Attentional bias and contamination fear

Results from a student sample

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Lokaverkefni til Cand. Psych. prófs
Háskóli Íslands
Sálfræðideild
Heilbrigðisvísindasvið

HÁSKÓLI ÍSLANDS

Athyglisskekkja í ótta við smit og mengun

Niðurstöður rannsóknar í úrtaki háskólanema

Aldís Eva Friðriksdóttir

Lokaverkefni til Cand. Psych. gráðu í sálfræði

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Sálfræðideild

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Ágrip

Fyrri rannsóknir benda til þess að athygli fólks með kvíðaraskanir sé valvís þannig að áreitum, sem það telur vera ógnandi eða kvíðavekjandi, er bæði veitt athygli fyrr og lengur, í samanburði við hlutlaus áreiti. Þá er kvíðvekjandi áreitum veittur forgangur við úrvinnslu sjónrænna upplýsinga á kostnað annarra áreita. Rannsóknir á slíkri athyglisskekkju í áráttu- og þráhyggjuröskun hafa þó gefið misvísandi niðurstöður. Þó sýna sumar rannsóknari að athyglisskekkja kunni að vera til staðar hjá fólki sem óttast mengun og smit, en þau einkenni eru algeng í áráttu- og þráhyggjuröskun. Tilgangur þessarar rannsóknar var að kanna athyglisskekkju hjá háskólanemum með því að bera saman tvo hópa sem hafa ýmist há (n=15) eða lág (n=17) skor á spurningalista um ótta við mengun og smit. Þátttakendur svöruðu spurningalistum auk þess sem þeir leystu athyglisblikk verkefni (attentional blink) í tölvu þar sem myndir birtust sem töldust vera hlutlausar, almennt óttablandnar, snúast um mengun og smit eða um viðbjóð. Tími milli markáreita er 200, 500 og 800 ms. Nákvæmni svara var mæld til að skoða getu tilfinningatengdra áreita til að grípa athygli. Gert var ráð fyrir að þátttakendur sem óttast mengun og smit myndu sýna athyglisskekkju í kjölfar mynda sem snúast um mengun og smit eða um viðbjóð en ekki í kjölfar hlutlausra eða almennt óttablandinna mynda. Gert var ráð fyrir að skekkjan kæmi frekar fram þegar tími milli markáreita væri stuttur (200 ms) heldur en langur (800 ms). Niðurstöður studdu hluta tilgátanna. Hái hópurinn sýndi verri frammistöðu samanborið við lága hópinn í kjölfar mengandi mynda þegar stuttur tími var milli áreita. Einnig sýndi hái hópurinn almennt verri frammistöðu á verkefninu heldur en lági hópurinn. Hái hópurinn sýndi aukningu í neikvæðum tilfinningum við þátttöku í athyglisblikk verkefninu og hafði það tengsl við mælingar á ótta við smit og mengun. Þetta var ekki að sjá lága hópnum. Báðir hópar sýndu verri jákvæða líðan við þátttöku í verkefninu. Athygliskekkja var til staðar hjá þeim sem höfðu ótta við smit og mengun í kjölfar mengandi myndar á sjálfvirku stigi upplýsinga-úrvinnslu.

Abstract

Attention has been found to favor threat in various anxiety disorders. Obsessive-compulsive disorder is characterized by anxious responding to threatening stimuli. OCD includes obsessions and/or compulsions aimed at preventing or reducing distress or preventing dreaded events. However, research has shown inconsistent results regarding the presence of attentional bias in obsessive-compulsive disorder. The aim of this study was to examine attentional bias towards contaminating and disgusting images, using an attentional blink paradigm in a sample of university students high (HCF; n=17) or low (LCF; n=15) in contamination fear. The accuracy in performance of these groups was compared across neutral-, generally threatening, contamination- and disgust-related images that were followed by discrimination task 200, 500 or 800 ms later in a row of images. This provides a measure of the ability of emotional task-irrelevant stimuli to capture attention. It was expected that HCF but not LCF participants, would demonstrate attentional bias towards disgust- and contamination-related images, particularly at shorter task presentations. Results showed lower accuracy in the HCF compared to the LCF group after presentation of disgusting images at lag 2, consistent with the literature on the attentional blink. The HCF group had lower overall accuracy on the attentional blink task. Increase in negative affect was observed in the HCF but not the LCF group and this was related to scores on contamination fear questionnaire. Decreased positive affect was observed in both groups. Results indicate delayed disengagement in individuals with contamination fear that is particularly pronounced with disgust related stimuli at automatic stages of information processing.

Þakkir

Ég vil þakka leiðbeinanda mínum Ragnari Pétri Ólafssyni fyrir að treysta mér fyrir þessu verkefni og fyrir að leiðbeina mér vel í gegnum það. Einnig vil ég þakka Árna Kristjánssyni fyrir að vera góður leiðbeinandi og Sigrúnu Þóru Sveinsdóttur fyrir alla aðstoð við athyglisblikk verkefnið. Að auki vil ég þakka Chris B. McClure, PhD. fyrir að gefa sér tíma til að svara spurningum og fyrir alla aðstoðina.

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List of abbreviation

OCD : Obsessive-compulsive disorder

CF : Contamination fear

HCF : High contamination fear

LCF : Low contamination fear

1 Introduction

Research has demonstrated attentional bias towards threatening information in various anxiety disorders (Amir, Elias, Klumpp, & Przeworski, 2003; Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Summerfeldt & Endler, 1998). For example, anxious individuals are faster searching for threatening faces, than non-anxious individuals (Eastwood & Smilek, 2005; Gilboa-Schectman, Foa & Amir, 1999; Fox et al., 2000) and have difficulty disengaging attention from threatening words and faces (Fox, Russo, Bowles & Dutton, 2001). The study of attentional bias indicates that it may be an important mechanism in the development and maintenance of anxiety (Bar-Haim et al. 2007; Heimberg, Brozovich & Rapee, 2010) and has informed treatment development for various anxiety disorders (e.g. Koster, Fox & MacLeod, 2009). This could also be the case for obsessive-compulsive disorder (OCD) that is characterized by anxious responding to potentially threatening stimuli. OCD includes the presence of obsessions and/or compulsions. These behaviors and mental acts are aimed at preventing or reducing anxiety/distress, or preventing dreaded events/situations; however, they are not connected in a realistic manner with which they were designed to neutralize or prevent. Obsessions or compulsions can cause clinically significant distress or impairment in social, occupational, or other important areas of functioning (American Psychiatric Association, 2013).

However, findings have been inconsistent on the presence of attentional bias favoring threatening information in the disorder (McNally, Riemann, Louro, Lukach, & Kim, 1992; Muller & Roberts, 2005; Morein-Zamir et al., 2013; Summerfeldt & Endler, 1998). This may be because of the heterogeneous and idiosyncratic nature of OCD (Abramowitz et al., 2010, Summerfeldt & Endler, 1998). The nature of stimuli needs to be relevant in terms of people's core beliefs about threat to activate attentional bias and elicit fear (Olatunji, Ciesielski & Zald, 2011). This could explain the inconsistencies of findings in studies attempting to demonstrate attentional bias in OCD as a result of irrelevant stimuli failing to elicit fear or access core beliefs in OCD (Olatunji, et al., 2011). For example, there is stronger evidence for attentional bias towards threat in studies of contamination fear (CF) - the most common form of OCD (Ball, Baer & Otto, 1996; Rasmussen & Eisen, 1992), where the nature of the activating stimuli can be more properly matched to the content of peoples threat beliefs and fears. Research indicates that certain obsessions and compulsions tend to co-occur to represent the three to five main dimensions of OCD (Bloch, Landeros-Weisenberger, Rosario, Pittenger & Leckman, 2008; McKay et al., 2004): 1) obsessions about being responsible for causing or failing to prevent harm, checking compulsions, and reassurance-seeking; 2) symmetry obsessions, and ordering and counting rituals; 3) contamination obsessions, and washing and cleaning ritual; 4) repugnant obsessions concerning sex, violence, and religion, and 5) hoarding, obsessions about acquiring and retaining objects, and associated collecting compulsions. These dimensions seem to be consistent across development ages from childhood through adulthood (Mataix-Cols, Rosario-Campos & Leckman, 2005; Stewart et al., 2008), and may be the blueprint for categories of stimuli in attentional bias research, that best represent core fears in different subtypes of OCD.

1.1 The relation of disgust to contamination

It has been suggested that attentional bias could play an important role in contamination fear (Armstrong, Sarawgi & Olatunji, 2012). Contamination is defined as an intense and persisting feeling of having been polluted or infected (Rachman, 2004). This feeling would be as a result of contact, direct or indirect, when something is perceived to be infectious or harmful. Negative emotions can accompany this feeling, such as fear, disgust, dirtiness, moral impurity and shame (Rachman, 2004). In fact, individuals with heightened CF report feelings of disgust when confronted with contamination-related stimuli (Deacon & Olatunji, 2007; Olatunji, Lohr, Sawchuk & Tolin, 2007) and display greater behavioral avoidance of disgusting objects relative to non-fearful and high trait anxious individuals (Olatunji, Sawchuk, Lohr, & de Jong, 2004; Olatunji et al., 2007; Tsao & McKay, 2004). Patients with CF have also described threat-relevant objects as disgusting rather than frightening (Tolin, Worhunsky & Maltby, 2004; Olatunji & Sawchuk, 2005). This suggests that disgust and contamination are related but distinct concepts on a similar continuum (Olatunji et al., 2007) and research has found support of the relation of disgust to contamination-related OCD (Olatunji, Williams, Lohr, & Sawchuk, 2005).

Disgust elicits reliable physiological responses, facial expressions, and withdrawal/avoidance patterns as a basic emotion with response patterns that are universally recognized (Olatunji, Cisler, McKay & Phillips, 2010). Contamination is viewed as the evaluative process occurring when experiencing disgust or anticipating exposure to disgust elicitors, which may vary in range of stimuli and in eliciting an interpretation of contamination (Olatunji & Sawchuk, 2005; Olatunji et al., 2010; Rozin & Fallon, 1987). Disgust appears to originate from the primitive sensation of distaste elicited by contaminated or bad-tasting foods, suggesting its purpose is to prevent ingestions of harmful substances or contaminants, thus protecting against diseases (Olatunji et al., 2010; Rozin & Fallon, 1987). According to some studies, health anxiety and disgust sensitivity scores best predict OCD-related washing distress out of questionnaire scores on anxiety, fear of death, fear of contamination and obsessionality (Thorpe, Patel & Simonds, 2003). Also, disgust predicts scores on compulsive washing above fear, anxiety and depression (Mancini, Gragnani, & D'Olimpio, 2001; Olatunji et al., 2005) and the relationship seems to be independent of anxiety and depression (Olatunji et al., 2007; Mancini et al., 2001).

Individuals classified as high in contamination fear report significantly greater disgust sensitivity across a broad range of disgust elicitors in comparison to low contamination fearful participants, even when controlling for negative affect (Olatunji et al., 2004; Olatunji et al., 2007; Woody & Tolin, 2002). Disgust sensitivity refers to peoples' physical or emotional reactions to feelings of disgust (van Overveld, et al., 2006). It has even been suggested that high disgust sensitivity may trigger obsessional concerns about health (Davey & Bond, 2006).

Disgust propensity is related to symptoms present in contamination-based OCD as well (Muris et al., 2000; Mancini et al., 2001; Olatunji et al., 2005, 2007). Disgust propensity refers to the degree or how easily people feel disgusted in daily life (van Overveld, et al., 2006). It has been shown that disgust propensity is a unique predictor of CF, but not other symptom dimensions of OCD, and that the relationship with CF is unmediated by trait anxiety (Moretz and McKay, 2008).

Thus, although, contamination related symptoms have mostly been thought to be attributable to excessive fear and anxiety (Olatunji et al., 2007), disgust may contribute to those symptoms as well (Rachman, 2004; Olatunji et al., 2007) suggesting a disgust-based, disease-avoidance approach in understanding contamination-related OCD-themes (Olatunji et al., 2007).

1.2 The attentional blink paradigm

Various tasks have been used to measure attentional processing in anxiety, including emotional Stroop, probe detection, visual search, spatial cueing, and attentional blink tasks (Cisler et al., 2009; Cisler & Koster, 2010; McHugo et al., 2013). The emotional attentional blink paradigm provides a robust measure of the ability of emotional task-irrelevant stimuli to capture attentional resources in a stimulus-driven manner (McHugo et al., 2013). Sigurjónsdóttir, Sigurðardóttir, Björnsson and Kristjánsson (2015) compared performance of 24 university students on four of these tasks, the dot probe, the spatial cueing, the irrelevant singleton and the attentional blink. The tasks' discriminant sensitivity to neutral and threatening facial expressions was measured. Their results indicate that the attentional blink is the most sensitive task for the detection of attentional bias towards threatening facial expressions and that the assessment of attentional biases may not be as precise as it could be when using the spatial cueing and dot probe tasks. The attentional blink is typically strongest at lags 2-3 and ends by lags 6-8, with little or no impairment observed in accuracy at lag 1 (Kristjánsson & Nakayama, 2002; Luck, Vogel, & Shapiro, 1996; McHugo et al., 2013).

1.3 Various stages of information processing

Attentional biases are observed at varying stimulus presentation duration (Bar-Haim et al., 2007, Mogg, Bradley, Williams & Mathews, 1993), which suggests that their presence is not specific to certain stages of information processing. Different stages of information processing may, however, be related to differing types of attentional biases (Cisler & Koster, 2010). It is generally assumed that information processing occurs at two stages: automatic (e.g., 100 ms) and strategic (e.g., +500 ms) (Bar-Haim et al., 2007; Cisler, Bacon & Williams, 2009; Koster, Verschuere, Crombez & Van Damme, 2005; Koster, Crombez, Verschuere, Van Damme & Wiersema, 2006). Automatic processing is effortless, capacity-free, unintentional, and free from conscious cognitive control; whereas strategic processing is effortful, capacity-limited, intentional, and dependent on conscious cognitive control (Cisler & Koster, 2010; Shiffrin & Schneider, 1997).

There is indication that attentional bias may occur at the strategic rather than automatic stage of processing in OCD (Olatunji et al., 2011). As Cisler and Olatunji (2010) point out, difficulty in disengagement may reflect an impaired ability to remove attention from sources of threat. This is consistent with theories positing that deficient inhibition ability is central to OCD (Chamberlain, Blackwell, Fineberg, Robbins, & Sahakian, 2005). Individuals with CF maintain attention on threats, possibly due to exaggerated appraisals of the stimuli as harmful (Cisler & Olatunji, 2010). According to Salkovskis' (1985) cognitive-behavioral theory, individuals with OCD appraise intrusive thoughts, images, and urges as indication of harm coming to themselves or others and, furthermore, take responsibility for this harm. The effect of attentional bias may occur when a stimulus signifies a

possible threat of harm, i.e., they feel responsible and therefore have to “watch-out”, becoming hyper-vigilant.

In a sample of university students with OC symptoms, compared to those without symptoms, it has been found that enhanced responsibility is related to visual selective attention deficits (Pleva & Wade, 2001). Responsibility also may mediate the relationship between interpretation of intrusive thoughts and OCD symptoms (Smári & Hólmsteinsson, 2001). Furthermore, attitudes of responsibility interact with impulsivity (i.e., lack of cognitive or behavioral control) when predicting OCD symptom scores in student samples (Snorrason, Smári & Ólafsson, 2011). Appraisal of threat may be connected to responsibility (Jones & Menzies, 1998) and is a plausible mechanism through which responsibility leads to the development of OCD symptoms (Menzies, Harris, Cumming & Einstein, 2000). Contamination and disgust have been shown to be related to contamination-based OCD and may be the indicative factors that individuals with CF assess as threatening.

1.4 Previous studies

Research on attentional biases in OCD has mostly focused on threat-related biases (Summerfeldt & Endler, 1998), but recent studies have turned their attention to stimuli in attentional tasks related to disgust and contamination.

Eye tracking has been used to examine attentional bias in participants high and low in CF when presented with disgusted, fearful, or happy faces paired with neutral faces for three-second trials (Armstrong, Olatunji, Sarawgi & Simmons, 2010). Those in the high CF (HCF) group oriented attention to fearful faces, but not disgusted faces when compared to low CF (LCF). The HCF group also maintained attention on both disgusted and fearful expressions compared to the LCF group. Evidence was for both vigilance and maintenance-based biases for threat (Armstrong et al., 2010).

Cisler and Olatunji (2010) attempted to determine the components of attentional bias taking place in CF. A spatial cueing task was conducted with neutral, disgusting or frightening pictures presented for 100 or 500 ms. Evidence was found for delayed disengagement from both fear and disgust stimuli in CF group, but not in control group. Effect appeared greater at 500 ms stimulus presentation, but did not differ between fear and disgust stimuli. This indicates that difficulty in disengagement seems confined to later stages of processing and suggests that fear and disgust stimuli may be equally relevant sources of threat for CF individuals.

Foa, Ilia, McCarthy, Shoyer, & Murdoch (1993) were among the first to demonstrate a bias towards contamination words in individuals with CF-related OCD. A modified Stroop task was used with contamination words, general threat words, neutral words, non-words, and priming words preceding each word in a randomized order: XXXXX, danger, disturb and fruit. Individuals with washing rituals evidenced longer response latencies toward contamination words than to neutral words compared to OC non-washers and individuals without OCD.

Individuals with contamination-related OCD have also been found to be more vigilant for contamination content than mood-matched high trait anxious controls, as well as displaying a general threat interference effect, although not content-specific. This was found when employing a modified

dot-probe task with social threat and contamination words, neutral words, and threat words presented for 500 ms (Tata, Leibowitz, Prunty, Cameron, & Pickering, 1996).

Armstrong and colleagues (2012) found that individuals with HCF gaze more often towards contamination threat in initial fixations than LCF individuals when recording eye movements during 30 second exposures to pleasant-, neutral-, general threat, and contamination threat-related images. The results also indicated the HCF group made shorter fixations on contamination threat relative to other image types with no group difference in maintenance of gaze.

Olatunji and colleagues (2011) used emotional blink task where patients with OCD and non-clinical controls searched for a target placed within a series of rapidly presented images with erotic, fear, disgust, or neutral distracter image appearing 200, or 800 ms before the target. Lower search accuracy was observed among OCD patients following erotic distracters, but only when presented 800 ms prior to the target. Most, Smith, Cooter, Levy, & Zald (2007) found with non-clinical participants, impaired target detection at earlier but not later lags following erotic stimuli. This might suggest that erotic images affect OCD patients to more extent and persist in all stages of information processing compared to non-clinical participants. McHugo, Olatunji & Zald (2013) suggest that research indicating erotic stimuli inducing attentional bias point to arousal rather than valence as a critical feature in capturing attention.

It is important to gain insight into the underlying etiological processes of OCD (Rachman, 2004). With better understanding, more efficacious treatments can be designed. For example, attentional bias for contamination may predict behavioral avoidance of contamination risks encountered in everyday life. In fact, Najmi and Amir (2010) found that reducing attentional bias in individuals with CF gets them to complete more steps when approaching feared objects compared to participants in control group.

2 Summary, purpose and hypothesis

The aim of the present study is to examine whether attentional bias is present in CF. The attention of individuals with anxiety disorders seems to favor threatening information. There have been inconsistent findings demonstrating attentional bias in OCD, but research indicates it may be present in contamination fear – the most prevalent subtype of OCD. Recent research used the attentional blink task and found an attentional bias towards erotic stimuli in a sample of individuals with OC symptoms across different subtypes of OCD. No bias was however found towards threatening or disgusting stimuli. The present study is the first, to our knowledge, that employs the attentional blink paradigm with a defined group of individuals with CF compared to a group of individuals with low or no contamination fear. The present investigation also employs empirically supported stimuli that has observably induced attentional bias and is matched to core beliefs of CF (i.e., disgust and contamination images) when compared to general fear and neutral images as controls. It also considers potential confounders in the ability to control attention, as well as trait anxiety, and measures participants' state affect before and after the attentional blink task.

Individuals with both high and low CF participated in an attentional blink task where attentional bias was measured using the proportion of correct answers in recognizing target stimulus. Distracting stimuli was either neutral, disgust-, contamination- or threat-related images. The proportions of correct answers were also measured when target stimuli were presented at varying intervals after distracting stimulus (200, 500, and 800 ms). It was hypothesized that high CF individuals would demonstrate more attentional bias to disgust and contamination-related images than participants in the low contamination group. Based on the attentional blink paradigm literature (McHugo et al., 2013), the attentional blink is strongest at lag 2 and, therefore, it was expected that attentional bias would be demonstrated at lag 2 but not later lags during the task.

3 Method

3.1 Participants

Participants were students at the University of Iceland. Email invitations were sent out to all students of the university in every department with an offer to participate in an online survey including the contamination subscale of the Padua Inventory-WSUR (see below). Following previous studies (Armstrong et al., 2012), participants with high (>13) or low (<6) scores (n = 59) on the scale were contacted and asked to participate in the experiment. In total, 47 individuals agreed to participate. The final sample was based on scores from the second administration of the PI-WSUR on the day of the experiment, and participants own reports of having a formal diagnosis of an attentional deficit disorder (ADD). Participants were excluded if their PI-WSUR fear of contamination scores did not fall within the high or low group range on the day of the experiment (n=8) or reported having ADD diagnosis (n=4) or both (n=1). One participant was excluded because of an error in the administration of the self-report questionnaires used in the study and one participant was unable to complete the experiment. This left a final sample of 32 participants, 15 in the high contamination fear group (HCF, all females) and 17 in the low contamination fear group (LCF, 83.3% female). Participants received 1000 ISK (≈8$) for their participation. Descriptive statistics for demographics and questionnaire measures used in the study are presented in table 1.

3.2 Stimuli

A total of 105 images from the International Affective Pictures System (IAPS) were shown in the attentional blink task, including contamination (18), disgust (17), fear (35), and neutral (35) images, as well as images of landscapes and people (109)[1]. Examples of images in each category can be found in Appendix A. The images were evaluated with the Self-Assessment Manikin (Lang, Bradley & Cuthbert, 2008). Moreover, they were selected based on the Self-Assessment Manikin and classified based on ecological validity; three separate trained raters (i.e., graduate students of psychology) reviewed the images by matching previous classifications of these images in already published

[1] Number of IAPS images: Disgust; 3030, 3059, 3160, 9040, 9300, 9320, 9322, 9325, 9321, 9570, 1275, 1111, 3016, 3195, 9301, 9302, 9332. Contamination; 9291, 9295, 9290, 9330, 7360, 7380, 8503money, 9340, 9341, 2750, 9031, 9090, 7359, 7504. Threat; 6250, 6260, 6370, 6510, 6520, 6571, 6832, 9440, 9623, 9427, 9414, 6830, 6242, 6821, 6244, 6840, 2691, 2683, 9422, 6243, 6825, 6211, 6210, 9621, 9600, 9941, 9425, 9430, 9404, 9403, 9490, 9622, 6800, 6241, 6940. Neutral; 7263, 7211, 7190, 7052, 7175, 7095, 7041, 7150, 7096, 7235, 7025, 7900, 7248, 7182, 7179, 7183, 7247, 7188, 7061, 7003, 7186, 7283, 7237, 7187, 7055, 7053, 7010, 7017, 7018, 7020.

research. Five additional images relating to contamination (i.e., public toilet, raw chicken, dirty hands, moldy bread, and a man sneezing), as well as four neutral images (with geometric patterns) were included. These additional nine images were acquired through stock photography websites.

3.3 Attentional blink task

Rows of images were shown on a computer screen with 20 images presented on each trial. Trials included a total of 200 rows (i.e., 2 trials with 100 images). Each image was presented for 100 milliseconds (ms) in the middle of a black screen. The size of each image was 1024 x 768 centimeters (cm). In each row, two target stimuli appeared. Target stimulus 1 was either a randomly chosen disgust, contamination, neutral, or fear-related image. Target stimulus 2 was an image of landscapes or people that had a small grey square in the middle with a green circle on either the left or the right. Other images on each trial were of landscapes or people. An example of a row can be seen figure 1. Target stimulus 2 was presented 200 (lag 2), 500 (lag 5) or 800 ms (lag 8) after target stimulus 1. Participants pressed '4' or '6' on the keyboard to indicate that the green circle was on the left or right side of the square.

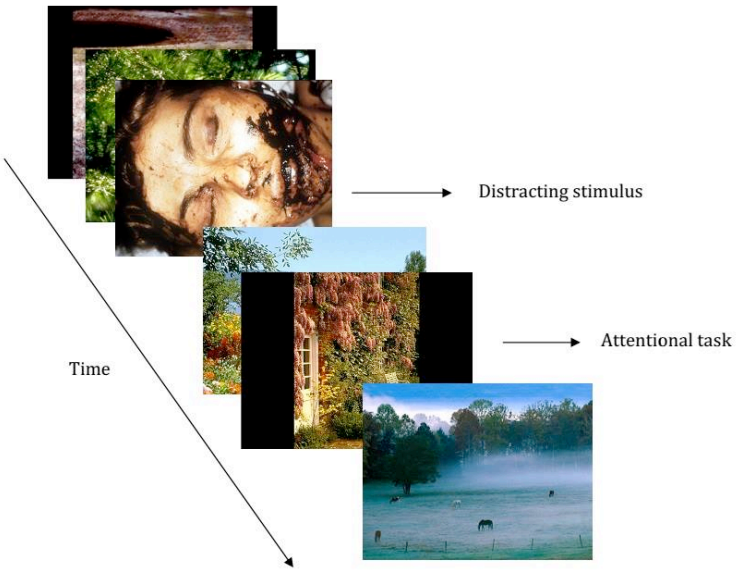

Figure 1 ***A row of images in the attentional blink task with distracting stimulus and the attentional task.***

3.4 Materials

3.4.1 Background questionnaire

A short background questionnaire was constructed to obtain information about participant's gender, age, education, and if they had ever received a professional diagnosis of attention deficit disorder.

3.4.2 Padua Inventory – WSUR (PI-WSUR)

The PI (Burns, Keortge, Formea & Sternberger, 1996) is a self-report measure of obsessive and compulsive symptoms, consisting of five subscales. Only the 10-item subscale measuring contamination obsessions and washing compulsions was used. Each item is rated on a five-point scale ranging from 0 (i.e., *not at all*) to 4 (i.e., *very much*). The PI has shown strong reliability and validity (Burns et al., 1996; Grabill et al., 2008). The Icelandic translation of the PI has good psychometric properties (Jónsdóttir & Smári, 2000; Ólafsson, Emmelkamp et al., 2013).

3.4.3 Dimensional Obsessive Compulsive Scale (DOCS)

Severity of OCD symptoms was assessed with the DOCS (Abramowitz et al., 2010). The DOCS contains 20 items with five items measuring severity of each of the following four symptom dimensions: 1) contamination, 2) responsibility for harm, injury, or bad luck, 3) unacceptable thoughts and 4) symmetry, completeness, and exactness. The items are rated on a 5-point scale ranging from 0 to 4. The measure has good psychometric properties (Abramowitz et al., 2010; Wheaton, Abramowitz, Berman, Riemann & Hale, 2010). The Icelandic translation of the DOCS has good psychometric properties in both student and clinical samples (Ólafsson, Arngrímsson et al., 2013; Ólafsson et al., 2016).

3.4.4 Obsessive Compulsive Core Dimension Questionnaire (OC-CDQ)

OC-CDQ (Summerfeldt, Kloosterman, Parker, Antony & Swinson, 2001) is a 20 item self-report questionnaire measuring the two hypothesized core motivational dimensions underlying symptoms of OCD: incompleteness and harm avoidance. Incompleteness is the demand to correct feelings of dissatisfaction regarding the need for flawless/perfect experiences or to feel “just right.” Harm avoidance is the tendency to avoid harm and the need to prevent it (Summerfeldt, et al., 2001). OC-CDQ has strong psychometric properties (Coles, Heimberg, Frost & Steketee, 2005). The questionnaire was translated into Icelandic by Ragnar P. Ólafsson to be used in this study. The psychometric properties of the translation are not known.

3.4.5 State Trait Anxiety Inventory – Trait (STAI-Trait)

The STAI-Trait (Spielberger, Gorsuch, Lushene, Vagg & Jacobs, 1983) was used to measure trait anxiety. The STAI-Trait is a brief self-report instrument consisting of 20 statements describing how people generally feel, that are rated on a 4-point frequency scale. The STAI-Trait generally has satisfactory psychometric properties (Barnes, Harp & Jung, 2002), as does the Icelandic translation of the questionnaire (Hólmfríður Bjarnadóttir & Ásrún Sigurðardóttir, 2011; Sif Einarsdóttir & Sigrún Sigurðardóttir, 1991).

3.4.6 Disgust Propensity and Sensitivity Scale-Revised (DPSS-R)

The DPSS-R (Van Overveld, de Jong, Peters, Cavanagh & Davey, 2006) was used to measure disgust propensity (the tendency to experience disgust frequently) and disgust sensitivity (negative reactions to experiences of disgust). Each item is scored on a 5-point Likert scale. The Icelandic translation has good psychometric properties (Ólafsson, Emmelkamp et al., 2013; Steinarsson, 2014).

3.4.7 Attentional Control Scale

The ACS (Derryberry & Reed, 2002) is a self-report questionnaire measuring two dimensions of attentional control: attentional focusing (10 items) and attentional shifting (10 items). It has been translated to Icelandic and the translation has good psychometric properties (Ólafsson et al., 2011).

3.4.8 State affect during the experimental testing

A short self-report questionnaire was constructed to measure changes in affect that might take place during the attentional blink task. This questionnaire was modeled after The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegan, 1988), which measures momentary positive and negative affect. The questionnaire contained 12 items, 8 measuring negative affect (anger and irritation; disgust and repulsion, fear and anxiety, depression and feeling down) and 4 measuring positive affect (elasion, joy, pleasure, happiness). Each item was rated on a four point scale ranging from not at all or very little (1) to very much (4). Scores were computed separately for each of the four negative affective states (anger/irritation, disgust/repulsion, anxiety/fear, depression/feeling down) as well as scores for negative and positive affect by summing up the relevant items divided by number of items.

3.5 Research Design

There were three independent variables in the experiment: participant group (LCF, HCF), image type (neutral, fearful, contamination, disgust), and time between target stimuli (200, 500, 800 ms). The dependent variable was the percentage of correct responses.

3.6 Procedure

All participants with high and low scores on the contamination scale of the Padua-WSUR in the Internet survey were contacted and offered to participate in the study. Upon arrival, participants completed a written informed consent after getting information about the study and then completed the self-report questionnaires in the study (STAI-T, PI-WSUR, DOCS, OC-CDQ, DPSS-R, ACS). Participants then answered the state affect questionnaire before receiving introduction on the attentional blink task. The program Vision Shell PPC was used for the attentional blink task, presented on a 75-Hz CRT screen controlled by a 400-MHz G4 Apple computer. All participants first finished a 10 trial practice run of the task (each showing 20 images) before starting the main task, which consisted of two rounds of 100 trials each. A short break was between rounds. Participants filled in the state affect questionnaire the second time, after task completion. Participants were then paid and thanked for their part in the study. Several participants also completed a pilot version of a thought control experimental task that will not be a part of the present analysis.

4 Results

4.1 Participant characteristics

The average age of the participants was 29.9 (SD = 10.1). In the low group (n = 17), the mean age was 31.7 (11.6) years; the mean age in HCF group (n = 15) was 28.3 (7.9) years (table 1). This difference was not significant (table 1).

Table 1 shows means and corresponding standard deviations of questionnaire scores for the two groups of participants. A significant difference between HCF and LCF groups was found on the Padua Inventory contamination subscale, the total score of DPSS, as well as the disgust propensity and sensitivity subscales of DPSS. There was no significant difference on the ACS total score or the subscale scores. Although the two groups did not differ in trait anxiety (STAI), a significant difference was found in negative affectivity between the groups showing that the HCF group had more negative affectivity, but not in positive affectivity, before participation in the attentional blink task.

Table 1. Descriptive statistics and group difference for questionnaire measures at baseline

	High CF (n = 15)		Low (n = 17)		
	Mean	Std. Dev.	Mean	Std. Dev.	*F*-value
PI Total	26.00	6.08	2.39	1.88	245.998***
ACS Total	47.31	8.84	51.72	9.54	1.94
ACS Focus	22.06	4.23	25.00	4.28	4.03
ACS Shift	26.00	4.55	26.72	4.61	.211
DOCS Total	24.75	9.94	9.78	8.38	22.69***
DOCS Contamination	7.50	4.21	.67	.91	45.20***
DOCS Harm	5.75	3.84	3.11	3.99	3.83
DOCS Symmetry	6.69	3.84	2.72	2.95	11.55**
DOCS Unacceptable thoughts	4.81	3.37	3.28	3.18	1.87
DPSS Total	35.81	11.95	20.11	12.22	14.27***
DPSS Propensity	20.69	6.63	11.94	6.78	14.38***
DPSS Sensitivity	15.12	6.47	8.17	5.70	11.12**
OC – CDQ Harm	24.12	8.52	16.33	9.11	6.59*
OC – CDQ Incompleteness	28.75	7.98	21.22	10.73	5.28*
STAI Total	42.31	9.43	37.50	6.57	3.04
Negative Affectivity	1.39	.35	1.15	.18	6.71*
Positive Affectivity	2.92	.96	3.28	.69	1.59
Age	27.63	7.86	31.11	11.75	1.02

Notes: PI = Padua Inventory, ACS = attentional control scale, DOCS = Dimensional obsessive compulsive scale, DPSS = Disgust Propensity and Sensitivity Scale-Revised, OC-CDQ = Obsessive compulsive core dimension questionnaire, STAI = State trait anxiety inventory.

*p<.05

**p<.01

***p<.001

4.2 Accuracy on the attentional blink task

We predicted that accuracy would be lower for the HCF than the LCF groups following contamination and disgust related pictures but not following neutral and treat related pictures. This difference should be more pronounced at Lag 2 than Lag 5 or 8. A 2 (Group) x 3 (Lag) x 4 (Type of image) mixed ANCOVA was conducted. Because the groups differed in baseline negative affectivity, state negative affect scores were added as a covariate. The main effects of image type ($F(3, 28)= .85$, $p = .469$, $\eta 2 = .029$) and lag ($F(1, 30)= .76$, $p = .391$, $\eta 2 = .026$) were not significant, but the main effect of group was significant ($F(1, 30)= 8.37$, $p < .05$, $\eta 2 = .224$), indicating that the overall accuracy on the task was lower for the HCF group (M= 74%; SD= 14%) than the LCF group (M= 87%; SD= 14%). The lag x group interaction was marginally significant ($F(2, 29)= 2.53$, $p = .089$, $\eta 2 = .080$) and the important image x lag x group interaction approached this as well ($F(6, 25)= 1.74$, $p = .113$, $\eta 2 = .057$). Because our primary hypothesis concerned group differences at lag 2, we investigated this three-way interaction further. Mixed-design ANCOVAS were conducted for each lag separately. Results showed that the main effect of group was significant in all three analysis ($p<.05$ in all cases) but the main effect of image type was not ($p>.10$ in all cases). More importantly, the group x type of image interaction was only significant at lag 2 ($F(3, 28)= 3.09$, $p = .031$, $\eta 2 = .096$). Simple within-subjects contrasts showed that this interaction was significant when comparing accuracies between neutral and disgust images ($F(1, 29)=5.35$, $p=.028$, $\eta 2 = .156$) but not when comparing neutral to threatening ($F(1, 29)=.243$, $p=.626$, $\eta 2 = .008$) or neutral to contaminating images ($F(1, 29)=.290$, $p=.294$, $\eta 2 = .010$). This interaction is depicted at different lags in figures 2, 3 and 4.

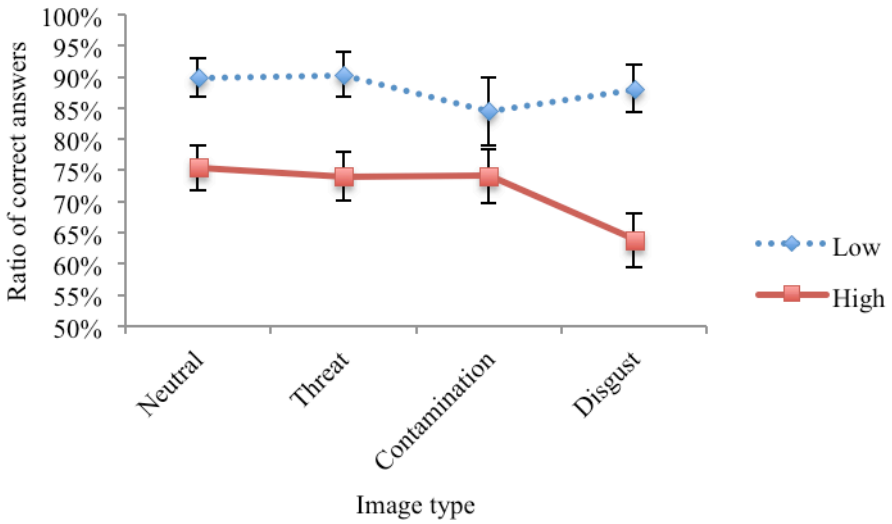

Figure 2. *Response accuracy at lag 2 (200ms) by image type and group (high and low CF groups).*

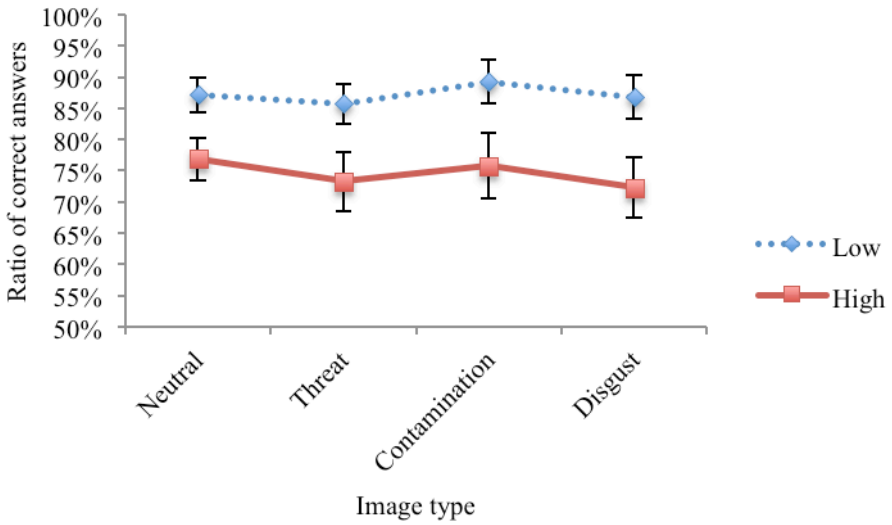

Figure 3 *Response accuracy at lag 5 (500ms) by image type and group (high and low CF groups).*

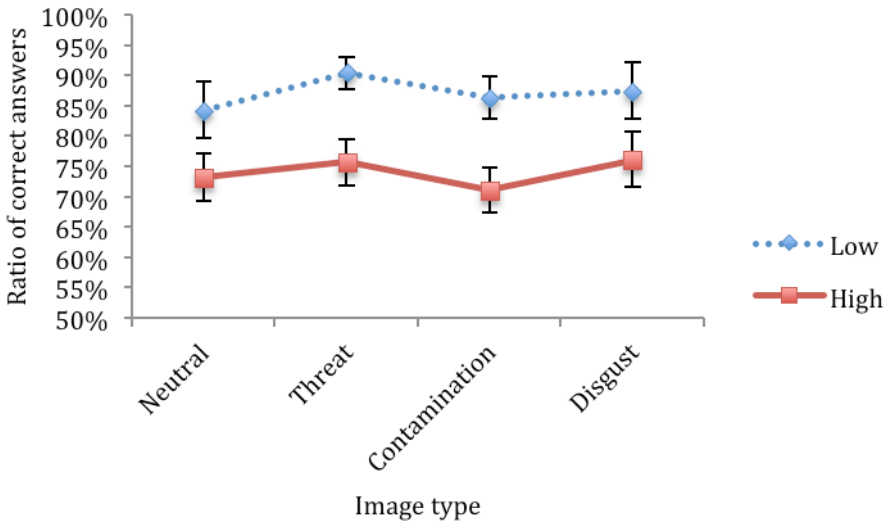

Figure 4. *Response accuracy at lag 8 (800ms) by image type and group (high and low CF groups).*

Figure 2 clearly shows that response accuracy drops only in the HCF on the discrimination task following disgust related images at lag 2. The overall pattern for HCF to be less accurate during the attentional blink task is also evident at all lags.

4.3 Changes in state affectivity during the task

The results of a 2 (Time: pre vs. post task) x 2 (Group: LCF vs. HCF) mixed ANOVA, with negative affectivity as the dependent variable, showed a significant main effect of time ($F(1, 30)= 9.78$, $p < .01$, $\eta 2 = .234$), group ($F(1, 30)= 13.5$, $p < .001$, $\eta 2 = .297$) and a significant time x group interaction ($F(1, 30)= 9.15$, $p < .01$, $\eta 2 = .222$). This interaction is shown in figure 5. Negative affect increases in the

HCF group (t(14)=-2.714, p=.017) during the attentional blink task but little change is observed in the LCF (t(16)=-.212, p=.835).

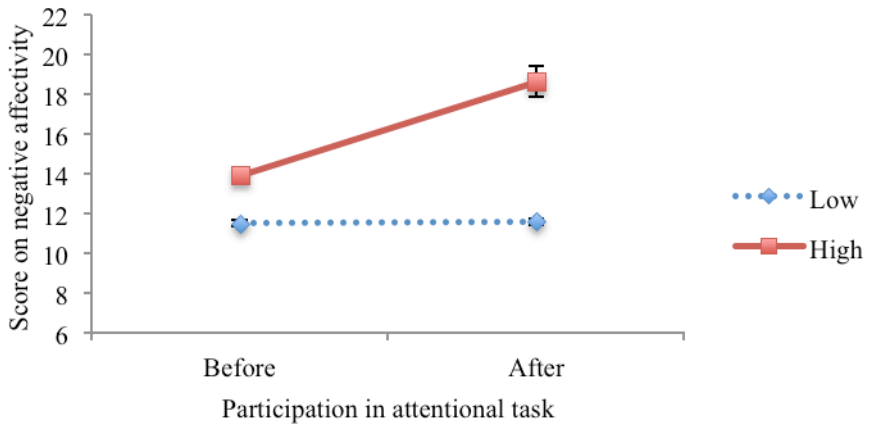

Figure 5. *Negative affectivity before and after participation in attentional blink task for both high and low CF groups.*

Similar analyses were carried out for changes in positive affect. The results of a 2 (Time: pre vs. post task) x 2 (Group: LCF vs. HCF) mixed ANOVA, showed a significant main effect of time ($F(1, 30)= 11.19$, $p < .01$, $\eta 2 = .259$), but not of group ($F(1, 30)= 2.64$, $p = .114$, $\eta 2 = .076$) or the time x group interaction ($F(1, 30)= .47$, $p =.498$, $\eta 2 = .015$). As can be seen in figure 6, positive affect decreases in both groups during the task.

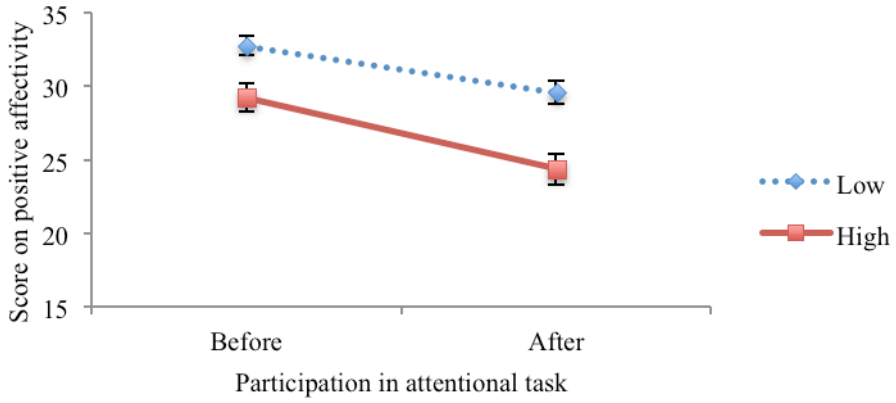

Figure 6. *Positive affectivity before and after participation in attentional blink task for both high and low CF groups.*

To see if changes in positive and negative affect, as a result of the attentional blink task, were related to fear of contamination, bivariate correlations were calculated between the PI total score and change scores pre to post task completion. In the HCF group, fear of contamination correlated strongly with increases in negative affect, $r = .642$, $p = .007$, and with reductions in positive affect, $r = -.628$, $p = .009$ Fear of contamination was not associated with changes in negative (r=.187, p= .472) or positive ($r = -.098$, $p = .710$) affect in the LCF group.

5 Discussion

The aim of this study was to investigate the presence of an attentional bias towards disgust and contamination related stimuli in participants with contamination fear. It was hypothesized that individuals with high contamination fear would be more likely to demonstrate attentional bias following disgust and contamination-related images at lag 2 than individuals with little or no fear. Results of this study indicate attentional bias towards disgust related material at short interval and lower accuracy on the task in people fearing contamination. There was also evidence for affective changes in highly fearful participants that were correlated with fear of contamination. These findings show that contamination fear is associated with attentional bias towards disgust-related stimuli.

The group with high contamination fear shows attentional bias at short time lags and when the stimulus is disgust-related. This attentional bias is not showing as time increases between stimuli and the discrimination task. Disgusting images seem to induce attentional bias and this is consistent with other previous studies (Armstrong et al., 2010; Armstrong et a., 2012; Cisler and Olatunji, 2010). This suggests that there may be a disgust reaction of some kind demonstrated by these individuals. Disgust-related feelings can be activated very quickly and can elicit strong reactions. Disgust is thought to be a basic emotion and elicits a reliable physiological response, facial expression, and withdrawal/avoidance pattern (Olatunji & Sawchuk, 2005). The bias in the present study is showing after a relatively short time-lag that suggests automatic rather than strategic information processing. However, no attentional bias was observed towards contamination-related stimuli as other studies have demonstrated (Foa et al., 1993; Tata et al., 1996). It may be that the experimental task was not effective in creating a real fear of contamination in participants using images on a computer screen. It may be possible to activate these feelings using a more vivid or realistic stimulus that affects the core of contamination fear and thus reliably evoking the same intense and persistent feeling of having been polluted or infected in practice (Rachman, 2004).

The results indicated delayed disengagement of attention in the task. Difficulty in disengaging attention refers to the degree to which a threatening stimulus captures attention and impairs switching attention from the threat to another stimulus (Cisler & Koster, 2010; Fox, Russo & Dutton, 2002). This is consistent with the results of Cisler and Olatunji (2010) demonstrating delayed disengagement in individuals with CF towards disgusting stimuli. Olatunji and colleagues (2011) also demonstrated delayed disengagement but with erotic stimuli. Although former studies point to attentional bias at later lags and thus, strategic stages of information processing in CF (Olatunji et al., 2011), the results of present study point to attentional bias playing out at automatic stages of information processing. This is consistent with other studies using the attentional blink paradigm to demonstrate attentional bias. Sigurðardóttir and colleagues (2015) found the attentional blink paradigm to be very sensitive to performance compared to dot probe, spatial cueing and irrelevant singleton paradigms. The attentional blink is also thought to be robust and involved in stimulus driven attentional resources (McHugo et al., 2013). Research has demonstrated the attentional blink to be strongest at earlier lags, thus indicating automatic information processing (Luck et al., 1996; McHugo et al., 2013). This

suggests that other attentional paradigms may be less sensitive for assessing attentional bias at earlier and more automatic stages of information processing.

Individuals in the HCF group had overall lower accuracy in the attentional blink task than those in LCF group. This suggests that the stimulus may have affected their ability to control attention in the attentional blink task; they may have had difficulty allocating or taking their attention off the distracting stimuli, making it more difficult to focus attention in the attentional blink task. This is consistent with the results of Olatunji and colleagues (2011) on the attentional blink paradigm where patients with OCD symptoms generally had lower accuracy in the task than the control group.

Increases in negative affect were observed in the HCF group after the attentional blink task, but not in the LCF group. It is novel to measure changes in participants' affect during attentional tasks. However, this may increase the clinical relevance of the findings concerning the presence of attentional bias in the study, especially since affective changes were highly correlated to scores on contamination fear, but only in the HCF group. It is possible that attentional bias induces negative affect that could increase behavioral avoidance on behavioral avoidance tasks (BATs; Deacon & Olatunji, 2007; Olatunji et al., 2007).

5.1 Limitations

There are some limitations to this study. Sample size was quite small (n = 32, 15 and 17 participants per group), which may raise the issue of limited statistical power. The sample was also almost exclusively females and only university students were included, thus the present results need to be extended to males, older adults and the general population. The present results should also be extended to the clinical population of contamination subtype of OCD. This said the HCF group scored quite high on the DOCS questionnaire (M = 24) measuring severity of OC symptoms. This indicates that the severity of OCD symptoms in the HCF group was closer to a representative sample of the clinical population (M = 30-32) than the normal population (M = 10 – 14) (Ólafsson et al., 2016).

5.2 Future directions

Further research is needed on the attentional blink in CF. It is necessary to examine different stages/mechanisms in attentional bias in fear of contamination to examine if there is a facilitated processing of threat or if it is difficult disengaging attention from threat. Moreover, prospective research is needed to determine if attentional bias is causing and maintaining anxiety in CF or if anxiety is causing attentional bias (see for example Van Bockstaele et al., 2014). Although attentional bias tasks seem to be efficient in detecting attentional biases towards emotional stimuli (McHugo et al., 2013; Sigurjónsdóttir et al., 2015), the task has not frequently been used in research concerning attentional bias in OCD. Future studies should continue using the attentional blink task when examining attentional bias in CF. This could reveal attentional bias at earlier stages of information processing that has not been thought to exist in OCD until now.

The results of this study may be used to enhance efficiency of treatment of contamination fear. Attentional retraining procedures have been found to be effective treatments for a variety of emotional

disorders, where individuals are trained to disengage attention from threat stimuli (Koster et al., 2009). This has been shown to reduce symptoms in clinical samples with general anxiety disorder (Amir, Beard, Burns, & Bomyea, 2009; Schmidt, Richey, Buckner, & Timpano, 2009) and in participants with subclinical OC symptoms (Najmi & Amir, 2010). Similarly, attention-retraining procedures may enhance the efficacy of existing treatments if difficulty in disengagement underlies CF (Cisler & Olatunji, 2010), although attentional modification may be unreliable and rewarding attention may influence dysfunctional attentional biases more (Sigurjónsdóttir, Björnsson, Ludvigsdóttir & Kristjánsson, 2015). Attentional bias for contamination may also predict behavioral avoidance of contamination risks encountered in everyday life, which can further enrich our understanding of treatment for CF (Armstrong et al., 2012).

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Appendix A

Example of a neutral image in the attentional blink task.

Example of a threat-related image in the attentional blink task.

Example of a contamination-related image in the attentional blink task.

Example of disgust-related image in the attentional blink task.