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ORIGINAL PAPER

Disgust Sensitivity and Anxiety Disorder Symptoms: Psychometric Properties of the Disgust Emotion Scale

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Abstract Recent research has implicated disgust sensitivity in the etiology of specific anxiety disorders. The Disgust Emotion Scale (DES) is a newly developed measure that was designed to improve the assessment of disgust sensitivity. The present study examines the psychometric properties of the DES. Exploratory factor analysis in Study 1 revealed five factors of disgust towards: (1) rotting foods, (2) blood and injection, (3) smells, (4) mutilation and death, and (5) small animals. The DES demonstrated adequate internal consistency and convergent validity. Significant positive correlations were found between the five factors of the DES and blood-injection-injury fears and obsessive-compulsive disorder symptoms. Confirmatory factor analysis in Study 2 provided support for the five-factor model. However, there was indication of item overlap within the factors. These findings suggest that the DES is a reliable measure of disgust as it relates to specific anxiety disorder symptoms.

Keywords Disgust sensitivity · Factor analysis · Measurement · Anxiety symptoms

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There is ample empirical evidence suggesting that there are individual differences in the propensity to experience heightened disgust reactions towards specific objects or under certain situations (Olatunji & Sawchuk, 2005). Research findings suggest that the propensity to experience heightened disgust reactions (i.e., disgust sensitivity) may operate as a disposition that may place individuals at risk for the development of specific anxiety disorders (McKay & Tsao, 2005). For example, descriptive (e.g., de Jong & Merckelbach, 1998) and experimental (e.g., Koch, O'Neill, Sawchuk, & Connolly, 2002; Olatunji, Lohr, Sawchuk, & Westendorf, 2005; Sawchuk, Lohr, Westendorf, Meunier, & Tolin, 2002) research has demonstrated a significant positive relation between disgust sensitivity and animal phobia and blood-injection-injury (BII) phobia. More recently, theoretical (e.g., Woody & Teachman, 2000) and research (e.g., Olatunji, Williams, Lohr, & Sawchuk, 2005) interest has developed regarding the potential role of disgust sensitivity in obsessive-compulsive disorder (OCD). Specifically, research has shown that individuals high in OCD symptoms score higher than individuals low in OCD symptoms on measures of disgust sensitivity (Olatunji, Sawchuk, Lohr, & de Jong, 2004). The majority of these studies have also found significant positive relations between measures of disgust sensitivity and symptoms of OCD even after controlling for symptoms of anxiety and depression (e.g., Tolin, Woods, & Abramowitz, 2006).

Initial descriptive studies examining the role of disgust sensitivity in anxiety disorders have used the Disgust Questionnaire (DQ; Rozin, Fallon, & Mandell, 1984). The DQ was developed to measure concerns about food contamination. However, it has been shown that stimuli that elicit disgust represent a rather broad and diverse range, thus the measure's sole emphasis on food-related aversions has limited its utility for assessing the role of disgust in the etiology of anxiety

disorder symptoms (Arrindell, Mulkens, Kok, & Vollenbroek, 1999). Due to the limited range of the DQ, Haidt, McCauley, and Rozin (1994) developed the Disgust Scale (DS). The DS is a self-report personality measure that is designed to assess individual differences in sensitivity to disgust. The DS consists of 32 items and assesses eight domains of disgust: (1) food that has spoiled, (2) animals that are slimy or live in dirty conditions, (3) body products including body odors, feces, mucus, etc., (4) body envelope violations, or mutilation of the body, (5) death and dead bodies, (6) culturally deviant sexual behavior, (7) hygiene violations, and (8) sympathetic magic (improbable contamination). The measure consists of four items for each of the eight domains, with two of the four items scored dichotomously and the other two scored on a three-point Likert scale.

Current conceptualizations regarding the disgust sensitivity-anxiety disorders relation are based almost exclusively on studies using the DS (Olatunji & Sawchuk, 2005). The DS represents an improvement in the assessment of individual differences in the experience of disgust. However, the measure is not without notable psychometric limitations (Tolin *et al*., 2006). For instance, the DS subscales yield a limited range of response scaling (0–4) which could result in ceiling effects that may reduce the scales' sensitivity to detect meaningful relations between disgust sensitivity and anxiety disorders or differences between anxious and nonanxious groups (Sawchuk, Lohr, Tolin, Lee, & Kleinknecht, 2000). Some of the items of the DS (e.g., "I think homosexual activities are immoral") also appear to assess emotions other than disgust (i.e., anger, contempt, or fear). A more important documented limitation of the DS is inadequate internal consistency (Schienle, Stark, Walter, & Vaitl, 2003). Although the DS total score shows good internal consistency (Haidt *et al*., 1994), the individual subscales do not. In the initial psychometric study, Haidt *et al*. (1994) report coefficient alphas for the DS subscales ranging from .27 to .63. Tolin *et al*. (2006) reported coefficient alphas for the DS subscales ranging from .36 to .64 and Schienle *et al*. (2003) found coefficient alphas for the subscales of a translated version of the DS ranging from .26 to .64. The low internal consistency raises concerns about the reliability of the items utilized to assess the domains of disgust that have been identified by the DS. The low internal consistency of the DS subscales may also attenuate the relation between the DS subscales and measures of anxiety disorder symptoms. The low internal consistency of the DS scales could also be problematic for studies attempting to partial out the relation between specific disgust sensitivity reactions (i.e., hygiene) and specific anxiety disorder symptoms (i.e., OCD). Taken together, these psychometric limitations caution against reliance on the DS in making claims regarding the role of disgust sensitivity in a broad range of anxiety disorders.

The Disgust Emotion Scale (DES; Walls & Kleinknecht, 1996) was developed to more reliably measure disgust sensitivity. The DES consists of 30 items and assesses five domains of disgust: (1) rotten foods, (2) small animals, (3) injections and blood draws, (4) mutilation and death, and (5) smells. The DES consists of 6 items for each of the 5 subscales and participants are asked to rate their degree of disgust or repugnance using a 5-point Likert scale. The DES subscales yield a much wider range (0–30) than the DS, allowing for a more sensitive detection of individual differences in disgust sensitivity. Despite its appeal as a potentially improved measure of disgust sensitivity, no published reports have evaluated the psychometric properties of the DES. To address this limitation, the present study examines the psychometric properties of the DES in two samples. In Study 1, it was hypothesized that the DES would consist of five factors assessing disgust towards rotting foods, disgust towards blood and injection, disgust towards smells, disgust towards mutilation and death, and disgust towards small animals. Furthermore, it was hypothesized that the DES would demonstrate a pattern of theoretically consistent relationships with the DS (convergent validity) and specific anxiety symptoms. Although the use of the DS as a measure of convergent validity is not ideal given its psychometric limitations, it is the most widely used measure of disgust sensitivity and the only measure that is conceptually similar to the DES. Study 2 employs confirmatory factor analysis as a replication of the factor structure of the DES reported in Study 1.

Study 1: Method

Participants

Participants were first year students at the University of Maastricht (faculties of Health Sciences and Medicine) in the Netherlands. The sample consisted of 41 men and 219 women ($N = 260$) with a mean age of 19.61 ($SD = 1.86$). The uneven gender distribution was due in large part to more women being registered in the courses sampled.

Measures

The Disgust Emotion Scale (DES; Walls & Kleinknecht, 1996) is a 30-item scale measuring disgust sensitivity across five domains of disgust elicitors: Animals, Injections and Blood Draws, Mutilation and Death, Rotting Foods, and Smells. 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 scale, ranging from 0 = "No disgust or repugnance at all" to 4 = "Extreme disgust or repugnance."

The Disgust Scale (DS; Haidt *et al*., 1994) is a 32-item scale assessing disgust sensitivity across seven domains of

disgust elicitors: Animals, Body Products, Death, Envelope Violations (blood, injuries, etc), Food, Hygiene, and Sex. An eighth subscale, Sympathetic Magic (improbable contamination), is factored into the total score. Each subscale is comprised of four questions: the first two items are answered true/false (yielding a score of 0 or 1), with reversed scoring for disgust-absent items. The remaining two items are answered on a 3-point Likert scale (0, .5, or 1) ranging from 0 = "Not disgusting at all" to 1 = "Extremely disgusting." The alpha coefficient for the DS total score is 0.84.

The Maudsley Obsessional Compulsive Inventory (MOCI; Hodgson & Rachman, 1977) is a 30-item measure of obsessions and compulsions related to washing, checking, slowness-repetition, and doubting-conscientiousness. Possible scores on this measure range from 0 to 30. Alpha coefficients for the MOCI scales range from 0.70 to 0.80.

The Blood-Injection-Injury (BII) Fear Questionnaire (Merckelbach, Muris, de Jong, & de Jongh, 1999) is a 10-item measure that contains five BII items from the Fear Questionnaire (FQ; Marks & Mathews, 1979) and five non-overlapping BII items from the Fear Survey Schedule (FSS; Wolpe & Lang, 1964). The BII-Fear Questionnaire has a reported alpha coefficient of 0.82.

Procedure

The DS, MOCI, and BIQ versions used in the present study were Dutch translations previously published in the literature. The third author and other colleagues translated the DES for the purposes of this study (back translation was not conducted). Questionnaire packages including informed consent and the above measures were distributed to student volunteers in groups of 10–50. Questionnaire packages were assembled in a predetermined random order for all participants and were completed in return for 5 euro. The Institutional Review Board (IRB) approved this study.

Results

Reliability and item-level analyses

The mean DES total score was 35.51 (SD = 13.84). DES total scores for women (M = 36.5, SD = 13.7) were significantly higher than those for men (M = 30.5, SD = 13.2), $t(255) = 2.56$, $p < .02$. Given that the scale consisted of 30 items, the mean DES total scores and visual inspection of the scale of the distribution indicate that participants tended to indicate "mild disgust or repugnance" in agreement with the scale items. Means and standard deviations for the DES items are presented in Table 1. Mean scores on 20 out of 30 items were at or above 1.0 (i.e., "mild disgust or repugnance" agreement with the item), suggesting that the content of most DES items was not outside of the experience of most participants. The DES demonstrated excellent internal consistency (α = .90). Based on the criterion of .30 as an acceptable corrected item-total correlation (Nunnally & Bernstein, 1994), 29 of the 30 items performed adequately (range = .31 to .62) with item 29 ("The sight of a spider") displaying a .22 item-total correlation.

Factor structure of the DES

Because no published studies have reported a factor analysis on the DES, exploratory factor analysis was conducted rather than confirmatory factor analysis. Principal components analysis (PCA) was chosen as the primary method of factor analysis because factor scores from principal-axis factor analysis (PAF) are indeterminate (Schönemann & Wang, 1972). Experts have debated the merits of PCA versus PAF, and there are reasons to recommend both approaches to factor extraction (Gorsuch, 1983; Velicer & Jackson, 1990). In the present study, factor analysis of the DES was conducted twice, once using PCA and once using PAF. Factors were rotated using an oblique (Oblimin) transformation in both cases.

Exploratory factor analysis yielded seven factors with eigenvalues greater than 1.0, however the scree plot indicated a 5-factor solution for this sample. Accordingly, five factors were extracted for both PCA and PAF. Table 1 displays the eigenvalues, pattern matrices (loadings), communalities, and percentage of variance for the five rotated factors. The pattern of salient loadings was very similar across PCA and PAF, indicating that both methods produced essentially the same factor structure. The five-factor solution accounted for 57.1% of the DES item variance in PCA, and 49.8% of the item variance in PAF. Table 1 shows that the first factor accounted for a large portion of the variance in DES item scores (26.1% in PCA), whereas the remaining four factors explained smaller portions of the item variance (between 13.5% and 5.1% each).

Factor I had 6 items with salient ($\geq$.30) loadings and all of the items on this factor address disgust or repugnance towards decaying foods (e.g., "A package of hamburger turned green with age"). Accordingly, this factor was labeled as "disgust towards rotting foods." Factor II had 6 items with salient loadings and was labeled "disgust towards blood and injection" given the reference towards objects (e.g., "A small vial of your blood") and situations (e.g., "Receiving a hypodermic injection in the arm") involving blood, injection, and blood draws. Factor III contained 6 items with salient loadings and was labeled "disgust towards smells" given the references towards bad odors (e.g., "The smell of a public rest room"). The fourth factor consisted of 6 items with salient loadings addressing disgust or repugnance towards death and mutilated bodies (e.g., "People injured in an auto accident") and was labeled "disgust towards mutilation and

Table 1 Disgust emotion scale (DES): Item means and standard deviations, obliquely-rotated factor loadings, and communalities for the five-factor solution from Study 1

DES item	*M*	*SD*	DES factor I	II	III	IV	V	h^2
12. A package of hamburger turned green with age	1.58	0.89	.83 (.83)					.74 (.71)
20. An old cup of coffee with mold in it	1.35	0.84	.80 (.77)					.69 (.64)
24. A piece of rotting steak	1.58	0.91	.79 (.77)					.73 (.69)
1. A slice of bread with green mold on it	1.37	0.83	.79 (.74)					.64 (.56)
16. A pile of rotting lettuce	1.00	0.74	.72 (.65)					.54 (.45)
6. A glass of spoiled milk	1.34	0.88	.70 (.64)					.55 (.47)
3. Having blood drawn from your arm	0.65	1.03		.94 (.99)				.84 (.88)
14. Receiving a hypodermic injection in the arm	0.64	1.01		.92 (.94)				.81(.80)
30. A small vial of your blood	0.23	0.60		.73 (.65)				.63 (.55)
9. A bottle of your blood	0.29	0.69		.71 (.62)				.57 (.48)
19. Handling a hypodermic needle	1.23	1.28		.68 (.63)				.64 (.58)
23. Receiving an anesthetic injection in the mouth	1.12	1.12		.66 (.58)				.51 (.43)
28. The smell of urine	1.46	0.81			.88 (.94)			.76 (.80)
7. The smell of human feces	1.67	0.90			.78 (.71)			.60 (.49)
2. The smell of a public rest room	1.54	0.82			.72 (.60)			.53 (.40)
11. The smell of vomit	2.34	0.98			.64 (.57)			.54 (.45)
17. The smell of a city dump	1.65	0.80			.63 (.54)			.53 (.42)
25. The smell of body odor	0.97	0.84			.45 (.36)			.35 (.25)
18. People injured in an auto accident	1.50	1.02				.75 (.69)		.65 (.56)
22. Photos of wounded soldiers	1.12	0.91				.70 (.64)		.60 (.52)
10. The mutilated body of a dog that had been run over by a car	2.18	1.03				.70 (.64)		.62 (.54)
15. A dead person unknown to you	1.07	1.03				.64 (.53)		.50 (.38)
4. Observing an amputation operation	1.80	1.21				.56 (.48)		.53 (.44)
27. A decaying animal on the road	2.12	0.99	.38 (.32)			.38 (.34)		.58 (.53)
26. A sewer rat	1.20	1.04					.78 (.89)	.71 (.80)
21. The sight of a house mouse	0.51	0.77					.77 (.67)	.60 (.44)
8. A snake	0.76	1.09					.53 (.36)	.37 (.23)
13. The sight of a large slug	0.39	0.62					.52 (.32)	.28 (.13)
5. An alley cat	0.35	0.57					.46 (.34)	.27 (.17)
29. The sight of a spider	0.50	0.84						.09 (.04)
% Variance of rotated factors			26.19 (26.19)	13.56 (13.56)	6.53 (5.53)	5.69 (5.69)	5.10 (5.10)	

Note. Factor loadings outside of parenthesis pertain to PCA; those inside parentheses pertain to PAF. Factor loadings $\geq$ |.30| are presented. The first seven eigenvalues were 7.86, 4.07, 1.96, 1.70, 1.53, 1.21, and 1.02.

death." Factor V contained only 5 items with salient loadings and was labeled "disgust towards small animals" given the references towards such animals (e.g., "A snake").

The adequacy of the five-factor solution was evaluated through consideration of simple structure (Thurstone, 1947), the criteria for stability suggested by Guadagnoli and Velicer (1988), and by examining the internal consistency of each factor. Each factor consisted of an adequate number of items with salient loadings (range in PCA = 5–6), and only one item failed to load on a factor (Item 29; "The sight of a spider"). PCA revealed only one complex item (i.e., items with salient loadings on more than one factor) for this sample and no items were markers (e.g., $\geq$ .60) for more than one factor. Based on the criteria recommended by Guadagnoli and Velicer (1988), each factor in the present study appears to be generally stable. Finally, to determine each factor's internal consistency, subscales were created by assigning items to subscales based on their highest salient factor loadings. Each subscale showed adequate internal consistency (α's for Factors I – V = .89, .88, .81, .81, & .67, respectively).

Convergence of the DES and its factors with dimensions of the DS

Table 2 presents correlations between the DES and its factors and the disgust dimensions of the DS. The DES and its factors were significantly correlated with DS total scores (range = .28 to .55). Contrary to expectations, Factor 1

Table 2 Pearson correlations between disgust emotion scale (DES) factors and dimensions of the disgust scale (DS) from Study 1

Scale	DES total score	DES factor scores				
		I	II	III	IV	V
DES factor I	.67	—				
DES factor II	.62	.12	—			
DES factor III	.71	.46	.22	—		
DES factor IV	.80	.37	.46	.46	—	
DES factor V	.61	.40	.17	.36	.39	—
DS total score	.55	.28	.30	.39	.51	.39
DS animals	.36	.25	.13	.22	.29	.43
DS body products	.35	.22	.09	.48	.26	.16
DS death	.40	.14	.31	.18	.42	.26
DS envelope violations	.41	.10	.40	.13	.53	.19
DS food	.25	.21	.13	.19	.16	.18
DS hygiene	.13	.00	.09	.14	.10	.14
DS sex	.07	.06	− .06	.07	.09	.09
DS sympathetic magic	.35	.21	.18	.23	.33	.23

Note. All r's $\geq .14$ are significant, $p < .01$. DES factor labels assigned in the present study: Factor I, disgust towards rotting foods; Factor II, disgust towards blood and injection; Factor III, disgust towards smells; Factor IV, disgust towards mutilation and death; Factor V, disgust towards small animals.

("disgust towards rotting foods") of the DES displayed the highest correlation with the Animals subscale of the DS ($r = .25$). However, the remaining four factors of the DES demonstrated theoretically consistent relations with dimensions of the DS. Factor II ("disgust towards blood and injection") had the highest association with Envelope Violations ($r = .40$), Factor III ("disgust towards smells") was most highly correlated with Body Products ($r = .48$), Factor IV ("disgust towards mutilation and death") was most strongly associated with Envelope Violations ($r = .53$) and Death ($r = .42$), and Factor V ("disgust towards small animals") was most strongly associated with Animals ($r = .43$).

The relation between the DES and its factors and specific anxiety symptoms

Zero-order correlations were also computed to determine relationships between the DES, its factors, and measures of specific anxiety symptoms. As shown in Table 3, correlations between DES total scores and symptoms of OCD and BII were statistically significant (r's $= .29$ and $.69$, respectively). Further examination of these relations revealed that Factor III ("disgust towards smells") was most strongly related to symptoms of OCD ($r = .28$), whereas Factor II ("disgust towards blood and injection") was most strongly related to BII fear ($r = .76$).

Discussion

The findings from Study 1 revealed that the DES is composed of five factors assessing disgust towards rotting foods, blood and injection, smells, mutilation and death, and small animals. These factors were internally consistent and demonstrated theoretically meaningful relationships with related variables. Evidence also was found for the convergent validity of the DES in relation to the DS. Study 1 also replicated prior findings that have found significant positive relations

Table 3 Pearson correlations between disgust emotion scale (DES) factors, disgust scale (DS) subscales and anxiety disorder symptoms from Study 1

	MOCI	BII Fear
DES total score	.29	.60
DES factor I	.24	.14
DES factor II	.16	.76
DES factor III	.28	.22
DES factor IV	.17	.61
DES factor V	.15	.19
DS total score	.20	.46
DS animals	.07	.28
DS body products	.19	.15
DS death	.04	.44
DS envelope violations	.06	.51
DS food	.11	.18
DS hygiene	.16	.17
DS sex	.08	− .06
DS sympathetic magic	.17	.28

Note. All r's $\geq .14$ are significant, $p < .05$. DES factor labels assigned in the present study: Factor I, disgust towards rotting foods; Factor II, disgust towards blood and injection; Factor III, disgust towards smells; Factor IV, disgust towards mutilation and death; Factor V, disgust towards small animals. MOCI: Maudsley Obsessional Compulsive Inventory.

between measures of disgust and symptoms of OCD (e.g., Olatunji *et al*., 2004) as well as symptoms of BII fears (e.g., Sawchuk *et al*., 2000). Although Study 1 offers supportive evidence for the psychometric properties of the DES, replication of its factor structure in an independent sample would bolster confidence in its stability. Accordingly, a confirmatory factor analysis was conducted on the DES in a second sample.

Study 2: Method

Participants

Participants were recruited from undergraduate psychology courses ($N = 307$) at the University of Arkansas in the United States who participated in exchange for research credit. Demographic data were unavailable for 152 participants in this sample due to a data management error. Of the remaining participants in which demographic data were available, the mean age was 20.52 years ($SD = 4.59$), with 69.7% of the sample being women. This study was approved by the IRB.

Measures

The DES described in Study 1.

Procedure

Participants completed questionnaire packages including informed consent and the DES in groups of 10–50 in exchange for coursework research credit.

Results

Reliability and item-level analyses

The mean DES total score was 47.6 ($SD = 20.0$). DES total scores for women ($M = 53.0, SD = 18.4$) were significantly higher than those for men ($M = 34.3, SD = 18.8$), $t(152) = 5.71$, $p < .001$. Because the scale consisted of 30 items, the mean DES total scores and visual inspection of the scale of the distribution indicate that participants tended to indicate either "mild disgust or repugnance" or "considerable disgust or repugnance" in agreement with the scale items. Means and standard deviations for the DES items are presented in Table 4. Mean scores on 24 out of 30 items were above 1.0 (i.e., "mild disgust or repugnance" agreement with the item), suggesting that the disgust content of most DES items was not outside of the experience of most participants. The DES demonstrated excellent internal consistency ($\alpha = .91$). All 30 items had an acceptable corrected item-total correlation (range = .30 to .68). Each subscale (disgust towards rotting foods, disgust towards blood and injection, disgust towards smells, disgust towards mutilation and death, and disgust towards small animals) showed adequate reliability (α's = .89, .88, .58, .84, & .59, respectively).

Confirmatory factor analysis of the DES

The present study employed confirmatory factor analysis (CFA) using the AMOS software package (Arbuckle, 1999) to evaluate the five-factor structure of the DES found in Study 1. Model fit was examined via Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA). Acceptable model fit is indicated by the following criteria: RMSEA ≤ 0.1 and CFI ≥ 0.90. Item 29 of the DES was not included in the CFA in Study 2 as it did not load $\geq .30$ on any of the five factors in Study 1. The initial CFA on the five-factor model demonstrated adequate fit to the data (e.g., RMSEA = 0.07; CFI = 0.95). Parameter estimates and standardized estimates for the Five Factor-Model of the DES are presented in Table 4.

Evaluation of localized areas of strain of the five-factor structure indicated strong evidence of a correlated error residual between item 10 ("The mutilated body of a dog that had been run over by a car") and item 27 ("A decaying animal on the road") of the Mutilation and Death subscale (modification index = 52.21). Strong evidence of a correlated error residual between item 30 ("A small vial of your blood") and item 9 ("A bottle of your blood") of the Injection and Blood Draw subscale (modification index = 54.85) was also indicated. A careful consideration of the item contents suggested that the correlated residuals might be accounted for by a method effect stemming from thematic overlap in item content. Accordingly, the model was refit to the data freely estimating the error covariance between items 10 and 27 and items 30 and 9. A χ^2 Difference Test (CSDT) indicated that these respecifications resulted in a significant improvement in the model fit (CSDT (3) = 162.58, $p < 0.01$) and the modified model demonstrated good fit to the data (RMSEA = 0.06; CFI = 0.96).

General discussion

The present study evaluated the psychometric properties of the DES in two samples. These findings provide evidence specifically for good internal consistency for the DES full scale and individual subscales. Participants tended to endorse either "mild disgust or repugnance" or "considerable disgust or repugnance" agreement with the vast majority of the DES items. These findings suggest that the disgust content of the DES is not far removed from the experience of most nonclinical participants. This finding may be of im-

Table 4 Item means and standard deviations, parameter estimates (and standardized estimates) for the five factor-model of the DES from the CFA in Study 2

DES item	*M*	*SD*	DES factor I	II	III	IV	V
24. A piece of rotting steak	1.69	1.08	.88 (.79)				
6. A glass of spoiled milk	1.68	1.05	.76 (.72)				
20. An old cup of coffee with mold in it	1.16	1.00	.76 (.76)				
12. A package of hamburger turned green with age	2.14	1.11	.88 (.79)				
1. A slice of bread with green mold on it	1.38	0.99	.71 (.72)				
16. A pile of rotting lettuce	1.07	0.95	.71 (.75)				
3. Having blood drawn from your arm	1.05	1.26		1.04(.82)			
14. Receiving a hypodermic injection in the arm	1.10	1.26		1.08 (.85)			
30. A small vial of your blood	0.62	0.99		.82 (.82)			
9. A bottle of your blood	0.97	1.27		1.01 (.79)			
23. Receiving an anesthetic injection in the mouth	1.49	1.29		.75 (.58)			
19. Handling a hypodermic needle	0.91	1.25		.83 (.66)			
17. The smell of a city dump	2.10	1.06			.75 (.71)		
2. The smell of a public rest room	1.95	0.94			.61 (.64)		
25. The smell of body odor	2.08	1.56			.84 (.53)		
11. The smell of vomit	2.76	1.10			.64 (.58)		
28. The smell of urine	1.86	1.02			.74 (.72)		
7. The smell of human feces	2.85	2.73			.63 (.23)		
4. Observing an amputation operation	2.56	1.34				.81 (.60)	
18. People injured in an auto accident	1.82	1.23				.80 (.65)	
22. Photos of wounded soldiers	1.53	1.12				.80 (.71)	
10. The mutilated body of a dog that had been run over by a car	2.37	1.26				.94 (.74)	
27. A decaying animal on the road	1.88	1.17				.87 (.74)	
15. A dead person unknown to you	2.08	1.37				.90 (.65)	
21. The sight of a house mouse	0.95	1.10					.89 (.81)
8. A snake	1.43	1.40					.69 (.49)
26. A sewer rat	1.77	1.28					1.07 (.83)
13. The sight of a large slug	0.85	1.03					.60 (.58)
5. An alley cat	0.32	0.76					.36 (.47)
29. The sight of a spider	1.08	1.21					—

portance as it suggests that disgust sensitivity may exist on a continuum in the same manner as other psychological vulnerability factors. Thus, the experience of disgust sensitivity in nonclinical samples may represent a vulnerability factor for the development of specific anxiety pathology. Results from the exploratory factor analysis in Study 1 and the confirmatory factor analysis in Study 2 indicate that the DES consists of five factors. These factors were assigned the following labels: (1) disgust towards rotting foods, (2) disgust towards blood and injection, (3) disgust towards smells, (4) disgust towards mutilation and death, and (5) disgust towards small animals. Each of the five factors generally demonstrated adequate internal consistency and had a substantial number of items with salient factor loadings.

The present study also provided evidence for the convergent validity of the DES. Specifically, the DES and its factors were significantly correlated with the DS. Disgust towards blood and injection was most correlated with DS Envelope Violations, disgust towards smells was most highly correlated with DS Body Products, disgust towards mutilation and death was most strongly associated with DS Envelope Violations and DS Death, and disgust towards small animals was most strongly associated with DS Animals. The findings that Envelope Violations is the DS dimension most strongly associated with disgust towards blood and injection and disgust towards mutilation and death suggests that violation of the bodily envelope may be a shared feature of the two DES factors. Contrary to expectations, disgust towards rotting foods displayed the highest correlation with DS Animals rather than DS Foods. Further examination of item content suggests that the limited relation between the disgust towards rotting foods factor of the DES and the Foods subscale of the

DS may be attributable to differences in item content. The disgust towards rotting foods factor of the DES appears to measure tangible aversive properties of foods ("A piece of rotting steak"), items of the Foods subscale of the DS appear to assess perceived aversive properties of foods ("You see someone put ketchup on vanilla ice cream, and eat it").

An important goal of the present study was to examine the relation between the DES and its factors and measures of anxiety disorder symptoms. Consistent with prior research examining the relation between disgust and anxiety disorder symptoms (e.g., Olatunji *et al*., 2004; Schienle *et al*., 2003), the DES was significantly correlated with measures of OCD and BII phobia symptoms. Rozin, Haidt and McCauley (2000) dichotomize disgust elicitors into two domains: *Core disgust and Animal Reminder disgust*. Core disgust is based on a sense of offensiveness and contamination, consisting of stimuli such as rotting foods, body products, and small animals associated with dirt and disease characteristics. Animal reminder disgust reflects the aversion of stimuli that serve as reminders of the animal origins of humans, consisting of death/mortality and bodily injury. Prior research suggests that Animal Reminder disgust is specifically associated with BII fears (e.g., de Jong & Merckelbach, 1998) and Core disgust is specifically associated with symptoms of OCD (e.g., Olatunji *et al*., 2005). Accordingly, Factor II ("disgust towards blood and injection") and IV ("disgust towards mutilation and death") were highly associated with symptoms of BII fears, whereas Factor I ("disgust towards rotting foods") and III ("disgust towards smells") were most highly associated with symptoms of OCD. DS subscales assessing core disgust (i.e., body products) were also most highly correlated with symptoms of OCD, whereas DS subscales assessing animal reminder disgust (i.e., envelope violations) were most highly correlated with BII fears (see Table 3). This pattern of findings is consistent with the notion that disgust elicitors are relatively heterogeneous and their relations with specific anxiety disorder symptoms may vary accordingly (Olatunji *et al*., 2004).

Although the DES appears to be a better instrument than the DS for assessing disgust sensitivity because of higher internal consistency, certain psychometric limitations should be mentioned. The confirmatory factor analysis in Study 2 revealed correlated error residuals between items of the Mutilation and Death subscale and items of the Injection and Blood Draw subscale. The degree of item overlap within the subscales of the DES may partially account for its high reliability. Examination of DES items also suggests that there may be thematic overlap with measures of anxiety disorder symptoms. For example, the DES item; "having blood drawn from your arm" seems similar to an item assessing BII fears and the DES item; "the smell of a public rest room" seems similar to an item assessing OCD concerns. Thus, it could be argued that the DES and measures of anxiety symptoms may be measuring the same general construct (e.g., BII distress and contamination concerns). Future revisions of the DES may consider removal of potentially redundant items as well as the inclusions of items that do not overlap with anxiety disorders symptoms.

To the extent that the DES is regarded as a measure of individual differences in the propensity to respond with disgust (i.e., disgust sensitivity), the significant positive correlations between the DES and BII fears and symptoms of OCD suggest that high BII fears and OCD corresponds with high disgust sensitivity. However, detailed examination of the DES indicates that the measure is limited in that it is bound to context. That is, the DES appears to measure only disgust reactions to specific stimuli (i.e., "A bottle of your own blood") and situations (i.e., "Observing an amputation operation"). Thus, a more likely interpretation of the present findings is that high BII fears and OCD correspond with heightened disgust reactivity to specific stimuli or situations. The development of trait measures of disgust (independent of context) may help determine the extent to which disgust predispositions (i.e., trait disgust propensity) contribute to anxiety disorder symptoms (Olatunji *et al*., 2005; van Overveld *et al*., 2004).

The present study suggests that the DES is an internally consistent instrument with highly replicable factor structure (across two culturally diverse samples). However, the extent to which the factor structure of the DES is invariant across community adults and patients with anxiety disorders needs to be addressed in future research. Indeed, total and gender specific means on the DES were generally higher in the U.S. sample compared to the Dutch Sample. Prior research suggests that disgust is a universal emotion that may become associated with stimuli in a consistent way across cultures (e.g., Davey *et al*., 1998). However, these findings suggest that the degree to which disgust is experienced in response to various stimuli may differ as a function of culturally specific variables. Perhaps a difference in the cultural environment might explain the higher DES scores in the US sample (e.g., with respect to the proportion of urban students and/or the level of and/or desire for modern comforts). For example, Bixler and Floyd (1997) have shown that higher desire for modern comforts and preference for built environments over wild land areas was related to higher levels of disgust sensitivity. It is possible that the urbanization in Arkansas is more pronounced than in Maastricht and that the level of modern comforts is also higher which may be one explanation for the differences between both samples. Consistent gender differences were also found across two culturally diverse samples such that women scored higher on the DES than men. This finding replicates prior work demonstrating higher disgust sensitivity in women (i.e., Haidt *et al*., 1994). However, future research is needed to determine if this finding reflects an actual difference in the experience of disgust sensitivity or

a differential response style between men and women (e.g., social desirability related to gender role expectations). It is worth noting that this gender difference in disgust sensitivity may explain why women also demonstrate higher levels of BII fears and symptoms of OCD-related contamination fears (Olatunji, Arrindell, & Lohr, 2005; Olatunji, Sawchuk, Arrindell, & Lohr, 2005).

In sum, these findings suggest that the DES is superior to the DS with respect to reliability. However, the nature of the research question should be considered when researchers are considering when to use the DS or the DES. The DS does assess a wider range of disgust domains than the DES. Thus, if capturing responding to a wide array of disgust stimuli or responding to specific disgust domains not assessed by other measures (i.e., sex, sympathetic magic) are central to the research hypothesis, then the use of the DS may be indicated. However, for a more internally consistent assessment of a relatively limited range of disgust elicitors, the DES may be more appropriate. Of note is that a potential limitation of the present study was the use of an undergraduate sample. Thus, further examination of the psychometric properties and factor structure of the DES in community and clinical samples is warranted in order to evaluate the reliability of the present findings. Extensions of the psychometric evaluation of the DES to more diverse samples may help clarify whether the psychometric limitations of the measure preclude it from being the measure of choice in the assessment of the role of disgust propensity and its domains in the etiology and maintenance of various anxiety disorders.

References

Arbuckle, J. L. (1999). *AMOS: Analysis of moment structures* (Version 4.0). Chicago: SmallWaters.

Arrindell, W. A., Mulkens, S., Kok, J., & Vollenbroek, J. (1999). Disgust and the sex difference in fears to common indigenous animals. *Behaviour Research and Therapy*, *37,* 273–280.

Bixler, R.D., & Floyd, M.F. (1997). Nature is scary, disgusting, and uncomfortable. *Environment & Behavior*, *29,* 443–467.

Davey, G. C. L., McDonald, A. S., Hirisave, U., Prabhu, G. G., Iwawaki, S., Jim, C. I., Merckelbach, H., de Jong, P. J., Leung, P. W. L., & Reimann, B. C. (1998). A cross-cultural study of animal fears. *Behaviour Research and Therapy*, *36,* 735–750.

de Jong, P. J., & Merckelbach, H. (1998). Blood-injection-injury phobia and fear of spiders: Domain specific individual differences in disgust sensitivity. *Personality and Individual Differences*, *24,* 153–158.

Gorsuch, R. L. (1983). *Factor analysis*. Hillsdale, NJ: Erlbaum.

Guadagnoli, E., & Velicer, W. F. (1988). Relation of sample size to the stability of component patterns. *Psychological Bulletin*, *103,* 265–275.

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,* 701–713.

Hodgson, R., & Rachman, S. (1977). Obsessional-compulsive complaints. *Behaviour Research and Therapy*, *28,* 389–395.

Koch, M. D., O'Neil, K., Sawchuk, C. N., & Connolly, K. (2002). Domain-specific and generalized disgust sensitivity in blood-injection-injury phobia: The application of behavioral approach/avoidance tasks. *Journal of Anxiety Disorders*, *16,* 511–527.

Marks, I. M., & Mathews, A. M. (1979). Brief standard self-rating for phobic patients. *Behaviour Research and Therapy*, *17,* 263–267.

McKay, D., & Tsao, S. D. (2005). A treatment most foul: Handling disgust in cognitive-behavior therapy. *Journal of Cognitive Psychotherapy*, *19,* 355–367.

Merckelbach, H., Muris, P., de Jong, P. J., & de Jongh, A. (1999). Disgust sensitivity, blood-injection-injury fear, and dental anxiety. *Clinical Psychology and Psychotherapy*, *6,* 279–285.

Nunnally, J., & Bernstein, I. (1994). *Psychometric theory*. New York: McGraw-Hill.

Olatunji, B. O., Arrindell, W., & Lohr, J. M. (2005). Can the sex differences in disgust sensitivity account for the sex differences in blood-injection-injury fears? *Personality and Individual Differences*, *39,* 61–71.

Olatunji, B. O., Lohr, J. M., Sawchuk, C. N., & Westendorf, D. H. (2005). Using facial expressions as CSs and fearsome and disgusting pictures as UCSs: Affective responding and evaluative learning of fear and disgust in blood-injection-injury phobia. *Journal of Anxiety Disorders*, *19,* 539–555.

Olatunji, B. O., & Sawchuk, C. N. (2005). Disgust: Characteristic features, social manifestations, and clinical implications. *Journal of Social and Clinical Psychology*, *27,* 932–962.

Olatunji, B. O., Sawchuk, C. N., Arrindell, W., & Lohr, J. M. (2005). Disgust sensitivity as a mediator of the sex differences in contamination fears. *Personality and Individual Differences*, *38,* 713–722.

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,* 93–104.

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,* 1069–1086.

Rozin, P., Fallon, A. E., & Mandell, R. (1984). Family resemblances in attitudes to food. *Developmental Psychology*, *20,* 309–314.

Rozin, P., Haidt, J., & McCauley, C. R. (2000). Disgust. In M. Lewis & J. M. Haviland (Eds.), *Handbook of emotions*. New York: Guilford Publications.

Sawchuk, C. N., Lohr, J. M., Tolin, D. F., Lee, T. C., & Kleinknecht, R. A. (2000). Disgust sensitivity and contamination fears in spider and blood-injection-injury phobias. *Behaviour Research and Therapy*, *38,* 753–762.

Sawchuk, C.N., Lohr, J.M., Westendorf, D.A., Meunier, S.A., & Tolin, D.F. (2002). Emotional responding to fearful and disgusting stimuli in specific phobia. *Behaviour Research and Therapy*, *40,* 1031–1046.

Schönemann, P. H., & Wang, M. M. (1972). Some new results on factor indeterminacy. *Psychometrika*, *37,* 61–91.

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 non-clinical sample. *Anxiety, Stress, and Coping*, *16,* 185–193.

Thurstone, L. L. (1947). *Multiple factor analysis*. Chicago, IL: University of Chicago Press.

Tolin, D. F., Woods, C. M., & Abramowitz, J. S. (2006). Disgust sensitivity and obsessive-compulsive symptoms in a nonclinical sample. *Journal of Behavior Therapy and Experimental Psychiatry*, *37,* 30–40.

van Overveld, W.J.M., de Jong, P.J., & Peters, M.L. (2004, November). *The Disgust Propensity and Sensitivity Scale: a study on psychometric qualities*. Paper presented at the Annual Conference of

the American Association of Behavioral Therapy (AABT), New Orleans.

Velicer, W. F., & Jackson, D. N. (1990). Component analysis versus common factor analysis: Some issues in selecting an appropriate procedure. *Multivariate Behavioral Research*, *25,* 1–28.

Walls, M. M. & Kleinknect, R. A. (April 1996). *Disgust factors as predictors of blood-injury fear and fainting*. Paper presented to the Annual Meeting of the Western Psychological Association, San Jose, CA.

Wolpe, J., & Lang, P. J. (1964). A fear of survey schedule for use in behavior therapy. *Behaviour Research and Therapy*, *2,* 27–30.

Woody, S. R., & Teachman, B. A. (2000). Intersection of disgust and fear: Normative and pathological views. *Clinical Psychology: Science and Practice*, *7,* 291–311.