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Fear Conditioning and Extinction in Childhood Obsessive-Compulsive Disorder

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
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Abstract

Fear conditioning and extinction are central in the cognitive behavioral model of obsessive-compulsive disorder (OCD), which underlies exposure-based cognitive behavioral therapy (CBT). Youth with OCD may have impairments in conditioning and extinction that carries treatment implications. The present study examined these processes using a differential conditioning paradigm. Forty-one youth (19 OCD, 22 community controls) and their parents completed a battery of clinical interviews, rating scales, and a differential conditioning task. Skin conductance response (SCR) served as the primary dependent measure across all three phases of the conditioning procedure (habituation, acquisition, and extinction). During habituation, no meaningful differences were observed between groups. During acquisition, differential fear conditioning was identified across groups evidenced by larger SCRs to the CS+ compared to CS-, with no significant group differences. During extinction, a three-way interaction and follow-up tests revealed youth with OCD failed to exhibit differential fear conditioning during early fear extinction; whereas community controls consistently exhibited differential fear conditioning throughout extinction. Across participants, the number and frequency of OCD symptoms was positively associated with fear acquisition and negatively associated with fear extinction to the conditioned stimulus. OCD symptom severity was negatively associated with differential SCR in early extinction. Youth with OCD exhibit a different pattern of fear extinction relative to community controls that may be accounted for by impaired inhibitory learning in early fear extinction. Findings suggest the potential benefit of augmentative retraining interventions prior to CBT. Therapeutic approaches to utilize inhibitory-learning principles and/or engage developmentally appropriate brain regions during exposures may serve to maximize CBT outcomes.

Introduction

Obsessive compulsive disorder (OCD) is a neuropsychiatric condition that affects approximately 1-2% of youth (Douglass, Moffitt, Dar, McGee, & Silva, 1995; Flament et al., 1988; Zohar, 1999). It is characterized by the presence of distressing, intrusive and persistent thoughts, impulses and/or images (obsessions), and/or the performance of repetitive behaviors, rituals and/or mental acts (compulsions) that provide temporary relief from obsession-related distress. Co-occurring psychiatric conditions are more common than naught for youth with OCD, with as many as 80% of treatment-seeking youth reported to have a co-occurring psychiatric disorder (POTS, 2004). Common co-occurring conditions include other anxiety disorders (e.g., separation anxiety, social phobia), depressive disorders (e.g., major depressive disorder, dysthymia), attention deficit hyperactivity disorder (ADHD), and oppositional defiance disorder (ODD) (Farrell, Barrett, & Piacentini, 2006; Geller et al., 2001; Masi et al., 2010; Storch et al., 2012). Youth with OCD often experience distress and impairment produced by the stress of engaging in obsessive thoughts, compulsive rituals, and/or avoidance of obsessive-compulsive triggers. Obsessive-compulsive symptoms and avoidance behaviors consume substantial amounts of time, and interfere with academic functioning, family functioning, peer relationships (Piacentini, Bergman, Keller, & McCracken, 2003). Indeed the associated distress and functional impairment that accompanies obsessive-compulsive symptoms contributes to a poor quality of life reported by many youth with OCD (Lack et al., 2009).

Fear Conditioning and Extinction in the Cognitive-Behavioral Model of OCD

Although multiple factors have been implicated in the etiology of OCD (Murphy, Frazier, & Kim, 2008), a cognitive behavioral model underlies one of the most efficacious treatments for obsessive-compulsive symptoms, namely cognitive behavioral therapy (CBT) with exposure and response prevention (ERP)(Abramowitz, Taylor, & McKay, 2009). In the cognitive-behavioral model, the

mechanisms of fear conditioning and extinction play an important role in symptom development, maintenance, and treatment of OCD. Fear conditioning occurs when an emotionally neutral stimulus (conditioned stimulus, CS) is paired with an aversive unconditioned stimulus (US) such as the belief that a door handle is contaminated and contact will cause severe illness/death—developing a CS-US association. Subsequent exposures to the CS trigger the CS-US association and produce a conditioned response (CR) such as fear/distress. Some individuals with OCD generalize these learned associations across successive degrees of contact between CS referred to as a "chain of contagion" (Tolin, Worhunsky, & Maltby, 2004). This chain of contagion has been shown to persist across several successive degrees of contact (Tolin et al., 2004), and suggests that these some individuals with OCD have difficulty discriminating between perceived and actually dangerous stimuli.

In an attempt to reduce the fear/distress (CR) elicited from the CS (e.g., contaminated door handle), individuals with OCD engage in compulsive behaviors (e.g., ritualized washing after touching contaminated door handle) or avoidance (e.g., actively avoiding touching the door handle) that provide temporarily relief. Indeed, certain obsessions have been linked to the performance of specific compulsive behaviors (e.g., fears of contamination with washing rituals). The reduction in fear/distress temporarily produced by compulsive ritual and/or active avoidance behavior reinforces the performed actions and strengthens the CS-US association. This operant conditioning mechanism suggests an increased chance that individuals with OCD will rely upon compulsive rituals or avoidance when faced with triggering CS again.

In fear extinction, the emotional response to the CS declines through repeated exposure in the absence of the feared outcome (e.g., illness/death) and/or engagement in safety behaviors (e.g., avoidance, compulsive rituals). Notably, this does not eradicate the initial CS-US association, but rather forms a new CS-no US association that inhibits the existing dysfunctional CS-US association. Over repeated exposures to the CS without engagement in the compulsive and/or avoidant behaviors, the original CR (fear/distress) will be inhibited (Myers & Davis, 2007) .

Cognitive Behavioral Therapy for Youth with OCD

For youth with OCD, CBT includes multiple components such as psycho-education, symptom hierarchy development, cognitive training, with the emphasis of treatment being placed on ERP (POTS, 2004). In exposure-based CBT, associations between the CS (e.g., contaminated door handle) and CR (e.g., repeated hand washing, active avoidance of touching door handle) are weakened through repeated exposures to the feared stimulus without ritual engagement. These exposures in the absence of ritual engagement allow for the formation of a competing association (e.g., sickness/death does not occur if I don't wash my hands) called the CS-no US association that inhibits the prior association (e.g., I will get sick/die if I don't wash my hands) referred to as the CS-US association. Over the course of repeated exposures, the CS-no US associations are strengthened and inhibit the prior CS-US associations. This results in the CS trigger (the contaminated door handle) no longer eliciting the original CR (fear/distress) and performance of the compulsive behavior (Myers & Davis, 2007).

Exposure-based CBT has been found to be an efficacious treatment for youth with OCD across several controlled studies, with large effect sizes observed (Piacentini et al., 2011; POTS, 2004; Storch et al., 2007). Exposure-based CBT is recommended as the first line treatment for youth with mild to moderate obsessive-compulsive severity, and suggested to be concurrent treatment in severe cases with serotonin reuptake inhibitors (SRIs) (Geller & March, 2012). In the largest treatment study to date that compared the efficacy of CBT, sertraline, combined CBT and sertraline, and pill placebo in symptom reduction for youth with OCD, youth receiving CBT demonstrated a significant reductions in obsessive-compulsive symptom severity (POTS, 2004). Despite its noted efficacy in randomized controlled trials (RCTs), approximately 60% of youth with OCD who responded to treatment still remained symptomatic after receiving a standard course of CBT (POTS, 2004). Moreover, approximately 25% of treatment-seeking youth failed to exhibit an adequate therapeutic response to CBT (POTS, 2004). Although the treatment study had some methodological issues (e.g., differences in CBT efficacy between sites), study findings highlight that some youth with OCD do not exhibit the desired therapeutic response to CBT. Given that the cognitive behavioral model serves as the cornerstone for CBT and that some youth failed

demonstrate an appropriate therapeutic response, it is important to closely examine the central mechanisms of actions (i.e., fear conditioning and extinction) implicated in this treatment model as they may influence therapeutic outcomes.

Empirical Examinations of Fear Conditioning and Extinction in Adults with OCD

Despite their presumed central role in OCD and its treatment, inferences about fear conditioning and extinction have been largely extrapolated from conditioning studies of adults with anxiety disorders (e.g., panic disorder, posttraumatic stress disorder) (Lissek, Powers, et al., 2005; Michael, Blechert, Vriends, Margraf, & Wilhelm, 2007; Orr et al., 2000). When considering an examination of fear conditioning among individuals with OCD, it is important to recognize that fear is not always learned through direct association. Indeed, some individuals with OCD report experiencing a chain of contagion, and/or displayed difficulty distinguishing between potential versus actual threats (Tolin et al., 2004). As such, differential fear conditioning paradigms can valuable information above and beyond their classical conditioning counterparts, and clarify whether individuals with OCD accurately appraise seemingly related threatening stimuli. In comparison to classical conditioning paradigms that present a single stimulus (CS), differential conditioning employs two conditional stimuli, one paired with the unconditional stimulus (CS+) and one presented alone (CS-).

Presently, only two studies have examined fear conditioning in adults with OCD compared to healthy community controls, using Pavlovian fear conditioning paradigms (Milad et al., 2013; Nanbu et al., 2010). Nanbu and colleagues (2010) administered a classical fear conditioning paradigm to 39 adults with OCD and 21 community controls (Nanbu et al., 2010). No group difference in skin conductance response (SCR) magnitude during fear acquisition was observed, but there was a tendency toward larger SCRs during extinction among OCD participants (Nanbu et al., 2010). Milad and colleagues (2013) used a differential conditioning paradigm to examine differences in SCR magnitude between 21 adults with OCD and 21 community controls (Milad et al., 2013). Both OCD and community control participants exhibited a larger SCR to the CS+ compared to the CS- during the acquisition phase, with no other observed group differences or interactions. This suggests similar levels of fear acquisition across the two

groups (Milad et al., 2013). During the extinction phase, there were no significant group differences or interaction effects, implying that participants with OCD extinguished the conditioned fear SCR to a level comparable to community controls (Milad et al., 2013). While there are notable methodological differences between these studies, findings collectively suggest that adults with OCD demonstrate comparable differential fear conditioning and extinction relative to community controls.

While these examinations in adults with OCD are noteworthy, it is important to recognize that there are considerable distinctions between adults and children with OCD that limit generalization across the developmental spectrum (Farrell et al., 2006). Age differences in differential fear conditioning have also been identified (Glenn et al., 2012; Jovanovic et al., 2014; Lau et al., 2011) such that younger participants exhibited worse discrimination of conditioned stimuli. Furthermore, age differences in the neurobiology of fear conditioning and extinction have been observed, with youth recruiting more sub-cortical regions (e.g., amygdala and hippocampus) and adult utilizing prefrontal cortex regions (Lau et al., 2011; Shechner, Hong, Britton, Pine, & Fox, 2014). Given that up to 80% of OCD cases initially onset during childhood (Nestadt et al., 2000), assessing mechanisms of fear conditioning and extinction among youth with OCD is bears considerable importance.

Empirical Examinations of Fear Conditioning and Extinction in Youth with OCD

To date, there has been no examination of fear conditioning and/or extinction among youth with OCD relative to community controls. However, there have been a few studies examining differential fear conditioning and extinction in youth with anxiety disorders relative to community controls (Britton et al., 2013; Craske et al., 2008; Lau et al., 2008; Liberman, Lipp, Spence, & March, 2006; Pliszka, Hatch, Borcherding, & Rogeness, 1993; Shechner, Britton, et al., 2014; Waters, Henry, & Neumann, 2009). Pliszka and colleagues (1993) examined differential fear conditioning between youth with anxiety (n = 11), ADHD (n = 23), and healthy community controls (n = 22) using SCR and heart rate response (Pliszka et al., 1993). During the acquisition stage, participants showed differential fear conditioning that was evidenced by greater SCR to the CS+ relative to the CS- in both SCR and heart rate, with no group

differences (Pliszka et al., 1993). Differential fear conditioning persisted throughout the extinction phase, with no group differences observed during extinction (Pliszka et al., 1993).

In 2006, Liberman and colleagues (2006) examined differential fear conditioning between youth with a variety of anxiety disorders (e.g., social anxiety disorder, generalized anxiety disorder, separation anxiety disorder) (n = 53) and healthy community controls (n = 30) using self-report ratings and SCR (Liberman et al., 2006). During the acquisition stage, Liberman found that community controls exhibited differential fear conditioning (CS+ > CS-) using self-report ratings, but anxious youth did not (Liberman et al., 2006). After the extinction phase, community controls exhibited no difference in fear ratings between the two stimuli, whereas anxious youth exhibited the persistence of differential fear conditioning (CS+ > CS-)(Liberman et al., 2006). During the acquisition phase, SCR data was available for 20 anxious youth and 16 community controls. There was no difference observed between groups, with neither group exhibiting differential fear conditioning during acquisition (Liberman et al., 2006). During extinction, SCR data was available for 19 anxious youth and 16 community controls. Liberman observed a trend toward differential fear conditioning among anxious youth (CS+ > CS-) that was not found amongst the community control participants (Stimulus x Group interaction, p = 0.09) (Liberman et al., 2006). Lau and colleagues (2008) also examined differential fear conditioning between youth with a variety of anxiety disorders (e.g., social anxiety disorder, generalized anxiety disorder, separation anxiety disorder) (n = 23) and healthy community control participants (n = 42) using self-report fear ratings (Lau et al., 2008). During the acquisition phase, both anxious youth and community controls exhibited differential fear conditioning (CS+ > CS-), with anxious youth reporting greater fear across a collapsed stimuli score relative to community controls (Lau et al., 2008). Although anxious youth reported greater fear to the CS+ relative to community controls, no significant difference was observed in fear to the CS- (Lau et al., 2008). During the extinction phase, differential fear conditioning was observed across both groups (CS+ > CS-), with no group differences in subjective fear reports (Lau et al., 2008).

Waters and colleagues (2009) examined differential fear conditioning between youth with a variety of anxiety disorders (e.g., social anxiety disorder, generalized anxiety disorder, separation anxiety disorder) (n = 17) and healthy community controls (
n = 18) using self-report fear ratings and SCR (Waters et al., 2009). During the acquisition phase, anxious youth exhibited differential fear conditioning (CS+ > CS-), but community controls did not using self-report fear ratings (Waters et al., 2009). Additionally, anxious youth exhibited elevated SCR to both stimuli relative to community controls (Waters et al., 2009). A similar pattern was observed for SCR between anxious youth and healthy controls during acquisition. Specifically, anxious youth showed increased SCR to both stimuli during acquisition (Waters et al., 2009). During extinction, no overall group difference was observed between anxious youth and community controls (Waters et al., 2009). Meanwhile, anxious youth exhibited greater SCR to the CS+ relative to community controls (Waters et al., 2009).

More recently, Britton and colleagues (2013) examined differential fear conditioning between adolescents with a variety of anxiety disorders (e.g., social anxiety disorder, generalized anxiety disorder, separation anxiety disorder) (n = 23) and healthy community controls (n = 42) using both self-report ratings and SCR (Britton et al., 2013). During the acquisition phase, anxious adolescents reported higher subject fear ratings for the both the CS+ and CS- relative to community controls (Britton et al., 2013). Meanwhile for SCR, differential fear conditioning (CS+ > CS-) was observed among both groups with no significant group differences. During the extinction phase, anxious youth continued to report greater subjective fear to both the CS+ and CS- relative to community controls (Britton et al., 2013). However, for SCR, there were no between group differences. Both anxious adolescents and community controls exhibited decreased SCR, with neither group continuing to exhibit differential fear conditioning (Britton et al., 2013). Lastly, Shechner and colleagues (2014) examined differential fear conditioning between anxious adolescents with a variety of anxiety disorders (e.g., social anxiety disorder, generalized anxiety disorder, separation anxiety disorder) (n = 15) and healthy community controls (n = 17) using subjective fear ratings and SCR (Shechner, Britton, et al., 2014). In both the acquisition and extinction phase, no

group differences were observed in differential fear conditioning or extinction on either self-report or SCR measures (Shechner, Britton, et al., 2014).

Collectively, findings predominantly suggest that fear conditioning elicits comparable differential fear learning between anxious and non-anxious youth during the acquisition phase. However, findings during extinction are less clear. Some evidence suggests that anxious youth exhibit resistance to within-session extinction as indicated by higher CR levels to the CS+ than CS- (i.e., persistence of differential fear learning)(Craske et al., 2008; Liberman et al., 2006; Pliszka et al., 1993; Waters et al., 2009), with two studies showing higher CR levels to both the CS+ and CS- among anxious youth relative to non-anxious youth (Britton et al., 2013; Craske et al., 2008) and one study finding only higher CR levels to the CS+ (Waters et al., 2009). Meanwhile, other evidence suggests no significant group differences in extinction between anxious and non-anxious youth (Shechner, Britton, et al., 2014; Shechner, Hong, et al., 2014), with both anxious and non-anxious youth exhibiting differential fear learning in extinction (Lau et al., 2008). These inconsistent findings may be attributable to differences in sample characteristics, conditioning procedures, outcome measures, and unconditioned stimulus.

Even though a fear conditioning model may not entirely account for the phenomenology of OCD (e.g., not-just-right sensations, disgust)(Coles, Heimberg, Frost, & Steketee, 2005; Olatunji, Tart, Ciesielski, McGrath, & Smits, 2011), understanding fear conditioning in youth with OCD is clinically relevant for several reasons. First, as OCD typically onsets in childhood (Nestadt et al., 2000), examining fear acquisition and extinction processes closer to symptom onset may help to identify whether impairments in these processes contribute to OCD phenomenology. Second, a considerable portion of youth with OCD exhibit inadequate or incomplete response to CBT (POTS, 2004). Given the central role fear conditioning and extinction are accorded in CBT, it would prove useful to better understand these mechanisms as they may influence treatment outcome. For example, it may be that youth with OCD who demonstrate normal fear acquisition and extinction will benefit from standard CBT approaches; whereas youth who show impaired extinction might benefit from augmentative interventions to retrain attention/cognitive bias before initiating CBT to achieve optimal benefit (Shechner, Rimon-Chakir, et al.,

2014), or CBT approaches that emphasize engagement of specific brain regions implicated in extinction among youth (e.g., amygdala, hippocampus). Finally, improved understanding of conditioned fear in OCD may help to guide future research. For instance, stronger fear acquisition ("conditionability") or impaired extinction may be with associated fear circuit abnormalities and/or utilization of different brain regions.

Aims and Hypotheses

The present study examined fear conditioning and extinction in youth with OCD and healthy community controls using a differential conditioning paradigm. First, given prior findings from the adult OCD and child anxiety literature, it was hypothesized that there would be a significant difference in the magnitude of fear acquisition between youth with OCD and community controls. Second, given the persistence of conditioned fear via the CS-US association, it was hypothesized that youth with OCD would exhibit worse extinction of a fear-conditioned SCR compared to community controls. Third, it was hypothesized that there would be a significant positive relationship between the magnitude of SCR to stimuli (CS+ and CS-) and subjective self-reported fear ratings to stimuli in the extinction phase. Fourth, it was hypothesized that there would be a significant positive associated between the magnitude of SCR to stimuli (CS+ and CS-) and OCD severity among youth with OCD in the extinction phase. Finally, it was hypothesized that there would be a significant positive association between subjective self-reported fear ratings to stimuli (CS+ and CS-) after the extinction phase and OCD severity among youth with OCD.

In addition to the above primary hypotheses, the following exploratory aims were examined across all participants. First, group differences in fear conditioning and extinction were examined using subjective fear ratings across the three fear conditioning phases. Second, the association of SCR and parent-reported anxiety/depression, child-reported anxiety, anxiety sensitivity, the number and frequency of OCD symptoms, and OCD severity was explored for all participants. Finally, the association between subjective fear ratings and parent-reported anxiety/depression, child-reported anxiety, anxiety sensitivity, the number and frequency of OCD symptoms, and OCD severity was explored for all participants.

Methods

Participants

Participants were recruited through a southeastern OCD specialty clinic and the surrounding community. Inclusion criteria for OCD participants were: a primary diagnosis of OCD based on a clinical interview as detailed below; 7-17 years of age; a moderate level of OCD severity as evidenced by a Children's Yale-Brown Obsessive Compulsive Scale (Scahill et al., 1997) total score ≥ 13; and English speaking. Exclusion criteria for youth with OCD included the presence of the following psychiatric disorders: autism spectrum disorder; mental retardation; bipolar disorder; posttraumatic stress disorder; conduct disorder; and schizophrenia or any other psychotic disorder. Inclusion criteria for community controls included: the absence of any psychiatric disorder other than specific phobia as determined by a clinical interview; 7-17 years of age; and English speaking.

A total of 57 (30 OCD, 27 community controls) underwent a differential fear conditioning procedure. Seven participants (4 OCD, 3 community controls) discontinued the study during the acquisition phase due to the US (a 95 decibel scream). This 12% discontinuation rate is consistent with other studies that have used this US (Britton et al., 2013; Glenn et al., 2012; Lau et al., 2011; Lau et al., 2008). Fifty participants completed the entire fear conditioning procedure. Eight participants' data were excluded from analyses due to either unreliable recording of skin conductance activity (e.g., poor connection between electrode and skin that produced unreliable recording of SC activity, $n = 4$) or small responses to the US ($n = 4$). This 16% unreliable recording rate is comparable with other studies that have examined fear conditioning in youth (Glenn et al., 2012; Liberman et al., 2006). Finally, data from 1 OCD participant was excluded due to missing parent and self-report measures that were not returned by

the participant's parent. The final sample consisted of 41 youth (19 OCD, 22 community controls) between 8 and 17 years of age.

Procedures

All study procedures were approved by the All Children's Hospital institutional review board. After written parent consent and child assent were obtained by the principal investigator, parents and youth completed a structured diagnostic interview to determine eligibility and a semi-structured clinician-administered interview to determine OCD severity. Participants were reminded that participation was voluntary, and that they did not have to answer specific questions that made them feel uncomfortable. Next, parents completed a demographic questionnaire and parent-report measures and youth completed self-report measures. After completing clinical interviews and respective rating scales, youth completed the differential fear conditioning paradigm. Participants were informed that they could discontinue participation during the conditioning paradigm at anytime. A computer and Coulbourn Modular Instrument System recorded SC level throughout the task using a Coulbourn Isolated Skin Conductance Coupler. Skin conductance was recorded through two 9-mm Ag/AgCl electrodes filled with isotonic paste and placed on the hypothenar surface of the participant's non-dominant hand. Electrodes were separated by 14 mm (the width of the adhesive collar) in accordance with published guidelines (Boucsein et al., 2012). Participant's SC level was digitized by a Coulbourn Lablinic Analog to Digital Converter; 10 samples per second were retained for calculating SCR. Finally, youth and families were collectively compensated $30 for participation.

Design Considerations

Several methodological issues were considered when developing the study design.

Inclusion of Co-occurring Conditions in the OCD Sample: Many youth with OCD seeking treatment report having co-occurring psychiatric conditions (Storch, Larson, et al., 2008; Storch, Merlo, et al., 2008). Indeed in the largest randomized controlled treatment child for youth with OCD to date (POTS, 2004), approximately 80% of youth had at least one co-occurring psychiatric condition. As co-occurring psychiatric conditions appear to be the rule, rather than the exception, inclusion of commonly reported co-

occurring conditions was permissible so long as these disorders were secondary to OCD in terms of severity and impairment, and did not require immediate initiation of treatment. However, co-occurring psychiatric conditions that could impair youth's ability to respond independently and/or complete study assessments served as exclusionary criteria from participation. Other studies of youth with OCD employ similar exclusion criteria (Storch et al., 2011; Storch et al., 2010), which improves the generalizability of study findings. These exclusionary disorders include autism spectrum disorder, mental retardation, psychosis, bipolar disorder, PTSD, conduct disorder, and schizophrenia.

Matching for Gender and Age among Community Control Participants: Healthy community control participants were recruited to serve as a gender and age matched control comparison group. Control participants were recruited to match according to gender and within two years of the OCD participant's age group. For instance, if a 12-year-old boy with OCD was enrolled in the study, the control participant was matched with another male between 10 and 14 years of age. This allowed for a comparison of relevant psychological constructs while controlling for factors such as gender, age, and psychological development. Although no effects for gender have been reported, there is some evidence to suggest that fear conditioning and extinction may differ by age (Glenn et al., 2012; Jovanovic et al., 2014; Shechner, Hong, et al., 2014). Thus, control participants' responses served as an index of typical fear conditioning and extinction to which youth with OCD's responses were compared.

Allowance of Specific Phobia among Youth in Community Control Participants: Specific phobias are characterized by a persistent fear that is unreasonable, and cued by the presence of a specific stimulus. Specific phobias are often categorized into five different domains: animal (e.g., insects, snakes, dogs), natural environment (e.g., darkness, storms, heights), situational (e.g., enclosed spaces, elevators, flying), blood-injection-injury (BII) (e.g., seeing blood, receiving shots or injections), and other (e.g., choking, loud sounds, costumed characters). Many youth report experiencing a specific phobia at some point in their young lives, with prevalence rates for specific phobia varying between 7.9-15.0% among sampled youth (Burstein et al., 2012; Kim et al., 2010). Although commonly occurring, specific phobias by nature do not result in distress unless the youth is in the presence of the phobic stimulus. As youth can

often avoid anxiety provoking stimuli (e.g., leave room where there is a dog, turn on a light to avoid darkness), specific phobias infrequently cause persistent impairment. As a result of their common occurrence among youth and limited duration of distress, specific phobias were considered permissible for control participants because the phobia itself is not suggestive of impaired fear conditioning and/or extinction. Control participants primarily served to provide a baseline for typical fear responses to stimuli. While individuals with specific phobia may have an exaggerated fear response to specific stimuli (e.g., dogs, the dark), this exaggerated fear response is restrictive to being in the presence of the specific stimuli. As phobic stimuli were not present in the testing/interview room, it was deemed permissible to include youth with a specific phobia in the control group. However, if a youth's specific phobia caused significant impairment (e.g., fear of going to physician's offices, excessive fear of vomiting), youth were excluded from participation.

Age Appropriate Fear Conditioning Paradigm: This fear conditioning paradigm was selected because of its novel US (i.e., a 95 decibel scream) and demonstrated tolerability in samples of youth. The most common US in adult studies has been electric shock; however, ethical constraints prohibit the use of this US in research with children, While several other US have been evaluated in youth (e.g., loud sounds, unpleasant photographs, air puffs), these US often only elicit a minimal fear response (Grillon et al., 2005). The minimal fear response elicited by these US may comprise the degree of fear conditioning experienced among youth. In comparison to other fear conditioning paradigms, this fear conditioning paradigm paired a facial photograph with a brief 95 decibel scream. The fear conditioning paradigm has been shown to be more aversive than other sounds or air puffs (Lissek, Baas, et al., 2005), and has been found to be tolerable among children who have anxiety disorders (e.g., Lau et al., 2008), as well as healthy control samples of youth (Glenn et al., 2012). As it has been used in studies of anxious youth, it allows for greater generalizability of study findings and facilitates descriptive comparisons been anxious youth and youth with OCD who have completed this paradigm.

Measures

Schedule for Affective Disorders and Schizophrenia for School-Age Children Present and Lifetime Version (KSADS-PL; Appendix A). The KSADS-PL is a clinician-administered diagnostic interview for DSM-IV childhood disorders (Kaufman et al., 1997). The KSADS-PL has excellent inter-rater reliability (ICC = 0.93-1.00), good test-retest reliability (kappa = 0.63-1.00), and exhibits concurrent validity respective rating scales (Kaufman et al., 1997). As there were no significant differences between groups across common co-occurring conditions with OCD (e.g., ADHD, depressive disorders, tic disorders), only the rates of OCD and anxiety disorders are reported below.

Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS; Appendix B). The CY-BOCS is a semi-structured clinician-administered measure of current obsession and compulsion severity (Scahill et al., 1997). The CY-BOCS consists of a symptom checklist and 10 severity items that are summed for a total severity score. The CY-BOCS has demonstrated strong psychometric properties (e.g., inter-rater reliability, internal consistency, test-retest reliability, discriminant validity, convergent validity) in youth between 4 and 18 years of age, and is considered the gold-standard measure for OCD severity in youth (Lewin et al., 2014; Scahill et al., 1997; Storch et al., 2005; Storch et al., 2004).

Demographic Form (Appendix C): Parents completed a demographic form to identify the following information about participating youth: age; gender; race; ethnicity; current psychiatric medication status; prior psychiatric history; and other clinically relevant information.

Child Behavior Checklist (CBCL; Appendix D). The CBCL is a 118-item parent-rated scale that assesses behavioral and emotional functioning across a variety of domains (Achenbach & Rescorla, 2001). Each item is rated on a 3-point Likert scale: *not at all* (0), *sometimes* (1), *all the time* (2). The CBCL produces eight clinical syndrome scales: anxious-depressed, withdrawn, somatic complaints, social problems, thought problems, attention problems, delinquent behavior, and aggressive behavior. The CBCL has demonstrated good reliability, internal consistency, and discriminant validity in youth between 4 and 18 years of age (Achenbach & Rescorla, 2001). For the purposes of the exploratory aims, only the association between the CBCL Anxious-Depressed scale score was examined in relation to fear

conditioning and extinction.

Multidimensional Anxiety Scale for Children (MASC; Appendix E). The MASC is a 39-item child-report questionnaire that assesses symptoms of general, social, and separation anxiety (March, Parker, Sullivan, Stallings, & Conners, 1997). Items are rated on a 4-point Likert-scale that ranges from *never true* (0) to *often very true about me* (3). Items are rated on a 4-point scale from 0 (never true) to 3 (often very true). Items are summed to produce a total anxiety severity score that is adjusted for age and gender (T-score). The MASC has demonstrated good reliability and validity in children between 8 and 17 years of age (March et al., 1997) .

Anxiety Sensitivity Index-3 (ASI-3; Appendix F).The ASI-3 is an 18-item self-report measure that assessed beliefs about the feared consequences of symptoms associated with anxious arousal (e.g., "it scares me when I become short of breadth") (Taylor et al., 2007). The 18-items are summed to produce a total anxiety sensitivity score. The ASI-3 has good reliability and validity in national and international samples (Taylor et al., 2007).

Obsessive-Compulsive Inventory-Child Version (OCI-CV; Appendix G). The OCI-CV is a 21-item child-report measure that assessed the presence and frequency of OCD symptoms, with items rated on a 0 (never) to 2 (always) scale (Foa et al., 2010). The OCI-CV includes six subscales (doubting/checking, obsessions, hoarding, washing, ordering, and neutralizing) that are summed to yield a total score. The OCI-CV had demonstrated good reliability (e.g., internal consistency, test-retest reliability) and validity (convergent validity, discriminant validity) in samples of youth with OCD (Foa et al., 2010; Jones et al., 2013).

Fear Conditioning Computer Task and Self-Report Rating (Appendix H and I). A differential fear conditioning procedure was administered, whereby a 95 decibel scream (US) was paired with a female face (CS+) and not with a second female face (CS-) (Lau et al., 2008). During a habituation phase, participants passively viewed 4 presentations each of the to-be CS+ and CS- without the US. Duration of the CS+ and CS- were 8 seconds and the inter-trial interval ranged from 12-18 seconds. After the habituation phase and prior to the acquisition phase, participants were asked to indicate on a 10-point

Likert scale the degree to which they felt afraid of each face. During the acquisition phase, the CS+ female face was paired with the US for 8 of 10 presentations; however, the CS- female face was never paired with the US for any of the 10 presentations. The US duration was 3 seconds; its onset immediately followed offset of the CS+. After the acquisition phase and prior to the extinction phase, participants were asked again to indicate the degree to which they felt afraid of each face on a 10-point Likert scale. During the extinction phase, there were 8 presentations each of the CS+ and CS- in the absence of the US. After the extinction phase, participants were asked indicate the degree to which they felt afraid of each face on the 10-point Likert scale. This differential conditioning task has been used in studies with children who have anxiety disorders (e.g., Lau et al., 2008), as well as healthy control samples of youth (Glenn et al., 2012) and adults (Haddad, Xu, Raeder, & Lau, 2013). The methodology associated with this paradigm has been shown to be ecologically-valid and well-tolerated by anxious youth, and avoids the safety and ethical issues related to more aversive unconditioned stimuli (e.g., electric shocks). Although collecting both physiological and subjective ratings, SCR served as the primary dependent measure of fear acquisition and extinction.

Analytic Plan

Descriptive statistics were used to characterize the sample on relevant demographic and clinical characteristics. Chi-square and independent sample t-test were used to evaluate difference between OCD and community control participants on categorical and continuous characteristics. Following the method used by Orr and colleagues (Orr et al., 2000), a SCR score for each CS presentation was calculated by subtracting the average SC level during the 2-second interval immediately preceding CS onset from the peak SC level during the 8-second CS interval. A SCR score for each US presentation was calculated by subtracting the average SC level during the last 2 seconds of the CS interval from the peak SC level during the 6-second interval following US onset. A square-root transformation was applied to the absolute values of all SCRs prior to analysis. If an SCR was negative, the minus sign was replaced following the square-root transformation. Four participants had unreliable SC recordings and 4 additional participants had a small mean SCR value for the US (mean SCR values: 0.00, 0.03, 0.23, 0.46 μS). Trial-block scores were created by calculating the average SCR to successive blocks of 2 trials of the same trial type. This produced 2 blocks each for the CS+ and CS- for the habituation phase, 5 blocks for the acquisition phase, and 4 blocks for the extinction phase. Independent sample t-tests were used to compare the orienting responses to the first presentation of the CS+ and CS- between groups. Consistent with previous work (Lau et al., 2008; Orr et al., 2000), a repeated measures analysis of variance (ANOVA) was conducted with diagnostic group (OCD, community control) as a between-group factor, stimulus type (CS+, CS-) as a within-group factor, and trial block as the repeated measure for each phase (habituation, acquisition, and extinction. Follow-up polynomial contrasts were used to examine the trends of significant main effects and interactions (e.g., linear, quadratic, cubic). The unconditioned response to the US (scream) was compared between groups using an independent samples t-test and a repeated-measure ANOVA, with

diagnostic group (OCD, community controls) as a between-group factor and trial block as the repeated measure. Follow-up polynomial contrasts were used to examine the trends of significant main effects and interactions (e.g., linear, quadratic, cubic). For all repeated measure ANOVAs, significance levels reflect the Greenhouse-Geisser correction for sphericity. Given that age may influence fear conditioning and extinction (Jovanovic et al., 2014), analyses were re-conducted using only the participants who were matched for gender and age within two years (n = 38, 19 OCD, 19 community controls). As there were no appreciable differences in study findings between approaches, only the former are presented. Pearson correlations examined the association between the average SCR magnitude to stimuli during the extinction phase, subjective fear ratings to stimuli after extinction, and OCD severity on the CY-BOCS.

For exploratory aims, a repeated measure ANOVA examined subjective fear ratings across the three conditioning phases. For this analysis, diagnostic group (OCD, community control) served as the between-group factor, stimulus type (CS+, CS-) served as the within-group factor, and phase (habituation, acquisition, and extinction) served as the repeated measure. Follow-up polynomial contrasts were used to examine the trends of significant main effects and interactions (e.g., linear, quadratic, cubic). Next, Pearson correlations examined associations between clinical characteristics (CY-BOCS total score, CBCL Anxious/Depressed scale, ASI-3 total score, OCI-CV total score, and MASC Total T-score) and the following measures of fear conditioning using SCRs: acquisition (change in SCR from last habituation trial block to last two acquisition trial blocks); early extinction (change in SCR from the last two acquisition trial blocks to first two extinction trial blocks); late extinction (change in SCR from the last two acquisition trial blocks to last two extinction trial blocks); differential response in acquisition (SCR difference score between CS+ and CS- for last two trial blocks during acquisition); differential response in early extinction (SCR difference score between CS+ and CS- for first two trial blocks during extinction); and differential response in late extinction (SCR difference score between CS+ and CS- for last two trial blocks during extinction). Finally, Pearson correlations examined associations between clinical characteristics (CY-BOCS total score, CBCL Anxious/Depressed scale, ASI-3 total score, OCI-CV total score, and MASC Total T-score) and the following measures of fear conditioning using

subjective fear ratings to the CS+ and CS-: acquisition (change in self-reported fear ratings from habituation to acquisition); extinction (change in self-reported fear ratings from acquisition to extinction); differential response after acquisition (self-reported fear rating difference score between CS+ and CS- after acquisition); differential response after extinction (self-reported fear rating difference score between CS+ and CS- after extinction). Consistent with other analyses of fear conditioning in youth (Lau et al., 2008; Liberman et al., 2006; Shechner, Britton, et al., 2014), no missing data imputation strategies were used and statistical significance was set at $p = 0.05$.

Results

Participants

Sample characteristics are presented in Table 1.The two groups did not differ in age or gender, with a non-significant trend towards fewer Caucasians among community controls (OCD group = 95% white; community control group = 73% white; $\chi^2 = 3.49$, $p = 0.06$). Figure 1 presents the results of fear conditioning and extinction for participants across all three phases.

Habituation Phase

When examining participants' orienting response, there was no significant difference in the magnitudes of the skin conductance orienting responses between youth with OCD ($M = 0.75$, $SD = 0.40$) and community controls ($M = 0.71$, $SD = 0.35$; $t_{39} = 0.34$, $p = 0.74$, $d = 0.11$) for the first CS+ presentation, or the first CS- presentation (OCD: $M = 0.50$, $SD = 0.38$; community control: $M = 0.48$, $SD = 0.39$; $t_{39} = 0.21$, $p = 0.84$, $d = 0.05$).

Table 2 provides results from repeated measures ANOVA for the habituation phase. There was a main effect for trial block that approached significance and reflected larger SCRs to the first trial block compared to the second trial block (see Figure 2). Additionally, there was a significant stimulus x trial block interaction. As illustrated in Figure 2, this interaction reflects a greater decrease in SCR magnitude for the CS+ from trial block 1 to trial block 2. Given that the soon-to-be CS+ was always the first stimulus to be presented, it is not surprising that there would be a larger initial response and larger subsequent decrease as participants habituate to its novelty. No other main effects or interactions were significant.

Acquisition Phase

As seen in Table 2, there was a significant stimulus main effect that reflected robust differential conditioning as indicated by larger SCRs to the CS+ (M = 0.53, SD = 0.29) compared to CS- (M = 0.40, SD = 0.24). This stimulus main effect was best characterized by a linear trend (F = 9.80, p = 0.003). There was also a significant main effect for trial block suggesting that SCR magnitudes differed across trials (see Figure 3). This effect was best characterized by a quadratic trend (F = 24.19, $p < 0.001$). Although youth with OCD (M = 0.53, SD = 0.26) appeared to produce somewhat larger SCRs to the CSs overall relative to community controls (M = 0.42, SD = 0.19), the group main effect only trended toward significance (see Table 2). There was a significant stimulus x trial block interaction, suggesting that SCR magnitudes to the CS+ and CS- differed across trial blocks (see Figure 3). This interaction was best characterized by a quadratic trend (F = 15.08, $p < 0.001$).

Figure 4 presents participants response to the US (a 95 decibel scream) in the acquisition phase. No significant difference was found in the averaged SCR magnitude to the US between youth with OCD (M = 1.14, SD = 0.37) and community controls (M = 1.06, SD = 0.30) for CS+ trials paired with the US (t_{39} = 0.74, p = 0.46, d = 0.24). There was a significant main effect for trial block (F = 6.46, $p < 0.001$, η^2_p = 0.14) that suggests that participants' responses to the US decreased over repeated trials (see Figure 4). The significant main effect for trial block was best characterized by a linear trend (F = 11.41, p = 0.002). The main effect for group ($F < 1.0$, *ns*) and the group x trial block interaction ($F < 1.0$, *ns*) were not significant.

Extinction Phase

As seen in Table 2, there was a significant stimulus main effect, with the CS+ (M = 0.49, SD = 0.29) exhibiting larger magnitude SCRs compared to the CS- (M = 0.40, SD = 0.25). This stimulus main effect was best characterized by a linear trend (F = 4.49, p = 0.04). The group x stimulus x trial block interaction approached significance and reached significance when only the age-and-gender matched samples were included in the analysis (n = 38; F = 2.72, p = 0.05, η^2_p = 0.07). This three way interaction was best characterized by a linear trend (F = 7.08, p = 0.01). When the groups were examined separately,

an interesting pattern emerged (see Table 3). For community controls, differential fear conditioning was observed throughout extinction as evidenced by a significant stimulus main effect. Meanwhile for youth with OCD, a significant stimulus x trial block interaction was observed suggesting that the pattern of response to stimuli varied across trials. This interaction was best characterized by a linear trend ($F = 9.97$, $p = 0.005$). As seen in Figure 5, youth with OCD exhibited greater SCR to the CS- during the early extinction blocks that eventually diminished to comparable levels with community controls by the last trial block. Meanwhile, youth with OCD exhibited lower SCR to the CS+ during the first trial block, but demonstrated increasing SCR over successive trials that persisted through the last trial block (see Figure 5).

Correlations between SCR, Self-report Fear Ratings, and OCD Severity

A significant positive relationship between stimuli were found for each measurement type across participants (SCR: $r_{41} = 0.50$, $p < 0.001$; subjective self-report: $r_{41} = 0.61$, $p < 0.001$). Despite this strong within measurement association, no significant relationship was found between the magnitude of SCR to stimuli and subjective self-report to stimuli for either the CS+ ($r_{41} = -0.02$, $p = 0.91$) or the CS- ($r_{41} = 0.05$, $p = 0.77$) across participants. When examining the association with OCD severity for youth with OCD, no significant relationship was found between OCD severity and the averaged magnitude of SCR to either the CS+ ($r_{19} = -0.08$, $p = 0.74$) or CS- ($r_{19} = -0.02$, $p = 0.92$). Similarly, no significant relationship was found between OCD severity and self-report fear ratings to either the CS+ ($r_{19} = 0.05$, $p = 0.83$) or CS- ($r_{19} = 0.10$, $p = 0.70$).

Self-report Fear Ratings

Table 4 provides results from repeated measures ANOVA for self-report fear ratings across all three phases. There was a significant main effect for stimulus, with the CS+ ($M = 2.54$, $SD = 2.38$) exhibiting greater responses relative to the CS- ($M = 1.73$, $SD = 2.11$) (see Figure 6). The significant main effect for stimulus was best characterized by a linear trend ($F = 11.42$, $p = 0.002$). There was also a significant main effect for phase showing that participant's responses to stimuli varied across phases (see Figure 6). The main effect for phase was best characterized by a quadratic trend ($F = 10.00$, $p = 0.003$).

There was also a significant stimulus x phase interaction, with participants' responses to stimuli varying across phases (see Figure 6). The stimulus x phase interaction was best characterized by a quadratic trend ($F = 16.04$, $p < 0.001$). The group x phase interaction trended towards significance ($p = 0.07$), suggesting a potential difference in youth with OCD and community controls subjective responses across phases (see Figure 6). No other main effects or interactions were significant.

SCR Correlations of Fear Acquisition, Fear Extinction, and Differential Response

Table 5 presents SCR correlations of fear acquisition, fear extinction, and differential response. Across all participants, there was a moderate positive association between SCR magnitude to the CS+ during fear acquisition and OCI-CV total score. During early extinction, there were significant negative correlations between SCR magnitude to the CS+ and both the ASI-3 total score and the OCI-CV total score. Additionally, there was a negative association between the early extinction differential SCR and CY-BOCS severity score and the ASI-3 total score. During late extinction, SCR magnitude to the CS+ was negatively associated with the OCI-CV total score.

Self-report Correlations of Fear Acquisition, Fear Extinction, and Differential Response

Table 6 presents subjective self-reported fear correlations with fear acquisition, fear extinction, and differential response. Across all participants, there was a moderate positive association between self-reported fear ratings to the CS- during fear acquisition and ASI-3 total score (see Table 5). For fear extinction, there was a moderate positive association between self-reported fear ratings to the CS+ and OCI-CV total score.

Discussion

This study examined differential fear conditioning in youth with OCD relative to healthy community controls, and explored clinical characteristics associated with fear acquisition, fear extinction, and differential response to conditioned stimuli. Several interesting findings emerged. First, contrary to the proposed hypothesis, there was no significant difference in fear acquisition between groups. Although there was a trend towards greater SCR response by youth with OCD relative to community controls, it did not reach statistical significance. This finding is consistent with the adult OCD fear conditioning literature (Milad et al., 2013; Nanbu et al., 2010), and broadly suggests that youth with OCD and community controls acquire conditioned fear in a similar manner and magnitude.

Second, consisted with the proposed hypothesis, youth with OCD exhibited a different fear extinction pattern relative to healthy community controls. Community controls retained differential fear conditioning throughout extinction. Although persistent differential fear conditioning throughout extinction is not always observed among healthy control participant groups (Shechner, Hong, et al., 2014), it is consistent with observations from studies that used the same conditioning paradigm (Lau et al., 2008). Meanwhile, youth with OCD showed a reversal of SCRs to the CS+ and CS- during early extinction followed by increased SC reactivity to the CS+ and decreased reactivity to the CS- over later extinction trials. This finding suggests the presence of impaired inhibitory learning during extinction among youth with OCD, which has been hypothesized to be central in the pathology of related fear-based psychopathology (e.g., anxiety disorders) (Craske et al., 2009; Lissek, Powers, et al., 2005). While initial CBT models emphasized within-and-between session habituation as the central mechanism for CBT (Foa & Kozak, 1986), inhibitory learning may be a key therapeutic component for youth with anxiety disorders and OCD (Craske, Liao, Brown, & Vervliet, 2012; Craske, Treanor, Conway, Zbozinek, & Vervliet,

2014). Indeed, within-and-between session habituation in CBT has not been found to predict treatment outcome for youth with OCD (Kircanski & Peris, 2015; Kircanski, Wu, & Piacentini, 2014). This inhibitory learning deficit may explain disparate exposure-based CBT outcomes among youth with OCD. For example, standard CBT protocols are on based on normal patterns of fear acquisition and extinction, which suggests that youth are able to accurately discriminate between feared stimuli and repeated exposure strengthen the CS-no US association. However, inhibitory learning deficits observed during extinction suggests that youth with OCD do not necessarily accurately discriminate between feared stimuli during extinction, and thus, may not form the appropriate CS-no US association. Moreover, youth with OCD may also generalize the CS-US association to related stimuli (e.g., CS-) as evidenced by the "chain of contagion" (Tolin et al., 2004). Thus, youth with OCD may benefit from CBT protocols that optimize inhibitory learning during extinction to maximize therapeutic outcomes relative to standard habituation-based approaches (Craske et al., 2014).

Third, it was hypothesized that there would be a significant positive relationship between the magnitude of SCRs to stimuli and subjective self-reported fear ratings to the CS+ and CS-. Although strong agreement was observed within measurement type, there was no significant association between these measures for either the CS+ or CS-. Poor agreement across measurement methodology in fear conditioning studies (e.g., SCR, subjective self-report ratings, heart rate, electromyography) has been observed across multiple studies of anxious youth and healthy community control samples (Shechner, Hong, et al., 2014). Given that youth displayed appropriate fear conditioning for SCR, this may suggest that youth have either poor insight or greater difficulty completing subjective fear ratings on a 10-point Likert scale that lack definitive anchor points. Irrespective of the cause of this disagreement, it highlights the importance of multiple forms of measurement when conducting fear conditioning research with youth.

Fourth, contrary to the proposed hypothesis, there was no significant association between the magnitude of SCR to stimuli (CS+ and CS-) with OCD severity among youth with OCD in the extinction phase. Similarly, contrary to the final proposed hypothesis, there was no significant association between subjective self-reported fear ratings to stimuli (CS+ and CS-) after the extinction phase and OCD severity

among youth with OCD. Collectively, these two findings suggest that the magnitude of fear extinction to either SCR or subjective fear ratings was not associated with OCD severity. This finding may suggest that OCD severity is independent of conditioned fear to stimuli, but could be explained in other ways. For instance, the measure of OCD severity (the CY-BOCS) relied on both parent and youth informants, whereas either measure of conditioned fear was solely dependent on youth as informants. Indeed, some research suggests poor agreement between parents and youth with OCD (Canavera, Wilkins, Pincus, & Ehrenreich-May, 2009). Thus, the lack of an observed relationship between conditioned fear and OCD severity may be attributed to a measurement artifact rather than a true lack of association. However, future research should investigate these associations in greater detail.

In addition to the primary hypotheses, the following exploratory aims were examined. First, group differences in fear conditioning and extinction were examined using participants' subjective fear ratings to stimuli across all three phases. The significant main effects for stimulus and phase, as well as the significant stimulus x phase interaction are typical of differential fear conditioning paradigm studies. Collectively, these effects suggest that participants responded differently to stimuli across the three phases. Although a trend emerged for the group x phase interaction, it did not reach statistical significance ($p = 0.07$). Taken together, these findings suggest minimal difference between youth with OCD and healthy community control participants on subjective fear ratings to stimuli. While this may be attributed to poor insight and/or difficulty rating subjective measures of fear, it could also be attributed to the fact that only a single rating was obtained for each phase. Thus, the nuanced relationship observed in SCR that developed over multiple trials did not have the opportunity fully manifest within these single ratings.

Second, the association of SCR and parent-reported anxiety/depression, child-reported anxiety, anxiety sensitivity, the number and frequency of OCD symptoms, and OCD severity was explored. The number and frequency of OCD symptoms (the OCI-CV total score) were found to be associated with greater fear acquisition to the CS+, diminished fear extinction to the CS+, and have no association with reactivity to the CS-. This suggests that youth with a greater number and frequency of OCD symptoms experienced a greater persistence of the conditioned response to the CS+ and provides empirical support

for the association of OCD phenomenology with greater "conditionability" and resistance to extinction. This also highlights the relevance of assessing the number and frequency of OCD symptoms, which are often overlooked in treatment outcome studies in lieu of global OCD severity ratings. Additionally, greater OCD severity was associated with smaller differential SCR scores during early extinction. A smaller differential SCR suggests that the individual responded similarly to the fear (CS+) and safety (CS-) cues during early extinction, which may reflect impaired inhibitory learning. The magnitude of differential SCR was negatively associated with OCD severity, one of the few replicated predictors of poor CBT response (Garcia et al., 2010; Ginsburg, Kingery, Drake, & Grados, 2008), suggesting a possible link between impaired inhibitory learning and diminished CBT response. When examining the association between anxiety symptom severity and fear acquisition and extinction across participants, no significant association was observed for either parent-reported anxiety/depression on the CBCL or child-reported anxiety on the MASC. This suggests that the present findings are not driven by underlying anxiety severity. Given that the findings from SCR outcomes are consistent with studies of youth with anxiety disorders relative to healthy community controls (Lau et al., 2008), this similar pattern of results highlights the shared mechanistic pathology implicated in fear-based disorders. Interestingly, youth with higher anxiety sensitivity scores showed poorer extinction of SCRs to the CS+ and poorer discrimination of the CS+ and CS-. Given the prior association observed between anxiety sensitivity and obsessive-compulsive symptoms in adults (Wheaton, Mahaffey, Timpano, Berman, & Abramowitz, 2012), there may be an overlap between these two constructs that warrants further examination.

Finally, the association between subjective fear ratings and parent-reported anxiety/depression, child-reported anxiety, anxiety sensitivity, the number and frequency of OCD symptoms, and OCD severity was explored. There was a moderate positive association between subjective fear acquisition to the CS- and anxiety sensitivity. This likely suggests that youth with greater anxiety sensitivity may be more prone to generalizing fear to other stimuli during fear acquisition. There was also a moderate positive relationship observed between subjective fear extinction to the CS+ and the number and frequency of OCD symptoms. This is somewhat contradictory to the findings from SCR analyses, and

may be attributed to poor insight and/or difficulty making ratings on subjective measures of fear that offer minimal anchor points. Similar to the association with SCR ratings, there was no association between either parent-report anxiety/depression on the CBCL or child-reported anxiety severity on the MASC and subjective self-reported fear ratings in acquisition and extinction. Furthermore, OCD severity was not associated with subjective self-reported fear ratings in acquisition and extinction.

Limitations

Several limitations to the reported work should be considered. First, this study had a small sample size. Although similar in size to adult OCD studies (Milad et al., 2013), results that trended towards statistical significance may be more robust in a larger sample. Second, this study set statistical significance at $p = 0.05$ *a priori* due to the nascent nature of this examination and did not employ a missing data imputation strategy. Although these decisions are consistent with other examinations fear conditioning in youth (Lau et al., 2008; Liberman et al., 2006; Shechner, Britton, et al., 2014), they may have had a minor influence on significance values, but would not have influenced the overall magnitude of effects observed in this study. Finally, the magnitude of conditioning can be influenced by study specific methodology (e.g., paradigm, UCS, sample characteristics) (Shechner, Hong, et al., 2014). Thus, findings from the present study may limited to the specific conditioning procedure and sample characteristics reported here.

Implications and Future Directions

In summary, youth with OCD exhibit normal acquisition but impaired differential fear extinction of a fear-conditioned SCR. This pattern is suggestive of impaired inhibitory learning. The number and frequency of OCD symptoms were associated with greater fear acquisition to the CS+ and persistence of the conditioned SCR to the CS+ during extinction. Also, with greater OCD symptom severity was associated with poorer discrimination between the CS+ and CS- in early extinction. These initial findings highlight several future directions for OCD research. First, given variable findings during extinction in fear conditioning studies of youth with anxiety disorders (Shechner, Hong, et al., 2014), replication and extension of these findings is warranted. Second, it would be informative to further examine the role of

anxiety sensitivity in OCD. Although briefly examined in adults with OCD (Taylor et al., 2007) and included in the current study, its investigation in youth and role in treatment is largely unknown and needs further exploration. Third, given the poorer discrimination of the CS+ and CS- observed in the early extinction trials, the use of attention/cognitive bias modification protocols may be of benefit prior to CBT in order to normalize the deficits and improve threat recognition. Although attention/cognitive bias modification protocols have shown some benefit as stand-alone interventions (Salemink, Wolters, & de Haan, 2015), it may exhibit greater benefit when preceding and/or augmenting CBT (Rozenman, Weersing, & Amir, 2011; Shechner, Rimon-Chakir, et al., 2014). Additionally, there is a growing body of evidence highlighting the importance of inhibitory learning in exposure therapy (Craske et al., 2012). Although presently focused on adults with anxiety disorders (Craske et al., 2012), the incorporation of inhibitory-learning based CBT may prove beneficial to strengthen observed inhibitory deficits and maximize the therapeutic benefit for youth with OCD (Craske et al., 2014). As youth and adults exhibited neurobiological differences fear extinction circuitry (Lau et al., 2011), future exposure-based CBT protocols should attempt to engage developmentally appropriate fear circuitry during exposures. For example, as fear extinction during memory reconsolidation diminishes prefrontal cortex involvement (Schiller, Kanen, LeDoux, Monfils, & Phelps, 2013), extinction should be attempted to occur within the memory reconsolidation window to engage amygdala and hippocampus regions utilized in adolescent fear extinction relative to adults, who rely more on prefrontal cortex for fear extinction.

Tables and Figures

Table 1.
Characteristics For Youth with OCD and Community Controls (N=41)

	OCD Group (*n*=19)	**Community Control Group (*n*=22)**		
	N (%)	**N (%)**	**χ^2**	***p***
Male Participants	10 (53%)	10 (45%)	0.21	0.65
Race/Ethnicity				
White/Caucasian	18 (95%)	16 (73%)	3.49	0.06
Non-Hispanic	17 (89%)	21 (95%)	0.54	0.46
Psychiatric Diagnoses				
OCD	19 (100%)	0 (0%)	41.00	< 0.01
Any Anxiety Disorder[a]	6 (32%)	6 (27%)	0.09	0.76
Psychiatric Medication				
SRI	8 (42%)	0 (0%)	11.51	< 0.01
Antipsychotic	2 (11%)	0 (0%)	2.44	< 0.01
	Mean (SD	**Mean (SD**	***t***	***p***
Age	13.26 (3.07)	12.59 (2.24)	0.81	0.43
CY-BOCS Total Score	23.42 (6.31)	0.00 (0.00)	16.18	< 0.01
CBCL Anxious/Depressed Scale	67.00 (10.41)	51.41 (3.42)	6.64	< 0.01
OCI-CV Total Score[b]	14.33 (7.78)	9.32 (4.59)	2.41	0.02
MASC Total T-Score[c]	55.53 (17.07)	50.56 (8.58)	1.03	0.31
ASI-3Total Score[d]	12.60 (11.98)	9.55 (7.56)	0.88	0.39

Note: OCD=Obsessive Compulsive Disorder; SRI=Serotonin Reuptake Inhibitor; CY-BOCS=Children's Yale-Brown Obsessive Compulsive Scale; CBCL=Child Behavior Checklist; OCI-CV=Obsessive Compulsive Inventory-Child Version; MASC=Multidimensional Anxiety Scale for Children; ASI-3=Anxiety Sensitivity Index-3rd Edition

[a]Any Anxiety Disorder Specific Phobia, Social Anxiety Disorder, Generalized Anxiety Disorder, Separation Anxiety Disorder, or Anxiety Disorder Not Otherwise Specified. Community Controls only had Specific Phobias.

[b] 1 participant did not complete the OCI-CV

[c] 2 participants did not complete the MASC

[d] 4 participants did not complete the ASI-3

Table 2.
ANOVA results for Comparisons of SC Responses For All Three Phases (N=41)

HABITUATION PHASE	**F**	***p***	η^2_p
Group	< 1.00	NS	0.01
Stimulus	< 1.00	NS	< 0.01
Trial Block	3.84	0.06	0.09
Stimulus x Trial Block	9.19	0.004	0.19
Group x Stimulus	1.34	0.26	0.03
Group x Trial Block	< 1.00	NS	0.02
Group x Stimulus x Trial Block	< 1.00	NS	< 0.01
ACQUISITION PHASE	**F**	***p***	η^2_p
Group	2.59	0.12	0.06
Stimulus	9.80	0.003	0.20
Trial Block	5.60	0.002	0.13
Stimulus x Trial Block	6.18	< 0.001	0.14
Group x Stimulus	< 1.00	NS	0.01
Group x Trial Block	1.87	0.14	0.05
Group x Stimulus x Trial Block	1.25	0.29	0.03
EXTINCTION PHASE	**F**	***p***	η^2_p
Group	1.48	0.23	0.04
Stimulus	4.49	0.04	0.10
Trial Block	1.66	0.19	0.04
Stimulus x Trial Block	2.26	0.09	0.06
Group x Stimulus	1.24	0.27	0.03
Group x Trial Block	< 1.00	NS	0.02
Group x Stimulus x Trial Block	2.54	0.06	0.06

Table 3.
SC Response Separated by Diagnostic Group During Extinction Phase

Youth with OCD (*n*=19)	**F**	***p***	**η^2_p**
Stimulus	< 1.00	NS	0.03
Trial Block	1.15	0.34	0.06
Stimulus x Trial Block	4.34	0.01	0.19
Community Controls (*n*=22)	**F**	***p***	**η^2_p**
Stimulus	4.94	0.04	0.19
Trial Block	1.22	0.31	0.06
Stimulus x Trial Block	< 1.00	NS	< 0.01

Table 4.
ANOVA Results for Comparisons of Self-report Fear Ratings Across all Phases (N=41)

	F	***p***	η^2_p
Group	0.16	0.70	0.004
Stimulus	11.42	0.002	0.24
Phase	8.43	0.001	0.19
Stimulus x Phase	15.88	<0.001	0.31
Group x Stimulus	2.79	0.10	0.07
Group x Phase	2.91	0.07	0.08
Group x Stimulus x Phase	1.60	0.21	0.04

Table 5.

Correlations Between Clinical Characteristics and Acquisition, Extinction and Generalization Across Participants (N=41) Using SCR

	ACQUISITION			EARLY EXTINCTION			LATE EXTINCTION		
Clinical Characteristic	CS+	CS-	DIFF	CS+	CS-	DIFF	CS+	CS-	DIFF
CY-BOCS Total Score	-0.15	< -0.01	0.10	-0.23	0.26	-0.43**	0.04	0.05	0.08
CBCL Anxious/Depressed	-0.01	-0.06	0.17	-0.11	0.27[b]	-0.24	-0.02	0.14	0.03
MASC Total T-Score	0.24	-0.02	0.13	-0.31[a]	0.09	-0.21	-0.10	-0.06	0.13
ASI-3 Total Score	0.12	0.08	0.11	-0.45**	0.13	-0.39*	-0.31[a]	-0.11	-0.01
OCI-CV Total Score	0.42**	0.16	0.18	-0.42**	0.06	-0.21	-0.33*	-0.10	0.03

*p<0.05, ** p<0.01, [a]p=0.06, [b]p=0.08

Note: CY-BOCS=Children's Yale-Brown Obsessive Compulsive Scale; CBCL=Child Behavior Checklist; MASC=Multidimensional Anxiety Scale for Children; ASI-3=Anxiety Sensitivity Index-3rd Edition; OCI-CV=Obsessive Compulsive Inventory-Child Version..

Table 6.
Correlations Between Clinical Characteristics and Acquisition, Extinction, and Generalization of Self-report Fear Ratings (N=41)

	ACQUISITION			EXTINCTION		
Clinical Characteristic	CS+	CS-	DIFF	CS+	CS-	DIFF
CY-BOCS Total Score	0.18	0.03	0.20	0.18	0.20	0.25
CBCL Anxious/Depressed	0.23	-0.10	0.23	0.06	0.05	0.20
MASC Total T-Score	0.03	0.17	0.03	0.17	0.26	-0.18
ASI-3 Total Score	0.02	0.37*	-0.02	0.15	0.03	0.02
OCI-CV Total Score	-0.05	-0.12	0.11	0.40*	0.29[a]	0.19

*$p<0.05$, ** $p<0.01$, [a]$p=0.08$

Note: CY-BOCS=Children's Yale-Brown Obsessive Compulsive Scale; CBCL=Child Behavior Checklist; MASC=Multidimensional Anxiety Scale for Children; ASI-3=Anxiety Sensitivity Index-3rd Edition; OCI-CV=Obsessive Compulsive Inventory-Child Version.

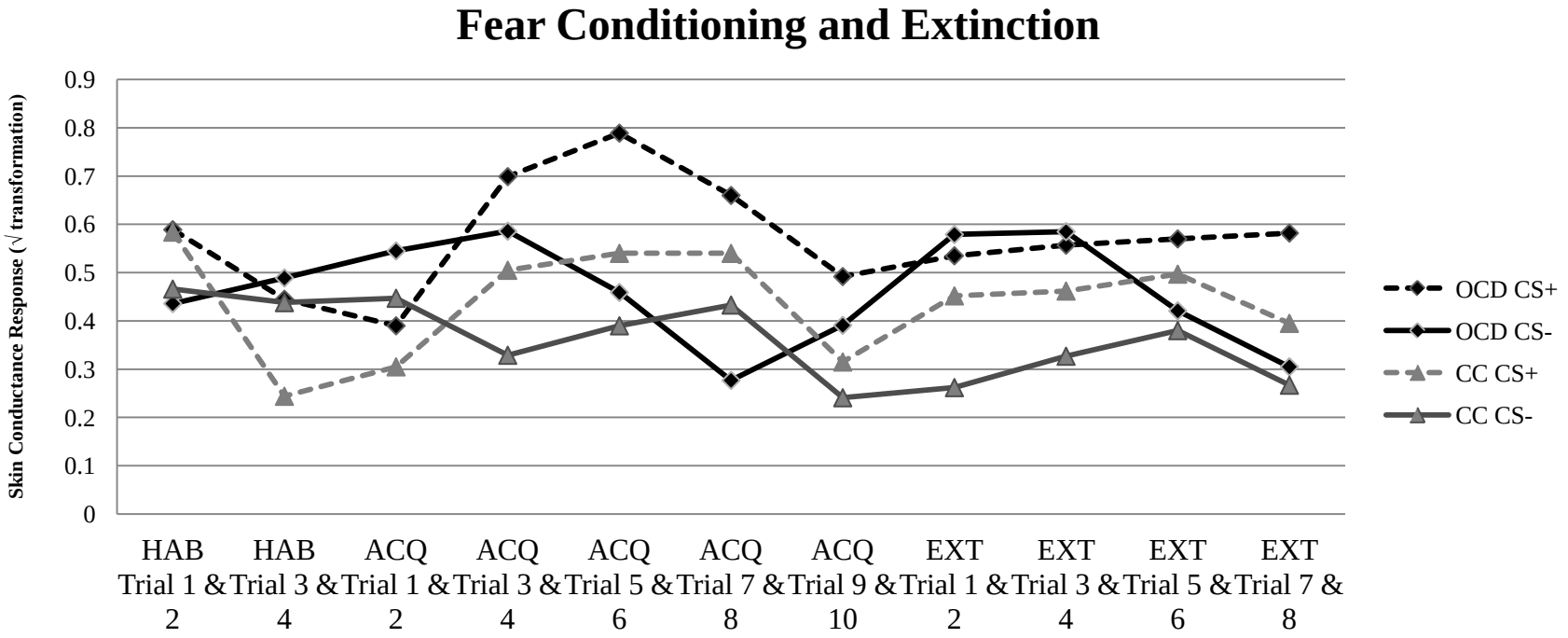

Figure 1. Skin Conductance Responses Across All Three Phases of the Fear Conditioning and Extinction Protocol.

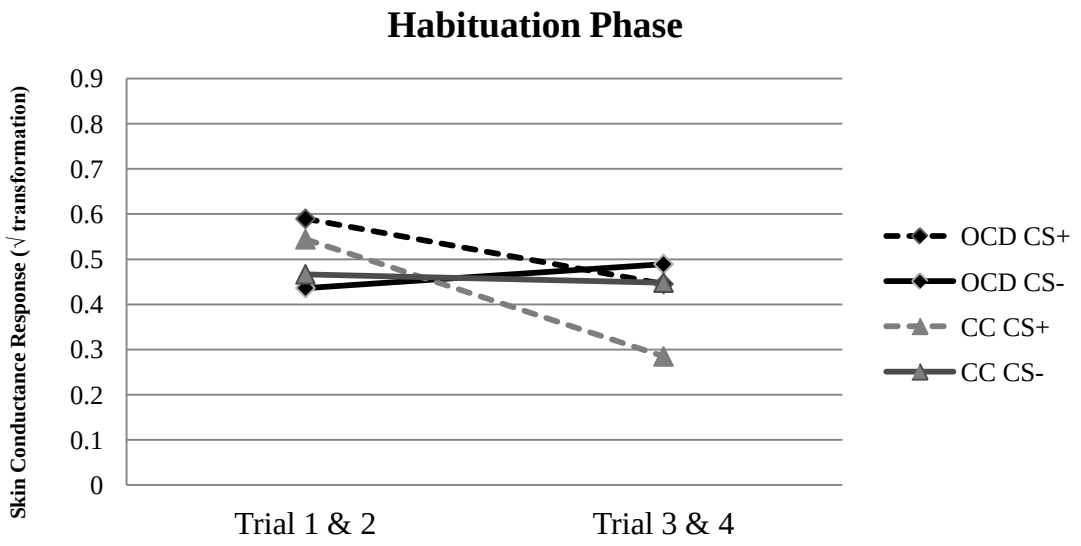

Figure 2. Skin Conductance Responses During Habituation Phase of Fear Conditioning.

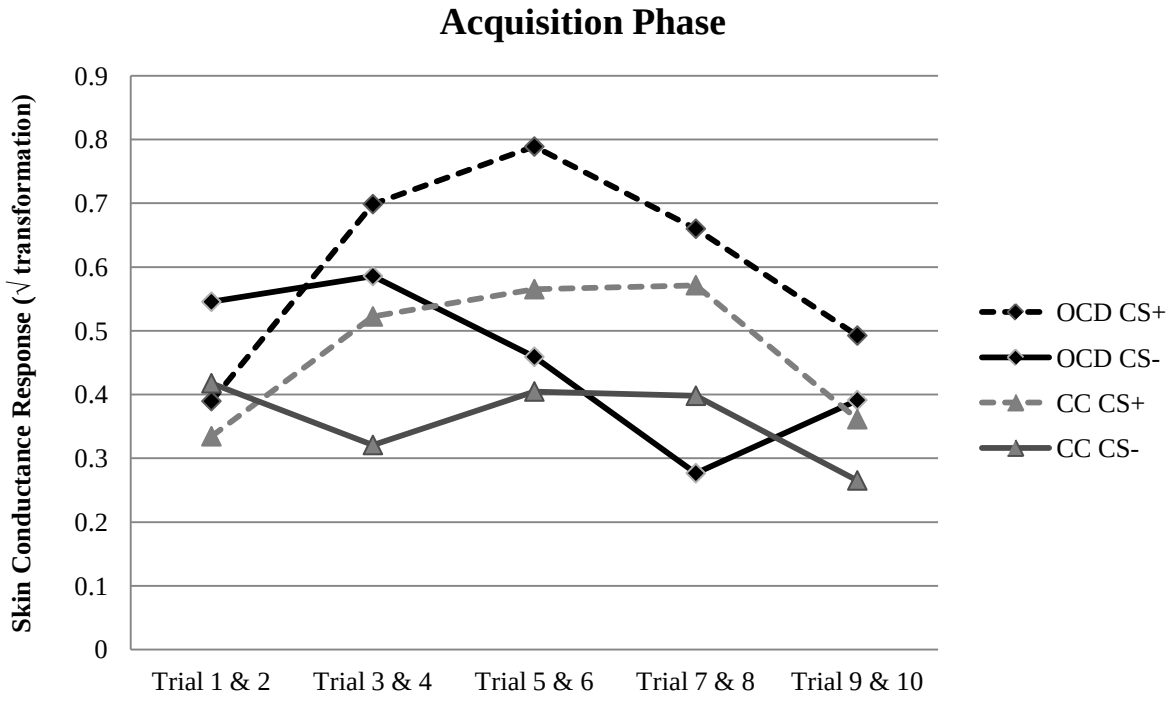

Figure 3. Skin Conductance Responses During Acquisition Phase of Fear Conditioning.

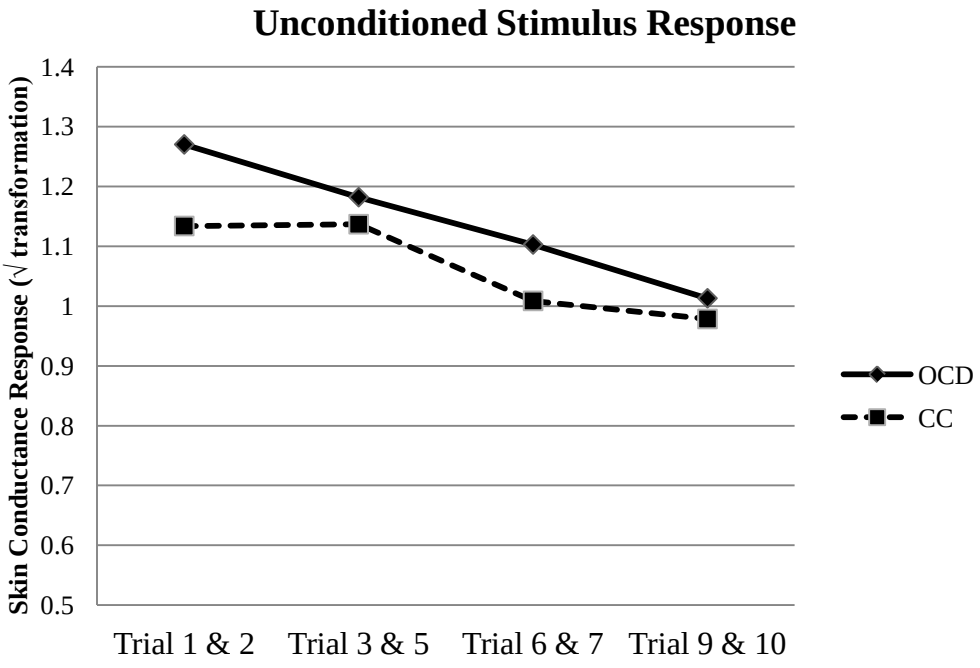

Figure 4. Skin Conductance Responses to Unconditioned Stimulus During Acquisition Phase of Fear Conditioning.

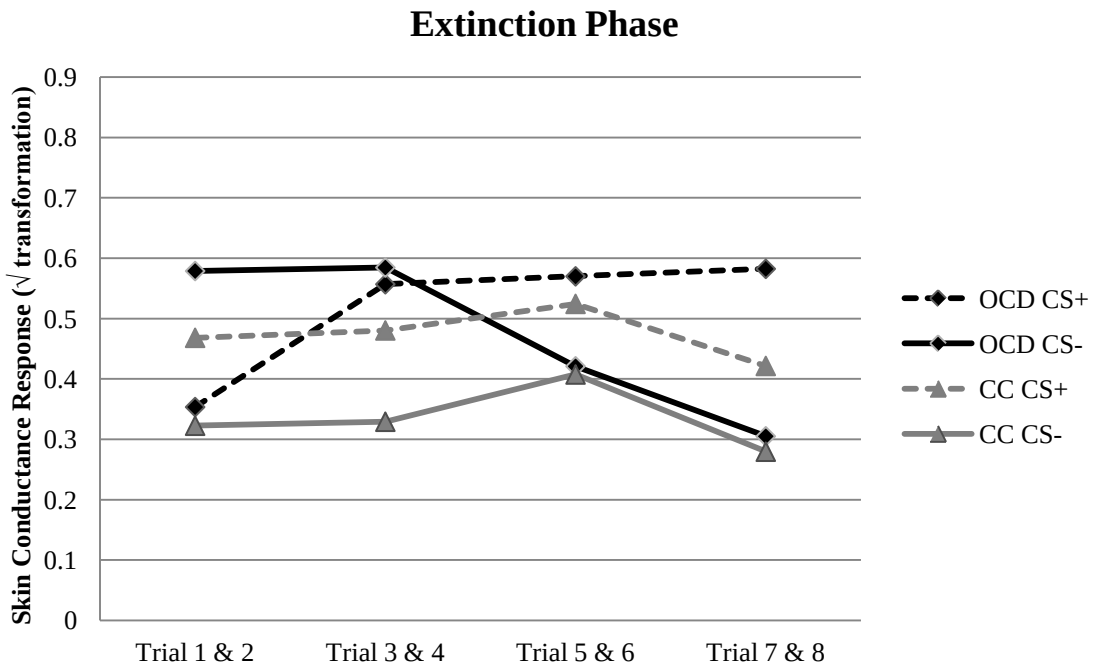

Figure 5. Skin Conductance Responses During Extinction Phase of Fear Conditioning Paradigm.

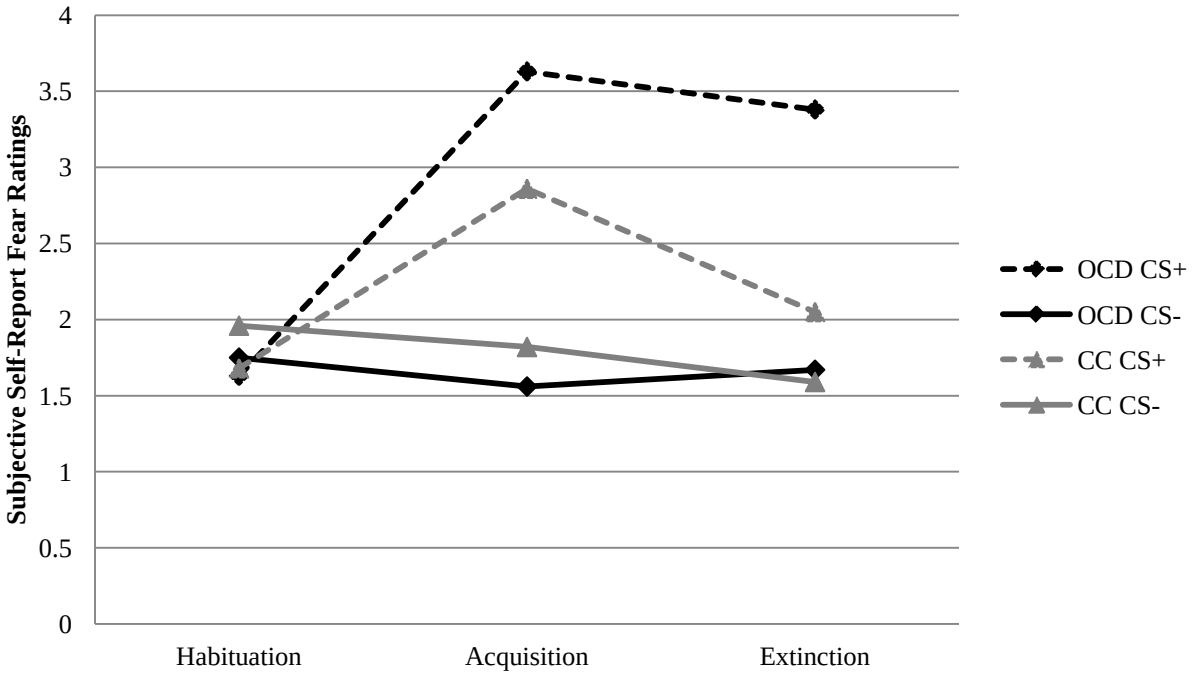

Figure 6. Subjective Fear Report to Stimuli Across Conditioning Phases For All Participants (N=41).

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Appendices

Appendix A: Schedule for Affective Disorders and Schizophrenia for School-Age Children Present and Lifetime Version

Summary Lifetime Diagnoses Checklist

Name _____ Med. Rec. # _____ Date _____ Interviewer _____

No information = 0
Not present = 1
Probable = 2
Partial Remission = 3
Definite = 4

Criteria for Probable Diagnosis

1. Meets criteria for core symptoms of the disorder.
2. Meets all but one, or a minimum of 75% of the remaining criteria required for the diagnosis, and
3. Evidence of functional impairment

	Diagnosis Previous Episode	Age of Onset First Episode	Diagnosis Current Episode	Age of Onset Current Episode	Duration in Months All Episodes	Total Number of Episodes
Major Depressive Disorder*	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Psychotic Features	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Dysthymia	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Depressive Disorder NOS	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Adj. Disorder w Depressed Mood	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Mania	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Hypomania	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Cyclothymia	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Bipolar NOS	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Bipolar I	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Bipolar II	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Schizoaffective Disorder - Manic	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Schizoaffective Disorder - Depressed	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Schizophrenia	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Schizophreniform Disorder	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Brief Reactive Psychosis	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Panic Disorder	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Separation Anxiety Disorder	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Avoidant Disorder of Childhood	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Simple Phobia	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Social Phobia	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Agoraphobia	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Overanxious Disorder	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Generalized Anxiety Disorder	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Obsessive-Compulsive Disorder	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Post-traumatic Stress Disorder	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Acute Stress Disorder	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Adj. Disorder w Anxious Mood	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Enuresis	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Encopresis	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____

NOTE: * = Specify Subtype

	Diagnosis Previous Episode	Age of Onset First Episodes	Diagnosis Current Episode	Age of Onset Current Episode	Duration in Months Episodes	Total Number of Episodes
Anorexia Nervosa	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Bulimia	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Attention Deficit Disorder*	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Conduct Disorder*	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Oppositional Defiant Disorder	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Adj. Disorder w Dist. of Conduct	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Adj. Dis w. Mixed Mood & Conduct	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Tourettes	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Chronic Motor or Vocal Tic Disorder	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Transient Tic Disorder	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Alcohol Abuse	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Alcohol Dependence	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Substance Abuse	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Substance Dependence	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Mental Retardation	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
Other Psychiatric Disorder (specify)	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____
No Psychiatric Disorder	0 1 2 3 4	_____	0 1 2 3 4	_____	_____	_____

Treatment History (Score: 0 = No information, 1 = No, 2 = Yes)

Outpatient Treatment	0 1 2	Antipsychotic (specify)	0 1 2
Age of First Outpatient Treatment	___ ___	Antidepressants (specify)	0 1 2
Total Duration of Outpatient Treatment (weeks)	___ ___	Sedatives of Minor Tranquilizers (specify)	0 1 2
Psychiatric Hospitalization	0 1 2	Stimulants (specify)	0 1 2
Age of First Psychiatric Hospitalization	___ ___	Lithium (specify)	0 1 2
Number of Psychiatric Hospitalizations	___ ___	Other (specify)	0 1 2
Total Duration of Inpatient Treatments (weeks)	___ ___	Current Medication (Specify:)	
		_____	
		_____	

Suicidal Behavior	No	Reliability of Information	
Ideation	____	Good	____
Gesture	____	Fair	____
Attempt	____	Poor	____

Notes:

Appendix B: Children's Yale-Brown Obsessive Compulsive Scale

CHILDREN'S YALE-BROWN OBSESSIVE COMPUSLIVE SCALE

CYBOCS TOTAL (add items 1-10) _____

Patient Name _____ Date _____
Patient ID _____ Rater _____

	None	Mild	Moderate	Severe	Extreme
1. TIME SPENT ON OBSESSIONS	0	1	2	3	4
1b. OBSESSION-FREE INTERVAL	No symptoms	Long	Moderately long	Short	Extremely short
(do not add to subtotal or total score)	0	1	2	3	4
2. INTERFERENCE FROM OBSESSIONS	0	1	2	3	4
3. DISTRESS OF OBSESSIONS	0	1	2	3	4
	Always resists				Completely Yields
4. RESISTANCE	0	1	2	3	4
	Complete control	Much control	Moderate control	Little control	No control
5. CONTROL OVER OBSESSIONS	0	1	2	3	4

OBSESSION SUBTOTAL (add items 1-5) _____

	None	Mild	Moderate	Severe	Extreme
6. TIME SPENT ON COMPULSIONS	0	1	2	3	4
6b. COMPULSION-FREE INTERVAL	No Symptoms	Long	Moderately Long	Short	Extremely Short
(do not add to subtotal or total score)	0	1	2	3	4
7. INTERFERENCE FROM COMPULSION	0	1	2	3	4
8. DISTRESS FROM COMPULSIONS	0	1	2	3	4
	Always Resists				Completely Yields
9. RESISTANCE	0	1	2	3	4
	Complete control	Much control	Moderate control	Little control	No control
10. CONTROL OVER COMPULSIONS	0	1	2	3	4

COMPULSION SUBTOTAL (add items 6-10) _____

	Excellent				Absent
11. INSIGHT INTO O-C SYMPTOMS	0	1	2	3	4

	None	Mild	Moderate	Severe	Extreme
12. AVOIDANCE	0	1	2	3	4
13. INDECISIVENESS	0	1	2	3	4
14. PATHOLOGIC RESPONSIBILITY	0	1	2	3	4
15. SLOWNESS	0	1	2	3	4
16. PATHOLOGIC DOUBTING	0	1	2	3	4

17. GLOBAL SEVERITY	0	1	2	3	4	5	6
18. GLOBAL IMPROVEMENT	0	1	2	3	4	5	6

19. RELIABILITY EXCELLENT = 0 GOOD = 1 FAIR = 2 POOR = 3

Appendix C: Demographic Form

DEMOGRAPHIC FORM

Date: _____
Person filling out this form: ☐ Mother ☐ Father ☐ Other: _____

1. Child's Date of Birth: ☐☐ ☐☐ ☐☐☐☐
   Month Day Year

2. Gender: (1 = Female, 2 = Male) ☐

3. Ethnicity: ☐

   1 = White (non-hispanic)
   2 = African-American (non-hispanic)
   3 = Hispanic/Latin American
   4 = Asian
   5 = Native American
   6 = Pacific Islander
   7 = Middle Eastern
   8 = Other (specify): _____

4. Living Situation: ☐

   1 = Lives with both biological parents (same residence)
   2 = Lives with both biological parents (different residences – shared custody)
   3 = Lives with single parent: Mother
   4 = Lives with single parent: Father
   5 = Lives with Mother and Stepfather
   6 = Lives with Father and Stepmother
   7 = Lives with Grandparents
   8 = Other (specify):_____

5. Father's highest education received ☐ Mother's highest education received ☐

   1 = less than 7 years of schooling
   2 = junior high/middle school
   3 = partial high school
   4 = high school graduate/GED
   5 = partial college/technical school
   6 = standard college/university graduate (BA/BS)
   7 = graduate professional training (MA/MS/PhD/MD)

6. Father's current occupation ☐ Mother's current occupation ☐

   1 = Never worked/on welfare
   2 = Unskilled laborer
   3 = Semi-skilled/armed services enlisted
   4 = Small business/Skilled worker/Craftsman/NCO
   5 = Clerical/Sales/Bank teller/Clerk/Telephone/Officer
   6 = Technician./Semiprofessional
   7 = Managers/Entertainers/Artists
   8 = Adminstrators
   9 = Executive/Professional
   10 = Student/Homemaker
   11 = Other – Mother:_____
   12 = Other – Father: _____

7. Number of participant's siblings (include adopted and step-siblings) ☐

SCHOOL INFORMATION:

8. This child attends ☐ **PUBLIC** school ☐ **PRIVATE** school ☐ **HOME** schooled

Last **grade** completed: _____

9. What type of **classes** does this child attend? ☐ **REGULAR** ☐ **GIFTED** ☐ **ESE** ☐ Other

What **marks/grades** does he/she earn? _____

Does your child have an IEP? ☐ **NO** ☐ **YES (reason:_____)**

Does your child have a 504 Plan? ☐ **NO** ☐ **YES (reason:_____)**

Has your child been held back? ☐ **NO** ☐ **YES (When:_____)**

Has your child been suspended/expelled from school? ☐ NO ☐ YES

10. How well does this child do in:

English/Language Arts/Reading ☐ excellent ☐ good ☐ fair ☐ poor ☐ failing ☐ n/a

Math/Arithmetic/Numbers ☐ excellent ☐ good ☐ fair ☐ poor ☐ failing ☐ n/a

Science ☐ excellent ☐ good ☐ fair ☐ poor ☐ failing ☐ n/a

Music/Art ☐ excellent ☐ good ☐ fair ☐ poor ☐ failing ☐ n/a

11. Has the child missed any days of school in the last 6 weeks? ☐ N/A ☐ NO ☐ YES
If yes, how many? _____

SOCIAL INFORMATION:

12. How many **close** friends does your child have? _____

13. How well does your child get along with his/her **peer** group?

☐ excellent ☐ good ☐ fair ☐ poor ☐ very poorly ☐ n/a

14. Do you have any concerns about your child's social relationships?

☐ No concern ☐ Mild concern ☐ Somewhat concerned ☐ Very concerned

15. How well does your child handle **changes** in schedule or routine?

☐ excellent ☐ good ☐ fair ☐ poor ☐ very poorly

FAMILY DYNAMICS INFORMATION:

16. How well does your child get along with:

siblings ☐ excellent ☐ good ☐ fair ☐ poor ☐ very poorly ☐ n/a

parents ☐ excellent ☐ good ☐ fair ☐ poor ☐ very poorly ☐ n/a

extended family ☐ excellent ☐ good ☐ fair ☐ poor ☐ very poorly ☐ n/a

What disciplinary measures are used in the home (circle any used)?

Timeout Spanking Scolding/Verbal Reprimand Loss-of-privileges/grounding Rewards/allowance

Avoiding contact with child **Other:**_____

FAMILY HISTORY

17. Has anyone in the family had a mental, emotional or behavioral problem? ☐ **NO** ☐ **YES**

If **YES**, please fill in the chart below.

Relationship	**Age**	**Suspected Diagnosis**	**Received Treatment**

LIFE STRESSES

18. Has the child experienced any of the difficulties listed in the table below? ☐ **NO** ☐ **YES**

If **YES**, check all that apply.

(X)		**Child's Age**	**Duration**
	Death of a parent		**n/a**

	Death of other loved one/close friend.		**n/a**
	Separation from parent or family		
	Parents' separation/divorce		**n/a**
	Loss of Home		
	Family financial problems		
	Physical abuse		
	Sexual abuse		
	Parent with substance abuse problem		
	Conflicts with parents		
	Removal of child from home		
	Victim of crime or violence		**n/a**
	Unwanted pregnancy		**n/a**
	School problems		
	Illness in self		
	Illness in family (specify:_____)		
	Other_____		

PSYCHOTHERAPY HISTORY

19. Has your child ever been treated for emotional/psychiatric/behavioral problems with therapy?

☐ **NO** ☐ **YES**

If YES, please complete the following:

Approximate Start and End Date/Child Age	**Therapist Name, Location**	**Problems Addressed, type of therapy if known**	**Reason for stopping/Response (poor, fair good)**

Approximate Start and End Date/Child Age	**Therapist Name, Location**	**Problems Addressed, type of therapy if known**	**Reason for stopping/Response (poor, fair good)**

20. **Does your child have problems with sleep? ☐ NO ☐YES**

If YES, please describe (e.g., problems falling asleep, nightmares, sleepwalking, waking up too early)

Where does your child sleep (e.g., own room, with parents, own bed)?

MEDICATION HISTORY

21. Has your child ever been treated for emotional or psychiatric problems with medication?

☐ NO ☐YES

If yes, please complete information in the table below:

MEDICATIONS	No	Yes	Dose	Start Date	Stop Date	Diagnosis	Response poor,fair,good	Side Effects
ANTI-DEPRESSANTS								
Amitriptyline (Elavil)								
Amoxapine (Asendin)								
Bupropion (Wellbutrin)								
Citalopram (Celexa, Lexapro)								
Clomipramine (Anafranil)								
Desipramine (Norpramin)								
Doxepin (Sinequan)								

MEDICATIONS	No	Yes	Dose	Start Date	Stop Date	Diagnosis	Response poor,fair,good	Side Effects
Fluoxetine (Prozac)								
Fluvoxamine (Luvox)								
Imipramine (Tofranil)								
Mirtazapine (Remeron)								
Nortriptyline (Pamelor)								
Paroxetine (Paxil)								
Sertraline (Zoloft)								
Desvenlafaxine (Pristiq)								
Trazodone (Desyrel)								
Venlafaxine (Effexor)								
Other:								
ANTIANXIETY/SLEEP DRUGS								
Alprazolam (Xanax)								

MEDICATIONS	No	Yes	Dose	Start Date	Stop Date	Diagnosis	Response poor,fair,good	Side Effects
Buspirone (Buspar)								
Clonazepam (Klonopin)								
Diazepam (Valium)								
Estazolam (ProSom)								
Hydroxyzine (Vistaril)								
Lorazepam (Ativan)								
Temazepam (Restoril)								
Diphenhydramine (Benadryl)								
Zolpidem (Ambien)								
Other:								
Other:								
ANTI-PSYCHOTICS/TIC MEDICINES								
Aripiprazole (Abilify)								

MEDICATIONS	No	Yes	Dose	Start Date	Stop Date	Diagnosis	Response poor,fair,good	Side Effects
Invega (Paliperidone)								
Clozapine (Clozaril)								
Fluphenazine (Prolixin)								
Haloperidol (Haldol)								
Olanzapine (Zyprexa)								
Perphenazine (Trilafon)								
Pimozide (Orap)								
Prochlorperazine (Compazine)								
Risperidone (Risperdal)								
Quitiepine (Seroquel)								
Ziprasidone (Geodon)								
Other:								
ADHD & Tic Medications								

MEDICATIONS	No	Yes	Dose	Start Date	Stop Date	Diagnosis	Response poor,fair,good	Side Effects
Amphetamine (Adderall)								
Clonidine (Kapvay)								
D-Amphetamine (Dexedrine, Dextrostat)								
Guanfacine (Tenex, Intuniv)								
Methylphenidate (Ritalin, Concerta, Metadate, Methylin)								
Atomoxetine (Straterra)								
Lisdexamfetamine (Vyvanse)								
Other:								
Other:								
Mood Stabilizers								
Lamotrigine (Lamictal)								
Valproic Acid (Depakote)								

MEDICATIONS	No	Yes	Dose	Start Date	Stop Date	Diagnosis	Response poor,fair,good	Side Effects
Gabapentin (Neurontin)								
Nutritionals								
Omega 3								
Fish Oil								
Flaxseed Oil								
Multivitamin								
Other Medications (for mental or physical health)								
Other:								
Other:								
Other:								

Appendix D: Child Behavior Checklist

For copyright protections purposes, the Child Behavior Checklist measure is not provided below.

Appendix E: Multidimensional Anxiety Scale for Children

For copyright protections purposes, the Multidimensional Anxiety Scale for Children measure is not provided below.

Appendix F: Anxiety Sensitivity Index-3

Anxiety Sensitivity Index-III

Subject ID: **Date:**

Instructions: Please circle the response that best describes you for the questions below.

1.	It is important for me to not appear nervous.	Very Little	A Little	Some	Much	Very Much
2.	When I cannot keep my mind on a task, I worry that I might be going crazy.	Very Little	A Little	Some	Much	Very Much
3.	It scares me when my heart beats rapidly.	Very Little	A Little	Some	Much	Very Much
4.	When my stomach is upset, I worry that I might be seriously ill.	Very Little	A Little	Some	Much	Very Much
5.	It scares me when I am unable to keep my mind on a task.	Very Little	A Little	Some	Much	Very Much
6.	When I tremble in the presence of others, I fear what people might think of me.	Very Little	A Little	Some	Much	Very Much
7.	When my chest feels tight, I get scared that I won't be able to breathe properly.	Very Little	A Little	Some	Much	Very Much
8.	When I feel pain in my chest, I worry that I'm going to have a heart attack.	Very Little	A Little	Some	Much	Very Much
9.	I worry that other people will notice my anxiety.	Very Little	A Little	Some	Much	Very Much
10.	When I feel "spacey" or spaced out, I worry that I may be mentally ill.	Very Little	A Little	Some	Much	Very Much
11.	It scares me when I blush in front of people.	Very Little	A Little	Some	Much	Very Much
12.	When I notice my heart skipping a beat, I worry that there is something seriously wrong with me.	Very Little	A Little	Some	Much	Very Much
13.	When I begin to sweat in a social situation, I fear people will think negatively of me.	Very Little	A Little	Some	Much	Very Much
14.	When my thoughts seem to speed up, I worry that I might be going crazy.	Very Little	A Little	Some	Much	Very Much
15.	When my throat feels tight, I worry that I could choke to death.	Very Little	A Little	Some	Much	Very Much
16.	When I have trouble thinking clearly, I worry that there is something wrong with me.	Very Little	A Little	Some	Much	Very Much
17.	I think it would be horrible for me to faint in public.	Very Little	A Little	Some	Much	Very Much
18.	When my mind goes blank, I worry there is something terribly wrong with me.	Very Little	A Little	Some	Much	Very Much

Appendix G: Obsessive Compulsive Inventory-Child Version

OCI-CV

On this page there are several questions that we want you to answer. Read each sentence carefully and tell us how much it has happened to you in the last month. If it never happens to you circle zero for the word "never." If it sometimes happens to you circle one for the word "sometimes." If it happens to you almost always circle two for "always." This is not a test so there are no right and wrong answers.

	Never	Sometimes	Always
1. I think about bad things and can't stop	0	1	2
2. I feel like I must wash hands and clean over and over again	0	1	2
3. I collect so much stuff that it gets in the way	0	1	2
4. I check many things over and over again	0	1	2
5. After I have done things, I'm not sure if I really did them	0	1	2
6. I need to count while I do things	0	1	2
7. I collect things I don't really need	0	1	2
8. I get upset if my stuff is not in the right order	0	1	2
9. I get behind in my school-work because I repeat things over and over again	0	1	2
10. I worry a lot about things being clean	0	1	2
11. I'm upset by bad thoughts	0	1	2
12. I have to say numbers over and over	0	1	2
13. Even after I'm done I still worry that I didn't finish things	0	1	2
14. I get upset by bad thoughts that pop into my head when I don't want them to	0	1	2
15. I check doors, windows, and drawers over and over again	0	1	2
16. I don't throw things away because I am afraid I might need them later	0	1	2
	Never	**Sometimes**	**Always**
17. I get upset if people change the way I arrange things	0	1	2
18. If a bad thought comes into my head, I need to say certain things over and over	0	1	2
19. I need things to be in a certain way	0	1	2
20. Even when I do something very carefully I don't think I did it right	0	1	2
21. I wash my hands more than other kids	0	1	2

Appendix H: Fear Conditioning Self-Report Rating

Screaming Lady Paradigm

Participant #

Date:

Habituation Fear Ratings:	_____	_____
Acquisition Ratings:	_____	_____
Extinction Ratings:	_____	_____

Appendix I: Fear Conditioning Computer Task