

Monk Prayogshala Working  
Paper # 2021-06

---

Arathy Puthillam

---

August, 2021

# WHAT MAKES YOU "EW!"?

Cross-National Measurement  
Invariance in Disgust  
Sensitivity

# What makes you “Ew!”? Cross-National Measurement Invariance in Disgust Sensitivity

**Arathy Puthillam**

Department of Psychology, Monk Prayogshala, Mumbai, India

Address correspondence to Arathy Puthillam at [ar@monkprayogshala.in](mailto:ar@monkprayogshala.in)

*The Psychology Working Papers are a series of ongoing research outputs from the Department of Psychology, Monk® Prayogshala®. The purpose of making these papers publicly available is to initiate dialogue and receive feedback on the preliminary work presented. The views and opinions expressed therein are those of the authors and do not necessarily reflect those of Monk Prayogshala, any supporting agencies, or any of its associated entities.*

*Monk® Prayogshala® is a Section 8 company registered under the Indian Companies Act, 2013. The contents of this document are the Intellectual Property of Monk® Prayogshala® (Sec. 25), a company incorporated under the provisions of the Companies Act, 1956 and having its registered office at 4114, Oberoi Garden Estates, C Wing, Next to Chandivali Studios, Powai, Mumbai 400 072, India. (C) Monk® Prayogshala®, 2011-2020. All rights reserved. The recipient of this document is not permitted to copy, make available, sell, disclose, publish, disseminate or otherwise transmit the information contained in this document without prior permission from Monk® Prayogshala®.*

*The author thanks Hansika Kapoor for comments on this manuscript and Sampada Karandikar for valuable inputs in all processes of the previous manuscript, and especially data collection. The data and materials for this study can be found at [osf.io/kmueh](https://osf.io/kmueh).*

# What makes you “Ew!”? Cross-National Measurement Invariance in Disgust Sensitivity

## Abstract

Disgust, as an emotional reaction to aversive stimuli, is thought to be universal; however, specific triggers of disgust may differ across cultures. Even though this has been acknowledged in previous studies, very little research has focused on measurement issues in cross-cultural assessment of disgust. The present study aimed to evaluate measurement equivalence of the three-domain disgust scale in a sample of US Americans and Indians. Specifically, confirmatory factor analysis, for the overall sample, as well as a subsample of Indians and Americans are reported. Next, a multi-group CFA and measurement invariance are tested, along with the size of non-equivalence. Scalar invariance was not found, implying that means cannot be compared across the two countries. However, the scale showed adequate fit in the Indian context, suggesting that it can be used to assess trait disgust sensitivity in India. Finally, item-level differences are noted, and explained via differences in cultural and legal norms.

*Keywords:* Disgust Sensitivity, Measurement Equivalence, Psychometrics, Cross-cultural psychology, Moral Psychology

### **What makes you “Ew!”? Cross-National Measurement Invariance in Disgust Sensitivity**

Disgust has been argued to have evolved as an emotional response to repulsive stimuli. Disgust sensitivity has been associated with a number of psychological phenomena, such as political behaviour (Inbar & Pizarro, 2016), anxiety-related disorders (Knowles et al., 2018), and other socially exclusionary behaviours (Inbar et al., 2009).

The three domain disgust scale (TDDS; Tybur et al., 2009) has measured disgust sensitivity across three domains - pathogen, sexual, and moral disgust. Specifically, each type of disgust has been argued to solve a distinct adaptive problem. Pathogen disgust serves as a first line of defence against infections; moral disgust serves to solve the adaptive problem of social transgressions; sexual disgust serves to avoid sexual contact with those whose sexual value might be relatively low, such as one's close relatives. Though previous work using this scale has studied other cultures in a limited way, measurement issues arising from studying different countries has not yet been explored. This is especially discordant considering that the initial development of the TDDS also did not include nationality details of the student participants (but see Tybur & Karinen, 2018), except one community sample in the US.

Considering the promising nature of the construct of disgust in understanding a range of avoidance behaviours, it might be of interest to study it in heterogeneous samples, including non-Western ones. One way to demonstrate cross-cultural compatibility of avoidance behaviours rooted in disgust may be by assessing the validity of the scales and tools used to measure the construct. However, it is unclear whether the TDDS is invariant across nationalities. In other words, it is unclear whether the scale is psychometrically equivalent in measuring the construct across cultures. In the present study, we aim to test the scale's measurement invariance in two countries - the United States and India.

### Cross-Cultural Differences in Disgust

The evolved function of disgust is likely to have universal similarities by default. For instance, using photo-based stimuli, Curtis et al. (2004) found that stimuli connoting disease relevance (e.g., a plate of liquid dyed blue) were rated as more disgusting than those with little to no disease relevance (e.g., the same plate of liquid color-morphed to look like bodily fluids), in a global sample. However, the specific elicitors of disgust, such as specific taboos against and acceptance for food (Harris, 1998; Hartmann et al., 2015) are likely to be culture-specific.

Given that disgust is purported to be a universal emotion that is likely to be a multidimensional construct and that the TDDS specifically measures three dimensions of disgust (Tybur et al., 2009, 2013), it is essential to assess the structure of the emotion cross-culturally (using the scale as an empirical proxy). This is also imperative given the likely differences in sexual and moral disgust across cultures. For instance, in many parts of the world, the specific meanings of incest differs (Buunk, 2017). Similarly, cultures differ along the lines of what is morally acceptable. For instance, it is likely that deceiving a friend or shoplifting might not be seen as *disgusting*, even if largely unacceptable. This might cause subtle differences in responding among individuals from different cultures. Other scales such as the Disgust Scale -R (Haidt et al., 1994; reviewed by Olatunji et al., 2007) measure how certain behaviours like touching a dead body are considered creepy or uncanny. TDDS, on the other hand, measures disgust in a more unambiguous manner (see Tybur et al., 2009). Further, it is likely that certain sexual acts, including those measured in the scale, are illegal or criminal in non-Western countries, and therefore are considered morally and sexually disgusting. Such issues are likely to have changed participants' understanding of the items, therefore, also reducing validity.

Previous work on TDDS has focused on comparing pathogen and moral disgust in Ghana and the U.S.; students from Ghana reported significantly lower disgust than those from the U.S. Contamination concerns in particular were found to drive cross-cultural differences in pathogen disgust (Skolnick & Dzokoto, 2013). In general, it has been argued that nations wherein burden of infectious diseases are higher should also experience higher disgust sensitivity (Fincher & Thornhill, 2012). However, other studies have not found results supporting this contention (Curtis et al., 2011; Tybur et al., 2016).

On the other hand, it is also important to assess whether such cross-cultural and/or cross-country comparisons are valid and meaningful, at the measurement level. This is especially crucial to understand how constructs and their expressions vary across countries/cultures, to portray a complete picture of human behaviour. Specific to disgust, though multinational samples have been utilized (e.g., Tybur et al., 2016), whether the measure of disgust is invariant across countries has not been explored.

### **The Present Study**

Following Fischer and Karl's steps (2019) to evaluate cross-cultural multigroup invariance testing, this study aims to evaluate measurement equivalence of the TDDS using samples from the USA and India. Specifically, the study aims to conduct a confirmatory factor analysis (CFA) on samples across the two countries (to replicate the factor structure in the current sample of US Americans), followed by a multi-group CFA to test for equivalence across Indians and Americans. This would be followed by an assessment of measurement invariance in terms of hierarchical constraining of various parameters, as well as changes in fit indices with a more constrained model (Cheung & Rensvold, 2000). Specifically, configural invariance would measure whether the latent factors are the consistent across the groups. If this holds true, then the second level of analysis

would be to test for metric invariance, which assesses whether factor loadings are equivalent. This allows for the assessment of non-uniform item bias (Mellenbergh, 1982), implying that the differences in item scores are a reflection of the differences in true scores across the groups. The third level assesses whether item intercepts are invariant across groups. Scalar invariance allows for means to be compared uniformly across groups in a meaningful manner. The next step is to assess residual invariance, implying that the residuals of the items can be compared across groups, in the sense that there is equal reliability of scores. Finally, each factor mean will be compared to assess mean invariance. If at either of the steps measurement invariance is not met, the next steps do not yield meaningful results. That is, if metric invariance is not met overall, assessing the other forms of invariance, starting from scalar is not meaningful. Finding noninvariance calls for a redefining of the construct, items, and/or residuals.

Next, multi-group CFAs would be conducted separately for the subscales of the TDDS along with assessing the effect size of (non)equivalence, using  $d_{MACS}$  (Nye & Drasgow, 2011). These allow to check the magnitude of non-equivalence at the item-level, interpretable along the lines of Cohen's  $d$ s (Cohen, 2013). Finally, item-level differences across the two samples would be assessed using Differential Item Functioning (DIF; Crane et al., 2004). This assesses whether the item is similarly endorsed across the two groups. When an item measures more than the latent trait, the item is labelled as having DIF. The chi-square criterion, along with an alpha of .001 and a minimum cell size of 5 (i.e., the default) was used.

Modification indices would be used for the India-specific model. This is because the scale has not been validated in India so far, whereas the original sample used for scale development was a US American one. If any item correlates with other items, it would be removed to run a revised confirmatory model and test for measurement invariance a second time with this revised model.

Further, sex differences (among men and women) on the scale and the subscales, as well as keeping with the Westermarck Hypothesis (1891) differences among those with and without opposite sex siblings (also see Lieberman et al., 2003) would be reported.

## Method

### Participants

Some data collected for a larger study (citation, 20XX) have been used for this investigation. Ethical review was granted from the institutional review board at XX XX (#021-018) in January, 2018. Participants were excluded based on self-reported honesty (<5 on a scale of 10), attention (<5 on a scale of 10), and fluency in English (<5 on a scale of 10). For the purpose of this study, only Indians and US Americans were considered. The current sample comprised 312 participants ( $N:q=14.86$ ), 135 ( $N:q=6.49$ ) of which were Indians and 177 ( $N:q=8.43$ ) Americans (women = 209, other genders = 6; students = 135) above 18 years of age ( $M_{Age} = 25.38$  years,  $SD = 7.67$ ; range = 18-74 years). Of these, 179 participants had at least one opposite sex sibling. Online sampling was used to collect data; a link to the study was posted on online portals such as Psychological Research on the Net as well as social media.

### Measure

**The Three Domain Disgust Scale** (Tybur et al., 2009): The scale comprises 21 items, seven items each measuring pathogen (e.g., “Stepping on dog poop”), sexual (e.g., “Performing oral sex”), and moral disgust (e.g., “Deceiving a friend”). Participants rated how disgusting they found the concepts described in the items on a 7-point scale (1 = *Not at all disgusting*; 7 = *Extremely disgusting*).

### Procedure



First, participants were provided information about the nature of the study; those who consented first entered their demographic details. They then responded to items regarding the number of opposite-sex siblings they had (response options ranged from 0 to 3 siblings). After this, they responded to vignettes, based on the larger study. Then, they were presented with the three-domain disgust scale and a measure of social desirability (not included in this study). Participants were debriefed and were provided with details of various helplines they could contact in case of distress across countries. They were also told they could quit any time by closing the window if they were uncomfortable, without consequences, and could also withdraw their consent by contacting the authors within two weeks of their participation

## Results

Item-level descriptives as well as total scores for TDDS and its subscales are presented in Table 1.

First, a Confirmatory Factor Analysis was conducted to test the three-factor model for the entire sample, using the 'lavaan' package (Rosseel, 2019), built under R (v. 4.0.2; R Core Team, 2020). Considering that the data were ordinal in nature and the sample size within the two groups were comparatively smaller, a Robust Maximum Likelihood (MLR) estimation was used (Li, 2016). An adequate fit (Hair et al., 2010) was found for the three-factor model: CFI<sup>1</sup> = .914, TLI = .902, RMSEA = .057, SRMR = .068;  $\chi^2(186) = 393.029, p < .001$ . The item loadings were above .4 on all items except "rubbing thigh," ( $\lambda = .368, SE = .104$ ; see Table 2). Factor correlations and internal consistencies are presented in Table 3.

---

<sup>1</sup> Robust values following Brosseau-Liard and Savalei (2014) and Brosseau-Liard, Savalei, and Li (2012) are reported here (Rosseel, 2019).

Next, a multigroup CFA was conducted across the two countries. The fit estimates dropped slightly in this case: CFI = .889, TLI = .875, RMSEA = .066, SRMR = .077;  $\chi^2(372) = 652.917$ ,  $p < .001$ . Among both Indians and those from the USA, all items except “rubbing thigh,” (India:  $\lambda = .346$ , SE = .120; USA:  $\lambda = .357$ , SE = .133) had an item loading above .4.

A separate CFA was then conducted among Indians, and a poorer fit was found, but can be considered adequate considering the sample size: CFI = .871, TLI = .855, RMSEA = .067, SRMR = .085;  $\chi^2(186) = 300.327$ ,  $p < .001$ ). Internal consistency scores were high and factor correlations were also not adequate (Table 3).<sup>2</sup>

The configural invariance model (Table 4A), based on the first model, had an acceptable fit ( $\chi^2(372) = 652.92$ , CFI = .879, RMSEA = .070). Metric invariance did not significantly differ from the first model ( $\chi^2(390) = 671.26$ , CFI = .879, RMSEA = .068;  $\Delta\chi^2(18) = 18.344$ ,  $p = .43$ ,  $\Delta\text{CFI} = .00$ ,  $\Delta\text{RMSEA} = .002$ ). However, there was a significant worsening with respect to the intercepts model and therefore, the scale was scalar noninvariant (Table 4 B). The results follow the same pattern when “rubbing thigh” is removed. At the subscale level, the fit estimates were slightly better (Table 4 C).

To estimate the effect size of non-invariance at the item level, differences in mean and covariance structures (*d*MACS; Nye & Drasgow, 2011) was estimated using the “dmacs” package (Dueber & Zhou, 2019) in R using the USA as the reference group. The effect sizes were between negligible and small for moral and sexual, and negligible and medium for pathogen disgust (Table 2). Difference in means and variance due to differential item functioning is also presented in Table 2.

---

<sup>2</sup> The model fit for Americans was comparable: CFI = .884, TLI = .869, RMSEA = .071, SRMR = .076;  $\chi^2(186) = 352.59$ ,  $p < .001$  (see Supplementary Materials).

Finally, Differential Item Functioning (DIF) was assessed for each dimension of disgust using the “lordif” package (Choi et al., 2011) in R. No items were differential in measuring moral disgust; 3 items (“oral sex,” “opposite sex stranger,” “anal sex”) were flagged for sexual disgust (3 iterations); and 2 for pathogen disgust (“body odor” and “bloody cut”).

Modification indices were examined in the Indian model, and one pair (i.e., “rubbing thigh” and “deception”) were allowed to correlate; the fit indices improved when “rubbing thigh” was removed from the model: CFI = .905, TLI = .89, RMSEA = .06, SRMR = .078,  $\chi^2(167) = 240.231$ ,  $p < .001$ . This also improved fit in the multigroup CFA model (see Table 4 A).

In general, disgust did not differ in terms of whether or not participants had opposite sex siblings, except with respect to one item (Table 5). On the other hand, women were more likely to be disgusted by most items involving sexual disgust (Table 5).

## Discussion

The present study aimed to understand country-level differences in measuring disgust. Specifically, measurement equivalence of the Three Domain Disgust Scale at the scale, subscale, and item-levels for India and the US were assessed.

Results showed that at the scale level, an adequate fit was found for the three-factor solution across the sample. This is in line with previous studies in both a student as well as a general, community sample (Tybur et al., 2009). The present study adds to previous literature arguing for heterogeneity in disgust sensitivity as a construct. A multi-group CFA also indicated that the three-factor solution was largely adequate across the two countries, indicating cross-country invariance in measurement in its present three-factor format.

Further, results indicated that the configural invariance as well as metric invariance was met. This implies that measuring disgust in its three-domain format is meaningful among Indians as among US Americans and that that factor variances and covariances are comparable across the two countries, and are not a property of the country (or culture) itself. However, scalar invariance was not met. This implies that group means are not comparable across the two countries.

At the subscale level, fit estimators were better, perhaps implying that the three domains of disgust were distinct, in line with Tybur et al (2009). This is also in line with inadequate factor correlations, both, in the full-sample model as well as the India-specific model. However, Further, considering the size of the difference in the overall mean and covariance structures at the item levels, a few items make the scale incompatible to assess differences between the two countries at the factor level. For instance, considering that moral disgust had the largest difference in means and variances due to items, comparing the two countries at the level of moral disgust is unlikely to be meaningful.

At the item level, moral disgust was equivalent across countries; however, three items for sexual and two for pathogen disgust had differential functioning. Thus, it seems that the two countries differ with respect to the underlying meaning of certain sexual and pathogen disgust items. This seems not surprising considering that at the beginning of data collection in January, 2018, up until, mid-July 2018, homosexuality was illegal in India, and in accordance with the associated law, oral and anal sex (two of the three items with DIF) were considered “unnatural” and therefore, punishable by law (*IPC Section 377*, n.d.; *Navtej Singh Johar vs Union Of India Ministry Of Law And ... On 6 September, 2018*, 2018). It is unclear whether this stipulation was known widely, however. It is also important to remember that just because the law has changed, personal attitudes need not have immediately changed (Tankard & Paluck, 2017). Indians, at least in this

sample, were more likely to consider oral and anal sex to be more disgusting than US Americans. This, of course, might be driven by a difference in connotation. Similar differences in the implications of pathogen disgust are possible. For instance, it is likely that bodily odor might have social or socioeconomic implications in the Indian context (e.g., Lee, 2017).

We also found that removing “rubbing thighs” ought to improve model fit among Indians. That is, in general, it is possible that Indians do not consider (or do not report) strangers touching their thighs as highly disgusting, and disgust, among Indians, may be modelled without considering this. This is not to say that Indians do not consider the act repulsive, just that disgust might not be the emotion associated with it. Future research should consider this further.

Additionally, we found that those who had and did not have opposite sex siblings did not differ in terms of disgust ratings. However, women were more likely than men to be disgusted by sexual behaviours than men, and the magnitude of differences was substantially large. This is in line with previous studies arguing that women are both, more likely to contract sexually transmitted infections (e.g., Centers for Disease Control and Prevention, 2008), and are likely to have reputational repercussions by engaging in such behaviours (see Al-Shawaf et al., 2018 for review; e.g., Gallup et al., 2009).

## **Conclusion**

The present study aimed to explore differences in the factor structure and invariance in the measurement of trait disgust sensitivity, as measured by the TDDS, among Indians and Americans. We found that the latent structures and factor variances are comparable across the two countries. However, the means are not. Further, the construct of disgust sensitivity may be considered equivalent in India and the US; however, individual items may have different insinuations, depending on social, moral, and legal norms in the two countries.

In comparing India and the US, the present study is, to the best of our knowledge, the first to assess equivalence in the measurement of the TDDS. This opens up avenues of research in disgust sensitivity in the Indian context, especially considering its relationship with a wide variety of constructs understudied in India, related to social ostracization, conservatism, and other avoidance behaviours.

The study, in finding that configural and metric invariance was met in the current set of countries, but scalar invariance was not met, opens up interesting questions about the conceptualization of disgust. For instance, if one considers disgust as a universal emotion, is it possible that elicitors of disgust varies across cultures?

On the other hand, the present study has a few shortcomings. First, the sample size represented across both countries was relatively small. Though the case-to-parameter ratio has been met according to Bentler and Chou's (1987) estimates, the power may still be low when assessing country-based parameters based on other estimates (see Nunnally, 1967). Further, the Indian sample may lack representativeness, considering that it is an English-speaking one. Further, other demographic details such as race of the US participants and caste of Indian participants were not assessed. TDDS may be translated across the many languages in India in the future, to assess equivalence. Future research should also try to replicate our findings using larger, more representative samples across a larger number of countries, wherein, perhaps a number of other disgust scales are also measured. For instance, in the future, researchers could explore the structure of pathogen disgust across the 30 countries in Tybur et al (2016). Future research should try to assess how participants interpret each of the items that had differential functioning. It is also to be noted that as no measure of culture has been employed, the present study explores measurement invariance of the TDDS cross-nationally, and results should only be interpreted that

way. Although countries are often used as proxies for cultures, the present study makes no such claims. Next, it might be difficult to pinpoint the reasons why the two countries differed in interpretations of some of the items. That is, although the present study assessed two distinct countries, it is by no means a cross-cultural study.

In sum, the present study assessed equivalence of the TDDS among Indians and Americans. Configural and metric invariance were met, implying that the scale can be used among Indians; however, group comparisons using means among Indians and US Americans on disgust sensitivity are unlikely to be meaningful.

## References

- Al-Shawaf, L., Lewis, D. M., & Buss, D. M. (2018). Sex differences in disgust: Why are women more easily disgusted than men? *Emotion Review*, *10*(2), 149–160.
- Bentler, P. M., & Chou, C.-P. (1987). Practical Issues in Structural Modeling. *Sociological Methods & Research*, *16*(1), 78–117. <https://doi.org/10.1177/0049124187016001004>
- Brosseau-Liard, P. E., & Savalei, V. (2014). Adjusting incremental fit indices for nonnormality. *Multivariate Behavioral Research*, *49*(5), 460–470.
- Brosseau-Liard, P. E., Savalei, V., & Li, L. (2012). An investigation of the sample performance of two nonnormality corrections for RMSEA. *Multivariate Behavioral Research*, *47*(6), 904–930.
- Buunk, A. P. (2017). All in the family: Attitudes towards cousin marriages among young dutch people from various ethnic groups. *Evolution, Mind and Behaviour*, *15*(1), 1–15. <https://doi.org/10.1556/2050.2017.0001>
- Centers for Disease Control and Prevention. (2008). Sexually transmitted disease surveillance. [Http://Www. Cdc. Gov/Std/Stats08/Syphilis. Htm](http://www.cdc.gov/std/stats08/syphilis.htm).
- Cheung, G. W., & Rensvold, R. B. (2000). Assessing extreme and acquiescence response sets in cross-cultural research using Structural Equations Modeling. *Journal of Cross-Cultural Psychology*, *31*(2), 187–212. <https://doi.org/10.1177/0022022100031002003>
- Choi, S. W., Gibbons, L. E., & Crane, P. K. (2011). Lordif: An R package for detecting differential item functioning using iterative hybrid ordinal logistic regression/item response theory and Monte Carlo simulations. *Journal of Statistical Software*, *39*(8), 1.
- Cohen, J. (2013). *Statistical Power Analysis for the Behavioral Sciences*. Academic Press.
- Crane, P. K., Belle, G. van, & Larson, E. B. (2004). Test bias in a cognitive test: Differential item functioning in the CASI. *Statistics in Medicine*, *23*(2), 241–256. <https://doi.org/10.1002/sim.1713>
- Curtis, V., Auger, R., & Rabie, T. (2004). Evidence that disgust evolved to protect from risk of disease. *Proceedings of the Royal Society of London. Series B: Biological Sciences*, *271*(suppl\_4), S131–S133. <https://doi.org/10.1098/rsbl.2003.0144>
- Curtis, V., de Barra, M., & Auger, R. (2011). Disgust as an adaptive system for disease avoidance behaviour. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *366*(1563). <https://royalsocietypublishing.org/doi/10.1098/rstb.2010.0117>
- Dueber, D., & Zhou, H. (2019). *Dmacs*. <https://cran.r-project.org/package=dmacs>
- Fincher, C. L., & Thornhill, R. (2012). Parasite-stress promotes in-group assortative sociality: The cases of strong family ties and heightened religiosity. *Behavioral and Brain Sciences*, *35*(2), 61–79. <https://doi.org/10.1017/S0140525X11000021>
- Fischer, R., & Karl, J. A. (2019). A primer to (cross-cultural) multi-group invariance testing possibilities in R. *Frontiers in Psychology*, *10*. <https://doi.org/10.3389/fpsyg.2019.01507>
- Gallup, A. C., O'Brien, D. T., White, D. D., & Wilson, D. S. (2009). Peer victimization in adolescence has different effects on the sexual behavior of male and female college students. *Personality and Individual Differences*, *46*(5–6), 611–615.



- 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*(5), 701–713. [https://doi.org/10.1016/0191-8869\(94\)90212-7](https://doi.org/10.1016/0191-8869(94)90212-7)
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis: International version*. New Jersey, Pearson.
- Harris, M. (1998). *Good to eat: Riddles of food and culture*. Waveland Press.
- Hartmann, C., Shi, J., Giusto, A., & Siegrist, M. (2015). The psychology of eating insects: A cross-cultural comparison between Germany and China. *Food Quality and Preference, 44*, 148–156. <https://doi.org/10.1016/j.foodqual.2015.04.013>
- Inbar, Y., & Pizarro, D. A. (2016). Pathogens and politics: Current research and new questions. *Social and Personality Psychology Compass, 10*(6), 365–374. <https://doi.org/10.1111/spc3.12250>
- Inbar, Y., Pizarro, D. A., Knobe, J., & Bloom, P. (2009). Disgust sensitivity predicts intuitive disapproval of gays. *Emotion (Washington, D.C.), 9*(3), 435–439. <https://doi.org/10.1037/a0015960>
- IPC Section 377.*
- Navtej Singh Johar vs Union Of India Ministry Of Law And ... On 6 September, 2018, (Union of India 2018). <https://indiankanoon.org/doc/168671544/>
- Knowles, K. A., Jessup, S. C., & Olatunji, B. O. (2018). Disgust in anxiety and obsessive-compulsive disorders: Recent findings and future directions. *Current Psychiatry Reports, 20*(9), 68. <https://doi.org/10.1007/s11920-018-0936-5>
- Lee, J. (2017). Odor and order: How caste is inscribed in space and sensoria. *Comparative Studies of South Asia, Africa and the Middle East, 37*(3), 470–490.
- Li, C.-H. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods, 48*(3), 936–949. <https://doi.org/10.3758/s13428-015-0619-7>
- Lieberman, D., Tooby, J., & Cosmides, L. (2003). The evolution of human incest avoidance mechanisms: An evolutionary psychological approach. *Evolution and the Moral Emotions: Appreciating Edward Westermarck*.
- Mellenbergh, G. J. (1982). Contingency table models for assessing item bias. *Journal of Educational Statistics, 7*(2), 105–118. <https://doi.org/10.3102/10769986007002105>
- Nunnally, J. C. (1967). *Psychometric theory* (pp. xiii, 640). McGraw-Hill.
- Nye, C. D., & Drasgow, F. (2011). Effect size indices for analyses of measurement equivalence: Understanding the practical importance of differences between groups. *Journal of Applied Psychology, 96*(5), 966–980. <https://doi.org/10.1037/a0022955>
- Olatunji, B. O., Williams, N. L., Tolin, D. F., Abramowitz, J. S., Sawchuk, C. N., Lohr, J. M., & Elwood, L. S. (2007). The Disgust Scale: Item analysis, factor structure, and suggestions for refinement. *Psychological Assessment, 19*(3), 281–297. <https://doi.org/10.1037/1040-3590.19.3.281>
- R Core Team. (2020). *R: A language and environment for statistical computing* [R]. R Foundation for Statistical Computing. <https://www.R-project.org/>
- Rosseel, Y. (2019). *Lavaan (0.6-5)* [Computer software].

- Skolnick, A. J., & Dzokoto, V. A. (2013). Disgust and contamination: A cross-national comparison of Ghana and the United States. *Frontiers in Psychology, 4*.  
<https://doi.org/10.3389/fpsyg.2013.00091>
- Tankard, M. E., & Paluck, E. L. (2017). The effect of a supreme court decision regarding gay marriage on social norms and personal attitudes. *Psychological Science, 28*(9), 1334–1344.  
<https://doi.org/10.1177/0956797617709594>
- Tybur, J. M., Inbar, Y., Aarøe, L., Barclay, P., Barlow, F. K., Barra, M. de, Becker, D. V., Borovoi, L., Choi, I., Choi, J. A., Consedine, N. S., Conway, A., Conway, J. R., Conway, P., Adoric, V. C., Demirci, D. E., Fernández, A. M., Ferreira, D. C. S., Ishii, K., ... Žeželj, I. (2016). Parasite stress and pathogen avoidance relate to distinct dimensions of political ideology across 30 nations. *Proceedings of the National Academy of Sciences, 113*(44), 12408–12413.  
<https://doi.org/10.1073/pnas.1607398113>
- Tybur, J. M., & Karinen, A. K. (2018). Measurement and theory in disgust sensitivity. In *The SAGE handbook of personality and individual differences: Applications of personality and individual differences* (pp. 159–179). Sage Reference. <https://doi.org/10.4135/9781526451248.n7>
- Tybur, J. M., Lieberman, D., & Griskevicius, V. (2009). Microbes, mating, and morality: Individual differences in three functional domains of disgust. *Journal of Personality and Social Psychology, 97*(1), 103.
- Tybur, J. M., Lieberman, D., Kurzban, R., & DeScioli, P. (2013). Disgust: Evolved function and structure. *Psychological Review, 120*(1), 65–84. <https://doi.org/10.1037/a0030778>
- Westermarck, E. (1891). *The history of human marriage*. Macmillan & Co.

Table 1: Item-level Descriptive Statistics and Total Scores

Item No.		Overall		US Americans		Indians	
		Means	SDs	Means	SDs	Means	SDs
	Age	25.38	7.67	26.31	9.56	24.15	3.72
	Number of Siblings	0.88	0.93	1.15	0.99	0.52	0.69
	Attention	8.96	1.22	8.9	1.27	9.04	1.17
	Honesty	9.24	0.97	9.36	0.9	9.09	1.04
	Fluency	9.67	0.73	9.91	0.47	9.36	0.88
DM1	Shoplifting a candy bar from a convenience store.	3.44	1.93	3.15	1.91	3.81	1.9
DS2	Hearing two strangers having sex.	4	1.85	4.16	1.81	3.79	1.9
DP3	Stepping on dog poop.	5.29	1.51	5.41	1.46	5.14	1.57
DM4	Stealing from a neighbor.	5.2	1.7	5.14	1.8	5.29	1.56
DS5	Performing oral sex.	2.57	1.93	2.36	1.74	2.84	2.13
DP6	Sitting next to someone who has red sores on their arm.	3.84	1.77	3.97	1.79	3.68	1.74
DM7	A student cheating to get good grades.	3.81	1.77	3.82	1.75	3.8	1.79
DS8	Watching a pornographic video.	2.78	1.9	3.05	2.03	2.44	1.66
DP9	Shaking hands with a stranger who has sweaty palms.	4.03	1.71	4.07	1.68	3.98	1.76
DM10	Deceiving a friend.	5.31	1.7	5.2	1.75	5.44	1.63
DS11	Finding out that someone you don't like has sexual fantasies about you.	4.12	1.91	4.29	1.89	3.9	1.92
DP12	Seeing some mold on old leftovers in your refrigerator.	4.91	1.8	4.9	1.78	4.92	1.82
DM13	Forging someone's signature on a legal document.	4.76	1.93	4.45	1.94	5.16	1.86
DS14	Bringing someone you just met back to your room to have sex.	3.38	2.02	3.59	1.95	3.11	2.08
DP15	Standing close to a person who has body odor.	4.95	1.52	4.86	1.54	5.06	1.49
DM16	Cutting to the front of a line to purchase the last few tickets to a show.	4.39	1.9	4.14	1.92	4.72	1.84
DS17	A stranger of the opposite sex intentionally rubbing your thigh in an elevator.	5.85	1.75	5.51	1.88	6.3	1.46
DP18	Seeing a cockroach run across the floor.	4.35	2.06	4.92	1.82	3.61	2.12
DM19	Intentionally lying during a business transaction.	4.43	1.74	4.36	1.78	4.52	1.7
DS20	Having anal sex with someone of the opposite sex.	3.85	2.24	3.69	2.24	4.04	2.25
DP21	Accidentally touching a person's bloody cut.	4.48	1.92	4.72	1.91	4.16	1.89
	Moral Disgust	31.33	9.37	30.26	9.73	32.74	8.71
	Sexual Disgust	26.54	8.78	26.64	8.99	26.41	8.53
	Pathogen Disgust	31.85	8.65	32.84	8.52	30.56	8.68
	Total Disgust	89.73	20.05	89.75	20.6	89.71	19.39

Social Deceptive Enhancement	30.1	7.32	30.94	7.39	29	7.11
Impression Management	31.93	8.02	32.07	7.8	31.74	8.31
Total Social Desirability	62.03	12.94	63.01	13.28	60.74	12.43



Table 3: Factor Correlations and Reliabilities

		Factor Correlations		Reliability (Alphas)
CFA	Factor	Moral	Sexual	
	Moral			0.86
	Sexual	0.24		0.76
	Pathogen	0.41	0.52	0.83
Multi-group CFA (India)	Moral			0.83
	Sexual	0.33		0.75
	Pathogen	0.19	0.4	0.82
Multi-group CFA (US)	Moral			0.88
	Sexual	0.23		0.79
	Pathogen	0.56	0.52	0.83
India-only CFA	Moral			0.83
	Sexual	0.34		0.75
	Pathogen	0.24	0.52	0.82

Table 4 A: Model Fits

Mode I No.		$\chi^2$	Df	CFI (Robust)	TLI (Robust)	RMSEA (Robust)	SRMR (Bentler)
1	First Confirmatory Factor Analysis	393.029** *	186	0.914	0.902	0.057	0.068
2	Multigroup Confirmatory Factor Analysis	652.917***	372	0.889	0.875	0.066	0.077
2.1	Multigroup Confirmatory Factor Analysis - Revised	561.367***	334.00 0	0.910	0.898	0.062	0.071
3	India-only Model	300.327** *	186	0.884	0.869	0.063	0.085
3.2	India-only Revised	261.034** *	167	0.905	0.892	0.059	0.078
4	US-only Model	352.590** *	186	0.884	0.869	0.071	0.076

Note: \*\*\* $p < .001$ , \*\* $p < .01$ .

Table 4 B: Measurement Invariance for Model 1 (CFA)

Model		Dfs	AIC	BIC	$\chi^2$	$\Delta\chi^2$	df ( $\Delta\chi^2$ )	CFI	RMSEA	$\Delta$ CFI	$\Delta$ RMSEA
1	Fit Configural	372	24514	25008	652.92			0.879	0.07	NA	NA
	Fit Loadings	390	24496	24923	671.26	18.344	18	0.879	0.068	0	0.002
	Fit Intercepts	408	24591	24951	802.15	130.889	18	0.83	0.079	0.049	0.011
	Fit Residuals	429	24619	24900	871.87	69.724	21	0.809	0.081	0.021	0.003
	Fit Means	432	24624	24894	883	11.126	3	0.805	0.082	0.004	0
2.2	Fit Configural	334	23306	23778	561.37			0.899	0.066		
	Fit Loadings	351	23290	23698	579.73	18.365	17	0.899	0.065	0.001	0.001
	Fit Intercepts	368	23368	23712	691.48	111.744	17	0.856	0.075	0.042	0.01
	Fit Residuals	388	23390	23659	753.26	61.789	20	0.838	0.078	0.019	0.003
	Fit Means	391	23395	23653	764.50	11.230	3	0.834	0.078	0.004	0.001

Table 4 C: Model Fits at the Factor Level

Model No.		$\chi^2$	Df	CFI (Robust)	TLI (Robust)	RMSEA (Robust)	SRMR (Bentler)
4	Moral Only	84.595***	28	0.943	0.915	0.104	0.042
5	Sexual Only	51.468***	28	0.955	0.932	0.072	0.047
6	Pathogen Only	59.771***	28	0.953	0.938	0.079	0.045

Note: \*\*\* $p < .001$ , \*\* $p < .01$ .



Table 5: Other Demographics

Item No	Men		Women		t		d		No Opposite Sex Sibling		Have Opposite Sex Sibling		t		d		
	Mean	SD	Mean	SD					Mean	SD	M	SD					
	Age	24.97	6.13	25.6	8.36			24.98	6.52	25.67	8.42						
	Number of Opposite Sex Siblings	0.78	0.9	0.92	0.93			0.06	0.36	1.48	0.73						
	Attention	8.89	1.22	9	1.23			8.87	1.26	9.02	1.19						
	Honesty	9.16	0.96	9.27	0.98			9.05	1.07	9.39	0.87						
	Fluency	9.46	0.88	9.76	0.64			9.61	0.77	9.72	0.7						
DM1	Shoplifting.	3.61	1.96	3.36	1.94	1.02	0.13	3.37	1.88	3.49	1.97	-0.53	0.06				
DS2	Stranger sex.	3.36	1.8	4.29	1.83	-4.14***	0.51	3.87	1.79	4.09	1.9	-1.02	0.12				
DP3	Dog poop.	4.97	1.65	5.44	1.43	-2.55**	0.31	5.23	1.49	5.34	1.54	-0.59	0.07				
DM4	Stealing.	5.16	1.68	5.24	1.72	-0.38	0.05	5.17	1.64	5.22	1.75	-0.26	0.03				
DS5	Oral sex.	1.93	1.44	2.85	2.04	-4.00***	0.49	2.44	1.83	2.66	2.01	-0.97	0.11				
DP6	Red sores.	3.75	1.79	3.88	1.77	-0.56	0.07	3.81	1.81	3.87	1.74	-0.27	0.03				
DM7	Cheating.	3.69	1.8	3.9	1.75	-0.98	0.12	3.77	1.84	3.85	1.72	-0.41	0.05				
DS8	Pornographic video.	2.26	1.64	3.05	1.98	-3.43***	0.42	2.57	1.86	2.94	1.92	-1.69	0.19				
DP9	Sweaty palms.	3.81	1.59	4.16	1.76	-1.64	0.20	4.05	1.71	4.02	1.71	0.18	0.02				
DM10	Deceiving.	5.23	1.75	5.37	1.67	-0.68	0.08	5.29	1.74	5.32	1.67	-0.13	0.01				
DS11	Sexual fantasies.	3.13	1.85	4.56	1.77	-6.49***	0.80	3.72	1.87	4.41	1.9	-3.21**	0.37				
DP12	Leftovers.	4.79	1.8	4.99	1.79	-0.89	0.11	4.98	1.8	4.85	1.8	0.60	0.07				
DM13	Forging.	4.72	2.07	4.8	1.86	-0.33	0.04	4.84	1.98	4.69	1.9	0.67	0.08				
DS14	Just met.	2.81	1.99	3.65	1.99	-3.42***	0.42	3.25	2.07	3.48	1.98	-1.01	0.12				
DP15	Body odor.	4.65	1.53	5.09	1.49	-2.39*	0.29	5.02	1.36	4.89	1.63	0.70	0.08				
DM16	Cutting line.	4.25	2.01	4.49	1.86	-1.03	0.13	4.5	1.89	4.31	1.91	0.90	0.10				
DS17	Rubbing thigh.	4.64	2.19	6.41	1.16	-9.22***	1.13	5.89	1.69	5.82	1.8	0.37	0.04				
DP18	Cockroach.	3.7	2.14	4.65	1.96	-3.81***	0.47	4.12	2.1	4.53	2.01	-1.73	0.20				

Item No		Men		Women				No Opposite Sex Sibling		Have Opposite Sex Sibling			
DM19	Lying.	4.48	1.93	4.43	1.63	0.28	0.03	4.46	1.73	4.4	1.75	0.28	0.03
DS20	Anal sex.	3.16	2.05	4.17	2.25	-3.74 <sup>***</sup>	0.46	4.01	2.28	3.73	2.22	1.10	0.13
DP21	Bloody cut.	4.3	1.99	4.58	1.88	-1.19	0.15	4.44	1.96	4.51	1.89	-0.29	0.03
	Moral Disgust	31.14	9.65	31.59	9.29	-0.39	0.05	31.41	9.56	31.28	9.25	0.12	0.01
	Sexual Disgust	21.3	7.69	28.98	8.21	-7.77 <sup>***</sup>	0.95	25.76	8.3	27.13	9.11	-1.36	0.16
	Pathogen Disgust	29.98	8.99	32.78	8.34	-2.66 <sup>**</sup>	0.33	31.65	8.18	32	9	-0.35	0.04
	Total Disgust	82.42	18.43	93.35	20	-4.56 <sup>***</sup>	0.56	88.82	19.54	90.41	20.45	-0.69	0.08
	Socially Desirable Enhancement	31.33	7.71	29.59	7.07			30.29	7.51	29.96	7.19		
	Impression Management	31.46	8.04	32.14	8.04			31.86	7.94	31.97	8.1		
	Social Desirability Scale – Total	62.79	12.65	61.74	13.05			62.16	12.85	61.93	13.05		

Note: <sup>\*\*\*</sup> $p < .001$  <sup>\*\*</sup> $p < .01$ .

Supplementary Material for Political Ideology, Empathy, and Moral Decision-Making

Appendix A

Supplementary Table: Factor Loadings for the US-only sample.

Item	Item No		Loadings	SE
Moral	DM1	Candy bar	1.168	0.136
	DM4	Stealing.	1.326	0.121
	DM7	Cheating.	1.293	0.117
	DM10	Deceiving.	1.245	0.119
	DM13	Forging.	1.395	0.131
	DM16	Cutting line.	1.255	0.134
	DM19	Lying.	1.414	0.115
Sexual	DS2	Strangers sex.	1.169	0.131
	DS5	Oral sex.	1.313	0.12
	DS8	Pornographic video.	1.458	0.142
	DS11	Sexual fantasies.	1	0.143
	DS14	Just met.	1.108	0.146
	DS17	Rubbing thigh.	0.417	0.152
	DS20	Anal sex.	1.523	0.159
Pathogen	DP3	Dog poop.	0.877	0.106
	DP6	Red sores.	1.117	0.128
	DP9	Sweaty palms.	1.204	0.115
	DP12	Leftovers.	0.98	0.132
	DP15	Body odor.	1.217	0.102
	DP18	Cockroach.	1.238	0.127
	DP21	Bloody cut.	1.087	0.14