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# Sex differences and sex similarities in disgust sensitivity

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ABSTRACT

Across two studies, we test for sex differences in the factor structure, factor loadings, concurrent validity, and means of the Three Domain Disgust Scale. In Study 1, we find that the Three Domain Disgust Scale has indistinguishable factor structure and factor loadings for men and women. In Study 2, we find a small sex difference in sensitivity to pathogen and moral disgust and a large sex difference in sensitivity to sexual disgust, with women more sensitive to disgust across domains. However, correlations between Three Domain Disgust Scale factors and the five factors and 30 facets of the NEO Personality Inventory were indistinguishable between the sexes. These findings suggest that, despite mean sex differences in disgust sensitivity, the Three Domain Disgust Scale measures similar constructs in men and women. Implications for understanding the constructs measured by the Three Domain Disgust Scale are discussed.



## 1. Introduction

Disgust sensitivity refers to the degree to which an individual experiences disgust toward common elicitors (e.g., spoiled food). To date, disgust sensitivity research has spanned myriad topics, including blood–injury–injection phobia (de Jong & Merckelbach, 1998), obsessive and compulsive traits (Mancini, Gragnani, & D'Olimpio, 2001; Olatunji et al., 2007), and political ideology (Inbar, Pizarro, & Bloom, 2009; Tybur, Merriman, Caldwell, McDonald, & Navarrete, 2010). The majority of these investigations have measured disgust sensitivity using the Disgust Scale (Haidt, McCauley, & Rozin, 1994), or revisions of the measure (e.g., Olatunji et al., 2007). Although versions of the Disgust Scale measure disgust responses toward varied sources of infectious disease threats (e.g., corpses, bodily wastes, interpersonal contact), they do not systematically measure disgust toward sexual or moral concepts, both of which elicit disgust (Chapman, Kim, Susskind, & Anderson, 2009; Danovitch & Bloom, 2009; Schaich Borg, Lieberman, & Kiehl, 2008; Simpson, Carter, Anthony, & Overton, 2006; Stevenson, Case, & Oaten, 2011). Given the absence of instruments designed to measure sensitivities to sexual and moral disgust, Tybur, Lieberman, and Griskevicius (2009) developed the Three Domain Disgust Scale (TDDS), which measures disgust sensitivity across pathogen, sexual, and moral domains. Hence, it allows for distinctions between "general" disgust sensitivity, sensitivity to pathogen disgust (which is substantially measured by the Disgust Scale, see Olatunji, Haidt, McKay, & Bieke, 2008; Tybur et al., 2009, 2010), and sensitivity to previously overlooked domains of sexual disgust and moral disgust.

Existing investigations have supported the validity of the TDDS as a three-factor measure. Confirmatory factor analysis suggests that a three-factor structure fits the 21-item measure well. Item composites possess good internal consistency, and the factors are weakly to moderately correlated (Tybur et al., 2009). Studies employing the TDDS have shown that different domains of disgust sensitivity have specific relationships with different outcomes, including mate preferences, social values, and political attitudes (e.g., DeBruine, Jones, Tybur, Lieberman, & Griskevicius, 2010; Kurzban, Dukes, & Weeden, 2010; Tybur et al., 2010). However, it has yet to be demonstrated that the TDDS measures the same constructs in men and women. This gap contrasts with evidence suggesting that disgust *responses* vary between the sexes, with women generally being more sensitive to disgust than men, and disgust differentially relating to other behaviors between the sexes (e.g., Fessler, Pillsworth, & Flamson, 2004; Haidt et al., 1994; Olatunji et al., 2007; Schaich Borg et al., 2008). In the current research, we test the critical assumption that the TDDS measures the same constructs in men and women. If it does, then examining mean differences and sex-specific relationships between the TDDS and other constructs is valid. If it does not, then sex differences involving the TDDS may reflect differences in the constructs measured by the instrument. Moreover, lack of equivalency in the factor structure of the TDDS may suggest meaningful sex differences in the

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nature of sensitivities to pathogen, sexual, and moral disgust as theoretical constructs.

### 1.1. The current studies

Here we investigate cross-sex validity of the TDDS using two methods. In Study 1, we test two necessary conditions for construct equivalence across groups: configural and metric invariance. In Study 2, we examine TDDS construct equivalence across the sexes in a different manner: we test for sex differences in concurrent validity of the TDDS using a revision of the NEO Personality Inventory (NEO PI-3; Costa & Mccrea, 1992; McCrae, Costa, & Martin, 2005).

## 2. Study 1

### 2.1. Methods

To possess comparable validity across groups, a measure must, at minimum, have the same factor structure across groups (Steenkamp & Baumgartner, 1998; Steinmetz, Schmidt, Tina-Booh, Wieczorek, & Schwartz, 2009). Without equivalency in a measure's factor structure, relationships with other variables (e.g., regression slopes, group mean differences) can reflect differences in what is being measured across groups rather than real group differences in the construct of interest (Horn & McArdle, 1992). A further, more stringent test of cross-group validity involves testing the equivalency of factor loadings across groups (Vandenberg & Lance, 2000). Even if the same items define a latent variable, group differences in item loadings suggest subtle differences in the nature of the measured construct(s) between groups. Tests of the equivalency of factor structure and factor loadings are referred to as tests of "configural" and "metric" invariance, respectively (Vandenberg & Lance, 2000). These tests are typically done using confirmatory factor analysis (CFA), which provides a superior framework to exploratory factor analysis techniques for invariance analyses (Marsh & Hocevar, 1985).

#### 2.1.1. Participants

Participants were 1496 individuals (71.1% female) recruited to participate in an online study on personality and emotions via advertisements on craigslist.org websites across the United States. Participant age was more varied than that of the college samples used during TDDS measure development ($M = 33.0$, $SD = 11.7$, range = 18–78). Web-based methods such as this allow for greater sample diversity without presenting serious method-specific threats to validity (see Gosling, Vazire, Srivastava, & John, 2004).

#### 2.1.2. Measures

Participants completed several measures, including the TDDS, which measures sensitivity to pathogen, sexual, and moral disgust across 21 items measured on a 1 (not at all disgusting) to 7 (extremely disgusting) scale. Each item describes a situation, act, or concept nominated during measure development based on its ability to elicit disgust. During measure development, items were retained based on the adequacy of factor loadings and item variability.

#### 2.1.3. Results

All analyses were conducted using EQS 6.1. First, a CFA was performed on the aggregated sample. Pathogen, sexual, and moral disgust items were constrained to load on three latent variables, which were free to covary. Cross-loadings and error covariances were constrained to zero. Mardia's coefficient (normalized estimate: 19.83) suggested that data violated assumptions of multivariate normality, so robust estimates were used to interpret model fit. Models with high numbers of degrees of freedom, including CFA on multi-dimensional measures such as the TDDS, rarely reach conventional thresholds for good model fit according to traditional measures such as comparative fit index (CFI) (Church & Burke, 1994; Marsh, Hau, & Wen, 2004). With the multi-dimensional nature of the TDDS and high degrees of freedom in mind, we interpreted model fit as adequate: S-B$\chi^2(186, N = 1496) = 1148.99$, CFI = 0.91, SRMR = 0.05, RMSEA = 0.06. These fit indices were similar for both sexes when examined separately (Men: S-B$\chi^2(186, N = 433) = 448.87$, CFI = 0.91, SRMR = 0.06, RMSEA = 0.06; Women: S-B$\chi^2(186, N = 1063) = 892.19$, CFI = 0.89, SRMR = 0.05, RMSEA = 0.06).

Next, we specified a multi-group model in which fit for both groups was examined simultaneously. In this model, the factor structure was specified identically across groups, but all item loadings, error variances, and factor covariances were free to vary. This is a method of formally establishing configural invariance (i.e., equivalence in factor structure across the sexes). Model fit was adequate: S-B$\chi^2(372, N = 1496) = 1344.43$, CFI = 0.90, SRMR = 0.06, RMSEA = 0.06. Hence, we observed evidence that the three-factor structure is the same across the sexes, with the same items characterizing each factor. Superficially, the standardized factor loadings were similar across the sexes (Table 1).

Having established configural invariance, we next tested for metric invariance across the sexes. Metric invariance is examined by constraining unstandardized factor loadings to equality across multiple groups. Nested models (i.e., a model in which factor loadings are free to differ across groups—in this case, the previous model used to test for configural invariance—versus a model in which factor loadings are not free to vary between groups) are compared. If the metric invariant model demonstrates inferior fit, factor loading equality constraints are relaxed until fit is indistinct from the baseline model.

Chi-square tests are not typically used as a critical evaluator of overall model fit, since very minor differences between specified and observed covariance structures can lead to the rejection of an adequate and parsimonious model, especially with large samples (Bentler & Bonett, 1980). Noting that a reliance on chi-square difference tests can lead to inappropriate rejection of invariant models, Chen (2007) and Cheung and Rensvold (2002) have suggested guidelines for evaluating measurement invariance using changes in common fit indices, including CFI, root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). Monte Carlo simulations conducted by Chen suggest that, for samples with unequal group sizes, metric invariance should be rejected if $\Delta$CFI is >0.005, $\Delta$RMSEA is >0.010, and $\Delta$SRMR is >0.025. Thus, instead of relying on chi-square difference tests to evaluate metric invariance, we report and interpret differences in these fit indexes.

CFA models require the unstandardized factor loading for one variable (i.e., the "marker" variable) for each latent variable to be fixed to 1.0. This factor loading cannot vary across the sexes, since it is constrained to the same value for both groups. We thus aimed to select marker variables demonstrating good evidence for metric invariance. We examined several models in which different items were designated as marker variables, and all other factor loadings were fixed to equality. After observing that factor loadings for TDDS items 19, 20, and 21 were consistently invariant across the sexes in these preliminary models, we designated them as marker variables for the moral, sexual, and pathogen factors, respectively, for the tests of metric invariance reported below. All other factor loadings were constrained to equality across the sexes. Fit indices were similar to those of the unconstrained model, S-B$\chi^2(390, N = 1496) = 1400.45$, CFI = 0.89, SRMR = 0.07, RMSEA = 0.06, and the model satisfied all criteria for accepting assumptions of metric invariance suggested by Chen (2007), $\Delta$CFI = 0.004,