

# The Effects of Disgust on Moral Judgments: Testing Moderators

David J. Johnson<sup>1</sup>, Jessica Wortman<sup>1</sup>, Felix Cheung<sup>1</sup>, Megan Hein<sup>1</sup>, Richard E. Lucas<sup>1</sup>, M. Brent Donnellan<sup>2</sup>, Charles R. Ebersole<sup>3</sup>, and Rachel K. Narr<sup>3</sup>

Social Psychological and  
Personality Science  
2016, Vol. 7(7) 640-647  
© The Author(s) 2016  
Reprints and permission:  
sagepub.com/journalsPermissions.nav  
DOI: 10.1177/1948550616654211  
spps.sagepub.com



## Abstract

There is evidence that inducing feelings of disgust increases the severity of moral judgments, but the size of this association has been questioned by a recent meta-analysis. Based on prior research and theory, we tested whether the effects of disgust on moral judgments might be moderated by sensitivity to bodily states (Studies 1 and 2) and the accessibility of mood (Study 2) in two large samples (total  $N = 1,412$ ). We did not find that disgust directly increased the severity of moral judgments nor did we find evidence that these moderators influenced the effect of disgust. Thus, the current studies do not support large effects for induced disgust and for two presumed moderators of these effects.

## Keywords

disgust, moral judgment, embodiment, replication

In contrast to rational theories of moral reasoning (Kohlberg, 1969; Turiel, 1983), the social intuitionist model (Haidt, 2001) proposes that “moral intuitions (including moral emotions) come first and directly cause moral judgments” (p. 814). According to this model, the emotion of disgust is thought to cue a judgment of immorality; if an action produces disgust, it is judged as morally wrong. However, research has provided mixed support for an association between disgust and moral judgments (for a review, see Chapman & Anderson, 2013), and a recent meta-analysis (Landy & Goodwin, 2015a) suggests that the size of the induced disgust effect is 0.11 using Cohen’s  $d$  (95% CI = [.04, .19]). The existence of moderators may explain the previously mixed findings and this small (at best) overall effect size. Accordingly, we tested the overall effect of induced disgust on moral judgments and evaluated two potential moderators: sensitivity to internal bodily cues and the accessibility of mood.

## Why and When Might Disgust Influence Moral Judgments?

Disgust is thought to have evolved to promote the avoidance of disease-causing stimuli such as rotten or poisonous food (Curtis, Aunger, & Rabie, 2004; Curtis & Biran, 2001; Oaten, Stevenson, & Case, 2009) and may have been co-opted to communicate reactions to immoral behaviors (Tybur, Lieberman, Kurzban, & DeScioli, 2013). Accordingly, because disgust may serve as a cue that an action is wrong, induced disgust might influence and guide moral judgments.

Several studies have demonstrated that induced disgust is related to harsher moral judgments. Participants made more severe moral judgments after a posthypnotic suggestion to feel disgust (Wheatley & Haidt, 2005), watching a disgusting film clip (Horberg, Oveis, Keltner, & Cohen, 2009), or drinking a disgusting beverage (Eskine, Kaciniak, & Prinz, 2011). However, not all work has consistently found such effects; in several experiments, disgust did not influence moral judgments when primed through images (Cameron, Payne, & Doris, 2013), videos (Ugazio, Lamm, & Singer, 2012, exp. 1b), or scents (Ugazio et al., 2012, exp. 1a).

Given inconsistencies in the induced disgust literature, Landy and Goodwin (2015a) conducted a meta-analysis and found a small overall effect ( $d = 0.11$ ) where induced disgust was associated with harsher moral judgments. There were also suggestions of publication bias in the literature, and when they used the trim-and-fill method, “the effect disappears entirely” (Landy & Goodwin, 2015a, p. 530;  $d = -0.01$ ). Critiquing this conclusion, Schnall, Haidt, Clore, and Jordan (2015) argued

<sup>1</sup> Michigan State University, East Lansing, MI, USA

<sup>2</sup> Texas A & M University, College Station, TX, USA

<sup>3</sup> University of Virginia, Charlottesville, VA, USA

### Corresponding Author:

David J. Johnson, Department of Psychology, Michigan State University, 316 Physics, Rm 244B, East Lansing, MI 48824, USA.

Email: djjohnson@smcm.edu

that it was important to take moderators into account, given significant heterogeneity among effect sizes.

One plausible moderator is that trait sensitivity to internal states might make some people more susceptible to disgust than others. Schnall, Haidt, Clore, and Jordan (2008; hereafter SHCJ) predicted that the impact of disgust would be accentuated for individuals with relatively high scores on the Private Body Consciousness Scale (PBC; Miller, Murphy, & Buss, 1981). In two out of three experiments, SHCJ found significant evidence at  $p < .05$  that disgust increased the severity of moral judgments only for participants high in PBC.

Another potential moderator of the effects of disgust on moral judgments is state mood accessibility. Schnall et al. (2015) argued that “in misguided attempts to increase rigor, investigators sometimes include premeasures of mood or otherwise call attention to participants’ feelings before collecting the dependent measures” (p. 538). The concern is that if participants focus on their mood in an experiment, they might attribute their reactions to moral stimuli to induced disgust rather than to the moral violations themselves. This process would eliminate the effect of disgust on moral judgment. This proposal is consistent with the affect as information model (Schwarz & Clore, 1983), which proposes that people rely on their current mood states to guide judgments unless the causes of their mood are made accessible.

Indeed, some studies with pretest measures of mood have failed to find the predicted effect of disgust (e.g., Ong, Mullette-Gillman, Kwok, & Lim, 2014). However, other studies have found predicted effects despite including pretest measures of mood (e.g., SHCJ). Although no study has directly manipulated the presence of pretest mood items, Landy and Goodwin (2015b) reported that across several studies moral judgment was only influenced by disgust when pretest mood items were absent.

## Overview of Studies

The goal of our first study was to directly replicate Experiment 3 from SHCJ. We chose this experiment because it was the only one in which both the disgust manipulation check was successful and the predicted interaction with PBC was statistically significant at  $p < .05$ . In the third experiment from SHCJ, participants completed a pretest mood rating and then recalled a disgusting experience (or not) before making moral judgments about six scenarios. Afterward, participants completed the PBC measure and a posttest mood rating (a manipulation check). Induced disgust did not directly affect the severity of moral ratings, but it interacted with PBC,  $F(1, 61) = 4.49, p < .04$ . Participants high in PBC who wrote about disgusting events rated moral scenarios marginally more harshly ( $p < .08$ ) than control participants; a difference between conditions was not statistically significant for participants low in PBC.

Our initial study did not find evidence consistent with the original SHCJ report. In response to feedback from the original authors, we conducted a preregistered experiment (Study 2) where we manipulated whether pretest mood items were

present. This allowed us to test whether pretest mood items might moderate the effects of induced disgust on moral judgment and further replicate the PBC moderator analyses.

## Method

### Study 1: Replication

#### Participants

Undergraduates from Michigan ( $n = 518$ ) completed the study for course credit during the spring 2014 semester. We initially planned to collect a sample at least 2.5 times larger than the original sample size of 69 (i.e., 173 participants; Simonsohn, 2015), but continued data collection until the end of the semester to maximize power. This decision was based on a need for larger samples when testing interactions between individual differences and experimental conditions (Simonsohn, 2014).

Participants were randomly assigned to either recall and describe a disgusting event (disgust condition;  $n = 262$ ) or a neutral event (control condition;  $n = 256$ ). Three authors read each response and independently judged whether the event was irrelevant to disgust, for example, “I don’t really have one, big, memorable moment that made me feel disgusted,” or dealt primarily with moral disgust, for example, “seeing someone get picked on by a whole group of people makes me feel disgusted.” Disagreements were solved via discussion. Following exclusion rules from SHCJ, participants in the disgust condition were removed if they did not write about a physically disgusting event ( $n = 40$ ).<sup>1</sup> This resulted in a final sample size of 478. Results and interpretations are unchanged if excluded participants are included in the analyses. Of those in the final sample, 70.7% were women, mean age was 19.5 ( $SD = 1.60$ ), and 73.7% identified as White. Assuming an effect size of  $\eta_p^2 = .07$  (SHCJ, p. 1103), the current study achieved 99.99% power with 478 participants.

#### Procedure

The procedure mimicked Experiment 3 in SHCJ. Research assistants were blind to condition. Participants completed all surveys on computers in separate rooms. As a cover story, participants were told they were helping to develop a life events inventory, and thus would be writing about a particular life event. Before filling out the inventory, participants answered a series of questions about their current mood, including a single-item disgust measure to provide baseline disgust information. They were told that the mood items were included so researchers would know their mood as they completed the inventory. Participants in the disgust condition were then asked to vividly describe a disgusting event that made them feel physically ill. Participants in the control condition were asked to recall the events of the previous day in clear detail. Participants were given up to 6 min to complete the writing task.

To discourage participants from connecting the disgust manipulation to the moral judgments, participants were next

told that they would be starting a different study. They then read and judged the moral scenarios. Afterward, they completed the PBC Scale, a posttest mood assessment, several individual difference measures,<sup>2</sup> and demographic information. The pre- and posttest mood assessments were used as a manipulation check.

### Study 1 Measures

Materials for both studies are available in the Supplemental Materials.

**Mood.** Participants described how much they were feeling an emotion both before the mood manipulation and after rating the moral scenarios on a 1 (*don't feel at all*) to 10 (*feel very strongly*) scale. The moods listed were relaxed, angry, happy, sad, afraid, depressed, disgusted, upset, and confused. The disgust item served as the manipulation check.

**Scenarios.** Six scenarios about moral violations were taken from SHCJ. Three scenarios involved physically disgusting violations (eating a dead dog, cannibalism, and masturbating with a kitten) and three involved nondisgusting moral violations (e.g., stealing a wallet, lying on a resume, and killing one person to save three). Participants were asked to judge the morality of the actions on a 0 (*perfectly okay*) to 9 (*extremely wrong*) scale. Moral scenarios were combined into two composites, one for physically disgusting scenarios ( $M = 7.98$ ,  $SD = 1.25$ ,  $\alpha = .52$ ) and one for morally disgusting scenarios ( $M = 6.16$ ,  $SD = 1.58$ ,  $\alpha = .55$ ).<sup>3</sup> All items were also combined to create a single variable indicating the severity of the participants' total moral judgments ( $M = 7.07$ ,  $SD = 1.17$ ,  $\alpha = .62$ ).

**PBC.** Participants reported sensitivity to their internal bodily states as measured by the PBC Scale (Miller et al., 1981). Participants responded to the items on a 1 (*strongly disagree*) to 6 (*strongly agree*) scale. Higher scores indicated greater bodily sensitivity ( $M = 4.22$ ,  $SD = 0.74$ ,  $\alpha = .60$ ).

**Differences between the current study and the original.** Our sample was drawn from a large university in the United States as opposed to the University of Plymouth. There may be differences in political or moral conservatism between these samples (see Schnall, 2014). Second, we included a writing activity in the control condition, whereas SHCJ did not have control participants complete any writing task. We chose to include a writing task for both groups to enhance our cover story and make the conditions more comparable. Other studies that used writing task manipulations have also included similar control conditions (e.g., Bodenhausen, Sheppard, & Kramer, 1994; Strack, Schwarz, & Gschneidinger, 1985).

## Study 1 Results

### Manipulation Check

We tested whether participants' disgust ratings were influenced by the writing task. A 2 (time: pretest vs. posttest)  $\times$  2 (condition: disgust vs. control) mixed analysis of variance (ANOVA) showed effects of condition,  $F(1, 475) = 4.40$ ,  $p = .036$ , and time,  $F(1, 475) = 102.72$ ,  $p < .001$ , which were qualified by a significant interaction,  $F(1, 475) = 13.63$ ,  $p < .001$ . Prior to the manipulation, there were no differences between the disgust ( $M = 1.36$ ,  $SD = 0.99$ ) and control ( $M = 1.46$ ,  $SD = 1.17$ ) conditions,  $F(1, 476) = 0.94$ ,  $p = .33$ ,  $d = 0.09$ , 95% CI  $[-.09, .27]$ . After the manipulation, participants in the disgust condition ( $M = 2.64$ ,  $SD = 2.20$ ) were more disgusted than participants in the control condition ( $M = 2.05$ ,  $SD = 1.82$ ),  $F(1, 475) = 10.07$ ,  $p = .002$ ,  $d = 0.29$ , 95% CI  $[.11, .48]$ .<sup>4</sup> Thus, the manipulation of disgust was successful.

### Main Analyses

We conducted a mixed analysis of covariance (ANCOVA) testing the effects of scenario type (physical vs. moral disgust) and condition, with PBC as a covariate. We deviated from the SHCJ analytic procedure by keeping PBC scores in their continuous metric (SHCJ used a median split). Many researchers have demonstrated that dichotomizing continuous predictors is problematic (e.g., Fitzsimons, 2008; Irwin & McClelland, 2003; MacCallum, Zhang, Preacher, & Rucker, 2002). However, median split analyses yielded the same conclusions.

To complement the frequentist analyses, a series of Bayesian ANCOVAs with model averaging (Hoeting, Madigan, Raftrey, & Volinsky, 1999; Rouder, Morey, Verhagen, Swagan, & Wagenmakers, in press) were conducted using JASP (Love et al., 2015), and Bayes factors (BFs) are reported alongside  $p$  values for the main analyses.<sup>5</sup> For nonsignificant results,  $BF_{01}$  are reported to quantify the extent to which the data favor the null hypothesis relative to the alternative hypothesis. For example, a  $BF_{01}$  of 10 suggests that, based on the observed data, prior beliefs about an effect should shift 10 times toward the null hypothesis relative to the alternative hypothesis (regardless of the strength of the initial beliefs). For significant results,  $BF_{10}$  are reported to quantify the evidence for the alternative hypothesis over the null. Based on the guidelines from Etz and Vandekerckhove (2016), BFs between 1 and 3, between 3 and 10, and larger than 10 are interpreted as ambiguous, moderate, and strong support, respectively.

Participants in the disgust condition did not rate the scenarios more severely ( $M = 7.09$ ,  $SD = 1.10$ ) than those in the control condition ( $M = 7.04$ ,  $SD = 1.22$ ),  $F(1, 474) = 0.04$ ,  $p = .84$ ,  $d = 0.04$ , 95% CI  $[-.14, .22]$ ,  $BF_{01} = 10.4$ . The BF suggests that these results provide strong support for the null hypothesis over the alternative hypothesis. PBC also did not moderate the effects of the disgust manipulation,  $F(1, 474) = 1.32$ ,  $p = .25$ ,  $BF_{01} = 9.6$ . However, participants rated the physically disgusting scenarios as more wrong ( $M = 7.98$ ,  $SD = 1.25$ ) than the morally disgusting scenarios ( $M = 6.16$ ,

$SD = 1.58$ ),  $F(1, 474) = 603.78$ ,  $p < .001$ ,  $d = 1.12$ ,  $BF_{10} > 9999.0$ . We also found an unpredicted main effect of PBC; participants more sensitive to their bodily states judged the moral scenarios more harshly,  $F(1, 474) = 11.68$ ,  $p < .001$ ,  $r_p = .15$ , 95% CI [.06, .24],  $BF_{10} = 19.1$ .

## Study 1 Discussion

We did not duplicate the major findings from Experiment 3 of SHCJ. Although the disgust manipulation increased self-reported disgust, individuals in the disgust condition did not rate the moral scenarios more harshly. From a Bayesian perspective, the data provided strong support for a null effect of disgust relative to the alternative hypothesis. Similarly, we found no evidence for the hypothesized interaction between PBC and disgust, and the data favored the null 9.6 times over the alternative. Individuals high in PBC did not rate moral scenarios more harshly when they were asked to recall a disgusting experience than when they completed a control writing task. This result is noteworthy, given that we had a sample size over 6 times larger than the original study (478 vs. 69). Thus, there was no evidence that PBC is a reliable moderator of the impact of induced disgust on moral judgments in the current experimental design.

Following Study 1, we received feedback from the original authors (Schnall, Haidt, Clore, & Jordan, in a signed review). They suggested that asking questions about mood prior to the disgust manipulation might have made disgust accessible and attenuated its effects on moral judgments (Schnall et al., 2015). Additionally, SHCJ mentioned that our modified control condition (in which participants described their day) might have increased variability in mood, attenuating any effects of disgust. However, the latter idea was not supported by the data. The disgust group showed *more* variability in postmanipulation disgust ( $SD = 2.20$ ) than the control group ( $SD = 1.82$ ), as measured by Levene's test,  $F(1, 476) = 15.53$ ,  $p < .001$ .

To address these issues, we conducted a preregistered study with two different samples (Michigan undergraduates and Texas undergraduates).<sup>6</sup> Although we invited the original authors to assist in experimental design and data collection, they declined because of prior commitments (S. Schnall, personal communication, November 8, 2014). Nonetheless, to address their concerns, we changed several aspects of our experimental design to improve its internal validity. Specifically, we randomly assigned participants to complete or not complete mood questions prior to the disgust manipulation. This allowed us to test whether exposure to a pretest mood questionnaire undercut the disgust manipulation. We also eliminated the writing activity in the control condition.

In addition, we strengthened the disgust manipulation to increase our power to detect its effects. Whereas in Study 1 we recreated the writing manipulation from SHCJ as closely as possible, in Study 2 we used a disgust manipulation that produced a strong manipulation check result,  $t(116) = 11.20$ ,  $d = 2.08$ , with an online sample (Winterich, Mittal, & Morales, 2014). In this method, participants list three to five things that

**Table 1.** Demographic Information for Samples From Study 2.

Variables	Michigan Sample	Texas Sample
Age ( <i>SD</i> )	19.8 (2.2)	19.0 (1.7)
Female (%)	61.6	74.1
White (%)	68.2	67.0
Total <i>N</i>	425	509
No mood, <i>n</i>	216	259
Pre mood, <i>n</i>	209	250
Control, <i>n</i>	236	287
Disgust, <i>n</i>	189	222

Note. Demographic information is reported for participants not removed from analyses.

make them feel physically disgusted and then describe the most disgusting thing as vividly as possible. We also used mood questions from Winterich, Mittal, and Morales (2014), as these questions focused more specifically on disgust.

## Study 2: Preregistered Experiment

### Participants

Undergraduates from a Michigan ( $n = 496$ ) and Texas university ( $n = 538$ ) completed the study for course credit. We planned to collect 500 participants per sample to maximize statistical power. Participants were excluded via the same method as Study 1 if they did not write about a physically disgusting event in the disgust condition (total  $n = 48$ ). Participants were randomly assigned to complete a mood pretest (or not) before the disgust manipulation and write about a series of disgusting events (or not), generating a  $2 \times 2$  design. Table 1 lists demographic information for both samples.

### Procedure

The procedure was identical to Study 1 except for three changes. First, participants completed the study online. Second, participants were randomly assigned to complete (or not) a series of pretest mood questions. Finally, participants in the disgust condition completed the Winterich et al. (2014) writing task, whereas participants in the control condition did not complete any writing task.

### Study 2 Measures

With the exception of the mood items, measures were identical to those presented in Study 1. Table 2 lists the reliabilities of all measures by sample.

**Mood.** Participants were asked to rate how much they felt each mood on a 1 (*don't feel at all*) to 10 (*feel very strongly*) scale. They rated the extent to which they felt angry, annoyed, dirty, disgusted, frustrated, good, gross, guilty, happy, negative, positive, sad, and unclear (Winterich et al., 2014). Following Winterich et al., we combined disgust-related words (dirty,

**Table 2.** Scale Reliabilities for All Samples in Study 2.

Variables	Michigan			Texas		
	$\alpha$	<i>M</i>	<i>SD</i>	$\alpha$	<i>M</i>	<i>SD</i>
Disgust T <sub>1</sub>	.89	2.07	1.53	.85	1.85	1.40
Disgust T <sub>2</sub>	.88	2.60	1.92	.88	2.44	1.83
Physical	.64	7.56	1.58	.47	8.08	1.21
Moral	.56	5.88	1.75	.41	6.56	1.40
Composite	.71	6.72	1.42	.56	7.32	1.06
PBC	.74	4.15	0.84	.61	4.20	0.75

Note. Physical = physically disgusting scenarios; Moral = morally disgusting scenarios; Composite = all disgusting scenarios; PBC = private body conscientiousness.

disgusted, gross, and unclean) into pre- and postmanipulation composites.

## Results

Because the samples in Study 2 used the same method and we expected small effect sizes (Landy & Goodwin, 2015a), we pooled data across the samples to increase statistical power.<sup>7</sup> This resulted in a sample of 986 participants. However, only 934 of those participants completed all measures (i.e., the moral scenarios, PBC Scale, and mood assessment items), limiting our final sample to 934. Assuming an effect size of  $\eta_p^2 = .07$  (SHCJ, p. 1103), the current study achieved 99.99% power with 475 participants in the no mood pretest condition (where the effects of disgust should be strongest). For analytic simplicity, we examined the composite score of all moral scenarios because a preliminary analysis showed no interaction between scenario type (physical or moral) and disgust. This result is consistent with SHCJ, who also did not find interactions between scenario type and disgust manipulation.

### Manipulation Check

A 2 (pretest vs. posttest disgust)  $\times$  2 (disgust vs. control) mixed ANOVA showed only a main effect of time,  $F(1, 457) = 97.03$ ,  $p < .001$ , which was qualified by a significant interaction between time and condition,  $F(1, 457) = 7.76$ ,  $p = .006$ . Prior to the manipulation, there were no differences between the disgust ( $M = 1.96$ ,  $SD = 1.54$ ) and control ( $M = 1.94$ ,  $SD = 1.41$ ) conditions,  $F(1, 457) = 0.02$ ,  $p = .89$ ,  $d = 0.01$ , 95% CI  $[-.17, .21]$ . After completing the experiment, participants in the disgust condition ( $M = 2.85$ ,  $SD = 2.12$ ) were more disgusted than participants in the control condition ( $M = 2.44$ ,  $SD = 1.83$ ),  $F(1, 457) = 5.00$ ,  $p = .026$ ,  $d = 0.21$ , 95% CI  $[.02, .39]$ . Thus, the manipulation of disgust was successful.

### Main Analyses

A three-way ANCOVA was conducted to test the effects of mood pretest and disgust manipulations, with PBC and all two-way and three-way interactions as predictors. A series of Bayesian ANCOVAs with model averaging were also

conducted to complement the frequentist approach. Participants in the disgust condition did not rate the scenarios more severely ( $M = 7.08$ ,  $SD = 1.27$ ) than those in the control condition ( $M = 7.02$ ,  $SD = 1.28$ ),  $F(1, 926) = 0.48$ ,  $p = .48$ ,  $d = 0.05$ , 95% CI  $[-.08, .18]$ ,  $BF_{01} = 25.0$ . PBC also did not moderate the effects of the disgust manipulation,  $F(1, 926) = 2.66$ ,  $p = .10$ ,  $BF_{01} = 20.0$ . Consistent with Study 1, the data strongly favored the null relative to the alternative for the main effect of disgust and the interaction between disgust and PBC.

It is possible that asking about mood prior to the disgust manipulation attenuated the main effect of disgust. However, the predicted two-way interaction between disgust and mood conditions was not significant,  $F(1, 926) = 3.30$ ,  $p = .070$ ,  $BF_{01} = 125$  (although the interaction was in the predicted direction). Again, it is possible that the moderating effects of mood accessibility on the disgust manipulation might only hold for participants are sensitive to their internal bodily states (i.e., a three-way interaction between participant mood pretest, disgust manipulation, and PBC). This interaction was significant, but ran counter to predictions; participants low in PBC showed an interaction between disgust manipulation and mood pretest,  $F(1, 926) = 5.58$ ,  $p = .018$ ,  $BF_{10} = 0.006$ . Furthermore, data favored the null hypothesis of no three-way interaction 100 times over the alternative hypothesis (a  $BF_{10}$  of 0.006 is equivalent to a  $BF_{01}$  of 166.7, indicating strong support for the null hypothesis). Finally, we replicated the main effect of PBC; participants more sensitive to their bodily states judged the moral scenarios more harshly,  $F(1, 926) = 18.72$ ,  $p < .001$ ,  $r_p = .14$ , 95% CI  $[.08, .20]$ ,  $BF_{10} = 1652.0$ . All other main effects and interactions were nonsignificant.

## Study 2 Discussion

Although Study 2 was conducted in response to criticisms of the internal validity of Study 1, we found little reason to reevaluate our interpretation of Study 1. The data strongly supported the null hypothesis that the disgust manipulation did not impact the severity of moral judgments and that this effect was not moderated by sensitivity to internal bodily sensations.

One possibility for the null results in Study 1 was that we made mood accessible by asking pretest mood questions. However, we explicitly manipulated this in Study 2. Despite this change, we found no evidence that the effects of induced disgust varied as a function of the accessibility of mood. The interaction between induced disgust and the mood pretest was not significant at the conventional  $\alpha$  level, and the data showed support for the null hypothesis over the alternative hypothesis from a Bayesian perspective. We note that some readers may want to interpret the two-way interaction close to the  $\alpha$  cutoff of .05. However, we caution against this because with such large samples (and thus, high power),  $p$  values close to .05 at best provide only weak support for the alternative hypothesis (Simonsohn, Nelson, & Simmons, 2014), if not actually more support for the null hypothesis. This is because when the null hypothesis is false, the distribution of  $p$  values will be positively skewed; this skew should increase as power increases.

Thus, values of  $.025 < p < .05$  should be much less common than values of  $p < .025$  when the studied effect is true. In short, the reported  $p$  values are consistent with the large BF in support of the null over the alternative hypothesis.

Furthermore, we also found a significant three-way interaction between induced disgust, mood accessibility, and PBC. Counter to the predictions from the social intuitionist model, for participants who did not complete the mood items, inducing disgust increased the severity of their moral judgments *if they were low in PBC*. In addition, the BF analyses revealed the data actually provided strong evidence for the null model over the alternative model. In sum, we found no evidence (in the predicted direction) of a main effect of induced disgust or for the moderating role of PBC or mood accessibility.

## General Discussion

Across two studies with over 1,400 participants, both frequentist and Bayesian approaches converged to show that written disgust manipulations did not impact moral judgments, nor was this effect moderated by individual differences in sensitivity to internal bodily sensations. The Bayesian approach suggests that current results provided strong support for these null effects relative to the alternative hypotheses and that beliefs about these effects should shift about 10–20 times toward the null relative to the alternative hypotheses. In short, there is little evidence that PBC is a reliable moderator of disgust manipulations, at least using the procedures in this report. In addition, there was only weak evidence (from a frequentist perspective) that including a mood pretest attenuated the effectiveness of disgust manipulations. However, this conclusion was strongly refuted by Bayesian analyses.

In Study 1, we mimicked the original procedures from SHCJ, including administering a mood pretest. However, this procedure has been criticized over concerns that drawing attention to mood might attenuate the misattribution effects of disgust on moral judgments (Schnall et al., 2015). We tested this notion in Study 2 and found that neither the effect of disgust on moral judgments nor the moderating role of PBC depended on the presence of a mood pretest at the conventional  $p < .05$  threshold. With a stronger mood accessibility manipulation (e.g., having participants complete mood items *directly* before making moral judgments), this difference may have been robust. Given this possibility, the most liberal tests of the effects of induced disgust should eschew pretest mood measures in future studies.

## Future Directions

One result that is strikingly clear from these studies is that the connection between disgust and moral severity was in no way moderated by PBC. It is possible that sensitivity to internal bodily sensations might moderate the effects of disgust manipulations, but that PBC is a poor indicator of this construct. Given low reliability in the measure ( $\alpha$  ranges from .60 to .80), this possibility cannot be ruled out. Future work testing

this possibility should use more reliable measures that better capture this construct.

Recent work on the evolved functions of disgust may also illuminate why it has little impact on moral judgment. Tybur, Lieberman, Kurzban, and DeScioli (2013) propose that disgust is produced by three independent systems built to avoid pathogens, avoid individuals with poor genetic compatibility, and to communicate reactions to immoral behaviors. Feelings of disgust are the output from the former two systems, but those feelings are *just one input of many* to the moral disgust system. Thus, it is unlikely that disgust would have a substantial influence on moral judgments. Rather, the communication function of moral disgust suggests that other individual differences might better predict judgment severity (e.g., the degree to which a person is willing to commit certain moral violations). Work from this functional perspective strikes us as a productive direction for future research.

## Conclusion

There is an ongoing controversy about the impact of induced disgust on moral judgments. Our work suggests it is difficult to find support for moderators of this effect using one specific paradigm even with sample sizes larger than what typically characterize this literature (the largest sample size in Landy & Goodwin, 2015a was 375 and the average was approximately 100). Thus, the basic conclusions of Landy and Goodwin (2015a) remain unchanged.

We do not suggest that this work should be the last word on the association between disgust and moral judgment. However, we stress that researchers should carefully consider the benefits of investigating questions in this domain with the costs associated with recruiting the extremely large samples necessary to have the power to detect these seemingly subtle effects.

## Authors' Note

All data and syntax from the current experiments are available to download from [osf.io/4kz32](https://osf.io/4kz32).

## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

## Supplemental Material

The supplemental materials are available at <http://spps.sagepub.com/supplemental>.

## Notes

1. We describe this manipulation as inducing “disgust” based on the social intuitionist literature. Although we excluded responses that primarily focused on moral disgust (vs. “core” physical disgust), the effects of the manipulation may be due to a transfer across

- moral events. However, this process would make it easier to find evidence for induction, making our test liberal.
- We also tested whether other individual differences might moderate the effects of disgust on moral judgment: gender, the trait of Honesty–Humility, political conservatism, and Need for Cognition. Most of these factors were correlated with moral judgment but none interacted with induced disgust. These analyses are described in the Supplemental Materials.
  - Although the reliability of these scales was low we created composites to be consistent with Schnall, Haidt, Clore, and Jordan (2008). Analyses on the individual scenarios are presented in the Supplemental Materials; these lead to largely the same conclusions.
  - In both Studies 1 and 2, participants in the control condition report significantly more disgust posttest (than pretest). Merely reading the moral scenarios may have induced disgust as three scenarios involved physical disgusting content by design.
  - Details about this procedure, including the models run for Studies 1 and 2, are included in the Supplemental Materials.
  - The preregistration for the Michigan sample can be found at [osf.io/mwgvj/](https://osf.io/mwgvj/). The preregistration for the Texas sample can be found at [osf.io/brn59/](https://osf.io/brn59/).
  - We intended to include a third study with Mechanical Turk workers, but this sample suffered from high levels of attrition. Analyses on this sample and the separate Michigan and Texas samples are in the Supplemental Materials. These individual analyses largely lead to the same substantive conclusions as the combined sample.

## References

- Bodenhausen, G. V., Sheppard, L. A., & Kramer, G. P. (1994). Negative affect and social judgment: The differential impact of anger and sadness. *European Journal of Social Psychology, 24*, 45–62.
- Cameron, C. D., Payne, B. K., & Doris, J. M. (2013). Morality in high definition: Emotion differentiation calibrates the influence of incidental disgust on moral judgments. *Journal of Experimental Social Psychology, 49*, 719–725.
- Chapman, H. A., & Anderson, A. K. (2013). Things rank and gross in nature: A review and synthesis of moral disgust. *Psychological Bulletin, 139*, 300.
- Curtis, V., Aunger, R., & Rabie, T. (2004). Evidence that disgust evolved to protect from risk of disease. *Proceedings of the Royal Society, Series B: Biological Sciences, 271*, S131–S133.
- Curtis, V., & Biran, A. (2001). Dirt, disgust, and disease. Is hygiene in our genes? *Perspectives in Biology and Medicine, 44*, 17–31.
- Eskine, K. J., Kacinik, N. A., & Prinz, J. J. (2011). A bad taste in the mouth: Gustatory disgust influences moral judgment. *Psychological Science, 22*, 295–299.
- Etz, A., & Vandekerckhove, J. (2016). A Bayesian perspective on the reproducibility project: Psychology. *PloS ONE, 11*, e0149794.
- Fitzsimons, G. J. (2008). Editorial: Death to dichotomizing. *Journal of Consumer Research, 35*, 5–8.
- Haidt, J. (2001). The emotional dog and its rational tail: A social intuitionist approach to moral judgment. *Psychological Review, 108*, 814–834.
- Hoeting, J. A., Madigan, D., Raftery, A. E., & Volinsky, C. T. (1999). Bayesian model averaging: A tutorial. *Statistical Science, 14*, 382–401.
- Horberg, E. J., Oveis, C., Keltner, D., & Cohen, A. B. (2009). Disgust and the moralization of purity. *Journal of Personality and Social Psychology, 97*, 963–976.
- Irwin, J. R., & McClelland, G. H. (2003). Negative consequences of dichotomizing continuous predictor variables. *Journal of Marketing Research, 40*, 366–371.
- JASP Team. (2016). *JASP (Version 0.7.0.0)* [Computer software]. Retrieved from <https://jasp-stats.org/>
- Kohlberg, L. (1969). Stage and sequence: The cognitive-developmental approach to socialization. In D. A. Goslin (Ed.), *Handbook of socialisation theory and research* (pp. 347–480). Chicago, IL: Rand McNally.
- Landy, J. F., & Goodwin, G. P. (2015a). Does incidental disgust amplify moral judgment? A meta-analytic review of experimental evidence. *Perspectives on Psychological Science, 10*, 518–536.
- Landy, J. F., & Goodwin, G. P. (2015b). Our conclusions were tentative, but appropriate: A reply to Schnall et al. (2015). *Perspectives on Psychological Science, 10*, 518–536.
- MacCallum, R. C., Zhang, S., Preacher, K. J., & Rucker, D. D. (2002). On the practice of dichotomization of quantitative variables. *Psychological Methods, 7*, 19–40.
- Miller, L. C., Murphy, R., & Buss, A. H. (1981). Consciousness of body: Private and public. *Journal of Personality and Social Psychology, 41*, 397–406.
- Oaten, M., Stevenson, R. J., & Case, T. I. (2009). Disgust as a disease-avoidance mechanism. *Psychological Bulletin, 135*, 303–321.
- Ong, H. H., Mullette-Gillman, O. A., Kwok, K., & Lim, J. (2014). Moral judgment modulation by disgust is bi-directionally moderated by individual sensitivity. *Frontiers in Psychology, 5*, 194.
- Rouder, J. N., Morey, R. D., Verhagen, J., Swagman, A. R., & Wagenmakers, E.-J. (in press). Bayesian analysis of factorial designs. *Psychological Methods*.
- Schnall, S. (2014). Clean data: Statistical artifacts wash out replication efforts. *Social Psychology, 45*, 315–317.
- Schnall, S., Haidt, J., Clore, G. L., & Jordan, A. H. (2008). Disgust as embodied moral judgment. *Personality & Social Psychology Bulletin, 34*, 1096–1109.
- Schnall, S., Haidt, J., Clore, G. L., & Jordan, A. H. (2015). Landy and Goodwin confirmed most of our findings then drew the wrong conclusions. *Perspectives on Psychological Science, 10*, 537–538.
- Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology, 45*, 513.
- Simonsohn, U. (2014). *No-way interactions* [Blog post]. Retrieved from <http://datacolada.org/2014/03/12/17-no-way-interactions-2/>
- Simonsohn, U., Nelson, L. D., & Simmons, J. P. (2014). P-curve: A key to the file-drawer. *Journal of Experimental Psychology: General, 143*, 534.
- Simonton, U. (2015). Small telescopes: Detectability and the evaluation of replication results. *Psychological Science, 26*, 559–569.
- Strack, F., Schwarz, N., & Gschneidinger, E. (1985). Happiness and reminiscing: The role of time perspective, affect, and mode of thinking. *Journal of Personality and Social Psychology, 49*, 1460.
- Turiel, E. (1983). *The development of social knowledge: Morality and convention*. Cambridge, England: Cambridge University Press.

- Tybur, J. M., Lieberman, D., Kurzban, R., & DeScioli, P. (2013). Disgust: Evolved function and structure. *Psychological Review*, *120*, 65–84.
- Ugazio, G., Lamm, C., & Singer, T. (2012). The role of emotions for moral judgments depends on the type of emotion and moral scenario. *Emotion*, *12*, 579.
- Wheatley, T., & Haidt, J. (2005). Hypnotic disgust makes moral judgments more severe. *Psychological Science*, *16*, 780–784.
- Winterich, K. P., Mittal, V., & Morales, A. C. (2014). Protect thyself: How affective self-protection increases self-interested, unethical behavior. *Organizational Behavior and Human Decision Processes*, *125*, 151–161.

### Author Biographies

**David J. Johnson** is a current graduate student at Michigan State University.

**Jessica Wortman** is a former graduate student at Michigan State University now employed at Northrop Grumman.

**Felix Cheung** is a current graduate student at Michigan State University.

**Megan Hein** is a former undergraduate student at Michigan State University.

**Richard E. Lucas** is a professor at Michigan State University.

**M. Brent Donnellan** is a professor at Texas A & M University.

**Charles R. Ebersole** is a current graduate student at the University of Virginia.

**Rachel K. Narr** is a current graduate student at the University of Virginia.

Handling Editor: Joseph Simmons