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Disgust and Obsessive Beliefs in Contamination-related OCD

Josh M. Cisler^{1,*}, Robert E. Brady¹, Bunmi O. Olatunji², and Jeffrey M. Lohr¹

¹University of Arkansas

²Vanderbilt University

Abstract

A large body of evidence suggests that disgust is an important affective process underlying contamination fear. An independent line of research demonstrates that obsessive beliefs, particularly overestimations of threat, are also an important cognitive process underlying contamination fear. The present study attempts to integrate these two lines of research by testing whether obsessive beliefs potentiate the influence of disgust propensity on contamination fear. The interaction between disgust propensity and obsessive beliefs was tested in two large non-clinical samples (N = 252 in Study 1; N = 308 in Study 2) using two different self-report measures of contamination fear. Regression analyses supported the hypotheses in both samples. The interaction remained significant when controlling for negative affect. The results are hypothesized to suggest that contamination fear results, at least partly, from obsessive beliefs about the contamination-based appraisals that accompany heightened disgust responding. These results complement previous affective-driven explanations of the role of disgust in contamination fear by suggesting cognitive factors that similarly potentiate disgust's role in contamination fear.

1. Introduction

Contamination fear refers to “an intense and persisting feeling of having been polluted, dirtied, or infected, or endangered as a result of contact, direct or indirect, with an item/place/person perceived to be soiled, impure, dirty, infectious, or harmful” (Rachman, 2006 p. 9).

Contamination fear is most often linked with obsessive-compulsive disorder (OCD), where obsessions are related to germs, disease, and/or general uncleanliness, and compulsions are typically related to washing rituals (Rachman, 2004; 2006). Contamination-related OCD is one of the most common clinical presentations of OCD (Rasmussen & Eisen, 1992).

Contamination-related OCD is a distinct subtype of OCD, in that it is associated with particular patterns of neural activation (e.g., anterior insula; Phillips et al., 2000) and obsessive beliefs (e.g., overestimation of threat; OCCGW, 2005; Tolin et al., 2008).

There has been a recent surge in research interest on contamination fear (Cougle et al., 2007; Deacon & Maack, 2007; McKay, 2006; Moritz & McKay, 2008; Olatunji et al., 2007a; Tolin et al., 2004). One of the most frequent topics of research interest has been investigating the role of disgust in contamination fear (e.g., Olatunji et al., 2004). Disgust is a distinct basic emotion that can be conceptualized as a revulsion response that motivates avoidance of disease and contamination (Rozin & Fallon, 1987). Several lines of evidence demonstrate a strong link between disgust and contamination fear (for reviews see Cisler, Olatunji, & Lohr, 2009; Olatunji & Sawchuk, 2005; Woody & Teachman, 2000). First, self-report measures of disgust propensity (i.e., the frequency or ease with which one generally responds with disgust)

*To whom correspondence should be directed: 216 Memorial Hall, Psychology Department, University of Arkansas, 72701, jcisler@uark.edu.

positively correlate with self-report measures of contamination fear (Mancini et al., 2001; Moretz & McKay, 2008; Olatunji et al., 2004; Olatunji et al., 2007b; Thorpe et al., 2003). For example, Olatunji and colleagues (2004) found that scores on self-report measures of disgust propensity explained 43% of the variance in scores on the contamination subscale of the Padua Inventory (Burns et al., 1996). Moreover, studies have found that the relation between disgust and contamination fear remains when controlling for negative affect (Cisler et al., 2008; in press; Moretz & McKay, 2008; Olatunji et al., 2007b) and depression (Tolin, Woods, & Abramowitz, 2006).

Second, contamination fear is associated with disgust-related cognitive characteristics, specifically 'sympathetic magic' beliefs such as the 'law of contagion' (Rozin & Fallon, 1987). For example, the 'law of contagion' belief refers to the belief that 'once in contact, always contaminated.' Tolin and colleagues (2004) engaged individuals with contamination-related OCD, Panic Disorder, or non-anxious controls in a study investigating the 'law of contagion' belief. Participants identified the most contaminated object in the building. The experimenter then rubbed a new pencil on the object and asked the participant how contaminated the pencil was. The experimenter then rubbed another new pencil on the previous pencil and asked participants how contaminated the new pencil was. This process was repeated for 12 pencils. Non-anxious controls and individuals with Panic Disorder demonstrated nearly a 100% reduction in contamination ideation across the pencils, but individuals with contamination-related OCD demonstrated only a 40% reduction. This study demonstrates that contamination-related OCD is associated with cognitive characteristics that resemble disgust. Cougle and colleagues (2007) found that among high contamination fear individuals whose primary threat appraisal was related to discomfort experiencing disgust, decreases in self-reported disgust during exposure and response prevention predicted declines in urges to wash throughout the exposure session. This study similarly demonstrates that cognitive appraisals about the negative consequences of feeling disgusted may be maintenance factors in contamination-related OCD. Finally, recent research demonstrates that disgust propensity positively predicts obsessive beliefs (Moretz & McKay, 2008), and obsessive beliefs have been found to prospectively predict the development of OCD symptoms over time, including contamination fear (Abramowitz et al., 2006, 2007).

Third, individuals with elevated contamination fear display increased avoidance of disgust-related objects. Tsao and McKay (2004) found that individuals with elevated contamination fear performed more poorly on behavior avoidance tasks (BATs) involving the different domains of disgust (e.g., small animal disgust, animal reminder disgust; Haidt et al., 1994) compared to high trait anxious and low trait anxious individuals. Olatunji and colleagues (2007a) similarly found that individuals with elevated contamination fear displayed greater avoidance on disgust-related BATs and self-reported more disgust than low contamination fearful individuals. Individuals with elevated contamination fear also reported more disgust than fear during the disgust tasks. Further, individual differences in disgust propensity mediate the relation between contamination cognitions and avoidance in contamination-related BATs (e.g., eating a cookie off of the floor), as well as the relation between self-reported anxiety during the BATs and avoidance (Deacon & Olatunji, 2007).

Accordingly, there is a large body of evidence implicating a role for disgust in contamination-related OCD. Theoretical speculation about the role of disgust in contamination has typically focused on affect-related processes. Olatunji and colleagues (2007a) suggested that disgust directly motivates excessive avoidance of objects that are possible sources of contamination, which may then also lead to excessive appraisals of contamination and washing urges. This possibility is analogous to the disease-avoidance model of small animal phobias (Matchett & Davey, 1991). This line of reasoning suggests that contamination fear will increase linearly with increases in disgust responding in either subjective, cognitive, physiological, or behavioral

domains. A related line of research has investigated whether affect-related processes moderate the relation between disgust propensity and contamination fear. Recent research demonstrates that anxiety sensitivity (i.e., a fear of internal manifestations of anxiety; Taylor, 1999) interacts with disgust propensity to potentiate contamination fears (Cisler, Olatunji, Sawchuk, & Lohr, 2008; Cisler, Reardon, Williams, & Lohr, 2007). This finding has been explained in the context of emotion regulation (Cisler et al., 2008). That is, heightened disgust responding (i.e., heightened subjective, cognitive, physiological, or behavioral indicators of disgust) *per se* may not be problematic in leading to contamination fear; rather, heightened disgust responding may only be problematic for individuals who are generally fearful of experiencing negative emotions (e.g., high anxiety sensitive individuals). Consistent with this explanation, a recent study found that self-reported difficulties in emotion regulation interact with disgust propensity to potentiate contamination fear (Cisler, Olatunji, & Lohr, in press). This line of evidence extends evidence of linear relations between disgust and contamination by elucidating affect-related factors that potentiate the effect of disgust on contamination. Accordingly, affect (i.e., disgust) and affect-regulation appear to be important processes underlying contamination fear.

In contrast, there has been relatively little investigation of cognitive processes that may affect the relation between disgust and contamination fear. There is evidence, however, to suggest that cognitive processes, specifically obsessive beliefs, may also be powerful moderating factors in the relation between disgust and contamination fear. Cognitive models of OCD (e.g., Rachman, 1997; 1998; 2002; Salkovskis, 1996) posit the importance of how one appraises or interprets obsessions. The Obsessive-Compulsive Cognitions Working Group (OCCWG, 1997; 2001; 2003; 2005) has extended these models and articulated 6 main obsessive beliefs corresponding to dysfunctional assumptions that may underlie OCD: 1) overestimation of threat, 2) intolerance of uncertainty, 3) importance of thoughts, 4) control of thoughts, 5) inflated responsibility, and 6) perfectionism. For example, individuals with OCD tend to overestimate the probability for harm, such as assuming danger until safety is proven instead of vice versa (OCCGW, 1997). Consistent with cognitive models of OCD, a wealth of research has demonstrated that these obsessive beliefs predict OCD symptoms (Abramowitz et al., in press; Abramowitz, Nelson, Rygwall, & Khandker, 2007; Coles, Cook, & Blake, 2007; Taylor, McKay, & Abramowitz, 2005; Tolin, Brady, & Hannan, 2008; Tolin, Woods, & Abramowitz, 2003; Tolin, Worhunsky, Brady, & Maltby, 2007; Tolin, Worhunsky, & Maltby, 2006). Overestimation of threat has emerged as the most consistent specific predictor of contamination-related OCD in both non-clinical (Tolin et al., 2003) and clinical (OCCGW, 2005; Tolin et al., 2008) samples. A good illustration of overestimated threat in contamination fear comes from Tolin and colleagues (2004) 'law of contagion' study (described above) in which contamination-related OCD individuals continued to estimate a high degree of contagion even after 12 degrees of removal from the original contamination source.

Based on the evidence that obsessive beliefs underlie OCD, it seems plausible that obsessive beliefs interact with disgust propensity to potentiate contamination fear. That is, it would be expected that disgust has a stronger influence on contamination fear in individuals who also have obsessive beliefs relative to individuals without obsessive beliefs. This may be because elevated disgust responding *per se* is not a sufficient etiological mechanism for the development of contamination-related OCD; rather, elevated disgust responding must be coupled with erroneous assumptions and beliefs (e.g., overestimation of threat) about the appraisals that may accompany heightened disgust responding (e.g., contamination estimations). Although independent lines of research suggest that both disgust and obsessive beliefs independently contribute to contamination fear, there has not yet been an investigation unifying these two lines of research. Accordingly, the main purpose of the present study is to test the hypothesis that obsessive beliefs moderate the relation between disgust and contamination fear. This line of investigation will extend previous research and theory on the role of disgust in contamination fear.

The current investigation employed two large non-clinical samples to investigate the relations between obsessive beliefs, disgust, and contamination fear. It is important to note that previous studies investigating obsessive beliefs and OCD symptoms in non-clinical samples (Tolin et al., 2003) correspond well to results from clinical samples (OCCWG, 2005; Tolin et al., 2008). We also examine if the interactive effects of obsessive beliefs and disgust remain when controlling for general negative affectivity (cf. Davey & Bond, 2006). We examined the relation in two different samples to investigate the robustness of the effect. We additionally employed two measures of contamination fear in order to test whether findings using one measure generalize to another measure, thus further increasing the reliability of the findings. Based on the hierarchical conceptualization of obsessive beliefs (Taylor et al., 2005), we first tested whether the Obsessive Beliefs Questionnaire (OCCGW, 2005) total score interacted with disgust propensity, then we tested whether each of the 3 OBQ factors (overestimation of threat/perfectionism, importance of thoughts, intolerance of uncertainty) specifically interacted with disgust propensity to predict contamination fear.

2.1. Study 1

2.1.1. Participants—Participants were 252 (180 female) undergraduate participants at a large public University. Mean age of the sample was 19.00 ($SD = 1.29$; range = 18–26). 87% of the sample endorsed themselves as Caucasian, 6% were Asian, 2% were Latino, 1% were African-American, and 4% endorsed themselves as ‘other.’ Mean number of undergraduate years completed was 1.67 ($SD = .77$; range = 1–4).

2.1.2. Measures—The Disgust Propensity (DP) subscale of the Disgust Propensity and Sensitivity Scale-Revised (van Overveld et al., 2006) is an 8 item self-report measure designed to assess the frequency of disgust experiences (i.e., disgust propensity). Subjects endorse the frequency with which they experience the content described in the items on a 5 point Likert scale (0 = “never” to 5 = “always”). For example, item 10 is ‘I experience disgust.’ Previous research demonstrates that the DP subscale correlates with the Disgust Scale (Haidt, McCauley, & Rozin, 1994; $r = .37$) and Disgust and Contamination Sensitivity Questionnaire (Rozin et al., 1984; $r = .21$) as well as with theoretically related constructs (e.g., spider fear; Olatunji et al., 2007b; van Overveld et al., 2006). The DP subscale demonstrates acceptable internal consistency with alpha coefficients of .78. (van Overveld et al., 2006). The DP scale was used in the present study instead of the Disgust Scale because the DP scale has an interpretable total score, whereas the Disgust Scale is comprised of 3 robust factors: animal-reminder disgust, core-disgust, and contamination disgust (Olatunji et al., 2007). Further, the Disgust Scale is limited in that it assesses disgust in response to specific elicitors (Olatunji & Cisler, 2009), whereas the DP assesses the degree to which an individual generally responds with disgust, thus providing a somewhat purer index of ‘disgust propensity.’

The Padua Inventory-Revised (PI; Burns, Keortge, Formea, & Sternberger, 1996) contamination subscale is a 10 item verbal-report instrument that measures an individual’s aversion towards contamination (e.g., “I feel my hands are dirty when I touch money”). Individuals respond to each item on a 5-point Likert scale indicating the degree to which they would be disturbed by the situations described in the items (0 = “not at all,” 4 = “very much”). The total score is computed by summing the 10 items. The complete PI has adequate psychometric properties, and the contamination subscale has high internal consistency ($\alpha = .85$; Burns et al., 1996). The PI contamination scale correlates highly with other measures of contamination fear (Burns et al., 1996; Thordarson et al., 2004). Only the contamination subscale of the PI was administered.

The Negative Affectivity (NA) scale of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) is a 10 item measure of negative mood/affect. Items consist

of descriptors of various negative affective states. Participants rate how much each item applies to them using a 5-point Likert scale (1 = “very slightly or not at all,” 5 = “extremely”). The items are summed into a total score. Only the negative affectivity scale was administered in the present study.

The Obsessive Beliefs Questionnaire-44 (OCCGW, 2005) is a 44 item self-report measure of obsessive beliefs. Participants endorse items on a 7-point Likert scale (1 = “disagree very much”, 7 = “agree very much”). Items are summed into a total score. There are three factors of obsessive beliefs (OCCGW, 2005) that can be conceptualized as lower order factors underneath a higher-order obsessive beliefs construct (Taylor et al., 2005): 1) overestimation of threat/perfectionism, 2) importance of thoughts, 3) intolerance of uncertainty. The OBQ has sound psychometric properties (OCCGW, 2005) and predicts obsessive-compulsive symptoms in both clinical (OCCGW, 2005; Taylor et al., 2005; Tolin et al., 2008) and non-clinical (Abramowitz et al., 2008; Tolin et al., 2003) samples.

2.2. Procedure

Undergraduate students learned about the current experiment via a university-based psychology website. This website listed available experiments that participants could complete to earn course credit. Participants interested in the current experiment were directed to a secure on-line website (www.surveymonkey.com) where they could complete the experiment. The first page of the on-line experiment provided the participants with informed consent. The participants then completed the questionnaires, followed lastly by a debriefing page. Prior research has demonstrated that on-line administration of anxiety symptom questionnaires correspond well with in-person administration (Coles, Cook, & Blake, 2007).

2.3. Results

2.3.1. Correlations and descriptive information—Table 1 provides the correlations and descriptive information for the measures. Small to large statistically significant correlations were observed between each measure (r 's ranging from .22 to .91; p 's < .001).

2.3.2. Main effects of DP and OBQ in predicting contamination fear—Previous research has revealed biological sex differences in contamination fears and disgust (Olatunji, Sawchuk, Arrindell et al., 2005; Haidt et al., 1994), thus we incorporated biological sex into our analyses as a covariate. We additionally controlled for negative affectivity to rule out spuriousness of our results per the recommendations of Davey (2003) and Davey and Bond (2006). Regression analyses were conducted in which PI scores were the criterion. Step 1 entered biological sex and negative affect. Step 2 entered the main effects of DP and OBQ. When controlling for biological sex and negative affect, both DP ($\beta = .31, t = 4.91, \text{partial } r = .30, p < .001$) and OBQ ($\beta = .31, t = 5.26, \text{partial } r = .32, p < .001$) were significant independent predictors of contamination fear (final $R^2 = .30$).

2.3.3. Interaction between DP and OBQ in predicting contamination fears¹—Stepwise regression analyses were conducted in which the first step controlled for biological sex and negative affect, step two entered the main effects of DP and OBQ, and step 3 entered the DP x OBQ interaction. The DP x OBQ interaction ($\beta = .11, t = 2.13, p = .034, \text{partial } r = .14$) significantly predicted unique variance in PI scores not accounted for by biological sex, negative affect, DP, or OBQ. The final model was significant: $R^2 = .31, F(5, 250) = 22.93, p < .001$.

¹All variables were centered before computing the interaction term performing the analyses.

We next tested whether each of the 3 OBQ factors specifically interacted with DP to predict contamination fear. Separate regression analyses were performed for each factor in which biological sex and negative affect were entered in step 1, main effects of DP and the OBQ factor were entered in step 2, and the DP $\times$ OBQ factor interaction was entered in step 3. Overestimation of threat ($\beta = .16, t = 2.99, \text{partial } r = .19, p = .003$) interacted with DP to potentiate contamination fears, but neither intolerance of uncertainty ($\beta = .09, t = 1.74, \text{partial } r = .11, p = .08$) nor importance of thought control ($\beta = .00, t = .00, \text{partial } r = .00, p = .99$) significantly interacted with DP.

We employed post-hoc probing (Holmbeck, 2002) to determine which level of the moderator (i.e., high or low OBQ) was potentiating DP. We only probed the DP $\times$ OBQ overestimation of threat factor because this was the only specific effect driving the overall interaction with the total OBQ score². Results revealed that DP was a robust predictor of contamination fears at high levels of OBQ overestimation of threat ($\beta = .40, t = 5.32, p < .001$), but DP was a non-significant predictor of contamination fear at low levels of OBQ overestimation of threat ($\beta = .12, t = 1.55, p = .12$). Further, the effect size for disgust predicting contamination fear was three times greater at high levels of OBQ (partial $r = .32$) compared to at low levels of OBQ (partial $r = .10$). These results statistically confirm the direction of the interaction: high level of OBQ potentiate the degree to which DP predicts contamination fears. The interaction is displayed in Figure 1.

2.4. Discussion

The results from study 1 replicated previous findings that disgust and obsessive beliefs predict contamination fear (OCCGW, 2005; Olatunji et al., 2004). The results also supported our hypothesis that obsessive beliefs would potentiate the degree to which disgust predicted contamination fear. Prior to discussing these initial findings, we first sought to replicate these findings in another sample using another measure of contamination fear in order to test the robustness of the effect. If the interaction effect is found on another measure of contamination fear, it would suggest that the effect generalizes to the ‘contamination fear’ construct, as opposed to being specific to how the PI uniquely measures contamination fear.

2.5. Study 2

2.5.1. Participants—Participants were 308 (218 female) undergraduate participants at a large public University. These students did not participate in study 1. Mean age of the sample was 19.48 ($SD = 2.49$; range = 18–43). 83% of the sample endorsed themselves as Caucasian, 6% were Asian, 2% were Latino, 5% were African-American, and 4% endorsed themselves as ‘other.’ Mean number of undergraduate years completed was 1.59 ($SD = .89$; range = 1–5).

2.5.2. Measures—We administered the same measures in study 2 that were administered in study 1, except that we instead administered the Dimensional Obsessive Compulsive Scale (DOCS) as the measure of contamination fear in order to test whether the results from the PI generalized to another measure.

The DOCS (Abramowitz et al., 2009) contamination fear subscale is a 5-item self-report measure. Participants are given a list of exemplar obsession and compulsions related to contamination fear (e.g., “Thoughts about germs, sickness, or the possibility of spreading contamination,” “Avoiding certain people, objects, or places because of contamination”) and are asked to endorse 1) how much time they spend on similar obsessions and compulsions per day, 2) the degree of avoidance related to contamination obsessions, 3) distress associated with contamination-related obsessions, 4) functional impairment, and 5) difficulty ignoring

²We also probed the interaction with the OBQ total score and results were similar to those with the OBQ overestimation of threat factor.

contamination-related obsessions. The DOCS has sound psychometric properties and converges well with other measures of OCD (Abramowitz et al., 2009).

2.5.3. Procedure—The procedure for study 2 was identical to study 1. Study 2 was conducted approximately 6 months after study 1.

2.6. Results

2.6.1. Correlations and descriptive information—Small to large statistically significant correlations were observed between each measure (r 's ranging from .25 to .90; p 's < .001). Table 2 provides the correlations and descriptive information for the measures.

2.6.2. Main effects of DP and OBQ in predicting contamination fear—A regression analysis was conducted with DOCS scores as the criterion. Biological sex and negative affect were entered in step 1; DP and OBQ were entered in step 2. When controlling for biological sex and negative affect, both DP ($\beta = .34$, $t = 5.82$, partial $r = .32$, $p < .001$) and OBQ ($\beta = .25$, $t = 4.35$, partial $r = .24$, $p < .001$) significantly predicted DOCS (final $R^2 = .25$). Replicating study 1, these results suggest that both DP and OBQ independently predict contamination fears.

2.6.3. Interaction between DP and OBQ in predicting contamination fears—Stepwise regression analyses were conducted in which the first step controlled for biological sex and the main effects of negative affect, DP, and OBQ. In the second step, we entered the DP $\times$ OBQ interaction. The DP $\times$ OBQ interaction ($\beta = .14$, $t = 2.82$, partial $r = .16$, $p = .005$) significantly predicted unique variance in DOCS scores not accounted for by biological sex, negative affect, DP, or OBQ. The final model was significant: $R^2 = .27$, $F(5, 307) = 23.64$, $p < .001$.

We next tested whether each of the three OBQ factors interacted with DP to potentiate contamination fears. Separate regression analyses were performed for each factor in which biological sex and negative affect were entered in step 1, main effects of DP and the OBQ factor were entered in step 2, and the DP $\times$ OBQ factor interaction was entered in step 3. Overestimation of threat ($\beta = .15$, $t = 2.99$, partial $r = .17$, $p = .003$), intolerance of uncertainty ($\beta = .12$, $t = 2.31$, partial $r = .13$, $p = .022$), and importance of thought control ($\beta = .12$, $t = 2.34$, partial $r = .13$, $p = .02$) all interacted with DP to potentiate contamination fear.

We employed post-hoc probing (Holmbeck, 2002) to determine which level of the moderator (i.e., high or low OBQ) was potentiating DP. We only probed the overall interaction with OBQ total score because each of the factors interacted with DP to predict contamination to a comparable degree. Results revealed that DP accompanied by high levels of OBQ was a strong predictor of contamination fear ($\beta = .44$, $t = 6.46$, $p < .001$), while DP accompanied by low levels of OBQ was a less robust predictor of contamination fear ($\beta = .22$, $t = 3.13$, $p = .002$). Indeed, the effect size for disgust predicting contamination fear was twice as large at high levels of OBQ (partial $r = .35$) compared to at low levels of OBQ (partial $r = .18$). These results statistically confirm the direction of the interaction: high level of OBQ potentiate the degree to which DP predicts contamination fears. The interaction is displayed in Figure 2.

2.7. Discussion

These results replicate findings from study 1. They additionally demonstrate that the effect generalizes to another measure of contamination fear, thus demonstrating robustness. Unlike study 1, however, each of the OBQ factors moderated DP when using the DOCS as the contamination fear measure, whereas only the overestimation of threat OBQ factor moderated DP when using the PI as the dependent measure. The DOCS differs from the PI in that the DOCS specifically measures diagnostic criteria, such as avoidance, interference, and time spent

obsessing or ritualizing. These content areas are related to functional impairment secondary to elevated contamination fear. In contrast, the PI asks participants to endorse how disturbed they would be in various contamination-related situations. The PI appears to measure the ease or frequency with which one responds with contamination fear, but it may not adequately assess functional impairment (although the frequency of feeling contaminated is probably highly correlated with impairment). One explanation of the different pattern of results across study 1 and study 2 is that the other OBQ factors are stronger moderators of the relation between disgust and functional impairment secondary to contamination fear, but these OBQ factors are not strong moderators of the relation between disgust and just contamination fear *per se*. This is an important theoretical difference because it suggests that certain obsessive beliefs (i.e., importance of thought control and intolerance of uncertainty) may potentiate the influence of disgust on functional impairment related to contamination fear, but not contamination fear *per se*. It appears as though the hierarchical obsessive beliefs construct (i.e., total score; Taylor et al., 2005) moderates the relation between disgust and both contamination fear as well as impairment related to contamination fear. Similarly, the overestimation of threat factor moderates the relation between disgust and both contamination fear and functional impairment, which is consistent with prior research demonstrating a strong link between overestimation of threat and contamination-related OCD (OCCGW, 2005; Tolin et al., 2003; 2008). In contrast, the intolerance of uncertainty and importance of thought control factors only moderate the relation between disgust and functional impairment secondary to contamination fear.

3. General Discussion

A wealth of research suggests that disgust is an important affective process underlying contamination fear (Cisler et al., 2009; Olatunji et al., 2007a). An independent line of research similarly demonstrates a role of obsessive beliefs in OCD generally (OCCGW, 1997, 2001; Rachman, 1997; 1998) and contamination fear specifically (Tolin et al., 2003; 2008). The present studies unified these two lines of research and supported the hypothesis that obsessive beliefs, particularly overestimations of threat, interact with disgust propensity to potentiate contamination fear. The effect appears robust: it was found in two independent samples, across two measures of contamination fear, and remained when controlling for negative affect. Heightened disgust responding has been theorized to directly motivate excessive avoidance of contamination-related objects and situations, which may have the effect of sensitizing the individual to contamination-related appraisals via latent inhibition (Olatunji et al., 2007a). The present results extend and complement the previous findings of a linear relation between disgust and contamination fear. Disgust had a weak (study 2) or non-significant (study 1) relation with contamination fear at low levels of obsessive beliefs. Accordingly, the degree to which disgust motivates washing behavior and excessive avoidance of possible contaminants may be dependent on whether disgust is accompanied by erroneous assumptions/beliefs (e.g., overestimation of threat).

The present results suggest a manner by which disgust may function in contamination fear. Disgust is associated with unique cognitive characteristics (Rozin & Fallon, 1987; Teachman, 2006; Williams et al., 2008; Woody & Teachman, 2000). Woody and Teachman (2000) argue that fear and disgust can be differentiated by their respective threat appraisals: fear appraisals are focused on the possibility for danger; disgust appraisals are focused on the possibility for contamination. This appraisal style of disgust is consistent with the proposed evolutionary function of disgust; namely, to avoid ingesting noxious (i.e., contaminated) substances (Rozin & Fallon, 1987). If disgust is characterized by contamination-based appraisals, then it follows that individuals with heightened disgust propensity will make more frequent or more exaggerated contamination-based appraisals. Obsessive beliefs may potentiate disgust's role in contamination-related OCD by causing an individual to 1) overestimate the degree of threat associated with contamination-based appraisals (e.g., "if I think it might be dirty then it is

definitely contaminated and harmful”), 2) place heightened importance on contamination-based appraisals (e.g., “I definitely have to listen to my thoughts if I think it’s dirty”), or 3) go to extreme lengths to avoid/control unwanted contamination-based appraisals (e.g., “I’ll clean the kitchen every time I have the thought that it might be dirty”). Based on this line of reasoning, heightened disgust responding itself may not necessarily lead to contamination-related OCD. Instead, contamination-related OCD may result, at least partly, from obsessive beliefs about the contamination-based appraisals that accompany heightened disgust responding.

Previous research has focused on affective factors in explaining disgust’s role in contamination fear. Anxiety sensitivity and emotion regulation both potentiate disgust’s role in contamination fear, suggesting that the manner by which an individual interprets and responds to emotional reactions may be an important maintenance process (Cisler et al., 2007; 2008; in press). The present results extend this research by illuminating cognitive factors that similarly potentiate disgust’s role in contamination fear. Accordingly, theoretical models of contamination fear need to account for affect-related processes (e.g., disgust, emotion regulation), cognitive-related processes (e.g., obsessive beliefs), as well as interactions between these processes. It is important to note that contamination fear cannot be explained *solely* by cognitive and affective processes. For example, a recent study found that experimentally induced safety behaviors increased contamination fear in college students (Deacon & Maack, 2008), demonstrating that safety behaviors also need to be explained in models of contamination fear. In another example, the focus of the threat appraisals underlying the contamination fear (e.g., being overwhelmed by disgust versus fear of contracting and illness) moderates disgust’s role in predicting treatment response (Coughe et al., 2007). These disparate lines of research underscore the importance of developing theoretical models that unify the existing lines of research into a coherent explanation. The present study represents a beginning attempt by unifying the obsessive beliefs line of research with the disgust line of research.

Finally, there may be clinical implications of the present research. The present results suggest that individuals who have heightened levels of both obsessive beliefs and disgust propensity may be particularly at risk for developing contamination-related OCD. Accordingly, these are the individuals on whom prevention efforts may need to be focused. In a related vein, there has been a paucity of research on the treatment of disgust, and emerging research demonstrates that disgust has a slower rate of extinction relative to fear (Olatunji et al., 2007; Smits et al., 2002). The notion that individuals with elevated obsessive beliefs and disgust propensity are at risk for developing contamination-related OCD underscores the importance of future research developing successful therapeutic procedures to treat disgust.

The present study is limited by a student sample and correlational design. It will be important to replicate these results experimentally with a clinical sample. One possibility could be to manipulate the presence of a disgust prime (e.g., a noxious smell versus a neutral smell) and an obsessive belief prime (e.g., reading a script about the importance of controlling thoughts versus reading a neutral script) and measure urges to wash during an exposure trial with individuals with contamination-related OCD. Based on the present results, an interaction would be expected between the disgust prime and obsessive belief prime conditions. Future research along these lines will be necessary to replicate the current results as well as to foster theoretical models. Another limitation is that the current study only tested whether disgust propensity interacts with obsessive beliefs. It remains to be seen whether obsessive beliefs moderate other aspects of disgust responding (e.g., physiological indices, self-reports of the subjective experience of disgust, etc). Again, future experimental research can address this limitation by experimentally manipulating disgust inductions and testing if an obsessive belief manipulation interacts with the disgust induction to heighten contamination fear.

Despite limitations, the present study does add to the literature in two main ways. First, the study offers a cognitive explanation for the role of disgust in contamination fear that complements previous affective explanations (e.g., Cisler et al., in press; Olatunji et al., 2007a). Second, the present results unify two previously disparate lines of research (e.g., disgust in contamination fear; obsessive beliefs in contamination fear) into a coherent explanation of contamination fear. Future experimental research is necessary to replicate the present results and refine the proposed model.

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Figure 1.

The DP x OBQ threat estimation interaction predicting PI contamination scores. PI scores are displayed as z-scores. 'OBQ -1 SD' = 1 SD below mean; 'OBQ +1 SD' = 1 SD above mean. 'DP -2 SD's' = 2 SD's below mean; 'DP -1 SD' = 1 SD below mean; etc.

Figure 2.

The DP x OBQ total score interaction predicting DOCS contamination scores. DOCS scores are displayed as z-scores. 'OBQ -1 SD' = 1 SD below mean; 'OBQ +1 SD' = 1 SD above mean. 'DP -2 SD's' = 2 SD's below mean; 'DP -1 SD' = 1 SD below mean; etc.

Table 1

Study 1 means (SD's), alphas, and correlation matrix for the PI, DP, PANAS—NA, OBQ Total, OBQ—RTE, OBQ—PC and OBQ—ICT.

Measure	1	2	3	4	5	6	7
1) PI	-	.46	.29	.44	.47	.37	.29
2) DP		-	.34	.36	.41	.31	.22
3) PANAS—NA			-	.35	.32	.31	.29
4) OBQ Total				-	.91	.90	.81
5) OBQ—RTE					-	.73	.64
6) OBQ—PC						-	.58
7) OBQ—ICT							-
Mean	10.82 (7.42)	13.34 (5.21)	11.08 (7.09)	144.60 (38.32)	53.38 (15.46)	33.22 (11.34)	58.00 (16.71)
Alpha	.89	.85	.89	.95	.89	.91	.86

Note: All correlations significant $p < .01$. OBQ—RTE = responsibility/threat estimation; OBQ—PC = perfectionism/intolerance of uncertainty; OBQ—ICT = importance and control of thoughts. PI = Padua Inventory Contamination Fear Subscale. DP = disgust propensity. PANAS—NA = negative affect scale of the PANAS.

Table 2

Study 2 means (SD's) alphas, and correlation matrix for the DOCS, DPSS, PANAS—NA, OBQ Total, OBQ—RTE, OBQ—PC and OBQ—ICT.

Measure	1	2	3	4	5	6	7
1) DOCS	-	.46	.25	.40	.38	.32	.31
2) DP		-	.44	.46	.35	.33	.25
3) PANAS—NA			-	.44	.46	.35	.33
4) OBQ Total				-	.90	.88	.80
5) OBQ—RTE					-	.67	.65
6) OBQ—PC						-	.53
7) OBQ—ICT							-
mean	3.86 (3.00)	12.72 (5.27)	12.23 (6.59)	144.08 (39.55)	52.93 (16.50)	58.74 (17.62)	32.61 (11.58)
Alpha	.79	.85	.86	.95	.90	.91	.86

Note: All correlations significant $p < .01$; OBQ—RTE = responsibility/threat estimation; OBQ—PC = perfectionism/intolerance of uncertainty; OBQ—ICT = importance and control of thoughts; DOCS = Dimensional Obsessive Compulsive Scale. DP = disgust propensity. PANAS—NA = negative affect scale of the PANAS.