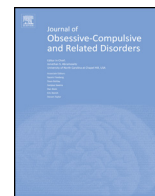




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# The behavioral inhibition system (BIS) mediates major aspects of the relationship between disgust and OCD symptomology

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## ABSTRACT

Disgust is highly related to obsessive-compulsive disorder (OCD) symptoms, yet its contribution to specific OCD symptoms is still unclear. In the present study, we examined how disgust–OD relationship is influenced by the behavioral inhibition system (BIS), a personality variable that co-varies with disgust and OCD. A large heterogeneous sample ( $N=314$ ), taken from the general population (using a convenience sampling method), completed a self-reported questionnaires of disgust (The Disgust Scale Revised), behavioral inhibition (The behavioral inhibition system questionnaire) and OCD symptoms (Obsessive-Compulsive Inventory-Revised). In addition, demographic factors, related to both disgust and OCD, were collected. The findings indicated that disgust and BIS were related to both shared and different elements of OCD. Disgust was exclusively related to symptoms of washing, while BIS was exclusively related to symptoms of hoarding. Both disgust and BIS influenced ordering. Furthermore, BIS mediated part of the relationship between disgust and OCD symptoms, namely, checking and obsessing, and to a lesser extent, neutralizing. We present a model, supported by a confirmatory factor and mediation analyses, suggesting that disgust and BIS are related to mostly different aspects of OCD: while disgust is related mainly to the contamination aspect of OCD, BIS is related to difficulties in behavior inhibition.

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## 1. Introduction

In the past decade a large body of work has successfully established a relationship between the subjective emotion of disgust, and different aspects of obsessive-compulsive disorder (OCD; Berle et al., 2012; Cisler, Brady, Olatunji, & Lohr, 2010; Mancini, Gragnani, & D'Olimpio, 2001; Olatunji, Ebesutani, David, Fan, & McGrath, 2011; Thorpe, Patel, & Simonds, 2003a). Specifically, OCD symptoms were positively correlated with both disgust sensitivity (i.e., how unpleasant the experience of disgust is) and propensity (i.e., how easily a person is disgusted), which together determine the level of unpleasantness evoked in potentially disgusting situations (Olatunji et al., 2011; van Overveld, de Jong, Peters, Davey, & Cavanagh, 2006).<sup>1</sup> This relationship, which was obtained in both self-report

questionnaires and behavioral avoidance tasks, remains significant after controlling for various variables such as anxiety and depression symptoms, age and gender (Berle et al., 2012).

Apart from disgust's relation to general OCD measurement scores, disgust is specifically related to several OCD symptoms, such as contamination concerns and washing compulsions. High levels of disgust were found to be associated with an intense feeling of being polluted and the compulsive need to wash away the polluting element (Cisler et al., 2010). This relationship is explained by what is considered disgust's most basic evolutionary role, a pathogen avoidance mechanism. As such, disgust has evolved to prevent contamination of the physical body by germs and other dangerous elements (Curtis, Aunger, & Rabie, 2004; Curtis, de Barra, & Aunger, 2011; Oaten, Stevenson, & Case, 2009).

In addition to the apparent relationship between disgust and OCD's washing symptoms, disgust may relate also to other OCD symptoms, at least from a theoretical perspective. For example, disgust is related with the need to prevent impurity and promote order (Douglas, 1966). These purity needs are not necessarily the result of contamination concerns, since disgust is elicited also by impurities in color, as well as homosexual marital forms (Inbar, Pizarro, Knobe, & Bloom, 2009; Sherman, Haidt, & Clore, 2012). Hence, disgust can also be associated with OCD symptoms of ordering.

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<sup>1</sup> The measure used in the present study to assess disgust proneness, namely the Disgust Scale Revised (Olatunji, Cisler, Deacon, Connolly, & Lohr, 2007), measures both aspects of disgust, and does not differentiate between sensitivity and propensity (van Overveld et al., 2006; van Overveld, Peters, & Jong, 2010). Thus, we will refer to the measured quality as disgust. Implications of the sensitivity/propensity dichotomy will be elaborated on in Section 5.

Another aspect of disgust, which may be related to specific OCD symptoms, other than washing, is morality. Although moral disgust is usually associated with washing-related moral issues, such as purity or bodily norms (Chapman & Anderson, 2014), studies have shown that feelings of disgust towards immoral acts (e.g., unusual sexual practices) are related to obsessions of religious implications (i.e., fear of punishment by God; Olatunji, Tolin, Huppert, & Lohr, 2005). Finally, obsessive (and intrusive) thoughts could also result from fear of contamination (Ólafsson et al., 2013).

However, the relationship between disgust and OCD symptoms (apart from contamination) is empirically supported by some studies (Olatunji, Cisler, McKay, & Phillips, 2010; Olatunji et al., 2011; Olatunji, Tolin, et al., 2005; Olatunji et al., 2010; Thorpe, Patel, & Simonds, 2003b), but not supported by others (Berle et al., 2012; Goetz, Lee, Cogle, & Turkel, 2013; Tolin, Woods, & Abramowitz, 2006). One potential cause for this variation may be attributed to a third variable that covaries with both disgust and the disputed OCD symptoms (obsessing, ordering), but not with the accepted disgust-related OCD symptoms, namely contamination and washing.

One possible candidate is the behavioral inhibition system (BIS), a system that modulates withdrawal behaviors, negative emotions, and the experience of anxiety. Moreover, BIS is sensitive to signals of punishment and lack of reward. Together with the behavioral activation system (BAS), the BIS is part of a dual personality system, regulating aversive and appetitive motivation (Gray, 1970, 1981, 1994). BIS was found to be strongly correlated with disgust by Olatunji, Haidt, McKay, and David (2008), who examined the relationship between several personality factors and disgust. The authors have speculated that this relationship between disgust and BIS may imply that disgust acts as a regulator of aversive motives. Specifically, since disgust is usually related to aversive stimuli, and since BIS is a functionally independent system which regulates behavior and motivation in response to aversive situations, the presence of a feeling of disgust may be processed by BIS as a signal of impending punishment. In other words, disgust marks an event as negative (aversion), a mark which is subsequently “picked up” by the BIS system and responded to by regulating future behavior and motivation.

In addition to its relation with disgust, BIS was also found to be related with OCD, specifically with symptoms of hoarding. For example, Fullana et al. (2004) have found a medium correlation between BIS score and the Yale–Brown Obsessive Compulsive Scale (Goodman et al., 1989), in a clinical sample of OCD diagnosed patients. The authors speculated that hoarding symptoms are caused by hyperactivation of BIS. Kort (2012) has also found high BIS levels in OCD patients and individuals with hoarding behavior, in comparison to healthy controls. He claimed that increased BIS scores might reflect, in both OCD and hoarding-disorder patients, a subjective experience of punishment, resulting from the discarding of their possessions.

Although the relationships between each pair of these three concepts have been established, the concurrent relationships among disgust, OCD and BIS have not been studied. The purpose of the present study is to examine these relations, and to offer a combined model. We hypothesize that disgust and BIS are related to different elements in OCD symptomatology, as indicated by previous work. In addition, we postulate that BIS would act as a moderator of disgust’s relationship with OCD. This assumption relies on the conception of disgust as a signal of impending punishment (Olatunji et al., 2008). These feelings of punishment will be felt more robustly in individuals with high BIS compared to individuals with low BIS, thus creating different levels of OCD symptoms across the BIS spectrum. Thus, disgust would influence OCD symptoms only when BIS is high but not when BIS is low.

In addition, disgust is related to several demographic variables, which also influence OCD. For example, women show higher levels of disgust (Olatunji et al., 2008). Similarly, female OCD patients show (among other differences) higher levels of OCD washing symptoms compared to male patients (Mathis et al., 2011). Gender difference in OCD was previously accounted for by gender difference in disgust (Olatunji, Sawchuk, Arrindell, & Lohr, 2005). In addition, intense religious scruples are an OCD risk factor, and have been related with disgust as well (Olatunji, Tolin, et al., 2005). Finally, age and education modestly inoculate from heightened disgust (Berger & Anaki, 2014), and also reduce OCD symptoms (Beadel, Green, Hosseinbor, & Teachman, 2012; Chamberlain et al., 2007; Erskine, Kvavilashvili, & Kornbrot, 2007; Kessler, Foster, Saunders, & Stang, 1995; Porche, Fortuna, Lin, & Alegria, 2011; Purcell, Maruff, Kyrios, & Pantelis, 1998). Due to the strong relationship of similar demographic variables to both disgust and OCD we included these variable in our study.

In the present study, we performed a four-step analysis. First, we examined the correlations among BIS, disgust, OCD symptoms and demographic variables in a heterogeneous sample. Second, we examined the different contributions of BIS, disgust factor scores, and demographic variables to OCD sub-scales with regression analyses. In the third step, we repeated the regression analyses separately for men and women. Finally, we constructed a structural model, using confirmatory factor analysis (CFA), which incorporated all the described elements. This model enabled an examination of the unique contribution of disgust to OCD variance, and any direct and indirect effects of BIS and demographic variables on OCD.

## 2. Method

### 2.1. Participants

The study’s sample consisted of 314 participants (168 women). Their mean age and education was 33.7 (range 16–78, SD=12.7) and 14.6 years (range 8–24, SD=2.27), respectively. Mean religiosity level was .4 (SD=.65), indicating a majority of participants with secular views. Mean political orientation was 1.02 (SD=.82) indicating a majority of central political orientation. Men and women did not differ in any of the demographic variables.

## 3. Measurements

### 3.1. Disgust Scale Revised (DS\_R) Hebrew version

The DS\_R Hebrew questionnaire (Berger & Anaki, 2014), a Hebrew translated and validated version of the Disgust Scale Revised (Olatunji et al., 2007), was administered to the participants. In that study the DS\_R was found to be reliable (Cronbach’s alpha of .79), containing three main factors (core, contamination, and animal reminder), as previously obtained by Olatunji et al. (2007).

### 3.2. The behavioral inhibition system questionnaire (BISq)

The behavioral inhibition system (Carver & White, 1994) questionnaire assesses how prone a participant is to feeling a negative affect or behavioral inhibition when presented with threat cues. Responses are given on a 4-point Likert scale, ranging from 1 (“strongly disagree”) to 4 (“strongly agree”). A previous study, which translated and validated the Hebrew version (Waisbrod, 2007), found it to be reliable with a Cronbach’s alpha value of .67.

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