

# The Disgust Scale: Item Analysis, Factor Structure, and Suggestions for Refinement

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In the 4 studies presented ( $N = 1,939$ ), a converging set of analyses was conducted to evaluate the item adequacy, factor structure, reliability, and validity of the Disgust Scale (DS; J. Haidt, C. McCauley, & P. Rozin, 1994). The results suggest that 7 items (i.e., Items 2, 7, 8, 21, 23, 24, and 25) should be considered for removal from the DS. Secondary to removing the items, exploratory and confirmatory factor analyses revealed that the DS taps 3 dimensions of disgust: Core Disgust, Animal Reminder Disgust, and Contamination-Based Disgust. Women scored higher than men on the 3 disgust dimensions. Structural modeling provided support for the specificity of the 3-factor model, as Core Disgust and Contamination-Based Disgust were significantly predictive of obsessive–compulsive disorder (OCD) concerns, whereas Animal Reminder Disgust was not. Results from a clinical sample indicated that patients with OCD washing concerns scored significantly higher than patients with OCD without washing concerns on both Core Disgust and Contamination-Based Disgust, but not on Animal Reminder Disgust. These findings are discussed in the context of the refinement of the DS to promote a more psychometrically sound assessment of disgust sensitivity.

*Keywords:* Disgust Scale, disgust sensitivity, obsessive–compulsive disorder, factor analysis

Disgust is a basic emotion with distinct behavioral, cognitive, and physiological dimensions (e.g., Levenson, 1992) that functions to prevent contamination and disease (Woody & Teachman, 2000). Earlier definitions considered the experience of disgust as primarily a revulsion response to distasteful foods (Darwin, 1872/1965). However, more contemporary accounts consider disgust to be a basic response to a wide range of stimuli that may communicate uncleanliness, contamination, and the potential for disease (Rozin, Haidt, & McCauley, 2000). Accordingly, there has been emerging research interest in the role of disgust in the etiology of various anxiety disorders (Olatunji & Sawchuk, 2005). This interest stems from the observation that the primary function of disgust is to

protect the self from physical and psychological contamination (Matchett & Davey, 1991; Rozin et al., 2000; Woody & Teachman, 2000), and the assessment of disgust in various anxiety-related disorders offers new theoretical and empirical directions beyond the traditional emphasis on fear (Rachman, 1990). The experience of disgust appears to exist on a continuum in which individual differences may be observed (Haidt, McCauley, & Rozin, 1994). It has been proposed that the experience of disgust may also consist of both “state” and “trait” components in a similar fashion to anxiety (Woody & Tolin, 2002). Drawing from prior work (e.g., Spielberger, 1972), we define *state disgust* as aversion during exposure to disgust-relevant stimuli. *Trait disgust* may reflect the existence of stable individual differences in the tendency to respond with state disgust in anticipation of aversive stimuli.

The Disgust Scale (DS; Haidt et al., 1994) was developed to function as a reliable measure of individual differences in disgust sensitivity and is the most widely used disgust measure to date (Olatunji & Sawchuk, 2005). Although the available data are limited, the term *disgust sensitivity* was defined as a predisposition to experiencing disgust in response to a wide array of aversive stimuli (de Jong & Merckelbach, 1998). The predisposition has also been conceptualized as a risk factor for various anxiety conditions (Olatunji & Sawchuk, 2005). The notion that the DS is

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potentially a measure of risk does provide some rationale for the conceptualization of the DS as a measure of trait disgust. However, the DS is context dependent in that it samples specific objects and/or situations in which individual differences in disgust responding may be observed. Thus, the measure may be best conceptualized as a context-dependent measure of disgust. Specifically, the DS is a 32-item measure of how disgusting particular experiences would be, and it assesses eight domains of disgust sensitivity, including the following: (a) Food (food that has spoiled, is culturally unacceptable, or has been fouled in some way); (b) Animals (animals that are slimy or live in dirty conditions); (c) Body Products (body products including body odors and feces, mucus, etc.); (d) Body Envelope Violations (body envelope violations or mutilation of the body); (e) Death (death and dead bodies); (f) Sex (sex involving culturally deviant sexual behavior); (g) Hygiene (violations of culturally expected hygiene practices); and (h) Sympathetic Magic (which involves stimuli without infectious qualities that either resemble contaminants—e.g., feces-shaped candy—or were once in contact with contaminants—e.g., a sweater worn by an ill person).

The DS has been the measure of choice in numerous studies examining the role of disgust sensitivity in the anxiety disorders (Olatunji & Sawchuk, 2005). Such studies have demonstrated that individuals with spider phobia respond with both fear and disgust to phobia-relevant stimuli (Tolin, Lohr, Sawchuk, & Lee, 1997). Furthermore, it has been shown that during exposure to spiders, spider-fearful individuals respond with greater disgust-specific facial electromyography activity than do nonfearful individuals (de Jong, Peters, & Vanderhallen, 2002). It has also been demonstrated that the fear of contamination is a better predictor of spider fear than the fear of physical harm (de Jong & Muris, 2002). Studies have also shown that individuals with blood-injection-injury (BII) phobia report more disgust than fear when exposed to phobia-relevant stimuli than do nonphobic individuals (Olatunji, Lohr, Sawchuk, & Westendorf, 2005; Sawchuk, Lohr, Westendorf, Meunier, & Tolin, 2002). Evidence for the role of disgust in BII phobia has also been found in psychophysiological (Page, 2003) and information-processing-bias studies (Sawchuk, Lohr, Lee, & Tolin, 1999). Evidence has also emerged implicating disgust in obsessive-compulsive disorder (OCD; Olatunji, Sawchuk, Lohr, & de Jong, 2004; Olatunji, Tolin, Huppert, & Lohr, 2005; Schienle, Stark, Walter, & Vaitl, 2003) and eating disorders (Davey, Buckland, Tantow, & Dallos, 1998).

The DS has been used in a variety of nonclinical (Olatunji et al., 2004), analogue (e.g., Sawchuk et al., 2002), clinical (e.g., Woody & Tolin, 2002), and cross-cultural research (e.g., Olatunji, Sawchuk, de Jong, & Lohr, 2006). However, the use of the measure in the context of anxiety research continues to grow in the absence of a comprehensive examination of the measurement properties of the DS. In fact, Haidt et al. (1994) provided the only comprehensive examination of the factor structure and psychometric properties of the original English version of the DS. Haidt et al. reported an eight-factor latent structure of the DS. However, inadequate coefficient Cronbach alpha estimates were found for each of the eight factors in two independent samples (Food,  $\alpha = .34, .27$ ; Animals,  $\alpha = .47, .45$ ; Body Products,  $\alpha = .55, .49$ ; Sex,  $\alpha = .51, .52$ ; Body Envelope Violations,  $\alpha = .60, .63$ ; Death,  $\alpha = .59, .61$ ; Hygiene,  $\alpha = .46, .42$ ; and Sympathetic Magic,  $\alpha = .44, .45$ ). Inadequate Cronbach's alpha estimates have also been reported for the eight

subscales in a German version of the DS (Food,  $\alpha = .26$ ; Animals,  $\alpha = .46$ ; Body Products,  $\alpha = .45$ ; Sex,  $\alpha = .52$ ; Body Envelope Violations,  $\alpha = .48$ ; Death,  $\alpha = .64$ ; Hygiene,  $\alpha = .30$ ; and Sympathetic Magic,  $\alpha = .30$ ; Schienle et al., 2003). In a recent psychometric evaluation of a Swedish version of the DS, confirmatory factor analysis (CFA) of the eight-factor model reported by Haidt et al. provided satisfactory fit to the data and was significantly better than the one-factor or five-factor models (Björklund & Hursti, 2004).

Rozin et al. (2000) proposed a two-factor model of disgust consisting of Core Disgust and Animal Reminder Disgust. Core Disgust is based on a sense of offensiveness and the threat of contamination. Animal Reminder Disgust reflects the aversion of stimuli that serve as reminders of the animal origins of humans. A recent study found that Rozin et al.'s two-factor model of disgust demonstrated superior model fit over a unitary model of disgust (Olatunji, Williams, Lohr, & Sawchuk, 2005). Prior research has also provided evidence for the utility of the two-factor model, in that animal fears and contamination-related OCD appear to be specifically related to Core Disgust, whereas BII fears share a specific relation with Animal Reminder Disgust (de Jong & Merckelbach, 1998; Olatunji, Williams, et al., 2005). Although a more parsimonious account of the factor structure of the DS would suggest a two-factor model similar to Rozin et al.'s model, empirical support has been reported only for the eight-factor model (e.g., Björklund & Hursti, 2004). However, it is possible that some of the confusion regarding the factor structure of the DS has likely arisen from the inclusion of potentially inadequate items; items that detract from performance of the DS may well load as separate factors. A second possibility for equivocal factor structure results is that past research has used normal-theory estimation procedures without consideration for the distributional properties of the DS. When applied to nonnormal data, as appears to be the case with the DS, such factor analytic techniques (i.e., maximum-likelihood estimation, principal-components analysis, factor analysis of a standard covariance matrix or matrix of Pearson product-moment correlations) are likely to lead to biased model fit statistics, negatively biased parameter estimates, and extraction of spurious factors (e.g., Bollen, 1989; Flora & Curran, 2004).

In the present set of studies we attempted to overcome limitations of previous psychometric evaluations of the DS. Four studies are presented to provide a comprehensive assessment of the adequacy of the 32-item DS and its factor structure, with an emphasis on recommendations for refinement of this measure. The first three studies used independent samples of nonclinical college student participants, and the final study used a clinical sample. In Study 1, we conducted a comprehensive assessment of the psychometric properties of the 32-item DS and examined the factor structure of DS using a distribution-free, exploratory approach. In Study 2, we performed a CFA of a revised version of the DS (i.e., having removed items with poor psychometric properties or that demonstrate redundancy). In Study 3, we assessed the validity of a stand-alone version of the revised DS and compared the revised and original versions of the scale. Finally, in Study 4, we examined the reliability and validity of the revised DS and its subscales in a clinical sample of patients with OCD with and without washing concerns and nonanxious community participants.

## Study 1

The primary goals of Study 1 were to assess the psychometric properties and examine the factor structure of the 32-item DS. Psychometric evaluation of the DS was initiated with examination of the distributional properties and response frequencies, as well as the corrected item-to-scale correlations for each item. The distributional properties of each DS item were also examined to assess the extent to which these items could be factor analyzed using normal-theory estimation procedures. Following these item-level analyses, an exploratory factor analysis (EFA) of the DS was conducted in an independent sample of participants. Finally, we assessed the extent to which individual DS items discriminated between high- and low-disgust-emotions groups based on responses to the Disgust Emotion Scale (DES; Kleinknecht, Kleinknecht, & Thorndike, 1997). The DES was chosen as a criterion measure because it offers an alternative measure of disgust reactions across five domains of potential disgust elicitors.

### Method

**Participants.** Participants were 655 undergraduate students (490 women and 165 men) from the University of Arkansas who were recruited from undergraduate psychology courses in exchange for research credit. Participants ranged in age from 18 to 39 years ( $M = 20.31$ ,  $SD = 3.27$ ) and were primarily Caucasian (90.4%).

**Measures.** The DS (Haidt et al., 1994) was constructed to assess sensitivity to seven domains of potential disgust-eliciting stimuli (i.e., Food, Animals, Body Products, Sex, Body Envelope Violations, Death, and Hygiene) and levels of Sympathetic Magic (i.e., beliefs about the transmission of contagion). This 32-item measure includes 16 true–false items (scored 0 or 1) and 16 items that are rated on a 3-point scale (scored 0, 0.5, 1). The 16 items rated on a 3-point scale assess the extent to which participants find a given experience “*not disgusting at all*, *slightly disgusting*, or *very disgusting*.” Three of the true–false items are reverse scored. Each of the eight subscales of the DS contains 4 items: 2 true–false items and 2 Likert-type items that are rated on a 3-point scale. Haidt et al. suggested that a total score for overall disgust sensitivity may be calculated by summing responses to the 32 items. The total scores can range from 0 to 32.

The DES (Kleinknecht et al., 1997) is a 30-item scale measuring the emotional expression of disgust across five domains: Animals, Injections and Blood Draws, Mutilation and Death, Rotting Foods, and Odors. Participants are asked to rate their degree of disgust or repugnance if they were to be exposed to each item, using a 5-point Likert-type scale with response options ranging from “*no disgust or repugnance at all* (0)” to “*extreme disgust or repugnance*” (4). A total score for the propensity to experience disgust emotions may be calculated by summing responses to the 30 items, with a range from 0 to 120. Olatunji, Sawchuk, de Jong, and Lohr (2007) provided evidence for the psychometric properties of the DES in two independent studies of nonclinical participants. In the present study, the total DES score demonstrated excellent internal consistency ( $\alpha = .91$ ) with interitem correlations ranging from .01 to .79 ( $M = .29$ ).

**Procedure.** Participants completed the DS and DES in small groups (5–10 participants). Participant data were randomly divided

into two groups, such that responses from 327 participants were used in the item-level analyses and responses from 328 participants were used in the EFAs.

### Results

**Item statistics and distributional properties.** Table 1 presents the item analyses for the DS items. The distributional properties of each item were examined by inspecting the skewness and kurtosis of the item’s distribution, as well as the pattern of response frequency. Given that the DS contains discrete variables, the item distributions were expected to demonstrate some degree of non-normality. Consistent with this expectation, 21 of the 32 DS items evidenced statistically significant skewness ( $p < .01$ ), and 28 of the 32 DS items evidenced statistically significant kurtosis ( $p < .01$ ). The highest levels of skewness and kurtosis occurred on the DS Sex subscale items (23 and 8), and inspection of the pattern of response frequencies revealed that the majority of participants endorsed these items as disgusting. In addition, results of Shapiro–Wilk tests of normality (Shapiro & Wilk, 1965) indicated that each DS item had a distribution that was significantly different from normal. These distributional findings provide evidence for the nonnormality of the DS items and suggest that normal-theory estimation procedures may not be appropriate for examining the underlying factor structure of the DS (see Bollen, 1989; Nunnally & Bernstein, 1994).

**Internal consistency and group discrimination.** The overall Cronbach’s alpha estimate for the DS scale was an acceptable .84 with an average interitem correlation of .16 (range =  $-.25$  to  $+.63$ ). The Cronbach coefficient is equivalent to the Kuder–Richardson 20 formula for discrete items. Based on the criterion of .30 as an acceptable corrected item–total correlation (Nunnally & Bernstein, 1994), five items were identified as unacceptable (Items 2, 7, 8, 23, and 24). Cronbach’s alpha estimates for the eight subscales of the DS proposed by Haidt et al. (1994) ranged from .33 to .65 (Food,  $\alpha = .33$ ; Animals,  $\alpha = .56$ ; Body Products,  $\alpha = .56$ ; Sex,  $\alpha = .45$ ; Body Envelope Violations,  $\alpha = .65$ ; Death,  $\alpha = .61$ ; Hygiene,  $\alpha = .51$ ; Sympathetic Magic,  $\alpha = .43$ ).

Group discrimination analyses were conducted to examine the extent to which each DS item discriminated between high- and low-disgust-emotions groups among a subsample of participants who completed the DES. Participants were placed in the high-disgust-emotions group if they scored in the top quartile on the DES ( $n = 76$ , mean DES = 74.63,  $SD = 9.15$ ) and were placed in the low-disgust-emotions group if they scored in the bottom quartile on the DES ( $n = 76$ , mean DES = 22.97,  $SD = 6.62$ ). Significant group differences ( $p < .01$ ; Cohen’s  $d = 6.46$ ) were observed on 28 of the 32 DS items, and high-disgust-emotions-group participants scored significantly higher than low-disgust-emotions-group participants on the DS total score. DS Items 2, 7, 8, and 23 failed to discriminate between the disgust emotions groups.

**EFAs.** EFAs using minimum residual method (MINRES; Harman, 1960) on the polychoric correlation matrix were conducted using PRELIS (Version 2.54) to determine the model that best described the data. An EFA approach was used because few studies have examined the psychometric properties of the DS, and those studies that have investigated the factor structure of the DS have used potentially inappropriate methods of factor extraction

Table 1  
*Disgust Scale (DS): Study 1 Item Analysis and Response Frequency*

DS item	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	<i>W</i> (326)	ISC	% false	% true	
1. I might be willing to try eating monkey meat, under some circumstances. (R)	.59	.49	-0.37**	-1.88**	.62**	.32	41	59	
2. It bothers me to see someone in a restaurant eating messy food with his fingers.	.30	.46	0.86**	-1.26**	.58**	.21	70	30	
3. It would bother me to see a rat run across my path in a park.	.44	.50	0.24	-1.95**	.63**	.33	56	44	
4. Seeing a cockroach in someone else's house doesn't bother me. (R)	.42	.49	-0.22	-1.97**	.63**	.41	45	55	
5. It bothers me to hear someone clear a throat full of mucus.	.54	.50	-0.14	-1.99**	.64**	.32	47	53	
6. If I see someone vomit, it makes me sick to my stomach.	.67	.47	-0.73**	-1.48**	.59**	.33	33	67	
7. I think homosexual activities are immoral.	.60	.49	-0.43**	-1.82**	.32**	.13	39	61	
8. I think it is immoral for someone to seek sexual pleasure from animals.	.91	.28	-2.98**	6.90**	.31**	.21	9	91	
9. It would bother me to be in a science class, and see a human hand preserved in a jar.	.45	.50	0.17	-1.98**	.63**	.45	54	46	
10. It would not upset me at all to watch a person with a glass eye take the eye out of the socket. (R)	.67	.47	-0.71**	-1.51**	.60**	.41	33	67	
11. It would bother me tremendously to touch a dead body.	.53	.50	-0.11	-2.01**	.64**	.47	47	53	
12. I would go out of my way to avoid walking through a graveyard.	.40	.49	0.41**	-1.84**	.62**	.32	60	40	
13. I never let any part of my body touch the toilet seat in a public washroom.	.28	.50	0.96**	-1.09**	.57**	.33	72	28	
14. I probably would not go to my favorite restaurant if I found out that the cook had a cold.	.39	.49	0.45**	-1.81**	.62**	.31	61	39	
15. Even if I was hungry, I would not drink a bowl of my favorite soup if it had been stirred with a used but thoroughly washed flyswatter.	.65	.46	-0.85**	-1.29**	.58**	.38	31	69	
16. It would bother me to sleep in a nice hotel room if I knew that a man had died of a heart attack in that room the night before.	.61	.49	-0.46**	-1.79**	.62**	.48	38	62	
							% not disgusting	% slightly disgusting	% very disgusting
17. If you see someone put ketchup on vanilla ice cream and eat it.	.48	.33	0.05	-0.70**	.80**	.33	29	56	20
18. You are about to drink a glass of milk when you smell that it is spoiled.	.58	.37	-0.28	-1.16**	.81**	.52	21	42	37
19. You see maggots on a piece of meat in an outdoor garbage pail.	.74	.34	-0.92**	-0.34	.72**	.54	10	32	58
20. You are walking barefoot on concrete and you step on an earthworm.	.49	.36	0.02	-1.09**	.81**	.44	27	48	25
21. You see a bowel movement left unflushed in a public bathroom.	.66	.34	-0.51**	-0.78**	.77**	.52	12	43	45
22. While you are walking through a tunnel under a railroad track, you smell urine.	.53	.34	-0.08	-0.81**	.80**	.53	20	54	26
23. You hear about an adult woman who has sex with her father.	.92	.22	-2.69**	6.72**	.42**	.26	2	11	87
24. You hear about a 30-year-old man who seeks sexual relationships with 80-year-old women.	.76	.31	-0.89**	-0.23	.71**	.27	7	35	58
25. You see someone accidentally stick a fishing hook through his finger.	.51	.36	-0.02	-1.01**	.81**	.47	25	49	26
26. You see a man with his intestines exposed after an accident.	.78	.32	-1.21**	-0.29	.67**	.55	8	27	65
27. Your friend's pet cat dies and you have to pick up the dead body with your bare hands.	.60	.38	-0.36**	-1.21**	.79**	.59	21	38	41
28. You accidentally touch the ashes of a person who has been cremated.	.38	.39	0.46**	-1.22**	.77**	.55	46	33	21
29. You take a sip of soda and realize that you drank from the glass that an acquaintance of yours had been drinking from.	.17	.30	1.62**	1.53**	.59**	.37	73	20	7
30. You discover that a friend of yours changes underwear only once a week.	.77	.33	-1.10**	0.05	.68**	.46	9	28	63
31. A friend offers you a piece of chocolate shaped like dog-doo.	.35	.34	0.45**	-0.81**	.78**	.43	42	45	13
32. As part of a sex education class, you are required to inflate a new lubricated condom, using your mouth.	.48	.41	0.07	-1.40**	.80**	.36	33	37	30

Note. *N* = 327. (R) = reverse-coded item; *W* = Shapiro-Wilk test of normality; ISC = corrected item-total correlation. Reverse-coded items were reversed in these analyses.

\*\* *p* < .01.

(e.g., maximum likelihood or principal components) that are based on normal-theory estimation or inappropriate methods of factor rotation (e.g., orthogonal) for factors that appear to be correlated. The polychoric correlation matrix was used because the DS items were discrete (i.e., rated either *true–false* or on a 3-point scale), and the data were treated as ordinal rather than interval. Oblique rotations (promax) were used, given previous research suggesting significant associations between potential domains of disgust. MINRES, an equivalent procedure to unweighted least squares common-factor analysis, was used because it does not require distributional assumptions, is very robust, and can be used with small samples and when the polychoric correlation matrix is not positive definite (Jöreskog, 2003). Factor pattern matrices were examined for simple structure and interpretability. Factor retention was based on an examination of simple structure and interpretability to determine the most conceptually coherent factor solution, as well as on parallel analyses (PAs; Horn, 1965) of the raw data.

Initially MINRES factor analyses were conducted on the full 32-item DS, and one through eight factor solutions were examined for simple structure and interpretability. Despite the robustness of the MINRES analyses, the extreme skewness and kurtosis of Item 8 consistently resulted in a “Heywood case” for this item’s factor loadings in all extractions. Given that this item failed to meet all criteria for item adequacy, subsequent MINRES analyses were conducted with Item 8 omitted. PAs were conducted twice, once using the mean eigenvalues and once using the 95th-percentile eigenvalues (Longman, Cota, Holden, & Fekken, 1989). Although seven factors had eigenvalues greater than 1.0, PA indicated a three-factor solution for both the mean and the 95th-percentile eigenvalues. Moreover, PA indicated a three-factor solution regardless of the inclusion of Item 8.

The initial three-factor solution on the 31 DS items indicated that four items (Items 2, 7, 23, and 24) did not demonstrate salient factor loadings (i.e.,  $> .30$ ) on any factor. Inspection of alternative factor solutions revealed that the lack of salient loadings for these four items was not an artifact of the three-factor solution but rather occurred across solutions. Given that these items were identified as potentially problematic in the item-level analyses (i.e., evidenced item–total correlations below  $.30$ , demonstrated significant non-normality, and did not discriminate between high and low disgust emotions groups), further analyses were conducted with 27 DS items (i.e., Items 2, 7, 8, 23, and 24 were omitted). Again, seven factors had eigenvalues greater than 1.0, and PA indicated a three-factor solution for both the mean and 95th-percentile eigenvalues, although the eigenvalue for Factor III was just above the mean and 95th-percentile cutoffs (i.e., 1.53 vs.  $M = 1.45$  and 95th percentile = 1.48). Thus, PA suggests that the DS contains two clear factors and a weaker, but salient, third factor. Consequently, both the two- and three-factor solutions were examined for simple structure and interpretability.

As shown in Table 2, the three-factor solution resulted in a clear and interpretable structure, although three items demonstrated complex factor loadings. Factor I contained 13 items with salient factor loadings ( $> .30$ ) including all of the retained items from the Food, Animals, and Body Products DS subscales, a Sympathetic Magic item (Item 15) that contains item content pertinent to Food- and Animal-related disgust sensitivity and a Hygiene item (Item 30) that contains item content pertinent to Body Products. In addition, one of the Animal items (Item 20) demonstrated a weaker

but salient cross-loading on Factor II due to content that overlaps with Death, and one of the Body Products items (Item 22) demonstrated a weaker but salient loading on Factor III due to item content that overlaps with contamination concerns. Taken together, Factor I appeared to represent *Core Disgust sensitivity*: disgust based on a sense of offensiveness and the threat of disease, consisting of stimuli such as rotting foods, waste products, and small animals (e.g., Rozin et al., 2000). Factor II contained 9 items with salient factor loadings including all of the items from the Death and Body Envelope Violations DS subscales. One of the Death items (Item 12) had a salient cross-loading on Factor III. This factor can be conceptualized as *Animal Reminder Disgust sensitivity*: disgust that reflects the aversion of stimuli that serve as reminders of the animal origins of humans (e.g., Rozin et al., 2000). Factor III contained 8 items with salient factor loadings including 3 items from the Hygiene subscale, 3 items from the Sympathetic Magic subscales, and 2 additional items from the DS (i.e., Item 22, smelling urine, and Item 12, walking through a graveyard). This factor appears to largely represent *Contamination-Based Disgust sensitivity*: disgust reactions based on the perceived threat of transmission of contagion. These factors were moderately correlated, with factor correlations ranging from  $.48$  to  $.56$ .

### Discussion

These results provide evidence that five items (Items 2, 7, 8, 23, and 24) failed to perform adequately and may detract from the overall DS total score. Specifically, these items were among the most nonnormally distributed, failed to demonstrate corrected item–total correlations  $> .30$  (Nunnally & Bernstein, 1994), and did not discriminate between high- and low-disgust-emotions groups as measured on the DES (with the exception of Item 24). These results also indicate that the DS items are not normally distributed, and, as a result, statistical analyses that assume a normal distribution are not likely appropriate for use with the DS. MINRES EFAs of the polychoric correlation matrix revealed a three-factor solution for the DS based on examination of simple structure and interpretability, and on PA (Horn, 1965). The DS appears to be a multidimensional instrument with two clear factors (i.e., Core Disgust and Animal Reminder Disgust) and a weaker, but salient, third factor (i.e., Contamination-Based Disgust). In addition, results of the EFAs revealed that the five problematic items (Items 2, 7, 8, 23, and 24) did not load significantly on an interpretable factor solution. Further examination of the factor structure of the 27-item DS would be useful given the exploratory nature of these analyses, the complex factor loadings of three DS items, and the relatively small sample size.

### Study 2

Building on the results of Study 1, we examined the factor structure of the 27-item DS scale within a CFA framework. The factor structure of the 27-item DS was examined by fitting several measurement models using CFA with weighted least squares (WLS) estimation on the polychoric correlation matrix and the asymptotic covariance matrix of the retained DS items. Specifically, we examined the fit of a unidimensional model of disgust sensitivity, a two-factor model of Core Disgust and Animal Re-

Table 2

Study 1: Promax Rotated Factor Matrix (Minimum Residual Method) of the 27 Disgust Scale (DS) Items

DS item	Factor I	Factor II	Factor III	Unique variance
1. I might be willing to try eating monkey meat, under some circumstances.	<b>.46</b>	.06	.13	.76
3. It would bother me to see a rat run across my path in a park.	<b>.34</b>	.11	.06	.84
4. Seeing a cockroach in someone else's house doesn't bother me.	<b>.42</b>	.10	.21	.76
5. It bothers me to hear someone clear a throat full of mucus.	<b>.32</b>	-.14	.28	.72
6. If I see someone vomit, it makes me sick to my stomach.	<b>.48</b>	.05	.13	.73
9. It would bother me to be in a science class, and see a human hand preserved in a jar.	-.14	<b>.80</b>	-.03	.46
10. It would not upset me at all to watch a person with a glass eye take the eye out of the socket.	.18	<b>.64</b>	.05	.49
11. It would bother me tremendously to touch a dead body.	-.10	<b>.65</b>	.20	.54
12. I would go out of my way to avoid walking through a graveyard.	-.12	<b>.38</b>	<b>.31</b>	.74
13. I never let any part of my body touch the toilet seat in a public washroom.	.16	-.20	<b>.60</b>	.62
14. I probably would not go to my favorite restaurant if I found out the cook had a cold.	.13	.01	<b>.56</b>	.54
15. Even if I was hungry, I would not drink a bowl of my favorite soup if it had been stirred with a used but thoroughly washed flyswatter.	<b>.43</b>	.05	.22	.59
16. It would bother me to sleep in a nice hotel room if I knew that man had died of a heart attack in that room the night before.	.16	.24	<b>.42</b>	.65
17. If you see someone put ketchup on vanilla ice cream and eat it.	<b>.37</b>	.08	.11	.73
18. You are about to drink a glass of milk when you smell that it is spoiled.	<b>.68</b>	-.07	.04	.58
19. You see maggots on a piece of meat in an outdoor garbage pail.	<b>.81</b>	-.03	-.13	.44
20. You are walking barefoot on concrete and you step on an earthworm.	<b>.36</b>	<b>.32</b>	.10	.71
21. You see a bowel movement left unflushed in a public bathroom.	<b>.42</b>	.01	.26	.57
22. While you are walking through a tunnel under a railroad track, you smell urine.	<b>.46</b>	-.05	<b>.38</b>	.51
25. You see someone accidentally stick a fishing hook through his finger.	.27	<b>.43</b>	-.02	<b>.65</b>
26. You see a man with his intestines exposed after an accident.	.07	<b>.81</b>	.06	.29
27. Your friend's pet cat dies and you have to pick up the dead body with your bare hands.	.11	<b>.59</b>	-.06	.42
28. You accidentally touch the ashes of a person who has been cremated.	-.05	<b>.56</b>	.24	.48
29. You take a sip of soda and realize that you drank from the glass that an acquaintance of yours had been drinking from.	.12	-.16	<b>.63</b>	.64
30. You discover that a friend of yours changes underwear only once a week.	<b>.47</b>	.16	.24	.65
31. A friend offers you a piece of chocolate shaped like dog-doo.	.06	.23	<b>.40</b>	.64
32. As part of a sex education class, you are required to inflate a new lubricated condom, using your mouth.	.19	.23	<b>.44</b>	.69

Note.  $n = 328$ . Factor loadings greater than .30 are presented in boldface.

minder Disgust (Rozin et al., 2000), and the three-factor model of disgust sensitivity identified in Study 1. Because the DS items are discrete, the polychoric correlation matrix (i.e., a matrix of correlations in which there is a linear relationship between two observed, discrete variables that are thought to represent manifestations of latent, normal continuous variables) was used in the CFA (see Flora & Curran, 2004). Moreover, because the DS items are discrete and nonnormally distributed, the normal-theory maximum-likelihood method of factor estimation that is typically used in CFA is not the best method of estimation (see Bollen, 1989). Instead, the preferred method of estimation is WLS applied to the matrix of polychoric correlations, where the weight matrix is defined as a consistent estimator of the asymptotic covariance matrix between all polychoric correlations (e.g., Muthén, 1993).

After arriving at a final modified measurement model, we examined the internal consistency and descriptive statistics for the revised DS total score and subscales, and we explored gender differences. Finally, using structural equation modeling, we examined the extent to which the DS subscales afford differential prediction of obsessive-compulsive symptoms. The Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002) was chosen for use because it assesses six domains of obsessive-compulsive symptoms in a short inventory and has demonstrated good psychometric properties with college students (Hajcak, Huppert, Simons, & Foa, 2004).

## Method

**Participants.** Participants were recruited from undergraduate psychology courses ( $n = 993$ ) at the University of North Carolina and participated in exchange for research credit. Participants were primarily women (75%,  $n = 745$ ) and Caucasian (75%,  $n = 748$ ) and ranged in age from 18 to 45 years ( $M = 19.01$ ,  $SD = 1.99$ ).

**Measures.** The OCI-R (Foa et al., 2002) is a new 18-item questionnaire based on the earlier 84-item OCI (Foa, Kozak, Salkovskis, Coles, & Amir, 1998). Participants rate the degree to which they were bothered or distressed by OCD symptoms in the past month on a 5-point scale (0 = *not at all*, 4 = *extremely*). The OCI-R assesses six types of OCD symptoms: (a) Washing Concerns, (b) Checking/Doubting, (c) Obsessing, (d) Mental Neutralizing, (e) Ordering, and (f) Hoarding. Foa et al. (2002) provided evidence for the convergent and divergent validity of the OCI-R in both clinical and nonclinical student samples. More recently, Hajcak et al. (2004) provided evidence that this scale is a psychometrically sound measure of obsessive-compulsive symptoms when used with nonclinical, college samples. In this study the OCI-R total score demonstrated good internal consistency (.89) with item-total correlations ranging from .11 to .69 ( $M = .32$ ).

**Procedure.** Participants completed the DS (as described in the Study 1 section) and the OCI-R via an Internet site in exchange for course credit. This method of data collection afforded the oppor-

tunity to generate a large sample of participants, and the overall descriptive statistics for the DS and the OCI-R were consistent with those collected from college samples in other studies; however, no data regarding the effects of collecting data on these measures via the Internet rather than in vivo are available.

### Results

**CFA.** Building on the results of Study 1, a CFA was conducted on the 27 retained items of the DS. We used PRELIS (Version 2.54; Jöreskog & Sörbom, 2003) to calculate the polychoric correlation and asymptotic covariance matrices to be used in the WLS estimation. WLS estimation was implemented by LISREL (Version 8.54; Jöreskog & Sörbom, 2003) to examine several competing models of interest. In each model the DS items served as manifest indicators (scores = 0 to 1), and the variance of the latent variable was set to 1. Model fit was examined via the chi-square statistic; the  $\chi^2/df$  ratio in which chi-square is adjusted for sample size; the root-mean-square error of approximation (RMSEA) and its 90% confidence interval (Steiger, 1990), for which smaller values (e.g., less than .05) are indicative of good fit; the adjusted goodness-of-fit index (AGFI; Jöreskog & Sörbom, 1989), for which values greater than .95 are indicative of good fit; and the expected cross-validation index (ECVI; Browne & Cudeck, 1989), for which smaller values indicate less discrepancy between the fitted covariance matrix and the expected covariance matrix that would be obtained in another sample of similar size. Model fit statistics are presented in Table 3, and the polychoric correlation matrix on which these CFAs were based is presented in Table 4. Comparisons of competing models were examined via inspection of the fit statistics and the Akaike (1987) information criterion (AIC)—a modification of the standard goodness-of-fit chi-square statistic that adjusts for the complexity of the model that can be used to compare models that are not hierarchically related (i.e., nonnested). The chi-square difference test (i.e.,  $\chi^2_{diff}$ ) was used to examine the significance of modifications to the original model and is the standard test to compare two nested models.

First, we tested a unidimensional model of disgust sensitivity with all 27 retained DS items as indicator variables. As shown in Table 3, this model provided a good fit to the data with  $\chi^2(324) = 1,434.47$ ,  $p < .01$ ; RMSEA = .06; AGFI = .94; and ECVI = 1.55. All DS items had significant loadings on the DS latent variable, with standardized parameter estimates that ranged from .33 to .87. Although the fit of this model was reasonably good, a unidimensional interpretation of the DS may oversimplify its true measure-

ment model (e.g., de Jong & Merckelbach, 1998; Olatunji, Williams, Sawchuk, & Lohr, 2006), given that previous studies have provided evidence that distinct domains of disgust sensitivity are differentially predictive of different anxiety disorder symptoms (e.g., contamination fear, BII fainting symptoms, spider fears).

Next, we tested the fit of the two- and three-factor models. The two-factor model consisted of Core Disgust and Animal Reminder Disgust sensitivity, as proposed by Rozin et al. (2000). Specifically, all retained items on the Food, Animals, Body Products, Hygiene, and Sympathetic Magic DS subscales were loaded on a Core Disgust latent factor, and the Body Envelope Violations and Death DS items were loaded on an Animal Reminder Disgust latent factor. The two-factor model provided a better fit to the data than the unidimensional model, as indicated by an improvement of 132.61 on the AIC. The three-factor model consisting of Core Disgust, Animal Reminder Disgust, and Contamination-Based Disgust obtained from the EFA in Study 1 provided a significantly better fit to the data than either the two-factor or the unidimensional model, as indicated by improvements in the AIC of 93.81 and 226.42, respectively. All 27 DS items had standardized loadings greater than .40 on their respective latent factors in the three-factor model. Thus, this model was determined to best fit the data based on both theory and quantitative analysis, and we examined potential modifications that could further improve the fit of the three-factor model.

**Modifications to the three-factor model.** Analysis of localized areas of strain indicated that there was strong evidence of correlated residuals between Items 21 and 22 (modification index = 64.6) and between Items 25 and 26 (modification index = 74.8). These modification indices were outliers and were 22.3 points above the next modification index value. Consideration of both of these outcomes suggested that the covariance of these items that was unaccounted for by their latent disgust factors was likely due to a method effect stemming from content overlap (i.e., seeing a bowel movement vs. smelling urine for Items 21 and 22; seeing someone accidentally stick a fishing hook through his finger vs. seeing intestines exposed after an accident for Items 25 and 26). Examination of the polychoric correlations presented in Table 4 revealed strong correlations between these pairs of items (Items 21 and 22,  $r = .64$ ; Items 25 and 26,  $r = .66$ ). Because the primary goal of this series of studies was to refine the DS scale, we decided to eliminate Items 21 and 25 to reduce item content overlap rather than relaxing the error covariances between item pairs. This modified model with Items 21 and 25 omitted was refit to the data and

Table 3  
Confirmatory Factor Analysis of the 27 Disgust Scale Items in Study 2: Overall Model Fit With Weighted Least Squares of the Polychoric Correlation Matrix

Model tested	$\chi^2$	df	$\chi^2/df$	AIC	$\Delta df$	RMSEA	90% CI	AGFI	ECVI
1-factor model	1,434.47	324	4.44	1,542.47		.060	.057, .062	.942	1.555
2-factor model	1,299.86	323	4.03	1,409.86	1	.055	.052, .058	.953	1.421
3-factor model	1,242.05	321	3.86	1,316.05	2	.052	.049, .056	.956	1.367
<b>3-factor modified model</b>	<b>918.06</b>	<b>272</b>	<b>3.37</b>	<b>1,024.86</b>	<b>49</b>	<b>.049</b>	<b>.045, .052</b>	<b>.970</b>	<b>1.03</b>

Note.  $N = 993$ .  $\chi^2/df$  = a ratio of chi-square divided by the degrees of freedom (see Kline, 1998); AIC = Akaike information criterion; RMSEA = root-mean-square error of approximation; CI = confidence interval for RMSEA; AGFI = adjusted goodness-of-fit index; ECVI = expected cross-validation index. The best fitting model is indicated in boldface.

Table 4  
*Polychoric Correlation Matrix of the 27 Disgust Scale (DS) Items Used in the Confirmatory Factor Analyses*

Item	1	3	4	5	6	9	10	11	12	13	14	15	16	17	18	19	20	21	22	25	26	27	28	29	30	31	32
DS1	—	.29	.24	.07	.21	.22	.22	.24	.31	.22	.19	.40	.20	.21	.15	.28	.24	.24	.23	.22	.15	.26	.25	.20	.20	.32	.23
DS3		—	.45	.30	.19	.32	.28	.33	.32	.11	.17	.20	.27	.32	.17	.36	.39	.19	.21	.29	.31	.38	.27	.15	.24	.23	.17
DS4			—	.26	.22	.25	.26	.14	.15	.11	.19	.23	.26	.15	.18	.28	.26	.16	.17	.16	.14	.20	.17	.04	.15	.17	.18
DS5				—	.33	.24	.18	.12	.11	.15	.20	.17	.20	.14	.07	.25	.25	.22	.18	.20	.28	.21	.14	.10	.19	.22	.08
DS6					—	.27	.23	.35	.18	.04	.16	.11	.18	.22	.15	.27	.20	.22	.20	.23	.35	.22	.17	.03	.12	.15	.14
DS9						—	.53	.63	.28	.04	.19	.13	.32	.27	.13	.26	.24	.14	.19	.41	.58	.38	.36	.07	.09	.23	.19
DS10							—	.42	.27	.01	.05	.10	.29	.17	.09	.22	.25	.20	.19	.37	.54	.26	.29	.04	.10	.21	.15
DS11								—	.41	.01	.18	.16	.33	.21	.12	.27	.23	.14	.16	.37	.57	.51	.49	.10	.05	.14	.21
DS12									—	.25	.28	.25	.40	.22	.10	.19	.25	.21	.20	.28	.30	.31	.40	.20	.23	.23	.21
DS13										—	.35	.34	.17	.07	.01	.14	.07	.20	.17	.03	.01	.10	.11	.50	.32	.23	.20
DS14											—	.34	.25	.09	.13	.20	.20	.24	.23	.18	.13	.13	.19	.44	.15	.24	.25
DS15												—	.30	.19	.20	.28	.20	.28	.22	.07	.06	.24	.22	.37	.30	.28	.30
DS16													—	.15	.16	.22	.15	.19	.26	.25	.36	.27	.39	.12	.16	.17	.16
DS17														—	.28	.27	.26	.25	.27	.24	.24	.24	.24	.16	.27	.26	.19
DS18															—	.42	.14	.23	.28	.15	.19	.18	.17	.09	.23	.17	.10
DS19																—	.26	.39	.38	.25	.33	.27	.20	.10	.26	.23	.17
DS20																	—	.30	.31	.34	.26	.36	.28	.24	.22	.27	.19
DS21																		—	.64	.20	.25	.25	.25	.26	.34	.41	.27
DS22																			—	.31	.22	.22	.31	.25	.30	.37	.26
DS25																				—	.66	.46	.35	.20	.13	.20	.18
DS26																					—	.46	.39	.06	.16	.15	.21
DS27																						—	.52	.32	.25	.28	.25
DS28																							—	.27	.29	.31	.33
DS29																								—	.38	.47	.41
DS30																									—	.34	.16
DS31																										—	.45
DS32																											—

resulted in a significant improvement in model fit over the initial three-factor model,  $\chi^2_{\text{diff}}(49) = 323.99, p < .01$ , with  $\chi^2(272) = 918.06, p < .01$ ; RMSEA = .04; AGFI = .97; and ECVI = 1.03. After this respecification of the three-factor model, fit diagnostic revealed no further areas of localized strain, and this model was chosen as the final measurement model. Figure 1 presents the final three-factor measurement model, and the items and scoring for the 25-item DS-R are presented in the Appendix.

*Internal consistency, sex differences, and descriptives of the DS-Revised.* The overall Cronbach's alpha estimate for the revised 25-item DS scale was an acceptable .84 with an average interitem correlation of .17 (range = .03 to .44). Although this increment in internal consistency is relatively small, this occurred while reducing the total number of scale items by seven. We examined the split-half reliability of the DS-R to compare the reliability for the dichotomous items with that of the 3-point Likert-type items. Inspection of the split-half reliability coefficients indicated that the reliability of the *true-false* items ( $\alpha = .69$ ) was lower than that of the Likert-type items ( $\alpha = .77$ ), with a Guttman split-half coefficient of .76. The DS-R total score was highly correlated with the original DS total score ( $r = .98$ ) and with the 27-item DS total score ( $r = .99$ ). The Cronbach's alpha estimates for the three subscales on the DS-R were as follows: Core Disgust = .74, average interitem correlation of .17 (range = .06 to .31); Animal Reminder Disgust = .78, average interitem correlation of .28 (range = .15 to .46); and Contamination-Based Disgust = .61, average interitem correlation of .24 (range = .14 to .35). Given that the five-item Contamination-Based Disgust subscale demonstrated internal consistency below the acceptable limit of .70, we examined the lengthening required to obtain a reliability

of at least .70 (the desirable reliability estimate) using the formula described by Nunnally and Bernstein (1994). According to this procedure the Contamination-Based Disgust subscale would need to be increased by three items to achieve acceptable internal consistency.

The means and standard deviations for the DS-R total score and subscales for the total sample and by participant sex are presented in Table 5. Women endorsed significantly higher levels of total DS, Core Disgust, Animal Reminder Disgust, and Contamination-Based Disgust than did men. Effect size estimates (i.e., partial eta squared) for these sex differences are presented in the right column of Table 5 and suggest that sex accounted for between 12.4% and 0.05% of the unique variance in the DS subscale scores of participants.

*Construct validity of the three-factor model.* Next, we examined the extent to which the three-factor model provided differential prediction of obsessive-compulsive symptoms. The six subscales of the OCI-R were used as indicators of latent obsessive-compulsive symptoms, and a measurement model was examined based on the final 25-item three-factor model. This measurement model provided a good fit to the data and is available on request from the authors, with  $\chi^2(455) = 1,912.29, p < .01$ ; RMSEA = .05; AGFI = .94; and ECVI = 2.07. All three latent disgust factors were significantly correlated with obsessive-compulsive symptoms in this measurement model. The structural model with the three latent disgust factors predicting obsessive-compulsive symptoms is presented in Figure 2. As shown in this figure, the three latent disgust factors were significantly correlated, but only Core Disgust and Contamination-Based Disgust emerged as significant predictors of latent obsessive-compulsive symptoms

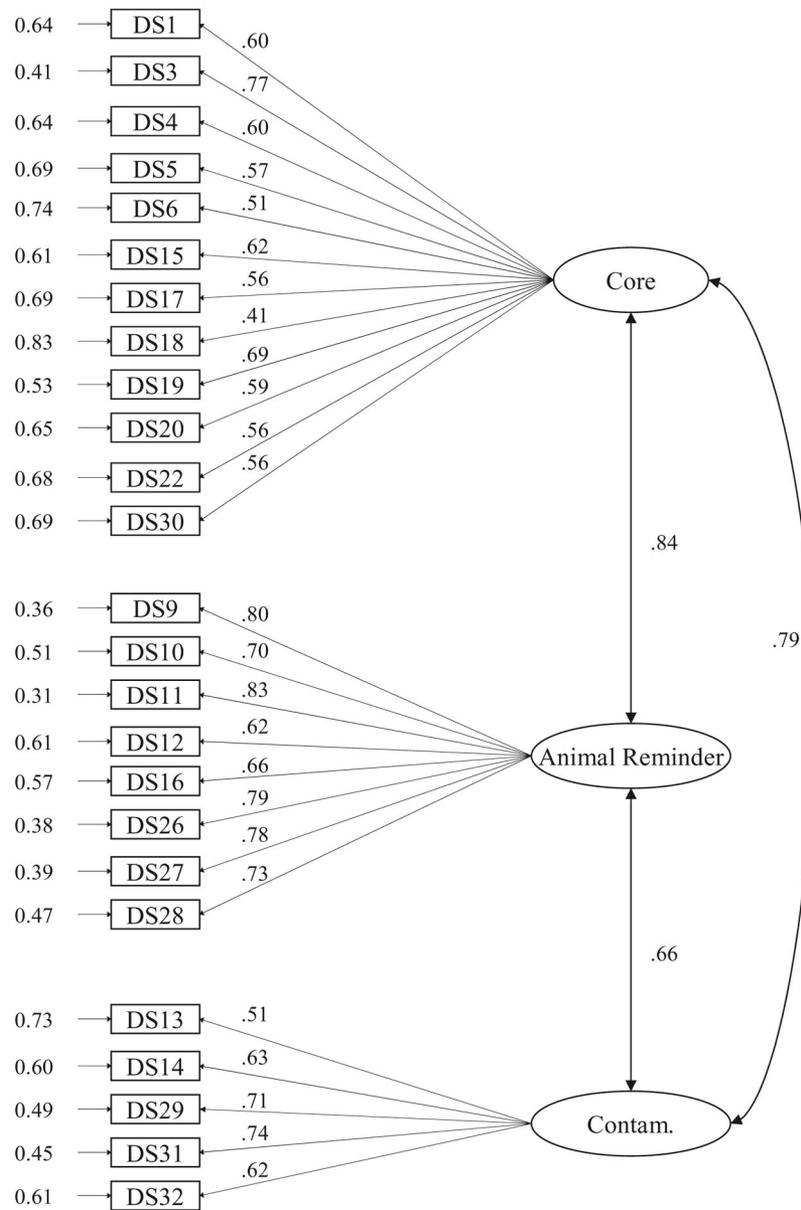


Figure 1. The final three-factor measurement model. DS = Disgust Scale; Contam. = Contamination.

when all three disgust latent factors were considered in the analysis.

### Discussion

CFAs on the 27-item polychoric correlation matrix and the asymptotic covariance matrix using WLS estimation indicated that a unidimensional model provided a good fit to the data and that a three-factor model (Core Disgust, Animal Reminder Disgust, and Contamination-Based Disgust) provided a significantly better fit to the data. Examination of the modification indices and the interitem correlations revealed that Items 21 and 25 could be removed from this model because of content overlap with other items. This respecified three-factor model, in which Items 21 and 25 were

omitted, provided a significantly better fit to the data than the unmodified three-factor model. Because we modified the three-factor model to improve model fit, it would be important to cross-validate this final measurement model in an independent sample in future studies. Examination of the internal consistency of the 25-item DS-R total score suggests a modest increment in internal consistency, despite a reduction of seven items. The Core Disgust (12 items) and the Animal Reminder Disgust (8 items) subscales demonstrated acceptable internal consistency ( $\alpha > .70$ ), whereas the Contamination-Based Disgust scale (5 items) demonstrated weaker internal consistency, suggesting the need to further refine and/or potentially lengthen this scale. Consistent with prior research (e.g., Olatunji, Sawchuk, Arrindell, & Lohr, 2005),

Table 5  
*Study 2: Descriptive Statistics (and Group Differences) on the Disgust Scale—Revised (DS–R) Total Score and Subscales*

DS-R	Total sample ( <i>n</i> = 993)	Women ( <i>n</i> = 745)	Men ( <i>n</i> = 248)	<i>F</i> (1, 991)	$\eta_p^2$
DS-R total score	13.18 (4.38)	13.91 (4.13)	10.98 (4.37)	90.76***	.08
Core Disgust	7.32 (2.17)	7.80 (2.12)	5.92 (2.26)	140.23***	.12
Animal Reminder Disgust	4.50 (2.08)	4.72 (2.03)	3.84 (2.09)	34.01***	.03
Contamination-Based Disgust	1.35 (1.15)	1.40 (1.18)	1.21 (1.09)	4.59*	.01

\* *p* < .05. \*\*\* *p* < .001.

women endorsed higher levels of disgust than men on the DS–R total score and its three subscales. Finally, preliminary evidence for the construct validity of the three latent factors was provided. Consistent with prior research (Olatunji, Williams, et al., 2005), Core Disgust and Contamination-Based Disgust predicted a latent factor of obsessive–compulsive symptoms, whereas Animal Reminder Disgust did not.

*Study 3*

Study 3 was conducted to examine the convergent and discriminant validity of a stand-alone version of the 25-item revised DS scale (DS–R). An independent sample of college students was administered the 25-item DS–R, the original DS, and measures of contamination fears, obsessive–compulsive symptoms, state anxiety, and the disgust emotions scale. In addition, the internal consistency of the 25-item DS–R and its three factors (i.e., Core Disgust, Animal Reminder Disgust, and Contamination-Based Disgust) was examined.

*Method*

*Participants.* Participants were recruited from undergraduate psychology courses (*n* = 215) at the University of Arkansas and participated in exchange for research credit. Participants ranged in age from 18 to 27 years (*M* = 19.17, *SD* = 3.35) and were primarily women (72.6% women; *n* = 156) and Caucasian (92.4%).

*Measures.* We administered the 25-item DS–R, the original DS, the DES, and the OCI–R (as described in the previous studies).

The Contamination Obsessions and Washing Compulsions subscale of the Padua Inventory (Padua–COWC: Burns, Keortge, Formea, & Sternberger, 1996) is a 10-item measure of contamination obsessions and washing compulsions on which participants rate their level of agreement on a 5-point Likert-type scale (0 = *not at all*, 4 = *very much*). Burns et al. provided evidence for the psychometric properties of the Padua–COWC and suggested that this measure effectively discriminates between OCD and other anxiety disorders. Convergent and divergent validity of the Padua–

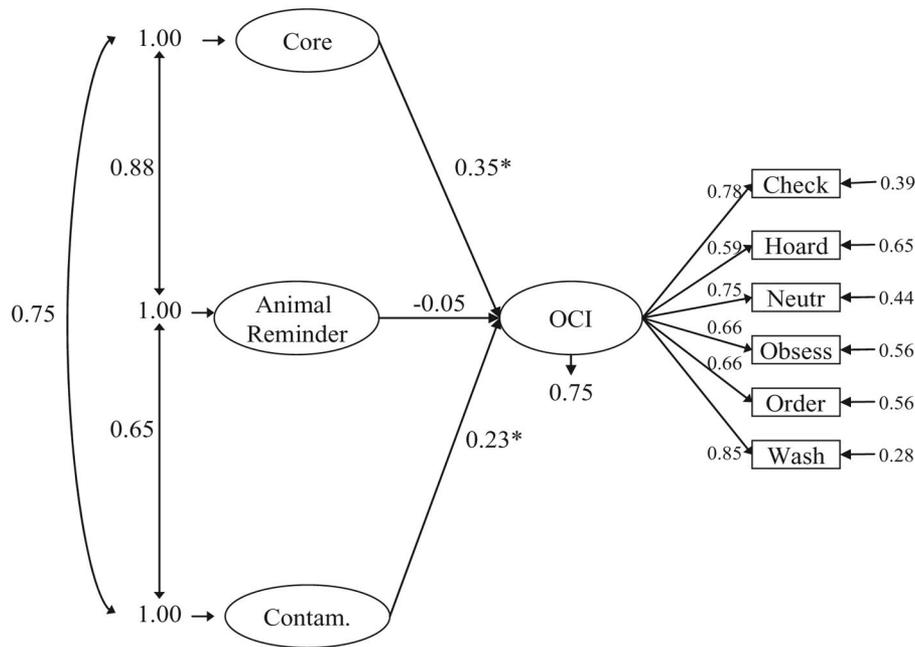


Figure 2. The structural model of latent disgust factors predicting obsessive–compulsive symptoms. Contam. = Contamination; OCI = Obsessive–Compulsive Inventory; Neutr = Neutralizing.

COWC has also been demonstrated in college student samples (e.g., Hajcak et al., 2004), and this subscale has reliably emerged in factor analytic studies of the Padua Inventory. In this study, the Padua-COWC demonstrated good internal consistency ( $\alpha = .89$ ) with interitem correlations that ranged from .31 to .64 ( $M = .47$ ).

The State subscale of the State-Trait Anxiety Inventory (STAI-S; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) is a 20-item well-validated self-report measure of current anxious symptoms (i.e., "How do you feel right now, at this moment?"). Respondents indicate how much each statement (e.g., "I feel frightened") reflects how they feel "right now, at this moment" on a 4-point Likert-type scale (1 = *not at all*, 4 = *very much so*). Good to excellent internal consistency for the STAI-S has been demonstrated in adult, college, high school, and military recruit samples (Spielberger et al., 1983). In the present study the STAI-S demonstrated excellent internal consistency ( $\alpha = .92$ ) with interitem correlations that ranged from .05 to .73 ( $M = .37$ ).

The Vancouver Obsessional Compulsive Inventory (VOCI; Thordarson et al., 2004) Contamination subscale is an 11-item measure of contamination fears and washing compulsions. Participants are asked to rate on a 5-point Likert-type scale (0 = *not at all*, 4 = *very much*) how much a series of statements is true for them (e.g., "I feel very dirty after touching money"). Thordarson et al. provided evidence that the Contamination subscale represented a distinct factor from other OCD symptoms and had good internal consistency ( $\alpha = .92$ ) and test-retest reliability ( $r = .97$ ). Further, participants with OCD reported significantly higher levels of contamination fears than anxious-depressive control participants, community adults, and university students ( $M = 19.41$  vs.  $M = 7.10$ ,  $M = 1.74$ , and  $M = 7.31$ , respectively). Prior research has used the VOCI to demonstrate the specificity of disgust sensitivity to contamination concerns, and the Contamination subscale has been used reliably as a stand-alone measure with university students (e.g., Olatunji et al., 2004).

*Procedure.* Participants completed the 25-item DS-R, the original DS, and the DES, as well as several measures of

obsessive-compulsive symptoms and contamination fears (i.e., the VOCI, OCI-R, and Padua-COWC) and a measure of state anxiety (i.e., STAI-S).

## Results

Internal consistency estimates and descriptive statistics for each measure in this study are presented in Tables 6 and 7. The Cronbach's alpha estimate for the 25-item DS-R was an acceptable .87 with an average interitem correlation of .23 (range = -.11 to .63). Further, the three DS-R subscales demonstrated acceptable internal consistency estimates: Core Disgust,  $\alpha = .80$  (mean interitem correlation = .23); Animal Reminder Disgust,  $\alpha = .82$  (mean interitem correlation = .34); Contamination-Based Disgust,  $\alpha = .71$  (mean interitem correlation = .31). In comparison, the overall Cronbach's alpha estimate for the original 32-item DS scale was .81 and interitem correlations ranged from -.19 to .54 ( $M = .13$ ). As shown in Table 6, Cronbach's alpha estimates for the eight subscales of the original DS were inadequate and ranged from .26 for Food to .66 for Death.

Correlations between the stand-alone 25-item DS-R and subscales and the original DS and subscales suggest that little information is lost with the removal of the seven problematic DS items. Specifically, the DS-R total score had an uncorrected correlation of .89 with the original DS total score, and a corrected correlation of .78 when accounting for measurement error (e.g., Levy, 1967). Results of these correlational analyses also provide support for the assessment of three factors of disgust, in that the correlations between Core Disgust, Animal Reminder Disgust, and Contamination-Based Disgust suggest that these factors are related but not redundant. As would be expected, Core Disgust on the DS-R evidenced significantly stronger correlations with the Food, Animal, and Body Products subscales of the original DS than with any other DS subscales—for example, tests of dependent correlations revealed stronger correlations,  $t(214) = 2.67$ ,  $p < .01$ , for the comparison between Food and Core Disgust ( $r = .60$ ) versus

Table 6  
Study 3: Descriptive Statistics and Intercorrelations Between the Disgust Scale—Revised (DS-R) and the Original DS

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. DS-R total	.87	.90**	.81**	.70**	.89**	.55**	.64**	.58**	.24**	.53**	.68**	.49**	.75**
2. Core disgust		.80	.54**	.57**	.84**	.60**	.68**	.63**	.24**	.35**	.44**	.41**	.62**
3. Animal reminder disgust			.82	.36**	.80**	.37**	.46**	.35**	.22**	.65**	.80**	.23**	.65**
4. Contamination-based disgust				.71	.60**	.32**	.36**	.41**	.08	.24**	.40**	.70**	.53**
5. DS original total					.81	.65**	.69**	.68**	.40**	.65**	.73**	.48**	.82**
6. Food						.26	.41**	.43**	.28**	.24**	.39**	.22**	.48**
7. Animal							.36	.41**	.13	.47**	.42**	.22**	.54**
8. Body product								.47	.21**	.32**	.34**	.33**	.51**
9. Sex									.44	.20**	.11	.04	.25**
10. Body envelope violations										.57	.49**	.08	.44**
11. Death											.66	.25**	.59**
12. Hygiene												.45	.36**
13. Sympathetic magic													.47
<i>M</i>	14.17	7.65	4.82	1.69	19.07	2.19	2.49	2.66	3.24	2.43	2.12	1.79	2.14
<i>SD</i>	4.45	2.24	2.03	1.13	5.10	0.88	0.91	0.99	0.78	1.09	1.21	0.93	1.03

Note.  $n = 215$ . Coefficient alphas are presented in italics on the diagonal.  
\*\*  $p < .01$ .

Table 7  
*Relations Between the Disgust Scale—Revised (DS–R), Original DS, and Measures of Convergent Validity*

Measure	DS–R total	Core Disgust	Animal Reminder Disgust	Contamination-Based Disgust	DS–old total	<i>M</i>	<i>SD</i>	$\alpha$
VOCI	.53**	.43**	.37**	.57**	.50**	20.80	8.26	.90
Padua-COWC	.52**	.42**	.38**	.56**	.47**	20.25	7.52	.89
STAI-S	.23**	.18**	.24**	.12	.23**	36.88	10.67	.92
OCI-R total	.30**	.20**	.19**	.44**	.19**	11.85	6.41	.88
Washing	.45**	.35**	.28**	.55**	.40**	4.23	2.68	.82
Obsessing	-.07	-.11	-.03	.03	-.08	4.65	2.35	.71
Hoarding	.12	.05	.12	.15	.04	6.03	2.61	.74
Ordering	.26**	.25**	.09	.35**	.15	7.06	3.10	.88
Checking	.35**	.25**	.24**	.44**	.30**	5.93	2.29	.59
Neutralizing	.19**	.10	.09	.36**	.10	3.61	2.68	.73
DES total	.78**	.71**	.64**	.53**	.75**	66.88	17.04	.91
Animals	.58**	.53**	.44**	.45**	.52**	12.62	4.86	.77
Injections	.49**	.35**	.49**	.36**	.54**	13.84	6.27	.89
Mutilation and Death	.67**	.54**	.70**	.33**	.68**	19.76	5.34	.83
Rotting Foods	.62**	.63**	.41**	.48**	.52**	16.73	4.82	.81
Odors	.72**	.74**	.46**	.54**	.66**	19.95	4.79	.86

Note.  $n = 215$ . VOCI = Vancouver Obsessional Compulsive Inventory; COWC = Contamination Obsessions and Washing Compulsions subscale of the Padua Inventory; STAI-S = State subscale of the State-Trait Anxiety Inventory; OCI-R = Obsessive-Compulsive Inventory—Revised; DES = Disgust Emotion Scale.

\*\*  $p < .01$ .

Death and Core Disgust ( $r = .44$ ). Similarly, Animal Reminder Disgust evidenced significantly stronger associations with the original Body Envelope Violations and Death subscales—for example, Animal Reminder Disgust was more strongly correlated with Body Envelope Violations ( $r = .65$ ) than with Animals ( $r = .46$ ),  $t(214) = 3.54$ ,  $p < .01$ . Finally, Contamination-Based Disgust evidenced the strongest associations with the Hygiene subscale of the original DS ( $r = .70$ ) compared with Body Products ( $r = .41$ ), the next strongest association,  $t(214) = 5.03$ ,  $p < .01$ . All three DS–R subscales were significantly correlated with the Sympathetic Magic subscale of the original DS, which suggests that magical thinking is inherent in the three DS–R disgust domains.

Convergent validity of the DS–R and its three disgust factors was examined via correlational analyses with established measures of contamination fears (e.g., VOCI and Padua-COWC), state anxiety, obsessive-compulsive symptoms (OCI-R), and disgust responding on the DES. As demonstrated in Table 7, the DS–R total score was significantly related to levels of contamination fears, state anxiety, obsessive-compulsive symptoms, and the DES total score and subscales. Moreover, the pattern of correlations between the DS–R and the external validity measures was similar to the pattern of correlations between the original DS and these measures, although modestly more robust. As in Study 2, Core Disgust and Contamination-Based Disgust demonstrated greater correlations with the measures of contamination fears and obsessive-compulsive symptoms. Regression equations predicting the external validity measures revealed that when the three DS–R disgust subscales were simultaneously regressed on VOCI contamination fears, Core Disgust,  $\beta = .17$ ,  $t(211) = 2.60$ ,  $p < .01$ , and Contamination-Based Disgust,  $\beta = .47$ ,  $t(211) = 7.04$ ,  $p < .01$ , emerged as significant predictors, whereas Animal Reminder Disgust did not,  $\beta = .07$ ,  $t(211) = 0.91$ , *ns*,  $F(3, 211) = 39.49$ ,  $R^2 = .36$ .

The pattern of relations between the DS–R disgust subscales and the subscales of the DES was also as expected. Core Disgust was highly related to the Rotting Foods and Odors subscales of the DES, and Animal Reminder Disgust was highly related to the Mutilation and Death subscale of the DES. Five simultaneous regression equations in which the three DS–R subscales were entered as predictors of each DES subscale were conducted to examine the construct validity of the revised subscales. All three DS–R subscales emerged as relatively equivalent predictors (betas ranged from .22 to .24) of DES Animals,  $F(3, 211) = 30.98$ ,  $R^2 = .31$ . Similarly, all three subscales emerged as significant predictors of both DES Rotting Foods,  $F(3, 211) = 52.70$ ,  $R^2 = .43$ —Core Disgust,  $\beta = .40$ ,  $t(211) = 6.19$ ,  $p < .01$ ; Animal Reminder Disgust,  $\beta = .22$ ,  $t(211) = 3.59$ ,  $p < .01$ ; and Contamination-Based Disgust,  $\beta = .18$ ,  $t(211) = 2.88$ ,  $p < .01$ —and DES Odors,  $F(3, 211) = 82.19$ ,  $R^2 = .53$ —Core Disgust,  $\beta = .50$ ,  $t(211) = 8.61$ ,  $p < .01$ ; Animal Reminder Disgust,  $\beta = .15$ ,  $t(211) = 2.88$ ,  $p < .01$ ; and, Contamination-Based Disgust,  $\beta = .22$ ,  $t(211) = 3.91$ ,  $p < .01$ . Both Animal Reminder Disgust,  $\beta = .37$ ,  $t(211) = 5.44$ ,  $p < .01$ , and Contamination-Based Disgust,  $\beta = .17$ ,  $t(211) = 2.43$ ,  $p < .05$ , significantly predicted DES Injections, whereas Core Disgust did not,  $\beta = .09$ ,  $t(211) = 1.29$ , *ns*,  $F(3, 211) = 26.60$ ,  $R^2 = .27$ . Finally, DES Mutilation and Death was significantly predicted by both Animal Reminder Disgust,  $\beta = .63$ ,  $t(211) = 11.44$ ,  $p < .01$ , and Core Disgust,  $\beta = .16$ ,  $t(211) = 2.73$ ,  $p < .01$ , but not by Contamination-Based Disgust,  $\beta = -.01$ ,  $t(211) = -0.16$ , *ns*,  $F(3, 211) = 75.50$ ,  $R^2 = .52$ .

Given that the DS–R total score and subscales were significantly correlated with state anxiety, partial correlation analyses were conducted to examine the extent to which these measures predicted contamination fears and obsessive-compulsive symptoms, beyond the effects of anxiety. When state anxiety was controlled, the DS–R total score and factor scores remained significantly correlated with measures of contamination fears—for example, with

VOCI contamination fears, DS–R total ( $pr = .50$ ), Core Disgust ( $pr = .40$ ), Animal Reminder Disgust ( $pr = .33$ ), Contamination-Based Disgust ( $pr = .53$ ), and original DS total score ( $pr = .46$ ); with Padua–COWC, DS–R total ( $pr = .49$ ), Core Disgust ( $pr = .39$ ), Animal Reminder Disgust ( $pr = .32$ ), Contamination-Based Disgust ( $pr = .55$ ), and original DS total score ( $pr = .47$ ); and with OCI–R total score, DS–R total ( $pr = .25$ ), Core Disgust ( $pr = .17$ ), Contamination-Based Disgust ( $pr = .41$ ). However, Animal Reminder Disgust ( $pr = .12$ , *ns*) and the original DS total score ( $pr = .12$ , *ns*) were no longer significantly correlated with total OCI–R total symptoms.

### Discussion

Results of Study 3 provide further evidence for the psychometric properties of a stand-alone version of the 25-item DS–R and its three factors (Core Disgust, Animal Reminder Disgust, and Contamination-Based Disgust). The DS–R total score evidenced good internal consistency, and the three disgust domains exhibited adequate internal consistency ( $\alpha$ 's  $> .70$ ). These analyses also suggest that the removal of the seven problematic or redundant items from the original DS (Items 2, 7, 8, 21, 23, 24, and 25) does not result in the loss of much explained variance in disgust sensitivity, as the DS–R correlated .89 with the original DS total score. Results also suggest that the three DS–R disgust factors are correlated but nonredundant. The validity of the DS–R was also examined via correlational analyses with external measures of contamination fears, obsessive–compulsive symptoms, state anxiety, and disgust emotions. Results indicate that the DS–R was correlated with the DES total score and all DES subscales. Further, results are consistent with those of the previous studies presented here in suggesting that the DS–R total score and disgust factors are significantly related to measures of contamination fears and obsessive–compulsive symptoms (particularly, washing, ordering, and checking symptoms). This pattern of relations was maintained when we controlled for state anxiety, suggesting that the DS–R is not simply a proxy measure of current negative affect. In short, the DS–R was found to retain many of the qualities of the original DS but has improved psychometric properties and a more parsimonious and psychometrically sound factor structure (three vs. eight subscales) compared with the original instrument.

### Study 4

Study 4 was conducted to examine group differences on a stand-alone version of the 25-item revised DS total score and subscale scores in a clinical sample of patients with OCD with and without washing concerns and nonclinical community participants with no previous psychological diagnosis. On the basis of prior research suggesting that disgust domains related to contagion may have a specific association with contamination obsessions and washing compulsions (e.g., Olatunji, Williams, et al., 2005), we anticipated that total disgust sensitivity, Core Disgust, and Contamination-Based Disgust would be elevated in patients with OCD who have washing concerns, but not in patients with OCD who do not have washing concerns or in nonclinical control participants. In addition, we predicted that Animal Reminder Disgust would be elevated in both groups of participants with OCD relative to the control sample based on prior research implicating

a generalized disgust propensity among those high in symptoms of OCD (e.g., Olatunji et al., 2004).

### Method

**Participants.** Fifty-six adult patients with a primary diagnosis of OCD (69.6% women; 91.1% Caucasian;  $M_{age} = 34.62$  years,  $SD = 11.42$ ) were recruited from two anxiety disorders clinics. In addition, 14 nonanxious comparison (NAC) participants with no Axis I psychiatric disorders and no history of psychiatric treatment (71.4% women; 64.3% Caucasian;  $M_{age} = 29.00$ ,  $SD = 10.79$ ) were recruited from university staff and community advertisements. The groups did not significantly differ in gender,  $\chi^2(2, N = 70) = 0.89$ , *ns*, or age,  $F(2, 66) = 1.46$ , *ns*, but the NAC group was more ethnically diverse,  $\chi^2(4, N = 70) = 24.31$ ,  $p < .01$ .

**Measures.** Participant diagnostic status was established using the Structured Clinical Interview for DSM–IV Axis I Disorders (SCID–I; First, Spitzer, Gibbon, & Williams, 1997). The SCID–I is a widely used semistructured interview for diagnosing common Axis I disorders. Examinations of the SCID–I psychometric properties provide overall evidence for interrater and test–retest reliability (e.g., Zanarini et al., 2000), and it has been used as a “gold standard” in clinical diagnosis (e.g., Shear et al., 2000).

Severity of current OCD symptoms was evaluated with the Yale–Brown Obsessive–Compulsive Scale (Y-BOCS; Goodman et al., 1989). The Y-BOCS is a 10-item clinician-administered scale that assesses OCD on two dimensions, obsessions and compulsions. The subscales are composed of five items each assessing frequency, interference, distress, resistance, and control. Items are rated over the past week on a 5-point Likert-type scale and can be summed to derive a total severity score. Although the factor structure of the Y-BOCS remains equivocal, psychometric evaluations have provided consistent evidence of reliability and of convergent and divergent validity (e.g., Woody, Steketee, & Chambless, 1995). The Y-BOCS yields an exhaustive list of obsessions and compulsions that was used to determine primary OCD symptom themes in the present study. Patients with OCD were identified as “washers” if they endorsed current clinically relevant compulsive washing or cleaning behavior, regardless of whether other compulsions were also present. In this manner, 32 patients with OCD were identified as washers and 24 were identified as nonwashers.

**Procedure.** Individuals with anxiety disorders completed the 25-item DS–R, detailed in the description of the previous study, as a part of their initial evaluation at the clinic. A doctoral-level clinical psychologist administered the SCID–I and Y-BOCS interviews. Members of the NAC group completed the 25-item DS–R as part of a packet of research questionnaires.

### Results

The Cronbach's alpha estimate for the 25-item DS–R was an acceptable .88, and interitem correlations ranged from .32 to .86 ( $M = .63$ ). Further, the three subscales of the DS–R demonstrated acceptable internal consistency estimates: Core Disgust,  $\alpha = .82$  (mean interitem correlation = .69); Animal Reminder Disgust,  $\alpha = .73$  (mean interitem correlation = .65); and Contamination-Based Disgust,  $\alpha = .71$  (mean interitem correlation = .48).

A univariate analysis of variance was conducted to examine whether the OCD washers, OCD nonwashers, and NACs differed

on the 25-item DS-R total score. As shown in Table 8, significant group differences were found on the DS-R total score, with OCD washers scoring higher than OCD nonwashers, and both OCD groups scoring higher than NACs. A multivariate analysis of variance revealed significant group differences on some combination of the three DS-R subscales,  $\lambda = 0.76$ ,  $F(3, 130) = 3.15$ ,  $p < .01$ ,  $\eta_p^2 = .13$ . Univariate analyses revealed that the groups differed on each of the DS-R subscales. Post hoc Tukey's honestly significant difference analyses indicated that OCD washers scored significantly higher than nonwashers and NACs on Core Disgust and Contamination-Based Disgust, with no significant differences between nonwashers and NACs. In addition, the OCD groups scored significantly higher than the NAC group on Animal Reminder Disgust, but no significant differences emerged as a function of washing status. Although the results of these tests were consistent with predictions, effect sizes were small to modest and power was limited.

### Discussion

Results of Study 4 provide evidence for the internal consistency and construct validity of the 25-item DS-R in a clinical sample. Although the study is limited by the sample size, acceptable internal consistency was found for the DS-R total score and subscales ( $\alpha_s > .70$ ). In addition, evidence of known group validity was obtained, in that OCD washers, OCD nonwashers, and NACs scored in the expected directions on the DS-R. Consistent with past findings (e.g., Olatunji et al., 2004), patients with OCD washing concerns endorsed significantly higher levels of total, Core Disgust, and Contamination-Based Disgust than either patients with OCD without washing concerns or NACs. In addition, no difference was observed between OCD washers and nonwashers on Animal Reminder Disgust. These findings suggest that whereas Core Disgust and Contamination-Based Disgust are heightened in OCD patients with washing concerns, Animal Reminder Disgust does not appear to have a specific relationship with OCD symptoms marked by contamination obsessions and washing compulsions.

### General Discussion

Despite the widespread use of the DS by researchers examining the relation between disgust sensitivity and specific anxiety disor-

der symptoms, basic questions concerning the psychometric properties of the DS have been left unanswered. The present studies used a number of converging methods to examine the adequacy of the DS in five independent samples. From these analyses we found that Items 2, 7, 8, 21, 23, 24, and 25 potentially detract from the performance of the DS. Items 8, 23, and 24 demonstrated moderate to extreme skewness and kurtosis; an examination of response frequencies suggested that few respondents endorsed these items as not disgusting. Items 2, 7, 8, 23, and 24 also had corrected item-to-scale correlations below the acceptable lower bound of .30. Consistent with prior research, the four items (Items 7, 8, 23, and 24) corresponding to the Sex subscale on the DS appear to be the most problematic (Schienle et al., 2003). Responses to DS Sex Items 7, 8, and 23 also failed to significantly differentiate a high-disgust-emotions group from a low-disgust-emotions group on the DES. Careful consideration of the face validity of the Sex items (i.e., "I think homosexual activities are immoral," "You hear about an adult woman who has sex with her father") suggests a "moral" theme in which emotions other than disgust (i.e., anger, contempt) may also be assessed. Results of our series of psychometric studies suggest that the DS Sex items do not converge well with the other items on the DS scale, and it may be useful to develop a separate and more psychometrically sound measure of sensitivity to sociomoral disgust for future studies.

Item 2 ("It bothers me to see someone in a restaurant eating messy food with his fingers") also appears to be problematic as it demonstrated an adjusted corrected interscale correlation below the lower bound. Indeed, food has been identified as a salient elicitor of disgust, and initial theoretical accounts suggest that a primary function of disgust is to prevent the oral incorporation of contaminated foods (Rozin et al., 2000). However, Item 2 appears to assess attitudes toward eating behavior rather than disgust reactions to a particular food (i.e., rotting meat). This may explain why this particular item fails to adequately correspond with the aggregate of DS items.

Prior studies examining the factor structure of the DS have found support for an eight-factor solution: Food, Animals, Body Products, Sex, Body Envelope Violations, Death, Hygiene, and Sympathetic Magic (e.g., Björklund & Hursti, 2004; Haidt et al., 1994). However, such studies have included inadequate items and have used potentially inappropriate statistical techniques that assume a normal distribution. Study 1 examined the factor structure

Table 8

Study 4: Descriptive Statistics and Group Differences on the Disgust Scale—Revised (DS-R) Total Score and Subscales in a Clinical Sample

DS-R	OCD-washers (n = 32)		OCD-nonwashers (n = 24)		Nonanxious control participants (n = 14)		F(2, 67)	$\eta_p^2$
	M	SD	M	SD	M	SD		
DS-R total score	17.31 <sub>a</sub>	0.77	15.07 <sub>b</sub>	0.87	12.86 <sub>c</sub>	1.17	5.31**	.14
Core Disgust	9.11 <sub>a</sub>	1.97	7.85 <sub>b</sub>	2.07	7.35 <sub>b</sub>	3.15	3.66*	.10
Animal Reminder Disgust	5.52 <sub>a</sub>	1.84	5.42 <sub>a</sub>	1.47	3.64 <sub>b</sub>	2.46	5.37**	.14
Contamination-Based Disgust	2.69 <sub>a</sub>	1.21	1.89 <sub>b</sub>	1.31	1.85 <sub>b</sub>	1.11	3.76*	.09

Note. Means that do not share subscripts differ at  $p < .05$ . OCD = obsessive-compulsive disorder.  $\eta_p^2$  represents partial eta squared.  
\*  $p < .05$ . \*\*  $p < .01$ .

of the DS using MINRES EFAs of the polychoric correlation matrix with promax rotated factor solutions. These EFAs revealed that Items 2, 7, 8, 23, and 24 did not load significantly on an interpretable factor solution. Secondary to removing these problematic items, EFAs revealed a three-factor solution: Core Disgust, Animal Reminder Disgust, and Contamination-Based Disgust. CFA also provided support for the three-factor solution over competing unidimensional and two-factor solutions. In addition to evidence suggesting that a three-factor conceptualization of the DS may yield a more reliable assessment of disgust dimensions relative to other conceptualizations, CFA also provided further evidence for refinement of the DS at the item level. Specifically, analysis of localized areas of strain of the three-factor model revealed that Items 21 and 22 (Body Products) and Items 25 and 26 (Body Envelope Violations) appear to share significant content overlap to the extent that they may be considered redundant items. Removal of the psychometrically limited items (Items 2, 7, 8, 23, and 24) and the redundant items (Items 21 and 25) resulted in a 25-item DS (DS-R).

The multidimensional nature of the DS has important implications for our understanding of the development and presentation of disgust sensitivity, as well as the potential pathways by which disgust sensitivity may lead to anxiety-related psychopathology. Prior research has shown that animal fears and contamination-related OCD appear to be specifically related to Core Disgust, whereas BII fears share a specific relation with Animal Reminder Disgust (de Jong & Merckelbach, 1998). Our results provide further evidence for the utility of a dimensional view of the DS. Specifically in Study 2, structural modeling with three latent disgust factors predicting obsessive-compulsive symptoms revealed that Core Disgust and Contamination-Based Disgust are specifically related to OCD concerns, whereas Animal Reminder Disgust is not. In Study 3, differential relations were obtained between the three disgust factors and measures of contamination fears, OCD concerns, and state anxiety. Further, the results of Study 4 provide converging evidence that Core Disgust and Contamination-Based Disgust differentiate between clinical patients with OCD who have washing concerns versus patients with OCD who do not have washing concerns, whereas Animal Reminder Disgust does not. These findings support the notion that distinct disgust sensitivity factors may correspond to distinct mechanisms in the etiology and maintenance of anxiety-related pathology (Olatunji, Williams, et al., 2005).

Psychometric evaluation of the DS-R revealed acceptable internal consistency and split-half reliability. Furthermore, the DS-R was highly correlated with the original DS total score. The Cronbach's alpha estimates for the three subscales corresponding to the three-factor solution of the DS-R were generally higher than those obtained for the eight factors of the original DS. The internal consistency of the three subscales was generally in the acceptable to good range, with the possible exception of the Contamination-Based Disgust subscale. These findings suggest that the three subscales of the DS provide a more internally consistent assessment of disgust sensitivity than do the original eight disgust domains, and they also highlight the need for continued refinement of this instrument.

The psychometric evaluation and refinement of the DS-R represents an important step toward the development of a psychometrically sound measure of disgust sensitivity. However, additional

measurement issues not addressed in the present studies have to be considered in order to obtain optimal refinement of the DS. For example, the DS does not give respondents the opportunity to rate items as anything but "disgusting." In fact, half of the DS items are rated "True" or "False," and the word "Disgust" does not appear on any item. Thus, it is even more difficult to ascertain whether these items actually measure disgust sensitivity as differentiated from other forms of aversion. It would be valuable to allow respondents to rate multiple emotions, such as the degree to which an item is "disgusting" versus "scary." In addition, refining the scaling of the DS-R such that items are rated on a 5- or 7-point Likert-type scale and evaluating the phrasing of current items may further improve its psychometric properties.

Studies have shown that some patients with anxiety disorder are characterized by high scores on the DS, suggesting that disgust sensitivity may be a "risk factor" for the development and maintenance of such disorders (Olatunji & Sawchuk, 2005). However, the proposed relation between disgust and anxiety disorders is confounded by the overlap between the DS and questionnaires measuring anxiety psychopathology. For example, some OCI-R Washing items are as follows: "I find it difficult to touch an object when I know it has been touched by strangers or certain people" and "I sometimes have to wash or clean myself simply because I feel contaminated." Some DS-Hygiene items are: "I never let any part of my body touch the toilet seat in public restrooms" and "I probably would not go to my favorite restaurant if I found out that the cook had a cold." Examination of these items suggests that thematically the OCI-R Washing and DS-Hygiene subscales are similar, and it could be argued that they both generally measure contamination concerns. As a result, inflated correlations between the DS and measures of OCD symptoms may arise because of items that enquire about similar objects-situations in both questionnaires.

At the item level, further refinement of the DS will ultimately require removal or revision of items that overlap with specific anxiety symptoms. Such modifications to the DS will allow for stronger inferences to be made regarding the nature of the relation between disgust sensitivity and specific anxiety disorders. At the conceptual level, it may be necessary to give further consideration to the construct validity of the DS. The DS is described in the literature as a measure of disgust sensitivity. However, it is important to note that items that assess levels of disgust to specific stimuli and situations (i.e., "You accidentally touch the ashes of a person who has been cremated") may be conceptually different from items that assess levels of disgust independent of context (i.e., "I feel disgusted").

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## Appendix

### Disgust Scale—Revised (DS–R): Items, Scaling, and Scoring

<i>DS–R Part I: Please circle true or false</i>	Scaling		
1. I might be willing to try eating monkey meat, under some circumstances. (R)	False		True
2. It would bother me to see a rat run across my path in a park.	False		True
3. Seeing a cockroach in someone else's house doesn't bother me. (R)	False		True
4. It bothers me to hear someone clear a throat full of mucus.	False		True
5. If I see someone vomit, it makes me sick to my stomach.	False		True
6. It would bother me to be in a science class, and see a human hand preserved in a jar.	False		True
7. It would not upset me at all to watch a person with a glass eye take the eye out of the socket. (R)	False		True
8. It would bother me tremendously to touch a dead body.	False		True
9. I would go out of my way to avoid walking through a graveyard.	False		True
10. I never let any part of my body touch the toilet seat in a public washroom.	False		True
11. I probably would not go to my favorite restaurant if I found out that the cook had a cold.	False		True
12. Even if I was hungry, I would not drink a bowl of my favorite soup if it had been stirred with a used but thoroughly washed flyswatter.	False		True
13. It would bother me to sleep in a nice hotel room if I knew that a man had died of a heart attack in that room the night before.	False		True
<i>DS–R Part II: Please rate how disgusting you would find the following experiences.</i>			
14. If you see someone put ketchup on vanilla ice cream and eat it.	Not	Slightly	Very
15. You are about to drink a glass of milk when you smell that it is spoiled.	Not	Slightly	Very
16. You see maggots on a piece of meat in an outdoor garbage pail.	Not	Slightly	Very
17. You are walking barefoot on concrete and step on an earthworm.	Not	Slightly	Very
18. While you are walking through a tunnel under a railroad track, you smell urine.	Not	Slightly	Very
19. You see a man with his intestines exposed after an accident.	Not	Slightly	Very
20. Your friend's pet cat dies and you have to pick up the dead body with your bare hands.	Not	Slightly	Very
21. You accidentally touch the ashes of a person who has been cremated.	Not	Slightly	Very
22. You take a sip of soda and realize that you drank from the glass that an acquaintance of yours had been drinking from.	Not	Slightly	Very
23. You discover that a friend of yours changes underwear only once a week.	Not	Slightly	Very
24. A friend offers you a piece of chocolate shaped like dog-doo.	Not	Slightly	Very
25. As part of a sex education class, you are required to inflate a new lubricated condom, using your mouth.	Not	Slightly	Very

*Note.* Scoring: Items with (R) are reverse scored; *True* = 1, *False* = 0; *Not disgusting* = 0, *Slightly disgusting* = 0.5, *Very disgusting* = 1. A total disgust sensitivity score can be calculated by summing responses to the 25 items (0–25). Scores for each of three subscales are calculated as follows. Core Disgust: sum of items 1, 2, 3, 4, 5, 12, 14, 15, 16, 17, 18, and 23; Animal Reminder Disgust: sum of items 6, 7, 8, 9, 13, 19, 20, and 21; Contamination-Based Disgust: sum of items 10, 11, 22, 24, and 25. Items are from “Individual Differences in Sensitivity to Disgust: A Scale Sampling Seven Domains of Disgust Elicitors,” by J. Haidt, C. McCauley, and P. Rozin, 1994, *Personality and Individual Differences*, 16, 700–713. Copyright 1994 by Elsevier.

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