

## ORIGINAL RESEARCH REPORT

# Disgust, Anger, and Aggression: Further Tests of the Equivalence of Moral Emotions

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People often report disgust toward moral violations. Some perspectives posit that this disgust is indistinct from anger. Here, we replicate and extend recent work suggesting that disgust and anger toward moral violations are in fact distinct in terms of the situations in which they are activated and their correspondence with aggressive sentiments. We tested three hypotheses concerning emotional responses to moral violations: (1) disgust is associated with lower-cost, indirectly aggressive motives (e.g., gossip and social exclusion), whereas anger is associated with higher-cost, directly aggressive motives (e.g., physical violence); (2) disgust is higher toward violations affecting others than it is toward violations affecting the self, and anger is higher toward violations affecting the self than it is toward violations affecting others; and (3) abilities to inflict costs on or withhold benefits from others (measured via physical strength and physical attractiveness, respectively) relate to anger, but not to disgust. These hypotheses were tested in a within-subjects study in which 233 participants came to the lab twice and reported their emotional responses and aggressive sentiments toward self-targeting and other-targeting moral violations. Participants' upper body strength and physical attractiveness were also measured with a dynamometer and photograph ratings, respectively. The first two hypotheses were supported – disgust (but not anger) was related to indirect aggression whereas anger (but not disgust) was related to direct aggression, and disgust was higher toward other-targeting violations whereas anger was higher toward self-targeting violations. However, physical strength and physical attractiveness were unrelated to anger or disgust or to endorsements of direct or indirect aggression.

**Keywords:** disgust; anger; morality; aggression; punishment

People often communicate being disgusted by moral violations, either verbally or via facial expression (Chapman & Anderson, 2013). Given that disgust toward things like spoiled food and bodily wastes is posited to have a pathogen-avoidance function (e.g., Curtis & Biran, 2001; Oaten, Stevenson, & Case, 2009; Tybur, Lieberman, Kurzban, & DeScioli, 2013), many researchers have viewed the disgust reported toward moral violations as a mystery. Notable approaches to solving this mystery have attempted to taxonomize the content of moral violations and identify which content domains elicit disgust and which content domains elicit anger (or other emotions). Proposals have suggested that disgust is elicited by acts that violate so-called purity norms, divinity norms, or bodily norms, such as incest or cannibalism (Graham, Haidt, & Nosek, 2009; Rozin, Lowery, Imada, & Haidt, 1999; Russel &

Giner-Sorolla, 2013), whereas anger is elicited by so-called harm or fairness violations, such as physical assault or theft. Under these accounts, moral disgust is posited to protect social order by deterring counter-normative behaviors that may perturb social cohesion (Haidt, 2003; Rozin, Haidt, & McCauley, 2008). However, a recent body of work undermines the contention that specific emotions are elicited by specific moral violation content (Cameron, Lindquist, & Gray, 2015). Further, much of the disgust toward purity violations owes to the pathogenic or sexual content implied by such acts – content that elicits disgust for reasons unrelated to social cohesion (Tybur et al., 2013) – rather than the posited immoral nature of the act (Royzman, Atanasov, Landy, Parks, & Gepty, 2014; Royzman & Sabini, 2001). Such observations have led to conclusions that anger, rather than disgust, is the predominant response to moral violations across content categories (Royzman et al., 2014).

Nevertheless, even for moral violations absent of pathogen and sexual content – and even for moral violations to which a majority of people respond with anger – individuals vary in the degree to which they

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report experiencing disgust and anger. How are we to understand this variation? One perspective posits that disgust toward moral violations reflects nothing more than a communicative flair for expressing an especially strong level of anger or outrage (Herz & Hinds, 2013; Royzman & Sabini, 2001). According to this view, disgust reported toward moral violations corresponds with motivational states and action tendencies that are either identical to those that accompany anger (i.e., an equivalence account; see Hutcherson and Gross, 2011, for an overview) or more intense, given that the disgust is posited to communicate, via metaphor, an extra degree of condemnation. Arguments endorsing the equivalence account have largely relied on evidence that disgust toward moral violations differs from disgust toward pathogen cues, either in terms of the duration of the experience or in terms of finer grain verbal descriptions, such as “grossed out” (e.g., Herz & Hinds, 2013; Marzillier & Davey, 2004; Nabi, 2002; Simpson, Carter, Anthony, & Overton, 2006).

Rather than comparing disgust toward moral violations with disgust toward pathogen cues, studies aiming to evaluate equivalence accounts should compare disgust toward moral violations with anger toward moral violations. Three notable studies following this approach have indeed unveiled such differences. The first asked participants to recall a time in which an individual had committed a social infraction, and then to report (1) the anger and moral disgust they experienced and (2) the types of behaviors they felt like engaging in during the event. Although both moral disgust and anger were related to a desire to punish the offender, only anger uniquely related to a desire to take actions to stop the offender (Hutcherson & Gross, 2011). The second asked participants to read a vignette describing a moral violation, and then to (1) indicate the degree to which arrays of faces expressing either anger or disgust matched their feelings toward the situation and (2) report the degree to which they felt like directly (e.g., physical confrontation) or indirectly (e.g., gossip) aggressing against the offender. Agreement with the anger array (but not the disgust array) was related to desires to directly aggress against the offender, and agreement with the disgust array (but not the anger array) was related to desires to indirectly aggress against the offender (Molho, Tybur, Güler, Balliet, & Hofmann, 2017). The third extended this finding, reporting that anger was higher when moral violations targeted the self or a highly-valued other (a sibling) than when they targeted an acquaintance, but disgust was higher when the same moral violations targeted an acquaintance than when they targeted the self or a highly-valued other (Lopez et al., 2019).

Each of these studies have important limitations. As pointed out by others (e.g., Herz & Hinds, 2013; Russell, Piazza, & Giner-Sorolla, 2013), the first study asked participants to report “anger” versus “moral disgust.” The adjective “moral” in front of disgust (but not anger) might have produced illusory emotion-specific responses. The second and third studies avoided this issue by using unlabeled arrays of facial expressions, but their

generalizability is limited by the fact that (like the first study) they were conducted in the United States. Language groups differ in the degree to which they use the same word (e.g., “disgust”) to describe reactions to both pathogen cues and acts that are morally condemned (Han, Kollareth, & Russell, 2016), and relations between facial expressions of disgust and responses to moral violations might similarly be nation-specific. Hence, the current investigation aims to add to the sparse literature directly testing the equivalence account in a non-U.S. country. In addition to replicating this study, it also tests further hypotheses inspired by the sociofunctional account described by Molho and colleagues (2017).

### **Disgust, anger, and aggression**

Reports of both anger and disgust are associated with desires to punish moral offenders (Hutcherson & Gross, 2011; Hofmann, Brandt, Wisneski, Rockenbach, & Skitka, 2018). However, the nature of punishment aligned with anger versus disgust might differ. As suggested by Molho and colleagues (2017), anger might be more strongly associated with direct verbal or physical confrontation, and disgust might be more strongly associated with gossip and social exclusion (cf. Fischer & Roseman, 2007; Hutcherson & Gross, 2011; Tybur et al., 2013). According to this reasoning, experiences of anger toward moral offenders, while more effective in stopping immoral actions or deterring repeat offenses (Krasnow, Delton, Cosmides, & Tooby, 2016; Sell, Tooby, & Cosmides, 2009), are also costlier; indeed, they can commit an individual to direct conflict, which can lead to counter-aggression (Frank, 1988; Reed, DeScioli, & Pinker, 2014). In contrast, disgust toward moral offenders might be both less effective as a deterrent and less costly to deploy. After all, the indirect aggression putatively associated with disgust is by definition intended to be unobservable to the target (Archer & Coyne, 2005). As such, disgust would be less likely to elicit counter-aggression, but it would also be less likely to stop a target or deter future aggression. Nevertheless, indirect aggression could usefully coordinate condemnation with other third parties, and hence decrease the costs of conflicts between those third parties (DeScioli, 2016). Alternatively, disgust (rather than anger) expressions could signal prosocial orientations (Kupfer & Giner-Sorolla, 2017), which increase the likelihood of being chosen as an exchange partner (Barclay, 2016).

Based on these ideas, Molho and colleagues (2017) proposed that individuals should report greater anger toward moral violations targeting themselves than toward those targeting other people, and, conversely, report greater disgust toward moral violations targeting other people than toward those targeting themselves. That is, the costlier – but more effective at deterring mistreatment – anger responses should increase when the violation is more costly to the self, whereas the less costly disgust responses should increase when the violation is less costly to the self (and, further, when some coordination between third parties could be advantageous). Results across four studies were consistent with these hypotheses: anger

was higher toward moral violations that targeted the self than those that targeted others, and disgust was higher toward moral violations that targeted others than those that targeted the self. Further, anger – but not disgust – was uniquely related to motivations to directly aggress against the perpetrator, whereas disgust – but not anger – was uniquely related to motivations to indirectly aggress against the perpetrator.

The logic described above can be used to predict further distinctions between anger and disgust toward moral violations. Some individuals might be more (or less) reluctant to deploy anger, given its costs. Existing work suggests that more physically attractive individuals – who are better able to withhold benefits given their higher social capital (e.g., income; Judge, Hurst, & Simon, 2009) – and stronger individuals – who are better able to inflict costs upon others in physical combat – anger more easily and tend to be more successful in direct conflicts (Price, Dunn, Hopkins, & Kang, 2012; Hess, Helfrecht, Hagen, Sell, & Hewlett, 2010; Sell, Eisner, & Ribeaud, 2016; Sell et al., 2009). These relationships putatively exist because such individuals run less risk of counter-aggression given their potential value as social allies and their potential threat as enemies. Notably, these effects may be sex-specific, such that strength relates to anger proneness in men (who more often settle disputes through physical combat), whereas attractiveness relates to anger proneness in women. No work has reported such relationships with disgust and, indeed, some work suggests that disgust sensitivity is associated with less aggression (Pond, DeWall, Lambert, Deckman, Bonser, & Fincham, 2012). Hence, in addition to replicating results from Molho and colleagues (2017) in a different country and language, the current study also aims to test a novel hypothesis: that formidability and attractiveness relate to anger, but not to disgust, toward moral violations. Further, the study will replicate existing findings of a relationship between formidability and attractiveness and histories of anger proneness, success in conflict, and history of fighting (e.g., Sell et al., 2009). Notably, a similar recent replication attempt has not detected a relationship between formidability and anger proneness in European (Scottish and German) samples (Von Borell, Kordsmeyer, Gerlach, & Penke, 2019). In sum, the hypotheses to be tested include:

- 1) Anger will be higher in response to moral violations that target the self than those that target others, and disgust will be higher in response to moral violations that target others than those that target the self.
- 2) Anger – but not disgust – will relate to directly aggressive sentiments toward a moral violation, and disgust – but not anger – will relate to indirectly aggressive sentiments toward a moral violation.<sup>1</sup>
- 3) Physical strength and attractiveness will relate to anger toward moral violations but not to disgust toward moral violations.
- 4) Replicating Sell et al. (2009), physical strength will relate to anger proneness in men, and physical attractiveness will relate to anger proneness in women.

## Method

### Participants

Participants were recruited from a Dutch university. They were required to be fluent Dutch speakers. We pre-registered a target sample size of 182 participants, with at least 91 men and 91 women (see <https://osf.io/w8qtv/> for the pre-registration, including descriptions of an priori power analysis, and an exhaustive list of measures). Because we had a much easier time recruiting women than men, we continued enrolling women until we reached the targeted sample size of 91 men. Ultimately, 233 individuals participated in at least the first of two experimental sessions in exchange for 10 euros or course credit, and 216 individuals participated in both sessions. Given the importance of participant sex to some of the analyses, we excluded one participant who was undergoing hormonal therapy while transitioning from female to male. No other participants were excluded. The final sample consisted of 92 men and 140 women, with ages ranging from 17 to 43 ( $M = 21.15$ ,  $SD = 3.56$ ). With an alpha equal to .05, this sample size affords 80% power to detect bivariate relationships of  $r = .18$ . It also affords 80% power to detect differences between anger and disgust in the self- and other-conditions equivalent to  $d_z = .19$ .

### Procedure

Participants completed two separate sessions, one week apart. They were greeted by a research assistant, who escorted them to the study location, gathered informed consent, asked the participant to turn off his or her mobile phone, and situated the participant at a computer. Participants then read a scenario in which, while attending a house party, they entered a room in which a man was smoking a cigarette and casually flicking ashes on a pile of party attendees' jackets, with the jacket on top of the pile badly damaged (adapted from Griskevicius et al., 2009). In the first session, participants were randomly assigned to read either a *self-victim* scenario in which the damaged jacket was their own or an *other-victim* scenario in which the damaged jacket belonged to someone else, with the participant's jacket lying undamaged in the middle of the pile. In the second session, they read the scenario they had not read in the first session. After reading the scenario, participants reported their disgust and anger (among other emotions) and their direct and indirect aggressive sentiments toward the man described in the scenario. These measures were identical to those used in Study 4 of Molho et al. (2017), though they were presented in Dutch rather than English. This was the only manipulation in the study.

Next, participants were given a break from the computer tasks to provide physical measurements. After removing their shoes and any jacket or sweater they were wearing, their height was recorded using a tape measure affixed to a wall, and their weight measured using a digital scale. They then squeezed a Jamar hydraulic hand dynamometer twice with their left hand and twice with their right hand (to measure forearm strength) and twice with both hands in front of the chest (to measure chest strength; Sell et al., 2009). If any of the two measurements differed substantially, a third measurement was taken to replace

the outlier of the other two. Finally, bicep circumference was measured for each arm using a BalanceFrom tape measure. After completing the physical measures, participants were asked to stand against a white wall at a standardized distance from a camera and assume a neutral facial expression. The researcher took one full body picture and one picture framing the participant's face.

After the physical measurements, participants returned to the computer, where they completed a series of individual differences measures, including those intended to assess anger proneness, success in conflict, and history of fighting. In the second session, participants first read the moral violation scenario they had not seen in their first session and provided emotion and aggression ratings in response to that scenario, and they again provided physical measurements and photographs. After this, they were thanked, received payment or credit, and were debriefed.

### Measures

#### Emotion

Participants saw arrays of six faces and reported their agreement with the statement “These faces match how I felt while reading the scenario” on a 1 (strongly disagree) to 7 (strongly agree) point scale. Separate arrays were presented for happiness, surprise, fear, sadness, anger, and disgust. Participants also selected which of the six arrays best matched their reaction to the scenario. Seventy-nine percent of participants selected either the anger or disgust array as best matching their reaction in the other condition (43.5% anger, 35.4% disgust), and 75% selected one of these two arrays in the self condition (55.5% anger and 19.8% disgust).

#### Aggression

Participants indicated their agreement with five statements describing directly aggressive responses (e.g., “I would insult the person described in the scenario to his face”) and five statements describing indirectly aggressive responses (e.g., “I would spread negative information about the person described in the scenario to others”) on a 1 (strongly disagree) to 7 (strongly agree) point scale. Alpha coefficients ranged from .81 to .87 for direct and indirect aggression in the self and other conditions.

#### Anger Proneness

Sell and colleagues (2009) found that formidability (in men) and attractiveness (in women) related to multiple indices of proneness to conflict. Based on factor analyses of Sell and colleagues' data, we administered 10 proneness to anger items (e.g., “I get very angry when someone makes fun of me,”  $\alpha = .74$ ), six success in conflict items (e.g., “When there's a dispute, I usually get my way,”  $\alpha = .80$ ), and five history of fighting items (e.g., “I have physically intimidated someone who had it coming,”  $\alpha = .79$ ), each of which were measured on a 1 (strongly disagree) to 7 (strongly agree) point scale.

#### Formidability

A principal component analysis was conducted on the average of the grip strength measures, the average of the chest strength measures, and the average of the bicep

circumference measures. The first principal component accounted for 75% of the total variance in strength measures. Regression estimates on this component were saved and treated as formidability scores.

#### Attractiveness

Fifty individuals rated targets on the question “What percentage of (fe)male VU students is this person more attractive than” on an 11-point scale, with points labeled at 10 percentile intervals ranging from 0 to 100. Raters were randomly assigned to rate either full-body or face images, and to rate photographs from either the first session or the second session. All raters first rated one set of the male or female photographs, and then rated a set of photographs from the other sex. Based on low ( $<.10$ ) or negative item-total correlations, four ratings were removed. Coefficient alpha for the remaining ratings were all above .84. Ratings were averaged across the two face sets ( $r = .85$ ) and across the two body sets ( $r = .70$ ). Because face and body ratings were also strongly correlated,  $r = .75$ , they were averaged into a single attractiveness score.

#### Additional measures

We also administered the HEXACO-100 (Ashton et al., 2004), the egalitarianism items of the SDO-7 (Ho et al., 2015), and the SVO slider measure (Murphy et al., 2011). We do not report analyses using these instruments here (though analyses involving SDO and SVO are described in the online supplement).

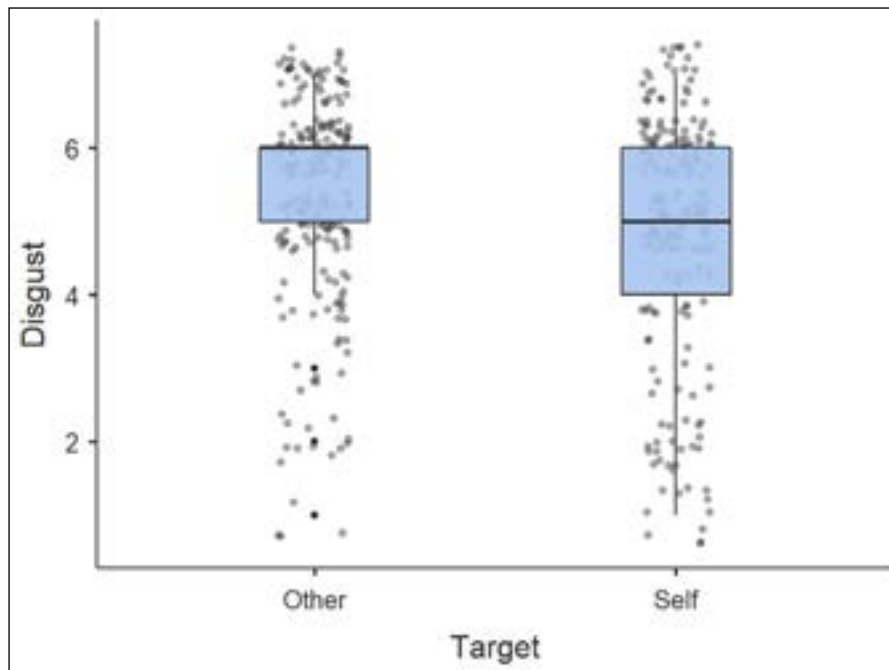
#### Open Practices

The data and analysis script, which can be used to reproduce the results reported below, are available at <https://osf.io/w8qtv/>. Materials – including an exhaustive list of items and procedures that could be used to reproduce the methods – are available at the same OSF page, as is a pre-registration of the methods and analyses. Four changes were made to the pre-registered analysis plan. First, as noted below, we neglected to describe one of the core hypotheses of the project (and, indeed, one of the core findings of the project we are replicating) in the pre-registration document. Second, we did not gather strength ratings based on participant photographs after seeing that the quality of the photographs were not sufficient for assessing strength. Third, we did not ask participants to report their fighting ability. Fourth, we do not describe how formidability relates to anger proneness independent of the HEXACO-100 (though bivariate relationships between formidability and the HEXACO-100 are described in the online supplement).

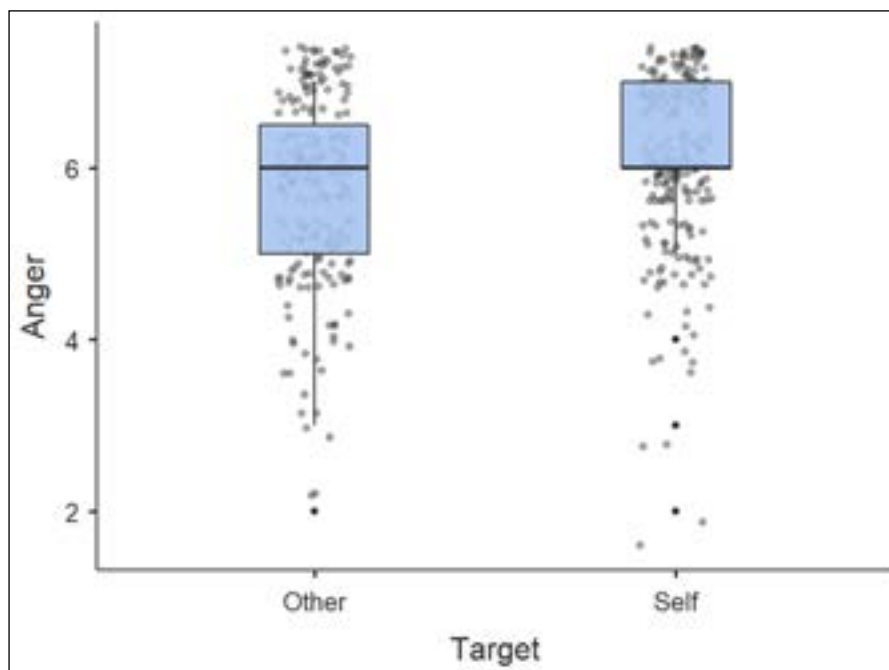
## Results

### Emotion across violation targets

Is disgust higher in response to other-targeting moral violations relative to self-targeting ones? And does anger show the opposite pattern? Consistent with our pre-registered analysis plan, we examined this question using a 2 (target: self versus other)  $\times$  2 (emotion: anger versus disgust) repeated-measures ANOVA with participant sex and session order included as between-subjects factors. We observed the predicted interaction between emotion and target,  $F(1,$



**Figure 1:** Reported disgust toward a moral violation that targeted another person versus the self. Disgust is greater in the other-targeting condition than in the self-targeting condition using both parametric ( $p = .001$ ) and non-parametric ( $p < .001$ ) analyses.



**Figure 2:** Reported anger toward a moral violation that targeted another person versus the self. Anger is greater in the other-targeting condition than in the self-targeting condition using both parametric ( $p < .001$ ) and non-parametric ( $p < .001$ ) analyses.

212) = 29.12,  $p < .001$ ,  $\eta_p^2 = 0.12$ . Disgust was higher in the other-target condition,  $M = 5.26$ , 95% CI = [5.06, 5.45], than in the self-target condition,  $M = 4.83$ , 95% CI = [4.61, 5.06],  $F(1, 212) = 12.16$ ,  $p = .001$ ,  $\eta_p^2 = 0.05$ , (See **Figure 1**) whereas anger was higher in the self-target condition,  $M = 6.12$ , 95% CI = [5.99, 6.25], than in the other-target condition,  $M = 5.72$ , (See **Figure 2**) 95% CI = [5.58, 5.87],  $F(1, 212) = 19.23$ ,  $p < .001$ ,  $\eta_p^2 = 0.08$ . Participant sex and session order had

no main effects or interactions on emotion (all  $p$ 's  $> .087$ ). Notably, inferences were the same using a non-parametric analyses (see the online supplement).

#### **Aggression across violation targets**

We repeated this analysis using direct versus indirect aggression in place of anger and disgust. We again observed an interaction between emotion and target,  $F(1, 212) = 17.44$ ,

$p < .001$ ,  $\eta_p^2 = 0.08$ . Indirect aggression was higher for self-targeting moral violations,  $M = 3.44$ , 95% CI = [3.26, 3.63], than other-targeting moral violations,  $M = 3.22$ , 95% CI = [3.05, 3.39],  $F(1, 212) = 12.05$ ,  $p = .001$ ,  $\eta_p^2 = 0.05$ . For direct aggression, this effect was in the same direction, though stronger (self:  $M = 4.07$ , 95% CI = [3.90, 4.24]; other:  $M = 3.49$ , 95% CI = [3.32, 3.64],  $F(1, 212) = 71.81$ ,  $p < .001$ ,  $\eta_p^2 = 0.25$ ). The interaction between aggression type and violation target was qualified by an interaction with session order,  $F(1, 212) = 19.33$ ,  $p < .001$ . In both session orders, direct aggression was higher in response to self-targeting moral violations, but the effect was stronger for participants who responded to the other-targeting moral violation in their first session.

**How emotion relates to aggression**

Next, we tested whether disgust (but not anger) relates to indirect aggression, and anger (but not disgust) relates to direct aggression. We first regressed direct aggression on anger and disgust and then regressed indirect aggression on anger and disgust. As with the other analyses, we controlled for participant sex and session order in each analysis. In the self-target condition, anger related to direct aggression,  $b = .40$ , 95% CI = [.24, .55],  $p < .001$ ,  $r_p^2 = .10$ , but disgust did not,  $b = -.03$ , 95% CI = [-.13, .06],  $p = .50$ ,  $r_p^2 < .01$ . This pattern also emerged in the other-target condition: anger related to direct aggression,  $b = .20$ , 95% CI = [.06, .34],  $p = .006$ ,  $r_p^2 = .03$ , but disgust did not,  $b = .05$ , 95% CI = [-.06, .15],  $p = .35$ ,  $r_p^2 < .01$ . However, disgust related to indirect aggression in both the self condition,  $b = .11$ , 95% CI = [.01, .23],  $p = .047$ ,  $r_p^2 = .02$ , and the other condition,  $b = .16$ , 95% CI = [.04, .27],  $p = .008$ ,  $r_p^2 = .03$ , whereas anger was unrelated to indirect aggression in both the self and other conditions ( $b = .15$ , 95% CI = [-.04, .33],  $p = .12$ ,  $r_p^2 = .01$ , and  $b = -.03$ , 95% CI = [-.19, .12],  $p = .68$ ,  $r_p^2 < .01$ , respectively). Again, results using non-parametric analyses corresponded with those reported here (see the online supplement).

**How formidability and attractiveness relate to emotion and aggression**

We next examined bivariate correlations between formidability and attractiveness and emotional (disgust and anger) and aggressive (indirect and direct) responses to both self-targeting moral violations and other-targeting moral violations (see **Table 1**). None of these correlations differed from zero for men or for women (all  $p$ 's  $> .09$ ). Hence, we found no support for the hypothesis that emotional reactions to moral violations relate to a target's or observer's ability to inflict costs or confer benefits.

Notably, though, we also did not detect a relationship between formidability and attractiveness and anger proneness, history of fighting, and success in conflict (cf. Sell et al., 2009). For men, neither formidability nor attractiveness were related to anger proneness, success in conflict, or history of fighting (all  $p$ 's  $> .23$ ). For women, formidability was related to history of fighting,  $r = .18$ , 95% CI = [.02, .34],  $p = .031$ , but no other relationships differed from zero at the  $p < .05$  level.

**Table 1:** Pearson correlations between physical strength (as assessed via chest and grip strength via dynamometer and bicep circumference), physical attractiveness (as assessed via ratings of photographs of participants) and measures of anger proneness, success in conflict, and history of fighting. Correlations for male participants ( $N = 91$ ) appear below the diagonal, and correlations for female participants ( $N = 140$ ) appear above the diagonal. Coefficient alpha appears on the diagonal for the three self-report measures, with men's coefficients below the diagonal and women's above the diagonal. Asterisks indicate  $p < .05$ .

	1	2	3	4	5
1. Strength	–	–.21*	–.01	.14	.18*
2. Attractiveness	.11	–	–.08	.15	.01
3. Anger Proneness	.13	.09	.74	.04	.37*
4. Success in Conflict	–.02	.04	.34*	.81	.03
5. History of Fighting	.09	.04	.45*	.25*	.79

**Exploratory multi-level approach**

Our pre-registered analysis plan did not allow for tests of whether within-person variability in disgust and anger across moral violation targets related to within-person variability in aggressive sentiments. We addressed this shortcoming with multi-level analyses in which effects of anger and disgust on aggression were modeled both at level 1 (i.e., separately for each experimental session, and within-person centered) and level 2 (i.e., averaged across the two experimental sessions). The level-1 analysis informs whether differences in disgust and anger across target scenarios relate to differences in aggression across target scenarios; the level-2 analysis informs whether average anger and average disgust across sessions relates to average aggression across sessions. Analyses were performed once with direct aggression as the dependent measure and once with indirect aggression as the dependent measure. Fixed effects of participant sex and session order were also modeled. Random intercepts were modeled in all analyses, as were random slopes for disgust (adding other random slopes to the model did not improve model fit as assessed via likelihood ratio tests).

Results revealed that, within-participants, increases in anger corresponded with increases in direct aggression,  $b = .26$ , 95% CI = [.16, .37],  $p < .001$ , but increases in disgust did not,  $b = .04$ , 95% CI = [-.05, .12],  $p = .43$ . However, neither increases in anger nor increases in disgust corresponded with increases in indirect aggression ( $b = -.03$ , 95% CI = [-.12, .07],  $p = .58$ , and  $b = -.04$ , 95% CI = [-.12, .04],  $p = .31$ , respectively). Across participants, higher average anger across scenarios corresponded with higher direct aggression  $b = .32$ , 95% CI = [.15, .49],  $p < .001$ , but higher average disgust did not,  $b = .001$ , 95% CI = [-.11, .11],  $p = .98$ . A different pattern emerged for indirect aggression, where higher average disgust corresponded with higher average indirect aggression,

$b = .20$ , 95% CI = [.08, .33],  $p = .002$ , but higher average anger did not,  $b = .10$ , 95% CI = [-.10, .30],  $p = .32$ .

## Discussion

Studies using three different approaches have now found that anger and disgust toward moral violations differentially vary as a function of who is victimized by the transgression: one asked participants to verbally report the degree to which they felt moral disgust and the degree to which they felt anger (Hutcherson & Gross, 2011); one asked participants to verbally report the degree to which they felt disgust (importantly, without the term “moral”) and the degree to which they felt anger (Study 2; Molho et al., 2017); and, with this study included, six have asked participants how well facial expressions of disgust and facial expressions of anger match their feelings (Studies 1–3, Lopez et al., 2019; Studies 1 and 4, Molho et al., 2017). Of course, a finding’s frequency in the literature is not necessarily diagnostic of its truth, since file drawers can be filled with null findings and methodological variety across studies can mask the unreliability of an effect (Pashler & Harris, 2012). Given that the current study followed a pre-registered protocol in replicating one of these earlier studies (albeit with a within-subjects rather than between-subjects design), results should increase our confidence in the distinct relationships between disgust and anger and different types of aggression, as well as distinct relationships between moral violation target and anger versus disgust.

The novel finding afforded by our within-subjects design suggests that individuals who tend to be disgusted by moral violations also tend to endorse indirect aggression, but that within-person variation in disgust does not relate to within-person variation in indirect aggression. In contrast, both within- and between-participant variance in anger related to direct aggression. Said differently: the type of people who respond to moral violations with more disgust also tend to endorse greater indirect aggression, but greater disgust within an individual does not relate to greater indirect aggression sentiments. Naturally, these findings should be interpreted tentatively, both given their exploratory nature and given that we only assessed emotional responses and aggression twice. Nevertheless, they might suggest that the relationship between disgust and aggression is less dose-dependent than is the relationship between anger and aggression. That is, a little bit of disgust might have a similar effect on indirect aggression as a lot of disgust, whereas a little bit of anger might have less of an effect on indirect aggression than a lot of anger.

The degree to which disgust is expressed or experienced in response to moral violations across cultures is debated (compare Curtis and Biran, 2001, and Haidt, Rozin, McCauley, and Imada, 1997, with Han et al., 2016). The current study is, to the best of our knowledge, the first to find distinct relationships between disgust and anger and distinct types of aggression outside of the U.S. Such findings suggest that these relationships are not limited to the U.S. or to (native) English-speaking populations. Of

course, the Netherlands and the U.S. are both Western, educated, developed nations that speak Germanic languages. Replications across more varied nations can usefully inform the degree to which these distinctions between disgust and anger generalize across cultures.

### *Implications for the recalibration theory of anger*

Multiple studies have lent support to the hypothesis that stronger and more attractive individuals are more prone to anger and have a greater history of success in conflicts. Based on this literature, we proposed that anger – but not disgust – toward moral violations would covary with strength and attractiveness. Our results were inconsistent with both this novel hypothesis and with previous findings. That said, while the 95% confidence interval for the correlation between men’s strength and anger proneness overlapped with zero, it also included  $r = .27$ , the correlation we estimated based on our literature review. Hence, the apparent difference between conclusions from this study and others does not offer strong evidence for a smaller (or null) relationship between strength and anger proneness in this population relative to other populations. Nevertheless, the relationship between physical strength and anger proneness might vary across cultural contexts (to the point of it being weaker or equal to zero in the population from which we sampled here), as suggested by Sell and colleagues (2009). In Dutch society, physical strength might afford less ability to inflict costs on others than in U.S. society (or in Aka society, where physical strength is also associated with a history of aggression, as reported in one study; Hess et al., 2010), perhaps due to greater social sanctioning of aggressive individuals and, relatedly, greater reliance on centralized authorities to solve disputes (Pinker, 2011). A recent study of men from Scotland and Germany – societies more similar to the Netherlands than the U.S. in terms of violence – similarly found little evidence for a relationship between strength and anger proneness (Von Borell et al., 2019). Ultimately, given the lack of replication of the finding that strength relates to anger proneness, we hesitate to abandon the hypothesis that strength differentially relates to anger and disgust. We recommend further tests of this idea, perhaps in other locations that have detected relationships between strength and anger proneness (e.g., the United States).

### *Limitations and future directions*

Naturally, multiple limitations apply to the current findings. We discuss three notable ones. First, data were collected from a relatively affluent sample of young Dutch participants. As noted above, some of the relationships observed in the current study might not be generalizable to other populations. Second, the single-item measures of emotion based on posed facial expressions are noisy. Imprecision in this measure might attenuate effect size, and results using this type of measure might not generalize to other measures of emotion (e.g., measurements of facial expression; verbal self-reports). Third, participants reported hypothetical responses to hypothetical moral

violations. The extent to which these responses – in terms of emotion or aggression – would generalize to behaviors in more ecologically valid conditions is an open question. Behavioral studies report that, in contrast to the strong sentiments to directly aggress against moral transgressors in third-party settings described here, people rarely directly aggress to help others (Pedersen et al., 2019). Further, some evidence suggests that responses to hypothetical moral transgressions and responses to actual moral transgressions are predicted by different factors (e.g., Baumert et al., 2013). Hence, null results (e.g., between formidability and aggression) should be interpreted tentatively, and relations between emotion and aggression should be investigated in non-hypothetical contexts.

### Concluding thoughts

In closing, the literature has too often focused on falsifying the hypothesis that moral disgust and pathogen disgust are “fundamentally the same emotion” (Herz & Hinds, 2013, pp. 276). Clearly, they are not (Tybur et al., 2013). However, a lack of equivalence between the disgust reported toward pathogen cues and the disgust reported toward moral violations should not be taken as evidence of equivalence between disgust and anger toward moral violations. Emotional responses to moral violations likely have many different shades (e.g., Russell & Fehr, 1994), and findings here suggest that reports of disgust versus anger differentiate between some of these. Other work finds that expressions of disgust versus anger have different effects on the targets and observers of those expressions (Kupfer & Giner-Sorolla, 2017; Giner-Sorolla & Espinosa, 2011) and different relationships with assessments of a transgressor’s moral character (Giner-Sorolla & Chapman, 2017). These studies have likely only scratched the surface of differences between disgust and anger. Deeper endeavors in this area may well reveal further differences between these emotions, with implications for aggression, punishment, and moral bandwagoning.

### Data Accessibility Statement

All stimuli, participant data, and analysis scripts can be found on this paper’s project page on the Open Science Framework: <https://osf.io/w8qtv/>.

### Note

<sup>1</sup> We erred by not describing this hypothesis in our pre-registration plan. Given that it was a core finding of one of the studies we replicate, we do not describe analyses testing it as exploratory here.

### Additional File

The additional file for this article can be found as follows:

- **Supplemental Material.** Nonparametric Analyses. DOI: <https://doi.org/10.1525/collabra.349.s1>

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The authors certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers’ bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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