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Specificity of disgust sensitivity in the prediction of fear and disgust responding to a brief spider exposure

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Abstract

This study examined the specificity of disgust sensitivity in predicting fear and disgust responses to exposure to a spider. Participants high ($n = 22$) and low ($n = 28$) in spider fear completed self-report measures of disgust sensitivity, contamination fear, anxiety, and negative affect. They then participated in a behavioral avoidance task (BAT) in which they were briefly exposed to a realistic-looking, but fake, tarantula. Results revealed that disgust sensitivity was associated with fear and disgust responding to the BAT. The association between disgust sensitivity and disgust responding to the BAT remained significant after controlling for gender, spider fear group membership, contamination fear, anxiety, and negative affect. However, the association between disgust sensitivity and fear responding to the BAT was only marginally significant after controlling for the same variables. Contamination fear was also strongly related to fear and disgust responding to the BAT. However, this relationship was fully mediated by disgust sensitivity. These findings indicate that disgust sensitivity has a unique association with aversive responding to spiders. The implications of these findings for better understanding the complex role of fear and disgust as they related to disgust sensitivity in spider phobia are discussed.

Keywords: Disgust; Fear; Spiders; Behavioral avoidance; Disgust sensitivity; Contamination

Epidemiological research has found that fear of small animals account for 46% of the total group of individuals who report any phobia (Chapman, 1997). Perhaps the most common specific phobia is the fear of spiders (Davey, 1992). Spider phobia is generally associated with the expectation that aversive, harm-related consequences with follow exposure to spiders. This expectancy bias is consistent with a fear-mediated predator-defense model (e.g., Öhman, Dimberg, & Öst, 1985) that is supported by spider phobics' endorsement of beliefs that spiders are predators (''the spider will kill me'') and that contact with spiders can be harmful (Arntz, Lavy, van den Berg, & van Rijsoort, 1993). In addition to fear, evidence suggests that phobic responses to spiders may also include disgust (e.g., de Jong & Merckelbach, 1998; Tolin, Lohr, Sawchuk, & Lee, 1997). For example, when viewing pictures of spiders, phobics report experiencing both elevated fear *and* disgust compared to non-phobics (Sawchuk, Lohr, Westendorf, Meunier, & Tolin, 2002), and this disgust response to picture presentations of spiders has been shown to be independent of fear responses (Olatunji, 2006).

Disgust responses to spider exposure among phobic individuals may be motivated by irrational beliefs about

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spiders. Indeed, phobics report that spiders are not only their most feared objects, they are also the ones they find most disgusting (Thorpe & Salkovskis, 1998). The disgust-evoking properties of spiders have been demonstrated with the ''contaminated cookie'' paradigm (Mulkens, de Jong, & Merckelbach, 1996). After allowing a spider to briefly contact a cookie, approximately 75% of spider phobics refused to eat the cookie compared to only 30% of a matched sample of non-phobics. These findings suggest that spiders may have a specific disgust-evoking property that may be perceived to result in contamination after physical contact among phobic individuals (Vermon & Berenbaum, 2002). Despite evidence of a co-occurring disgust response during spider exposure, spider phobic individuals are categorized as primarily fearful with disgust occurring as a secondary emotion (Sawchuk et al., 2002). However, recent research has shown that disgust is a stronger predictor than anxiety of avoidance of spiders (Woody, McLean, & Klassen, 2005), and expectancy bias towards disgust-relevant consequences, rather than fear-relevant consequences, has recently been shown to be a predictor of spider fear (van Overveld, de Jong, & Peters, 2006). Supportive evidence of the spider phobia–disgust relation has also been found in psychophysiological studies. For example, spider phobic individuals appear to respond with greater disgust-specific facial EMG activity than non-fearful individuals when exposed to spiders (i.e., activity of the m. levator labii; de Jong, Peters, & Vanderhallen, 2002). A recent study also found that spider phobic individuals show greater amygdala activation than control subjects while viewing disgust inducing (i.e., dirty toilets) pictures (Schienle, Schafer, Walter, Stark, & Vaitl, 2005).

Disgust responses to and appraisals of spiders have been elucidated in the context of the disease-avoidance model. This model suggests that certain small animals (e.g., rat, spider, cockroach, maggot, snail, slug) may be avoided due to their perceived disgust, contamination, and disease (subsequent to physical contact) properties rather than concerns of harm during exposure to the animals (Matchett & Davey, 1991). Sawchuk, Lohr, Tolin, Lee, & Kleinknecht (2000) provided preliminary evidence for the disease-avoidance model by demonstrating that spider phobics score higher than do non-phobics on self-report inventories of contamination concerns. In fact, de Jong and Muris (2002) found that spider phobic girls rated their eagerness to eat their favorite candy bar as significantly dampened if a spider had walked across it, even if the bar remained in its packaging. Furthermore, it has been shown that the fear of being contaminated by a disgusting object is the best predictor of spider fear (de Jong & Muris, 2002), and contamination-related implicit associations have been shown to discriminate strongly between spider phobic and non-phobic individuals (Huijding & de Jong, 2007).

Disgust sensitivity, defined as the propensity to experience disgust towards a wide range of stimuli, has been described as a specific, genetically based personality vulnerability factor (as opposed to a general vulnerability such as neuroticism or behavioral inhibition) that may contribute to the development of spider phobia (Davey, Forster, & Mayhew, 1993; Muris, 2006). In support of this, researchers have documented a significant relationship between measures of disgust sensitivity and spider phobia (e.g., de Jong & Merckelbach, 1998). Studies have also shown that spider phobics score significantly higher than non-phobics on measures of disgust sensitivity (Merckelbach, de Jong, Arntz, & Schouten, 1993; Tolin et al., 1997). Although it has been suggested that the relation between disgust sensitivity and spider phobia may be spurious and accounted for by trait anxiety or negative affect (e.g., Muris, Merckelbach, Schmidt, & Tierney, 1999; Thorpe & Salkovskis, 1998), Mulkens et al. (1996) found that the relationship between spider phobia and disgust sensitivity was unchanged when the effects of neuroticism and introversion were controlled, suggesting that the relation between disgust sensitivity and spider fear is relatively unique.

Although there is mounting evidence in the literature implicating disgust sensitivity in spider phobia, the relationship between disgust sensitivity and fear and disgust responses to spiders is yet to be clearly elucidated. It is possible that disgust sensitivity is a specific vulnerability for disgust responses to spiders, whereas more traditional vulnerabilities (i.e., trait anxiety) are specific to fear responses to spiders. One study did find that disgust sensitivity was significantly correlated with fear ($r = .41$) and disgust ($r = .38$) responding to a spider behavioral avoidance task (BAT) (Vermon & Berenbaum, 2002). However, this study did not examine if the association between disgust sensitivity and fear and disgust responding was a possible artifact of negative affectivity. Thus, there is a need for additional studies that examine the extent to which potential third variables (i.e., anxiety, negative affect) account for the proposed disgust—spider phobia association (e.g., Davey & Bond, 2006; Thorpe & Salkovskis, 1998).

The present study examines the specificity of disgust sensitivity in predicting fear and disgust responding

after a brief exposure to a spider. It was predicted that disgust sensitivity would be significantly associated with fear and disgust responding to the spider exposure. It was further predicted that the disgust sensitivity–spider exposure response relationship would remain significant when controlling for potential third variables that might explain the association. Because the disease-avoidance model suggests that spiders may be regarded as aversive due to contamination concerns (Matchett & Davey, 1991), in concert with the observation that spiders are considered high in contamination potency among phobic individuals (e.g., de Jong & Muris, 2002), we also examined the relation between the fear of contamination, fear and disgust responses to the brief spider exposure, and disgust sensitivity. It was predicted that contamination fear would be significantly associated with responses to the exposure and disgust sensitivity. However, it was hypothesized that disgust sensitivity would mediate the relationship between contamination fear and fear and disgust responses to the spider BAT.

1. Method

1.1. Participant selection

Participants were selected from a pool of 323 undergraduate students enrolled in introductory psychology courses. Fifty participants (mean age = 19.86; S.D. = 5.18) were selected and classified into two mutually exclusive groups based on their scores on the Spider Phobia Questionnaire (SPQ; Klorman, Hastings, Weerts, Melamed, & Lang, 1974). The spider phobic[1] group ($N = 22$; 96% women) consisted of participants meeting the following criteria: scoring at least 1 S.D. above their respective gender means on the SPQ and reporting avoidance of situations in which spiders may be present. The non-phobic group ($N = 28$; 100% women) consisted of participants meeting the following criteria: scoring at lease 1 S.D. below their respective gender means on the SPQ and reporting no avoidance of situations in which spiders may be present.

[1] The use of the term ''phobic'' is admittedly problematic, as formal diagnostic interviews were not conducted. However, given our hypotheses, referring to these participants as ''fearful'' presumes that they experience fear rather than disgust. Thus, the more conventional label of ''phobic'' was used for the sake of clarity.

1.2. Measures

1.2.1. Spider Phobia Questionnaire (SPQ; Klorman et al., 1974)

The SPQ is a 31-item true/false measure of fear and avoidance of spiders. Scoring is reversed for fear-absent items. Three-week test–retest reliability for the SPQ has been shown to be excellent ($r = .94$; Muris & Merckelbach, 1996). The alpha coefficient for the SPQ was .96 in the present study.

1.2.2. Disgust Scale (DS; Haidt, McCauley, & Rozin, 1994)

The DS is a 32-item questionnaire assessing sensitivity to a range of disgust elicitors, including animals, body products, death, body envelope violations (e.g., injuries), food, hygiene, and sex. The DS yields a total score and eight subscale scores. Evidence has been provided for the convergent validity of the DS with positive correlations with measures of food neophobia and nausea frequency (Björklund & Hursti, 2004). Because the subscale scores have consistently been shown to possess unsatisfactory internal consistencies (e.g., range in α's = .34–.64 in Haidt et al., 1994), only the DS total score ($\alpha = .91$) was used in the present study.

1.2.3. Padua Inventory Contamination Fear subscale (PI; Burns, Keortge, Formea, & Sternberger, 1996)

The PI is a 10-item measure of contamination obsessions and washing compulsions. Items are scored on a five-point scale ranging from 0 (''not at all'') to 4 (''very much''). Evidence has been provided for the convergent validity of the PI contamination subscale with positive correlations with measures of disgust (Olatunji, Sawchuk, Lohr, & de Jong, 2004). Internal consistency was excellent in the present study ($\alpha = .94$).

1.2.4. State-Trait Anxiety Inventory—Trait version, form Y (STAI-T; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983)

The STAI-T is a 20-item scale that measures the stable (trait) propensity to experience anxiety and the tendency to perceive stressful situations as threatening. This measure has been used extensively in anxiety research with clinical and non-clinical populations. 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). The alpha coefficient for the STAI-T was .93 in the present study.

Table 1
Group means (standard deviations) on study measures among non-phobic and spider phobic participants and the total sample

Measure	All participants ($n = 50$)	Non-phobic ($n = 28$)	Spider phobic ($n = 22$)	t (48)	d
Spider Phobia Questionnaire	13.05 (9.97)	4.74 (2.35)	23.64 (3.91)	21.19***	5.86
PI Contamination Fear scale	10.38 (9.11)	7.14 (6.92)	14.50 (10.01)	3.07**	0.86
Disgust Scale	18.70 (5.25)	16.82 (4.19)	21.09 (5.58)	3.09**	0.87
PANAS negative affect	14.84 (4.72)	13.93 (3.67)	16.00 (5.66)	1.56	0.43
STAI-T	23.36 (14.11)	14.07 (10.60)	35.18 (7.66)	2.80**	2.28
BAT fear	15.66 (13.91)	6.46 (8.37)	27.36 (10.24)	7.86***	2.23
BAT disgust	13.05 (9.97)	4.74 (2.35)	23.64 (3.91)	7.94***	5.86

PI: Padua Inventory; PANAS: Positive and Negative Affect Scale; STAI-T: State-Trait Anxiety Inventory—Trait version; BAT: behavioral avoidance task. Cohen's d was calculated as the difference between the mean scores in each group divided by the pooled standard deviation.
** $p < .01$.
*** $p < .001$.

1.2.5. Positive and Negative Affectivity Schedule (PANAS-NA: Watson, Clark, & Tellegen, 1988)

The PANAS-NA is a 10-item measure of the propensity to experience chronic negative emotions. Participants are asked to rate the degree to which they generally experience 10 negative affective experiences (i.e., nervous, jittery, distressed, scared, afraid). The PANAS has demonstrated good psychometric properties in past research with clinical and non-clinical populations with an alpha coefficient of .85 for the negative affect subscale (Crawford & Henry, 2004). The alpha coefficient for the negative affect subscale was .52 in the present study.

1.2.6. Behavioral Task Rating Scale (BTRS; Olatunji, Lohr, Sawchuk, & Tolin, 2007)

The BTRS was used to assess participants' fear and disgust responses to the BAT across *subjective, behavioral, physiological, and interpretive* dimensions. The BTRS is an 8-item, 11-point Likert-scale ranging from 0 = "not at all true" to 10 = "very true." Each response domain was preceded by the question, "This task makes me feel …": (1) afraid; (2) disgusted; (3) like running away; (4) like pushing the stimuli away from me; (5) like my heart is pounding; (6) sick to my stomach; (7) like I am in danger; and, (8) like I might be contaminated or infected.

1.3. Behavioral avoidance task

The BAT was employed as an alternative measure of exposure to threat-relevant stimuli (compared to self-report measures and picture presentations that have been employed in prior studies). In the BAT, participants were asked to approach a black box that contained a spider and open the box and look inside. The spider was a realistic-looking, but fake, tarantula that was relatively large in size.

1.4. Procedure

Following the informed consent process, participants completed self-report measures of disgust sensitivity, contamination fear, anxiety, and negative affect. Participants were then given a brief introduction to the BAT after completing the measures and given the option to comply or refuse the BAT. Eighteen participants (36% of the sample) choose not to comply. If the participant chose not to comply, the experimenter opened the black box and asked the participant to get as close as they felt comfortable enough to be able to see the spider that was inside the box. The participants then completed a BTRS after the BAT. Composite fear and disgust scores were calculated by summing the appropriate BTRS subjective, physiological, behavioral, and interpretive items referring to dimensions of fear ["This task makes me feel …": (1) afraid; (3) like running away; (5) like my heart is pounding; (7) like I am in danger] and disgust ["This task makes me feel …": (2) disgusted; (4) like pushing the stimuli away from me; (6) sick to my stomach; (8) like I might be contaminated or infected].[2]

2. Results

2.1. Participant characteristics and validation of group membership

Table 1 presents descriptive statistics on each measure for the total sample. Separate scores are also presented for non-phobic and spider phobic participants

[2] The four items that were aggregated for fear (α's = .97; range in r's = .87–.90, p's < .001) and disgust (α's = .94; range in r's = .84–.89, p's < .001) responding to the BAT were internally consistent and highly correlated.

Table 2
Pearson correlations between the study measures

Measure	SPQ	PI	DS	PANAS	STAI-T	BAT fear	BAT disgust
SPQ	–						
PI	.40**	–					
DS	.43**	.42**	–				
PANAS	.22	.27	.12	–			
STAI-T	.34*	.20	.03	.40**	–		
BAT fear	.78***	.37**	.45**	.32*	.43**	–	
BAT disgust	.78***	.40**	.55***	.33*	.45**	.89***	–

SPQ: Spider Phobia Questionnaire; PI: Padua Inventory Contamination Fear scale; DS: Disgust Scale; PANAS: Positive and Negative Affect Scale—Negative Affect; STAI-T: State-Trait Anxiety Inventory—Trait version; BAT: behavioral avoidance task.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

along with the results of between-group comparisons (independent samples *t*-tests and effect size estimates). Spider phobics and non-phobics did not differ with respect to age, $t\ (48) = 0.88$, $p > .10$, or gender, $\chi^2 = 2.65$, $p > .10$. To establish the validity of the distinction between participants with or without spider phobia, we examined group differences on the PI Contamination Fear scale, DS, PANAS, STAI-T, and BAT responses. As shown in Table 1, the spider phobic group had significantly higher scores ($p < .01$) than the non-phobic group on measures of contamination fear, disgust sensitivity, and trait anxiety, but not negative affect ($p > .10$). Statistically significant group differences were also evident on fear ($p < .001$) and disgust ($p < .001$) experienced during the spider BAT. These findings indicate that the spider phobic group exhibits characteristics theoretically expected to discriminate between individuals with and without clinical levels of spider fear.

2.2. Zero-order correlations between BAT responses and study variables

Zero-order Pearson correlations between the study measures are presented in Table 2. As hypothesized, DS scores were significantly associated with fear ($p < .01$) and disgust ($p < .001$) responding to the spider BAT. The DS was not unique in this regard, as scores on the SPQ, PI, PANAS, and STAI-T were also significantly associated with fear and disgust BAT responses. The DS, SPQ, PI, PANAS, and STAI-T were also significantly correlated with each other in 5 of the 10 correlations reported in Table 2. As a result, these correlational analyses cannot distinguish the extent to which any given measure's association with BAT responses reflects a unique relationship or shared variance with other measures.

2.3. Specificity of disgust sensitivity in the prediction of BAT responses

We conducted two hierarchical multiple regression analyses to examine the specific contribution of disgust sensitivity to fear and disgust experienced during the spider BAT. Sets of predictor variables were entered in two blocks. In the first block, spider phobia status (non-phobic versus spider phobic), age, and gender were simultaneously entered as predictors. In the second block, the PANAS, STAI-T, PI Contamination Fear scale, and the DS were simultaneously entered as predictors. In this manner, we determined the contribution of disgust sensitivity to BAT responses after controlling for the presence of spider phobia, age, gender, negative affect, trait anxiety, and contamination fear. Given the expected positive association between spider phobic status and the PI Contamination Fear scale with BAT responses, this analytic strategy provided a very stringent test of the incremental validity of disgust sensitivity.

Table 3 presents the results of these analyses. In the hierarchical regression predicting BAT fear, variables entered in the first step explained a highly significant portion of the variance, $F\ (3, 46) = 19.92$, $p < .001$, with spider phobic status emerging as the only significant predictor (partial $r = .74$, $p < .001$). In the second step, the PANAS, STAI-T, PI Contamination Fear scale, and DS explained an additional 6.7% of the variance in BAT fear, $F\ (4, 42) = 1.90$, $p > .10$. While the DS emerged as a marginally significant predictor ($p < .10$) in the second step, only spider phobic status explained significant, unique variance in BAT fear (partial $r = .60$, $p < .001$). In the second hierarchical regression predicting BAT disgust, variables in the first step accounted for 57.3% of the variance, $F\ (3, 46) = 20.60$, $p < .001$, with the presence of spider

Table 3
Specificity of disgust sensitivity in predicting fear and disgust in response to a spider behavioral avoidance task (BAT)

Measure	ΔR^2	B	S.E. B	β	t
Predicting BAT fear					
Step 1	.57***				
Spider phobia group		−21.45	2.84	−.76	−7.56***
Age		.02	.27	−.01	0.06
Gender		3.53	7.14	.05	0.49
Step 2	.07				
PANAS—negative affect		.31	.32	.11	0.98
STAI-T trait anxiety		.24	.16	.16	1.50
PI Contamination Fear scale		.00	.17	.00	0.0
Disgust sensitivity		.53	.30	.20	1.78#
Predicting BAT Disgust					
Step 1	.57***				
Spider phobia group		−21.44	2.77	−.77	−7.73***
Age		.03	.26	.01	−0.12
Gender		5.41	6.97	.08	0.78
Step 2	.13**				
PANAS—negative affect		.30	.28	.10	1.06
STAI-T trait anxiety		.30	.14	.21	2.10*
PI Contamination Fear scale		.01	.15	.00	0.05
Disgust sensitivity		.88	.26	.33	3.31**

Coding for dichotomous variables: 1 = phobic, 2 = non-phobic (spider phobia group); 1 = male, 2 = female (gender).
# $p < .10$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

phobia once again emerging as a powerful predictor (partial $r = .75$, $p < .001$). Variables added in the second step explained an additional 12.9% of the variance, F (4, 42) = 4.53, $p < .01$, with the STAI-T (partial $r = .31$, $p < .05$), DS (partial $r = .46$, $p < .01$), and spider phobic status (partial $r = .59$, $p < .001$) each accounting for significant, unique variance in BAT disgust.

2.4. Disgust sensitivity as a mediator of the relationship between Contamination Fear and BAT responses

Using the recommendations of Baron and Kenny (1986), we tested whether disgust sensitivity mediated the relationship between the fear of contamination and responses to the BAT. Evidence of mediation requires the following conditions to be present: (a) a significant relationship between disgust sensitivity and contamination fear, (b) a significant association between BAT responses and contamination fear, (c) a significant relationship between disgust sensitivity and BAT responses, and (d) the statistically significant relationship between BAT responses and contamination fear diminishes or disappears when disgust sensitivity is controlled. As shown in Table 2, Pearson correlation coefficients indicated that conditions (a–c) above were met.

We investigated condition (d), the critical test of mediation, by examining the magnitude of the relationship between the fear of contamination and BAT

Table 4
Reductions in standardized regression coefficients for contamination fear in the prediction of behavioral avoidance task (BAT) responses after controlling for disgust sensitivity

Measure	BAT composite score	
	Fear	Disgust
Step 1		
R^2 change for PI	.14**	.16**
β for PI	.37**	.40**
Step 2		
R^2 change for DS	.10**	.18***
β for PI controlling for DS	.23	.21
β for DS	.35*	.47***
Overall R^2	.24	.34
F (2, 47)	7.54***	12.20**

PI: Padua Inventory Contamination Fear scale; DS: Disgust Scale.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

responses after controlling for disgust sensitivity. A two-step regression equation was estimated for each BAT measure by entering, in order, the PI Contamination Fear scale and the DS as predictors. The key comparison involved the change in standardized regression coefficients for the PI Contamination Fear scale from step 1 (total effect) to step 2 (direct effect controlling for disgust sensitivity). Results of these analyses appear in Table 4. As can be seen, the highly significant ($p < .01$) relationship between contamination fear and each BAT composite score became non-significant ($p > .10$) after controlling for disgust sensitivity. Moreover, disgust sensitivity emerged as a significant, unique predictor in both analyses. Thus, all a priori conditions were met, indicating that disgust sensitivity fully mediated the relationship between the fear of contamination and fearful and disgust responses to the BAT.

3. Discussion

Phobic avoidance of spiders has traditionally been conceptualized as a fear-mediated anxiety disorder (Olatunji & Sawchuk, 2005). However, studies have shown that spiders also have a specific disgust-evoking status (de Jong & Muris, 2002), and spider phobics report higher levels of both fear and disgust when compared to non-phobics to images of spiders (Tolin et al., 1997). Although these findings are encouraging, there is a relative paucity of studies examining fear and disgust responses to spiders during in vivo exposure. The few available studies employing in vivo spider exposure (rather than self-report or picture ratings) have shown that spider phobics respond with significantly more fear and disgust than non-phobics (e.g., Vermon & Berenbaum, 2002). The present study replicates prior research as spider phobics reported significantly higher levels of fear and disgust than non-phobic participants to a BAT involving a brief exposure to a realistic-looking, but fake tarantula.

The development of phobic avoidance is traditionally understood in the context of general vulnerability factors such as neuroticism or trait anxiety. Thus, the tendency for spider phobic individuals to respond with fear and disgust during in vivo exposure to spiders may be an artifact of heightened trait anxiety (Muris et al., 1999; Thorpe & Salkovskis, 1998). However, there is a growing body of literature suggesting that disgust sensitivity, as a genetically based personality trait, may also contribute to the etiology of spider phobia (e.g., de Jong & Merckelbach, 1998). Indeed, preliminary research has shown that the relation between disgust sensitivity and spider phobia remains significant even after controlling for neuroticism (Mulkens et al., 1996) and trait anxiety (Muris et al., 1999). In line with these studies, the present findings indicate that spider phobics report significantly higher levels of disgust sensitivity than non-phobic participants. These results lend further support to the notion that the general predisposition towards experiencing disgust is associated with spider phobia.

Despite the demonstrated role of fear and disgust responding and disgust sensitivity in spider phobia, it is not yet clear how disgust sensitivity levels relate to fear and disgust responding to spiders. There is preliminary evidence that disgust sensitivity is significantly associated with fear and disgust responding to spiders (Vermon & Berenbaum, 2002). However, it has been suggested that the relation between disgust sensitivity and aversion towards spiders may be illusory and mediated by symptoms of negative affective (Muris et al., 1999; Thorpe & Salkovskis, 1998). Indeed, contamination fear, anxiety, and negative affect were significantly associated with fear and disgust responding to spider exposure in the present study. Thus, it was important to clarify whether the association between disgust sensitivity and fear and disgust responding to the brief spider exposure reflected a unique relationship or shared variance with other variables. Hierarchical multiple regression analyses in the present study revealed the association between disgust sensitivity and disgust responding to the BAT remained significant after controlling for gender, spider fear group membership, contamination fear, anxiety, and negative affect whereas the association between disgust sensitivity and fear responding to the BAT was only marginally significant after controlling for the same variables. These findings suggest that disgust sensitivity has a unique and specific association with negative affective responses, particularly disgust, to spiders that is not attributable to third variables.

Contamination appraisals have also been implicated in the development and maintenance of spider phobia. For example, it has been shown that the strength of spiders' perceived contaminating properties is a crucial factor in distinguishing spider phobic and non-phobic participants (de Jong & Muris, 2002). In the present study, contamination fear was significantly related to spider phobic group membership as well as fear and disgust responses to the spider BAT. While these results are consistent with the proposed role of contamination fear in spider phobia (e.g., Sawchuk et al., 2000), they do not clarify the mechanism by which the fear of contamination contributes to spider phobia. Given the

robust relationship between disgust sensitivity and spider phobia, we predicted that contamination fear might elicit fear and disgust responding towards spiders via its effects on disgust sensitivity. In this study, the significant association between contamination fear and BAT responses became non-significant and was substantially diminished after controlling for disgust sensitivity. In contrast, disgust sensitivity remained a significant predictor of BAT fear and disgust after controlling for contamination fear. Accordingly, our hypothesis that disgust sensitivity would mediate the relationship between contamination fear and fear and disgust responding to the BAT was supported. The present study suggests that spider phobia may develop in the context of contamination fear which evokes sensitivity to disgust-relevant stimuli and motivates avoidance. However, additional research is needed to replicate and clarify the joint contributions of disgust sensitivity and the fear of contamination in spider phobia.

The present findings highlight the notion that disgust sensitivity may be central, perhaps more so than other relevant variables (i.e., trait anxiety, contamination fear), in the etiology and/or maintenance of spider phobia (Muris, 2006). Importantly, the relation between disgust sensitivity and fear responding to the spider exposure became only marginally significant after controlling for other variables whereas the relation between disgust sensitivity and disgust responding remained highly significant. This finding highlights potential differences in the function of fear and disgust among participants high in disgust sensitivity who also present with phobic avoidance of spiders. Prior research has shown that when disgust levels are high, the effects of fear on spider distress are diminished (Vermon & Berenbaum, 2002). Thus, one possibility is that among spider phobics who are high in disgust sensitivity, disgust responding may drive spider avoidance whereas fear responding may drive distress towards spiders (e.g., Woody et al., 2005).

Consistent with previous research, the present findings support the systematic focus on disgust and disgust sensitivity in the treatment of spider phobia. Studies have shown that disgust is readily acquired and not easily extinguished (Rozin, 1986; Olatunji, Forsyth, & Cherian, 2007a) and declines more slowly than fear responses during exposure to spiders. The ‘‘resistant to extinction’’ feature of disgust responding, relative to fear responding, in spider phobia may be a function of elevated levels of disgust sensitivity. Indeed, it has been shown that spider phobics’ degree of disgust sensitivity remains relatively unchanged even after successful exposure-based treatment (de Jong, Andrea, & Muris, 1997). Although the inferences that can be made based on the present findings are limited by our use of a non-clinical sample, the findings suggest that future research examining fear and disgust responding in the context of exposure-based treatment of spider phobia may also benefit from incorporating interventions that may more directly target disgust and disgust sensitivity (e.g., McKay, 2006). Development and implementation of interventions that address disgust at the emotion (disgust responding) and the personality level (disgust sensitivity) in spider phobic individuals could ultimately improve treatment outcome.

References

Arntz, A., Lavy, E., van den Berg, G., & van Rijsoort, S. (1993). Negative beliefs of spider phobics: a psychometric evaluation of the spider phobia beliefs questionnaire. *Advances in Behaviour Research and Therapy, 15*, 257–277.

Baron, R., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research; conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173–1182.

Björklund, F., & Hursti, T. J. (2004). A Swedish translation and validation of the disgust scale: a measure of disgust sensitivity. *Scandinavian Journal of Psychology, 45*, 279–284.

Burns, G. L., Keortge, S. G., Formea, G. M., & Sternberger, L. G. (1996). Revision of the Padua inventory of obsessive compulsive disorder symptoms: distinctiveness between worry, obsessions, and compulsions. *Behaviour Research and Therapy, 34*, 163–173.

Chapman, T. F. (1997). The epidemiology of fears and phobias. In: G. C. L. Davey (Ed.), *Phobias; a handbook of theory, research and treatment*. Chichester: Wiley.

Crawford, J., & Henry, J. (2004). The positive and negative affect schedule (PANAS): construct validity, measurement properties and normative data in a large non-clinical sample. *British Journal of Clinical Psychology, 43*, 245–265.

Davey, G. C. L. (1992). Characteristics of individuals with fear of spiders. *Anxiety Research, 4*, 299–314.

Davey, G. C. L., & Bond, N. (2006). Using controlled comparisons in disgust psychopathology research: the case of disgust, hypochondriasis and health anxiety. *Journal of Behavior Therapy and Experimental Psychiatry, 37*, 4–15.

Davey, G. C. L., Forster, L., & Mayhew, G. (1993). Familial resemblance in disgust sensitivity and animal phobias. *Behaviour Research and Therapy, 31*, 41–50.

de Jong, P., Andrea, H., & Muris, P. (1997). Spider phobia in children: disgust and fear before and after treatment. *Behaviour Research and Therapy, 35*, 559–562.

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.

de Jong, P. J., & Muris, P. (2002). Spider phobia: interaction of disgust and perceived likelihood of involuntary physical contact. *Journal of Anxiety Disorders, 16*, 51–65.

de Jong, P. J., Peters, M. L., & Vanderhallen, I. (2002). Disgust and disgust sensitivity in spider phobia: facial EMG in response to

spider and oral disgust imagery. *Journal of Anxiety Disorders, 16*, 477–493.

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.

Huijding, J., & de Jong, P. J. (2007). Beyond fear and disgust: the role of (automatic) contamination-related associations in spider phobia. *Journal of Behavior Therapy and Experimental Psychiatry, 38*, 200–211.

Klorman, R., Hastings, J., Weerts, T., Melamed, B., & Lang, P. (1974). Psychometric description of some specific fear questionnaires. *Behavior Therapy, 5*, 401–409.

Matchett, G., & Davey, G. C. (1991). A test of the disease-avoidance model of animal phobias. *Behaviour Research and Therapy, 29*, 91–94.

McKay, D. (2006). Treating disgust reactions in contamination-based obsessive–compulsive disorder. *Journal of Behavior Therapy and Experimental Psychiatry, 37*, 53–59.

Merckelbach, H., de Jong, P. J., Arntz, A., & Schouten, E. (1993). The role of evaluative learning and disgust in the etiology and treatment of spider phobia. *Advances in Behaviour Research and Therapy, 15*, 243–255.

Mulkens, S. A., de Jong, P. J., & Merckelbach, H. (1996). Disgust and spider phobia. *Journal of Abnormal Psychology, 105*, 464–468.

Muris, P. (2006). The pathogenesis of childhood anxiety disorders: considerations from a development psychopathology perspective. *International Journal of Behavioral Development, 30*, 5–11.

Muris, P., & Merckelbach, H. (1996). A comparison of two spider fear questionnaires. *Journal of Behavior Therapy and Experimental Psychiatry, 27*, 241–244.

Muris, P., Merckelbach, H., Schmidt, H., & Tierney, S. (1999). Disgust sensitivity, trait anxiety and anxiety disorders symptoms in normal children. *Behaviour Research and Therapy, 37*, 953–961.

Öhman, A., Dimberg, U., & Öst, L.-G. (1985). Animal and social phobias: biological constraints on learned fear responses. In: S. Reiss & R. R. Bootzin (Eds.), *Theoretical issues in behavior therapy* (pp. 123–175). New York: Academic Press.

Olatunji, B. O. (2006). Evaluative learning and emotional responding to fearful and disgusting stimuli in spider phobia. *Journal of Anxiety Disorders, 20*, 858–876.

Olatunji, B. O., Forsyth, J. P., & Cherian, A. (2007a). Evaluative differential conditioning of disgust: a sticky form of relational learning that is resistant to extinction. *Journal of Anxiety Disorders, 21*, 820–834.

Olatunji, B. O., Lohr, J. M., Sawchuk, C. N., & Tolin, D. F. (2007). Multimodal assessment of disgust in contamination-related obsessive-compulsive disorder. *Behaviour Research and Therapy, 45*, 263–276.

Olatunji, B. O., & Sawchuk, C. N. (2005). Disgust: characteristic features, social implications, and clinical manifestations. *Journal of Social and Clinical Psychology, 24*, 932–962.

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.

Rozin, P. (1986). One trial learning of acquired likes and dislikes in humans: disgust as a US, food predominance and negative learning predominance. *Learning and Motivation, 17*, 180–189.

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. H., Meunier, S. A., & Tolin, D. F. (2002). Emotional responding to fearful and disgusting stimuli in specific phobics. *Behaviour Research and Therapy, 40*, 1031–1046.

Schienle, A., Schafer, A., Walter, B., Stark, R., & Vaitl, D. (2005). Brain activation of spider phobics towards disorder-relevant, generally disgust- and fear-inducing pictures. *Neuroscience Letters, 388*, 1–6.

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the state-trait anxiety inventory (Form Y)*. Palo Alto, CA: Mind Garden.

Thorpe, S. J., & Salkovskis, P. M. (1998). Studies on the role of disgust in the acquisition and maintenance of specific phobia. *Behaviour Research and Therapy, 36*, 877–893.

Tolin, D. F., Lohr, J. M., Sawchuk, & Lee, T. C. (1997). Disgust and disgust sensitivity in blood-injection-injury and spider phobia. *Behaviour Research and Therapy, 10*, 949–953.

van Overveld, W. J. M., de Jong, P. J., & Peters, M. (2006). Differential UCS expectancy bias in spider fearful individuals: evidence towards an association between spiders and disgust-relevant outcomes. *Journal of Behavior Therapy and Experimental Psychiatry, 37*, 60–72.

Vermon, L. L., & Berenbaum, H. (2002). Disgust and fear in response to spiders. *Cognition and Emotion, 16*, 809–830.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063–1070.

Woody, S. R., McLean, C., & Klassen, T. (2005). Disgust as a motivator of avoidance of spiders. *Journal of Anxiety Disorders, 19*, 461–475.