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Can the sex differences in disgust sensitivity account for the sex differences in blood–injection–injury fears?

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Abstract

Recent research has shown a positive relationship between disgust sensitivity and blood–injection–injury (BII) fears. This line of research has also found that females report higher levels of BII fears and disgust sensitivity than males. The present study sought to determine if the sex difference in BII fears can be accounted for by the sex difference in disgust sensitivity in a sample of undergraduate participants ($N = 162$). Using a mediational test, very strong support was found for this view in relation to fear of Blood. The findings in relation to fears of Injections and Blood Draws, of Sharp Objects, of Mutilation, and of Examinations and Symptoms showed that disgust sensitivity was a potent mediator, albeit not both a necessary and a sufficient condition for a mediational effect to occur, thereby pointing to the operation of multiple mediating factors. Research and clinical implications of the predictive capabilities of disgust sensitivity and sex in relation to BII fears are discussed.

Keywords: Disgust sensitivity; BII fears; Sex differences

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1. Introduction

Blood–injection–injury (BII) phobia encompasses a wide range of situations (e.g., hospitals; physical examinations), procedures (e.g., blood draws; surgery), and stimuli (e.g., needles) that may result in serious health consequences if needed medical treatment is delayed or avoided (Hamilton, 1995). Although BII related avoidance has traditionally been attributed to anxiety, developments in theory (Page, 1994; Woody & Teachman, 2000) and research (Sawchuk, Lohr, Tolin, Lee, & Kleinknecht, 2000; Schienle, Start, Walter, & Vaitl, 2003; Tolin, Lohr, Sawchuk, & Lee, 1997) suggest that disgust sensitivity may also be functional in the etiology and maintenance of BII fears. Studies also suggest that fainting symptoms associated with BII fears are most evident among those high in disgust (e.g., Page, 2003). Consideration of disgust elicitors as representing a fairly broad range has lead to the findings that the strongest associations emerge with disgust domains directly related (e.g., blood, mutilation) to BII concerns (de Jong & Merckelbach, 1998).

One possible mechanism by which disgust may mediate the onset of BII related aversion is the fear of contamination and infection (Sawchuk et al., 2000). In line with the disease-avoidance model of animal fears (Matchett & Davey, 1991; Ware, Jain, Burgess, & Davey, 1994), disgust may mediate BII fears by preventing direct contact and subsequent infection by contaminated (i.e., blood) stimuli. In efforts to identify additional mechanisms that may serve as risk factors for the development of BII fears, studies have investigated sex differences (e.g., Pate, Blount, Cohen, & Smith, 1996). This line of research has consistently found that females report more BII fears than males (e.g., Aho & Erickson, 1985; Arrindell et al., 2003; Farley, Sewell, & Mealiea, 1982; Labus, France, & Taylor, 2000; Muris, Merckelbach, Schmidt, & Tierney, 1999; Schienle et al., 2003). This line of research has also consistently found that females report more disgust sensitivity than males (e.g., Davey, 1994; Schienle et al., 2003). Further examination of gender differences does suggest that gender differences vary across disgust domains. For instance, Haidt, McCauley, and Rozin (1994) found large gender differences (females > males) (11–20 points) for sympathetic magic (improbable contamination), animals, death, body products, body envelope violations, and food, and smaller gender differences (5–8 points) for hygiene and sex disgust elicitors.

The present study sought to determine if the sex differences in disgust sensitivity could account for the sex differences in BII (injections and Blood Draws, Blood, and Mutilation) and related (Sharp Objects and Examinations and Symptoms) fears. Given that research has shown that females report more BII fears and disgust sensitivity than males, it is hypothesized that the magnitude of the sex difference in BII fears may be affected by the magnitude of the sex difference in disgust sensitivity. That is, disgust sensitivity may operate as a mediator of the sex–BII fear relationship.

The present study also investigated the predictive capabilities on BII fears of sex and disgust sensitivity independent of contamination fear. Studies have found disgust sensitivity to be highly correlated with contamination fear (e.g., Olatunji, Sawchuk, Lohr, & de Jong, 2004) and the inclusion of this variable in the present study was to rule out the possibility that the relationship between sex or disgust sensitivity and BII fears would in fact reflect spurious associations. A spurious association would occur when the relationships between sex or disgust sensitivity and self-reported BII fears were the result of the fact that either one or both of these independent variables were correlated with contamination fear.

2. Method

2.1. Participants

The participants for this study were 162 students who were selected from undergraduate psychology courses. They participated in exchange for research credit. There were 115 females (71%) and 47 males (29%) with a joint mean age of 20.5 years (SD = 4.59; range 18–52 yr).

2.2. Measures

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, with reversed scoring for disgust-absent items. The remaining two items are answered on a 3-point Likert scale ranging from 0 = "Not disgusting at all" to 1 = "Extremely disgusting". The alpha coefficient for the DS is 0.84 (Haidt et al., 1994).

The *Medical Fear Survey* (MFS; Kleinknecht, Thorndike, & Walls, 1996) is a 50-item measure assessing degree of BII fears across five domains: Injections and Blood Draws, Sharp Objects, Blood, Mutilation, and Examinations and Symptoms. Participants are asked to rate their degree of fear or tension if they were to be exposed to each item, using a 5-point Likert scale, ranging from 0 = "No fear or tension" to 4 = "Terror". Alpha coefficients for the MFS range from 0.84 to 0.94 (Kleinknecht et al., 1996).

The Padua Inventory (PI; Burns, Keortge, Formea, & Sternberger, 1996) contamination subscale consists of ten items assessing contamination obsessions and washing compulsions. Items are scored on a 5-point scale ranging from 0 = "Not at all" to 4 = "Very much". The alpha coefficient for the PI contamination subscale is 0.85 (Burns et al., 1996).

2.3. Statistical analysis

As described in Arrindell, Mulkens, Kok, and Vollenbroek (1999), to establish a mediated relationship, a series of regression models should be estimated. Following Baron and Kenny (1986), they suggested that one should estimate the three following regression equations:

1. Regressing the mediator (disgust sensitivity) on the independent variable (sex).
2. Regressing the dependent variable (any dimensional measure of BII fear) on the independent variable.
3. Regressing the dependent variable on both the independent variable and on the mediator.

To establish mediation the following conditions must hold:

1. Sex must affect disgust sensitivity in the first equation.
2. Sex must be shown to affect BII fears in the second equation.
3. Disgust sensitivity must affect BII fears in the third equation.

4. If the above three conditions all hold in the predicted directions, then the effect of sex on BII fears must be less in the third equation than in the second. Perfect mediation is found if sex has no effect when disgust sensitivity is controlled.

As indicated above, to test mediation the statistical approach advanced by Baron and Kenny (1986) was employed. To rule out the possibility of inequivalence of disgust sensitivity effects across sex, a sex × disgust sensitivity product term was also included in the regression analyses. Interactions were examined two-sidedly. Furthermore, multicollinearity between product terms and their constituent main effects were counteracted by centering variables prior to multiplication (Cohen & Cohen, 1983). Reported effect sizes were interpreted in line with guidelines proposed by Cohen (1992). The working alpha was set at 0.05 (5%).

3. Results

3.1. The mediation hypothesis

Means and standard deviations of questionnaire measures by gender are presented in Table 1. As shown in Table 2, sex was significantly associated with the proposed mediator (disgust sensitivity) ($p < 0.01$), indicating that females reported higher disgust sensitivity than males. This replicates Davey (1994), Arrindell et al. (1999), and others (e.g., Haidt et al., 1994; Schienle et al., 2003). Thus, the first criterion proposed by Baron and Kenny (1986) was met. Consistent with previous findings (e.g., Aho & Erickson, 1985; Labus et al., 2000; Muris et al., 1999), the results also showed that females reported higher levels of fear than males to injections and blood draws, sharp objects, blood, mutilation, and examinations and symptoms, (all p's < 0.01). Thus, Baron and Kenny's second criterion was also satisfied. Satisfying condition number 3 which states that high disgust sensitivity levels must be related to high self-reported levels of BII fears, the results also showed that high disgust sensitivity was significantly associated with high levels of fear of injections and blood draws, sharp objects, blood, mutilation, and of examinations and symptoms (all p's < 0.01).

Table 1
Means and standard deviations (SD) for self-report measures

Self-report measures	Females		Males		Total sample	
	M	SD	*M*	SD	*M*	SD
Disgust sensitivity	20.47	5.07	14.92	6.57	18.86	6.08
Injections and Blood Draws	17.69	8.94	8.89	7.33	15.14	9.38
Sharp Objects	11.58	8.67	6.17	6.67	10.01	8.49
Blood	9.73	5.80	6.89	4.81	8.90	5.66
Mutilation	6.89	7.84	1.95	3.10	5.46	7.16
Examinations and Symptoms	6.97	6.20	2.25	2.54	5.60	5.80
Contamination Fear	10.03	6.84	5.23	4.43	8.63	6.59

Note: $N = 162$.

Table 2
Correlations between predictors (main effects) and BII fears

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Sex	–	0.41	0.42	0.29	0.22	0.31	0.37	0.33
(2) Disgust Sensitivity		–	0.69	0.50	0.52	0.48	0.44	0.51
(3) Injections and Blood Draws			–	0.69	0.60	0.69	0.54	0.40
(4) Sharp Objects				–	0.57	0.78	0.39	0.43
(5) Blood					–	0.54	0.43	0.37
(6) Mutilation						–	0.48	0.54
(7) Examinations and Symptoms							–	0.42
(8) Contamination Fear								–

Note: All values significant at $p < 0.01$. $N = 162$.

The final and most critical test of mediation entailed the observation of the magnitude of the relationship between sex and self-assessed BII fears by controlling for disgust sensitivity. Reduced-form equations, a form of hierarchical multiple regression analysis, was estimated to assess change in magnitudes of sex–BII fear relationships. A three-step regression equation was estimated in relation to each BII fear dimension in the following order: (1) sex, (2) disgust sensitivity, and (3) sex × disgust sensitivity. The critical comparison involved the change in standardized regression coefficients for sex from step 1 (total effect) to step 2 (direct effect controlling for disgust sensitivity).

As shown in Table 3, sex accounted for 5–18% of the variance across five indices of BII fears. Furthermore, sex retained its predictive power in relation to only fears of Injections and Blood Draws and Examinations and Symptoms after controlling for disgust sensitivity. However, adding the disgust sensitivity measure at step 2 also produced significant increments in the R^2 across all five measures of BII fear, accounting for an additional 10–32% of the variance. Furthermore, the change in regression weights for sex from step 1 to step 2 indicated that controlling for disgust sensitivity levels reduced the β's for sex significantly, namely by 41–96%. The 96% reduction which brought the β for sex in relation to fear of Blood very close to 0.00 (0.01) provided "strong evidence for a single, dominant mediator" (Baron & Kenny, 1986, p. 1176).

In spite of the fact that the remaining three out of four changes did not reflect reductions of β to zero, they did point to changes where the effect size (translated to r) was reduced from a higher magnitude class to a lower one, i.e., from either a practically large (0.50) or a medium effect size (0.30) to a small effect size (0.10). This was particularly true in relation to two dimensions of BII fear where the β's for sex were reduced to non-significant levels, namely fears of Sharp Objects and fears of Mutilation. According to Baron and Kenny (1986, p. 1176), from a theoretical perspective, "a significant reduction demonstrates that the given mediator is indeed potent, albeit not both a necessary and a sufficient condition for an effect to occur". In Baron and Kenny's view, reductions such as these indicate the operation of multiple mediating factors.

Studies have shown that individuals with elevated disgust sensitivity also report elevated levels of contamination fear (e.g., Olatunji et al., 2004). In the present study, contamination fear (PI) was significantly correlated with disgust sensitivity ($r = 0.51$, $p < 0.01$). Therefore, contamination fear is now introduced as a potential predictor of BII fears in order to rule out the possibility of a spurious association between disgust sensitivity and BII fears. Table 4 depicts the findings of

Table 3
Reductions in standardized regression coefficients for sex controlling for disgust sensitivity and potential interactions between main effects

	Dependent variables				
	Injections and Blood Draws	Sharp Objects	Blood	Mutilation	Examinations and Symptoms
Step 1					
R^2 Change for sex entry	0.18***	0.08***	0.05**	0.10***	0.14***
β for sex	0.43***	0.29***	0.23**	0.31***	0.37***
Step 2					
R^2 Change for disgust sensitivity entry	0.32***	0.18***	0.23***	0.15***	0.10***
β for sex controlling for disgust sensitivity	0.17**	0.10	0.01	0.14	0.22**
% Reduction in β for sex	61%	66%	96%	55%	41%
β for disgust sensitivity	0.63**	0.46**	0.52***	0.42***	0.35***
Step 3					
β for sex × disgust sensitivity	0.16	0.12	0.04	0.34**	0.25*
Multiple R (R^2)	0.72 (0.52)	0.52 (0.27)	0.53 (0.28)	0.55 (0.30)	0.51 (0.26)
Effect size, f^2	1.08, Very large	0.37, Large	0.38, Large	0.43, Large	0.35, Large
F (df = 3, 158)	56.48***	19.41***	20.42***	22.52***	19.05***

Note: $N = 162$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

conventional multiple regressions of sex, disgust sensitivity, contamination fear, and the sex × disgust sensitivity interaction term on five dimensions of BII fears. The relevant findings may be summarized as follows.

3.2. Injection and blood draws

Being female and having a high disgust sensitivity score were significant, independent predictors of high levels of fears of Injections and Blood Draws. The sex × disgust sensitivity interaction term just failed to attain statistical significance ($\beta = 0.15$, $t = 1.85$, $p = 0.06$).

3.3. Sharp objects

High levels of disgust sensitivity and high levels of fear of contamination were the only significant, independent predictors of high levels of fears of Sharp Objects.

3.4. Blood

High levels of fear of contamination and of disgust sensitivity were the only significant, independent predictors of Blood fears.

Table 4
Regression of sex, disgust sensitivity, contamination fear, and the sex × disgust sensitivity interaction term on five dimensions of BII fear

	BII/medical fears									
	Injections and Blood Draws		Sharp Objects		Blood		Mutilation		Examinations and Symptoms	
Predictors	β	Partial r	β	Partial r	β	Partial r	β	Partial r	β	Partial r
Sex	0.20**	0.24**	0.08	0.08	−0.06	−0.06	0.19*	0.19*	0.24**	0.24**
Sex × disgust sensitivity	0.15	0.15	0.04	0.03	−0.08	−0.07	0.30**	0.23**	0.18	0.14
Disgust sensitivity	0.72***	0.54***	0.39***	0.27***	0.29**	0.22**	0.56***	0.38***	0.37***	0.26***
Contamination fear	0.00	0.00	0.22**	0.21**	0.39***	0.37***	0.10	0.10	0.19*	0.18*
Multiple R (R^2)	0.72 (0.52)		0.55 (0.30)		0.61 (0.38)		0.56 (0.31)		0.54 (0.29)	
Effect size, f^2	1.08, Very large		0.43, Large		0.61, Large		0.45, Large		0.41, Large	
F (df = 4, 156)	42.56***		17.00***		24.03***		17.34***		16.08***	

Note: $N = 162$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

3.5. Mutilation

Being female or having a high level of disgust sensitivity predicted high levels of Mutilation fears. Furthermore, the sex × disgust sensitivity interaction term also emerged as a significant predictor of Mutilation fears, indicating that disgust sensitivity correlated inequivalently with Mutilation fears across sex, such that the association was only just statistically significant in males ($r = 0.28$, $t = 2.01$, $p = 0.049$), whereas in females a statistically significant relationship of practically large effect size was obtained ($r = 0.48$, $t = 5.84$, $p < 0.001$).

3.6. Examinations and symptoms

Being female, having a high disgust sensitivity score and a high level of fear of contamination were significant, independent predictors of fears of Examinations and Symptoms. The sex × disgust sensitivity interaction term just failed to attain statistical significance ($\beta = 0.18$, $t = 1.84$, $p = 0.06$).

4. Discussion

Recent research has implicated the role of disgust sensitivity in BII fears (e.g., Koch, O'Neil, Sawchuk, & Connolly, 2002; Sawchuk, Lohr, Westendorf, Meunier, & Tolin, 2002; Schienle et al., 2003). Extensions of this line of research have found females to report higher levels of BII fears (e.g., Labus et al., 2000) and disgust sensitivity (e.g., Davey, 1994) than males. Despite the fact that the present study consisted on an unequal distribution of men and women, the findings do replicate previous studies demonstrating that females report more BII fears and disgust sensitivity than males.

Drawing from findings that females report more BII fears and disgust sensitivity than males, it was predicted that the sex difference in BII fears might be accounted for by the sex difference in disgust sensitivity. A mediational test provided convincing evidence for such an effect. The strongest evidence was obtained in relation to fear of Blood suggesting that perhaps disgust sensitivity operates as a predisposition to blood fears (e.g., Page, 2003). Findings in relation to the remaining four BII related variables revealed that disgust sensitivity was potent, albeit not both a necessary and sufficient condition for an effect (i.e., a reduction of the predictive capability of sex to zero) to occur, pointing to the operation of (not yet identified) multiple mediating factors. When the fear of contamination was introduced as a potential predictor, sex continued to maintain a significant relationship with fears of Injections and Blood Draws, of fears of Mutilation, and of fears of Examinations and Symptoms. However, disgust sensitivity retained its predictive capabilities in relation to all dimensions of BII fears.

The present study also revealed a complex interaction between sex and disgust sensitivity in the prediction of mutilation fears. Specifically, disgust sensitivity was more strongly predictive of high levels of fears of mutilation in females than in males. Perhaps the gender differences in BII fears is particularly greater for bodily mutilation, with females being more fearful. Given that fear and disgust may interact in a bidirectional manner in exacerbating the experience of the other (e.g.,

Woody & Teachman, 2000), the experience of disgust may intensify among females high in mutilation fears. Although the presented study is limited with the use of a non-clinical sample, the complex interaction between disgust sensitivity and sex in predicting mutilation fears does support the consideration of an assessment of gender-specific disgust sensitivity that may be incorporated into individually tailored exposure interventions and may enhance the specificity of the treatment of BII fears.

Previous research would support the consideration of the role of sex, independent of disgust sensitivity in other (i.e., animal) specific fears (i.e., Arrindell et al., 1999). However, in the present study, sex emerged as a significant predictor of only specific dimensions of BII fears following significant reductions (41–96%) in β's when controlling for disgust sensitivity. Disgust sensitivity retained its predictive powers in relation to all dimensions of BII fears, even after controlling for other potential predictors. These findings appear to support the notion that disgust sensitivity is independently associated with BII fears. While the discrepancy between the present findings and those of Arrindell et al. (1999) may represent phenomenological differences between animal fears and BII fears, the discrepancy could also be due to differences in the assessment of disgust sensitivity. The present study assessed disgust with the DS and Arrindell et al. (1999) assessed disgust with the Disgust Questionnaire (DQ; Rozin, Fallon, & Mandell, 1984). Although developed as a measure of contagion, the DQ has been used as a measure of disgust sensitivity. Certain authors have cautioned, however, that the DQ has limited utility, relative to the DS, given its sole focus on food-related elicitors (e.g., Olatunji & Sawchuk, in press).

Consistent with the hypothesis, disgust sensitivity was found to mediate the sex–BII fear relationship, particularly in regards to the fear of blood. However, potential method effects that may contribute to these findings must be addressed. It could be argued that the relation between disgust and BII fears may be due to some conceptual overlap between measures. Indeed, examination of the items for the Envelope Violation subscale of the DS (i.e., "You see someone accidentally stick a fishing hook through his finger") and items of the MFS (i.e., "Observing someone getting their finger stitched") would suggest some thematic overlap. However, the DS remained significantly associated (all p's < 0.01) with high levels of fear of Injections and Blood Draws ($r = .64$), Sharp Objects ($r = .47$), Blood ($r = .51$), Mutilation ($r = .45$), and of Examinations and Symptoms ($r = .41$) when the items of the Envelope Violation subscale of the DS were removed. This suggests that the relation between disgust sensitivity and BII fears may not be entirely accounted for by conceptual overlap between measures. However, the development of disgust measures that do not confound fearful responses may be needed to further clarify potential method effects that may contribute to these findings (e.g., Olatunji & Sawchuk, in press).

In addition to assessment issues, future research will be required to determine the impact that social desirability may have on the present findings. Specifically, it may be more acceptable or socially desirable for females to report higher levels of BII fears and disgust sensitivity than males (Craske, 1999). Such an analysis may predict that social desirability may also mediate the sex–BII fear relationship. Gender role expectations may also account for the sex–BII fear relationship, as males are often encouraged to display less fear/avoidance and disgust/aversion than females. Other predispositions that may better account for the sex differences in BII fears should also be considered. For instance, studies have shown that females report more negative affect than males (e.g., Fujita, Diener, & Sandvik, 1991) and disgust may represent an amplified component of negative affectivity associated with phobic stimuli (Thorpe & Salkovskis, 1998). Future research

should examine the degree to which disgust operates independent of negative affect as a mediator of the sex differences in BII fears.

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