DANGER APPRAISALS AS PROSPECTIVE PREDICTORS OF DISGUST AND AVOIDANCE

by

Nicole Michelle Dorfan

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Abstract

Recent theories posit that cognitive factors explain the development and maintenance of contamination fears associated with obsessive compulsive disorder (OCD). Few studies to date have aimed to establish causality or temporal precedence for cognitions predicting OCD-relevant distress and avoidance. The current study used a prospective design to assess threat appraisals, personality traits, and obsessive compulsive symptoms in an unselected sample of university students and community members (*N* = 105) several days prior to a contamination behavioural approach task (BAT) in a public washroom. Results of the hierarchical regressions demonstrated that prospective danger appraisals significantly predicted both disgust and avoidance on the BAT, even when controlling for neuroticism, disgust sensitivity, and OCD symptoms. In contrast, looming germ spread appraisals and responsibility appraisals were not significant predictors of the BAT. Results from in vivo distress ratings and implicit reaction time data indicated that disgust is more strongly associated with contaminants compared with anxiety. The findings of this research suggest that psychological treatment for contamination concerns should include monitoring of disgust as a process and outcome variable in exposure paradigms, and focus on reappraisal of danger estimates related to disease in cognitive paradigms.

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~ Nicole

Introduction

Exposure to contaminants is unavoidable in the modern world. Daily routine requires people use public restrooms, ride on public transportation, interact with sick coworkers, and breath polluted air. Given this ubiquitous exposure, why do some people experience anxiety or disgust in response to contaminants while others are not bothered? Furthermore, why do some people experience extreme feelings of contamination that can linger for hours, days or even years after contact, as in the case of obsessive-compulsive disorder (OCD)? Emotional reactions to contaminants can be understood within the paradigm of cognitive models of threat (e.g., Beck, Emery, & Greenberg, 1985; Freeston, Rhéaume, & Ladouceur, 1996; Lazarus, 1966; Riskind, 1997; Salkovskis, 1985). Such models suggest that a person's appraisal or evaluation of an event will determine subsequent emotional, physiological, and behavioural responses. The link between appraisals, emotions, and behaviour can be adaptive and even life-saving in the presence of true threats (e.g., a pedestrian's perception of danger when a bus is approaching at high speed triggers the "fight or flight" response). However, this system can produce false alarms and pathological levels of distress when a person frequently perceives threat in the absence of significant danger.

In recent years, outbreaks of avian influenza, severe acute respiratory syndrome (SARS), and anthrax threats have produced widespread contamination fears across the world. Overreactions to such threats have large costs at the individual level (e.g., psychological distress and functional impairment), as well as at the societal level (e.g., economic costs secondary to avoidance of work and travel). Who is vulnerable to overreacting to contamination threats? Does cognition promote emotional distress, avoidance, and unnecessary cleaning behaviour in normal populations, and if so, what types of cognition?

To date, there is a paucity of knowledge regarding contaminant-related cognitions and their prediction of maladaptive emotions and behaviours. The majority of research evaluating the relationship between OCD-relevant cognitions, distress, and avoidance has relied solely on self-report instruments (e.g., OCCWG, 2001, 2003, 2005; Riskind, Abreu, Strauss, & Holt,

1997). While there has recently been a move to test cognitive theories with prospective designs, outcome measures in these few studies have been based on self reported symptoms or interviews (Abramowitz, Khandker, Nelson, Deacon, & Rygwall, 2006; Coles & Horng, 2006; Riskind, Tzur, Williams, Mann, & Shahar, 2007). Research eliciting contamination fears with actual stimuli has used concurrent measurement of appraisals and outcome variables (Deacon & Olatunji, 2007; Jones & Menzies, 1997a) or small sample sizes (Jones & Menzies, 1998b), leaving open the question of whether threat appraisals prospectively predict or cause in vivo distress and avoidance of contaminants. The present research will address this question.

The current study explored the role of situational threat appraisals as prospective predictors of distress, avoidance, and cleaning behaviours in a normal sample engaged in a contaminant behavioural approach task. This study tested the relative contribution of several threat appraisals proposed by competing cognitive theories of OCD and demonstrated the importance of these threat appraisals beyond dispositional traits and OCD symptoms. The study also explored the relative association of fear and disgust with contaminants, using both self-reported in vivo emotions and implicit associations on computer based reaction time tasks. Together, the various aspects of this study documented key cognitions involved in normative responses to contaminating stimuli in the environment. The current research builds on former studies by utilizing a rigorous prospective design which allowed for appraisals to be measured prior to affect, thus insuring temporal precedence for the predictor variables. The study also extended prior research by assessing disgust both as a dispositional trait and as an outcome variable of the approach task. Finally, the implicit associations tested by this study were unique and addressed questions that have not previously been asked in the literature. Before outlining the study in detail, I will first review the literature relevant to contamination concerns and cognitive theories of OCD. I will then describe the design and methodology of this dissertation project.

Obsessive Compulsive Disorder

Individuals with extreme fears of contamination and repetitive cleaning rituals that interfere with normal functioning are often diagnosed with obsessive compulsive disorder. OCD is an anxiety disorder that typically involves both obsessions and compulsions. Obsessions are recurrent and intrusive thoughts, impulses or images that cause distress, while compulsions are repetitive behaviours or mental acts that are performed in response to obsessions in an effort to reduce distress or prevent a negative outcome (American Psychiatric Association, 2000). OCD has a lifetime prevalence rate of 1.9 - 2.5% (Weissman, Bland, Canino, & Greenwald, 1994), and the disorder usually takes a chronic course that waxes and wanes over time (American Psychiatric Association, 2000).

Contamination fears constitute the most common type of obsession in OCD (Foa & Kozak, 1996). Although the contamination/washing subtype of OCD was once considered to be one of the most well understood forms of OCD, Rachman (2004) has noted that much is still unknown regarding contamination fears. In support of this notion, some recent treatment outcome studies have found that very few contamination fearful patients meet criteria for "recovered" status at the end of treatment (Jacobi, Whittal, & McLean, 2005; McLean et al., 2001). Furthermore, cognitive therapy, which focuses on reappraisal of intrusive thoughts, is less effective than exposure and response prevention for contamination fearful patients (Jacobi et al., 2005). Therefore, cognitive and emotional processes involved in contamination concerns need to be better understood.

Contamination-related distress can be viewed as occurring along a continuum, from the occasional mild to moderate distress seen in the normal population to the severe, persistent, and functionally impairing distress observed in cases of OCD. Although most of the literature on contamination concerns stems from researchers interested in OCD, much of this research has utilized non-clinical populations given the many challenges of recruiting symptom-specific patient samples and empirical data supporting the continuous model of OCD (Gibbs, 1996). Gibbs notes several advantages of using non-clinical participants in research (especially for

prospective studies), including the ability to study vulnerability factors, differentiate between antecedents and consequences, and explore etiological factors.

Contamination Threat

Rachman (2004) defines contamination as, “an intense and persisting feeling of having been polluted or infected or endangered as a result of contact, direct or indirect, with a person/place/object that is perceived to be soiled, impure, infectious or harmful” (p. 1229). Theorists suggest that contamination concerns involve a blend of emotions including fear and disgust (Woody & Teachman, 2000), as well as feelings of shame, moral impurity, and dirtiness (Rachman, 2004). Cognitive theorists generally agree that a fear response is associated with an appraisal of a stimulus as threatening or dangerous. Woody and Teachman propose that appraisals relevant to disgust may overlap with appraisals related to fear in their shared assessments of danger. They further postulate that overlapping fear and disgust appraisals regarding threat of contamination could explain the role of disgust in anxiety disorders such as OCD and phobias.

Several types of threat appraisals may evoke the particular blend of fear and disgust known as contamination. Woody and Teachman (2000) offer such examples as appraisals of threat of bodily harm (e.g., disease; death), social threat (e.g., violation of social norms related to cleanliness and subsequent ostracism), and threats to emotional control and mental well-being (e.g., intolerance of feeling contaminated; fear of “going crazy”). Appraisals of contamination threat are implicitly guided by a pattern of beliefs known as the “laws of sympathetic magic” that are consistent across a wide range of cultures (Rozin & Nemeroff, 1990). These laws specify conditions under which individuals perceive contamination threat even in the absence of objective impurity. For example, the law of contagion suggests that things transfer some of their properties when they touch other things, so that the effect of contact remains even after the actual connection has been broken ("once in contact, always in contact"). The law of similarity holds that things that resemble one another share fundamental properties. Empirical support for these laws comes from work by Rozin, Nemeroff and

colleagues (see for example Rozin, Millman, & Nemeroff, 1986; Rozin, Nemeroff, Wane, & Sherrod, 1989).

Davey and his colleagues have argued that evolutionary pressure has shaped a disgust response toward certain animals in order to prevent the transmission of disease by motivating avoidance (Davey, 1992; Matchett & Davey, 1991; Webb & Davey, 1992). This theory holds that disease avoidance, rather than defense against predators, drives discomfort with non-predatory and disgust evoking animals (e.g., snakes, spiders, worms). Webb and Davey (1992) posit a causal role of disgust sensitivity (the tendency to feel disgusted by a variety of stimuli) in producing fear and provide evidence that exposure to a disgust-evoking video increases fear of non-predatory animals. Disgust has also been implicated in avoidance, with state levels of disgust and disgust sensitivity both predicting avoidance of worms on a behavioual approach task (Woody & Tolin, 2002). Woody, McLean, and Klassen (2005) found that state levels of disgust, but not state levels of anxiety, predicted avoidance of spiders and a spider contaminated pen. Vernon and Berenbaum (2002) found that state levels of disgust and fear were both uniquely related to spider distress scores on a questionnaire measure, but only fear was uniquely associated with in vivo avoidance of a spider. While these two studies used different methods and statistical analyses (e.g., Woody et al. used a more challenging approach task that involved touching the animal), the contradictory findings cannot easily be explained and the functional role of disgust in promoting avoidance of animals awaits further empirical scrutiny.

Webb and Davey (1992) further suggest that disgust sensitivity is likely to be involved in the development of OCD. This idea is supported by empirical work documenting disgust sensitivity as a significant predictor of washing symptoms (Mancini, Gragnani, & D'Olimpio, 2001; Muris, Merchelbach et al., 2000; Olatunji, Lohr, Sawchuk, & Tolin, 2007; Olatunji, Sawchuk, Arrindell, & Lohr, 2005; Thorpe, Patel, & Simonds, 2003) and fears of illness (Matchett & Davey, 1991; Thorpe et al., 2003). Individuals with OCD washing compulsions have elevated scores on the animal and body products disgust sensitivity subscales compared

with non-washing obsessive compulsives, socially anxious, and non-anxious controls (Woody & Tolin, 2002). Similar group differences were found between washers and non-washers with OCD for core disgust and contamination-related disgust factors (Olatunji, Williams et al., 2007). Contamination fearful participants and those with higher disgust sensitivity evidence greater avoidance of many disgust evoking tasks (Deacon & Olatunji, 2007; Olatunji, Lohr, et al., 2007; Rozin, Haidt, McCauley, Dunlop, & Ashmore, 1999; Tsao & McKay, 2004). Furthermore, disgust sensitivity predicts behavioural avoidance even after controlling for self-reported contamination fear and washing symptoms (Olatunji, Lohr, et al., 2007). Despite these findings, it remains possible that neuroticism at least partially explains the relationship between disgust sensitivity, trait anxiety, and avoidance behaviour (Woody & Tolin, 2002).

Disgust versus Fear

Most of the theory, research, and treatment models for contamination concerns stem from the literature on fear and anxiety. Only a small body of research exists evaluating the role of disgust in specific phobias, OCD, and other clinical disorders. Clinical experience suggests that disgust does feature prominently in some cases of compulsive washing (Woody & Teachman, 2000). However, the relative contribution of disgust versus fear in contamination concerns is unknown.

Fear and disgust demonstrate a number of similarities (Rachman, 2004). Both emotions involve negative affect and can promote avoidance and cleaning behaviour. Furthermore, women report greater disgust sensitivity and contamination fear compared with men (e.g., Cisler, Reardon, Williams, & Lohr, 2007; Dowson, 1977; Mancini, Gragnani, et al., 2001; Mancini, Gragnani, Orazi, & Pietrangeli, 1999; Muris, Merckelbach et al., 2000; Noshirvani, Kasvikis, Marks, & Tsakiris, 1991; Olatunji et al., 2005). However, important differences exist in regards to facial expressions, elicitors, and physiological components. For example, disgust cues involve visual and olfactory elements (e.g., the smell of bodily waste), whereas fear is not typically associated with smell (although smells can trigger posttraumatic fear). Fear is associated with activation of the sympathetic nervous system (e.g., rapid heart

rate, shortness of breath, sweating), whereas disgust is associated with nausea and gagging (Rachman, 2004). In addition, different neural regions have been associated with fear and disgust, although these findings are not without question (Husted, Shapira, & Goodman, 2006). Given these differences, it seems likely that disgust may operate somewhat differently than fear (i.e., different eliciting stimuli, different appraisals, and different pattern of recovery), and this may have important implications for the psychological treatment of OCD contamination concerns.

Within the contamination literature, anxiety and disgust constructs have shown independent contributions. For instance, fear and disgust were found to differentially predict avoidance, worry, and depressive symptoms, while both emotions showed unique associations with disgust sensitivity and spider distress scores (Vernon & Berenbaum, 2002). Other researchers demonstrated that anxiety sensitivity (the tendency to believe that symptoms of autonomic arousal are signs of physical or mental harm) and disgust sensitivity were both unique predictors of contamination symptoms in student samples (Cisler et al., 2007; Olatunji et al., 2005). The interaction of these two constructs explained additional variance in contamination scores, whereby higher levels of disgust sensitivity were associated with more contamination symptoms for participants who also had high anxiety sensitivity (Cisler et al., 2007). In another study, habituation of anxiety during exposure to a contaminant predicted declines in urge to wash for high contamination fearful participants with illness related concerns, whereas habituation of disgust predicted declines in urge to wash for high fearful participants who endorsed fears of their own negative emotions and losing control (Cougle, Wolitzky-Taylor, Lee, & Telch, 2007). Given this small body of research, there is reason to suspect that disgust is not simply redundant with anxiety, but instead contributes uniquely to the experience of phobic distress.

Cognitive Theory: Role of Threat Appraisals

Cognitive theories have proposed that threat appraisals play a causal role in evoking anxiety related to a variety of stimuli (Beck et al., 1985; Freeston et al., 1996; Lazarus, 1966;

Riskind, 1997; Salkovskis, 1985). Lazarus (1966) defined appraisal as, "the cognitive process that intervenes between the stimulus and the emotional reaction. It is an evaluation by the individual of the significance of the stimulus" (p. 52). Appraisals can include expectations, interpretations and judgments, and are differentiated from beliefs, which are more enduring assumptions or attitudes that hold across multiple situations (OCCWG, 1997).

Cognitive models of anxiety typically focus on threatening appraisals regarding a confined set of stimuli, specific to the particular disorder. For some anxiety disorders, these triggering stimuli present in the external environment (e.g., spiders; social encounters), whereas for other disorders triggers are internal experiences (e.g., autonomic arousal symptoms in panic disorder; post-traumatic memories). Given the huge heterogeneity of fears and eliciting stimuli present in cases of OCD, the field has focused on models based on threatening appraisals of intrusive thoughts (e.g., Salkovskis, 1985) – a common factor across most individuals with OCD (Weissman et al., 1994). In this model, the crucial appraisal may be "if I ignore this thought, I could be responsible for serious harm" (p. 1003, OCCWG, 2001). Several categories of threatening beliefs have also been proposed as central to OCD, including importance and control over thoughts, inflated responsibility and overestimation of threat, and perfectionism and intolerance for uncertainty (OCCWG, 1997, 2001, 2003, 2005).

An appraisal model based on the meaning and interpretation of intrusive thoughts may not conceptualize the most critical appraisals for individuals with contamination concerns. Research indicates that 90% of individuals with compulsive washing rituals have fears that are primarily triggered by stimuli in their external environment (Steketee, Grayson, & Foa, 1985). These findings are consistent with clinical observations that a majority of cleaning rituals are triggered by contact with an external stimulus (Rachman & Hodgson, 1980). Given these particular concerns, cognitions under scrutiny in the current project are appraisals that relate to external threats in the environment, including overestimation of threat, responsibility for harm, and the looming or spreading nature of contamination threats. The theoretical foundations for

these constructs, as well as empirical support from studies of clinical and non-clinical samples will be outlined below.

Overestimation of Threat. Following the work of Lazarus (1966), an initial cognitive model of OCD was put forward by Carr (1974) that focused on abnormally high estimates for the probability of negative outcomes. In this model, rituals served to reduce anxiety and the likelihood of unfavorable outcomes. Empirical work indicates that cognition related to overestimation of threat is associated with many obsessive compulsive symptom clusters, even when controlling for anxiety and depression (OCCWG, 2001). Threat overestimation has also been linked specifically with contamination and washing symptoms in clinical and non-clinical samples (Deacon & Olatunji, 2007; Jones & Menzies, 1997a; OCCWG, 2001; Riskind et al., 1997; Tolin, Woods, & Abramowitz, 2003). For instance, self-reported washing scores correlated with danger appraisals including probability, severity, and lack of control in a college sample (Riskind et al., 1997). Tolin, Woods, and Abramowitz (2003) found that general beliefs of threat provided unique prediction of self-reported washing scores in undergraduate students, while categories of uncertainty, perfectionism, responsibility, control of thoughts, and importance of thoughts were not uniquely predictive of washing scores, despite comparable bivariate correlations. However, threat beliefs not only correlated with washing symptoms but also predicted scores on the checking, hoarding, neutralizing, and obsessing subscales. This is not surprising, given that overestimation of threat is a broad defining characteristic for all anxiety disorders.

Responsibility. In an attempt to distinguish between threat appraisals in OCD, anxiety, and depression, Salkovskis (1985; 1999), proposed a model based on the evidence that intrusive thoughts are normal occurrences (Rachman & de Silva, 1978; Salkovskis & Harrison, 1984), which only cause distress when their content or occurrence is appraised as indicating personal responsibility or blame for harm to themselves or others. Responsibility is specifically defined as “the belief that one has power which is pivotal to bring about or prevent subjectively crucial negative outcomes” (p. 110-111, Salkovskis, Rachman, Ladouceur, & Freeston, 1992, as

cited in Salkovskis, 1996). In this model, rituals are seen as an effort to correct any foreseeable problems and avert blame.

Numerous studies have found positive correlations between OCD symptoms and beliefs or appraisals of responsibility in clinical and non-clinical samples (e.g., Foa, Amir, Bogert, Molnar, & Przeworski, 2001; OCCWG, 2001, 2003; Rhéaume, Freeston, Dugas, Letarte, & Ladouceur, 1995; Scarrabelotti, Duck, & Dickerson, 1995), although some studies have not found significant relationships (e.g., Frost, Steketee, Cohn, & Griess, 1994; Rachman, Thordarson, Shafran, & Woody, 1995). Research has also demonstrated that responsibility uniquely predicted OCD symptoms, even when controlling for the contributions of negative affect (Ghassemzadeh, Bolhari, Birashk, & Salavati, 2005; Scarrabelotti et al., 1995), perfectionism (Rhéaume, Freeston et al., 1995; Rhéaume, Ladouceur, & Freeston, 2000), and danger appraisals (Rhéaume et al., 2000).

Salkovskis (1985) specifically addressed the issue of contamination when he suggested that a formulation based on responsibility and blame regarding the effects of contamination may explain the phenomenon better than a formulation regarding a fear of contamination *per se*. However, evidence is mixed regarding the importance of responsibility for contaminant related distress. For instance, some studies have documented weaker associations between responsibility and washing as opposed to checking (Mancini, D'Olimpio, & D'Ercole, 2001; Rhéaume et al., 2000), whereas others found equivalent effect sizes (Rhéaume et al., 2000; Smári, Gylfadóttir, & Halldórsdottír, 2003; Wilson & Chambless, 1999). The construct of responsibility is multidimensional, with different factors predicting different symptom clusters. Prevention of harm predicted washing symptoms, while self-granted power over harm predicted checking (Mancini, D'Olimpio, et al., 2001). The complexity of this construct, along with variability in operational definitions of responsibility beliefs and appraisals, may partially explain the mixed findings for the role of responsibility in OCD and contamination concerns.

Looming vulnerability. Riskind (1997) argues for the importance of a specific type of danger appraisal; he postulates that the construal of danger as rapidly evolving and advancing

is a central cognitive component of threat. Riskind claims that this "looming vulnerability" elicits anxiety, sensitizes individuals to threat cues, biases cognitive processing, and impedes fear reduction. This model sees danger appraisal as a dynamic and constantly changing process, rather than a static snapshot of threat. The construct of looming vulnerability is distinguished from the cognitive factor of imminence (i.e., perceived proximity), as a stimulus can be far away while rapidly approaching, or nearby but stationary. The key factor producing fear in this model is the degree to which the stimulus is appraised as looming. With each moment that the stimulus advances, it becomes more dangerous, and the individual feels more threatened and perceives greater risk of losing control over the situation and emotional responding. The looming vulnerability model adds specificity to traditional cognitive models by indicating conditions that elicit greater threat appraisals (i.e., perceived stimulus movement). Riskind's theory posits that perceived looming predicts fear above and beyond the effects of other cognitive constructs, such as probability of harm, lack of control, and imminence (Riskind et al., 1997).

Preliminary evidence has supported Riskind's theory regarding a role of looming attributes in contamination-related fears (Riskind et al., 1997; Riskind & Maddux, 1994; Riskind & Rector, 2007; Tolin, Worhunsky, & Maltby, 2004) and specific phobias (Rachman & Cuk, 1992; Riskind, Kelley, Harman, Moore, & Gaines, 1992; Riskind, Moore, & Bowley, 1995). For instance, high fear of contamination students responded to vignettes describing germs, dirt, and contamination with more appraisals of looming vulnerability than did members of a low fear control group, although the grouping and outcome variables were somewhat confounded (Riskind et al., 1997). While looming appraisals were highly correlated with both OCD symptoms and other cognitive appraisals (likelihood of harm, imminence, and lack of control), the looming factor was independently related to contamination fears after other appraisals were partialed from the analysis. In contrast, the other cognitive factors made no significant unique contributions to the prediction of OCD symptoms. In a similarly designed study of HIV fears, Riskind and Maddux (1994) found nearly identical results. Participants who were strongly afraid

of HIV reported more looming and danger appraisals in response to descriptions of public encounters with HIV-positive strangers compared with the low fear group. Finally, looming appraisals regarding a variety of disgust scenarios differentiated between contamination fearful, socially anxious, and non anxious undergraduate students (Williams, Olatunji, Elwood, Connolly, & Lohr, 2006).

Studies have also documented the importance of looming appraisals in OCD samples. For instance, a study by Tolin et al. (2004) found that individuals with OCD washing rituals reported more looming appraisals of contamination regarding the idiographically selected "most contaminated object in the building" compared with both anxious and non-anxious control participants. Further, looming appraisals mediated the relationship between diagnostic group and chain of contagion, whereby OCD patients (but not controls) reported that a succession of pencils touching the original contaminated object were also strongly contaminated, even if there were 12 degrees of separation between the new pencil and the original contaminant. Riskind and Rector (2007) documented that looming appraisals regarding a variety of OCD relevant scenarios accounted for 43% of the variance in OCD symptoms, with contamination specific looming appraisals accounting for a full 22% of the variance. Furthermore, looming appraisals including evaluations of contamination spread predicted OCD symptoms, even after controlling for dysfunctional beliefs and appraisals of intrusive thoughts. Thus, situation specific appraisals of looming threat differentiate between patient groups and show incremental value beyond general threat beliefs for individuals with OCD.

Establishing Causality of Cognitions

Empirical support for cognitive models presented thus far has been based on group differences and correlational evaluations of self-reported symptoms. A critical next step is to determine the causal direction of relationships, preferably using in vivo measures of distress and avoidance. While few experimental studies have addressed contamination concerns, a greater number of experiments have tested the causal role of responsibility for OCD related

checking behaviour. This causal evidence will be presented below, along with a discussion of limitations of these experimental designs.

Two separate experiments demonstrated that manipulations that decreased perceived responsibility in individuals with OCD caused subsequent declines in distress and urge to neutralize during approach tasks (Lopatka & Rachman, 1995; Shafran, 1997). Researchers also demonstrated that a responsibility induction with OCD patients caused an increase in both subjective OCD experiences and checking behaviours on a pill sorting task (Arntz, Voncken, & Goosen, 2007). The responsibility manipulations in all of these studies produced changes in danger appraisals regarding the probability and severity of negative consequences. It is therefore possible that danger appraisals, as opposed to responsibility, could have been the driving force in OCD patients' distress (Shafran, 1997) and mediated the observed relationship between responsibility, distress, and ritualistic behaviours.

The relevance of these studies for individuals with washing rituals is somewhat unclear. Lopatka and Rachman's study was restricted to checkers; their initial attempt to manipulate responsibility in washers was unsuccessful and the authors concluded that responsibility was less pertinent to compulsive cleaning (Lopatka & Rachman, 1995). Despite this claim, Shafran (1997) used a mixed sample including 8 washers, 14 checkers, and 14 people with other types of compulsions. She found no evidence of an interaction between symptom presentation and responsibility condition, although it is likely that power was insufficient to find such an effect. Finally, Arntz et al. (2007) reported that washing symptoms were not significantly associated with experienced danger, responsibility, or OCD symptoms on their sorting task.

Studies manipulating responsibility in nonclinical samples have documented effects on both subjective distress and checking behaviour (Bouchard, Rhéaume, & Ladouceur, 1999; Ladouceur et al., 1995; MacDonald & Davey, 2005; Mancini, D'Olimpio, & Cieri, 2004). However, because these studies varied both aspects of Salkovskis' responsibility definition at the same time (pivotal influence and negative consequences), it is difficult to determine which aspect caused the increase in distress and checking – a heightened sense of influence (i.e.,

responsibility appraisal; Rhéaume, Ladouceur, Freeston, & Letarte, 1995), or simply a heightened sense of potential for harm (i.e., danger appraisal). Ladouceur et al. (1995) investigated this confound using a post hoc discriminant analysis of their four manipulation check variables (probability, severity, influence, and responsibility). The results indicated that their procedure mainly affected perceived severity of potential outcomes; this variable accounted for 40% of the variance, whereas other variables accounted for less than 5%. In a follow-up study, Ladouceur, Rhéaume, and Aublet (1997) separately manipulated pivotal influence, negative consequences, and their combination. They found that a manipulation of negative consequences alone (or in combination with influence) produced checking behaviour, whereas the influence condition alone (i.e., responsibility) was not sufficient to produce checking. Only the combined condition produced increased behaviour modifications, doubt, and preoccupation with errors. Together, these studies lend support for the importance of basic danger appraisals, especially in regards to the cost or severity of negative consequences, in producing distress and compulsive behaviour.

Experiments specific to contamination have also explored several cognitive constructs as predictors of distress. For instance, Jones and Menzies (1998b) experimentally manipulated illness related danger expectancies prior to a contaminant exposure with a subclinical OCD undergraduate sample. Participants assigned to the high danger condition spent less time touching the contaminant stimulus and washed their hands longer after the exposure than did the low danger participants. Differences between groups on ratings of anxiety and urge to wash were in the expected direction but did not reach statistical significance, likely due to the small sample size (n = 9 per condition). In another study, Dorfan and Woody (2006) manipulated cognitive content by instructing non-clinical participants to use either imagery of moving harm, static harm, or safety during a 30-minute exposure to human urine. The results indicated that imagery of moving and spreading germs (i.e., looming) produced increases in distress over time, whereas static harm and safety imagery both produced declines in distress. However, findings from a follow-up study using a stronger static harm condition found that both the static

and moving harm imagery increased distress and impeded habituation, while the safety imagery again produced declines in distress (Dorfan & Woody, 2008). Therefore, both "static" disease cognition and a focus on the looming movement of germs increase distress during contaminant exposure.

The experimental studies to date have provided evidence that cognitions can play a causal role in producing distress and compensatory behaviour. Clearly, a majority of the work has focused on responsibility and checking, with a paucity of research establishing causality for washing-related concerns. While experimental studies represent the pinnacle of causal determination, such designs are not always feasible. Furthermore, the experiments described above demonstrated the challenge of manipulating single cognitive constructs (Dorfan & Woody, 2006; Ladouceur et al., 1995); manipulating responsibility or looming movement also increased perceived danger. Due to these confounds, the specific causal cognition in an experiment can be difficult to pinpoint, and comparing multiple types of cognitions and determining unique effects of these many variables can be challenging. Experiments can also produce artificial conditions, such as by asking participants to engage in imagery that may not have occurred naturally to them. Given these limitations, experiments must be complemented with alternative designs to study predictors of distress and avoidance.

Do Appraisals Predict Distress and Avoidance on Contaminant Approach Tasks?

The research question that I am addressing is whether appraisals predict distress and avoidance on contaminant approach tasks. Several researchers have looked at this question using correlational designs. Following from work identifying danger appraisals as predictors of specific phobic anxiety and avoidance in vivo (Menzies & Clarke, 1995; Williams & Watson, 1985), Jones and Menzies (1997a) explored a variety of predictors of contaminant distress and related behaviour. In Jones and Menzies' study, individuals with OCD washing concerns were asked to submerge their hand into a trash can holding a mixture of potting soil, animal hair, raw meat, and food scraps. Five potential predictors of emotional and behavioural responses were examined: danger expectancies (likelihood and severity of illness), responsibility for a negative

outcome to self or other, perfectionism, self-efficacy, and anticipatory anxiety. Only danger expectancies remained significantly correlated with anxiety, urge to wash, duration of the exposure, and time spent washing, after partialing out the contributions from other variables (partial *r*'s = .25 - .76).

More recently, Deacon and Olatunji (2007) evaluated contamination danger appraisals and disgust sensitivity as predictors of three contaminant behavioural approach tasks (BATs) in an undergraduate sample. The BATs included exposure to a used comb, a cookie that had been on the floor, and a bedpan filled with toilet water. Anxiety and avoidance on the BATs were correlated with danger appraisals and disgust sensitivity (*r*'s = .40 - .50). In a set of hierarchical regression analyses, the authors found that disgust sensitivity remained a significant unique predictor of BAT anxiety and avoidance, even when controlling for gender, depression, anxiety symptoms, and level of contamination fear. Note they did not control for danger appraisals. In a separate set of analyses, the relationship between danger appraisals and BAT outcomes was evaluated when controlling for disgust sensitivity. Inclusion of disgust sensitivity significantly reduced the effect of danger appraisals; only disgust sensitivity was a significant unique predictor when both variables were entered in the model. Thus, the importance of danger appraisals for contamination tasks beyond disgust sensitivity appears questionable.

Summary and Current Project

What predicts normative responses to contaminating stimuli that people encounter in their daily life? Why are some people highly distressed by contaminants while others are not bothered? The answer, according to cognitive theorists, is that appraisals mediate individual differences in distress and avoidance in response to a stimulus. However, the field has not yet reached a consensus on which particular threat appraisals are crucial for understanding contamination concerns. Furthermore, few studies have conducted stringent tests of appraisals as causal factors in predicting contamination related distress and avoidance.

When studying appraisals related to obsessive compulsive disorder, much of the research has focused on general cognitive factors that underlie all OCD subtypes, despite evidence of meaningful subtypes (McKay et al., 2004) and theories suggesting that subtype-specific appraisals are key to understanding different presentations of the disorder (Rachman, 2002, 2004). In addition, recent theory and research has focused primarily on threatening interpretations of intrusive thoughts (e.g., OCCWG, 2001; Salkovskis, 1985). Much less attention has been paid to threat appraisals of external stimuli or situations that appear to play an especially large role in triggering contamination concerns. Furthermore, most research of appraisals has been conducted using concurrent self-report instruments, so little is known about the connection between specific appraisals, in vivo distress, and avoidance behaviour. Following from the work of Jones and Menzies (1997a) and Deacon and Olatunji (2007), the present study evaluated contaminant threat appraisals as predictors of distress, avoidance, and washing behaviour.

Jones and Menzies (1997a) exposed individuals with OCD to a contaminating stimulus to assess five potential predictors of distress and avoidance behaviour: danger expectancies (likelihood and severity of illness), responsibility, perfectionism, self-efficacy, and anticipatory anxiety. Through a series of partial correlations, these authors concluded that danger expectancies were the most likely mediator of obsessive hand-washing. Although compelling, this study suffered from a critical limitation. While perfectionism, self-efficacy, and anticipatory anxiety were measured prior to the exposure, appraisals of illness and responsibility were measured during the exposure, at the same time that three outcome measures were assessed (anxiety, urge to wash, and duration of the exposure). Temporal precedence was not established; heightened anxiety may have increased danger expectancies rather than danger expectancies increasing anxiety. This would be consistent with empirical evidence of emotional reasoning found by Arntz, Rauner, and van den Hout (1995): "If I feel anxious, there must be danger". Deacon and Olatunji (2007) measured contaminant appraisals prior to the BATs, although participants knew they would subsequently be asked to touch noxious stimuli when

they completed the appraisal measure. Thus, measurement of danger appraisals may have been confounded with anticipatory anxiety in the Deacon and Olatunji study as well.

Many appraisals have been implicated in OCD distress. Although danger appraisals were found to be significant predictors by Jones and Menzies (1997a), and to a lesser extent by Deacon and Olatunji (2007), the role of looming appraisals was not assessed in either study. Experiments manipulating imagery of looming germ spread have produced increases in distress during contaminant exposure (Dorfan & Woody, 2006, 2008), although the effects of looming cognition were no greater than static cognition in the latter study (Dorfan & Woody, 2008). Therefore, Riskind's claim that looming appraisals add explanatory value beyond basic danger cognition requires further testing. Further research is also needed to clarify the relationship between responsibility and contamination concerns, given that findings to date have been mixed (Jones & Menzies, 1997a; Lopatka & Rachman, 1995; Mancini, D'Olimpio, et al., 2001; Rhéaume et al., 2000; Smári et al., 2003; Wilson & Chambless, 1999).

The role of disgust has been largely ignored in the literature on OCD, including the study by Jones and Menzies (1997a). Recent research has shown that disgust sensitivity predicts avoidance on contaminant BATs (Olatunji, Lohr, et al., 2007; Rozin et al., 1999), even when controlling for negative affect (Deacon & Olatunji, 2007). However, disgust sensitivity has not been tested as a prospective predictor of distress or cleaning behavior. Also lacking are studies that integrate disgust and cognition. In one such study using an undergraduate sample, Deacon and Olatunji (2007) did not find evidence for direct effects of general danger appraisals when controlling for disgust sensitivity, but they did not measure appraisals of the specific stimuli participants were asked to approach. This likely weakened the differential value between stimulus appraisals and a general measure of disgust responding, limiting the ability to find unique effects of danger appraisals beyond the dispositional trait of disgust sensitivity.

The current study utilized a prospective design to compare the unique predictive value of three specific types of threat appraisals (danger, looming germ spread, and responsibility) in a normal sample. Threat appraisals were measured during session one using a questionnaire

assessing evaluations of in vivo contaminants. Personality traits, OCD symptoms and beliefs, and implicit associations were also measured during the first session. Two days later, participants engaged in a behavioural approach task in a public washroom in order to measure anxiety, disgust, avoidance, urge to wash, and cleaning behaviour. An additional implicit association test was administered during the second session. Situation specific appraisals were expected to prospectively predict distress, avoidance, urge to wash, and cleaning behaviour on the BAT, even when controlling for gender, neuroticism, disgust sensitivity, and OCD symptoms. Disgust was expected to be a prominent component of contamination responding, and this proposition was tested with in vivo distress ratings and reaction time data evaluating implicit associations of contaminants.

Method

Research Design

Based on a continuous model of contamination distress, the current study used a normal sample and a prospective correlational design. Multiple regression analyses were used to determine whether threat appraisals from session one significantly predicted distress, avoidance, and cleaning behaviour during session two, while controlling for other relevant variables. For the implicit association data, t-tests were used to determine whether the concept of anxiety or the concept of disgust was more strongly associated with contaminants.

Participants

Participant volunteers were recruited from the psychology participant pool website and poster advertisements around the University of British Columbia campus. Posters and website postings described the study as an investigation of how thoughts and personality relate to how people feel in new workplace environments. Participants were informed that they would complete questionnaires, computer tasks, and other tasks in the laboratory. Following ethical review board guidelines at the University of British Columbia, volunteers recruited from the departmental participant pool were required to be at least 17 years old, and other participants

were required to be at least 19 years old. All participants were required to be fluent in English. Participants received either partial course credit or $20 for their time.

Of the 105 consenting participants, two never returned for the second session and were therefore eliminated from the sample. Of the remaining 103 participants used for data analysis, 60% were female (N = 62). Ethnic original was reported as follows: 48% Caucasian, 44% Asian, and 8% reporting other ethnicities. Age of participants ranged from 18 to 56, with a mean of 21.97 years (SD = 7.07).

Questionnaire Measures

The Washroom Appraisal Questionnaire (WAQ; see Appendix A) is a 17-item questionnaire designed specifically for this study. The WAQ asks participants how they would feel if they were asked to touch objects in a public washroom (e.g., toilet, floor, garbage can, tampon disposal receptacle, garbage on the floor) using 7-point appraisal scales with descriptive anchors. The questionnaire measures appraisals of general danger (4 items: perceived vulnerability to germs, vulnerability compared to others, level of risk, likelihood of something bad occurring), disease (three items: likelihood of illness, likelihood of illness compared to others, severity of illness), looming germ spread (seven items: spread on/into body, spread by touching hands to other parts of body, spread through the air, speed of spread, acceleration, speed of spread to others, spread of illness to others), and responsibility appraisals (two items: responsibility to self, responsibility to others). One item assessed appraisals of ability to cope with feelings of anxiety or disgust. Psychometric properties of this questionnaire are presented in the results section.

The Looming of Contamination Questionnaire (LOC; Riskind et al., 1997) includes five brief vignettes describing encounters with possible germs, dirt or contamination (e.g., a dirty bathroom at a gas station; shaking hands with a person who just threw out trash). After reading each vignette and vividly imagining the situation described, participants rate appraisals regarding the looming movement of the contamination (three items: speed of spread, rapidity of approach, and acceleration) as well as static threat appraisals (three items: probability of

contamination, imminence, and lack of control). Both the looming appraisal and static indices demonstrate excellent internal consistency (α's = .93) and correlate moderately (r = .44 - .50) with self-reported contamination fears and washing behaviour (Riskind et al., 1997). Minor changes to the instructions, order of the items, and wording of questions were made for the purpose of this study (e.g., subway changed to city bus for greater pertinence to Vancouver). Two additional questions were added to the LOC after each vignette in order to measure responsibility appraisals (responsibility to self; responsibility to others) associated with the vignettes.

The Obsessive-Compulsive Inventory - Revised (OCI-R; Foa et al., 2002) is an 18-item questionnaire rated on a 5-point distress scale that includes content domains of washing, checking, ordering, obsessing, hoarding, and neutralizing. The OCI-R total score has good internal consistency (α = .81 - .93), test-retest reliability (r = .82 - .84), and correlates with other self report and interview measures of OCD (Foa et al., 2002).

The Obsessive Beliefs Questionnaire (OBQ-44; OCCWG, 2005) measures cognitions relevant to obsessive compulsive disorder. The scale consists of 44 items rated on a 7-point scale, including three empirically derived subscales: 1) exaggerated sense of responsibility and overestimation of threat, 2) perfectionism and need for certainty, and 3) belief in the importance of thoughts and need to control them. The OBQ total score demonstrates strong internal consistency (α = .95) and correlates with other measures of OCD symptoms. Subscales are correlated (r = .42 - .73), especially in non-OCD samples. The OBQ has a hierarchical structure with one higher-order general factor and three lower-order factors (Taylor, McKay, & Abramowitz, 2005). This higher-order factor accounts for a greater amount of variance in OBQ scores, and demonstrates equivalent or greater associations with washing symptoms compared with the lower-order factors (Taylor et al., 2005), justifying the use of total score versus subscales in the current study.

The Disgust Scale (DS; Haidt, McCauley, & Rozin, 1994) assesses disgust sensitivity, or the propensity to feel disgusted by a variety of stimuli. It contains 16 true/false questions and 16

items rated on a 3-point scale. The scale assesses seven domains of disgust elicitors (food, animals, body products, sex, body envelope violations, death and hygiene) in addition to a domain of magical thinking (i.e., similarity and contagion). Internal consistency is good, α = .81 (Haidt et al., 1994), test-retest (r = .79) is quite higher over several months (Rozin et al., 1999), and the scale correlates with distress and avoidance on disgust related behavioural approach tasks (Deacon & Olatunji, 2007; Rozin et al., 1999).

The Big Five Inventory (BFI; John & Srivastava, 1999) is a 44-item measure of core personality traits that are described in short phrases and rated on a 5-point scale. Subscales include extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. Psychometric properties of the scale are good, including 3-month test-retest reliability (r = .80 - .90). Only the 8-item neuroticism versus emotional stability scale was used in this study given its relevance for understanding anxiety and disgust. The BFI neuroticism scale (BFI-N) demonstrates good internal consistency (α = .84) and correlates strongly (r = .76) with two other big five neuroticism scales, Goldberg's Trait Descriptive Adjectives (TDA) and Costa and McCrae's NEO Five Factor Inventory (John & Srivastava, 1999).

Behavioural Approach Task Measures

Participants engaged in a behavioural approach task (BAT) with a series of objects that are often perceived as dirty or contaminated. Generally, BATs involve asking participants to look at and then touch stimuli in increasingly emotionally-evocative steps in order to determine their degree of emotional distress and behavioural avoidance. In this study, participants were presented with objects in a single-occupancy wheelchair accessible public washroom. Once inside the washroom, the experimenter asked participants to touch 13 items with the palm of their non-dominant hand in the following order: 1) doorknob, 2) handrail near toilet, 3) top of the trash can, 4) swinging lid of the trash can, 5) top of the tampon disposal receptacle, 6) toilet flush handle, 7) outside of the toilet bowl (near the base of the toilet), 8) floor (near the toilet), 9) floor drain, 10) tissue on the floor (placed by experimenter unbeknownst to participant), 11) wet area of the basin behind the faucet, 12) basin rim (run two fingers along rim), and 13) basin

drain. The experimenter asked participants if they were willing to complete each task, even if they had declined prior tasks. The experimenter modeled each task so that all participants touched items in the same manner, although the experimenter, unlike the participant, wore latex gloves to avoid providing a coping model for exposure to contaminants. The cumulative number of objects that participants declined to touch served as an index of avoidance behaviour.

To assess levels of anxiety and disgust for each BAT stimulus, the experimenter asked participants to make two separate ratings using 0-100 scales. This type of distress indicator is used regularly in both clinical practice and research to monitor emotional response to BATs and exposure exercises. Because previous research has indicated that self-reported anxiety and disgust are highly correlated (r = .61 - .90) (Smits, Telch, & Randall, 2002; Woody & Tolin, 2002), alternate descriptor words were used ("nervous" and "grossed out") in an attempt to increase discrimination between the two scales (see Woody et al., 2005). Anchors for the anxiety scale were as follows: 0 (not at all nervous: like relaxing on the beach), 25 (somewhat nervous), 50 (moderately nervous), 75 (very nervous), and 100 (extremely nervous: panic attack, heart racing). Anchors for the disgust scale were as follows: 0 (not at all grossed out: feeling pleasant), 25 (somewhat grossed out), 50 (moderately grossed out), 75 (very grossed out), and 100 (extremely grossed out: throwing up, nauseous).

At the completion of the BAT, participants rated their urge to wash their hands on a 0-100 scale. Anchors for the scale were: 0 (no urge to wash, I could wait until tomorrow and not even think about it), 25 (a little urge, I could wait a few hours), 50 (moderate urge, I could wait an hour but it would be on my mind), 75 (strong urge, I could wait 15 minutes), and 100 (extremely strong urge, I must wash right now, it is all I can think about). After making their rating, participants were given the opportunity to wash their hands. The amount of time spent washing was used an index cleaning behaviour (i.e., the amount of time the tap was running and/or the participant was using the liquid soap). Upon return to the laboratory, the experimenter offered participants antibacterial wipes. The number of wipes taken was a measure of repetitive cleaning behaviour.

Rozin and his colleagues (1999) have explored the ethical implications of using disgusting stimuli in laboratory research. Their study involved BATs with a variety of stimuli, in which the most emotionally-evocative steps involved actions such as touching a dead sterilized cockroach, drinking water with spit in it, drinking apple juice from a clean bedpan, and sticking a pin in the eye of a fresh pig's head. After completing the study, participants rated it as interesting and somewhat enjoyable, and they gave pleasantness ratings above the midpoint. Most participants indicated they would be likely to recommend the study to a friend. The authors concluded that if the option of task refusal is a clear and acceptable choice, such studies are ethical and non-traumatizing for participants. In my prior research (Dorfan & Woody, 2006, 2008), less than 10% of participants declined a direct exposure to touching human urine. Many participants in the current study stated that they found the interactive nature of the study interesting, and no participants raised any concerns about the approach task after the debriefing process.

Implicit Association Test

Psychometrics and task description. In order to measure associations of contaminants with the concepts of anxiety and disgust, the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) was administered. The IAT is a computer based reaction time index of implicit associations. This test is designed to measure the relative strength of automatic associations in memory that occur outside of conscious control, and at times, outside of awareness (Greenwald et al., 1998). Because this implicit measure is relatively impervious to attempts to fake or manipulate associations (De Houwer, 2002), it avoids response biases such as impression management and demand characteristics of the testing situation that can occur with self-report instruments. The IAT has an added benefit in that prior studies document smaller overlap between anxiety and disgust on IAT indices (r = .34 - .47) (Teachman, Gregg, & Woody, 2001; Teachman & Woody, 2003) as compared with in vivo self reports (r = .61 - .90) (Smits et al., 2002; Woody & Tolin, 2002).

IATs have shown stronger psychometric properties compared with a number of other implicit measures (Bosson, Swann, & Pennebaker, 2000). IATs have demonstrated good internal consistency (α =.77 - .89) and adequate (*r* = 0.57 - 0.66) test-retest reliability (Asendorpf, Banse, & Mücke, 2002; Egloff & Schmukle, 2002). In addition, because threat and non-threat category labels are both present in all of the IAT trials, the influence of state anxiety is held constant across critical comparisons. In this study, three separate IATs were conducted to assess emotional associations of dirty versus clean objects: 1) afraid versus sad, 2) disgusted versus sad, and 3) disgusted versus afraid. The disgusted versus afraid IAT was used to directly compare associations of these two emotion categories with dirty versus clean objects. The first two IAT tasks were included to demonstrate associations of disgust and fear independently, to aid interpretation in case the direct comparison showed no differences. Sad was used as a comparator instead of a polar opposite (e.g., afraid vs. unafraid) in order to control for valence across response options.

In critical trials of the IAT, two pairs of opposing categories appeared simultaneously at the top of the screen: the target pair (e.g., dirty/clean) and the descriptor pair (e.g., disgusted/afraid). Participants categorized words that appeared in the middle of the screen into one of the four categories. For example, the word “germs” had to be categorized into one of two superordinate target categories (e.g., dirty or clean) that were simultaneously paired with one of two descriptor categories (e.g., disgusted or afraid). To categorize the stimulus, participants pressed a computer key (‘d’ or ‘k’) with their left or right index finger corresponding to the side of the computer screen where the appropriate category appeared (see Figure 1). The IAT is based on the idea that participants should respond faster when highly associated categories are paired together on one side of the screen and share a response key, than when incongruent categories are paired together and share a response key.

Each IAT was administered using seven blocks of categorization trials and took five minutes to complete (see Table 1 for more details about the disgusted versus afraid IAT). In the first block of trials (practice), participants learned to categorize stimulus words into the

superordinate target categories of dirty versus clean. Category label presentation was counterbalanced across participants such that half of the sample started with dirty on the left key and clean on the right key, and the other half started with clean on the left key and dirty on the right key. In the second block (also practice), participants learned to categorize another set of stimulus words into the emotion descriptor categories of disgusted versus afraid. In the third and fourth test blocks (i.e., critical trials), participants completed a combined task in which four category labels were presented in two pairs, as described above. In the fifth trial, participants again had a practice block with a single pair of target categories in which the location of the dirty and clean labels switched sides. The number of trials were increased in block five to decrease order effects (Greenwald, Nosek, & Banaji, 2003; Nosek, Greenwald, & Banaji, 2005). Finally, the sixth and seventh blocks involved critical test trials for the combined task in which pairings of target and descriptor category labels were opposite to those in blocks three and four.

During each combined task block, stimulus presentation alternated between target words and descriptor words. Words were selected randomly without replacement (independently for each participant) until the available stimuli for a particular category was exhausted; the stimulus pool was then replaced. Equal numbers of stimulus words from each of the four categories were presented. The order of critical blocks for each IAT (i.e., congruent versus incongruent category pairings) was counterbalanced across participants, such that half of the participants had dirty paired with disgusted (and clean paired with afraid) as their first combined task, and the other half had clean paired with disgusted (and dirty paired with afraid) as their first combined task. Participants were instructed to respond as quickly as possible, while making as few errors as possible. When participants made a categorization error, a red "X" appeared on the screen and they were required to make the correct response before the next stimulus appeared. Latencies were recorded as the amount of time to enter the correct response. The IAT was programmed using Inquisit software (2003), and was presented on an 18-inch monitor running in Windows XP.

Stimulus words. Pilot data were collected in order to determine the best stimulus words for the IAT tasks. First, labels were chosen for the target categories (dirty, clean) and the descriptor categories (disgusted, afraid, sad). The word dirty was selected instead of the word contaminated due to its higher frequency of use in the English language and a lower reading grade level, which was consistent with the other category labels (Francis & Kucera, 1982; Zeno, Ivens, Millard, & Duvvuri, 1995).

Potential stimulus words representing the five categories (dirty, clean, disgusted, afraid, sad) were generated from a thesaurus and prior IAT research (Teachman et al., 2001). For the disgusted and afraid categories, only the three words that were used by Teachman et al. for each category were included, as they had already been selected for ease of categorization and word length (words used by Teachman et al. for their 'disgusting' category were altered to be used in the 'disgusted' category for the present study). Pilot participants (N = 16) classified each stimulus word into one of the five categories, and rated the ease of classification on a 7-point scale. Words being considered for the dirty category were also rated on a five-point scale ranging from 1 (only disgusting or gross; no threat of illness) to 5 (only threat of illness; not at all gross or disgusting). The midpoint of the scale (3) indicated both disgusting and threat of illness.

Based on the pilot data, stimulus words were selected according to the accuracy and ease of classification into the appropriate category label (see Table 2). All stimulus words selected for the task had average ease ratings between 5 and 7, meaning that pilot participants fount them "somewhat easy" to "very easy" to classify. Additional consideration was given to word length, frequency in the English language, and reading grade level (Zeno et al., 1995). Finally, the three stimuli for the dirty category were selected to represent the range of disgust versus illness threat: "polluted" was at the midpoint of this scale (M = 2.97, SD = 0.84), "germs" was above the midpoint (M = 3.88, SD = 0.72), and "trash" was below the midpoint (M = 1.88, SD = 0.62).

Construct validity. Numerous studies support the validity of IATs for measuring constructs relevant to anxiety and disgust (Asendorpf et al., 2002; Egloff & Schmukle, 2002; Ellwart, Rinck, & Becker, 2006; Huijding & de Jong, 2007; Neumann, Hülsenbeck, & Seibt, 2004; Schnabel, Banse, & Asendorpf, 2006; Teachman et al., 2001; Teachman & Woody, 2003; Westberg, Lundh, & Jonsson, 2007). For example, implicit anxiety on the IAT predicted behavioural indices of anxiety during videotaped speech tasks, and experimenter rated anxiety during a "concentration" task after receiving failure feedback (Egloff & Schmukle, 2002; Schnabel et al., 2006). In another study, implicit social anxiety correlated with self-reported social anxiety symptoms, and both implicit and self reported anxiety increased after giving a speech (Westberg et al., 2007). IAT measures of anxiety and disgust have also shown declines over the course of a 3-week treatment for spider phobics (Teachman & Woody, 2003), although no such changes were documented after a single exposure session (Huijding & de Jong, 2007). Finally, implicit measures of spider threat and spider disgust show differential patterns of association with self reports measuring either general spider aversion or spider-specific disgust (Huijding & de Jong, 2007).

Despite empirical evidence supporting the IAT, the construct validity of the measure has been questioned on a number of fronts (De Houwer, 2002). There is evidence that the IAT is somewhat context dependent, with priming procedures, mood induction, and systematic biases between the sets of exemplar stimuli affecting results (Dasgupta & Greenwald, 2001; Gemar, Segal, Sagrati, & Kennedy, 2001; Steffens & Plewe, 2001). De Houwer (2002) notes, however, that self-report belief measures have also been shown to be context dependent, so this issue is not unique to implicit measures. It has also been suggested that IAT results may reflect the dominant views of society or associations present in the environment, rather than individual beliefs (Karpinski & Hilton, 2001). However, several studies have documented expected group differences based on level of spider fear, including participants classified as fearful, non-fearful, or spider enthusiasts (Ellwart et al., 2006; Huijding & de Jong, 2007; Teachman et al., 2001; Teachman & Woody, 2003). In addition, individual differences on IAT anxiety and disgust

measures are related to behavioural avoidance of spiders (Ellwart et al., 2006; Teachman & Woody, 2003). Another concern is that respondents may reframe the implicit task and respond on the basis of valence alone, instead of utilizing the specific category constructs. To address this concern, negative valence opposing descriptor categories were used for all IATs (e.g., sad instead of unafraid). Finally, Rothermund and Wentura (2001) suggested that the salience of the categories, as opposed to the association between categories, can influence IAT scores. Unfamiliar categories appear particularly salient (De Houwer, 2002), and therefore category word labels in this study were selected based on frequency in the English language and reading level (Zeno et al., 1995).

The IAT is a relative measure, and it can only be understood in relation to the opposing category chosen. Although non-relative versions of the IAT have been developed recently (e.g., Go/No Go Association Task, Extrinsic Affective Simon Task, and the one-category IAT), not much is known about their validity (De Houwer, 2002). Given the lack of psychometric support for these newer measures, the original IAT is a strong choice for studying implicit associations, despite its relative nature.

Procedure

Participants completed the study individually during two laboratory sessions, separated by two days. Each session lasted 40-60 minutes. During the first session, participants completed threat appraisal and general psychopathology questionnaires in addition to two of the IAT tasks (afraid versus sad; disgusted versus sad). During the second session, participants completed a third IAT task (disgusted versus afraid) and engaged in the behavioural assessment. Four female experimenters were used for this study, including a doctoral student (Nicole Dorfan), and three undergraduate psychology students who were trained and closely supervised by the doctoral student. In the majority of cases, participants were paired with the same experimenter for both sessions.

In order to achieve the research goals of this project, elements of deception were required. Specifically, this deception involved two elements: 1) using a cover story involving

workplace evaluations instead of specifying that the study was an investigation of contamination threat appraisals, and 2) withholding information on the first day of the study about the procedures for the second session (i.e., the approach task). The primary purpose of these procedures was to insure that the direction of the causal arrow between threat appraisals and distress could be determined in a prospective design, as prior research on contamination fears measured appraisals and distress concurrently. Specifically, the deception was used to reduce anticipatory anxiety when appraisals were being assessed on the first day (so that appraisals were not overly influenced by emotion) and to ensure that participants returned for the second session, especially those who were more fearful or disgusted by contaminants.

When participants arrived for the first session, they read and signed a consent form covering procedures for the first session only. The study was presented as an evaluation of how thoughts, evaluations, and personality factors contribute to challenges in adapting to new workplace situations. Participants were told that they would be randomly assigned to complete questionnaires and make evaluations regarding one of three possible conditions: 1) workers' social environment (e.g., interactions with coworkers), 2) workers' physical environment (e.g., office layout), or 3) workplace hygiene and cleanliness. The experimenter told participants that the study involved material that may be disturbing or uncomfortable for them, and they were free to stop their involvement at any time if they did not wish to continue.

After signing the consent form for session one, all participants were informed they had been assigned to the workplace hygiene and cleanliness condition. The anxiety and disgust scales (0-100) were described, and participants provided a personal example of being "extremely nervous" and "extremely grossed out" before giving a baseline rating for each scale.

Participants then completed two IATs (afraid versus sad; disgusted versus sad); the order was counterbalanced across participants. They were instructed to respond as quickly as possible, while making as few errors as possible. Short breaks were provided when instructions appeared on the screen between trials. The computer tasks were conducted prior to the questionnaires to avoid the influence of the imagined situations and multiple appraisal ratings on

implicit reaction times. While participants completed the computer tasks, the experimenter checked the washrooms to ensure they were ready for the subsequent viewing (see Appendix B for washroom cleanliness standardization procedures).

Participants next completed a series of questionnaires. They first completed a work experience questionnaire, which was used to support the cover story and collect demographic information. Participants then completed three questionnaire packets in a counterbalanced order: 1) personality and psychopathology questionnaires including the BFI-N, OCI-R, DS, and OBQ-44, 2) the adapted Looming of Contamination (LOC) vignette appraisals, and 3) the Washroom Appraisal Questionnaire (WAQ). This counterbalancing created six different possible orders for questionnaire administration. Participants provided ratings of anxiety and disgust (0-100) after completing the WAQ and the adapted LOC.

Just prior to completing the WAQ, the experimenter stated that in order to make evaluations about hygiene and cleanliness, participants would visit a public washroom in the psychology building and visualize a situation there before returning to the lab to make evaluations about it. The experimenter escorted the participant to a roomy wheelchair-accessible, single-occupancy (i.e., private) washroom. Once inside the washroom, the experimenter instructed the participant as follows:

> "Please imagine this is the first day of a new job. Your job requires you to touch items in a washroom similar to this one that you may not normally touch. For instance, you may have to touch the toilet, the floor, the garbage can, the tampon receptacle, or some garbage on the floor. Please close your eyes for a few minutes and visualize yourself touching these objects in a public washroom. I will tell you when to open your eyes."

After visualizing this scene for 15 seconds, participants returned to the lab to complete the WAQ.

At the end of the first session, the experimenter reminded participants that the second part of the study would occur two days later and would involve further evaluations for one of the three aspects of workplace environments: social, physical, or hygiene and cleanliness. The

experimenter asked participants not to discuss the study with others, and stated that any detailed questions about the study could be answered at the end of the second session. Participants provided final ratings of anxiety and disgust (0-100) before leaving the laboratory, and received one subject pool credit or $10 for their time at the completion of the first session.

When participants returned for the second session[1], the experimenter explained that this part of the study would concentrate on distress and avoidance of situations at work, and because they had been assigned to the hygiene condition, the focus would be on situations that could be perceived as dirty or contaminated at work. The experimenter told participants that in addition to completing questionnaires and computer tasks, they would be asked to touch a series of objects that might be perceived as dirty or contaminated. Participants were informed that not all people choose to touch all of the objects, and that some individuals feel nervous or grossed out in response to the tasks. Participants were reminded that they were free to refuse the tasks or to terminate their involvement at any point. Participants then signed another consent form covering procedures for the second session.

After reviewing the anxiety and disgust scales (0-100) and eliciting personal examples of each from participants (similar to the start of session one), the experimenter recorded participants' baseline emotional ratings. Participants then completed the final IAT (disgusted versus afraid), with breaks as needed when instructions appeared between trial blocks. This final IAT task was conducted during a separate session from the first two IATs in order to reduce fatigue or boredom on this repetitive task. While participants completed the computer task, the experimenter prepared the washroom for the approach task by placing some crumpled tissue paper on the floor near the toilet and wetting the counter area around the sink. Two washrooms were prepared in case one was in use when it was needed (see Appendix B for standardization procedures).

When participants completed the computer task, the experimenter introduced the approach task to the participant before leaving the laboratory:

[1] Participants who missed their scheduled appointment for the second session (n = 8) were rescheduled as soon as possible. The number of days between sessions ranged from 2-7, M = 2.20, SD = 0.84.

> "We will now do a behavioral assessment in which you will be asked to touch a variety of objects in a public washroom in this building. Please note that most people do not touch all of these objects – the purpose of this task is to determine what you are willing to touch and what you are not willing to touch. I will ask you if you are willing to do every step, even if you decline some of the previous steps. But feel free to refuse as many of the tasks as you do not wish to complete. I will ask you to report how grossed out and nervous you feel for each object you touch."

Once the experimenter and participant were inside the roomy single stall washroom, the door was closed and locked for privacy and instructions were repeated to the participant. Participants were informed that the washroom was used by students, faculty, and staff who worked in the building. They were asked to hold a card showing the anxiety and disgust rating scale anchors with their dominant hand, and to use the palm of their non-dominant hand to touch the washroom stimuli. They were asked to look at each object (to reduce the chance of cognitive avoidance) and touch it while making their two distress ratings (anxiety and disgust). The experimenter then reminded participants of the voluntary nature of the tasks:

> "Please remember that you are free to decline any of these tasks. I will ask if you are willing to do each task, even if you have declined some of the previous ones. When I ask if you are willing, just say 'no' if you prefer not to touch that object. We expect that most people will say 'no' to some of these objects. Do you have any questions?"

The experimenter then asked participants if they were willing to touch the 13 objects in the BAT (see Measures section for details); each task was modeled by the experimenter, who wore latex gloves. While touching each object, participants reported their level of anxiety and disgust on 0-100 scales. Participants who declined to touch an object were asked to estimate their distress ratings based on imagining themselves touching the object. The order of the disgust and anxiety ratings was counterbalanced across participants.

At the completion of the BAT, participants rated their urge to wash their hands (0-100). The experimenter then invited participants to wash their hands before leaving the washroom

(liquid soap was provided). The experimenter discretely measured the amount of time participants spent washing with a digital wristwatch. Upon return to the laboratory, participants were offered a bowl containing 10 individually wrapped antibacterial wipes. They were left alone to use the wipes and to complete several questionnaires (used simply to provide a reason for the experimenter to leave the room to insure privacy in using wipes); the number of wipes used was determined after the participant left the laboratory.

The experimenter provided an oral and written debriefing statement to participants at the end of the second session, explaining the motivation for using a deceptive cover story and withholding information until the start of the second session. Participants were again asked not to discuss the study with others who might want to participate. Participants were invited to ask questions and provided final ratings of anxiety and disgust (0-100) before leaving the laboratory. Participants received another subject pool credit or $10 for their time during the second session.

Results

Development of the Washroom Appraisal Questionnaire Subscales

Factor analysis. The original Washroom Appraisals Questionnaire (WAQ), created specifically for this study, included 17 items measuring contaminant related appraisals. Because the psychometrics of this measure were unknown, each item was evaluated for adequate response variability, and then a series of factor analyses were conducted in order to produce empirically derived subscales that mapped onto theoretically meaningful constructs.

Two WAQ items had minimal response variability: vulnerability compared to others (item 2) and likelihood of illness compared to others (item 6). Because a majority (~60%) of participants selected the midpoint response (i.e., “similar to others”), these items were removed and a principal axis factor analysis with direct oblimin oblique rotation was conducted on the remaining 15 items. Extracting factors with eigenvalues greater than one produced a five-factor solution. However, two factors had eigenvalues smaller than expected by chance based on a parallel analysis (Horn, 1965); one of these factors was uninterpretable and the other had only a single significant loading. Therefore, the factor analysis on the 15 items was rerun specifying

three factors, which were interpreted as 1) danger, 2) germ spread, and 3) responsibility. Three items did not have loadings of .40 or greater on any of the factors: spread from touching body (item 9), spreading illness to others (item 14), and coping with distress (item 17). In addition, the item describing germ spread on or into the body (item 8) had a relatively weak loading on the danger factor (.44), with a similar loading on the germ spread factor (.37). These four items were removed, and the factor analysis was repeated. A final principal axis factor analysis with direct oblimin rotation was run using the 11 items retained from the original WAQ. The Kaiser-Meyer-Olkin index of sampling adequacy was 0.78, indicating that the correlation matrix was suitable for factor analysis (Tabachnick & Fidell, 2007). A three factor solution was supported by the parallel analysis and scree plot (see Figure 2), and all retained factors had eigenvalues greater than one. The three factors cumulatively accounted for 68% of the variance. Factor loadings, eigenvalues, percent of variance explained by each factor, and communalities are reported in Table 3.

Three WAQ subscales were created by computing average scores of items that significantly loaded on each factor (i.e., loadings $\geq$ 0.40). Cronbach's alphas are listed in Table 4. The WAQ responsibility scale had a lower alpha than other scales, although still acceptable, and it was remarkably high considering the brevity of this scale (two items). The responsibility scale was retained given its importance to cognitive theories of OCD (Salkovskis, 1985). Intercorrelations between the WAQ subscales are listed at the bottom of Table 5. The relatively low associations between subscales, ranging from r = .14 - .33, support their use as independent constructs.

Construct validity. Table 5 presents correlations between the WAQ and another contamination appraisal scale, the adapted LOC. Significant correlations emerged between corresponding subscales of the WAQ and LOC (danger with static threat; germ spread with looming threat; and between responsibility subscales), supporting the concurrent validity of the WAQ. Weaker correlations generally emerged for discrepant subscales of the WAQ and LOC. The WAQ performed better than the LOC in differentiating between appraisal dimensions. The

correlation between danger and germ spread subscales on the WAQ was *r* = .33, whereas the association between static and looming subscales of the LOC was *r* = .70. Finally, the WAQ demonstrated good distinction between the responsibility subscale and the two other WAQ subscales, as shown in the bottom of Table 5.

Session One Measures

Table 4 presents descriptive statistics for measures collected during session one. As expected, distress ratings during the first session were generally low, with positively skewed distributions which were also kurtotic for some of the disgust ratings. Distress ratings were low both prior to and after completing the Washroom Appraisal Scale (see Table 4), supporting the claim that appraisal ratings from session one were not unduly influenced by negative affect. For the published scales (BFI, DS, OCI-R, and OBQ), means in the current sample all fell within one standard deviation of means reported in prior studies using college samples (Benet-Martínez & John, 1998; Foa et al., 2002; Hajcak, Huppert, Simons, & Foa, 2004; OCCWG, 2005; Sawchuk, Lohr, Tolin, Lee, & Kleinknecht, 2000). Relatively low correlations between the WAQ subscales and published measures in Table 5 indicate that the contamination appraisals are not redundant with pre-established measures of personality traits, OCD symptoms, or OCD relevant beliefs.

Session Two Behavioural Approach Task (BAT)

Avoidance and distress. Table 6 provides avoidance and distress ratings for each of the 13 BAT tasks, as well as average scores across all tasks. Participants avoided (i.e., declined to touch) an average of 5.35 items (*SD* = 3.59) during the BAT. The initial tasks of the BAT were less emotionally evocative; few participants avoided them, and distress ratings were primarily low, causing positively skewed distributions. As the BAT progressed, a greater percentage of the sample avoided the tasks, and distress ratings showed greater variability with higher means and roughly normal distributions. Indices used for regression analyses, including frequency of avoided items, average disgust, and average anxiety across the 13 tasks, demonstrated roughly normal distributions.

There was great variability in individuals' patterns of avoidance across the 13 tasks. A minority of participants (17%) touched all items on the BAT, including 4 females and 13 males. Another 35% of the sample stopped touching items at a certain point (avoiding all subsequent items); the number of items touched before stopping greatly varied across participants. Finally, 49% of the sample alternated between touching items and avoiding items throughout the 13 tasks.

Cleaning behaviour. At the completion of the BAT, participants (on average) expressed a "strong" urge to wash[2] on the 0-100 scale (*M* = 76.58, *SD* = 20.32; *Mdn* = 80). Participants then proceeded to wash their hands with soap and water for an average of 18.35 seconds (*SD* = 8.51). By way of context, a naturalistic observational study found that only 30% of college students wash for longer than six seconds after using the toilet in a public washroom on campus (Monk-Turner et al., 2005). In the current study, 92% of participants washed for more than six seconds. Upon returning to the laboratory, 53% of the sample used one or more antibacterial hand wipes[3]. Thus, a majority of participants elected to use additional means of cleaning and disinfection just minutes after washing their hands for a relatively long period of time.

Reliability and validity of the BAT outcome variables. Cronbach's alphas and correlations between BAT indices are listed in Table 7. Avoidance and distress ratings across the 13 tasks demonstrated strong internal consistency with moderate to large item-total correlations (avoidance: *r* = .27 - .71; anxiety: *r* = .54 - .88; disgust: *r* = .58 - .83). As expected, average disgust and anxiety were correlated (*r* = .65), and both were associated with avoidance of touching contaminated objects. Distress during the BAT was also related to urge to wash and antibacterial wipe usage. The urge to wash rating was moderately correlated with actual time spent washing, although it was not significantly associated with usage of antibacterial

[2] Urge to wash data were negatively skewed; raw data are reported here. The variable was transformed for all analyses using the square root after reflection (to improve the shape of the distribution), then multiplying by -1 to keep it in the same direction as all other outcome variables.
[3] Antibacterial wipe usage was coded as a dichotomous variable (0 = no wipes taken; 1 = one or more wipes taken) due to the small number of participants taking two or more wipes.

wipes. Finally, time spent washing and usage of antibacterial wipes were positively correlated. Interestingly, time spent washing was not significantly associated with emotional distress during the BAT. In addition, urge to wash and cleaning behaviours were not related to avoidance of touching contaminated objects. This pattern of correlations generally supports the convergent validity of BAT indices while showing some desynchrony between different types of measurement, which is common in anxiety research and treatment (Lang, Levin, Miller, & Kozak, 1983; Rachman & Hodgson, 1974).

Stimulus equivalence. One-way ANOVAs were used to test whether appraisals and BAT indices differed across the four experimenters or two washrooms[4] used in the study (chi-square analyses was used for the wipes variables). The WAQ subscales did not differ across experimenters (*F*'s < 1.51, *p*'s > .21, partial η^2's < .05), or across washrooms used for the viewing prior to filling out the appraisal questionnaire in session one (*F*'s < .42, *p*'s > .51, partial η^2's < .01). For session two, the BAT indices did not differ across experimenters (*F*'s < 1.03, *p*'s > .38, partial η^2's < . 04; wipes $\chi^2(3, N = 103) = 2.64$, $p = .45$), or across washrooms for BAT disgust, urge to wash, or time spent washing (*F*'s < 1.43, *p*'s > .23, partial η^2's < . 02). However, small but significant differences between washrooms did emerge for BAT avoidance ($F = 5.05$, $p = .03$, partial $\eta^2 = .05$), anxiety *(*$F = 4.59$, $p = .04$, partial η^2's = .05), and wipe usage ($\chi^2(1, N = 100) = 3.89$, $p < .05$). Due to these differences, the two-washroom variable was entered into the regression equations as a control prior to entering the variables of interest.

Gender Differences

A series of *t*-tests was used to evaluate differences between women and men for all predictor and outcome variables. As seen in Table 8, women endorsed significantly higher levels of danger appraisals, with statistical trends for higher germ spread appraisals, responsibility appraisals, and disgust sensitivity. Women also avoided touching more items and endorsed greater disgust on the BAT compared with men, demonstrating large effect sizes. In addition, a higher percentage of women used antibacterial wipes at the completion of the BAT

[4] Three participants used a third washroom; they were not included in this analysis due to the small cell size.

compared with males (61% vs. 41%, respectively, $\chi^2(1, N = 103) = 3.90$, $p < .05$). The female sample was also younger ($M = 19.95$, $SD = 1.89$) than the male sample ($M = 25.02$, $SD = 10.31$), $t(41.78) = -3.12$, $p < .005$, adjusted for unequal variances. The female sample ranged in age from 18-27, while the male sample ranged from 18-56, with nine men being 35 years or older. Patterns of correlations between predictor and outcome variables for men remained largely unchanged when excluding these nine older participants; therefore, they were left in the sample. Finally, ethnic representation (Caucasian versus Asian) did not differ between genders, $\chi^2(1, N = 94) = 1.80$, $p = .18$. Given the differences between women and men in our sample, gender was entered as a control variable for all regression analyses predicting BAT outcomes.

Appraisals as Prospective Predictors of In Vivo Distress and Avoidance

Purpose and Hypotheses. The primary purpose of this study was to test whether situation-specific appraisals predict distress, avoidance, and cleaning behavior in response to contaminating stimuli. A second aim was to determine the relative importance of several types of appraisals (danger, germ spread, and responsibility) for contamination concerns. While the current study did not manipulate appraisals, the prospective design allowed for appraisals to be measured in the absence of strong emotions or threat of contact with the stimulus two days prior to the BAT, thus establishing temporal precedence for appraisals as predictors of distress. Appraisals were expected to predict BAT outcomes, even after controlling for other variables including gender, personality traits, and OCD symptoms.

Bivariate correlations. Correlations between all predictor and outcome variables are listed in Table 9. Associations of BAT outcomes with danger and germ spread appraisals were moderate, at best, while responsibility appraisals were not associated with the BAT. Several other measures shown in Table 9 were associated with BAT outcome indices. In particular, the Disgust Scale showed moderate to strong correlations with avoidance and distress ratings. Also of note, few of the correlations between predictors and the three cleaning indices (urge to wash, time spent washing, and wipe usage) were significantly different from zero.

Multiple regressions. The correlations presented thus far cannot determine unique effects for particular appraisal subscales. In order to address this issue, a series of hierarchical multiple regression analyses were run to predict each continuous BAT outcome measure from the three appraisal subscales. In addition, a hierarchical logistic regression was run to determine whether appraisals predicted which participants would subsequently use one or more antibacterial wipes after the BAT. In all regressions, the washroom variable and gender were entered in step one to control for differences between the two primary washrooms used in the study, as well as the gender differences discussed above. In step two, the three washroom appraisal subscales (danger, germ spread, and responsibility) were entered together in a block. Assumptions of multiple regression were met for each analysis, including normality, linearity, homoscedasticity, and independence of residuals. Assumptions of logistic regression were also met, including adequate expected cell frequencies for categorical variables and linearity between continuous predictors and the log odds of the dependent variable. There was no indication of multicollinearity, and no cases had undue influence on any of the regression models.

As seen in Table 10, gender was a significant predictor of avoidance and disgust, with men avoiding fewer stimuli and expressing lower levels of disgust than women (consistent with findings from the *t*-tests reported above). After controlling for both gender and the washroom variable, appraisals explained significant variance in the models for avoidance and disgust, while the effect for anxiety was much weaker and was not statistically robust. When examining the standardized regression coefficients for the three appraisal subscales, only danger appraisals significantly predicted BAT avoidance and disgust. In contrast, germ spread appraisals were a weak predictor of anxiety, but this effect did not rise to the level of statistical significance. Responsibility appraisals did not predict avoidance or distress ratings on the BAT. Also evident from Table 10, the appraisal subscales did not explain significant variance in the prediction of urge to wash or time spent washing.

Approximately half of the sample used antibacterial wipes after the BAT (53%). The logistic regression predicting which participants used antibacterial wipes is seen in Table 11. After controlling for washroom and gender, the incremental change in chi-square for appraisals predicting wipe usage did not reach the level of statistical significance (p = .08). The regression coefficient for danger appraisals also failed to reach significance, although the odds ratio was sizable, indicating that participants were 1.5 times more likely to take a wipe with a 1-point increase in danger appraisals. There was also a statistical trend for responsibility as a negative predictor; participants were 0.73 times as likely to take a wipe with a 1-point increase in responsibility appraisals. As seen in Table 11, the final model had unimpressive classification rates, with overall correct classification falling at only 64%.

Additional Predictors of In Vivo Distress and Avoidance

The findings thus far demonstrate that danger appraisals were a significant predictor of BAT avoidance and disgust, while germ spread appraisals were a weak predictor of anxiety. The above model, which included appraisals, gender, and washroom, accounted for 25-27% of the variance in disgust and avoidance, and 11% of the variance in anxiety. Clearly, additional predictors are needed to better understand the phenomenon of contaminant-related distress and avoidance. Bivariate correlations in Table 9 demonstrated that all of the global predictors (with the exception of the OBQ) significantly predicted at least one BAT outcome variable. In an effort to determine which of these variables predict unique variance in BAT outcomes, and to test whether appraisals remain significant after accounting for these global measures, another set of multiple regression analyses was conducted. The correlations in Table 9 indicate that the global predictors were generally not associated with the three cleaning variables (urge to wash, time spent washing, and antibacterial wipes). Therefore, these analyses were run for outcome measures of avoidance, disgust, and anxiety only.

Similar to the analyses reported above, the washroom variable and gender were controlled for in step one. In step two, global predictors representing personality traits and obsessive compulsive symptoms (BFI-Emotional Stability, Disgust Scale, and OCI-R) were

entered together in a block. Finally, in step three, danger appraisals were entered to determine if they explained unique variance in avoidance and disgust, beyond the global predictors. For the prediction of anxiety, the germ spread subscale was entered in step 3, given that it was the only appraisal subscale showing potential for predicting anxiety in the initial set of regressions. Assumptions of multiple regression were met for each analysis, including normality, linearity, homoscedasticity, and independence of residuals. There was no indication of multicollinearity, and no cases had undue influence on any of the regression models.

As seen in Table 12, the global predictors explained significant variance in each of the three outcome variables (avoidance, disgust, and anxiety) after controlling for washroom and gender. Inspection of the standardized beta coefficients indicated that of the global predictors, only the Disgust Scale was a significant positive predictor of avoidance, disgust, and anxiety (note, however, that the OCI-R was a negative predictor of avoidance). In fact, the Disgust Scale had the largest standardized regression coefficient of all predictors in the model. Despite this strong predictor (which was conceptually similar to some of our outcome variables, especially in vivo disgust), danger appraisals remained a significant predictor of both avoidance and disgust. In total, the models predicting avoidance and disgust accounted for a substantial amount of variance (49% and 41%, respectively). In contrast, the model for anxiety explained only 22% of the variance. The Disgust Scale and the washroom variable were the only significant predictors of anxiety, and germ spread appraisals (previously a weak predictor) explained virtually no variance after accounting for the global measures.

Further Exploration of Gender and Appraisals

In the analyses presented thus far, gender was included as a control variable, essentially removing variance explained by gender in order to understand the contributions of variables implicated by cognitive models of OCD. Given the relatively strong gender effects exhibited in this study, a deeper understanding of this phenomenon was warranted in order to guide future research. In regards to the main research question, it seemed possible that gender might moderate the relationship between danger appraisals and contaminant-induced distress,

avoidance, and cleaning behaviour, which could wash out gender-specific effects when looking at results for the full sample. The lack of significant findings in the full sample for predicting urge to wash, time spent washing, and antibacterial wipe usage may be an example of this phenomenon.

In order to further explore the role of gender in this study, correlations between danger appraisals and BAT outcomes were assessed separately for women and men (see Table 13). For women, danger appraisals were moderately correlated with avoidance, disgust, and urge to wash. In contrast, danger appraisals correlated moderately with time spent washing and antibacterial wipe usage for men. When directly comparing correlations in the male and female samples (see Table 13), the only significant difference was for urge to wash, likely driven by the unexpected and statistically insignificant negative correlation in the male sample. The lack of statistically significant differences between our samples may reflect a lack of power given small sample sizes for these unplanned post-hoc analyses (n = 62 women; n = 41 men).

Disgust versus Anxiety

Purpose. In addition to testing the role of danger appraisals and individual difference variables for contamination-related distress and avoidance, a second (more exploratory) aim of the current study was to better understand the relationship of disgust to contamination concerns. The following sections outline findings regarding the relative associations of disgust versus anxiety with contaminants based on self report data and implicit cognitions.

Emotional response to contaminants. To determine whether the contamination BAT evoked more disgust or anxiety, in vivo distress ratings were evaluated for each of the 13 BAT tasks described in Table 6. Because data were skewed, especially for the initial tasks, Wilcoxon signed-rank parametric tests were used to analyze these data. Results indicated that participants reported significantly more disgust as compared with anxiety for each of the 13 tasks (Z's = 2.37 - 6.91, effect sizes: r = .16 - .48, p's < .05).

Disgust and anxiety were substantially correlated on the BAT, and both emotions correlated with avoidance and at least one of the cleaning variables. In order to investigate

unique relationships of each emotion with other BAT outcomes, partial correlations were calculated. As shown in Table 14, disgust significantly correlated with avoidance, urge to wash, and time spent washing after partialing out anxiety. In contrast, anxiety was not associated with any of these variables when partialing out disgust. However, anxiety remained significantly correlated with antibacterial wipe usage after controlling for disgust, whereas disgust did not remain associated with wipe usage after controlling for anxiety.

Implicit associations of contaminants. The aim of the current set of analyses was to test whether participants implicitly associated anxiety and disgust with contaminants, and to determine whether one of these emotional constructs demonstrated a stronger implicit association with dirtiness. Disgust and anxiety (compared with sadness) were both expected to show implicit associations with “dirty” in comparison to “clean”. No specific hypothesis was put forward regarding the relative strength of associations for disgust versus anxiety given the exploratory nature of this analysis.

Three separate IATs were conducted as described in the method section. All used target categories of dirty versus clean. During critical blocks, these category labels were paired with emotion descriptors that were balanced for negative valence. In the first IAT, these descriptors were afraid versus sad. In the second IAT, they were disgusted versus sad. Finally, the third IAT directly compared the constructs of interest using descriptors of disgusted versus afraid (see Figure 1 and Table 1). The basis of the IAT effect is the assumption that participants will complete the word categorization task more easily (and therefore more quickly) when category and descriptor pairs that share a response key are more closely associated in their memory.

Data analysis followed the widely used scoring algorithm of Greenwald et al. (2003) based on latencies measured in milliseconds (ms). First, data for each IAT were examined for evidence of extremely fast or slow responses, indicative of anticipation or inattention. All 103 participants were retained for analyses, given that none demonstrated excessively fast responding (defined as latencies of less than 300ms) for more than 5% of trials. Trials with

excessively slow latencies (greater than 10,000ms) were deleted from the dataset as follows: one trial from the afraid vs. sad IAT, five trials from disgusted vs. sad IAT, and none from the disgusted versus afraid IAT. Next, inclusive standard deviations were computed for all trials in blocks 3 and 6; and separately for all trials in blocks 4 and 7. Then, mean latencies were created for each critical block, and difference scores were calculated for block 6 minus block 3, and for block 7 minus block 4. Each difference score was divided by its associated inclusive standard deviation, creating two effects that are similar in nature to Cohen's *d*. Finally, these two effects were averaged to compute the final IAT score. Effects were computed such that positive scores indicated faster responding for: 1) afraid+DIRTY (and sad+CLEAN) in the first IAT, 2) disgusted+DIRTY (and sad+CLEAN) in the second IAT, and 3) disgusted+DIRTY (and afraid+CLEAN) in the final IAT. Women and men did not differ significantly on any of the IAT scores (*F*'s < 0.94, *p*'s > .33).

Most participants demonstrated low percentages of errors on the critical blocks of the IATs: afraid vs. sad (*M* = 5.74, *SD* = 4.86, *Md* = 4.17.), disgusted vs. sad (*M* = 6.14, *SD* = 5.41, *Md* = 5.00), and disgusted vs. afraid (*M* = 7.53, *SD* = 7.04, *Md* = 5.83). Because trial latencies were measured until the correct response was given (and incorrect responses required additional time to enter a second response), the results below have a built-in error penalty, as recommended by Greenwald et al. (2003).

The afraid vs. sad IAT score for the full sample was positive (*M* = 0.19, *SD* = 0.35), and significantly greater than zero, *t*(102) = 5.66, *p* <.001. This indicates that in general, participants were faster to classify stimuli when DIRTY was paired with afraid, and CLEAN was paired with sad (*M* = 940.76 ms, *SD* = 610.86, for 60 compatible trials), than when DIRTY was paired with sad, and CLEAN was paired with afraid (*M* = 1014.82 ms, *SD* = 693.62, for 60 incompatible trials). While this was a small effect, it provides support for an implicit association between contamination and anxiety (relative to sadness).

The disgusted vs. sad IAT score was also positive (*M* = 0.40, *SD* = 0.29), and significantly greater than zero, *t*(102) = 14.02, *p* <.001. This result shows that participants were

faster to classify stimuli when DIRTY was paired with disgusted, and CLEAN was paired with sad (*M* = 905.24 ms, *SD* = 633.10), than when DIRTY was paired with sad, and CLEAN was paired with disgusted (*M* = 1090.32 ms, *SD* = 817.67). This provides support for an implicit association between contamination and disgust (relative to sadness). Furthermore, this effect for disgust was stronger than the effect found for implicit anxiety above (paired sample *t*(102) = -4.65, *p* <.001), and these two IATs were orthogonal (*r* = .02).

The disgusted vs. afraid IAT score was positive (*M* = 0.29, *SD* = 0.36), and significantly greater than zero, *t*(102) = 8.00, *p* <.001. Thus, participants were faster to classify stimuli when DIRTY was paired with disgusted, and CLEAN was paired with afraid (*M* = 826.17 ms, *SD* = 510.24), than when DIRTY was paired with afraid, and CLEAN was paired with disgusted (*M* = 942.96 ms, *SD* = 595.99). This provides support for an implicit association between contamination and disgust that was stronger than the association between contamination and anxiety. However, it is interesting to note that this effect was small, and a minority of subjects (21%) showed a stronger implicit association for dirtiness with anxiety. The 22 participants who showed a stronger implicit association for anxiety with dirtiness did not differ significantly from the 81 participants showing a stronger implicit association for disgust on any of the appraisal subscales, global measures, or BAT outcomes (*t*'s < 1.68, *p*'s > .09, *d*'s < 0.43). The disgusted versus afraid IAT was somewhat correlated with the disgusted versus sad IAT (*r* = .24, *p*<.05), but not the afraid versus sad IAT (*r* = -0.11).

No specific hypotheses were proposed regarding the relationship between the implicit and explicit measures in the study. However, I was curious to explore whether any relationships existed between the IATs, BAT outcomes, and questionnaire measures. As seen in Table 15, implicit and explicit measures were generally orthogonal. The few exceptions should not be given much weight due to the large number of correlations conducted. Thus, automatic associations between the concept of dirtiness and concepts of anxiety and disgust were not correlated with emotional reactions or controlled behaviours in response to specific washroom stimuli. Implicit measures were also not synonymous with danger appraisals, neuroticism,

disgust sensitivity, or OCD symptoms. Despite the lack of association with explicit measures, the implicit and explicit tests demonstrated parallel conceptual findings: both anxiety and disgust are associated with contaminants, and disgust typically shows stronger associations with dirtiness than anxiety.

Discussion

Testing Cognitive Models

To date, there are surprisingly few stringent tests evaluating cognitive models of OCD, which posit a causal role of appraisals in determining distress and avoidance behaviour. The current research was designed to test the strength of the appraisal model in regards to contaminating stimuli, and determine which particular appraisals are causally important to distress and avoidance of contaminants in a normal sample. Although the current study did not experimentally manipulate appraisals, the prospective design allowed for specific stimulus-relevant appraisals to be measured in the absence of strong emotions two days prior to the BAT, thus establishing temporal precedence for appraisals as predictors of distress.

The discussion will first outline findings in regard to each of the appraisal subscales and OCD relevant beliefs. Next it will cover the influence of emotion on cognition, and discuss possible reasons for the lack of predictors of anxiety. The role of disgust sensitivity and gender will be presented given their relationship to BAT outcomes. The relative association of disgust versus anxiety will be reviewed, and the discordance between implicit and explicit variables will be discussed. Finally, generalizability of the findings and clinical implications will be suggested.

Danger Appraisals

Results of this study indicated that participants who endorsed stronger danger appraisals of a public washroom during session one reported more disgust when confronting contaminating objects and avoided touching more of these stimuli during session two. Impressively, this effect remained significant even when controlling for gender differences, neuroticism, disgust sensitivity, and OCD symptoms. The finding that danger appraisals were the most robust cognitive predictor of contaminant-related distress and avoidance is consistent

with Carr's (1974) original cognitive theory of OCD, which focused on overestimating the probability of negative outcomes. In Carr's theory, threat is determined by a multiplicative function of subjective probability and subjective cost or unpleasantness of the event. Results of this study are also consistent with prior empirical evaluations of normal and clinical samples indicating that danger cognition predicts in vivo emotional distress and avoidance of phobic objects and contaminants (Dorfan & Woody, 2008; Jones & Menzies, 1997a, 1998b, 2000; Menzies & Clarke, 1995; Williams & Watson, 1985). The study is also in line with the broader theoretical literature proposing that danger cognition plays a role in a wide variety of anxiety related symptoms (e.g., Beck et al., 1985).

In regard to effect sizes, danger appraisals showed moderate correlations with disgust and avoidance (*r's* = .39 - .40) and smaller associations with other BAT variables (*r's* = .15 - .21). These values are similar to effect sizes found between danger appraisals, distress, and avoidance in analog studies involving exposure to fear and disgust-related stimuli (Deacon & Olatunji, 2007; Menzies & Clarke, 1995), although stronger associations have been noted in other studies (Dorfan & Woody, 2008; Jones & Menzies, 2000). All of these previous studies measured appraisals and outcome measures concurrently, increasing the chance that affect and cognition ratings were influencing one another. For instance, in a study of OCD participants with washing symptoms, Jones and Menzies (1997a) found larger effects (*r*'s = .44 - .77) regarding the association between danger appraisals and contamination BAT outcomes than in the current study, especially for anxiety and washing variables. This is not surprising, given that clinical participants typically show stronger correlations between such measures compared with control groups (Jones & Menzies, 2000; Menzies & Clarke, 1995). It is also possible that anxiety ratings in Jones and Menzies' study tapped a range of emotions including disgust, as anxiety was not explicitly differentiated from disgust. The present research extended previous findings by demonstrating that danger appraisals predicted both avoidance and disgust in a rigorous prospective design, thus insuring that appraisal ratings were not influenced by affect.

Inclusion of global predictors in the regression analyses diminished the strength of the effects of danger appraisals as predictors of BAT outcomes. Danger appraisals explained only 5% of the variance in avoidance and 3% of the variance in disgust after partialing out the variance from gender, disgust sensitivity, and other predictors. This phenomenon was also observed in Deacon and Olatunji's (2007) study, in which danger appraisals no longer predicted avoidance or anxiety on their BATs after controlling for disgust sensitivity (interestingly, gender was not a significant predictor in their study). Given that the construct of disgust sensitivity is so similar in nature to the experience of disgust and desire to avoid it, it is quite impressive that this study showed unique effects for danger appraisals after controlling for the Disgust Scale. Deacon and Olatunji's study may not have been able to detect this unique effect, given that their appraisal scale was not specific to the stimuli they used in the BAT (creating a more generalized appraisal scale perhaps akin to disgust sensitivity). Their study also had a much smaller sample than the current study, suggesting insufficient power to detect this small effect.

The regression analyses conducted in the current study were conservative, holding the appraisal model to an extremely stringent test. Any shared variance between appraisals and other variables (e.g., gender, disgust sensitivity) was attributed to the latter variable. This type of analysis presumes that demographic variables and dispositional traits exist before the formation of particular appraisals, which should serve as a more proximal and specific cause of distress and avoidance. However, one can also argue for bidirectional relationships. For instance, repeated appraisals made over time in response to contaminants likely contribute to a person's sensitivity to disgust, in addition to disgust sensitivity influencing danger appraisals. Furthermore, differences observed between genders for emotional and behavioural responses may be partially due to different thinking patterns or appraisals. Therefore, some variance attributed to gender or disgust sensitivity in the prediction of BAT outcomes may have been more appropriately attributed to danger appraisals. The upper limit of this argument is indicated by the bivariate correlations, showing that danger appraisals at most accounted for 15-16% of the variance in disgust and avoidance behaviour, respectively. Of course, it is possible that

appraisals not captured in these analyses such as ability to cope, loss of mental control, social consequences, and anxiety sensitivity would have explained additional variance in BAT outcomes. In addition, ideographic danger appraisals were not assessed (e.g., "I read on the internet that you can get herpes by touching trash cans"), and these may have contributed additional predictive power.

In summary, danger appraisals were robust prospective predictors of disgust and avoidance of washroom contaminants, even showing unique effects after controlling for gender, neuroticism, disgust sensitivity, and OCD symptoms. This effect, which explained at most 16% of the variance, was demonstrated in an unselected sample of normal participants. Stronger effect sizes would be expected in a clinical population, especially in regard to the prediction of anxiety. The lack of anxiety predictors will be discussed in further detail after reviewing findings for the other appraisals and beliefs examined by this study.

Looming Germ Spread Appraisals

Riskind (1997) has claimed that appraisal of a stimulus as looming is a critical aspect of threat estimation. In the current study, looming germ spread appraisals were significantly associated with disgust and anxiety in the bivariate correlations. However, evaluations of looming germ spread were not uniquely predictive of the BAT outcomes when controlling for the contributions of the other appraisal subscales or global variables. Thus, there was no evidence that looming appraisals showed unique effects beyond "static" danger appraisals and dispositional traits related to disgust. Some of the items used for the looming subscale were developed specifically for this study and have less precedence in the literature than items and constructs used for the danger appraisal subscale. Despite this caveat, findings from this study strongly question results from a vignette study (Riskind et al., 1997) in which the authors concluded that looming appraisals show unique effects in predicting contamination and cleaning symptoms above and beyond other static cognitions. In the Riskind et al. (1997) study, looming and static appraisals were nearly redundant (r = .92), and the contamination symptoms were measured using a composite score that combined a contamination/washing scale and an item

from the vignette appraisal questionnaire (degree of worry about contamination). When these authors examined the relationship between looming appraisals and the washing scale alone (without merging it with the vignette worry item), the partial correlation for looming and washing symptoms controlling for static appraisals was quite weak (*pr* = .16), in line with the current findings.

The concept of looming originated from observations of animal fears of predators in response to perceptual experiences such as looming overhead shadows (see examples described in Marks, 1987). Research on human fears of rapidly approaching animals was a natural extension to these observations (Riskind et al., 1992; Riskind et al., 1995). Applying looming concepts to other types of fears such as contamination rests on the assumption that people create imaginal constructions of rapidly increasing threat (e.g., germs spreading with great speed). Looming cognitions of this kind have been endorsed by individuals diagnosed with contamination-based OCD (Tolin et al., 2004). Looming cognitions of germ spread can also be experimentally induced in non-clinical participants (Dorfan & Woody, 2006, 2008), although this type of catastrophic thinking may not typically occur for individuals in the general population. Indeed, non-anxious control participants in Tolin's (2004) study endorsed almost no contamination looming appraisals, and participants in the current sample reported only "a little" looming germ spread; a lower degree of endorsement compared with the danger and responsibility ratings. Therefore, there is little evidence to suggest that looming is a critical factor determining emotional and behavioural responses to contaminants for non-anxious individuals.

The concept of looming may be more applicable to the emotion of fear than disgust. Individuals with OCD typically express intense fears of contaminants which can be accompanied by feelings of disgust. In contrast, the non-clinical participants in the current study reported more prominent disgust reactions compared with anxiety. The lack of prominent anxiety in this study may have limited the predictive value of looming appraisals. Situations or cognitions that prompt stronger levels of threat, such as those related to fear of contracting HIV

or Hepatitis C, may well show a stronger association with looming appraisals. Future research should test this hypothesis.

Responsibility Appraisals

Salkovskis's theory (1985, 1999) places a prominent role of responsibility in the determination of distress for all types of OCD, including contamination fears. Given the centrality of this construct to cognitive theories of OCD, a great deal of research has focused on responsibility, with mixed findings in regard to its association with contamination and washing symptoms (Jones & Menzies, 1997a; Lopatka & Rachman, 1995; Mancini, D'Olimpio, et al., 2001; Rhéaume et al., 2000; Smári et al., 2003; Wilson & Chambless, 1999). The current study found that responsibility appraisals were not associated with any of the contamination BAT outcome measures, even when looking at the bivariate correlation coefficients. This finding should be taken cautiously, however, given that the responsibility appraisal scale had only two items which likely contributed to its marginal internal consistency. Despite the questionable reliability of the scale, the current findings are consistent with Jones and Menzies' (1997a) data which did not find responsibility to be a significant predictor of contaminant-related anxiety, avoidance, or washing behaviour in OCD participants. Also consistent is the fact that Lopatka and Rachman (1995) were not able to successfully manipulate responsibility in OCD participants with cleaning compulsions. Together, these studies suggest that responsibility is not the primary source of threat in relation to contaminating stimuli; rather, assessments of danger appear to be the focal cognition related to distress and avoidance of contaminants.

Responsibility has been noted as an important clinical feature for some OCD patients with contamination concerns (Rachman, 2004, 2006). This often involves an obsessive need to prevent transferring germs to family members or friends. Thus, even if responsibility is not the typical concern for clinical and non-clinical participants in a lab based studies, this cognitive construct likely has important implications for individualized work with at least some clients with washing compulsions. Responsibility is also an important construct for understanding other subtypes of OCD, and it will likely remain central to theories of repetitive checking behaviour.

Other Appraisals

The current study focused on three categories of appraisals: danger, looming, and responsibility. Other appraisals discussed in the anxiety and disgust literature were not addressed. For instance, Teachman (2006) suggested that secondary appraisals regarding the ability to cope with being contaminated or disgusted may distinguish normal and pathological disgust reactions. This claim was supported by an analog study in which contamination fearful participants were distinguished from anxious and non-anxious controls based on ratings of ability to cope with disgust scenarios (Williams et al., 2006). In addition, a clinical study found that that while appraisals regarding the severity of consequences of feared negative events correlated with OCD symptoms, only coping appraisals significantly predicted symptoms in a multiple regression analysis (Woods, Frost, & Steketee, 2002). Thus, there are compelling reasons to further study coping appraisals, especially in clinical populations.

Appraisals related to fear of negative affect, loss of control, anxiety sensitivity, and intolerance of uncertainty have also been studied in the anxiety literature, including studies specific to contamination (Cisler et al., 2007; Cougle et al., 2007; Dorfan & Woody, 2006; Olatunji et al., 2005). While I considered assessing these constructs, including appraisals related to fear of mental health (i.e., going crazy) and fears of social consequences (e.g., I'll be rejected if people think I'm dirty), these cognitions had less precedence in the contamination literature, and I considered them to be of secondary importance compared with the constructs I focused on. It would be quite interesting to widen the scope of investigation of future work to include these other appraisals.

OCD Symptoms and Beliefs

Surprisingly, symptoms of OCD as measured by the OCI-R total scale did not uniquely predict distress in response to the contamination BAT. One reason may have been that the OCI-R taps symptoms related to all subtypes of OCD (e.g., checking, hoarding, ordering); only three of the 18 items relate to contamination and washing. It is likely that a contamination specific measure would have shown greater predictive strength given the outcome variables in

this study. Unfortunately, the 3-item OCI-R washing subscale had unexpectedly low reliability in this sample, preventing its use as a stand alone measure.

A surprising finding was that the OCI-R was a significant negative predictor in the regression predicting avoidance, despite no association with avoidance on the bivariate correlations. This suppression effect appeared to be driven by the inclusion of the Disgust Scale in the regression, which was a strong predictor of avoidance, and also correlated moderately with the OCI-R (r = .28). This negative association between OCD symptoms and avoidance, which was not observed with the other BAT outcome variables, is inconsistent with theoretical and empirical literature, and likely represents a chance finding.

A crucial tenet of the cognitive model of OCD suggests that maladaptive beliefs make an individual more vulnerable to interpreting stimuli as threatening, and thus vulnerable to experience more distress and avoidance (e.g., Salkovskis, 1999). My data, using the well developed Obsessive Beliefs Questionnaire, did not support this argument. The OBQ had small and mostly non-significant associations with the appraisal subscales. Furthermore, the OBQ-total score was not significantly associated with any of the BAT outcomes (nor were any of the OBQ subscales; these correlations were not presented in the results section). This contrasts findings from other prospective studies finding moderate correlations (r = .24 - .41) between the OBQ total score and washing symptoms (Abramowitz et al., 2006; Coles & Horng, 2006). The greater correlation in these prior studies is likely due to the contribution of shared method variance as both beliefs and OCD symptoms were measured using questionnaire formats, in comparison to the present study which measured contamination and washing symptoms in vivo.

Because the OBQ assesses beliefs of a general nature (e.g., “I often think things around me are unsafe”; “For me, not preventing harm is as bad as causing harm”), the measure does not target stimuli-specific beliefs (e.g., beliefs about contaminants). As noted by Sookman and Pinard (2002), individuals with OCD are not fearful and avoidant of all things. Instead, they tend to have circumscribed areas of threat that are quite idiosyncratic, defy logic, and at times involve magical thinking (e.g., fear of contracting HIV from walking on public sidewalks; fear of being

contaminated by cosmetics that are transformed by sunlight into carcinogens (Salkovskis, 1985)). The lack of salience in belief measurement may be one reason that the OBQ did not correlate with contamination specific appraisals and BAT outcomes in this study. The generality of the measure may also help to explain findings of recent studies showing that more than half of OCD patients do not present with inflated levels of dysfunctional beliefs compared with student and anxious control groups (Calamari et al., 2006; Taylor et al., 2006). Given the huge heterogeneity of symptoms in OCD and the possibility that different subtypes may be characterized by different belief structures, creating cognitive measures of OCD that reliably differentiate individuals with OCD from control groups is difficult. Given this challenge, general cognitive measures such as the OBQ should be supplemented with subtype specific measures of cognition and assessments that allow idiosyncratic assumptions and appraisals to be measured.

In trying to explain the subset of OCD patients who do not report inflated beliefs, researchers (Calamari et al., 2006; Taylor et al., 2006) have referred to the sensory-affective motivations associated with “not just right experiences” (Coles, Frost, Heimberg, & Rhéaume, 2003). To give some examples, an individual may wash his or her hands, repeatedly check the oven, or arrange items on a shelf until feeling “just right,” in the absence of concerns of illness, responsibility, or other cognitive constructs. Not surprisingly, these “just right” feelings are associated with perfectionism (Coles et al., 2003). As with intrusive thoughts, just right experiences are reported by a majority of people, and these interoceptive experiences may only become problematic when they are appraised as being important or meaningful (Coles et al., 2003). Clearly, more research is needed to elucidate these types of motivators and determine their importance for compulsive washing.

To date, the most influential cognitive models of OCD have focused on the content of maladaptive cognitions, and the current study employed this focus on content of appraisals. An alternative approach to studying cognition is the evaluation of information processing deficits (e.g., attention or memory biases that distinguish clinical and normal populations). Studies of

this kind have documented that individuals with OCD show content-specific attentional vigilance to contamination words (but not social anxiety words) compared with trait-anxious participants (Tata, Leibowitz, Prunty, Cameron, & Pickering, 1996). Memory biases for contaminated objects and their sources of contamination have also been noted for individuals with OCD washing symptoms, although consistency across studies is lacking (Ceschi, Van der Linden, Dunker, Perroud, & Bredart, 2003; Radomsky & Rachman, 1999). As the field advances, theories will need to better integrate findings from these two aspects of cognition research, determining the scope of additive and/or interactive relationships between content and process variables in producing distress and avoidance.

Causal Direction: Influence of Emotion

A focus on stringent testing of the cognitive model has led to evaluation of a one-way directional model (i.e., appraisals as determinants of distress and avoidance). The proposition that cognition must precede affect has been strongly challenged by Zajonc (1980). Zajonc notes that "in nearly all cases…feeling is not free of thought, nor is thought free of feelings (p. 154)." He further notes that affective processing can influence behaviour in the absence of cognition, and argues for the primacy of emotions based on their evolutionary value, universality among animal species, and the efficient speed of emotional processing. The relatively large correlations between in vivo distress ratings and avoidance in this study (*r*'s = .48 - .66), as well as significant associations between distress ratings and cleaning variables, provides support for Zajonc's theory. Of course, if appraisals are defined broadly to include even the most basic (unconscious) perceptions of stimuli, then the difference between appraisal theories and emotion theories is greatly diminished (Barlow, 2002).

The current study aimed to disentangle emotion from cognition in order to determine the predictive power of stimulus appraisals in the absence of strong affect. Results indicated that danger appraisals predicted up to 15-16% of the variance in disgust and avoidance. A larger effect was documented by Dorfan and Woody (2008), in which danger appraisals predicted nearly 50% of the variance in distress in response to touching human urine. The Dorfan and

Woody (2008) study used a similar non-clinical sample; however, appraisals were measured immediately prior to the exposure, and participants were aware they were about to touch the urine stimulus. Therefore, anticipatory anxiety or anticipatory disgust regarding the upcoming exposure may have intensified danger appraisals about the urine, increasing the concordance between measures of cognition and emotion. The difference between the effect sizes in these two studies suggests that emotions serve as a prominent cue for the evaluation of danger. This is not surprising, given the putative survival value of fear and disgust. It is also consistent with the construct of emotional reasoning, memorably summed up by Arntz et. al (1995): "If I feel anxious, there must be danger." The construct of emotional reasoning is rooted in James's writing on emotions (1981) which raised questions about the temporal sequence and causal direction among emotions and physiological and behavioural responses. Beck et al. (1985) carried these ideas further in relation to cognitive distortions in maladaptive anxiety.

Cognitions and emotions are likely to have bidirectional relationships in rapid moment-to-moment interactions as well as across longer time spans. The rapid interactions between emotions and cognitions have the power to create vicious cycles of escalating symptoms. The synergy that occurs between emotions and cognitions in the presence of noxious stimuli may be a crucial aspect of threat which is not adequately acknowledged by current cognitive models. Despite the bidirectional nature of these interactions, there is great clinical utility in focusing on the causal effects of cognition on emotion. Training patients to recognize the relationship between negative thoughts and resulting emotional states, and helping patients to challenge threatening appraisals and beliefs can produce the desired reduction in OCD symptoms (Whittal, Thordarson, & McLean, 2005).

While researchers have typically discussed the role of cognition versus emotion, Epstein (1985, 1998) has proposed an alternate approach based on his model of personality, the cognitive experiential self-theory. According to this model, people make use of two independent, parallel, and interactive cognitive processes: the rational-analytic and the experiential-intuitive (Epstein, 1985, 1998; Pacini & Epstein, 1999). The rational system is

thought to be conscious, effortful, and relatively affect-free, whereas the experiential system is preconscious, automatic, and closely associated with affect. To cite an example from Epstein (1985):

> Most people are more afraid of riding in airplanes than in automobiles, although they know full well that the safety record of airplanes is far better. The reassuring experience of being on firm, familiar ground apparently outweighs the knowledge of the cold facts. (p. 294)

People must balance input from multiple sources of information; some originate from logical inferences, others from personal experiences. Even people who have a tendency to rely on logic and facts (e.g., believing that airplanes are safe) may at times be influenced by experiential factors (e.g. feeling scared when the airplane encounters turbulence during flight). Given that threat appraisals likely intensify in the "heat" of the moment, it would have been interesting to measure participants' danger appraisals *during* the BAT in the present study to compare how they differed in content and severity to participants' prospective danger ratings.

Research has indicated that rational and experiential thinking styles can be measured reliably, are indeed orthogonal, and demonstrate different patterns of relationships with other personality traits and belief measures (Pacini & Epstein, 1999). For instance, a rational thinking style is uniquely associated with emotional stability (i.e., "non-neuroticism") and belief in a predictable, controllable world, whereas an experiential thinking style is associated uniquely with agreeableness and emotional expressivity. According to the cognitive experiential self-theory, the balance of rational and experiential thinking styles, combined with environmental contingencies, determine a person's behavioural responses. The key to adaptive responding is flexibility and balance between the systems, such that there are few conflicts between what a person feels like doing and what they believe is reasonable to do.

Based on the cognitive experiential self-theory, I would expect that people with a strong experiential thinking style (who rely on their gut feelings) combined with a low rational thinking style would be most susceptible to having danger appraisals inflated by affect as they would

likely trust their emotions to serve as a guide for judgments (i.e., emotional reasoning), and subsequent behaviour. Interestingly, Woody and Teachman (2000) have proposed that while individuals with and without OCD may endorse similar types of contamination appraisals, normal people may show a greater ability to identify these appraisals as a "gut" response with little importance or significance for their life, whereas those with OCD would give such thoughts much greater weight. According to Pacini & Epstein (1999), "an important function of rational processing is to control the influence of maladaptive experiential processing when incentive is high, particularly for people with strong experiential tendencies (p. 984)." Perhaps one reason that cognitive therapy is useful for individuals with anxiety disorders is that it fosters rational thinking in situations that are highly affect-laden, thereby challenging (previously automatic) emotionally inflated danger cognitions. Alternatively, exposure treatments allow for experiential based learning, which might be more persuasive for individuals who put great faith in their emotions and past experiences to guide their behaviour.

Lack of Findings for Anxiety

An especially puzzling aspect of the current results was the lack of significant predictors of anxiety on the BAT. While danger appraisals, germ spread appraisals, disgust sensitivity, and the OCI-R were all significant bivariate predictors of anxiety, only disgust sensitivity showed significant unique effects in the regression analyses. Partial correlations also demonstrated that anxiety was not uniquely related to avoidance, urge to wash, or time spent washing after partialing out disgust; its only unique relationship was with antibacterial wipe usage. These findings are generally inconsistent with Jones and Menzies' results (1997a), in which danger appraisals were a significant predictor of anxiety during contaminant exposure. An important difference of the Jones and Menzies (1997a) study from the present study was the use of a clinical sample of OCD participants with contamination concerns. Jones and Menzies also did not control for disgust sensitivity, nor did they differentiate feelings of in vivo anxiety from in vivo disgust. Thus, it is possible that their measure of anxiety was partially tapping disgust responses and was not a pure measure of anxious affect.

There are numerous reasons why a pure measure of anxiety is difficult to obtain. One issue regards the concept of imprecise labeling; people find it difficult to define their emotions with specificity, especially if the emotion is only mild or moderate in degree (Woody & Teachman, 2000). There are likely individual differences in the cues that people use to label their experienced emotions, such as physiological symptoms, stimulus properties, environmental factors, cultural background, social cues, and prior learning experiences. Given the size of the correlation between disgust and anxiety in this study (r = .65), it is safe to assume that participants were generally not experiencing a "pure" form of disgust or anxiety in response to the contaminants, and may have even experienced a bidirectional relationship in which feelings of anxiety and disgust enhanced one another.

Anxiety ratings (measured on a 0-100 "nervous" scale) likely tapped into some non-contamination related concerns. For instance, participants may have experienced a desire to perform appropriately and comply with experimenter's requests despite the aversive nature of the tasks. They may been embarrassed or felt other types of distress regarding this unusual task that had an unavoidable social component due to the close proximity of the experimenter. Anticipatory anxiety may have also been experienced, as participants were unsure what particular task would come next. Two of these factors (sensitivity to embarrassment and willingness to comply) were evident in a prior study of contaminant related BATs (Rozin et al., 1999). If anxiety during the BAT reflected these additional constructs, then washroom-specific appraisals measured during the first session (under conditions of low anxiety and few performance expectations) would not likely correlate strongly with anxiety on the BAT. In contrast, it is hard to imagine that in vivo disgust ratings (measured on a 0-100 "grossed out" scale) reflected constructs other than a reaction to the washroom stimuli.

Several aspects of this study may have increased participants' sense of safety, thereby reducing anxiety ratings. For instance, the university research setting and the presence of an experimenter providing instructions likely provide inherent safety cues. Such implicit safety knowledge may dampen fears that might otherwise be present in less controlled environments

(e.g., using a public washroom in a run-down area of the city). Furthermore, participants were empowered to refuse tasks as they wished, providing a direct way to avoid unwanted anxiety. Contamination was also confined to one hand; there was no threat of spreading germs to other parts of the participants' body or clothing which might typically be present when one completes daily activities. Together, these factors created a contained and controllable situation which may have reduced the experience of anxiety in this laboratory based study. Future researchers may attempt to increase anxiety by conducting exposure sessions in a higher-threat location (e.g., a washroom in an HIV clinic) or by leading participants to believe they will not be able to wash their hands before spreading the contamination to their clothing or food. Instructions or experimental manipulations that heighten anxiety can also be used to increase perceptions of danger (Jones & Menzies, 1998b).

The current study was intended to create conditions akin to contamination-related OCD based on a dimensional (continuous) model of psychopathology, in which normal populations are assumed to have qualitatively similar, but less severe, symptoms of distress. While this study was successful at inducing disgust, it was less successful at inducing anxiety related to contaminants. The lack of prominent anxiety reactions and correlates of this emotional response may be partly due to the severity of perceived threat in this study. On average, participants reported "moderate" levels of risk on the WAQ, rating the perceived level of danger in public washrooms as similar to "being near someone with the flu" (one of the WAQ item anchors). This appears to be a manageable level of risk, similar to the dangers participants face in daily life as they interact with other students and family members. In contrast, individuals with OCD are often terrified by the prospect of contracting life-threatening illnesses, such as HIV or Hepatitis C. Negative consequences involving survivable and time-limited illness (e.g., the flu) seem qualitatively different compared with chronic or enduring diseases that can result in premature death.

Another factor that may contribute to differential threat appraisals in individuals with OCD versus normals is the strong intolerance for uncertainty in OCD (OCCWG, 2001, 2003),

even if the likelihood of a negative outcome is low. Theorists have proposed that individuals with OCD assume danger when there is no evidence of safety, whereas most people assume safety unless danger is evident (Kozac & Foa, 1985 as cited in Kozak, Foa, & McCarthy, 1987). This suggests that even a small amount of uncertainty will be a cue for danger in those with OCD, but not for those without anxiety disorders. Therefore, while research indicates that individuals in the general population report similar types of symptoms to those with OCD (Gibbs, 1996), some qualitative differences emerge making it difficult to adequately test OCD models with normal populations, and limiting generalizability of the findings.

Disgust may be the normative emotion to feel in response to public washroom stimuli. In contrast, anxiety may be reflective of more intense and problematic distress toward contaminants. Given that anxiety (and not disgust) was uniquely associated with supplemental usage of antibacterial wipes after washing with soap and water, anxiety may more strongly related to irrational and excessive responses compared to disgust. In clinical samples, one would expect to see higher ratings of anxiety, and perhaps a greater correspondence between anxiety and avoidance and washing behaviours. Furthermore, feelings of disgust in clinical samples may be interpreted more catastrophically, thus inducing greater anxiety (e.g., “I can’t handle feeling disgusted; I’ll lose control!”).

Disgust Sensitivity

The Disgust Scale was the single strongest predictor of contaminant-related distress and avoidance, and this association was independent of neuroticism and self-reported OCD symptoms. This finding is consistent with prior studies showing that the Disgust Scale is associated with emotional and behavioural outcomes on contaminant tasks (Deacon & Olatunji, 2007; Olatunji, Lohr, et al., 2007; Rozin et al., 1999), as well as being associated with self-reported contamination and washing symptoms (Mancini, Gragnani, et al., 2001; Muris, Merchelbach et al., 2000; Olatunji, Lohr, et al., 2007; Olatunji et al., 2005; Thorpe et al., 2003). The current study builds on many others by using a prospective design and controlling for neuroticism.

The Disgust Scale is typically interpreted as a measure of disgust sensitivity, defined as "the degree to which a person feels disgusted in response to a variety of stimuli (p. 544)" (Woody & Tolin, 2002). Disgust sensitivity has been construed as a dispositional trait that is distinguished from state or in vivo affective experiences of disgust (Woody & Teachman, 2000; Woody & Tolin, 2002). The fact that disgust sensitivity was a robust predictor of in vivo disgust and avoidance of washroom stimuli is not at all surprising, given the strong similarity between these concepts. More surprising is the finding that disgust sensitivity predicted anxiety on the BAT. An explanation may lie in the construction of the scale and the difficulty in measuring pure constructs. While half of the items in the Disgust Scale are rated on a disgust-specific rating scale, the other half are true-false items written in vague language (e.g., "I never let any part of my body touch the toilet seat in public washrooms"; "It would bother me tremendously to touch a dead body"). Participants endorsing such items as true may do so due to a heightened sense of disgust, anxiety, or some other negative emotional response such as intolerance of feeling dirty in the absence of illness fears. This lack of specificity may explain why the Disgust Scale was highly associated with both anxiety and disgust on the contamination BAT, as well as being associated with both of these emotions in prior BAT studies (Deacon & Olatunji, 2007; Vernon & Berenbaum, 2002).

What are the clinical implications of disgust sensitivity being a potent predictor of contamination distress and avoidance? In regard to prevention, this construct could be used to identify individuals at risk for developing contamination fears or specific phobias involving disgust. As for treatment, exposure models currently target anxiety (and disgust) associated with a particular set of stimuli. However, a person with high disgust sensitivity by definition is disgusted by a large range of stimuli (e.g., food, animals, sex, body envelope violations, death, hygiene, magical thinking), and this wide-ranging sensitivity may make the person more likely to have recurrences or develop new variations of clinically relevant concerns. Interestingly, disgust sensitivity to food did not predict treatment outcome for spider phobics engaging in exposure therapy (Merchelbach, de Jong, Arntz, & Schouten, 1993), although it remains to be

seen whether the current broader version of the Disgust Scale is predictive of therapy outcomes.

As a trait-level variable, disgust sensitivity is thought to be stable over time. Indeed, a food-specific measure of disgust sensitivity remained unchanged after a brief course of exposure therapy for spider phobia, despite declines in spider specific disgust (de Jong, Helene, & Muris, 1997) and this food-specific measure showed good stability from pre-treatment to several months post-treatment (Merchelbach et al., 1993). Test-retest for the broader disgust sensitivity measure is quite high over several months, $r = .79$ (Rozin et al., 1999). Despite these data, it seems likely that certain experiences should change sensitivity to disgust (e.g., going to medical school; working as a garbage collector; spending extended periods of time in an impoverished country). Future research should determine whether such experiences, or extended versions of exposure therapy targeting a wide range of disgust elicitors, have the ability to change a person's general sensitivity to disgust. Another question of interest is the relative contribution of biological and environmental experiences in determining individual differences in disgust sensitivity.

Gender Effects

Gender was a robust predictor of questionnaire data and BAT outcomes in this study. Interestingly, gender is not typically discussed by cognitive theorists, and it is rarely the primary focus of empirical investigations evaluating cognition in anxiety disorders. Consistent with this literature, the current study was not designed or powered to examine gender-specific effects in contamination-related distress and behaviour. Despite this, some interesting gender findings were found and will be discussed below.

Prior literature had shown inconsistent findings regarding gender and appraisal ratings. For instance, studies evaluating gender differences in catastrophic interpretations of anxiety symptoms have shown mixed findings regarding higher levels of threat appraisals in women versus men (Armstrong & Khawaja, 2002; Schmidt & Koselka, 2000; Starcevic, Latas, Kolar, & Berle, 2007; Stewart, Taylor, & Baker, 1997). In a study of appraisals related to OCD-relevant

scenarios, a college sample of women reported higher ratings than men for the probability of negative consequences; however, ratings of severity and responsibility were equivalent across genders (Rhéaume, Ladouceur et al., 1995). Another study found that females report higher levels of perceived stress and lower levels of perceived control regarding daily events, while assessments of threat were equivalent (Ptacek, Smith, & Zanas, 1992). The current data extends the current knowledge on gender and cognition by showing that women reported significantly greater danger appraisals of contaminants compared to men, representing a medium effect size (d = 0.56).

In addition to the gender differences for danger appraisals, there was also a trend for women reporting more disgust sensitivity than men (d = 0.40). These findings are consistent with numerous studies showing higher scores for women on measures of contamination and disgust sensitivity (e.g., Cisler et al., 2007; Dowson, 1977; Mancini, Gragnani, et al., 2001; Mancini et al., 1999; Muris, Merckelbach et al., 2000; Noshirvani et al., 1991; Olatunji et al., 2005). However, the effect size for gender differences on the Disgust Scale was smaller than in prior non-clinical studies that have shown medium to large effects, d's = 0.53 - 0.77 (Cisler et al., 2007; Mancini, Gragnani, et al., 2001; Mancini et al., 1999).

In regard to BAT outcomes, women demonstrated greater disgust and avoidance, and a higher percentage of women used antibacterial wipes compared with men. A striking difference between genders was observed for total compliance on the BAT: fewer than 7% of the females touched all 13 contaminating stimuli in this study, whereas 32% of the males touched all items. This may be due partly to the particular BAT stimuli selected for this study (i.e., objects in a public washroom). Public washrooms used by men and women likely differ in their typical level of cleanliness, so men may have a higher tolerance for items in a disgusting washroom. The greater willingness of men to approach stimuli in this scenario is consistent with epidemiological studies evidencing lower prevalence rates of men with anxiety disorders including phobias and OCD (Robins et al., 1984; Weissman et al., 1994).

Somewhat surprisingly, women in this study did not wash significantly longer than men. This may be related to greater avoidance by women during the BAT, which resulted in less tainting of the womens' hands. There may also be washing variables not captured by this study that distinguish women and men, such as how much soap was used and how thoroughly participants scrubbed all parts of their hands. Indeed, prior research indicates that women use soap more often than men when washing after using a public washroom (Monk-Turner et al., 2005). Although there is no evidence from the current study that women were "better" hand washers, a greater percentage of women used antibacterial wipes after returning to the laboratory compared to men.

In addition to the main effects of gender, some unexpected gender-specific effects emerged in the relationship between danger appraisals and BAT outcomes. Specifically, danger appraisals were significant predictors of disgust, avoidance, and urge to wash for women while these appraisals predicted time spent washing and antibacterial wipe usage for men. This was especially intriguing given the lack of significant relationships between cleaning variables and appraisals in the full sample. These findings suggest that danger appraisals provoked different types of responses in men and women. Assessments of danger prompted women to verbalize their distress and avoid contaminants outright. In contrast, men touched contaminating stimuli, but their danger appraisals motivated them to clean after being soiled to undue the effects of this contamination.

The fact that danger appraisals did not predict time washing and wipe usage for women is more difficult to understand. It may be that in general, cleaning behaviours are motivated more strongly by affect experienced in the moment rather than by a direct relationship with danger appraisals. This would be consistent with Zajonc's (1980) position on the importance of emotions in promoting behaviour. The partial correlation coefficients demonstrated that disgust was a significant predictor of time washing (when partialing out anxiety), whereas anxiety was a significant unique predictor of wipe usage. So while women were not directly motivated by danger appraisals to clean, in vivo affect was associated with these behaviours and was likely

promoting them. As noted above, the current study was not properly designed or powered to test gender effects; all experimenters were female and sample sizes were small, especially for men. Therefore, any gender-specific effects, especially in regard to the relationship between danger appraisals and BAT outcomes, should be considered tentative and in need of replication.

Behaviour must be interpreted within its social context. In the present study, men may have been reluctant to verbalize distress and show overt avoidance in the presence of a female experimenter due to gender role expectations, presentation concerns, and/or fear of negative evaluation from the opposite sex. If this was the case, then the relationship between danger appraisals and response to contaminants would be obscured in the case of outcome variables that are sensitive to demand characteristics such as verbal reports of emotion or overt avoidance. For the two unobtrusive measures (washing time and wipe usage), cleaning behaviour was significantly related to men's appraisals of danger.

The influence of participant-experimenter gender interactions on behaviour and self-reports have been widely examined (see review by Rumenik, Capasso, & Hendrick, 1977). Especially fascinating are recent data indicating that male university students reported lower pain intensity when tested by female versus male experimenters (Aslaksen, Myrbakk, Hoifodt, & Flaten, 2007; Levine & De Simone, 1991), and this relationship was not explained by objective physiological indicators (Aslaksen et al., 2007). In another study, university participants tolerated pain for longer periods of time when tested by an experimenter of the opposite sex (Kallai, Barke, & Voss, 2004). Social context and psychological factors such as gender roles (e.g., men wanting to appear macho) demonstrably influence participants' reporting of distress and tolerance of aversive activities in the laboratory. Given this body of literature, the gender effects seen in the current study may result at least partially from the use of all female experimenters. Therefore, it is unclear whether the current results should be interpreted as experimental artifacts, chance findings, or true gender differences in the relationship between

appraisals and emotional and behavioural responding to contaminants. Future research should attempt to clarify the basis of these unexpected findings.

Disgust versus Anxiety

In addition to testing the role of danger appraisals and individual difference variables for contamination-related distress and avoidance, a second (more exploratory) aim of the current study was to better understand emotions involved in contamination concerns. Strong evidence for disgust was provided by the emotional responses to the washroom stimuli, and implicit associations of disgust with dirtiness on the reaction time tasks. These divergent methods of measurement both demonstrated that disgust is more strongly associated with contaminants compared with anxiety, at least among normal young adults and community members.

In vivo disgust showed a stronger unique relationship with other BAT variables compared with in vivo anxiety. Specifically, self-reported disgust demonstrated significant correlations with avoidance, urge to wash, and time spent washing after partialing out anxiety, whereas anxiety was not associated with any of these variables when partialing out disgust. The only variable to show the opposite pattern was usage of antibacterial wipes, which was associated with anxiety after controlling for disgust, but not associated with disgust after controlling for anxiety. It is important to remember that in vivo anxiety was likely tapping some contamination-irrelevant factors such as embarrassment and compliance concerns. Furthermore, it is possible that participants perceived that the study was more grounded in disgust than anxiety, and answered questions accordingly in an effort to be helpful to the experimenter. These additional factors may have reduced the ability to detect significant and meaningful relationships between anxiety and other BAT variables, especially after partialing out the (likely purer) disgust rating.

Anxiety may play a greater role in clinical presentations of contamination concerns. The present data suggest that disgust is associated with (normative) avoidance, desire to wash, and time spent washing when confronting contaminating stimuli in a public washroom. Unlike the other BAT variables, antibacterial wipe usage was measured after participants had returned to

the clean laboratory setting. Thus, any wipe usage was associated with residual feelings of distress that remained after participants had washed their hands with soap and water and exited the contaminating premises. Rachman (2006) proposed that while disgust may be diminished with a simple hand wash, anxiety about one's health prompts usage of disinfectants and antibacterial products, perhaps indicating that anxiety motivates excessive and irrational cleaning behaviour.

The disease avoidance model proposes that disgust serves to motivate avoidance of animals and objects associated with contamination in order to prevent transmission of disease (Davey, 1992; Matchett & Davey, 1991; Webb & Davey, 1992). The data from this study are generally supportive of the disease avoidance model. Specifically, danger appraisals regarding the likelihood and severity of disease were significant predictors of disgust and avoidance. In addition, disgust sensitivity was the greatest single predictor of anxiety, disgust, and avoidance, making a strong case for the role of disgust as a motivator of avoidance of contaminants.

When one cannot avoid contact with a contaminant, prevention of disease can sometimes be achieved with cleaning behaviours. Interestingly, disgust sensitivity did not predict any of the cleaning outcome variables on the BAT. Therefore, there is no direct evidence that disgust sensitivity is a specific risk factor for excessive washing in normals. However, when looking at the correlational data involving in vivo emotions, disgust was uniquely associated with urge to wash and time spent washing after partialing out the effect of anxiety. Therefore, it appears that unlike disgust sensitivity, state levels of disgust may have motivated subsequent washing. Together, these data suggest that disgust plays an important functional role in contamination-related distress, avoidance, and washing behaviour.

Implicit Associations

The IATs demonstrated that both anxiety and disgust are implicitly associated with dirtiness, in comparison to sadness. Of these two tests (both conducted during session one), the disgusted versus sad IAT had a larger effect than the afraid versus sad IAT. This was consistent with the findings of the direct IAT comparison of disgusted versus afraid during

session two, which found that 79% of the sample demonstrated a stronger implicit association of dirtiness with disgust compared with anxiety. Because the IAT is a relative measure, it must be interpreted in relation to the contrast categories used. Given that each effect is a difference score between two pairings of category and descriptor labels, multiple interpretations of the findings are possible. For instance, in the disgusted versus afraid IAT, participants were faster to classify stimuli when DIRTY was paired with disgusted (and CLEAN was paired with afraid) than when DIRTY was paired with afraid (and CLEAN was paired with disgusted). This effect could be interpreted as meaning that clean is more strongly associated with anxiety than with disgust. However, this interpretation lacks logical sense and has no precedence in the literature. Therefore, it seems safe to assume that the effect is being driven by the pairings of DIRTY/disgusted versus DIRTY/afraid. A similar argument can be made for the interpretation of the other two IATs as well.

Both category labels and exemplar stimuli used in the IAT contribute to participants' construal of the concepts being studied and can therefore influence effect sizes (Lane, Banaji, Nosek, & Greenwald, 2007). While category and stimulus words were carefully selected based on pilot data and past research, one must consider how these decisions influence generalizability of the findings. For instance, the word dirty was selected as a category label instead of the word contaminated due to its higher frequency of use in the English language and a lower reading level (Francis & Kucera, 1982; Zeno et al., 1995). Contaminate implies, "intrusion of or contact with dirt or foulness from an outside source," whereas dirty is defined as, "not clean or pure…. likely to befoul or defile with dirt….contaminated with infecting organisms…..containing impurities" (Merriam-Webster Online Dictionary, 2005). Despite these similar definitions, the question remains whether the word dirty imparts the same concept, severity, and/or breadth of meaning to participants as the word contaminated. For instance, the word contaminated may communicate a more serious level of threat than the word dirty, given its less frequent usage. If true, this would potentially lessen the association of anxiety with the word dirty, in comparison to the word contaminated.

Another issue to consider is the possibility that the word dirty may be more strongly associated with disgust than the word contaminated. It is perhaps informative to examine the pattern of the few classification errors participants made on the IAT stimulus piloting questionnaires. Four of the five errors were due to either misclassifying a dirty stimulus word into the disgusted category, or misclassifying a disgusted stimulus word into the dirty category. Thus, the implicit association between these categories is also seen (to a lesser degree) within an explicit questionnaire format. Care was taken to select stimulus words for the dirty category that balanced ratings of illness threat versus being only gross and disgusting; these words were: germs, trash, and polluted (see method section for more details). It would be interesting to see whether the findings would hold for a different set of stimuli (e.g., AIDS, hepatitis, avian flu, herpes), which on the surface appear to be more related to illness anxiety than disgust, and also appear to have a higher general threat value than words used in the present study. One might expect anxiety to be more strongly associated with these words. Other categories of stimuli might include poisonous chemicals and pesticides (likely more anxiety related), contaminated foods, and body products such as feces, blood, and urine (all likely more disgust related).

Relationship between Implicit and Explicit Measures

Exploratory analyses demonstrated that implicit and explicit measures were generally not correlated in this study, and the minority of participants who showed a stronger implicit association for dirtiness with anxiety versus disgust did not differ from other participants on any of the explicit measures. Thus, it appears that the implicit tests were tapping different constructs from the explicit measures. On the surface, this finding is at odds with several other studies that have documented associations between IATs, BAT outcomes, and self-reports related to anxiety and disgust (Teachman et al., 2001; Teachman & Woody, 2003). However, it is important to carefully consider IAT construction and the sample characteristics to understand the implications and expectations for connections with explicit measures. For instance, Teachman and Woody (2003), used photographs of phobic stimuli in an IAT evaluating associations of phobic versus control participants. These authors found much larger anxiety

and disgust IAT effects for phobic participants versus controls prior to treatment. Therefore, Teachman and Woody likely had greater variability in their full sample (which combined phobics and controls), which would facilitate detection of correlations between implicit scores, BAT outcomes, and self-reports. Teachman and Woody also used polar opposites for descriptor labels (e.g., afraid versus unafraid; disgusting versus appealing), which may have produced greater effects than using a negative valence control category such as sad. Also of note, the current study used stimuli for the dirty category that people encounter on a daily basis (germs, trash, and polluted). Thus, these familiar word stimuli may have been less threatening than photos of less familiar types of stimuli, further contributing to the smaller effects sizes.

While some literature suggests that implicit-explicit associations are an index of measurement validity (Greenwald et al., 2003), other papers claim that these measures tap conceptually distinct constructs based on different levels of consciousness (Banaji, 2001 as cited in Blanton, Jaccard, Gonzales, & Christie, 2006). In approaching this issue, Fazio and Olsen (2003) note that the critical question is not whether implicit and explicit measures are related per se, but rather when, under what conditions, and with whom are they related. Theories such as the Motivation and Opportunity as Determinants (MODE) model of attitude-behaviour processes (Fazio & Towles-Schwenn, 1999) have inspired tests of the hypothesis that implicit measures should be correlated more strongly with spontaneous behaviours while explicit measures should better predict controlled behaviour (Asendorpf et al., 2002; Egloff & Schmukle, 2002; Neumann et al., 2004).

Studies intentionally designed to measure spontaneous behaviour such as anxious or avoidant body movements have shown associations with implicit measures (Asendorpf et al., 2002; Egloff & Schmukle, 2002; Neumann et al., 2004). For instance, Neumann et al. (2004) found that negative implicit associations of individuals with AIDS were predictive of impulsive avoidance of photographs of such individuals. In another study, implicit shyness scores on the IAT were directly related to spontaneous behavior during an interaction with a stranger, and only indirectly related to controlled behavior via explicit measures of shyness. In contrast, explicit

ratings of shyness were uniquely associated with controlled behaviours, but not spontaneous behaviours (Asendorpf et al., 2002). Thus, theory and empirical evidence both support differential patterns of associations of behaviour with explicit and implicit measures, depending on the type of behaviour being assessed.

The findings of the current study are consistent with the body of literature inspired by the MODE theory. While several explicit measures including questionnaires and in vivo distress ratings significantly correlated with avoidance behaviour on the BAT, none of the IATs were associated with participants' conscious decisions to touch contaminated objects. The avoidance measure was made purposefully deliberate; participants were asked whether they were willing to touch each object before they approached it, and they were repeatedly reminded that they did not need to touch all objects. Antibacterial wipe usage (another deliberate, controlled behaviour) was associated with explicit distress ratings on the BAT, but not implicit measures. Hand washing behaviour that was under conscious control but perhaps more practiced or automated than the other behaviours, was related to the explicit urge to wash, and not with implicit scores.

In addition to predicting behaviour, the MODE model also speaks to the prediction of automatic versus deliberate judgments. Participants' reports of anxiety and disgust during the BAT were deliberate judgments, and I have already speculated as to some of the additional motivators behind the anxiety ratings (e.g., self-presentation concerns, desire to comply). Based on the MODE theory, one would expect these distress measures to correlate more strongly with other controlled explicit responses in the study, and less strongly with automatic implicit associations. The data generally supported this hypothesis, with in vivo distress ratings showing significant correlations with questionnaires and other BAT variables, but not with the IATs. It should also be noted that the BAT ratings of anxiety and disgust were measures of experienced emotion in response to specific washroom stimuli. In contrast, the IATs were measuring associations in memory between the conceptual categories of dirtiness, disgust, and anxiety. Clearly, the IATs in this current study should not be considered measures of

experienced emotion, personality, or OCD relevant symtomatology. It would be quite interesting to learn whether these implicit measures would predict spontaneous or automatic contaminant-related behaviours, such as keeping a greater distance from a sick stranger during a forced interaction, or averting eye gaze with a person perceived as contaminating.

The value of the IAT in relation to understanding anxiety and disgust depends on the research question, particularly the extent to which one is hoping to predict deliberate versus automatic responses. This relates to the opportunity aspect of the MODE theory (i.e., does a person have the time or resources necessary to use deliberate reasoning; do they have the ability to control the behaviour). The value of the IAT also depends on motivational aspects of the MODE theory. There should be greater utility in using the IAT in situations where participants' responses might be shaped by the pressure of social desirability (e.g., studies of racial prejudice). To the extent that participants feel comfortable reporting their appraisals and emotional reactions *and are able to do so accurately*, the IAT is unlikely to have great incremental value beyond self-reports in explaining controllable behaviour. A promising area to use the IAT within the realm of contamination concerns is in understanding attitudes and emotions related to people with communicable diseases such as AIDS (Neumann et al., 2004), as respondents may feel ashamed or embarrassed to report their true feelings or behavioural intentions on this topic. Other areas related to disgust that may be promising to study with the IAT are taboo topics such as attitudes toward unusual sexual behaviours, or evaluations of people who are obese, lower class, or users of cigarettes, drugs or alcohol. In all such cases, people's implicit responses may predict their behaviour more strongly than self-reports. Finally, evaluating vulnerability-stress models using implicit versus explicit cognitive vulnerability assessments have shown promising results for the prediction of distress and depression symptoms in a normal college sample (Haeffel et al., 2007), and this type of design may also be useful for the prospective prediction of anxiety and OCD symptoms.

The Measurement Debate: Self Report versus Behaviour

The challenge of measuring cognition has been tackled from two divergent paradigms: 1) the appraisal approach which utilizes self-reports to ascertain the content of cognitions, and 2) the information processing approach which relies on behavioural indicators such as reaction times to infer aberrant responding (McNally, 2001). Each of these methodological approaches has its own set of limitations. For instance, some scientists are highly critical of self-reports, suggesting that people do not respond on the basis of valid introspection, but rather respond based on a priori theories of causal factors or by post hoc reasoning (Nisbett & Wilson, 1977). Epstein (1985) notes that because self-reports can only tap conscious attitudes, they will often be a poor predictor of behaviours that are mediated by preconscious attitudes. This concept clearly applies to disgust. As noted by Woody and Teachman (2000), people often cite concerns of illness as their motive for avoidance of contaminants; however, disgust and avoidance are evident in situations even where there is no objective danger (e.g., drinking juice that has been touched by a dead sterilized cockroach, Rozin et al., 1986). Epstein (1985) suggests that instead of relying on self-reports, preconscious attitudes can be inferred from emotions and behaviours. This may partially explain why emotions were a stronger predictor of avoidance and cleaning behaviour compared to appraisals. If emotions were tapping into preconscious experiential appraisals (as opposed to participant's accessible rational appraisals), then emotions were more likely to accurately predict behavioural responding.

Another alternative to self-reports are reaction time measures such as the IAT. In addition to questions of construct validity (De Houwer, 2002), the IAT paradigm has been criticized as suffering from poor ecological validity. In an IAT, participants respond to words on a computer screen, not true threats in the real world. The current study demonstrated that self-reports had far greater predictive validity for overt behavioural responses than did the implicit construct measured with reaction times, consistent with Teachman and Woody's (2003) study. As noted above, implicit measures show greater incremental validity when predicting

spontaneous and automated behaviours (Asendorpf et al., 2002; Egloff & Schmukle, 2002; Neumann et al., 2004).

Smith and Miller (1978) note that accurate self-reporting should occur in situations that involve novelty and/or interest. The tasks in the current study were certainly novel in some ways (e.g., people are not usually asked to rate their emotional response to touching a washroom floor), but most people are quite familiar with making judgments about their willingness to touch objects in a public washroom. When tasks become overlearned and routine (e.g., driving a car or typing on a keyboard), people lose their ability to report on what they are doing and why (Smith & Miller, 1978). Therefore, it would be interesting to test whether the IAT or other implicit tests show greater predictive validity when measuring subtle forms of avoidance or highly ritualized behaviours that are pervasive in the lives of those with OCD (e.g., handwashing when alone). Future researchers may also wish to tap appraisals or beliefs with implicit instruments (e.g., Haeffel et al., 2007; Teachman et al., 2001; Teachman & Woody, 2003), although fine grained comparisons (e.g., looming threat vs. static threat) may be challenging to measure in this format.

Generalizability of Findings

The current study tested predictions of cognitive models of OCD using an unselected sample of normal university students and community members. While the BAT procedure was successful at evoking distress, avoidance, and hand washing, much greater reactivity would be expected in a clinical sample of individuals with contamination related OCD. Furthermore, while danger appraisals showed robust effects in both the current sample and a prior study of individuals with OCD (Jones & Menzies, 1997a), it remains to be tested whether a prospective study of clinical participants would show the same set of predictors found in the current study, which included gender and disgust sensitivity.

This study highlighted the need to consider demographic variables such as gender, which have often been overlooked compared to other variables stemming from the theoretical literature. The current sample had a majority of women (60%), and it appears that the findings

of the explicit data in the full sample are most robust for women versus men. Also of note, this study was conducted with a sample of English speaking participants, a majority of whom were university students. University students may be less contamination averse than the general population, given exposure to shared accommodations such as dormitory bedrooms and washrooms. In addition, while there was variation in the sample in regards to ethnic background, including 44% Asian participants, one cannot assume the findings would hold in cross-cultural studies. Disgust is known to be influenced by cultural factors (e.g., disgust reactions to particular foods like snails or pork vary across cultures). However, aversion to body products appears to be nearly universal (Angyal, 1941). Thus, while it is likely that the type of contamination threats that I studied are universally meaningful, it should not be assumed that the same dispositional variables and cognitive appraisals would predict emotional and behavioural responses to these contaminants in other cultures. Furthermore, given issues such as imprecise labeling and language differences across cultures, the findings regarding the predominance of disgust versus anxiety for contaminants based on self reported emotions and implicit associations may be especially culturally dependent.

Clinical Implications

The current study suggests that certain variables should be routinely assessed and integrated into a clinician's case conceptualization and treatment plan for individuals with OCD washing concerns. These variables include illness-related danger appraisals, disgust sensitivity, and stimulus specific disgust reactions, in addition to anxiety. Given that OCD is classified as an anxiety disorder, the assessment of disgust as a process variable and treatment outcome indicator can easily be forgotten, losing clinically important information.

The two primary models of psychological treatment for OCD are exposure and response prevention (EX/RP) and cognitive therapy. EX/RP is based on a behavioural model of fear reduction over repeated or prolonged exposures to feared stimuli (i.e., habituation). If contaminants are associated with disgust as well as anxiety, it is important to know how disgust influences the habituation process. Studies have demonstrated that disgust does indeed

decline with exposure to contaminating stimuli (McKay, 2006; Smits et al., 2002). However, one study found that disgust decays more slowly than does anxiety (Smits et al., 2002). Therefore, individuals presenting with predominant disgust reactions may require longer exposure sessions or more numerous sessions to successfully diminish their affect.

Cognitive theorists would argue that exposure therapy is effective because it disconfirms predicted (feared) consequences, changing belief structures and threat appraisals (e.g., I shook hands with people without washing my hands afterwards and I didn't get sick. It must not be as dangerous as I thought). Disconfirming evidence can be difficult to obtain when fears have a long incubation period, such as a concern of developing AIDS or cancer. Even if patients agree that such fears are highly unlikely, the severity of the consequences (premature death) make them difficult to dismiss. These factors may explain why many cases of contamination distress do not fully remit after a course of treatment, or show recurrences in symptoms over time (Rachman, 2004).

Cognitive therapy for OCD is based on reappraisal of the meaning and importance of intrusive thoughts (Whittal & McLean, 1999). To date, this form of therapy has not been as efficacious as EX/RP for the treatment of contamination concerns (Jacobi et al., 2005). A subtype-specific alternative form of cognitive therapy called Danger Ideation Reduction Therapy (DIRT) was created specifically to address inflated danger appraisals related to contamination and washing symptoms (Jones & Menzies, 1997b, 1998a). DIRT interventions solely challenge danger expectancies related to contamination, without discussion of responsibility, perfectionism, or other cognitive constructs. For instance, clients obtain corrective information via videos with experts in the microbiology field and health care workers who are frequently exposed to contaminating stimuli. They also view microbiological experiments demonstrating the type of actual microorganisms left behind on a therapists' hand after he or she touches "contaminated" stimuli. These procedures appear to be on target to address the primary threat appraisals identified in the current study (i.e., danger appraisals related to illness), and preliminary data support the efficacy of this treatment for contamination based OCD (Jones &

Menzies, 1997b, 1998a), even outperforming EX/RP in one randomized controlled study (Krochmalik, Jones, Menzies, & Kirkby, 2004). DIRT procedures are advantageous in that they do not require patients to directly confront (touch) contaminants, which can be a source of treatment refusal and dropouts. DIRT has also shown therapeutic effects relatively quickly (after 6-12 hours of treatment) and can be delivered in a group setting, making it a potentially cost effective treatment (Jones & Menzies, 1997b, 1998a; Krochmalik et al., 2004).

Conclusions

The current study was undertaken in part to answer the following questions: Why do some people experience anxiety and disgust in response to contaminants while others are not bothered? What predicts distress and avoidance of contaminating stimuli that people encounter in daily life? Recent models of anxiety and OCD suggest that threatening appraisals of stimuli are the causal agents producing distress, avoidance, and compulsive cleaning (Freeston et al., 1996; Riskind, 1997; Salkovskis, 1985). In an effort to provide a robust test of these cognitive models, this study used a prospective design, in vivo stimuli, and multiple outcome measures to evaluate response to contaminants. Results demonstrated that danger appraisals significantly predicted both disgust and avoidance on a behavioural task, even after controlling for gender, disgust sensitivity, neuroticism, and OCD symptoms. In contrast, germ spread and responsibility appraisals were not uniquely predictive of any BAT outcomes. The study also highlighted the importance of disgust. Both in vivo distress ratings and implicit reaction time tasks demonstrated that disgust was more strongly associated with contaminants than anxiety in this non-clinical sample.

At present, cognitive models may be hampered by near-exclusive focus on cognition, without serious efforts to account for demographic variables, disposition, and other factors such as biological determinants, learning history, and environmental stressors. The current study specifically highlighted the need to consider gender and disgust sensitivity as risk factors for developing maladaptive responses to contaminants. This study also suggested that affect may play a vital role in escalating danger appraisals, and is likely a potent motivator of avoidance

and cleaning behaviours. Revising cognitive models to emphasize the importance of synergistic effects between cognition and emotion may be warranted. Greater attention is also needed in applying cognitive models to understanding overreactions to contamination threats in normal populations.

Given the huge variability in presenting symptoms and evidence of meaningful OCD subtypes (including a subtype who do not report inflated levels of dysfunctional beliefs), an important question facing the field today is whether OCD represents a unitary disorder as opposed to a spectrum of symptoms arising from multiple etiologies (Taylor et al., 2006). Even within the contamination subtype, motivation for compulsive washing varies from person to person. While some people are concerned with contracting an illness or passing it to others (implicating danger and responsibility appraisals), others are intolerant of feeling dirty or disgusted (Feinstein, Fallon, Petkova, & Liebowitz, 2003), while others wash until they feel "just right." Still others fear "contamination by evil" (Calamari et al., 2004) or feel dirty as a result of insults or moral transgressions in the absence physical contaminants (Rachman, 2006). Washing compulsions can arise in all such cases, but the washing functions to alleviate very different concerns. Clearly, cognitive theories need to be flexible enough to account for these diverse motivations, only some of which are associated with appraisals of danger.

Cognitive models of OCD and subtype-specific conceptualizations are still in early stages of development. There is a clear need for further research to better understand the etiological and maintaining factors contributing to distress and compensatory behaviours, in both clinical and non-clinical populations. Investigations into the role of disgust for contamination concerns is just beginning, and the current study suggests that this will be a fruitful area of future research, especially when expanded to clinical samples and treatment outcome data.

Table 1

Trials for the Disgusted versus Afraid Implicit Association Test (IAT)

Block	Number of Trials	Function	Left Key Response	Right Key Response
1	20	Practice	DIRTY	CLEAN
2	20	Practice	Disgusted	Afraid
3	20	Test 1	Disgusted + DIRTY	Afraid + CLEAN
4	40	Test 2	Disgusted + DIRTY	Afraid + CLEAN
5	40	Practice	CLEAN	DIRTY
6	20	Test 1	Disgusted + CLEAN	Afraid + DIRTY
7	40	Test 2	Disgusted + CLEAN	Afraid + DIRTY

Note. Half of the participants started with CLEAN on the left key, and DIRTY on the right key, meaning that blocks 1, 3, and 4 were switched with blocks 5, 6, and 7 respectively.

Table 2

IAT Pilot Data: Correct Classification and Ease of Classifying Stimulus Words into Categories

Stimulus words in each category	Correct classification of word into category	Ease of classifying word into a category	
	%	*M*	*(SD)*
Dirty			
Germs	100	6.19	(1.11)
Trash	100	5.38	(1.36)
Polluted	94	5.56	(1.15)
Clean			
Sterile	100	6.38	(1.02)
Washed	100	6.44	(0.63)
Spotless	100	6.69	(0.79)
Disgusted			
Repulsed	100	6.69	(0.60)
Grossed Out	94	6.50	(1.10)
Sickened	81	5.06	(1.73)
Afraid			
Scared	100	6.88	(0.34)
Frightened	100	6.94	(0.25)
Alarmed	100	5.44	(1.15)
Sad			
Heartbroken	100	6.81	(0.40)
Depressed	100	6.69	(0.48)
Unhappy	100	6.69	(0.60)

Note. *N* = 16 pilot participants. The ease scale ranged from 1 (very hard to classify; doesn't fit very well in this category) to 7 (very easy to classify; fits very well in this category).

Table 3

Rotated Pattern Matrix Loadings for Retained Items of the Washroom Appraisal Questionnaire

WAQ Item	Factors			Communalities	
	Danger	Spread	Resp	Initial	Extract
Vulnerable to germs	**0.70**	0.04	-0.06	0.53	0.49
Risky or dangerous to touch things	**0.86**	-0.01	0.02	0.66	0.74
Likelihood of something bad happening	**0.85**	-0.14	0.01	0.61	0.66
Likelihood of sickness or disease	**0.83**	0.02	-0.07	0.64	0.69
Seriousness of illness or disease	**0.49**	0.14	0.13	0.36	0.36
Germs spread through air towards you	0.06	**0.64**	-0.07	0.38	0.42
Speed of germ spread	-0.02	**0.84**	-0.08	0.55	0.67
Germ spread accelerating	0.15	**0.44**	0.24	0.36	0.37
Speed of germ spread to others	-0.09	**0.86**	0.04	0.57	0.71
Responsibility for harm to self	0.04	0.01	**0.68**	0.34	0.47
Responsibility for harm to others	-0.07	-0.05	**0.81**	0.34	0.63
Eigenvalue	3.95	1.98	1.52		
% of variance accounted for	35.88	17.97	13.84		

Note. Principal axis factor analysis with direct oblimin rotation. Spread = Germ Spread; Resp = Responsibility; Initial = estimated common variance before extraction. Extract = common variance after factor extraction.

Table 4

Descriptive Statistics for Session One Measures

Measure	Scale Range	Mean	Median	*SD*	Alpha (α)
Washroom Appraisals					
Danger	0 - 6	2.75	2.80	1.05	.85
Germ Spread	0 - 6	1.98	2.00	1.04	.79
Responsibility	0 - 6	3.02	3.00	1.37	.69
Global Traits					
BFI-Emotional Stability	1 - 5	3.04	3.00	0.73	.80
Disgust Scale	0 - 32	17.53	17.50	5.37	.85
OCI-R Total	0 - 72	14.74	14.00	8.38	.81
OBQ Total	44 - 308	142.77	142.00	29.98	.90
Distress Ratings					
Baseline Disgust	0 - 100	1.52	0.00	4.30	--
Baseline Anxiety	0 - 100	12.79	10.00	9.43	--
Post WAQ Disgust	0 - 100	12.39	5.00	15.45	--
Post WAQ Anxiety	0 - 100	9.43	10.00	9.81	--

Note. BFI = Big Five Inventory; OCI-R = Obsessive-Compulsive Inventory-Revised; OBQ = Obsessive Beliefs Questionnaire; WAQ = Washroom Appraisal Questionnaire; Sample size ranges from 102-103.

Table 5

Pearson Correlations with the Washroom Appraisal Questionnaire

	Washroom Appraisals		
	Danger	Germ Spread	Responsibility
Construct validity			
LOC-Static threat	**.45****	.41**	-.01
LOC-Looming threat	.19	**.56****	.04
LOC-Responsibility	-.02	.02	**.51****
Global Measures			
BFI-Emotional Stability	-.11	-.12	-.10
Disgust Scale	.28**	.25*	.10
OCI-R Total	.24*	.26**	.07
OBQ Total	.19	.22*	.13
Washroom Appraisals			
Danger	--	.33**	.14
Germ Spread	--	--	.19
Responsibility	--	--	--

Note. LOC = Adapted Looming of Contamination Questionnaire; BFI = Big Five Inventory; OCI-R = Obsessive-Compulsive Inventory-Revised; OBQ = Obsessive Beliefs Questionnaire; Numbers in bold indicate subscales assessing similar constructs. Sample size ranges from 102-103. *$p < .05$, **$p < .01$ (2-tailed).

Table 6

Behavioural Approach Task (BAT): Frequency of Avoidance and Distress for each Step

		Disgust		Anxiety	
	Avoidance Frequency	*M*	(*SD*)	*M*	(*SD*)
Baseline*	--	2.34	(5.03)	9.01	(8.40)
BAT Tasks					
1. Doorknob	2%	13.11	(17.72)	8.63	(10.93)
2. Handrail	5%	11.45	(15.44)	8.47	(11.04)
3. Trash can top	11%	15.97	(19.45)	11.15	(13.90)
4. Trash can swinging lid	25%	26.62	(23.23)	16.68	(18.94)
5. Tampon receptacle	42%	33.85	(25.77)	22.55	(20.93)
6. Toilet flush handle	28%	32.74	(25.53)	19.94	(17.95)
7. Outside of toilet bowl	61%	46.79	(25.32)	31.52	(23.62)
8. Floor (near toilet)	47%	43.22	(27.68)	30.79	(24.94)
9. Floor drain	58%	45.15	(25.71)	31.66	(24.61)
10. Tissue on floor	73%	52.28	(26.35)	36.78	(25.34)
11. Wet basin counter	43%	39.20	(22.55)	29.53	(22.85)
12. Run finger on basin rim	72%	51.97	(25.34)	36.19	(26.08)
13. Basin drain	69%	48.84	(24.87)	34.90	(25.01)
BAT Average	41%	35.46	(18.47)	24.51	(16.98)
Debriefing**	--	8.52	(12.18)	6.85	(8.39)

Note. Avoidance is the frequency of sample that declined each task. *Baseline ratings were taken at the start of the second session, prior to participants knowing what the BAT would involve. **Debriefing ratings were taken after participants cleaned their hands and receiving a debriefing statement. Distress scale anchors: 0 = not at all grossed out (or nervous); 25 = somewhat; 50 = moderate; 75 = very; 100 = extremely grossed out (or nervous).

Table 7

Bivariate Correlations Among BAT Outcome Variables

	Avoidance	Disgust	Anxiety	Urge to Wash^{+} (sqrt)	Time Spent Washing
Avoidance	(.88)				
Disgust	.66**	(.95)			
Anxiety	.48**	.65**	(.95)		
Urge to Wash^{+} (sqrt)	-.01	.31**	.14	--	
Time Spent Washing	-.09	.12	-.06	.36**	--
Wipes Taken	.11	.25**	.31**	.13	.24*

Note. Cronbach's alphas for ratings across 13 BAT items are presented along the diagonal. BAT = Behavioural Approach Task; $^{+}$Urge to wash was transformed (-1 x square root of reflection). Avoidance indicates the frequency of items the participants declined to touch. Disgust and anxiety indicate average ratings across the 13 tasks. Wipes taken is a dichotomous variable (0 = no wipes taken; 1 = one or more wipes taken). Sample size ranges from 100-103. *p < .05, **p < .01 (2-tailed).

Table 8

Gender Differences on Predictor and Outcome Variables

	Women		Men				
	M	*(SD)*	*M*	*(SD)*	*t*	*p*	*d*
Washroom Appraisals							
Danger	2.98	(0.91)	2.40	(1.16)	2.84	.01	0.56
Germ Spread	2.14	(1.08)	1.74	(0.94)	1.92	.06	0.40
Responsibility	3.22	(1.23)	2.72	(1.52)	1.83	.07	0.36
Global Measures							
BFI-Emotional Stability	2.96	(0.70)	3.16	(0.78)	-1.38	.17	-0.27
Disgust Scale	18.38	(5.55)	16.28	(4.88)	1.96	.05	0.40
OCI-R Total	14.89	(8.67)	14.51	(8.03)	0.22	.83	0.05
OBQ-Total	142.64	(29.11)	142.98	(31.59)	-0.06	.96	-0.01
BAT Outcomes							
Avoidance	6.42	(3.28)	3.73	(3.45)	3.99	<.001	0.80
Disgust	41.26	(18.14)	26.69	(15.40)	4.23	<.001	0.87
Anxiety	25.96	(18.15)	22.33	(14.99)	1.10	.27	0.22
Urge to Wash	78.27	(19.03)	74.14	(21.74)	1.02	.31	0.21
Time Spent Washing	18.88	(8.50)	17.55	(8.56)	0.77	.45	0.16
Wipes Taken	61%	--	41%	--	--		

Note. BFI = Big Five Inventory; OCI-R = Obsessive-Compulsive Inventory-Revised; OBQ = Obsessive Beliefs Questionnaire. BAT = Behavioural Approach Task; Avoidance indicates the frequency of items the participant declined to touch. Disgust and anxiety are mean of 13 BAT tasks. Wipes taken is the percent of sample that took one or more wipes after the BAT. The *t*-test for anxiety was adjusted for unequal variances. Sample sizes range from *n* = 60-61 (women); *n* = 40-41 (men).

Table 9

Bivariate Correlations with BAT Outcome Variables

Session 1 Predictors	BAT Outcome Variables (Session 2)					
	Avoidance	Disgust	Anxiety	Urge to Wash^{+} (sqrt)	Time Spent Washing	Wipes Taken
Washroom Appraisals						
Danger	.40**	.39**	.20*	.15	.19	.21*
Germ Spread	.14	.24*	.23*	.08	.03	.09
Responsibility	.05	.11	-.04	.06	-.02	-.12
Global Measures						
BFI-Emotional Stability	-.15	-.21*	-.14	.01	.09	.08
Disgust Scale	.55**	.53**	.42**	-.00	.04	.10
OCI-R Total	-.03	.24*	.21*	.20*	.07	.12
OBQ Total	.03	.15	.02	.15	.13	-.02

Note. BAT = Behavioural Approach Task; BFI = Big Five Inventory; OCI-R = Obsessive-Compulsive Inventory-Revised; OBQ = Obsessive Beliefs Questionnaire. Avoidance indicates the frequency of items the participant declined to touch. Disgust and anxiety are mean of 13 BAT tasks. $^{+}$Urge to wash was transformed (-1 x square root of reflection); Wipes Taken is a dichotomous variable (0 = no wipes taken; 1 = one or more wipes taken). *N*'s =100-103. *p < .05, **p < .01.

Table 10

Hierarchical Multiple Regressions Predicting BAT Outcomes from Appraisals (Controlling for Washroom and Gender)

	β	p	$\Delta adjR^2$	ΔR^2	ΔF	p
Criterion: Avoidance						
Step 1			.16	.18	10.60	<.001
Washroom	0.21	.03				
Gender (male)	-0.36	<.001				
Step 2			.07	.09	3.80	.01
WAQ-Danger	0.32	.001				
WAQ-Germ Spread	-0.02	.85				
WAQ-Responsibility	-0.04	.67				
Criterion: Disgust						
Step 1			.15	.16	9.36	<.001
Washroom	0.11	.26				
Gender (male)	-0.38	<.001				
Step 2			.07	.09	3.76	.01
WAQ-Danger	0.27	.01				
WAQ-Germ Spread	0.09	.36				
WAQ-Responsibility	0.01	.91				
Criterion: Anxiety						
Step 1			.04	.05	2.78	.07
Washroom	0.21	.04				
Gender (male)	-0.10	.33				

Criterion: Anxiety	β	*p*	ΔR^2 *adj*	ΔR^2	ΔF	*p*
Step 2			.04	.06	2.23	.09
WAQ-Danger	0.11	.30				
WAQ-Germ Spread	0.20	.06				
WAQ-Responsibility	-0.09	.36				
Criterion: Urge to Wash						
Step 1			.00	.02	1.18	.31
Washroom	0.10	.32				
Gender (male)	-0.11	.26				
Step 2			-.02	.02	0.51	.68
WAQ-Danger	0.11	.31				
WAQ-Germ Spread	0.02	.87				
WAQ-Responsibility	0.04	.73				
Criterion: Time Washing						
Step 1			-.01	.01	0.33	.72
Washroom	0.03	.76				
Gender (male)	-0.08	.46				
Step 2			.00	.03	1.01	.39
WAQ-Danger	0.19	.09				
WAQ-Germ Spread	-0.03	.78				
WAQ-Responsibility	-0.05	.65				

Note. WAQ = Washroom Appraisals Questionnaire. Gender (0 = female; 1 = male). Avoidance indicates the frequency of items the participant declined to touch. Disgust and anxiety are mean of 13 BAT tasks. Urge to wash was transformed (-1 x square root of reflection).

Table 11

Logistic Regression for the Prediction of Antibacterial Wipe Usage from Appraisal Subscales (Controlling for Washroom and Gender)

	Individual Predictor Statistics					Model Statistics				Correct Classification		
	B	*SE*	*Wald*	*p*	Odds Ratio	Nagel R^2	*-2LL*	$\Delta\chi^2$	*p*	no wipes	wipes taken	over-all
Step 1						.09	130.37	7.26	.03	44%	82%	65%
Washroom	0.97	0.51	3.64	.06	2.64							
Gender (male)	-0.76	0.43	3.19	.07	0.47							
Step 2						.18	123.64	6.73	.08	56%	71%	64%
WAQ-Danger	0.39	0.24	2.74	.10	1.48							
WAQ-Germ Spread	0.09	0.22	0.15	.70	1.09							
WAQ-Responsibility	-0.32	0.17	3.60	.06	0.73							

Note. Nagel R^2 = Nagelkerke's R^2; *-2LL* = *-2 x* log-likelihood. *N* = 100.

Table 12

Hierarchical Multiple Regressions Predicting BAT Avoidance and Distress from Appraisals, Personality Variables, and OCD Symptoms (Controlling for Washroom and Gender)

	β	p	ΔR^2 adj	ΔR^2	ΔF	p
Criterion: Avoidance						
Step 1			.16	.18	10.49	<.001
Washroom	0.21	.03				
Gender (male)	-0.36	<.001				
Step 2			.25	.26	14.52	<.001
BFI-Emotional Stability	0.05	.56				
Disgust Scale	0.56	<.001				
OCI-R Total	-0.20	.02				
Step 3			.05	.05	9.49	.003
WAQ-Danger	0.25	.003				
Criterion: Disgust						
Step 1			.14	.16	9.27	<.001
Washroom	0.11	.26				
Gender (male)	-0.38	<.001				
Step 2			.21	.22	11.11	<.001
BFI-Emotional Stability	0.03	.75				
Disgust Scale	0.45	<.001				
OCI-R Total	0.11	.22				
Step 3			.02	.03	4.54	.04
WAQ-Danger	0.19	.04				

	β	*p*	ΔR^2 *adj*	ΔR^2	ΔF	*p*
Criterion: Anxiety						
Step 1			.04	.05	2.75	.07
Washroom	0.21	.04				
Gender (male)	-0.10	.33				
Step 2			.14	.16	6.52	<.001
BFI-Emotional Stability	0.04	.66				
Disgust Scale	0.40	<.001				
OCI-R Total	0.09	.36				
Step 3			.00	.01	1.55	.22
WAQ-Germ Spread	0.12	.22				

Note. WAQ = Washroom Appraisals Questionnaire; Gender (0 = female; 1 = male); BFI = Big Five Inventory; OCI-R = Obsessive-Compulsive Inventory-Revised. Avoidance indicates the frequency of items the participant declined to touch. Disgust and anxiety are mean of 13 BAT tasks.

Table 13

Bivariate Correlations between Danger Appraisals and BAT Outcome Variables for Women and Men

	WAQ-Danger		
BAT Outcomes	Women	Men	Z_{diff}
Avoidance	.46**	.20	1.42
Disgust	.43**	.18	1.34
Anxiety	.15	.22	-0.35
Urge to Wash^{+} (sqrt)	.35**	-.14	2.43*
Time Spent Washing	.02	.35*	-1.66
Wipes Taken	.00	.36*	-1.81

Note. WAQ = Washroom Appraisals Questionnaire. BAT = Behavioural Approach Task; $^{+}$Urge to wash was transformed (-1 x reflected square root). Avoidance indicates the total number of items declined to touch. Disgust and anxiety indicate average ratings across the 13 tasks. Wipes taken is a dichotomous variable (0 = no wipes taken; 1 = one or more wipes taken). Sample size ranges from 60-62 in women, and 40-41 in men. *p < .05 (2-tailed).

Table 14

Full and Partial Correlations for Disgust and Anxiety with other BAT Outcome Variables

	Disgust		Anxiety	
	r	pr^1	*r*	pr^2
Avoidance	.66**	.53**	.48**	.08
Urge to Wash$^+$ (sqrt)	.31**	.29**	.14	-.09
Time Spent Washing	.12	.21*	-.06	-.18
Wipes Taken	.25**	.07	.31**	.20*

Note. pr^1 = partial correlation with disgust, controlling for anxiety; pr^2 = partial correlation with anxiety, controlling for disgust; BAT = Behavioural Approach Task; $^+$Urge to wash was transformed (-1xsquare root of reflection). Avoidance indicates the frequency of items the participant declined to touch. Disgust and anxiety indicate average ratings across the 13 tasks. Wipes taken is a dichotomous variable (0 = no wipes taken; 1 = one or more wipes taken). Sample size ranges from 97-100. *p < .05, **p < .01 (2-tailed).

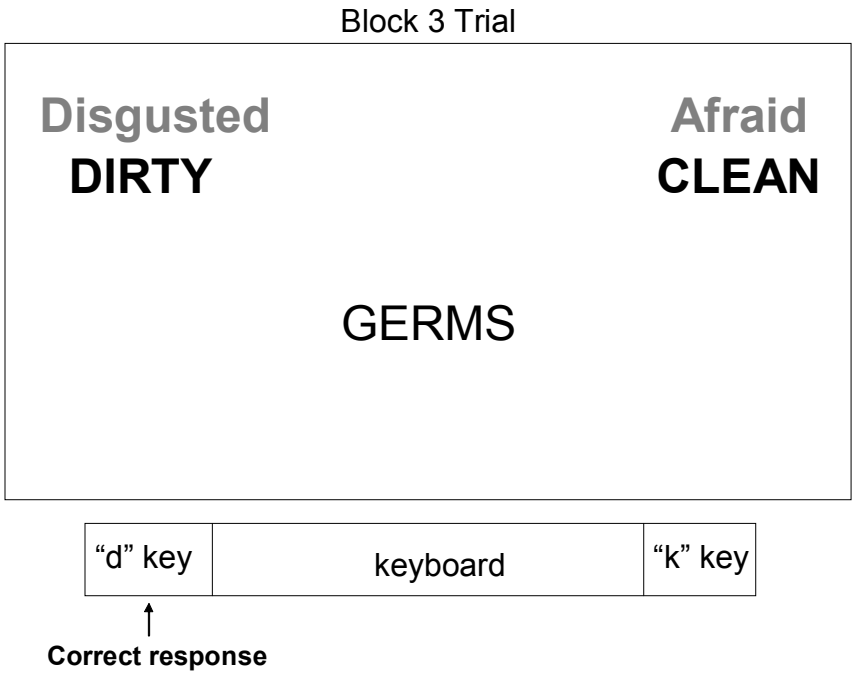
Table 15

Bivariate Correlations Among Implicit and Explicit Measures

	IATs		
	Afraid vs. Sad	Disgusted vs. Sad	Disgusted vs. Afraid
BAT Outcomes			
Avoidance	-.09	.03	.08
Disgust	.04	.01	.04
Anxiety	.05	-.10	.05
Urge to Wash^{+} (sqrt)	.01	.01	.11
Time Spent Washing	-.04	.04	-.02
Wipes Taken	.04	-.33**	-.11
Washroom Appraisals			
Danger	.11	.08	.03
Germ Spread	.27**	.03	-.13
Responsibility	.14	.33**	.14
Global Measures			
BFI-Emotional Stability	-.03	-.01	-.15
Disgust Scale	.01	.10	.09
OCI-R Total	-.04	-.03	-.01
OBQ-Total	.03	-.03	-.01

Note. IAT = Implicit Association Test; BAT = Behavioural Approach Task; $^{+}$Urge to wash was transformed (-1 x square root of reflection). Avoidance indicates the frequency of items the participant declined to touch. Disgust and anxiety indicate average ratings across the 13 tasks. Wipes taken is a dichotomous variable (0 = no wipes taken; 1 = one or more wipes taken). BFI = Big Five Inventory; OCI-R = Obsessive-Compulsive Inventory-Revised; OBQ = Obsessive Beliefs Questionnaire. Sample size ranges from 100-103. *p < .05, **p < .01 (2-tailed).

Figure 1. Sample Computer Screens for Critical Trials in Blocks 3 and 6 of the IAT



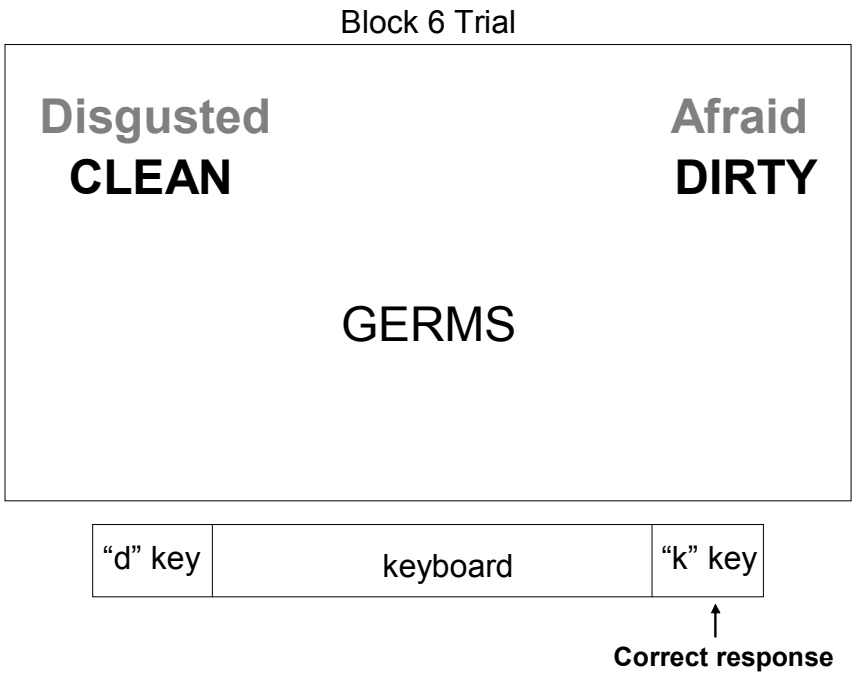
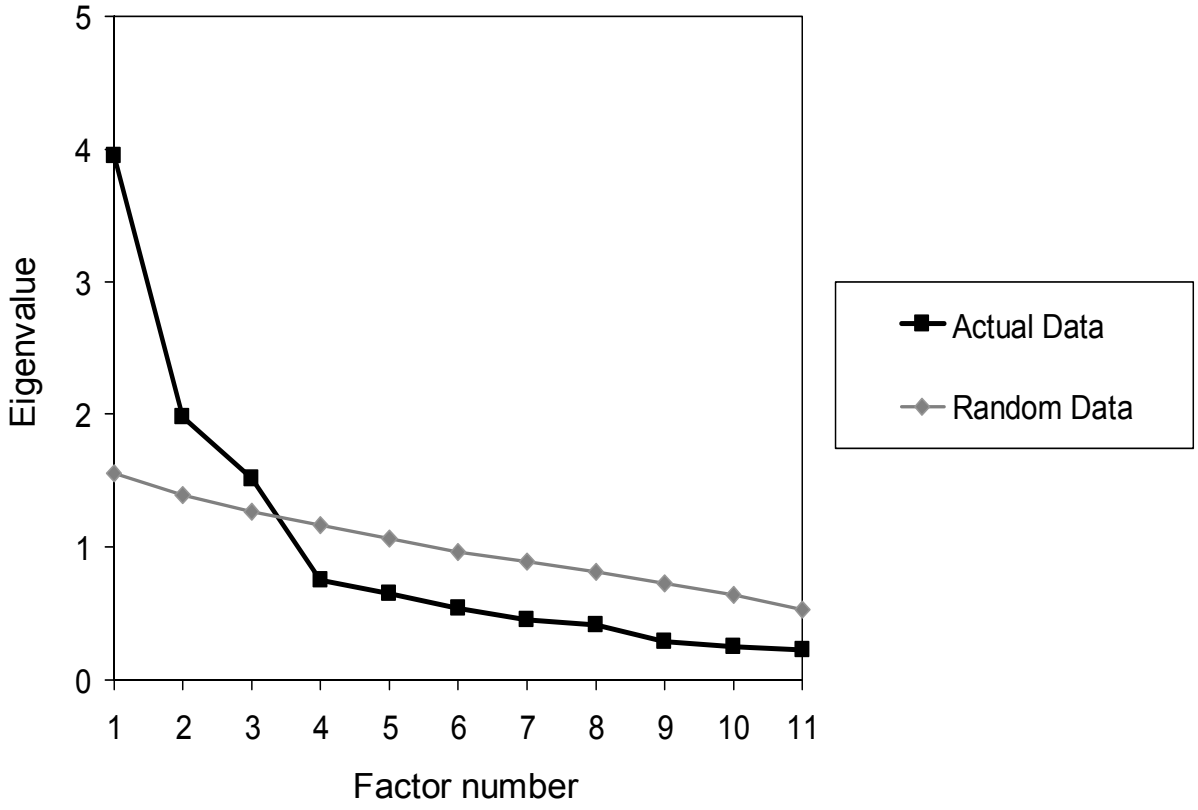


Figure 2. Scree Plots for the Washroom Appraisal Questionnaire and the Parallel Analysis using Random Data



Note. The random data line represents the eigenvalues produced by a parallel analysis using 100 random datasets, each with 11 variables and samples of 103.

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APPENDICES

Appendix A

Washroom Appraisal Questionnaire

Please evaluate how you would feel if you were asked to touch objects in the public washroom that you just looked at (e.g., the toilet, the floor, the garbage can, the tampon receptacle).

1. If you touched these objects in the public washroom, how vulnerable to germs and contamination would you be?

0	1	2	3	4	5	6
Not at all vulnerable	A little vulnerable		Moderately vulnerable	Very vulnerable		Extremely vulnerable

2. How vulnerable to germs and contamination would you be, <u>compared to others</u>?

0	1	2	3	4	5	6
Much <u>less</u> vulnerable than others	Somewhat less vulnerable	A little less vulnerable	<u>Similar</u> vulnerability to others	A little more vulnerable	Somewhat more vulnerable	Much <u>more</u> vulnerable than others

3. How <u>risky or dangerous</u> would it be to touch things in the public washroom?

0	1	2	3	4	5	6
No risk or danger (like sitting on my couch at home)			Some risk/danger (like being near someone with the flu)			Extreme risk/danger (like unsafe sex with an infected partner)

4. How likely is it that <u>something bad</u> would happen to you or someone else because you touched things in the public washroom?

0	1	2	3	4	5	6
No chance of bad things happening	Very unlikely	Unlikely	Moderate Chance	Likely	Very likely	Bad things are 100% certain to happen

5. How likely is it that you would become sick or catch a disease if you touched things in the public washroom?

0	1	2	3	4	5	6
No chance of getting sick	Very unlikely	Unlikely	Moderate Chance	Likely	Very likely	100% certain to get sick

6. How likely is it that you would become sick, compared to others?

0	1	2	3	4	5	6
Much less likely than others to get sick	Somewhat less likely	A little less likely	Similar chance to others	A little more likely	Somewhat more likely	Much more likely than others to get sick

7. If you did become sick, how serious do you think the illness or disease would be?

0	1	2	3	4	5	6
Not at all serious (like a few sniffles)			Moderately serious (like the flu)			Extremely serious (like HIV/AIDS or Hepatitis C)

8. Once you've touched objects in a public washroom, how much do you think the germs or contamination could travel or spread on or into your body?

0	1	2	3	4	5	6
No germ spread on or into my body	A little germ spread		Moderate germ spread	A lot of germ spread		Great amount of germ spread on or into my body

9. How much would you spread germs by touching your hands to other parts of your body (e.g., face)?

0	1	2	3	4	5	6
No germ spread from touching	A little germ spread		Moderate spread from touching	A lot of germ spread		Great amount of germ spread from touching

10. How much do you think the germs or contamination could travel or spread <u>through the air towards you</u>?

0	1	2	3	4	5	6
No germ spread through air	A little germ spread		Moderate germ spread	A lot of germ spread		Great amount of germ spread through air

11. How <u>slow or fast</u> could the germs or contamination spread?

0	1	2	3	4	5	6
Germs don't move	Spread very slowly	Spread slowly	Spread at moderate speed	Spread quickly	Spread very quickly	Spread extremely quickly (instantly!)

12. To what degree do you sense that the germs are moving or spreading faster with every moment that goes by?

0	1	2	3	4	5	6
Germ spread is <u>staying the same</u> over time			Germ spread is increasing moderately over time			Germ spread is <u>increasing rapidly</u> over time

13. How <u>slow or fast</u> could the germs or contamination spread <u>to others</u>?

0	1	2	3	4	5	6
Germs don't move	Spread very slowly	Spread slowly	Spread at moderate speed	Spread quickly	Spread very quickly	Spread extremely quickly (instantly!)

14. If you did become sick, how likely is it that you would spread germs or illness to other people?

0	1	2	3	4	5	6
No chance of spreading germs to others	Very unlikely	Unlikely	Moderate chance of spreading germs to others	Likely	Very likely	100% certain to spread germs to others

15. If you got sick or something bad happened to you because you touched things in a public washroom, how responsible would you feel (how much would you blame yourself)?

0	1	2	3	4	5	6
I'm not at all responsible; it's not my fault	A little bit responsible		I'm moderately responsible	Mostly responsible		I'm completely responsible; it's all my fault

16. If something bad happened to someone else or they got sick because you touched things in a public washroom, how responsible would you feel (how much would you blame yourself)?

0	1	2	3	4	5	6
I'm not at all responsible; it's not my fault	A little bit responsible		I'm moderately responsible	Mostly responsible		I'm completely responsible; it's all my fault

17. If you felt nervous or grossed out while touching objects in the public washroom, how well would you be able to cope with these feelings?

0	1	2	3	4	5	6
I would cope exceptionally well – no problems	I would cope well, but it would require effort.		I would cope moderately well.	I would cope poorly		I would not cope. I would have a meltdown.

Appendix B

Stimulus Protocol for Experimenter

Washroom Set Up for Day 1

→ Insure that the toilet seat is down, the seat is clean, and the toilet is flushed.

→ Make sure that the trash can does not have any papers hanging out it or stuck in the swinging lid.

→ Insure there are no tissues or trash on the washroom floor.

→ Rinse the sink and wipe anything visible from sink area (e.g., hairs, makeup, lint).

→ If odor is a problem, prop open the door or use the other washroom.

→ Make sure to have two washrooms ready, in case one is in use.

Washroom Set Up for Day 2

→ All above from Day 1.

→ Leave a (clean) crumpled tissue near the toilet.

→ Wet the sink counter top area.

Appendix C

Ethical Approval

The University of British Columbia
Office of Research Services and Administration
Behavioural Research Ethics Board

Certificate of Approval

PRINCIPAL INVESTIGATOR	DEPARTMENT	NUMBER
Woody, S.	Psychology	**B05-0920**

INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT
UBC Campus ,

CO-INVESTIGATORS:
Donegan, Eleanor, Psychology; Dorfan, Nicole, Psychology; Hult, Dagny, Psychology

SPONSORING AGENCIES

TITLE:
Prospective Appraisals

APPROVAL DATE	TERM (YEARS)	DOCUMENTS INCLUDED IN THIS APPROVAL
NOV 17 2005	1	Nov. 11, 2005, Advertisement / Debriefing form / Oct. 6, 2005, Questionnaires / Consent form

CERTIFICATION:

The protocol describing the above-named project has been reviewed by the Committee and the experimental procedures were found to be acceptable on ethical grounds for research involving human subjects.

Approv[redacted]hics Board
by one of the following:
~~Dr. Peter Suedfeld, Chair,~~
Dr. Susan Rowley, Associate Chair

This Certificate of Approval is valid for the above term provided there is no change in the experimental procedures