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Disgust sensitivity and the sex difference in fears to common indigenous animals

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Abstract

Davey's mediational hypothesis [Davey, G. C. L. (1994). Self-reported fears to common indigenous animals in an adult UK population: the role of disgust sensitivity. *British Journal of Psychology*, *85*, 541–554.] suggests that the sex difference in self-assessed animal fears can be accounted for by the sex difference in disgust sensitivity. An empirical test failed to support this hypothesis in a non-clinical sample ($N = 214$). Holding constant the influences of confounders such as age, fear of contamination, sex roles, neuroticism, psychoticism and disgust sensitivity, biological sex kept emerging as a significant predictor in relation to four types of animal fears (fear-relevant animals, dry or non-slimy invertebrates, slimy or wet looking animals and farm animals). Other things being equal, high disgust sensitivity either lost its predictive capability (in relation to dry or non-slimy invertebrates and slimy or wet looking animals) or predicted high fear of fear-relevant animals and of farm animals inequivalently across, respectively, the sexes (high in females only) and age groups (high in the old only). A multifactorial, interactionist approach should be advocated in the study of the aetiology of animal fears if progress in this area is to be achieved.

1. Introduction

In spite of the prevalence of animal fears, there have been few attempts to establish some of the general causal factors which might underlie these fears. Davey (1994) found significant relationships in both males and females between fear of animals in the invertebrate and fear-

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relevant categories on the one hand and disgust sensitivity levels on the other hand, with females also reporting significantly higher levels of disgust sensitivity than their male counterparts. Davey (1994) concluded that between 20 and 25% of the variance in the two main categories of animal fears could be accounted for by individual disgust sensitivity levels and since females exhibited significantly higher disgust sensitivity levels than males, this factor could be held responsible for a majority of the gender differences in prevalent animal fears. In other words, Davey (1994) actually argued that evidence was found for the notion that the magnitude of the sex difference in animal fears was affected by disgust sensitivity or that such a sex difference could be accounted for by sex differences in disgust sensitivity. Hence, that disgust sensitivity would *mediate* the biological sex–animal fear relationship (henceforth: the mediational hypothesis). However, Davey's claim is premature for having been drawn on the basis of inadequate statistical data analysis. Baron and Kenny (1986) have noted that to establish a mediated relationship, a series of regression models should be estimated. One should estimate the three following regression equations: first, regressing the mediator (disgust sensitivity) on the independent variable (biological sex); second, regressing the dependent variable (any dimension of animal fears) on the independent variable and, third, regressing the dependent variable on both the independent variable and on the mediator. Separate coefficients for each equation should be estimated and tested. The final and most critical test of mediation which was not carried out by Davey (1994) involves observation of the change in the magnitude of the relationship between biological sex and the dependent measures produced by controlling for disgust sensitivity. To establish mediation, the following conditions must hold: (1) the independent variable must affect the mediator in the first equation; (2) the independent variable must be shown to affect the dependent variable in the second equation and (3) the mediator must affect the dependent variable in the third equation. If these conditions all hold in the predicted direction, then the effect of the independent variable on the dependent variable must be less in the third equation than in the second. Perfect mediation holds if the independent variable has no effect when the mediator is controlled: put somewhat differently, if the association reduces to zero, one has strong evidence for a single, dominant mediator; if a reduction to zero does not occur, this indicates the operation of multiple mediating factors.

The aims of the present study were two-fold. Using a non-clinical sample, it set out to (1) address the question as to whether disgust sensitivity could be taken to account for the sex difference in animal fears and (2) study the predictive capabilities on animal fears of biological sex and disgust sensitivity independent of other potential predictors. These additional predictors included age, fear of contamination, masculinity, femininity and the major Eysenckian dimensions of personality termed psychoticism and neuroticism[1].

Aim number (2) extends the Davey (1994) study in the following respect. The inclusion of additional potential correlates and predictors of self-assessed animal fears to the ones that were of central importance to the Davey (1994) study would do justice to the possibility that the

[1] Limitations of space preclude an outline of the empirical arguments for inclusion of these specific predictors. An extended report of this article which is available upon request contains these arguments and the relevant sources on which they are based.

relationships of biological sex and/or disgust sensitivity to animal fears might reflect spurious associations. This situation would occur when the relationships between biological sex or disgust sensitivity and animal fears are solely the result of the fact that either one or both of these variables are correlated with both another potential predictor (e.g. fear of contamination) and the criterion measure (self-assessed animal fears) (e.g. Baron & Kenny, 1986).

2. Method

2.1. Subjects[2]

The series comprised 214 community *S*'s who volunteered to participate in a study on personality and fears. There were 112 females (52.3%) and 102 males (47.7%) with a joint mean age of 30 yr (S.D. = 13 yr; range: 14–79 yr).

2.2. Measures

Animal Fears Questionnaire (AFQ): the list of 35 animals included in the survey was based on Davey (1994, p. 542). Factor analysis of the self-ratings of the present sample of *S*'s (Arrindell, submitted) yielded four factors: (1) fear-relevant animals (e.g. mouse, rat, snake), (2) dry or non-slimy invertebrates (e.g. wasp, cockroach, spider), (3) slimy or wet looking animals (e.g. snail, slug, eel, fish) and (4) farm animals (e.g. cow, goat, horse)[3].

Disgust Sensitivity Questionnaire (DSQ): the DSQ (Rozin, Fallon, & Mandell, 1984) is a 24-item self-report measure that is widely used for measuring disgust sensitivity (e.g. Merckelbach, de Jong, Arntz, & Schouten, 1993; Davey, 1994; Mulkens, de Jong, & Merckelbach, 1996; de Jong, Andrea, & Muris, 1997). The DSQ asks *S*'s to rate on a 9-point scale how much they would like to eat 'contaminated' food items. It should be pointed out that the DSQ does not measure fear, phobia or avoidance behaviour.

The *short Bem Sex Role Inventory* (BSRI) is a widely-employed, reliable and valid measure of masculinity (Mas) and femininity (Fem) (Bem, 1981; Arrindell, Kolk, Pickersgill, & Hageman, 1993).

Padua Inventory-Contamination subscale: this is a reliable and valid, factorially-derived (Sanavio, 1988) 10-item measure that focuses on contamination fear.

The *abbreviated Eysenck Personality Questionnaire-Revised* is a reliable and valid multidimensional measure of four personality traits: psychoticism (or toughmindedness), extraversion, neuroticism and lie (Eysenck & Eysenck, 1991; Sanderman, Arrindell, Ranchor, Eysenck, & Eysenck, 1995, Dutch version).

Measures were scored in such a way that *higher* scores pointed to *stronger* (higher) endorsements of the states or traits assessed.

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[2] The extended report also describes the sample in terms of marital, educational and occupational status. Neither on age nor on any of these variables did the sexes differ from one another.

[3] The first author wishes to thank Professor Graham Davey for his suggestions in naming of the factors.

2.3. Statistical analysis

As pointed out above, to test mediation three regression equations should be estimated using multiple regression analysis. To rule out the possibility of inequivalence of disgust sensitivity effects across sex or age, age × disgust sensitivity and biological sex × disgust sensitivity product terms were included in the regression analyses in addition to an age × biological sex product term. Interactions were examined two-sidedly. Multicollinearity between interaction terms and their constituent main effects was counteracted by centering variables prior to multiplication (Cohen & Cohen, 1983).

3. Results and discussion

3.1. The mediational hypothesis[4]

Biological sex (male = 1, female = 2) was significantly associated with the alledged mediator (disgust sensitivity) (0.17, $P < 0.01$, one-tailed), indicating that females reported higher disgust sensitivity levels than their male counterparts (small effect size in terms of Cohen, 1992), which is a replication of Davey (1994) and others (e.g. Wronska, 1990). Thus, the first criterion proposed by Baron and Kenny (1986) was met. Again in line with Davey (1994), females reported higher levels on all dimensions of animals fears: medium effect-sized r's were observed in relation to fear-relevant animals (0.34, $P < 0.0001$) and dry or non-slimy invertebrates (0.32, $P < 0.0001$), whereas small effect-sized r's were yielded in relation to slimy or wet looking animals (0.22, $P < 0.001$) and farm animals (0.17, $P < 0.01$). Thus, Baron and Kenny's second criterion was also satisfied. Third, high disgust sensitivity must be related to high self-reported levels of fear. Once more in agreement with Davey (1994), high levels of disgust sensitivity were associated with high levels of self-reported fears of fear-relevant animals (0.35, $P < 0.001$, medium effect size), of dry or non-slimy invertebrates (0.25, $P < 0.001$, medium effect size) and of slimy or wet looking animals (0.12, $P < 0.05$, small effect size). Disgust sensitivity, however, was not significantly associated with farm animals (0.10, NS). Thus, condition number 3 was satisfied for three out of four fear measures.

The final and most critical test of mediation is the change in the magnitude of the relationship between biological sex and self-assessed fears produced by controlling for disgust sensitivity. Reduced-form equations, a form of hierarchical multiple regression analysis (Cohen & Cohen, 1983), was estimated to assess change in magnitudes of biological sex–animal fear relationships. A six-step regression equation was estimated in relation to each animal fear dimension in the following order: (1) age, (2) biological sex, (3) disgust sensitivity, (4) age × biological sex, (5) age × disgust sensitivity, and (6) biological sex × disgust sensitivity. The critical comparison involved the change in standardised regression coefficients for biological sex

[4] Marital, educational and occupational status and extraversion and lie were not significantly associated with any of the dependent variables.

from step 2 (total effect) to step 3 (direct effect controlling for disgust sensitivity). Table 1 summarizes the outcome.

As shown in Table 1, biological sex accounted for 3 to 11% of the variance across the four fear measures after controlling for age. Adding the disgust sensitivity measure (at step 3) also produced significant increments in R^2 across all fear measures, accounting for an additional 0.4 to 9% of the variance. The change in regression weights for biological sex from step 2 to step 3 indicates that controlling for disgust sensitivity reduced the β's for biological sex only slightly, namely by 5 to 15%. This is definitely not a reduction of any β to zero; and the reductions clearly reflect less than 40% change in which case one could have spoken of a sizeable drop, i.e. one where the effect size (e.g. r) would be reduced from a higher magnitude class to a lower one (cf. Cohen, 1992, p. 157). Biological sex retained its predictive power in relation to each of the measures of self-assessed animals fears, independent of the predictive capabilities of disgust sensitivity. These observations thus refute the claim made by Davey (1994) that disgust sensitivity could be held responsible for sex differences in animals fears.

The significant interactions shown in Table 1 will be discussed further on.

Table 1
Reduction in standardized regression coefficients for biological sex controlling for disgust sensitivity and possible interactions between main effects

Step	Dependent variables			
	fear-relevant animals	dry or non-slimy invertebrates	slimy or wet looking animals	farm animals
Step 2				
R^2 change for biological sex entry	0.11^{***}	0.11^{***}	0.05^{***}	0.03^{*}
β for biological sex	0.33^{***}	0.33^{***}	0.22^{***}	0.17^{**}
Step 3				
R^2 change for disgust sensitivity entry	0.09^{***}	0.05^{***}	0.01^{***}	0.004^{*}
β for biological sex controlling for disgust sensitivity	0.28^{***}	0.30^{***}	0.21^{**}	0.16^{*}
% Reduction in β for biological sex	15%	9%	5%	6%
β for disgust sensitivity	0.31^{***}	0.23^{***}	0.11	0.07
Step 4: β for age × biological sex	0.07	−0.02	−0.03	−0.02
Step 5: β for age × disgust sensitivity	0.06	−0.02	−0.04	0.21^{**}
Step 6: β for biological sex × disgust sensitivity	0.18^{**}	0.11	0.05	0.10
Multiple R (R^2)	0.49 (0.24)	0.44 (0.19)	0.28 (0.08)	0.30 (0.09)
Effect size, f^2	0.32, large	0.24, medium	0.09, small	0.10, small
F (df = 6, 206)	11.02^{***}	8.27^{***}	2.99^{**}	3.32^{**}

Minimum pairwise $N = 213$. Main effects have been evaluated one-sidedly, interaction effects: two-sidedly. $^{*}P \leq 0.05$, $^{**}P \leq 0.01$, $^{***}P \leq 0.001$. Regression equations were estimated controlling for age entered in step 1.

Table 2
Regressions of age, biological sex, disgust sensitivity, contamination fear, sex roles, two Eysenkian personality dimensions and two interaction terms (age × disgust sensitivity and biological sex × disgust sensitivity) on four dimensions of animal fears

	Animal fears							
	fear-relevant animals		dry or non-slimy invertebrates		slimy or wet looking animals		farm animals	
Predictors	β	partial r	β	partial r	β	partial r	β	partial r
Age × disgust sensitivity	0.01	0.01	−0.07	−0.08	−0.04	−0.04	0.17^{*}	0.17^{*}
Masculinity	-0.17^{**}	-0.18^{**}	-0.18^{**}	-0.19^{**}	0.03	0.03	-0.13^{*}	-0.12^{*}
Biological sex	0.28^{***}	0.30^{***}	0.28^{***}	0.31^{***}	0.22^{***}	0.23^{***}	0.19^{**}	0.19^{**}
Neuroticism	0.03	0.04	0.11^{*}	0.13^{*}	0.10	0.10	0.07	0.07
Age	−0.06	−0.06	-0.19^{**}	-0.21^{**}	-0.19^{**}	-0.20^{**}	0.03	0.03
Biological sex × disgust sensitivity	0.18^{**}	0.20^{**}	0.09	0.11	0.05	0.05	0.08	0.08
Disgust sensitivity	0.22^{***}	0.22^{***}	0.10	0.11	0.03	0.03	0.03	0.03
Femininity	0.00	0.00	0.01	0.01	-0.20^{**}	-0.19^{**}	-0.12^{*}	-0.12^{*}
Psychoticism	−0.05	−0.05	−0.06	−0.07	-0.12^{*}	-0.12^{*}	0.11	0.11
Contamination fear	0.15^{**}	0.16^{**}	0.23^{***}	0.24^{***}	0.16^{*}	0.15^{*}	0.08	0.08
Multiple R (R^2)	0.55 (0.30)		0.56 (0.31)		0.40 (0.16)		0.38 (0.15)	
Effect size, f^2	0.43, large		0.45, large		0.19, medium		0.18, medium	
F (df = 10, 197)	8.50^{***}		8.84^{***}		3.65^{***}		3.33^{***}	

Minimum pairwise $N = 208$. Main effects have been evaluated one-sidedly, interaction effects: two-sidedly. $^{*}P \leq 0.05$, $^{**}P \leq 0.01$, $^{***}P \leq 0.001$.

3.2. Fear of contamination[5], sex roles and Eysenckian personality dimensions held constant

The findings of conventional multiple regression analysis could be summarized as follows (see Table 2).

3.2.1. Fear-relevant animals

Low masculinity, being female (the strongest predictor), high disgust sensitivity and high fear of contamination (a replication of Ware, Jain, Burgess, and Davey, 1994) emerged as significant, independent predictors of high levels of fear of fear-relevant animals. In addition, the biological sex × disgust sensitivity product term also emerged as a significant predictor of this type of fear, indicating that, when the influences of masculinity and fear of contamination were held constant, disgust sensitivity no longer correlated with nor predicted fear levels in males (partial $r = 0.05$, $\beta = 0.05$ NS), whereas in females significant relationships of medium effect sizes were obtained (partial $r = 0.35$, $\beta = 0.36$, $t = 3.79$, $P < 0.001$).

[5] Fear of contamination is distinct from disgust sensitivity. The overlap between both measures is only 15% ($r = 0.39$, $P < 0.001$, one-tailed). In addition, both predictors occupy quite different locations in the dimensional space defined by the major higher-order dimensions of personality in the Eysenckian system (see Arrindell, submitted).

3.2.2. Dry or non-slimy invertebrates

Again, low masculinity, being female and high fear of contamination emerged as significant, independent predictors of high fear levels. In addition, high neuroticism and young age also predicted high levels of fear. Thus, when additional predictors were introduced, disgust sensitivity lost its predictive capability and just fell short of statistical significance ($t = 1.51$, $P = 0.065$).

3.2.3. Slimy or wet looking animals

Being female, low femininity, young age, high fear of contamination and low toughmindedness (i.e. low psychoticism) were the significant, independent predictors of high levels of fears of slimy or wet looking animals. Again, the predictive power of disgust sensitivity vanished when additional predictors were introduced.

3.2.4. Farm animals

Being female, low masculinity and low femininity predicted high levels of fear. Moreover, the age × disgust sensitivity product term too emerged as a significant predictor. Taking significant main effects into account, this significant interaction term pointed to non-significant negative relationships between disgust sensitivity and fear levels in the young, i.e. *S*'s younger than 30 yr (partial $r = -0.10$, $\beta = -0.10$, $t = -1.23$, $P = 0.11$ NS), whereas in the old, i.e. *S*'s of 30 yr or older, significant relationships of practically medium effect sizes were yielded in the opposite direction, with high disgust sensitivity predicting high levels of animal fears (partial $r = 0.26$, $\beta = 0.27$, $t = 2.12$, $P < 0.05$).

4. General discussion

Davey (1994) suggested that the sex difference in animal fears could be accounted for by sex differences in disgust sensitivity. Application in the present study of the appropriate statistical technique for demonstrating the mediational effect of disgust sensitivity showed no convincing evidence for such an effect in relation to any of the animal fears dimensions. Instead, biological sex kept predicting self-reports of each type of animal fears, independent of the predictive capability of disgust sensitivity. Even when other potential predictors (age, sex roles, Eysenckian personality dimensions) were also introduced, biological sex kept emerging as a significant predictor of each type of animal fears. By contrast, disgust sensitivity either lost its predictive capability in relation to fears of dry or non-slimy invertebrates and of slimy or wet looking animals or revealed complex predictive power in relation to fear of fear-relevant animals and of farm animals. Thus, other things being equal, high disgust sensitivity predicted (a) high levels of fear of fear-relevant animals in females but not in males and (b) high levels of fear of farm animals in the 'old', but not in the 'young'.

The present findings clearly argue, and obviously so, for a multifactorial, psycho-bio-social approach in the further study of the aetiology of animal fears. Such an approach should not only include background factors (biological sex, age), sex roles, major dimensions of personality, disgust sensitivity and fear of contamination as potential predictors, but also traumatic experiences, sex role stress, genetic aspects (e.g. intrafamilial resemblances in disgust

sensitivity and fear of contamination), parental rearing factors (Arrindell, Kolk, Pickersgill, & Hageman, 1993; Davey, Forster, & Mayhew, 1993; de Jong, Andrea, & Muris, 1997), environmental aspects of familiarity or exposure to animals, and interactions among these factors that are of interest.

References

Arrindell, W. A. (submitted). *Phobic dimensions* (Vol. IV: the structure of animal fears).

Arrindell, W. A., Kolk, A. M., Pickersgill, M. J., & Hageman, W. J. J. M. (1993). Biological sex, sex role orientation, masculine sex role stress, dissimulation and self-reported fears. *Advances in Behaviour Research and Therapy, 15,* 103–146.

Baron, R. M., & 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.

Bem, S. L. (1981). *Bem Sex-Role Inventory: Professional Manual*. Palo Alto, CA: Consulting Psychologists Press.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112,* 155–159.

Cohen, J., & Cohen, P. (1983). *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: LEA.

Davey, G. C. L. (1994). Self-reported fears to common indigenous animals in an adult UK population: the role of disgust sensitivity. *British Journal of Psychology, 85,* 541–554.

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

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

Eysenck, H. J., & Eysenck, S. B. G. (1991). *Manual of the Eysenck Personality Scales (EPS Adult)*. London: Hodder and Stoughton.

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

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

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

Sanavio, E. (1988). Obsessions and compulsions: the Padua Inventory. *Behaviour Research and Therapy, 26,* 169–177.

Sanderman, R., Arrindell, W. A., Ranchor, A. V., Eysenck, H. J., & Eysenck, S. B. G. (1995). *Het Meten van Persoonlijkheidskenmerken met de Eysenck Personality Questionnaire (EPQ): Een Handleiding*. Groningen, The Netherlands, Noordelijk Centrum voor Gezondheidsvraagstukken.

Ware, J., Jain, K., Burgess, I., & Davey, G. C. L. (1994). Disease-avoidance model: factor analysis of common animal fears. *Behaviour Research and Therapy, 32,* 57–63.

Wronska, J. (1990). Disgust in relation to emotionality, extraversion, psychoticism and imagery abilities. In P. J. D. Drenth, J. A. Sergeant, & R. J. Takens (Eds.), *European Perspectives in Psychology* (Vol. 1). Chichester: Wiley.