Different Disgust Domains Specifically Relate to Mental and Contact Contamination Fear in Obsessive-Compulsive Disorder: Evidence From a Path Analytic Model in an Italian Clinical Sample

Andrea Poli*

Institute for Behavioral and Cognitive Psychology and Psychotherapy of Florence (IPSICO)

Gabriele Melli

Institute for Behavioral and Cognitive Psychology and Psychotherapy of Florence (IPSICO)
University of Pisa

Adam S. Radomsky

Concordia University

Both contact contamination (CC) and mental contamination (MC) fears—which combined represent the most common manifestation of obsessive-compulsive disorder (OCD)—have been widely associated with disgust propensity. However, extant research explored this relationship using measures assessing only pathogen-related disgust, not taking into account the potential role played by sexual and moral disgust, despite literature about MC suggesting that this might be particularly relevant. In Study 1, the psychometric properties of the Italian version of the Three Domains of Disgust Scale (TDDS) were assessed in a large Italian community sample. Exploratory and confirmatory factor analyses confirmed the three-factor structure of the TDDS. The scale also showed good internal consistency and construct validity. In Study 2, the differential patterns of relationships between CC and MC and the three disgust domains were explored in an Italian clinical OCD sample using a path analytic approach. The TDDS-Pathogen subscale was a unique predictor of CC while the TDDS-Sexual subscale was a unique predictor of MC, after controlling for anxiety and depression. Surprisingly, the

TDDS-Moral subscale was not a predictor of either domain of contamination fear. Limitations and clinical implications are discussed.

OBSESSIVE COMPULSIVE DISORDER (OCD) is a severe psychopathological disorder characterized by the occurrence of repetitive thoughts, urges, or images that are experienced as intrusive and unwanted (i.e., obsessions), and by behaviors that the individual feels the need to perform (compulsions), which are aimed at preventing or reducing anxiety or distress, or preventing some undesired event or situation entailed by the obsession (American Psychiatric Association, 2013). The rates of the disorder are similar around the world, although there may be regional biases toward particular forms of OCD such as those involving contamination (Nedeljkovic, Moulding, Foroughi, Kyrios, & Doron, 2012).

Among the OCD symptom dimensions, only contamination and, to a lesser extent, symmetry (but not responsibility for harm and mistakes and unacceptable thoughts) dimensions were found to be significantly and moderately correlated with

* Address correspondence to Andrea Poli, Psy.D., Ph.D., Via Mannelli, 139, 50132 Firenze, Italy; e-mail: andrea.poli@gmail.com.

disgust propensity (DP; David et al., 2009; Melli, Chiorri, Carraresi, Stopani, & Bulli, 2015; Olatunji, Williams, Lohr, & Sawchuk, 2005; Schienle, Stark, Walter, & Vaitl, 2003). Contamination-related OCD (C-OCD) is consistently found to be a distinct symptom dimension of OCD (Bloch, Landeros-Weisenberger, Rosario, Pittenger, & Leckman, 2008), and it is the most common symptom manifestation of OCD (Foa et al., 1995; Rasmussen & Eisen, 1992). Contamination-related obsessions are accompanied by compensatory behaviors (e.g., washing, cleaning, checking) designed to remove the contaminant and to protect the individual from threat of illness and other negative outcomes. A large body of research has underlined the role of DP in C-OCD (David et al., 2009; Olatunji et al., 2005; Olatunji, Sawchuk, Lohr, & de Jong, 2004; Schienle et al., 2003), in particular using the Dimensional Obsessive-Compulsive Scale (DOCS; Abramowitz et al., 2010; Melli, Chiorri, et al., 2014) and its Contamination subscale (Melli, Bulli, et al., 2017; Melli, Chiorri, et al., 2014, 2015; Melli, Chiorri, Stopani, Bulli, & Carraresi, 2017; Melli, Moulding, & Poli, 2016; Olatunji et al., 2010), highlighting the relevant role of DP in contact contamination (CC) fear.

In general, contamination fear is considered to be the fear of coming into direct or indirect contact with a person or item that is perceived to be dirty or harmful (i.e., CC; Rachman, 2004). However, as described by Rachman (2004), contamination can also occur in the absence of contact with an external object (mental contamination [MC]; e.g., by merely observing or thinking about something unclean, immoral, or undesirable). Rachman (2004, 2006) described some of the main differences between these two kinds of contamination as including the nature of the contamination process (resulting from physical contact vs. occurring in the absence of direct contact), the effectiveness of washing (washing is helpful when the contaminant is physical, but ineffective when it is not), the perceived source (a known and tangible source for CC vs. an intangible and obscure source for MC), the kind of source (inanimate dirty/harmful substances for CC vs. usually human persons for MC), the vulnerable persons (self and others for CC vs. uniquely self for MC), and the range of contamination provocations (dirt, germs, or harmful substances vs. thoughts, memories, betrayal, etc.). Nearly all previous research on contamination fear has focused on CC—as such, an examination of contamination fears and their relationships with disgust is both timely and important.

Research has recently demonstrated that the tendency to experience disgust is also related to MC (Fairbrother, Newth, & Rachman, 2005; Herba & Rachman, 2007; Radomsky, Rachman, Shafran, Coughtrey, & Barber, 2014; Travis & Fergus, 2015). MC was a partial mediator of DP effects in triggering contamination fear (Carraresi, Bulli, Melli, & Stopani, 2013; Melli, Bulli, Carraresi, & Stopani, 2014), and, in particular, of contamination fear based upon disgust avoidance (Melli, Bulli, et al., 2017). Furthermore, DP has been shown to be a unique predictor of MC following sexual trauma (Badour, Feldner, Babson, Blumenthal, & Dutton, 2013; Badour, Ojserkis, McKay, & Feldner, 2014). Overall, these studies highlight the relevant role of DP in the expression of MC as well.

Disgust has been conceptualized as a basic emotion with an associated negative valence that facilitates a rejection or revulsion response that is implemented in order to promote behavior that reduces the probability of exposure to pathogens (Davey, 1994; Olatunji & Sawchuk, 2005). However, as other lines of disgust research have underlined, sexual concepts (Borg, de Jong, & Schultz, 2010) and noninfectious social transgressions (Cannon, Schnall, & White, 2011) are able to elicit disgust as well. Over the past two decades, the theoretical model proposed by Rozin, Haidt and McCauley (2016) has become the gold standard in the field (Haidt, McCauley, & Rozin, 1994). This model proposes that the disgust system evolved from a toxin-based food-rejection system (distaste) that motivates pathogen avoidance and comprises four domains: core disgust (e.g., revulsion toward food, animals, and body products), animal reminder disgust (e.g., aversion toward sex, corpses, bad hygiene, and body envelope violations), interpersonal disgust (e.g., rejection of contact with strangers or undesirable individuals), and moral disgust (e.g., aversion toward moral violations protecting social order; Rozin et al., 2016). This also led to the development of the 32-item Disgust Scale (DS; Haidt et al., 1994). Subsequent suggestions for the refinement of the DS, consisting of the removal of seven items, including the four sexual disgust items, led to the development of the DS–Revised (Olatunji, Lohr, et al., 2007).

Considering the key shortcomings of the model theorized by Haidt and colleagues (1994), Tybur and colleagues (Tybur, Lieberman, & Griskevicius, 2009; Tybur, Lieberman, Kurzban, & DeScioli, 2013) proposed a recent functional model, conceived within an evolutionary framework, in which the emerging function of disgust developed as a protective mechanism related to food rejection but

subsequently, additional functions evolved to pre-serve organisms from other types of stimuli. The authors proposed three evolutionarily adaptive domains of DP, including (a) pathogen disgust (e.g., aversion toward pathogens that may increase the chance of getting ill), (b) sexual disgust (e.g., aversion of sexual partners and behaviors that would jeopardize one's long-term reproductive success), and (c) moral disgust (e.g., aversion toward individuals who transgress moral norms, threatening the integrity of critical social networks and social structures).

Pathogen disgust serves the rejection of invisible physical contagious agents from contamination of the body, and is elicited by stimuli related to body products and rotten foods, thus facilitating the disease-avoidance purpose. Through the stimula-tion of the urge to avoid the disgusting cue, pathogen disgust likely facilitates the withdrawal from the physical contact with or ingestion of pathogens (Curtis, de Barra, & Aunger, 2011; Oaten, Stevenson, & Case, 2009). Since body wounds, exchange of bodily fluids, and physical proximity increase the opportunity for the trans-mission of pathogens, sexual behavior obviously represents a risk for the transmission of disease. Accordingly, there is a high probability that pathogen disgust may arise during sex.

Conversely, sexual disgust is not implied in any risk related to sex, but specifically refers to disgust elicited by potential sexual partners. Intrinsic mating quality and genetic compatibility may elicit sexual disgust toward potential sex partners as an evolved solution to the adaptive problem of avoiding biologically costly mates and sexual behaviors. A mate's intrinsic quality is expressed by features regarding objective physical attractive-ness, such as body symmetry, facial attractiveness, and body shape (e.g., Thornhill & Gangestad, 2006), regardless of genetic compatibility. Instead, genetic compatibility is referred to as a potential partner's genetic similarity to oneself—rather than intrinsically low genetic quality—which is regulated by factors such as major histocompatibility com-plex (Jan Ejsmond, Radwan, & Wilson, 2014) and genetic similarity (e.g., siblings, parents, offspring). Both mates' intrinsic qualities and genetic compat-ibility can reduce reproductive success, and observ-ing such physical features (e.g., bodily deformations, extreme obesity) in a potential sex partner may elicit sexual disgust, evolved to facilitate avoidance of sexual partners and behav-iors that may jeopardize long-term reproductive success (Tybur et al., 2009, 2013). Considering the results found by Badour and colleagues (2014), where DP was a unique significant predictor of MC,

and that in MC the perceived contaminant is expected to be of human origin, sexual disgust may exhibit a stronger relationship with MC than with CC. In addition, it has been recently shown that high levels of sexual disgust were associated with a reduced number of sex partners and that individuals with high levels of moral disgust were more likely to show moral behavior toward sex partners (Zhang, Zheng, & Zheng, 2017).

Finally, witnessing others' moral transgressions may elicit a moral form of disgust in observers, evolved to protect the integrity of critical social networks and social structures (Tybur et al., 2009, 2013). When elicited in witnesses, moral disgust would serve to coordinate condemnation of partic-ular acts committed by transgressors that may threaten individuals' social integrity. When elicited in the actors, moral disgust may activate already internalized sociomoral rules and increase their stringency (Wheatley & Haidt, 2005), helping the actor prevent future infringements of social norms. Moral disgust may also be elicited by sexual behaviors that infringe on important sociomoral rules. Relying on stringent sociomoral standards would increase the probability that a particular sexual behavior will be experienced as a transgres-sion and will evoke moral disgust directed to the self, to the witnessed behavior, or to the transgres-sor (Koukounas & McCabe, 1997).

Consistent with a three-factor model, Tybur and colleagues (2009) introduced a new measure of DP, the Three Domains of Disgust Scale (TDDS), showing that factor analyses divided DP into domains related to pathogens, sexuality, and morality. Olatunji and colleagues (2012) supported the three-factor model and found evidence for the validity of the Pathogen and Sexual Disgust subscales, along with strong associations with the Contamination subscale of the Padua Inventory (Burns, Keortge, Formea, & Sternberger, 1996), while the validity of the Moral Disgust subscale was found to be limited. Subsequently, Olatunji, Ebesutani, and Kim (2015) highlighted that TDDS items are highly multidimensional and that a general disgust dimension is able to explain half of the variability in the items of the total score while the remaining variability is explained by the specific disgust domains and other sources of variance. Interestingly, pathogen disgust showed the most significant relationship with an obsessive-compul-sive disorder (OCD) symptom latent factor above and beyond the general disgust factor.

Unfortunately, a large amount of research that has studied the role of DP in CC or in MC used the Disgust Scale–Revised (DS-R; Melli, Chiorri, & Smurra, 2013; Olatunji, Lohr, et al., 2007) or the

Disgust Propensity Questionnaire (DPQ; Melli, Chiorri, et al., 2017) that mainly investigate pathogen disgust, not taking into account the roles of sexual and moral disgust (Tybur et al., 2009, 2013). Nevertheless, there is evidence supporting the notion that MC can be either triggered (Elliott & Radomsky, 2009; Fairbrother et al., 2005; Herba & Rachman, 2007; Radomsky & Elliott, 2009) or re-evoked (Badour et al., 2013; Fairbrother & Rachman, 2004) by mental images or thoughts related to betrayal or immorality (e.g., Elliott & Radomsky, 2009, 2012; Fairbrother et al., 2005; Herba & Rachman, 2007; Rachman, Radomsky, Elliott, & Zysk, 2012). Furthermore, Rachman (2004, 2006) hypothesized that sexual assaults were likely to result in MC and basic research has often linked sexuality and appraisals of disgust/self-disgust and contamination, and morality/immorality (de Jong & Borg, 2015). These findings suggest that moral and sexual disgust may be mainly implicated in both clinical and nonclinical manifestations of MC (Radomsky, Coughtrey, Shafran, & Rachman, 2018).

To our knowledge, no study to date has evaluated the possible differential roles of pathogen, sexual, and moral disgust in CC and MC—we propose that identifying specific disgust predictors of CC and MC would be helpful in directing clinical treatment, as they are likely to be of use to therapists interested in novel targets in the treatment of those struggling with contamination fears. Study 1 was designed to assess the factor structure, reliability, and construct validity of the TDDS in a large Italian nonclinical sample. Study 2 was carried out to examine which domains of the TDDS, using a path analysis approach, were able to differentially predict MC and CC fear in a heterogeneous clinical OCD sample. The following were hypothesized: (a) pathogen disgust would relate more strongly with CC fear, while sexual and moral disgust would relate more strongly with MC; and (b) pathogen disgust would be a major predictor of CC fear, while sexual and moral disgust would be a major, unique predictor of MC, independent of negative mood.

Study 1

MATERIAL AND METHODS

Participants
The sample consisted of 1,077 (56.9% female) community participants ($M = 37.78$ years, $SD = 14.50$, range 16–83) who responded to advertisements requesting potential volunteers for psychological studies in Central Italy. In terms of education, 52.8% of the participants had a medium level of education (12–13 years, high school degree), 33.5% had a higher-level degree (16 or more years, bachelor's degree or Ph.D.), and the remaining 13.7% had a low level of education (8 or less years, primary or secondary school). Most were employed (51.9%), 26.4% were undergraduate university students, and the remaining 21.7% were homemakers, unemployed, or retired. Regarding marital status, 44.7% were single, 49.0% were married or cohabiting, 4.4% were divorced, and 1.9% were widows or widowers.

Measures
   Three Domains of Disgust Scale (TDDS; Tybur et al., 2009).   This 21-item self-report scale investigates DP on three subscales: Pathogen Disgust, Sexual Disgust, and Moral Disgust. Participants are asked to rate each item on a 6-point Likert scale from 0 (*not at all*) to 7 (*extremely disgusting*). The original version of the scale showed a trifactorial structure in different samples and good psychometric properties. The Italian translation of the TDDS was carried out through a mixed forward- and back-translation procedure (Behling & Law, 2000). The authors and one bilingual Italian–English psychologist independently translated the English version of the TDDS into Italian. After consensus among translators was achieved, an Italian–English researcher blind to the original version translated this preliminary version back into English. Discrepancies emerging from this back translation were discussed with the primary original author of the scale until a consensus was reached on the final formulation of the items. In addition, before being used in this study, the newly developed Italian version of the TDDS was administered to 10 naïve participants in order to check the understandability of the items, which were all found to be easy to understand and to respond to.

   Disgust Propensity Questionnaire (DPQ; Melli, Chiorri, et al., 2017).   This nine-item scale was recently developed to assess individual DP in Italian samples. Participants are asked to rate each item on a 5-point Likert scale ranging from 0 (*not at all*) to 4 (*very much*). The scale was found to have a one-factor structure, good internal consistency ($\alpha = .85$), adequate test–retest reliability (ICC = .85), and construct validity (e.g., correlation with the DS-R = .69). In the current study, this scale showed good internal consistency ($\alpha = .88$).

   Guilt Sensitivity Questionnaire (GSQ; Melli, Carraresi, Poli, Marazziti, & Pinto, 2017).   This 10-item self-report measure has been recently developed to assess guilt sensitivity (the extent to

which the experience of guilt is negatively evaluated by the individual) in Italian samples. Response choices are scored from 1 (*strongly agree*) to 5 (*strongly disagree*) and total scores range from 11 to 55. The scale was found to have a one-factor structure, excellent internal consistency (α = .91) and construct validity. In the present study, internal consistency was also excellent (α = .91).

Depression Anxiety Stress Scales–21 (DASS-21; Antony, Bieling, Cox, Enns, & Swinson, 1998; Clara, Enns, & Cox, 2001). This 21-item scale is the short version of the DASS (Lovibond & Lovibond, 1995), a self-report questionnaire listing negative emotional symptoms. It has three subscales measuring depression, anxiety, and stress. Participants rated how often a particular symptom was experienced in the previous week on a scale ranging from 1 (*did not apply to me at all*) to 4 (*applied to me most of the time*). The original DASS-21 has shown good psychometric properties and its Italian version (Bottesi et al., 2015) has replicated the three-factor structure of the original version and has shown adequate internal consistency (α's in the range .74–.92), test–retest reliability (r's in the range .64–.74), and construct validity. In the current study, all the subscales showed good internal consistency (α's between .84 and .90).

Procedure

All participants volunteered to take part in the study after being presented with a detailed description of the procedure, signed a written consent form, and were treated in accordance with the Ethical Principles of Psychologists and Code of Conduct (American Psychological Association, 2010). All participants completed the TDDS, and the questionnaire took between 3 and 10 minutes to be completed. A subsample of 540 participants completed all the aforementioned measures. The batteries took between 10 and 25 minutes to be completed. The scales were administered in a counterbalanced fashion to control for order and sequence effects. No external incentives were offered for participating in this study.

RESULTS

Factor Structure

The factor structure of the TDDS was investigated through a cross-validation procedure. The sample was randomly divided into two subgroups using the SPSS 18.0 "random sample of cases" function with the subgroup size set at "approximately 50%." An exploratory (common) factor analysis (EFA) was carried out using data from one subgroup (*n* = 540); a confirmatory factor analysis (CFA) was then

Table 1

Item Descriptive Statistics, Item Analyses (*n* = 1,077), and Factor Loadings From the Exploratory Factor Analysis of the TDDS (*n* = 540) in Study 1

Item	*M*	*SD*	Range	SK	KU	r_{it}	α w/o	Pathogen	Sexual	Moral
1.	3.28	2.02	0-6	-.09	-1.27	.52	.79			.51
2.	2.22	2.02	0-6	.51	-.99	.63	.86		.62	
3.	3.62	1.82	0-6	-.20	-1.10	.54	.76	.61		
4.	5.38	1.33	0-6	-2.67	6.86	.48	.80			.65
5.	1.53	2.08	0-6	1.12	-.17	.65	.85		.85	
6.	2.28	1.79	0-6	.49	-.73	.50	.76	.63		
7.	2.32	2.02	0-6	.46	-1.05	.53	.79			.51
8.	1.93	2.11	0-6	.73	-.86	.72	.84		.85	
9.	2.72	1.77	0-6	.28	-.94	.58	.75	.71		
10.	5.16	1.32	0-6	-1.95	3.73	.49	.80			.53
11.	2.61	2.20	0-6	.25	-1.35	.58	.86		.55	
12.	3.10	2.07	0-6	-.01	-1.31	.50	.76	.57		
13.	4.21	1.98	0-6	-.83	-.60	.62	.77			.68
14.	3.18	2.38	0-6	-.11	-1.57	.66	.85		.70	
15.	4.17	1.59	0-6	-.59	-.49	.59	.75	.82		
16.	2.99	1.99	0-6	-.01	-1.20	.58	.78			.64
17.	3.56	2.25	0-6	-.38	-1.34	.61	.86		.59	
18.	2.81	2.12	0-6	.14	-1.35	.45	.78	.49		
19.	3.51	1.93	0-6	-.35	-1.00	.64	.77			.68
20.	2.82	2.45	0-6	.13	-1.63	.69	.85		.81	
21.	3.38	1.97	0-6	-.18	-1.17	.48	.77	.58		

Note. TDDS = Three Domains of Disgust Scale; *M* = mean; *SD* = standard deviation; SK = skewness; KU = kurtosis; r_{it} = corrected item-total correlation; α w/o = Cronbach's alpha if item deleted.
Loadings < .35 were not reported.

performed using data from the second subgroup (n = 537).

Since a substantial number of items in both subgroups showed values of skewness and kurtosis that fell outside the $-1, +1$ range recommended by Muthén and Kaplan (1985) for using a maximum likelihood estimator (see Table 1), factor analyses were performed in Mplus 6.1 using the mean- and variance-adjusted weighted least squares estimator (WLSMV; Muthén, duToit, & Spisic, 1997). When using WLSMV estimator, Mplus 6.1 provides fit indices for EFA analogous to those of CFA—that is, the Tucker–Lewis index (TLI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). Following Marsh, Wen, and Hau (2004), values $\geq .90$ were considered as adequate and $\geq .95$ as optimal for the TLI and the CFI, and values $\leq .08$ as adequate and $\leq .06$ as optimal for the RMSEA.

The issue of determining the number of factors to extract was determined by performing dimensionality analyses on the polychoric correlation matrix of TDDS items through parallel analysis (PA) with optimal implementation (Timmerman & Lorenzo-Seva, 2011). On the basis of the recommendations of Buja and Eyuboglu (1992), PA was performed on 1,000 random correlation matrices obtained through permutation of the raw data, and following Longman, Cota, Holden, and Fekken (1989), both the mean eigenvalues and the 95th percentile eigenvalues were considered. This analysis was performed with FACTOR8 (Lorenzo-Seva & Ferrando, 2006). PA suggested the extraction of three factors both when mean percentile was considered and when 95th percentile was considered. This result suggested the three-factor solution was most appropriate.

EFA was hence performed on the first subgroup ($n = 540$) with the number of factors to extract set to three, GEOMIN rotation. Following the criteria stated above, the three-factor solution showed adequate fit indices (CFI = .95, TLI = .93, RMSEA = .07) and all the items substantially (i.e., $\geq .49$) loaded on its own factor, as shown in Table 1. Factor correlations were in the range .22–.54[1].

CFA was then used on the second subgroup ($n = 537$). Consistently with the EFA results, the three-factor model showed a good fit (CFI = .94, TLI = .93, RMSEA = .07) and all the items substantially (i.e., $\geq .52$) loaded on its own factor in the standardized model. Factor correlations were in the range .48–.61. In summary, the results of the

factor analyses showed that the three-factor solution met all the criteria for an adequate fit.

Item Analysis and Reliability
Table 1 also displays the results of item and distribution analyses. Cronbach's alpha showed good reliability for all of the subscales (Pathogen: $\alpha = .80$, Sexual: $\alpha = .87$, Moral: $\alpha = .81$). Corrected item-total correlations were never smaller than .45, and the mean interitem correlation was in the range .36–.49, which are considered adequate values for narrow constructs (Clark & Watson, 1995). In no case was the alpha if item deleted higher than the computed alpha, suggesting that all items contribute to the internal consistency of their subscale.

Construct Validity
It was predicted that the TDDS-Pathogen and the TDDS-Sexual scores would be more strongly correlated with the DPQ, than with the GSQ and the DASS-21 subscale scores. It was also predicted that the TDDS-Moral scores would be more strongly correlated with the GSQ than with all other measures, including the DPQ. We indeed expected that TDDS-Pathogen and—to a lesser extent—TDDS-Sexual scores would be strongly related to other DP measure scores that mainly assess pathogen disgust, while TDDS-Moral scores would be related to GSQ, in that guilt has been conceptualized as a self-conscious moral emotion signaling anticipatory and consequential reactions to the self (Tangney, Stuewig, & Mashek, 2007). There could be an overlap between moral disgust and guilt sensitivity, as being more sensitive to guilt could well leave individuals vulnerable to feeling morally disgusted about themselves. As shown in Table 2, correlation between TDDS-Pathogen and DPQ was .62, whereas correlations between TDDS-Pathogen and other measures ranged from .12 to .26. A z contrast test (Westen & Rosenthal, 2003) was used to compare compare the strengths of the correlations. As expected, TDDS-Pathogen scores were significantly ($z = 19.51$, $p < .001$) more strongly correlated with DP as assessed by the DPQ than with guilt sensitivity, depression, anxiety, and stress. Correlation between the TDDS-Sexual and DPQ was .35, whereas correlations between TDDS-Sexual and other measures ranged from .01 to .23. As expected, TDDS-Sexual scores were significantly ($z = 10.57$, $p < .001$) more strongly correlated with DP as assessed by the DPQ than with guilt sensitivity, depression, anxiety, and stress. Correlation between TDDS-Moral and GSQ was .22, whereas correlations between TDDS-Moral and other measures ranged from −.10 to .19. As expected, TDDS-Moral scores were significantly ($z = 4.94$, $p < .001$) more strongly correlated with guilt sensitivity than with DP as assessed by the DPQ,

---

[1] The table showing the full set of factor loadings and cross-loadings is available as supplemental material for interested investigators.

Table 2
Pearson's Correlations Among the Study 1 Measures (*n* = 1,077)

Measure	1	2	3	4	5	6	7
1. TDDS-Pathogen	-						
2. TDDS-Sexual	.48**	-					
3. TDDS-Moral	.36**	.46**	-				
4. DPQ	.62**	.35**	.19**	-			
5. GSQ	.26**	.23**	.22**	.29**	-		
6. DASS-21-Depression	.12*	.06	-.10*	.17**	.27**	-	
7. DASS-21-Anxiety	.18**	.15**	-.03	.21**	.25**	.69**	-
8. DASS-21-Stress	.15**	.01	-.05	.19**	.23**	.75**	.66**

Note. TDDS = Three Domains of Disgust Scale; DPQ = Disgust Propensity Questionnaire; GSQ = Guilt Sensitivity Questionnaire; DASS-21 = Depression Anxiety Stress Scales–21.
All correlations significant $p < .001$.

depression, anxiety, and stress. These results indicate that the scale has excellent construct validity.

DISCUSSION OF STUDY I

The present study aimed to evaluate the psychometric properties of the Italian version of the TDDS in a community sample, and to replicate its factor structure and reliability as a precursor to the second clinical study. Exploratory and confirmatory factor analyses supported the expected three-factor measurement model of the TDDS items. All of the TDDS subscales also showed good reliability and construct validity, though unexpectedly the correlation between the TDDS-Moral subscale and GS was low, and the TDDS-Pathogen and TDDS-Sexual Disgust subscales actually showed larger correlations with GS than the TDDS-Moral Disgust subscale. This may be due to a limited validity of the Moral Disgust subscale, consistent with Olatunji et al. (2012, 2015). Unfortunately, this study did not assess the temporal stability of the scale nor its sensitivity to change (e.g., in treated patients). Moreover, further studies should confirm the three-factor structure and the construct validity of the scale in clinical samples, although this would require large sample sizes to pursue. Bearing in mind the limitations described above, this study provided evidence that the Italian version of the TDDS retains the sound psychometric properties of the original English-language version and suggests that this measure can be confidently employed in clinical and research settings in which the sexual and moral disgust domains are of interest.

Study 2

MATERIAL AND METHODS

Participants
Initially, 117 patients with OCD were referred to an Italian private center for adult psychotherapy for evaluation and treatment. During the routine assessment phase patients were interviewed by one of the members of the research team (all doctoral-level psychologists experienced in diagnosing psychiatric disorders) using the Anxiety Disorder Interview Schedule IV (ADIS-IV; Brown, Di Nardo, & Barlow, 1994) and the Yale–Brown Obsessive-Compulsive Scale–Second Edition (Y-BOCS-II; Storch et al., 2010; Italian version in Melli, Avallone, et al., 2015) to establish diagnoses. All cases were audio recorded and reviewed in supervision meetings, and all diagnoses were reached by consensus (interrater reliabilities were excellent: ADIS-IV, κ = .92; Y-BOCS-II, ICC = .96). Some participants had one or more current secondary diagnoses, comprising anxiety disorders (social phobia [*n* = 3], panic disorder [*n* = 5], and generalized anxiety disorder [*n* = 10]) and mood disorders (major depressive disorder [*n* = 31]). Potential participants with a secondary or tertiary diagnosis of OCD were excluded (*n* = 7). Five participants were excluded as they were under 18 years old. The presence of psychosis, current mania, and/or substance dependence were other exclusionary criteria (*n* = 2).

The final sample included 103 OCD patients (57.3% males), with a mean age of 32.3 (*SD* = 10.7) years. Of these, 55.3% of the participants had a medium level of education (12–13 years, high school degree), 33.9% had a high level (16+ years, bachelor's degree or Ph.D.), and the remaining 10.8% had a low level (8 or less years, primary or secondary school). Most of the participants were employed (42.8%), 31.1% were undergraduate university students, and the remaining 26.1% were homemakers, unemployed, or retired. Most were single (65.0%), while 31.1% were married or cohabiting, 2.9% were divorced, and 1.0% were widows or widowers. Twenty-nine participants out of 103 reported contamination-related symptoms or concerns as a primary complaint, as determined by the Y-BOCS-II.

Table 3

Descriptive Statistics and Correlations Among the Study Measures in Study 2 (OCD Sample; *n* = 103)

Measure	*M*	*SD*	Range	α	1	2	3	4	5	6
1. TDDS-Pathogen	21.36	9.17	2-42	.80	-					
2. TDDS-Sexual	15.22	10.99	0-42	.85	.51**	-				
3. TDDS-Moral	27.24	9.43	0-42	.83	.22*	.34**	-			
4. OCI-R-Washing	3.50	3.48	0-12	.82	.51**	.33**	.06	-		
5. VOCI-MC	18.74	17.03	0-74	.93	.25*	.48**	.12	.67**	-	
6. BDI-II	21.06	13.87	0-55	.95	.25*	.21*	.19	.16	.28**	-
7. BAI	19.81	12.69	0-53	.92	.08	.20*	.07	.10	.23*	.75**

Note. OCD = obsessive-compulsive disorder; *M* = mean; *SD* = standard deviation; α = Cronbach's alpha; TDDS = Three Domains of Disgust Scale; OCI-R = Obsessive-Compulsive Inventory–Revised; VOCI-MC = Vancouver Obsessional Compulsive Inventory–Mental Contamination scale; BDI-II = Beck Depression Inventory-II; BAI = Beck Anxiety Inventory.
*p < .05, ** p < .001.

Measures

Three Domains of Disgust Scale (TDDS; Tybur et al., 2009). As described above.

Vancouver Obsessional Compulsive Inventory–Mental Contamination scale (VOCI-MC; Rachman, 2006; Radomsky et al., 2014). This 20-item scale assesses MC symptoms. Participants rate each item using a 5-point scale that ranges from 0 (*not at all*) to 4 (*very much*). The original VOCI-MC has shown excellent psychometric properties. The Italian version of the scale has shown a one-factor structure, good internal consistency (α's in the range .85–.95), test–retest reliability (*r* = .88), and construct validity (Melli, Carraresi, Stopani, Radomsky, & Bulli, 2015).

Obsessive-Compulsive Inventory–Revised (OCI-R; Foa et al., 2002). This is a brief, 18-item, self-report questionnaire designed to measure obsessive-compulsive symptom presence and distress on a 5-point Likert scale from 0 (*not at all disturbed*) to 4 (*extremely disturbed*). The OCI-R assesses symptoms in six different dimensions including washing, checking, ordering, obsessing, hoarding, and mental neutralizing (three items each). The Italian version of the OCI-R has been found to have good internal consistency (α = .85), excellent test–retest reliability (*r* = .93) for the total score, adequate internal consistency (α in the range .60–.80), and test–retest reliability (*r* in the range .76–.99) for each subscale (Sica et al., 2009). In the current study, only the Washing subscale was used as a measure of CC symptoms.

Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988). This is a 21-item self-report inventory that assesses the severity of state anxiety. Statement choices are scored from 0 (*not at all*) to 3 (*severely*). The original version has shown good psychometric properties (Beck et al., 1988), and the Italian version has shown a one-factor structure, good internal consistency (α > .80), adequate test–retest reliability (*r* > .62), and good construct validity (Sica & Ghisi, 2007; Sica, Coradeschi, Ghisi, & Sanavio, 2006).

Beck Depression Inventory–II (BDI-II; Beck, Steer, & Brown, 1996). This 21-item self-report inventory is used to assess depressive symptoms over the preceding 2 weeks. Response choices are scored from 0 (*absent*) to 3 (*severe*). The BDI-II has shown good psychometric properties (Beck et al., 1996) and the Italian version of the BDI-II (Ghisi, Flebus, Montano, Sanavio, & Sica, 2006; Sica & Ghisi, 2007) has shown a one-factor structure, adequate internal consistency (α in the range .80–.87), test–retest reliability (*r* = .76), and construct validity.

Procedure

After signing the consent form, participants were given a brief explanation of the study and asked to complete a set of self-report questionnaires that included the aforementioned measures. Questionnaires were presented in a counterbalanced fashion to control for order and sequence effects, and batteries took between 15 and 25 minutes to complete. A research assistant waited until the participant had completed all the questionnaires and provided assistance if the participant did not understand the meaning of any question. No external incentives were offered for participating in this study.

RESULTS

Descriptive Statistics

Mean scores, standard deviations, ranges, and Cronbach's alphas for each measure are reported in Table 3. The sample mean scores on all measures
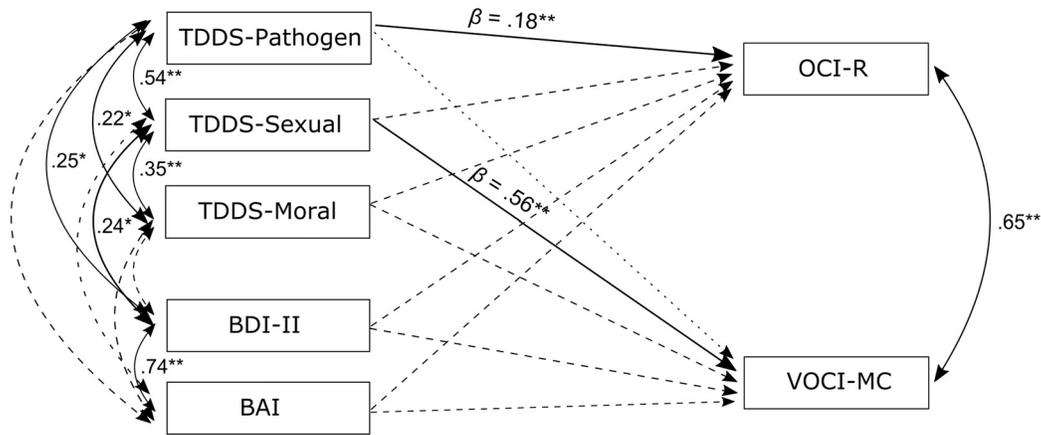
FIGURE 1   Path analytic model (OCD sample; $n = 103$).*Note*. OCD = obsessive-compulsive disorder; TDDS = Three Domains of Disgust Scale; BDI-II = Beck Depression Inventory-II; BAI = Beck Anxiety Inventory; OCI-R = Obsessive-Compulsive Inventory–Revised; VOCI-MC = Vancouver Obsessional Compulsive Inventory–Mental Contamination scale. Dashed lines indicate nonsignificant relationships.*$p < .05$, ** $p < .001$.

fell within the normal range reported in other Italian clinical samples (e.g., Melli, Carraresi, et al., 2015; Sica & Ghisi, 2007). Internal consistency estimates for all measures were good or excellent (all Cronbach's alpha ≥ .80).

Zero-Order Correlations
Table 3 shows the zero-order correlations between the TDDS subscales, the VOCI-MC, the OCI-R, and the other study variables.[2] A z contrast test (Westen & Rosenthal, 2003) was used to compare the strength of the correlations. As expected, we found a strong ($r = .51$) correlation of the TDDS-Pathogen subscale scores with the OCI-R-Washing subscale scores, while the same showed only a weak correlation ($r = .25$) with the VOCI-MC scores, indicating that the relationship between pathogen disgust and CC is significantly stronger ($z = 3.59$, $p < .001$) than the one with MC. Conversely, the correlation between the TDDS-Sexual subscale scores with the VOCI-MC scores ($r = .48$) was significantly stronger ($z = 2.07$, $p < .05$) than the one with the OCI-R-Washing subscale scores ($r = .33$), although they were both moderate in magnitude. As expected, this finding indicates that the role of sexual disgust in MC is significantly more relevant than the same in CC. Unexpectedly, the correlation between the TDDS-Moral subscale scores and both the OCI-R-Washing subscale and the VOCI-MC scores were not significant, indicating that moral disgust did not have the hypothesized role in MC fear. All of the TDDS subscales

showed weak or nonsignificant correlations with both the BDI-II and the BAI.

Path Analysis
A path analytic model was evaluated using Mplus 6.1. Some variables analyzed were slightly non-normally distributed: skewness ranged from −.59 to 1.32, and kurtosis ranged from −.67 to 1.02. To account for this slight violation of normality, the robust maximum likelihood (MLR) estimator was used.

As expected, the TDDS-Pathogen subscale was a unique significant predictor ($\beta = .18$, $p < .001$) of the OCI-R-Washing subscale, when controlling for the effect of depression and anxiety, while it was a nonsignificant predictor of VOCI-MC. Conversely, the TDDS-Sexual subscale was a unique significant predictor ($\beta = .56$, $p < .001$) of the VOCI-MC, when controlling for depression and anxiety, while it was a nonsignificant predictor of the OCI-R-Washing subscale. Unexpectedly, the TDDS-Moral subscale was a nonsignificant predictor of both the contamination fear measures.

These findings support our hypotheses that pathogen disgust has a specific role in CC, while sexual disgust has a specific role in MC. Moral disgust, as assessed by the TDDS, seems not to have the expected significant role in MC.

DISCUSSION OF STUDY 2

To the best of our knowledge, no previous studies to date evaluated the possible differential role of pathogen, sexual, and moral disgust in association with both CC and MC. After validating the Italian version of the TDDS in a large Italian nonclinical sample, we investigated the possibility that disgust

---

[2] The table showing the full set of correlations among the study measures' subscales in Study 2 is available as supplemental material for interested investigators.

domains of the TDDS were able to differentially predict MC and CC fear in a heterogeneous and relatively large clinical OCD sample, using a path analytic approach (see Figure 1). It should be noted that in the path model not only could we control for the effects of the predictors as in a "classical" regression model but also for their indirect effects through the correlations among them and the correlation among criterion variables.

Consistent with our hypothesis, the TDDS-Pathogen subscale scores were moderately correlated with the OCI-R-Washing subscale scores, but only weakly correlated with the VOCI-MC scores, and path analysis revealed that the TDDS-Pathogen subscale was a unique significant predictor of the OCI-R-Washing subscale, over and beyond anxiety and depression. Previous research is in line with our findings as the TDDS-Pathogen subscale has been found to be moderately correlated with the Padua Inventory Contamination Fear subscale (PI-C; Burns et al., 1996) in a nonclinical sample of 206 undergraduate students (Olatunji et al., 2012)—in addition, the DP subscale of the Disgust Propensity and Sensitivity Scale–Revised (DPSS-R; van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006) has been found to be moderately correlated with PI-C in a nonclinical sample of 535 undergraduate students (Olatunji, Cisler, Deacon, Connolly, & Lohr, 2007).

The DPSS-R-DP subscale was also found to be strongly correlated with the VOCI-MC in a sample of 72 adult women with a history of at least one instance of sexual victimization (Badour et al., 2014), while we found only a weak correlation between the TDDS-Pathogen subscale and the VOCI-MC. However, it should be considered that the DPSS-R assesses domain-independent disgust experiences (van Overveld et al., 2006) and that the sample used by Badour and colleagues suffered from sexual victimization while we investigated a sample of OCD patients.

Regarding sexual disgust consistent with our hypothesis, the TDDS-Sexual subscale scores were more strongly correlated with the VOCI-MC scores than with the OCI-R-Washing subscale scores, though both correlations were moderated in magnitude—furthermore, path analysis revealed that the TDDS-Sexual subscale was a unique significant predictor of the VOCI-MC, over and beyond anxiety and depression. Previous research showed that the TDDS-Sexual subscale was weakly correlated with the PI-C (Olatunji et al., 2012), while our results showed a moderate correlation between the TDDS-Sexual subscale and the OCI-R-Washing subscale. This difference in magnitude may be explained by different reasons: (a) we used a heterogeneous

clinical OCD sample instead of a nonclinical sample; (b) taking into account that avoiding infectious disease might also partially shape sexual strategies (Tybur, Inbar, Güler, & Molho, 2015) and the strong correlation we found in our sample between pathogen and sexual subscales (.54), it appears reasonable to hypothesize that increased DP (pathogen) levels may lead to increased levels of sexual disgust as well; and (c) investment in avoiding infectious disease might also partially shape sexual strategies, in that relatively restricted sexual strategies might function to avoid specifically sexually transmitted infections or pathogens that may be transmitted via close contact, though not necessarily genital contact (Tybur et al., 2015).

In accordance with this view, and for the first time, we showed that the TDDS-Sexual subscale scores were moderately correlated with the VOCI-MC scores, and the magnitude of the correlation was significantly stronger than the one between the TDDS-Pathogen subscale scores and the VOCI-MC scores. Previous research demonstrated that DP, assessed by the DPQ (Melli, Chiorri, et al., 2017), was moderately correlated with the VOCI-MC scores in a clinical sample of 63 C-OCD patients (Melli, Bulli, et al., 2014) and in a clinical sample of 168 OCD patients (Melli, Bulli, et al., 2017)—furthermore, the DPSS-R-DP scores were found to be strongly correlated with the VOCI-MC scores in a sample of women who suffered from sexual victimization (Badour et al., 2014). However, in all the aforementioned studies, the authors did not assess the specific domain of sexual disgust that may retain even stronger correlations with the VOCI-MC scores. In addition, Millar, Salkovskis, and Brown (2016) examined the role of CC (e.g., saliva, tongue intrusion) in an imagined betrayal scenario of a nonconsensual kiss, perpetrated by a stranger or by a friend, compared with an imagined betrayal scenario not involving bodily contact (a theft), perpetrated by a stranger or by a friend, in triggering feelings of MC. Although the authors found significantly increased levels of a reported sense of betrayal when the violations where perpetrated by a friend with respect to a stranger, independent of the contact condition, a significant sense of internal dirtiness, with subsequent urges to wash, were present only in the imagined nonconsensual kiss scenario. This may lead to hypothesize that the betrayal scenario of the nonconsensual kiss may trigger the sexual disgust that resulted in feelings of MC and, since the betrayal scenario implied bodily violations, the subsequent feelings of internal dirtiness and urges to wash may be exerted by recruiting pathogen disgust that ultimately leads to washing rituals.

Contrary to our hypothesis, the TDDS-Moral subscale scores were not significantly correlated with the OCI-R-Washing subscale scores or the VOCI-MC scores, and path analysis confirmed that the TDDS-Moral subscale scores were not significant predictors of both measures of contamination fear. Although unexpected, this finding is consistent with a previous study in which the TDDS-Moral subscale scores were not correlated with the PI-C (Olatunji et al., 2012).

It may seem surprising that the TDDS-Moral subscale scores show a nonsignificant correlation with the VOCI-MC scores, since it has been qualitatively reported that MC typically also includes elements or judgments related to morality/immorality (Coughtrey, Shafran, Lee, & Rachman, 2012; Elliott & Radomsky, 2009, 2012). However, these elements pertain to past experiences of violation or to the betrayal of an intimate and trusted relationship (Rachman, 2010; Rachman et al., 2014; Warnock-Parkes, Salkovskis, & Rachman, 2012), and these experiences have not been addressed in any items of the TDDS-Moral subscale. In addition, Russell and Giner-Sorolla (2013) depicted the benefits of distinguishing between bodily violations (disgust expressed when moral codes related to the body are violated) and nonbodily violations (disgust expressed when other moral codes are violated) when investigating moral disgust, since it has been shown that moral disgust is primarily experienced when bodily norms are violated (e.g., sexual taboos, incest, pedophilia). In conditions of nonbodily violations (e.g., deception or betrayal), moral disgust is often associated with anger and it is hard to separate from it (Landy & Piazza, 2017).

The TDDS-Moral subscale mainly describes nonbodily conditions in its items, so a partial overlap between moral disgust and anger may have generated the lack of prediction between the TDDS-Moral subscale and both measures of contamination fear. However, it could be hypothesized that even conditions of nonbodily violations, like betrayal, may be able to evoke MC, as described by Rachman (2010). A trusted and intimate relationship may lead to consensual bodily violations, or involve consensual body intimacy, and these can become distrusted in the act of betrayal; friends may feel that their trust is violated by the actions of another and when this is extreme such betrayal can be perceived as humiliating in ways that could in theory give rise to MC; finally, normal manifestations of MC may also arise as a result of less extreme violations (Radomsky, Coughtrey, Shafran, & Rachman, 2018). Furthermore, the analysis of the correlations among the three disgust

domains of the TDDS and the subscales of the Moral Foundations Questionnaire (MFQ; Graham, Haidt, & Nosek, 2009) revealed that in both the TDDS-Pathogen and the TDDS-Sexual but not the TDDS-Moral subscale, disgust domains were associated only with the moral dimension of purity/sanctity, in accordance with a view in which coming in contact with pathogens or being involved in immoral sexual activities generates a sense of internal dirtiness and impurity (Olatunji, 2008). Unexpectedly, the TDDS-Moral subscale scores were not associated with the moral dimension of purity/sanctity, though the latter identifies the body as "a sacred place that must not be violated by immoral actions." These results may be explained by hypothesizing that tolerable moral violations (e.g., theft, lies, and other nonbodily violations) may be preferentially associated with the moral dimension of harm/care and that suffering such nonbodily moral violations may frequently evoke disgust associated with anger. More severe moral violations (e.g., sexual assault, incest, pedophilia, homophilia, nazism, and other bodily violations) may be preferentially associated with the moral dimension of purity/sanctity and that suffering such bodily violations may preferentially evoke disgust independently of anger (Russell & Giner-Sorolla, 2013). However, these more severe bodily moral violations have not been addressed by the moral subscale of the TDDS and these may partially explain why the TDDS-Moral subscale scores and the VOCI-MC scores were found to be uncorrelated. Nonetheless, it could be hypothesized that witnessing or experiencing sexual disgust-related violations may recruit and strengthen moral disgust, in order to prevent the reexperiencing of sexual disgust—and sexual disgust-related situations—through an appraisal of moral condemnation or self-condemnation. In addition, it has been shown that neural correlations of domains of disgust are distinct but overlapping (Schaich Borg, Lieberman, & Kiehl, 2008; Vicario, Rafal, Martino, & Avenanti, 2017).

To conclude, our study does not support the role of moral disgust in predicting both contact and MC fears in OCD patients, and identified sexual disgust as a unique predictor of MC and pathogen disgust as a unique predictor of CC, over and above anxiety and depression. The following limitations should, however, be considered. (a) Our study is cross-sectional and the specific temporal order of the variables cannot be defined; alternative orders have not been ruled out and it is possible that these relationships are bidirectional in nature. Longitudinal studies are essential in order to draw conclusions about changes occurring within the

individual over time. (b) We did not include a control group. Without a nonclinical control or other psychiatric comparison group, it is impossible to know whether the reported relationships are specifically relevant to OCD. Furthermore, as the subsample of participants who reported contamination-related symptoms as the primary problem was small, we could not appropriately study the relationships of interest in this subgroup. (c) Participants were self-selected; this might limit the generalizability of our conclusions. (d) Disgust and anger have often been found to be evoked together. Future research would benefit from the inclusion of measures of anger in order to disentangle the specific effect of disgust. (e) We included a single OCD symptom measure in our study, the OCI-R (Foa et al., 2002). Future research could replicate our results using other dimensional OCD symptom measures. (f) As a measure that specifically assesses contact (and not mental) contamination does not exist, we used the OCI-R as a measure of CC symptoms. However, two out of three items of the Washing subscale of the OCI-R (Foa et al., 2002) are purely washing questions that do not refer to the trigger—it cannot be ruled out that washing behaviors were elicited by triggers pertaining MC, and not only CC. (g) All of the data were derived from self-report measures—relying exclusively on self-report data tends to inflate associations among variables. (h) In light of the findings of both Study 1 and 2, the TDDS-Moral subscale may retain limited validity since its items mainly pertain to nonbodily violations that tend to evoke moral disgust in association with anger and, in addition, showed weaker correlations with the other TDDS subscales. Overall, this may also represent a potential limitation for the Italian version of the TDDS.

Despite these limitations, our study has the potential to inform both assessment-related and clinical decision making by fostering a better sense of which forms of disgust may be associated with CC vs. MC. Indeed, the sexual (and perhaps moral) themes that are so often associated with MC could be readily assessed via the TDDS and may well help the clinician to explore emotional and cognitive mechanisms associated with different manifestations of contamination fear in OCD. Furthermore, the recurring connection between MC and past traumatic experiences in patients' life events (like sexual assault, humiliation, and betrayal; Rachman, 2010), often related to sexual disgust, suggests the possible integration of approaches typically used in trauma treatment, such as imagery rescripting, or a focus on distinctions between past events and the present, with CBT techniques to reduce feelings of internal uncleanliness. The

potential to elucidate cognitive targets of therapy based on appraisals and beliefs about disgust, betrayal, and other perceived violations is also quite promising. However, further research is needed to examine the underlying mechanisms of these constructs and to apply them in clinical populations to develop novel treatment approaches.

Conflict of Interest Statement

The authors declare that there are no conflicts of interest.

Appendix A. Supplementary Data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.beth.2018.07.006.

References

Abramowitz, J. S., Deacon, B. J., Olatunji, B. O., Wheaton, M. G., Berman, N. C., Losardo, D., & Hale, L. R. (2010). Assessment of obsessive-compulsive symptom dimensions: Development and evaluation of the Dimensional Obsessive-Compulsive Scale. *Psychological Assessment*, 22(1), 180–198. https://doi.org/10.1037/a0018260

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: Author.

American Psychological Association (2010). Ethical principles of psychologists and code of conduct. Retrieved from. http://www.apa.org/ethics/code/principles.pdf.

Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales in clinical groups and a community sample. *Psychological Assessment*, 10(2), 176–181. https://doi.org/10.1037/1040-3590.10.2.176

Badour, C. L., Feldner, M. T., Babson, K. A., Blumenthal, H., & Dutton, C. E. (2013). Disgust, mental contamination, and posttraumatic stress: Unique relations following sexual versus non-sexual assault. *Journal of Anxiety Disorders*, 27(1), 155–162. https://doi.org/10.1016/j.janxdis.2012.11.002

Badour, C. L., Ojserkis, R., McKay, D., & Feldner, M. T. (2014). Disgust as a unique affective predictor of mental contamination following sexual trauma. *Journal of Anxiety Disorders*, 28(7), 704–711. https://doi.org/10.1016/j.janxdis.2014.07.007

Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology*, 56(6), 893–897. https://doi.org/10.1037/0022-006X.56.6.893

Beck, A. T., Steer, R. A., & Brown, G. (1996). *Manual for the Beck Depression Inventory–II*. San Antonio, TX: Psychological Corporation.

Behling, O., & Law, K. S. (2000). *Translating questionnaires and other research instruments: Problems and solutions*. Thousand Oaks, CA: Sage. https://doi.org/10.4135/9781412986373

Bloch, M. H., Landeros-Weisenberger, A., Rosario, M. C., Pittenger, C., & Leckman, J. F. (2008). Meta-analysis of the symptom structure of obsessive-compulsive disorder.

American Journal of Psychiatry, *165*(12), 1532–1542. https://doi.org/10.1176/appi.ajp.2008.08020320

Borg, C., de Jong, P. J., & Schultz, W. W. (2010). Vaginismus and dyspareunia: Automatic vs. deliberate disgust responsivity. *Journal of Sexual Medicine*, *7*(6), 2149–2157. https://doi.org/10.1111/j.1743-6109.2010.01800.x

Bottesi, G., Ghisi, M., Altoè, G., Conforti, E., Melli, G., & Sica, C. (2015). The Italian version of the Depression Anxiety Stress Scales–21: Factor structure and psychometric properties on community and clinical samples. *Comprehensive Psychiatry*, *60*, 170–181. https://doi.org/10.1016/j.comppsych.2015.04.005

Brown, T. A., Di Nardo, P., & Barlow, D. H. (1994). *Anxiety Disorders Interview Schedule Adult Version (ADIS-IV): Client interview schedule*. San Antonio, TX: Psychological Corporation.

Buja, A., & Eyuboglu, N. (1992). Remarks on parallel analysis. *Multivariate Behavioral Research*, *27*(4), 509–540. https://doi.org/10.1207/s15327906mbr2704_2

Burns, G. L., Keortge, S. G., Formea, G. M., & Sternberger, L. G. (1996). Revision of the Padua Inventory of Obsessive Compulsive Disorder Symptoms: Distinctions between worry, obsessions, and compulsions. *Behaviour Research and Therapy*, *34*(2), 163–173. https://doi.org/10.1016/0005-7967(95)00035-6

Cannon, P. R., Schnall, S., & White, M. (2011). Transgressions and expressions: Affective facial muscle activity predicts moral judgments. *Social Psychological and Personality Science*, *2*(3), 325–331. https://doi.org/10.1177/1948550610390525

Carraresi, C., Bulli, F., Melli, G., & Stopani, E. (2013). Mental contamination in OCD: Its role in the relationship between disgust propensity and fear of contamination. *Clinical Neuropsychiatry*, *10*(3, Suppl. 1), 13–19.

Clara, I. P., Enns, M. W., & Cox, B. J. (2001). Confirmatory factor analysis of the Depression–Anxiety–Stress Scales in Depressed and Anxious Patients. *Journal of Psychopathology and Behavioral Assessment*, *23*(1), 61–67. https://doi.org/10.1023/A:1011095624717

Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological Assessment*, *7*(3), 309–319. https://doi.org/10.1037//1040-3590.7.3.309

Coughtrey, A. E., Shafran, R., Lee, M., & Rachman, S. (2012). It's the feeling inside my head: A qualitative analysis of mental contamination in obsessive-compulsive disorder. *Behavioural and Cognitive Psychotherapy*, *40*(2), 163–173. https://doi.org/10.1017/S1352465811000658

Curtis, V., de Barra, M., & Aunger, R. (2011). Disgust as an adaptive system for disease avoidance behaviour. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, *366*(1563), 389–401. https://doi.org/10.1098/rstb.2010.0117

Davey, G. C. L. (1994). Self-reported fears to common indigenous animals in an adult UK population: The role of disgust sensitivity. *British Journal of Psychology*, *85*(4), 541–554. https://doi.org/10.1111/j.2044-8295.1994.tb02540.x

David, B., Olatunji, B. O., Armstrong, T., Ciesielski, B. G., Bondy, C. L., & Broman-Fulks, J. (2009). Incremental specificity of disgust sensitivity in the prediction of obsessive-compulsive disorder symptoms: Cross-sectional and prospective approaches. *Journal of Behavior Therapy and Experimental Psychiatry*, *40*(4), 533–543. https://doi.org/10.1016/j.jbtep.2009.07.004

de Jong, P. J., & Borg, C. (2015). Self-directed disgust: Reciprocal relationships with sex and sexual dysfunction.

In P. A. Powell, P. G. Overton, & J. Simpson (Eds.), *The revolting self: Perspectives on the psychological and clinical implications of self-directed disgust* (pp. 89–112). London, UK: Karnak Books.

Elliott, C. M., & Radomsky, A. S. (2009). Analyses of mental contamination: Part I. Experimental manipulations of morality. *Behaviour Research and Therapy*, *47*(12), 995–1003. https://doi.org/10.1016/j.brat.2009.03.004

Elliott, C. M., & Radomsky, A. S. (2012). Mental contamination: The effects of imagined physical dirt and immoral behaviour. *Behaviour Research and Therapy*, *50*(6), 422–427. https://doi.org/10.1016/j.brat.2012.03.007

Fairbrother, N., Newth, S. J., & Rachman, S. J. (2005). Mental pollution: Feelings of dirtiness without physical contact. *Behaviour Research and Therapy*, *43*(1), 121–130. https://doi.org/10.1016/j.brat.2003.12.005

Fairbrother, N., & Rachman, S. (2004). Feelings of mental pollution subsequent to sexual assault. *Behaviour Research and Therapy*, *42*(2), 173–189. https://doi.org/10.1016/S0005-7967(03)00108-6

Foa, E. B., Huppert, J. D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G., & Salkovskis, P. M. (2002). The Obsessive-Compulsive Inventory: Development and validation of a short version. *Psychological Assessment*, *14*(4), 485–496. https://doi.org/10.1037/1040-3590.14.4.485

Foa, E. B., Kozak, M. J., Goodman, W. K., Hollander, E., Jenike, M. A., & Rasmussen, S. A. (1995). DSM-IV field trial: Obsessive-compulsive disorder. *American Journal of Psychiatry*, *152*(1), 90–96. https://doi.org/10.1176/ajp.152.1.90

Ghisi, M., Flebus, G. B., Montano, A., Sanavio, E., & Sica, C. (2006). *Beck Depression Inventory*. Firenze, Italy: Organizzazioni Speciali.

Graham, J., Haidt, J., & Nosek, B. A. (2009). Liberals and conservatives rely on different sets of moral foundations. *Journal of Personality and Social Psychology*, *96*(5), 1029–1046. https://doi.org/10.1037/a0015141

Haidt, J., McCauley, C., & Rozin, P. (1994). Individual differences in sensitivity to disgust: A scale sampling seven domains of disgust elicitors. *Personality and Individual Differences*, *16*(5), 701–713. https://doi.org/10.1016/0191-8869(94)90212-7

Herba, J. K., & Rachman, S. J. (2007). Vulnerability to mental contamination. *Behaviour Research and Therapy*, *45*(11), 2804–2812. https://doi.org/10.1016/j.brat.2007.07.010

Jan Ejsmond, M., Radwan, J., & Wilson, A. B. (2014). Sexual selection and the evolutionary dynamics of the major histocompatibility complex. *Proceedings of the Royal Society B: Biological Sciences*, *281*(1796), 20141662. https://doi.org/10.1098/rspb.2014.1662

Koukounas, E., & McCabe, M. (1997). Sexual and emotional variables influencing sexual response to erotica. *Behaviour Research and Therapy*, *35*(3), 221–230. https://doi.org/10.1016/S0005-7967(96)00097-6

Landy, J. F., & Piazza, J. (2017). Reevaluating moral disgust: Sensitivity to many affective states predicts extremity in many evaluative judgments. *Social Psychological and Personality Science*. https://doi.org/10.1177/1948550617736110

Longman, R. S., Cota, A. A., Holden, R. R., & Fekken, G. C. (1989). A regression equation for the parallel analysis criterion in principal components analysis: Mean and 95th percentile eigenvalues. *Multivariate Behavioral Research*, *24*(1), 59–69. https://doi.org/10.1207/s15327906mbr2401_4

Lorenzo-Seva, U., & Ferrando, P. J. (2006). FACTOR: A computer program to fit the exploratory factor analysis

model. *Behavior Research Methods*, *38*(1), 88–91. https://doi.org/10.3758/BF03192753

Lovibond, S. H., & Lovibond, P. F. (1995). *Manual for the Depression Anxiety Stress Scales* (2nd ed.). Sydney, Australia: Psychology Foundation.

Marsh, H. W., Wen, Z., & Hau, K. T. (2004). Structural equation models of latent interactions: Evaluation of alternative estimation strategies and indicator construction. *Psychological Methods*, *9*(3), 275–300. https://doi.org/10.1037/1082-989X.9.3.275

Melli, G., Avallone, E., Moulding, R., Pinto, A., Micheli, E., & Carraresi, C. (2015). Validation of the Italian version of the Yale–Brown Obsessive Compulsive Scale–Second Edition (Y-BOCS-II) in a clinical sample. *Comprehensive Psychiatry*, *60*, 86–92. https://doi.org/10.1016/j.comppsych.2015.03.005

Melli, G., Bulli, F., Carraresi, C., & Stopani, E. (2014). Disgust propensity and contamination-related OCD symptoms: The mediating role of mental contamination. *Journal of Obsessive-Compulsive and Related Disorders*, *3*(2), 77–82. https://doi.org/10.1016/j.jocrd.2014.01.002

Melli, G., Bulli, F., Carraresi, C., Tarantino, F., Gelli, S., & Poli, A. (2017). The differential relationship between mental contamination and the core dimensions of contact contamination fear. *Journal of Anxiety Disorders*, *45*, 9–16. https://doi.org/10.1016/j.janxdis.2016.11.005

Melli, G., Carraresi, C., Poli, A., Marazziti, D., & Pinto, A. (2017). The role of guilt sensitivity in OCD symptom dimensions. *Clinical Psychology and Psychotherapy*, *24*(5), 1079–1089. https://doi.org/10.1002/cpp.2071

Melli, G., Carraresi, C., Stopani, E., Radomsky, A. S., & Bulli, F. (2015). Factor structure and temporal stability of the Vancouver Obsessional Compulsive Inventory–Mental Contamination Scale (VOCI-MC) and psychometric properties of its Italian version. *Comprehensive Psychiatry*, *58*, 198–204. https://doi.org/10.1016/j.comppsych.2014.12.017

Melli, G., Chiorri, C., Bulli, F., Carraresi, C., Stopani, E., & Abramowitz, J. (2014). Factor congruence and psychometric properties of the Italian version of the Dimensional Obsessive-Compulsive Scale (DOCS) across non-clinical and clinical samples. *Journal of Psychopathology and Behavioral Assessment*, *37*(2), 329–339. https://doi.org/10.1007/s10862-014-9450-1

Melli, G., Chiorri, C., Carraresi, C., Stopani, E., & Bulli, F. (2015). The role of disgust propensity and trait guilt in OCD symptoms: A multiple regression model in a clinical sample. *Journal of Obsessive-Compulsive and Related Disorders*, *5*, 43–48. https://doi.org/10.1016/j.jocrd.2015.01.007

Melli, G., Chiorri, C., & Smurra, R. (2013). Further revision and psychometric properties of an Italian version of the Disgust Scale–Revised. *Psicoterapia Cognitiva E Comportamentale*, *19*, 63–93.

Melli, G., Chiorri, C., Stopani, E., Bulli, F., & Carraresi, C. (2017). Development and validation of a new Italian short measure of disgust propensity: The Disgust Propensity Questionnaire (DPQ). *Clinical Psychology and Psychotherapy*, *24*(5), 1189–1204. https://doi.org/10.1002/cpp.2073

Melli, G., Moulding, R., & Poli, A. (2016). Is it more disgusting if I think about it? Examining the interaction of obsessive beliefs and disgust propensity in clinical obsessive-compulsive disorder. *Journal of Obsessive-Compulsive and Related Disorders*, *11*, 74–81. https://doi.org/10.1016/j.jocrd.2016.09.001

Millar, J. F. A., Salkovskis, P. M., & Brown, C. (2016). Mental contamination in the "dirty kiss": Imaginal betrayal or bodily fluids? *Journal of Obsessive-Compulsive and Related Disorders*, *8*, 70–74. https://doi.org/10.1016/j.jocrd.2015.12.004

Muthén, B., duToit, S. H. C., & Spisic, D. (1997). *Robust inference using weighted least squares and quadratic estimating equations in latent variable modeling with categorical and continuous outcomes*. Unpublished technical report.

Muthén, B., & Kaplan, D. (1985). A comparison of some methodologies for the factor analysis of non-normal Likert variables. *British Journal of Mathematical and Statistical Psychology*, *38*(2), 171–189. https://doi.org/10.1111/j.2044-8317.1985.tb00832.x

Nedeljkovic, M., Moulding, R., Foroughi, E., Kyrios, M., & Doron, G. (2012). Cultural issues in understanding and treating obsessive compulsive and spectrum disorders. In G. Steketee (Ed.), *The Oxford handbook of obsessive compulsive and spectrum disorders* (pp. 1–66). Oxford, UK: Oxford University Press. https://doi.org/10.1093/oxfordhb/9780195376210.013.0102

Oaten, M., Stevenson, R. J., & Case, T. I. (2009). Disgust as a disease-avoidance mechanism. *Psychological Bulletin*, *135* (2), 303–321. https://doi.org/10.1037/a0014823

Olatunji, B. O. (2008). Disgust, scrupulosity and conservative attitudes about sex: Evidence for a mediational model of homophobia. *Journal of Research in Personality*, *42*(5), 1364–1369. https://doi.org/10.1016/j.jrp.2008.04.001

Olatunji, B. O., Adams, T., Ciesielski, B., David, B., Sarawgi, S., & Broman-Fulks, J. (2012). The Three Domains of Disgust Scale: Factor structure, psychometric properties, and conceptual limitations. *Assessment*, *19*(2), 205–225. https://doi.org/10.1177/1073191111432881

Olatunji, B. O., Cisler, J. M., Deacon, B. J., Connolly, K., & Lohr, J. M. (2007). The Disgust Propensity and Sensitivity Scale–Revised: Psychometric properties and specificity in relation to anxiety disorder symptoms. *Journal of Anxiety Disorders*, *21*(7), 918–930. https://doi.org/10.1016/j.janxdis.2006.12.005

Olatunji, B. O., Ebesutani, C., & Kim, E. H. (2015). Examination of a bifactor model of the Three Domains of Disgust Scale: Specificity in relation to obsessive-compulsive symptoms. *Psychological Assessment*, *27*(1), 102–113. https://doi.org/10.1037/pas0000039

Olatunji, B. O., Lohr, J. M., Williams, N. L., Tolin, D. F., Abramowitz, J. S., Sawchuk, C. N., & Elwood, L. S. (2007). The Disgust Scale: Item analysis, factor structure, and suggestions for refinement. *Psychological Assessment*, *19* (3), 281–297. https://doi.org/10.1037/1040-3590.19.3.281

Olatunji, B. O., Moretz, M. W., Wolitzky-Taylor, K. B., McKay, D., McGrath, P. B., & Ciesielski, B. G. (2010). Disgust vulnerability and symptoms of contamination-based OCD: Descriptive tests of incremental specificity. *Behavior Therapy*, *41*(4), 475–490. https://doi.org/10.1016/j.beth.2009.11.005

Olatunji, B. O., & Sawchuk, C. N. (2005). Disgust: Characteristic features, social manifestations, and clinical implications. *Journal of Social and Clinical Psychology*, *24*(7), 932–962. https://doi.org/10.1521/jscp.2005.24.7.932

Olatunji, B. O., Sawchuk, C. N., Lohr, J. M., & de Jong, P. J. (2004). Disgust domains in the prediction of contamination fear. *Behaviour Research and Therapy*, *42*(1), 93–104. https://doi.org/10.1016/S0005-7967(03)00102-5

Olatunji, B. O., Williams, N. L., Lohr, J. M., & Sawchuk, C. N. (2005). The structure of disgust: Domain specificity in relation to contamination ideation and excessive washing. *Behaviour Research and Therapy*, *43*(8), 1069–1086. https://doi.org/10.1016/j.brat.2004.08.002

Rachman, S. J. (2004). Fear of contamination. *Behaviour Research and Therapy*, 42(11), 1227–1255. https://doi.org/10.1016/j.brat.2003.10.009

Rachman, S. J. (2006). *The fear of contamination: Assessment and treatment*. New York, NY: Oxford University Press. https://doi.org/10.1093/med:psych/9780199296934.001.0001

Rachman, S. J. (2010). Betrayal: A psychological analysis. *Behaviour Research and Therapy*, 48(4), 304–311. https://doi.org/10.1016/j.brat.2009.12.002

Rachman, S., Coughtrey, A., Shafran, R., & Radomsky, A. (2014). *Oxford guide to the treatment of mental contamination*. Oxford, UK: Oxford University Press. https://doi.org/10.1093/med:psych/9780198727248.001.0001

Rachman, S. J., Radomsky, A. S., Elliott, C. M., & Zysk, E. (2012). Mental contamination: The perpetrator effect. *Journal of Behavior Therapy and Experimental Psychiatry*, 43(1), 587–593. https://doi.org/10.1016/j.jbtep.2011.08.002

Radomsky, A. S., Coughtrey, A., Shafran, R., & Rachman, S. (2018). Abnormal and normal mental contamination. *Journal of Obsessive-Compulsive and Related Disorders*, 17, 46–51. https://doi.org/10.1016/j.jocrd.2017.08.011

Radomsky, A. S., & Elliott, C. M. (2009). Analyses of mental contamination: Part II. Individual differences. *Behaviour Research and Therapy*, 47(12), 1004–1011. https://doi.org/10.1016/j.brat.2009.08.004

Radomsky, A. S., Rachman, S. J., Shafran, R., Coughtrey, A. E., & Barber, K. C. (2014). The nature and assessment of mental contamination: A psychometric analysis. *Journal of Obsessive-Compulsive and Related Disorders*, 3(2), 181–187. https://doi.org/10.1016/j.jocrd.2013.08.003

Rasmussen, S. A., & Eisen, J. L. (1992). The epidemiology and clinical features of obsessive compulsive disorder. *Psychiatric Clinics of North America*, 15(4), 743–758.

Rozin, P., Haidt, J., & McCauley, C. R. (2016). Disgust. In L. F. Barrett, M. Lewis, & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (pp. 815–834). (4th ed.). New York, NY: Guilford Press.

Russell, P. S., & Giner-Sorolla, R. (2013). Bodily moral disgust: What it is, how it is different from anger, and why it is an unreasoned emotion. *Psychological Bulletin*, 139(2), 328–351. https://doi.org/10.1037/a0029319

Schaich Borg, J., Lieberman, D., & Kiehl, K. A. (2008). Infection, incest, and iniquity: Investigating the neural correlates of disgust and morality. *Journal of Cognitive Neuroscience*, 20(9), 1529–1546. https://doi.org/10.1162/jocn.2008.20109

Schienle, A., Stark, R., Walter, B., & Vaitl, D. (2003). The connection between disgust sensitivity and blood-related fears, faintness symptoms, and obsessive-compulsiveness in a nonclinical sample. *Anxiety, Stress and Coping*, 16(2), 185–193. https://doi.org/10.1080/10615806.2003.10382972

Sica, C., Coradeschi, D., Ghisi, M., & Sanavio, E. (2006). *Beck Anxiety Inventory (BAI): Manuale*. Firenze, Italy: Organizzazioni Speciali.

Sica, C., & Ghisi, M. (2007). The Italian versions of the Beck Anxiety Inventory and the Beck Depression Inventory–II: Psychometric properties and discriminant power. In M. A. Lange (Ed.), *Leading-edge psychological tests and testing research* (pp. 27–50). Hauppauge, NY: Nova Science.

Sica, C., Ghisi, M., Altoè, G., Chiri, L. R., Franceschini, S., Coradeschi, D., & Melli, G. (2009). The Italian version of the Obsessive Compulsive Inventory: Its psychometric properties on community and clinical samples. *Journal of Anxiety Disorders*, 23(2), 204–211. https://doi.org/10.1016/j.janxdis.2008.07.001

Storch, E. A., Rasmussen, S. A., Price, L. H., Larson, M. J., Murphy, T. K., & Goodman, W. K. (2010). Development and psychometric evaluation of the Yale–Brown Obsessive-Compulsive Scale–Second Edition. *Psychological Assessment*, 22(2), 223–232. https://doi.org/10.1037/a0018492

Tangney, J. P., Stuewig, J., & Mashek, D. J. (2007). Moral emotions and moral behavior. *Annual Review of Psychology*, 58(1), 345–372. https://doi.org/10.1146/annurev.psych.56.091103.070145

Thornhill, R., & Gangestad, S. W. (2006). Facial sexual dimorphism, developmental stability, and susceptibility to disease in men and women. *Evolution and Human Behavior*, 27(2), 131–144. https://doi.org/10.1016/j.evolhumbehav.2005.06.001

Timmerman, M. E., & Lorenzo-Seva, U. (2011). Dimensionality assessment of ordered polytomous items with parallel analysis. *Psychological Methods*, 16(2), 209–220. https://doi.org/10.1037/a0023353

Travis, R., & Fergus, T. A. (2015). The potentiating effect of disgust sensitivity on the relationship between disgust propensity and mental contamination. *Journal of Obsessive-Compulsive and Related Disorders*, 6, 114–119. https://doi.org/10.1016/j.jocrd.2015.06.007

Tybur, J. M., Inbar, Y., Güler, E., & Molho, C. (2015). Is the relationship between pathogen avoidance and ideological conservatism explained by sexual strategies? *Evolution and Human Behavior*, 36(6), 489–497. https://doi.org/10.1016/j.evolhumbehav.2015.01.006

Tybur, J. M., Lieberman, D., & Griskevicius, V. (2009). Microbes, mating, and morality: Individual differences in three functional domains of disgust. *Journal of Personality and Social Psychology*, 97(1), 103–122. https://doi.org/10.1037/a0015474

Tybur, J. M., Lieberman, D., Kurzban, R., & DeScioli, P. (2013). Disgust: Evolved function and structure. *Psychological Review*, 120(1), 65–84. https://doi.org/10.1037/a0030778

van Overveld, W. J. M., de Jong, P. J., Peters, M. L., Cavanagh, K., & Davey, G. C. L. (2006). Disgust propensity and disgust sensitivity: Separate constructs that are differentially related to specific fears. *Personality and Individual Differences*, 41(7), 1241–1252. https://doi.org/10.1016/j.paid.2006.04.021

Vicario, C. M., Rafal, R. D., Martino, D., & Avenanti, A. (2017). Core, social and moral disgust are bounded: A review on behavioral and neural bases of repugnance in clinical disorders. *Neuroscience and Biobehavioral Reviews*, 80, 185–200. https://doi.org/10.1016/j.neubiorev.2017.05.008

Warnock-Parkes, E., Salkovskis, P. M., & Rachman, J. (2012). When the problem is beneath the surface in OCD: The cognitive treatment of a case of pure mental contamination. *Behavioural and Cognitive Psychotherapy*, 40(4), 383–399. https://doi.org/10.1017/S1352465812000252

Westen, D., & Rosenthal, R. (2003). Quantifying construct validity: Two simple measures. *Journal of Personality and Social Psychology*, 84(3), 608–618.

Wheatley, T., & Haidt, J. (2005). Hypnotic disgust makes moral judgments more severe. *Psychological Science*, 16(10), 780–784. https://doi.org/10.1111/j.1467-9280.2005.01614.x

Zhang, J., Zheng, L., & Zheng, Y. (2017). Moral and sexual disgust suppress sexual risk behaviors among men who have sex with men in China. *Frontiers in Psychology*, 7, 2045. https://doi.org/10.3389/fpsyg.2016.02045