah Altman, BS
Psychology
1007 W Harrison St., 1009BSB, M/C 285
Chicago, IL 60612
Phone: (312) 413-2681 / Fax: (312) 413-4122

RE: Protocol # 2009-0689

Dear Ms. Altman:

Your Initial Review (Response To Modifications) was reviewed and approved by the Expedited review process on August 24, 2009. You may now begin your research.

Please note the following information about your approved research protocol:

**Protocol Approval Period:** August 24, 2009 - August 23, 2010

**Approved Subject Enrollment #:** 150

**Additional Determinations for Research Involving Minors:** These determinations have not been made for this study since it has not been approved for enrollment of minors.

**Performance Sites:** UIC

**Sponsor:** None

**Research Protocol(s):**
- The Relation Between Bulimia Nervosa and OCD: a Startle Study of Aversiveness Sensitivity

**Recruitment Material(s):**
- Psychology Subject Pool recruitment procedures will be used.

**Informed Consent(s):**
- Educational Debriefing Form; Version 1; 08/21/2009
- Emotional Processing Specificity; Version 2; 08/21/2009
Your research meets the criteria for expedited review as defined in 45 CFR 46.110(b)(1) under the following specific categories:

(4) Collection of data through noninvasive procedures (not involving general anesthesia or sedation) routinely employed in clinical practice, excluding procedures involving X-rays or microwaves. Where medical devices are employed, they must be cleared/approved for marketing. (Studies intended to evaluate the safety and effectiveness of the medical device are not generally eligible for expedited review, including studies of cleared medical devices for new indications.)

(7) Research on individual or group characteristics or behavior (including but not limited to research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

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>Initial Review</td>
<td>Expedited</td>
<td>08/14/2009</td>
<td>Modifications Required</td>
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<tr>
<td>08/21/2009</td>
<td>Response To Modifications</td>
<td>Expedited</td>
<td>08/24/2009</td>
<td>Approved</td>
</tr>
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</table>

Please remember to:

→ Use your research protocol number (2009-0689) 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"

Please note that the UIC IRB has the prerogative and authority to ask further questions, seek additional information, require further modifications, 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 OPRS at (312) 996-1711 or me at (312) 996-9299. Please send any correspondence about this protocol to OPRS at 203 AOB, M/C 672.

Sincerely,

Marissa Benni-Weis, M.S.
IRB Coordinator, IRB # 2
Office for the Protection of Research Subjects
Enclosure(s):

1. UIC Investigator Responsibilities, Protection of Human Research Subjects
2. Informed Consent Document(s):
   a) Educational Debriefing Form; Version 1; 08/21/2009
   b) Emotional Processing Specificity; Version 2; 08/21/2009

cc:   Gary E. Raney, Psychology, M/C 285
       Stewart Shankman, Psychology, M/C 285
Sarah Emily Altman  
Curriculum Vitae

EDUCATION

<table>
<thead>
<tr>
<th>Degree</th>
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<th>Institution</th>
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<th>State</th>
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<tbody>
<tr>
<td>Ph.D.</td>
<td>Received August, 2011, Clinical Psychology</td>
<td>University of Illinois at Chicago, Chicago, IL</td>
<td></td>
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<tr>
<td>M.A.</td>
<td>Received July, 2007, Clinical Psychology</td>
<td>University of Illinois at Chicago, Chicago, IL</td>
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<tr>
<td>Post B.S. Coursework</td>
<td>2002-2004, Psychology</td>
<td>University of Pittsburgh, Pittsburgh, PA</td>
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<tr>
<td>B.S.</td>
<td>Received May, 2001, Cum Laude in Health</td>
<td>University of Richmond, Richmond, VA</td>
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</table>

THESES AND DISSERTATION

Positive affect, history of depression, and treat consumption  
Masters of Arts in Psychology. University of Illinois at Chicago, 2007. Committee: Bonnie Spring, PhD, ABPP (Chair), Larry Grimm, PhD, Audrey Ruderman, PhD

Obsessive-compulsive disorder and eating disorder comorbidity: What is the association and why do they co-occur?  
Doctoral candidacy entrance paper, University of Illinois at Chicago, 2008. Committee: Stewart Shankman, PhD (Chair), Evelyn Behar, PhD, Audrey Ruderman, PhD

The relation between binge-purge behaviors and contamination fears: a startle study of aversiveness sensitivity.  
Defended June 2011. University of Illinois at Chicago. Committee: Stewart Shankman, PhD (Chair), Evelyn Behar, PhD, Eunice Chen, PhD, Larry Grimm, PhD, Audrey Ruderman, PhD

AWARDS

<table>
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<tr>
<th>Year</th>
<th>Award</th>
<th>Institution</th>
<th>Description</th>
<th>Total Award</th>
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<tr>
<td>2009</td>
<td>University of Illinois at Chicago, Graduate College Provost Award.</td>
<td>University of Illinois at Chicago, Chicago, IL</td>
<td>(Total Award: $1000)</td>
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<td>2009</td>
<td>University of Illinois at Chicago, Department of Psychology Dissertation Award</td>
<td>University of Illinois at Chicago, Chicago, IL</td>
<td>(Total Award: $300)</td>
<td></td>
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<tr>
<td>2009</td>
<td>University of Illinois at Chicago Graduate Student Council/Graduate College/Department of Psychology Travel Award to the Association for Psychological Science, San Francisco, CA, May 2009</td>
<td>University of Illinois at Chicago, Chicago, IL</td>
<td>(Total Awards: $600)</td>
<td></td>
</tr>
</tbody>
</table>
2007  University of Illinois at Chicago Graduate Student Council/Graduate College/Department of Psychology Travel Award to the Society for Research in Psychopathology, Iowa City, IA, October 2007 (Total Awards: $600)

PEER-REVIEWED PUBLICATIONS


NON PEER-REVIEWED PUBLICATIONS


**Reprinted in Clinical Health Psychology Perspective, (2005) University of Manitoba, Issue 10, pp. 3-6**


PROFESSIONAL CONFERENCE SYMPOSIA, PRESENTATIONS, AND POSTERS


4. Altman, S.E., Spring, B., & Shankman, S.A. (October, 2007). Does depression history moderate the effect of acute tryptophan depletion on positive emotions? Poster presented at the annual meeting of the Society for Research in Psychopathology, Iowa City, IA.


CLINICAL EXPERIENCE

Postdoctoral Fellow
Cleveland Center for Eating Disorders, Cleveland, OH
September 2011-August 2013

- Will provide standard empirically-supported treatments for adults with eating disorders including CBT as well as DBT for multi-diagnostic patients
- Will provide individual CBT and DBT and facilitate CBT and DBT skills groups
- Will develop a training program for area graduate students and supervise students
- Will be involved in ongoing research for development of treatments, presentations at conferences and publications

Predoctoral APA-Accredited Internship, Adult Track
West Virginia University, Morgantown, WV
July 2010 to June 2011

- Rotations include Outpatient Adult psychotherapy and intakes, Eating Disorder and Obesity Clinic, Behavioral Health Consulting in Family Medicine, Adult and Pediatric Consult and Liaison service, CBT Insomnia Treatment Team, Homeless Clinic, Dual Diagnosis Unit, Psychiatric Intensive Care Unit and CBT Anxiety groups
- Supervisor of graduate students on vertical team in treating insomnia and geriatric patients
  Supervisors: J. Scott Mizes, PhD, Jeannie Sperry, PhD, Kevin Larkin, PhD, Amy Fiske, PhD

Practicum, Eating and Weight Disorders Clinic
University of Chicago, Chicago, IL
July 2007 to June 2010

- Trained in Dialectical Behavioral Therapy (DBT) for funded study on efficacy of DBT for individuals with eating and weight disorders with co-occurring disorders
- Provided weekly group and individual Dialectical Behavior Therapy
- Attended a weekly therapist consultation team meeting
- Provided 24-hour paging support
- Treatment development for Anorexia Nervosa adult patients
  Supervisor: Eunice Chen, Ph. D.
Practicum, Office of Applied Psychological Services
University of Illinois at Chicago, Chicago, IL
August 2004 to June 2010
- Provided outpatient therapy services to adults from multiethnic inner city population
- Conducted psychodiagnostic and neuropsychological assessment of cognitive and emotional functioning for adult and child outpatients with Attention Deficit Hyperactivity Disorder, learning disabilities, and personality issues
- Weekly individual supervision involved discussion of cases, including diagnosis and treatment plans, and review of audio and videotapes
- Treatment orientation is primarily cognitive-behavioral, but also include interpersonal, systems theory, dynamic, and schema-focused components.
  Supervisors: Gloria Balague, Ph.D., Evelyn Behar, Ph.D., Nancy T. Dassoff, Ph.D., Audrey J. Ruderman, Ph.D., Stewart Shankman, Ph.D.

Practicum, Center for the Surgical Treatment of Obesity (CSTO)
University of Chicago, Chicago, IL
July 2007 to July 2008
- Provided brief assessment and therapy to patients recovering from bariatric surgery in a multidisciplinary outpatient hospital-based clinic
  Supervisor: Eunice Chen, Ph.D

CLINICAL SUPERVISION EXPERIENCE

2010-2011  Insomnia Clinic, Department of Family Medicine, West Virginia University
- Provide supervision for intakes and CBT-I sessions for graduate students

2007-2009  Office of Applied Psychological Services, University of Illinois at Chicago
- Provided intake supervision for advanced graduate students

2007-2009  Department of Psychology, University of Illinois at Chicago
- Provided supervision for clinical interviewing skills for undergraduates majoring in applied psychology

RESEARCH EXPERIENCE

Research Assistant, Affective Science and Physiology Research Lab University of Illinois at Chicago, Department of Psychology
February 2007-July 2010
NIH funded grant investigating aversiveness and reward sensitivity in individuals with Panic Disorder, Major Depression Disorder and co-morbid Panic and MDD.
- Conducted diagnostic interviews (SCIDs)
- Ran subjects through EEG and EMG startle protocol
  P.I: Stewart Shankman, PhD
**Research Assistant, Role of Inhibin-B on Premenstrual Dysphoric Disorder**  
**Rush University**, Department of Psychiatry  
*May 2006 to February 2007*  
NIH funded grant investigating the role of Inhibin-B on Premenstrual Dysphoric Disorder  
- Primary diagnostic interviewer for participants in the Chicago metropolitan area  
P.I.: Ann Hartlage, MD

**Research Assistant, Multiple Behavior Change in Diet and Inactivity**  
**University of Illinois at Chicago**, Department of Psychology  
*August 2004 to May 2006*  
NIH funded grant that investigated the effects of making specific dietary and activity changes in fruit, vegetable and fat intake and sedentary and physical activity  
- Conducted diagnostic interviews (SCIDs)  
- Coached participants in changes of diet and activity  
P.I.: Bonnie Spring, PhD

**Senior Research Associate, Prevention of Depression in At-risk Adolescents**  
**Western Psychiatric Institute and Clinic**, University of Pittsburgh Medical Center  
*June 2003 to July 2004*  
NIMH funded multi-site grant examining the effects of a cognitive-behavioral intervention on the prevention of depression in at-risk adolescents  
- Conducted adult and adolescent diagnostic interviews (SCIDs; KSADS)  
- Managed data collection  
P.I: David Brent, MD

**Research Coordinator, Psychopathology and Course of Recurrent Abdominal Pain**  
**Western Psychiatric Institute and Clinic**, University of Pittsburgh Medical Center  
*September 2001 to June 2003*  
NIMH longitudinal study examining the relationship between anxiety and recurrent abdominal pain in children aged 6 to 12.  
- Primary adolescent diagnostic interviewer  
- Liaison for medical sites  
- Managed recruitment and screening  
- Coordinated data collection  
P.I.: John Campo, MD

**INVITED TALKS**

April 2011  
*Dialectical Behavior Therapy for Eating Disorders*  
Grand Rounds, Department of Psychiatry, West Virginia University

April 2009  
*Using Dialectical Behavior Therapy to Treat Bulimia Nervosa*  
Division of Clinical Psychology Brown Bag, University of Illinois at Chicago

October 2007  
*Criminal Profiling*  
Psychology and Law Brown Bag, University of Illinois at Chicago
April 2007  
*Awareness and Prevention of Eating Disorders in College Sorority Life*
National Association of Anorexia Nervosa and Associated Disorders  
Awareness Night, Delta Phi Epsilon, University of Illinois at Chicago

April 2006  
*Positive Affect, Overeating and a History of Depression: Their Relation*
Division of Clinical Psychology Brown Bag, University of Illinois at Chicago

**TEACHING EXPERIENCE**

*Teaching Assistant*
- Psychology 100—Introduction to Psychology (Spring 2007)
- Psychology 270—Abnormal Psychology (Fall 2007; Spring 2008)
- Psychology 381—Psychology of Interviewing (Summer 2006; Spring, Summer, Fall 2008; Summer 2009)
- Psychology 382—Psychological Interventions (Fall 2006; Fall 2007)
- Psychology 385—Fieldwork in Psychology (Spring 2009; Fall 2009)
- Psychology 394—Special Topics—Sports Psychology (Summer 2008)
- Psychology 481—Graduate Clinical Interviewing (Fall 2008; Fall 2009)

*Teaching Assistant Coordinator*
- Psychology 100—Introduction to Psychology (Spring 2007)

*Guest Lecturer*
- Sports Psychology (Summer 2008)  
  **Topic:** Eating Disorders in Athletes
- Cognitive & Behavioral Therapy (Graduate course, October 2007)  
  **Topic:** Identification and assessment of automatic thoughts
- Introduction to Psychology (Spring 2007)  
  **Topic:** Mind/Body Relaxation Response

**PROFESSIONAL WORKSHOPS AND TRAINING**


*Dialectical Behavior Therapy for Eating Disorders* (2006). Presented by Eunice Chen, PhD, University of Chicago, IL.


PROFESSIONAL SERVICE

2011  Ad Hoc Journal reviewer
       Journal of Psychiatric Research

2009  Ad Hoc Journal Co-reviewer
       Journal of Abnormal Psychology

2009  Clinical Division Representative
       Department of Psychology Open House Forum

2004-2006 Coordinator
       Evidence Based Behavioral Medicine Committee, Society of Behavioral Medicine

AFFILIATIONS

Association for Behavioral and Cognitive Therapies, Student Affiliate
Society for a Science of Clinical Psychology, Student Affiliate
Eating Disorder and Obesity SIG, ABCT Student Affiliate
Academy of Eating Disorders, Student Affiliate