Disgust and OC Symptoms: The Mediating Role of Harm Avoidance and Incompleteness

Ragnheiður Ragnarsdóttir
Sóley Siggeirsdóttir

Lokaverkefni til BS-gráðu
Sálfræðideild
Heilbrigðísíðasvið Háskóla Íslands
Disgust and OC Symptoms: The Mediating Role of Harm
Avoidance and Incompleteness

Ragnheiður Ragnarsdóttir
Sóley Siggeirsdóttir

Lokaverkefni til BS-gráðu í sálfræði
Leiðbeinandi: Ragnar Pétur Ólafsson

Sálfræðideild
Heilbrigðisvísindasvið Háskóla Íslands
Júní 2016
Ritgerð þessi er lokaverkefni til BS-gráðu í sálfræði og er óheimilt að afrita ritgerðina á nokkurn hátt nema með leyfi réthafa.

© Ragnheiður Ragnarsdóttir, Sóley Siggeirsdóttir

Prentun: Háskólaprent
Reykjavík, Ísland 2016
An experimental study was conducted to investigate the relationship between disgust and contamination fear. The main purpose was to examine the mediating role of the two motivation dimensions of harm avoidance and incompleteness in this relationship. The final sample consisted of 84 students at the University of Iceland. Data was collected using self-report questionnaires and a behavioral avoidance task (BAT) designed to induce disgust. Results revealed that those who experienced more disgust showed less approach behavior on the BAT. Also, disgust predicted contamination fear over and above what could be accounted for by anxiety. Finally, mediational analysis using self-report questionnaires revealed that incompleteness, but not harm avoidance, was a mediating factor in the relationship between disgust and contamination fear. This suggests that it might be sensory sensitivity, rather than overestimation of threat, that explains why disgust leads to contamination related OC symptoms. However, mediational analysis using data from the BAT did not replicate these results, where neither incompleteness nor harm avoidance emerged as independent mediators.
Acknowledgements

This thesis was written under the guidance of Dr. Ragnar P. Ólafsson. We would like to thank him for his excellent guidance and assistance. We would also like to thank our co-researchers, Árný Áradóttir and Sólveig Anna Daníelsdóttir, for outstanding collaboratio
# Contents

**Introduction** .......................................................................................................................... 6

**Method** ................................................................................................................................... 12
  Participants ................................................................................................................................. 12
  Measures ..................................................................................................................................... 13
    Background Questions .............................................................................................................. 13
    Hospital Anxiety and Depression Scale (HADS) .................................................................... 13
    Obsessive Compulsive Inventory – Revised (OCI-R) ............................................................ 13
    Padua Inventory – Washington State University Revision (PI) ................................................ 13
    Obsessional Beliefs Questionnaire (OBQ44) ......................................................................... 14
    Not Just Right Experiences – Revised (NJREs questionnaire) ............................................... 14
    Disgust Propensity and Sensitivity Scale Revised (DPSS-R) .................................................. 14
    Behavioral Avoidance Task ..................................................................................................... 15
    BAT questionnaire .................................................................................................................. 16
    Obsessive-Compulsive Core Dimensions Questionnaire ...................................................... 16
    Fruit Game ............................................................................................................................... 16
  Procedure .................................................................................................................................... 16
  Statistical Analysis .................................................................................................................... 17

**Results** .................................................................................................................................... 17
  Descriptive statistics, correlations and reliability ...................................................................... 17
  Validation of the Behavioral Avoidance Task ........................................................................... 19
  Multiple regression analysis: The specific contribution of disgust to contamination fear ....... 19
  Mediational analysis: The mediating role of harm avoidance and incompleteness ............... 20

**Discussion** ............................................................................................................................... 23

**References** ............................................................................................................................... 27
Obsessive Compulsive Disorder (OCD) is characterized by obsessions and/or compulsions (American Psychiatric Association [APA], 2013). According to DSM-5, “obsessions are recurrent and persistent thoughts, urges, or images that are experienced as intrusive and unwanted, whereas compulsions are repetitive behaviors or mental acts that an individual feels driven to perform in response to an obsession or according to rules that must be applied rigidly” (APA, 2013, p.235). In order to be diagnosed with the disorder, obsessions and/or compulsions must cause significant anxiety or distress and disruptions in daily functioning (APA, 2013).

The specific content of obsessions and compulsions varies between individuals. The most common approach to this heterogeneity is to classify patients on the basis of their overt symptoms (Summerfeldt, 2004). Therefore, there are certain symptom dimensions common in OCD. Those include cleaning, symmetry, forbidden or taboo thoughts, and harm (APA, 2013). This diverse range of symptoms can pose a challenge for those who seek to understand and treat the disorder. Furthermore, classification based on peoples’ overt symptoms can have the effect of overlooking some important underlying themes (Summerfeldt, 2004).

According to cognitive models of OCD, emotional responses arise from appraisals of otherwise normal cognitive experiences. Salkovskis (1985) proposed that responsibility appraisals related to intrusive thoughts can induce compulsive behaviors. According to his model, some people seem to have a tendency to appraise otherwise normal intrusive thoughts as indicating that harm to themselves or others is highly likely, and that they may be responsible for possible harm or its prevention. Rachman (1997) presented a purely cognitive theory of obsessions, where he claims that intrusive thoughts become obsessions when the individual misinterprets the personal significance of the thoughts, as being highly important, personally revealing and threatening. Rachman concludes that obsessions will persist for as long as such misinterpretations continue, and that they will diminish or even disappear when these misinterpretations are weakened or eliminated. Purdon and Clark (1999) offer a formulation of the role of metacognition in OCD. They suggest that in addition to Salkovskis’ and Rachman’s models, two other factors should be considered for understanding the disorder. They emphasize the ego-dystonic nature of obsessional thoughts, when thoughts are inconsistent with one’s believes and self-view. Whereas such thoughts are often undesirable, it can lead one to believe that he himself possesses undesirable traits. Additionally, they
suggest the role of excessive thought control, but such attempts can have paradoxical effects, and result in increased frequency of the undesirable thought (Purdon & Clark, 1999).

The role fear and anxiety play in OCD is well known, and cognitive theories have emphasized this role (Purdon & Clark, 1999; Rachman, 1997; Salkovskis, 1985). Evidence has recently been accumulating on the possible role of disgust in the disorder, particularly in association with fear of contamination and washing compulsions (Cisler, Olatunji, & Lohr, 2009; Davey, 2011). Contamination has been defined as “an intense and persisting feeling of having been polluted or infected or endangered as a result of contact with a person/place/object that is perceived to be impure, infectious or harmful” (Rachman, 2004, p. 1229). Among the negative emotions that accompany feelings of being contaminated are fear and disgust. Fear and disgust are different emotions and organisms show distinct responses towards them. Fear is a defensive response to a looming threat (Lang, Davis, & Öhman, 2000). Disgust, on the other hand, is a revulsive response towards potential contamination, and serves to protect against illness, disease and contamination (Cisler et al., 2009; Davey, 2011). Even though disgust is one of the basic emotions that can be found across different cultures, it is under the influence of social norms and personal experiences. What one considers to be disgusting can therefore vary within and between cultures (Olatunji & Sawchuck, 2005).

One factor that fear and disgust have in common is the action tendency of avoidance. According to Woody and Teachman (2000) avoidance motivated by fear serves to protect the person from perceived danger while avoidance motivated by disgust is more of a sensory phenomenon, an effort to repel the smell, taste, sight, sound or feel of an aversive stimulus. Because behavioral avoidance is characteristic of both fear and disgust, it can be hard to differentiate between fear-motivated and disgust-motivated avoidance (Olatunji & Sawchuck, 2005; Woody & Teachman, 2000).

Research results support the idea that disgust plays a role in OCD. Mancini, Gragnani and D’Olimpio (2001) found that disgust predicts self-reported OC symptoms in a non-clinical sample. In particular, disgust turned out to be the best predictor for some symptom types, such as washing and checking symptoms. Furthermore, Olatunji and colleagues (2007) examined the relationship between disgust and contamination related OCD symptoms in a non-clinical sample. Their results showed that those who scored high on contamination symptoms reported experiencing more disgust than those who scored low (Olatunji, Lohr,
Sawchuk, & Tolin, 2007). Individuals with elevated fear of contamination also show less approach behavior and report experiencing more disgust towards a disgust provoking stimuli during a behavioral avoidance task (BAT) than those who report low contamination (Olatunji et al, 2007) or those who experience high or low anxiety (Tsao & McKay, 2004) The relationship between disgust and OC symptoms has been found in other studies using self-report measures in non-clinical samples (Muris et al., 2000; Olatunji, Sawchuck, Lohr and de Jong, 2004; Thorpe, Patel, & Simonds, 2003) but this relationship has been found in a clinical sample as well. For example, Whitton, Henry and Grisham (2015) compared emotional experiences of healthy, anxious and OCD participants and found that OCD participants experienced more disgust when shown images of body waste.

OC patients are prone to hold irrational or “magic” believes about how contamination is transmitted. Two laws apply the role disgust plays in fear of contamination. Both describe how a person may irrationally perceive a threat of contamination based on features of similarity or contagion. Law of similarity describes how an item can be perceived as disgusting simply because it resembles something already believed to be contaminated (Rachman, 2004; Rozin & Fallon, 1987). Rozin and Fallon (1987) demonstrated that people would rather eat a fudge shaped as a muffin than one shaped as dog feces. Law of contagion describes how a non-contaminated object acquires disgust properties once it comes into contact with a perceived contaminant. Tolin, Worhunsky, and Maltby (2004) showed that when OC patients watched a clean pencil come into contact with a contaminated object, the previously clean pencil was now believed to be contaminated. Furthermore, when a second pencil was touched to the first one, it was believed to be just as contaminated as the first one. This was repeated for 12 pencils. The patients found the 12th pencil to be just as contaminated as the first one, therefore perceiving a so called “chain of contagion.” This illustrates one of the characteristics of the law of contagion; once in contact, always in contact (Rozin & Fallon, 1987).

Harm avoidance has been considered to be the prevailing motivational factor for OC symptoms. Harm avoidance is a dominant factor in anxiety disorders and is characterized by anxiety, hypervigilance to potential threat, and abnormal avoidance of harm (Summerfeldt, 2004). This theme has been the focus of most models of OCD (Purdon & Clark, 1999; Rachman, 1997; Salkovskis, 1985). This was also the theme of Rachman’s (2004) theoretical speculations on the role of fear and disgust in relation to contamination fear, where he claims
that harm avoidance is the motivating factor underlying cleaning compulsions. However, researchers have suggested that this single motivational factor can not adequately explain all OC symptoms (Pietrefsa & Coles, 2008; Summerfeldt, 2004). Clinical observation suggests that OC symptoms may also be motivated by feelings of imperfection or the feeling of things being “not just right” (Tallis, 1996) and this second motivational factor has been called incompleteness (Summerfeldt, 2004). The feeling of things being not-just-right is accompanied by a need to perform an action to get things just right. Incompleteness can be seen as a sensory-affective dysfunction, meaning that there is a deficiency in one’s ability to use sensory feedback and emotional experience to guide behavior (Summerfeldt, 2004) This differs from the cognitive nature of harm avoidance (Summerfeldt, Kloosterman, Antony, & Swinson, 2014).

Research supports the role of incompleteness in OCD. For example, Coles, Frost, Heimberg and Rhéaume (2003) found that so called “not just right” experiences (NJREs) are common natural occurrences, and can be both mental and physical in nature. Additionally, their findings showed that more often than not, participants reported taking some action to correct this feeling of things being “not just right.” Their results also revealed that NJREs were significantly associated with OC symptoms in non-clinical participants with strongest association being observed with checking, ordering and doubting. Finally, their study showed that not just right experiences had stronger correlations with OC symptoms than with a measure of excessive worrying, social anxiety, trait anxiety and depression.

Coles, Heimberg, Frost and Steketee (2005) compared high- and low-intensity not just right experiences on several measures. First, they induced NJREs in an experimental setting. This revealed that NJREs do not provoke the need to prevent harm, but cause distress and the need to change something so it will feel just right. This provides evidence that harm avoidance is not the only factor that drives compulsions, but that incompleteness also plays a part. Additionally, participants were asked to self-monitor their NJREs for one week. This revealed that it is peoples’ reactions to their NJREs which lead to compulsions, but not the occurrence of such thoughts.

Pietrefsa and Coles (2008) established the validity of harm avoidance and incompleteness as two separate constructs in a study using the Obsessive-Compulsive Trait Core Dimensions Questionnaire (OC-TCDQ). They also found that both factors were correlated with multiple symptom domains in OCD, including washing, checking, ordering,
obsessing, and neutralizing. Their results did not show a stronger relationship between harm avoidance and washing, checking and mental neutralizing, than those symptom dimensions had with incompleteness. This suggests that compulsive washing may not be exclusively motivated by a desire to prevent contamination. However, they did find that harm avoidance was more strongly correlated with obsessing, and that incompleteness had a stronger correlation with ordering. Thus, their results suggest that while both of these dimensions may drive compulsions, they may be differentially related to the various symptom domains in OCD.

The studies mentioned above demonstrate that both harm avoidance and incompleteness can motivate OC symptoms. Summerfeldt and colleagues (2014) have proposed a model suggesting that these two dimensions serve as the prevailing motivational factors underlying OC symptoms. As previously mentioned, research suggests that the emotion of disgust also plays a role in driving OC symptoms, especially symptoms concerning fear of contamination and washing behavior (Olatunji et al., 2007). However, it is still not clear why disgust drives these symptoms. Cisler and colleagues (2010) showed that obsessive beliefs, especially overestimation of threat and harm, interact with disgust to heighten fear of contamination. This may explain when disgust leads to contamination fear. However, why this happens is still unclear. Olatunji, Unoka, Beran, David and Armstrong (2009) investigated whether harm avoidance plays a mediating role in the relationship between disgust and OC symptoms. Their results showed a significant relationship between disgust and harm avoidance, between disgust and OC symptoms, as well as between harm avoidance and OC symptoms. However, when they controlled for the effect of harm avoidance the relationship between disgust and OC symptoms diminished and became non-significant (Olatunji et al., 2009). This suggests that harm avoidance serves as a mediating factor in the relationship between disgust and OC symptoms, explaining why this relationship exists. These results are in line with Rachman’s (2004) thoughts on compulsive cleaning as being driven by an attempt to avoid harm, independent of whether it is fear or disgust that drives the behavior.

However, some evidence suggests that compulsions related to contamination are not only driven by harm avoidance. Tallis (1996) reported cases of OCD patients with cleaning compulsions where the compulsions were not driven by a need to avoid illness but by a need to have things remain in perfect conditions or achieve a perfect sensation of being clean. In
one study, factor analysis revealed that there are two types of contamination worries, one related to fear of harm and the other driven by a need to reduce discomfort (Feinstein, Fallon, Petkova & Liebowitz, 2003). Also, as Pietrrefsa and Coles’ (2008) results showed, it is not only harm avoidance, but also the dimension of incompleteness that is associated with washing compulsions. Cougle and colleagues (2011) used both self-report and behavioral methods to examine if NJREs were associated with hand washing. Their results revealed that both intensity and frequency of NJREs were positively correlated with duration of hand washing (Cougle, Goetz, Fitch & Hawkins, 2011). This suggests that while duration of washing may partly be determined by avoidance of harm (Wahl, Salkovskis & Cotter, 2008), it may not be entirely cognitively based. That is, termination of washing may also be determined by subjective sensory experiences (Cougle et al, 2011).

Considering this, there have been speculations about whether incompleteness might also play a mediating role in the relationship between disgust and fear of contamination and/or washing behavior. Ólafsson, Emmelkamp, Ólason and Kristjánsson (work in progress) carried out two separate studies to examine the mediating role of harm avoidance and incompleteness in the relationship between disgust, as measured with Disgust Propensity and Sensitivity scale (DPSS), and contamination fear, as measured with the Padua inventory. In study 1, the Repsonsibility Attitude Scale was used to measure harm avoidance, and the Not-Just-Right-Experiences questionnaire to measure incompleteness. In order to better validate the results, the study was repeated in another sample using Obsessive-Compulsive Core Dimensions Questionnaire (OC-CDQ) as a measure of harm avoidance and incompleteness. Both studies revealed that the dimension of incompleteness and NJREs plays a mediating role in this relationship, but the results did not support a mediating role of harm avoidance. This emphasizes the role of sensations, but not sensitivity to harm, in explaining why disgust leads to symptoms of contamination. In particular, the experience of disgust triggers a feeling of internal imbalance, that leads to contamination related symptoms, such as washing, in order to restore a feeling of things being just right (Ólafsson et al, work in progress).

This study attempts to explore the role of disgust in OC symptoms. Consistent with previous research (Olatunji et al., 2007; Tsao & McKay, 2004) it is hypothesized that those who report more disgust will show less approach behavior towards a disgusting stimulus. Moreover, it is expected that disgust serves as a predictor for fear of contamination over and above what can be accounted for by anxiety (Mancini et al., 2001; Muris et al., 2000;
Furthermore, the main purpose of this study is to explore whether both harm avoidance and incompleteness might mediate the connection between disgust and contamination fear. Such model can be seen in Figure 1.

![Diagram](image)

Figure 1. The mediating role of harm avoidance and incompleteness in the relationship between disgust and contamination fear.

Consistent with Ólafsson’s et al. (work in progress) results, it is hypothesized that incompleteness, but not harm avoidance, serves as a mediating factor in the relationship between disgust and fear of contamination.

**Method**

**Participants**

The sample consisted of 86 students at the University of Iceland. Two participants were excluded on the basis of missing data. The final sample thus consisted of 84 students, of which 57 (68%) were female and 27 (32%) were male. Age ranged from 20 to 34 years, mean age was 25 (SD= 2.8). Participants were sampled by convenience. An email was sent to all students at the university in which they were invited to participate in the study and the study was also introduced during class hours. Pregnant women were advised not to participate. Participants received 1000 ISK for their participation.
Measures

Background Questions
Participants were asked about their age and gender.

Hospital Anxiety and Depression Scale (HADS)
HADS is a 14 item self-report scale developed by Zigmond and Snaith in 1983. It has two 7 item subscales, measuring symptoms of depression and anxiety. Items are scored on a 4-point scale from 0-3. The scale is reliable and a valid measure of depression and anxiety (Herrmann, 1997). The Icelandic version is a translation by Hógni Óskarsson, and has good psychometric properties (Smári, Ólason, Arnarson, & Sigurðsson, 2008). In this study, HADS was used to control for symptoms of anxiety and depression.

Obsessive Compulsive Inventory – Revised (OCI-R)
OCI-R is a short version of the Obsessive Compulsive Inventory (OCI), assessing symptoms of Obsessive Compulsive Disorder. It is an 18 item self-assessment scale developed by Foa et al. (2002). The scale evaluates the distress one experiences due to his/her symptoms. Items are scored on a 5-point Likert-type scale from 0 (never) to 4 (always). Scores range from 0-72, with higher score indicating more distress. The instrument contains 6 subscales measuring washing, obsessing, hoarding, ordering, checking, and neutralizing behaviors. The scale has been shown to be both valid and reliable for measuring OCD symptoms (Foa et al., 2002). The Icelandic version was translated by Ásdís Eyþórsdóttir and Jakob Smári, and has shown to be both reliable (α=0.87) and valid (Smári, Ólason, Eyþórsdóttir & Frölund, 2007).

Padua Inventory – Washington State University Revision (PI)
The revised version of the Padua Inventory (PI) is a self-report measure of OC symptoms. The scale has 5 subscales, but in this study only the 10 item subscale for contamination obsessions and washing compulsions was used. It is scored on a 5-point Likert-type scale from 0 (not at all) to 4 (very much). Scores range from 0-40 with higher scores indicating more symptoms. The contamination subscale has been shown to be both reliable (α=.85) and valid (Burns, Keortge, Formea, Sternberger, 1996). The Icelandic version was translated by Sigrún Drífa Jónsdóttir and Jakob Smári. This version has also shown to be reliable (α=0.80) and valid (Jónsdóttir & Smári, 2000). In the present study the Padua washing and contamination subscale was used to measure fear of contamination.
Obsessional Beliefs Questionnaire (OBQ44)

OBQ is a 44 item questionnaire measuring beliefs and appraisals characterizing OCD patients (Obsessive Compulsive Cognitions Working Group, 2005). OBQ contains three subscales but in the present study only the threat subscale was used, which measures responsibility and threat appraisals. This subscale contains 16 items, scored on a 7-point Likert-type scale ranging from 1 (disagree very much) to 7 (agreed very much) where participants report how much each item describes their regular thinking pattern. Possible range of scores for the threat subscale is 16-112. Research has reported good reliability for this subscale (OCCWQ, 2005; Tolin, Woods, & Abramowitz, 2003; Tolin, Worhunsky, & Maltby 2006). The questionnaire has also shown good convergent validity (OCCWQ, 2005). The Icelandic version was translated by Eggert Birgisson and Jakob Smári. In this study the OBQ threat subscale was used as a measure of harm avoidance.

Not Just Right Experiences – Revised (NJREs questionnaire)

The NJREs questionnaire is a 19 item scale measuring both number and severity of NJREs. In this questionnaire participants are first asked if they have experienced within the last month any of 10 sample items, each indicating a specific not just right experience. Number of NJREs is calculated by summing scores on those 10 questions. Next they are asked which NJRE they experienced most recently and when it last occurred (from within hours to within the past month). Lastly, participants are asked to think about this particular experience and rate its frequency, intensity, immediate distress, delayed distress, rumination, urge to respond, and sense of responsibility. These questions were rated on a scale from 1 (absence) to 7 (extreme), severity is rated by summing the scores for those questions (Coles, Heimberg, Frost, & Steketee, 2005). Reliability for the first 10 questions is good (α=.79). The scale has also shown to be valid (Coles, Frost, Heimberg, &Rhéaume, 2003). The Icelandic version was translated by Ragnar P. Ólafsson. In this study the scale was used as a measure of incompleteness.

Disgust Propensity and Sensitivity Scale Revised (DPSS-R)

DPSS-R attempts to measure disgust propensity; defined as peoples general tendency to experience disgust, as well as disgust sensitivity; the extent to which one experiences this emotion as negative. Each subscale contains 8 items scored on a 5-point Likert-type scale from 1 (never) to 5 (always). Scores for each subscale range from 8-40, where higher scores
indicate more disgust. Total score on the scale ranges from 16-80. Reliability for each subscale is adequate; α=.77 and α=.78 respectively for sensitivity and propensity (van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006). Both subscales show good validity. The Icelandic version was translated by Bjartmar S. Steinarsson, Pórey K. Dórisdóttir, and Ragnar P. Ólafsson. This version has shown to be reliable for sensitivity (α=.80) and for propensity (α=.83; Steinarsson, 2014). In this study the DPSS total score was used as a single measure of disgust.

**Behavioral Avoidance Task**

A behavioral avoidance task (BAT) was employed as an attempt to assess avoidance behavior in relation to disgusting stimuli. The stimulus in this experiment was a used litter box for cats. Chocolate was used to resemble cat feces, and water to resemble cat urine. The task consisted of eight levels, and four times during the task, participants were asked two questions regarding the level of disgust and anxiety they were experiencing. They were asked to rate the intensity of these feelings on a scale from 0 (not at all) to 100 (most disgust/anxiety they could imagine). Before the task began, participants were asked to take position two meters from the litter box. At this point they were asked to rate their anxiety and disgust. Next they were instructed to put a rubber glove on one hand. The first step was to walk towards the box. The second step was to take the lid of the litter box. At this point participants were asked to rate their feelings again. The third step was to touch the outside of the litter box, wearing a glove, for approximately five seconds. The fourth step was to touch the inside of the litter box, wearing a glove, for approximately five seconds. During the fifth step, participants were asked to run their fingers through the cat litter where no feces were present, for approximately five seconds wearing their glove. The sixth step involved running their fingers through the cat feces, wearing a glove, for approximately five seconds. The seventh step was the same as the fifth, but now participants were asked to complete this with bare hands. The eighth step was the same as the sixth step, but now participants were asked to complete this with bare hands. When participants had completed this assignment, they were again asked to rate their feelings. After that, they were given an opportunity to clean their hands with wet wipes. This was an attempt to measure washing compulsions by counting the number of wet wipes each participant used. At last, they were once again asked to rate their feelings.
**BAT questionnaire**

A 12 item questionnaire was designed by Ragnar P. Ólafsson for the purpose of this study. This questionnaire was used to assess participants’ affective, cognitive and physical experiences during the BAT. Items included: “I wanted to get away” and “I felt discomfort in my body.” Only two items from this scale are used in the present report, items 11 (I felt infected, dirty or contaminated) and 12 (I felt the urge to wash/clean myself). Items were rated on a scale from 0 (not at all) to 10 (very much) with higher scores indicating stronger feelings.

**Obsessive-Compulsive Core Dimensions Questionnaire**

OC-CDQ attempts to measure two constructs, harm avoidance and incompleteness (Pietrefesa & Coles, 2008; Summerfeldt et al., 2014). The Icelandic version was translated by Ragnar P. Ólafsson, both subscales of this version have shown to be reliable (α=.91; Ólafsson et al., work in progress). This measure was not used for calculations in this study.

**Fruit Game**

Fruit game is a computer game used to assess habit learning. Data from the game was not used in this study.

**Procedure**

The study was approved by the National Bioethics Committee. Participants met the researchers one at a time in a laboratory at the University. All gave their written consent. First they were asked to fill out questionnaires. Next they were given instructions on how to play the Fruit-computer game, and asked to complete the game. After they had finished, they filled out a questionnaire regarding the game. The final task was a behavioral avoidance task (BAT). Before the task began, participants were instructed that the BAT consisted of a few stages and at each stage, they had the choice to complete the stage or quit the task. Lastly, they were asked to fill out a questionnaire concerning their feelings regarding the BAT. After completing this they were debriefed and payed for their participation. Debriefing included giving participants further information about the purpose of the study, as well as informing them that the feces in the litter box were not real and completely harmless.
Statistical Analysis

Statistical analyses were carried out using SPSS 23. Mediation analyses were carried out using PROCESS v2.13, an SPSS macro for conducting mediational analyses with multiple mediators and allowing for an estimation of both direct and indirect effects (Hayes, 2016). The ordinary least squares method was used to analyze all regression models. Disgust served as an independent variable and fear of contamination as the dependent variable. Measures of incompleteness and harm avoidance were used as mediators for assessing the indirect effect of disgust and fear of contamination. Using this method, it is possible to test simultaneously the specific indirect effect of each mediator while taking into account the shared association between the variables. In prediction of the dependent variable, measures of anxiety and depression were included as covariates. 95% bias-corrected bootstrap confidence intervals were used to infer about indirect effects, using 5000 bootstrap samples.

Results

Descriptive statistics, correlations and reliability

Means, standard deviations and reliability estimates were computed for all measures (see Table 1). Internal consistency was satisfactory for all measures (α ≥ .77), except for number of not-just-right experiences on the NJREs questionnaire (α=.67). Means and standard deviations were in line with previous studies using similar samples.

Table 1. Descriptive statistics and internal consistency of measures used in the study.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean</th>
<th>SD</th>
<th>Alpha (α)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HADSanx</td>
<td>6.83</td>
<td>4.24</td>
<td>.87</td>
</tr>
<tr>
<td>HADSdep</td>
<td>2.90</td>
<td>2.87</td>
<td>.77</td>
</tr>
<tr>
<td>OCI</td>
<td>13.85</td>
<td>11.92</td>
<td>.92</td>
</tr>
<tr>
<td>Picont</td>
<td>5.68</td>
<td>6.19</td>
<td>.91</td>
</tr>
<tr>
<td>OBQ</td>
<td>43.5</td>
<td>19.32</td>
<td>.93</td>
</tr>
<tr>
<td>NJREsev</td>
<td>23.51</td>
<td>9.54</td>
<td>.87</td>
</tr>
<tr>
<td>NJRenumb</td>
<td>3.26</td>
<td>2.19</td>
<td>.67</td>
</tr>
<tr>
<td>DPSS</td>
<td>34.04</td>
<td>9.53</td>
<td>.89</td>
</tr>
</tbody>
</table>

HADSanx = Hospital Anxiety and Depression Scale anxiety scale score; HADSdep = Hospital Anxiety and Depression Scale depression scale score; OCI-R = Obsessive Compulsive Inventory – Revised total score; Picont = Padua Inventory-WSUR washing and contamination subscale score; OBQthreat = Obsessional Beliefs Questionnaire threat subscale score; NJREsev = Not-Just-Right-Experiences Questionnaire Revised-severity of experiences; NJRenumb = Not-Just-Right-Experiences Questionnaire Revised-number of experiences; DPSS = Disgust Propensity and Sensitivity Scale-Revised total score.
Means and standard deviations were computed for performance on the behavior avoidance task (BAT), feelings of anxiety and disgust during the task, and feelings of contamination and washing compulsions reported after completing the task. Correlations between measures regarding the BAT were also computed. These calculations can be seen in Table 2.

Table 2. Descriptive statistics for the behavioral avoidance task

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Exposed to waste</th>
<th>Before washing</th>
<th>After washing</th>
<th>During the task</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>- .11</td>
<td>- .06</td>
<td>- .48</td>
<td>- .35</td>
<td>- .43</td>
</tr>
<tr>
<td>2.</td>
<td>.39</td>
<td>.29</td>
<td>.28</td>
<td>.07</td>
<td>.10</td>
</tr>
<tr>
<td>3.</td>
<td>.31</td>
<td>.47</td>
<td>.14</td>
<td>.26</td>
<td>.00</td>
</tr>
<tr>
<td>4.</td>
<td>.54</td>
<td>.75</td>
<td>.45</td>
<td>.49</td>
<td>.33</td>
</tr>
<tr>
<td>5.</td>
<td>.50</td>
<td>.81</td>
<td>.18</td>
<td>.18</td>
<td>.38</td>
</tr>
<tr>
<td>6.</td>
<td>.59</td>
<td>.58</td>
<td>.42</td>
<td>.58</td>
<td>.42</td>
</tr>
<tr>
<td>7.</td>
<td>.25</td>
<td>.70</td>
<td>.48</td>
<td>.22</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>.40</td>
<td></td>
<td></td>
<td>.23</td>
<td>.08</td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td>.40</td>
<td>.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.64</td>
</tr>
</tbody>
</table>

Mean 6.80  2.27  9.14  18.27  8.92  20.52  7.21  6.88  2.74  1.21  3.14
S.D.  1.32  8.64  14.55  19.95  15.39  22.34  14.77  12.43  5.54  2.22  3.06

Note. *ns non-significant; **p < 0.01; *p < 0.05. BAT = Behavioral avoidance task score; Disg1 = Disgust felt in beginning of BAT; Anx1 = Anxiety felt in beginning of BAT; Disg2 = Disgust felt when exposed to cat waste; Anx2 = Anxiety felt when exposed to cat waste; Disg3 = Disgust felt after completing the BAT; Anx3 = Anxiety felt after completing the BAT; Disg4 = Disgust felt after washing; Anx4 = Anxiety felt after washing; Cont_fear = fear of contamination during the BAT; Urge_wash = The urge to wash during the BAT.

Correlations between all measures were computed (see Table 3). All correlations were significant except between DPSS and the HADS depression subscale. As expected, DPSS and PI washing and contamination subscale were strongly correlated (.63). PI washing and contamination subscale was also positively correlated with both HADS anxiety and depression subscales, but this correlation was only small to moderate (≤ .32). Important for the present analysis, correlations between measures of NJREs, responsibility and threat appraisals were all significant.
Table 3. Correlations between measures used in the study.

<table>
<thead>
<tr>
<th></th>
<th>1. HADSanx</th>
<th>2. HADSdep</th>
<th>3. OCI-R</th>
<th>4. PIcont</th>
<th>5. OBQthreat</th>
<th>6. NJREsev</th>
<th>7. NJREnumb</th>
<th>8. DPSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>.57</td>
<td>.55</td>
<td>.32</td>
<td>.53</td>
<td>.53</td>
<td>.52</td>
<td>.39</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>.34</td>
<td>.28</td>
<td>.41</td>
<td>.31</td>
<td>.42</td>
<td>.21</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>.69</td>
<td>.71</td>
<td>.65</td>
<td>.63</td>
<td>.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>.45</td>
<td>.52</td>
<td>.48</td>
<td>.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>.56</td>
<td>.58</td>
<td>.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>.68</td>
<td>.45</td>
<td>.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>.43</td>
<td>.</td>
<td>.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td>1</td>
<td>.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All correlation coefficients > .21 in the table are significant (p ≤ .01). HADSanx = Hospital Anxiety and Depression Scale anxiety scale score; HADSdep = Hospital Anxiety and Depression Scale depression scale score; OCI-R = Obsessive Compulsive Inventory – Revised total score; PIcont = Padua Inventory-WSUR washing and contamination subscale score; OBQthreat = Obsessional Beliefs Questionnaire threat subscale score; NJREsev = Not-Just-Right-Experiences Questionnaire Revised-severity of experiences; NJREnumb = Not-Just-Right-Experiences Questionnaire Revised-number of experiences; DPSS = Disgust Propensity and Sensitivity Scale-Revised total score.

Validation of the Behavioral Avoidance Task

In order to assess the validity of the BAT as an indicator of sensitivity to disgust, Pearson correlation coefficients were calculated. First, correlation between scores on DPSS and compliance on the BAT were calculated. When controlling for anxiety and depression, as indicated by scores on HADS, disgust was negatively correlated with compliance on the BAT, $r = -.274, p < .05$. Those calculations were repeated, using reported level of disgust during stage 2 of the BAT instead of scores on DPSS. When controlling for reported anxiety on stage 2 of the BAT, this revealed a significant negative correlation between reported disgust and compliance on the BAT, $r = -.366, p < .01$. This indicates that those who reported higher levels of disgust tended to show more avoidance behavior on the BAT. In order to further validate the results, correlation between anxiety at level 2 and compliance on the BAT was computed. When controlling for disgust at level 2, this correlation did not reach significance $r = -.122, p = .27$.

Multiple regression analysis: The specific contribution of disgust to contamination fear

In order to examine the specific contribution of disgust in predicting fear of contamination, while controlling for age, gender and anxiety, multiple regression analysis was conducted. In the analysis, (1) age and gender were entered first, (2) followed by anxiety, (3) and then disgust. First, scores on the anxiety subscale of HADS were used as a measure of anxiety and
scores on DPSS as a measure of disgust. These measures were used as predictors of contamination fear, as measured by the Padua Inventory. The ANOVA was significant, $F(4, 83) = 15.459, p < .01$. The analysis revealed that disgust was the only significant predictor of contamination fear, $\beta=.581, t(83) = 6.251, p < .01$. The coefficient of multiple determination was $R^2 = .439$. This indicates that the model explains 43.9% of the variability of contamination fear.

This calculation was repeated using reported anxiety and disgust after participants had completed the BAT as predictors of fear of contamination as measured by question 11 (I felt infected, dirty or contaminated) on the BAT questionnaire. The ANOVA was significant, $F(4, 83) = 11.444, p < .01$. The analysis revealed that both anxiety, $\beta=.231, t(83) = 2.028, p <.05$, and disgust, $\beta=.41, t(83) = 3.450, p < .01$ were significant predictors of contamination fear. Although both correlation coefficients were significant, disgust was a stronger predictor of contamination fear. The coefficient of multiple determination was $R^2 = .367$. The same calculation was conducted but now using washing compulsion as a dependent variable, as measured by question 12 (I felt the urge to wash/clean myself) on the BAT questionnaire. The ANOVA was significant, $F(4, 83) = 4.886, p < .01$. The analysis revealed that disgust, $\beta=.389, t(83) = 2.907, p < .01$, but not anxiety, $\beta= -.03, t(83) = -.237, p=.81$, significantly predicted washing compulsions. The coefficient of multiple determination was $R^2 = .198$. The results of the regression analyses indicate that disgust contributes to contamination fear, over and above what can be accounted for by anxiety.

**Mediational analysis: The mediating role of harm avoidance and incompleteness**

Mediational analyses were conducted using number of NJREs (Figure 2A) and severity of such experiences (Figure 2B) as indicators of incompleteness. In order to replicate Ólafsson’s et al (work in progress) results, total scores of DPSS were used as an indicator of disgust and scores on the Padua Inventory as a measure of contamination fear. Figures 2A and 2B show that disgust had both direct and indirect effect on contamination fear. Both number (Figure 2A; .06, 95% CI = .003-.169) and severity (Figure 2B; .086, 95% CI = .019-.198) of NJREs mediated this indirect effect but not overestimation of threat (.027, 95% CI = -.037-.093; .021, 95% CI = -.038-.086).
Total effect of Disgust on Contamination fear = .394***. Total indirect effect of Disgust on Contamination fear = .087 (.011; .102). Indirect effect through Overestimation of threat = .027 (.037; .093). Indirect effect through Not-just-right experiences = .060 (.003; .169). HADS anxiety and depression were used as covariates in this analysis (data not shown). ***p<.001; **p<.01; *p<.05; +p<.10.

Figure 2A. Mediational analysis using DPSS, PI, number of NJREs, and OBQ.

Total effect of Disgust on Contamination fear = .394***. Total indirect effect of Disgust on Contamination fear = .108 (.037; .213). Indirect effect through Overestimation of threat = .021 (.038; .086). Indirect effect through Not-just-right experiences = .086 (.019; .198). HADS anxiety and depression were used as covariates in this analysis (data not shown). ***p<.001; **p<.01; *p<.05.

Figure 2B. Mediational analysis using DPSS, PI, severity of NJREs, and OBQ.

Mediational analyses were repeated, now using reported disgust after finishing the BAT as a measure of disgust and question 11 (“I felt infected, dirty or contaminated”) on the BAT
questionnaire as a measure of contamination fear. Figures 3A and 3B show that disgust had both direct and indirect effect on contamination fear. However, when looking at the specific effects of harm avoidance and incompleteness, number of NJREs (.005, 95% CI = -.001-.016), severity of NJREs (.004, 95% CI = -.001-.014) and overestimation of threat (.007, 95% CI = -.001; .020; .007, 95% CI = -.001; .020) did not reach significance (confidence intervals included zero). This means that in association, incompleteness and harm avoidance mediated the relationship between disgust and contamination fear. However, the specific contribution of each factor was not strong enough, which means that neither incompleteness nor harm avoidance served as independent mediators.

Total effect of Disgust on Contamination fear = .057***. Total indirect effect of Disgust on Contamination fear = .012 (.002; .026). Indirect effect through Overestimation of threat = .007 (.001; .020). Indirect effect through Not-just-right experiences = .005 (-.001; .016). ***p<.001; **p<.01; *p<.05; +p<.10.

Figure 3A. Mediational analysis using the BAT, number of NJREs, and OBQ.
Total effect of Disgust on Contamination fear = \( .057^{***} \). Total indirect effect of Disgust on Contamination fear = \( .012 (.002; .028) \). Indirect effect through Overestimation of threat = \( .007 (-.001; .020) \). Indirect effect through Not-just-right experiences = \( .004 (-.001; .014) \). ***p<.001; **p<.01; *p<.05; p<.10.

Figure 3B. Mediational analysis using the BAT, severity of NJREs, and OBQ.

**Discussion**

Results support the hypothesis that those who report more disgust tend to show less approach behavior towards a disgust provoking stimulus. This effect was found to be over and above that accounted for by anxiety and depression. When controlling for disgust, this relationship was not found between anxiety and approach behavior on the BAT. Thus, our results indicate that disgust affects the behavior shown during the behavioral avoidance task, but not anxiety and depression. This is consistent with previous research (Olatunji et al., 2007).

When using self-report measures, disgust predicted contamination fear over and above that accounted for by anxiety. This is in line with Mancini’s et al. (2001) results that showed that disgust predicts self-reported OC symptoms. This relationship between disgust and contamination fear has been found in both non-clinical (Muris et al., 2000; Olatunji, Sawchuck, Lohr and de Jong, 2004; Thorpe, Patel, & Simonds, 2003) and clinical samples (Whitton et al., 2015). However, when using measures of disgust and anxiety reported during the behavioral task, both emotions served as predictors of contamination fear. Thus, there are some inconsistencies between the results from self-report scales and the results gathered during the experimental condition. Although both disgust and anxiety predicted contamination fear, disgust did serve as a better predictor. It could be that the heightened
anxiety experienced during the experimental condition stemmed from the ambiguous situation. Participants never knew what the next step would be, and thus did not necessarily know what to expect. These results might suggest that contamination symptoms in some OCD patients are aimed at reducing disgust rather than anxiety. Knowledge of what drives compulsions is very important for clinical purposes. Whereas this research was conducted in a non-clinical sample caution must be taken when generalizing the results to clinical OCD patients. However, both theory (Rachman, 1997; Salkovskis, 1985) and research (Burns, Formea, Keortge, & Sternberger, 1995) on OCD support a dimensional model of the disorder and thus support an extension from non-clinical to clinical population. For future research it would be interesting to measure physiological responses during an experimental condition. As previous research has revealed the emotions of disgust and anxiety differ from each other on several domains including heart rate and brain mechanisms (Ekman, Levenson & Friesen, 1983; Philips et al., 1998; Williams et al., 2005). Thus, this kind of research could reveal if reported level of disgust and anxiety is in concordance with known physiological responses associated with these two emotions.

The main purpose of this study was to examine the mediational effect of harm avoidance and incompleteness in the relationship between disgust and contamination fear. First, it was hypothesized that Ólafsson’s et al. (work in progress) results would be replicated, revealing that incompleteness, but not harm avoidance would serve as a mediating factor in this relationship. Using self-report measures, this hypothesis was supported. Both number and severity of NJREs, but not overestimation of threat, mediated the relationship between disgust and contamination fear. This indicates that it might be sensory sensitivity, rather than overestimation of threat, that explains why disgust leads to contamination related OC symptoms. It might be that underlying some OC symptoms is an inner feeling of incompleteness, and that compulsions are driven by an inner need to reduce a feeling of things being not just right. The role of sensory sensitivity in OC symptoms has been reported in research using both clinical (Tallis, 1996) and non-clinical (Coles, Heimberg, Frost, & Steketee, 2005) samples. For example, Tallis (1996) reported that cleaning compulsions of some OCD patients were driven by a need to achieve a perfect sensation of being clean, but not a need to avoid illness. Additionally, Cougle and colleagues (2011) found that washing compulsions may be determined by subjective sensory experiences. Thus, there is a possibility that contamination related compulsions are aimed at reducing a feeling of
imbalance caused by the bodily sensations that accompany disgust, such as nausea (Olatunji & Sawchuk, 2005), heart rate (Ekman et al., 1983) and certain facial expressions (Olatunji & Sawchuk, 2005).

A unique feature of the present study was to extend research using self-report scales to include experimental conditions. Again, the purpose was to see if Ólafsson’s et al (work in progress) results would be replicated, but now using measures from the behavioral avoidance task as indicators of disgust and contamination fear. Results revealed that disgust had both direct and indirect effects on contamination fear. However, neither incompleteness nor harm avoidance served as significant independent mediators in the relationship between disgust and contamination fear. Therefore, the results from the experimental conditions are neither in concordance with our results using the self-report scales, nor with Ólafsson’s et al. (work in progress) results that demonstrated incompleteness as an independent mediator. There are several reasons that can explain why this is. First, it is possible that people react differently to real life situations than they report on self-report scales. Second, the limitations of this study might contribute to this inconsistency. The sample size was rather small and homogeneous, where the sample consisted exclusively of university students. Also, the measures of harm avoidance and incompleteness used in the analysis of the experimental condition were obtained with self-report scales before participants started the behavioral task, and thus were not obtained during the task. These self-report scales measured a general tendency to experience NJREs and to overestimate threat, but the behavioral task was extremely specific. It would have been ideal to use measures of experienced harm avoidance and incompleteness during the task. Such measures were obtained in this study, but they turned out not to be valid enough.

The results from the present study provide a better understanding of the nature of contamination related obsessions and compulsions. The possibility that incompleteness serves as a motivational factor in some OC symptoms may pose a challenge to current methods of therapy, that are based on the idea that OC symptoms are mainly driven by a need to avoid harm. For example, those who have symptoms driven by an inner need to reduce a feeling of incompleteness might benefit from a sensory-affective based therapy rather than cognitively based. However, the results from this study need to be replicated in order to better understand the relationship between disgust and contamination fear. Future research should include more specific measures of harm avoidance and incompleteness during an experimental condition.
Also, it would be ideal to use several different behavioral avoidance tasks to obtain a more
generalized measure of the disgust response. This would allow for stronger generalization of
the results.
References


