

Prosocial aggression tracks genetic relatedness distinctly from emotional closeness

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IN PRESS AT EMOTION

Author note

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Abstract

Altruistic behavior is understood to largely stem from adaptations for kin altruism, contingent on degree of relatedness, and/or reciprocal altruism, contingent on degree of benefits conferred in exchange for help. As kin qualify for both kin *and* reciprocal altruism, they should receive greater support than friends, as has been demonstrated in prior research. Here, we tested this prediction with regard to willingness to punish on another's behalf, comparing inclinations to aggress against transgressors when the victim was framed as an acquaintance, close friend, cousin, sibling, or oneself. Participants endorsed comparably greater direct aggression on behalf of the self, kin or friends relative to acquaintances, despite reporting substantially greater emotional closeness to friends, consistent with what has been termed a *kinship premium*. Kin engendered greater aid than is explicable by affiliative emotion. Participants also reported less anger—yet trends toward greater disgust—when victims were acquaintances relative to all other conditions, replicating prior work distinguishing the social functions of anger and disgust. These results are discussed as they inform both the kinship premium hypothesis and sociofunctional accounts of moral emotion.

Keywords: kinship premium, aggression, anger, disgust, moral cognition, evolutionary psychology

Introduction

Punishment of moral transgressions appears to be a human universal (Brown, 1991), deterring antisociality and enhancing cooperation across all known societies (Balliet, Mulder & Van Lange, 2011; Baumard, André, & Sperber, 2013; Boyd & Richerson, 2009). However, punishment entails a number of costs, including physical and reputational risks should the target of one's punishment or their allies respond antagonistically, as well as the foreclosure of other opportunities. Conversely, punishment of moral transgressors can produce benefits by deterring transgressions against oneself or one's allies (Fischer & Roseman, 2007; Krasnow, Cosmides, Pederson, & Tooby, 2012), by signaling one's prosocial values to potential collaborative partners, and, in some cases, by sparing one from higher-order punishment (i.e., individuals caught shirking normative obligations to punish transgressors may themselves be punished) (Barclay, 2006; Fessler & Haley, 2003; Santos, Rankin & Wedekind, 2011). Given such cost/benefit tradeoffs, adaptationist approaches to morality predict that transgressive harms inflicted upon oneself, kin, or attachment partners should elicit greater direct confrontation and punishment than transgressive harms against strangers or mere acquaintances (Molho, Tybur, Van Lange & Balliet, 2020).

At the proximate level of description, direct confrontation is closely associated with experiences of the emotion *anger* (Carver & Harmon-Jones, 2009), including overt punishment of moral violations (Seip, Van Dijk, & Rotteveel, 2014). In addition to anger, the emotion *disgust* has also been documented to be reliably evoked by acts deemed immoral (Tybur, Molho & Balliet, 2018; Chapman & Anderson, 2013), even when these acts are unrelated to elicitors functionally central to disgust, such as pathogen cues (e.g., economic unfairness; Chapman, Kim, Susskind & Anderson, 2009). Rather than direct confrontation, disgust motivates aloofness from transgressors (Tybur, Lieberman, & Griskevicius, 2009) and is thought to marshal indirect punishment via gossip (Curtis & Biran, 2001). Integrating the cost/benefit incentives of direct punishment with prior work linking anger and disgust

to direct versus indirect forms of punishment, Molho and colleagues (2017) conducted a series of studies to test whether anger and inclinations toward direct punishment would be more pronounced when moral violations incur greater fitness costs, and thus justify the risk inherent to deterrent confrontation (also see Sell et al., 2017). Indeed, they observed that immoral acts framed as harming the self-elicited greater anger, which in turn predicted greater motivation to directly aggress against the transgressor, than did the same acts framed as harming an acquaintance. Conversely, transgressions framed as harming acquaintances elicited greater feelings of disgust, and disgust was positively associated with inclinations to indirectly aggress (for a conceptual replication, see Tybur et al., 2020).

Noting that the adaptive logic of the sociofunctional account predicts a similar profile of affective responses and punishment tendencies when transgressions befall kin relative to acquaintances, Lopez and colleagues (2019) conducted a series of pre-registered replication studies extending Molho et al. (2017)'s research by adding an adult sibling condition. In all three studies, Lopez et al. found that hypothetical transgressions against oneself or one's sibling elicited comparably heightened anger and inclinations toward direct aggression relative to transgressions against an acquaintance. In a pattern which also agreed with Molho et al.'s sociofunctional model, anger predicted direct (but not indirect) punishment, whereas disgust predicted indirect (but not direct) punishment. Departing from the findings of Molho et al., tendencies toward indirect punishment were not significantly greater when harms were framed as befalling an acquaintance. Nonetheless, the overall pattern obtained in the replication series supported the sociofunctional account and generalized the effect of harms to the self to siblings. In complementary findings consistent with those of Lopez and colleagues (2019, Study 3), individuals have been found angrier and more aggressive toward malefactors when siblings are insulted than when strangers are (Gesselman & Webster, 2012), more prone to incur risks on behalf of a relative than a friend (Kruger, 2001), and more willing to endure physical pain in order to benefit kin than strangers (Madsen et al., 2007).

Lopez and colleagues (2019, Study 3) also compared the sibling condition to a friend condition in order to exploratorily assess the role of genetic relatedness in moral emotions and inclinations to aggress. Despite notably greater reports of emotional closeness to friends than to siblings, harm to siblings (but not to friends) elicited significantly more anger than did harm to acquaintances, and harm to siblings aroused greater inclinations toward direct aggression than did harm to friends or acquaintances. Prosocial cooperation with friends or with kin is theoretically rooted in psychological adaptations promoting *reciprocal altruism* and *kin altruism*, respectively (Barkow, Cosmides, & Tooby, 1992).¹ Reciprocal cooperation supports the formation of relationships whose cooperative benefits offset the relatively lower costs of helping (Trivers, 1971), whereas kin selection theory contends that others may be expected to be offered help in proportion to the probability that they share genes with the prospective helper (Hamilton, 1964). As Curry, Roberts, and Dunbar (2013) observed, kin qualify for both forms of cooperation, whereas friends can only derive support related to adaptations for reciprocity. All else being equal, family may be expected to receive greater aid than friends, a prediction that has been supported by the findings of a number of conceptually convergent studies focusing on non-aggressive modes of helping (Booyesen, Guvuriro, Munro, Moloji & Campher, 2018; Bressan, Colarelli & Cavalieri, 2009; Hackman, Danvers & Hruschka, 2015; Pollet, Roberts & Dunbar, 2013; Madsen et al., 2007; Rachlin & Jones, 2008; Schneider, Sauerland, Merckelbach, Puschke & Cohrs, 2021) including cross-culturally replicable effects. Complementarily, the fitness incentive to obtain reciprocal aid from siblings coupled with the inclusive fitness benefits intrinsic to aiding kin may explain why participants in the series of studies conducted by Lopez and colleagues (2019) consistently responded to harms inflicted upon siblings with anger and aggressive inclinations comparable to when harms were inflicted on the self.

Insofar as relationship quality, or “closeness”, indexes assessments of friends as likely to provide cooperative benefits in the future, closeness should be expected to predict appraisals of harm

befalling friends as costly, potentiating greater anger and willingness to aggress on their behalf (see Gervais & Fessler, 2017). However, the inclusive fitness incentive to aid kin is orthogonal to the incentive to foster the reciprocity between friends that is hypothetically indexed by emotional closeness. Accordingly, Curry and colleagues tested whether kinship might promote helping independently of closeness. Indeed, in line with what they termed a *kinship premium*, Curry et al. (2013) found that kinship significantly predicted helping (i.e., hypothetical willingness to donate a kidney) even when controlling for closeness (also see Webster, 2008). Lopez et al.'s (2019) results accord with a kinship premium in the context of emotional and aggressive responses to moral transgressions, but were exploratory in nature and have to date only been demonstrated in one study. Here, in a pre-registered follow-up study, we sought to further test the predictions of both kin selection and the kinship premium hypothesis in the context of moral emotions and punishment by both replicating the conditions employed in the Lopez et al. study and varying the degree of genetic relatedness via a new kinship condition: first cousins.

The kinship premium hypothesis and the sociofunctional account of moral emotions generate several predictions. With respect to direct aggression, in line with the kinship premium hypothesis:

1. Harm to siblings should elicit greater willingness to aggress than harm to cousins.
2. Harm to friends *should not* elicit greater aggression than harm to siblings or cousins despite relatively greater emotional closeness with friends.

With respect to emotion, in line with the kinship premium hypothesis:

3. Harm to siblings should elicit greater state anger than harm to cousins.
4. Harm to friends *should not* elicit greater state anger than harm to siblings or cousins, despite relatively greater emotional closeness with friends.

In line with the sociofunctional model of moral emotions (Molho et al., 2017):

5. Harms against the self, siblings, cousins, or friends should all elicit greater state anger than harms against acquaintances.
6. Harms against acquaintances should elicit greater state disgust than harms against the self, siblings, cousins, or friends.
7. Harms against acquaintances should elicit lower inclinations to directly aggress than harms against the self, siblings, cousins, or friends.
8. Anger should significantly positively correlate with direct aggression when controlling for covarying indirect aggression, but not significantly correlate with indirect aggression when controlling for covarying direct aggression.
9. Disgust should significantly positively correlate with indirect aggression when controlling for covarying direct aggression but not significantly correlate with direct aggression when controlling for covarying indirect aggression.

Based on the distributions obtained in Molho et al. (2017) and Lopez et al. (2019), we also predicted that:

10. Anger should be the predominant emotion reported both in forced-choice measures and in terms of mean intensity ratings.

A summary of which predictions were or were not supported is provided in Table 2.

Method

Transparency and Openness. This study's design, hypotheses, and analysis plan were preregistered, and all data, analysis syntax, and research materials are available at <https://osf.io/vp4rh/> (Ocampo et al., 2021, November 18). We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study, and we follow JARS (Kazak, 2018). Data were analyzed using SPSS version 27 (IBM Corp, 2020).

Participants. We recruited 960 adult participants on Amazon’s Mechanical Turk online platform in exchange for \$1.25 compensation on April 29th, 2021. The sample size was increased relative to Lopez et al. (2019; Study 3) due to the addition of a between-subjects Cousin condition. We screened for incompleteness, failing attention-check questions, age, and reported sex, yielding a final sample of 863 (49.4% female, $M_{\text{age}} = 41.02$, $SD = 12.66$), of whom 744 reported having a sibling, 801 reported having a first cousin, and 699 reported having both a sibling and a first cousin. The study was approved by the University of California, Merced, Institutional Review Board.

Procedure. Participants first reported having an adult brother, sister, both, or neither, as well as an adult first cousin, and were then assigned to one of five conditions (*Self*: $N = 175$; *Sibling*: $N = 176$; *Cousin*: $N = 157$; *Friend*: $N = 171$; *Acquaintance*: $N = 184$). Those with a sibling or first cousin were randomly assigned to any condition, and those without a sibling or first cousin were randomly assigned to the friend, self, or acquaintance conditions. Those reporting exclusively male or female kin were only randomly assigned to kin conditions of corresponding sex (e.g., to prevent a person with only sisters from being assigned to envision a brother being transgressed against). To maximize demographic comparability of the target person in the scenarios, participants were asked to think of an acquaintance, close friend, or kin member closest in age to themselves. Participants then read four brief scenarios in which the target person is violated (e.g., via theft or deception), as in Lopez et al. (2019, Study 3), who in turn modified scenarios from Molho et al. (2017). To portray the transgressor as a member of a shared community with the participant, and thereby render indirect aggression a feasible strategy, the transgressor was described in each scenario as “a guy you know.”

Participants were next asked to select which of the four scenarios was most personally upsetting, and then to rate the degree to which they felt state anger, disgust, sadness, surprise, fear, and happiness while vividly imagining that particular scenario occurring. Emotional responses were rated according to both facial arrays and lexical terms (counterbalanced order). Facial arrays were

used, following Molho et al. (2017), to address the possibility that lexical self-report measures may not distinguish well between disgust and anger, due to semantic conflation of the words “anger” and “disgust” among English speakers (Chapman & Anderson, 2013; Nabi, 2002). Self-report using facial arrays provides an alternative to such potential linguistic confusion. Lexical measures were also included, however, following Lopez et al. (2019, Study 3), to assess the generalizability of the results across methods. The six lexical terms were *angry*, *happy*, *afraid*, *grossed out/disgusted*, *surprised*, and *sad*. Participants first selected which one of the six choices (arrays or lexical terms) best matched how they felt while reading about the focal transgression scenario, then were asked to rate how well each array/lexical item reflected their feelings according to a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). Next, participants were presented with a forced-choice question (answered according to both facial arrays and lexical items) probing whether anger or disgust best matched their feelings.

Next, we assessed inclinations toward direct aggression versus indirect aggression against the transgressor (counterbalanced order). Following Molho et al. (2017, Study 4) and Lopez et al. (2019, Study 3), five items measured direct aggression (e.g., “I would hit the person described in the scenario”; $\alpha = .90$) and five items measured indirect aggression (e.g., “I would try to get others to dislike the person described in the scenario”; $\alpha = .88$) according to the same 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). As in prior research, indirect and direct aggression were significantly correlated, $r(861) = .49, p < .001$. The sociofunctional approach does not indicate that direct versus indirect forms of aggression are mutually exclusive, but only that direct (indirect) strategies should be preferred when the severity of the costs inflicted by a transgressor is relatively high (low). To elucidate potentially unique relationships between the degree of costs inflicted and inclinations toward direct versus indirect aggression, we planned to conduct analyses controlling for

covariation between the two strategies in order to reveal potentially unique relationships between experimental condition, emotion, and inclinations toward direct versus indirect aggression.

To explore the role of affiliation, we collected measures of both subjective and objective closeness to the sibling, cousin, and friend using measures modified from the Adult Sibling Relationship Questionnaire (Lanthier & Stacker, 1992). The overall closeness measure was comprised of two 4-item subscales: subjective closeness (e.g., “How often do you talk to your [sibling/cousin/friend] about things that are important to you?”; sibling, cousin, and friend $as > .95$) and objective closeness (e.g., “How often do you and your [sibling/cousin/friend] see each other?”; sibling, cousin, and friend $as > .85$). The two subscales utilized distinct rating scales (objective closeness: 1 = *at least once a week*, 2 = *at least once a month*, 3 = *at least once in 6 months*, 4 = *at least once a year*, 5 = *less than once a year* [reverse-scored]; subjective closeness: 1 = *never*; 2 = *rarely*; 3 = *occasionally*; 4 = *regularly*). In addition, we administered versions of the Relationship Closeness Scale (RCS; Dibble, Levine, & Park, 2012), which also measures feelings of affiliation, customized to apply to a sibling, cousin, or friend. The scale consisted of 10 items (e.g., “When we are apart, I miss my [sibling/cousin/friend] a great deal,” “My relationship with my [sibling/cousin/friend] is close,” sibling, cousin, and friend $as > .95$) rated according to a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). The three closeness scales were all highly positively intercorrelated, $ps > .001$ (see SOM Table S3). All participants were asked to complete the friend closeness measures; participants who reported having an adult sibling and/or an adult first cousin were also asked to complete the relevant closeness measures. We also created a kinship index variable to compare with the closeness measures in simultaneous regression models by recoding the Friend condition as 0, the Cousin condition as .125, and the Sibling condition as .5. Finally, participants answered demographic questions before being thanked and debriefed.

Results

The design did not fully randomize assignment to condition because the 164 participants who did not report possessing an adult sibling or first cousin were assigned to one of the remaining conditions rather than excluded. We therefore conducted a re-analysis including only the subsample of participants whose assignment to condition was fully randomized (see SOM). Here, in the analyses of the full sample, we will flag any results which differed in significance at the .05 (two-tailed) level in the re-analysis. The facial array and lexical results are presented side-by-side to facilitate comparison.

State emotions elicited by the moral transgression. Of the six facial array options, most participants endorsed anger (66.4%) or disgust (14.8%) as best reflecting their feelings, with relatively low selections of sadness (10.2%), surprise (4.1%), fear (3.8%), or happiness (0.7%). With regard to the six lexical options, most participants also endorsed anger (80.3%), but, departing from the pattern observed using facial arrays, more participants selected sadness (9.7%) than disgust (lexicalized as “Grossed out / Disgusted”) (5.1%). (This pattern of greater endorsement of sadness when measured lexically than via facial arrays was also observed by Lopez et al. [2017, Study 3].) As with the facial arrays, relatively few participants selected lexical surprise or fear as best reflecting their feelings about the transgression.

With regard to participants’ mean ratings of each state emotion, anger was most strongly endorsed (*facial*: $M = 6.09$, $SD = 1.15$; *lexical*: $M = 6.41$, $SD = .98$), followed by sadness (*facial*: $M = 4.49$, $SD = 1.70$; *lexical*: $M = 5.10$, $SD = 1.53$), disgust (*facial*: $M = 4.29$, $SD = 1.85$; *lexical*: $M = 3.86$, $SD = 1.94$) and surprise (*facial*: $M = 3.81$, $SD = 1.75$; *lexical*: $M = 4.42$, $SD = 1.66$), with relatively low ratings for fear (*facial*: $M = 3.42$, $SD = 1.81$; *lexical*: $M = 2.82$, $SD = 1.70$) or happiness (*facial*: $M = 1.24$, $SD = .82$; *lexical*: $M = 1.20$, $SD = .65$).

When asked to dichotomously choose between anger or disgust, the majority of participants selected anger (*facial*: 84.4%; *lexical*: 92.2%) over disgust (*facial*: 15.6%; *lexical*: 7.8%), as predicted, and as in prior research by Molho et al. (2017) and Lopez et al. (2019).

Contrasts between sibling, cousin, and friend closeness. We compared ratings of closeness to siblings, first cousins and friends among those participants who reported having both a brother and a sister as well as first cousins ($N = 242$), to maximize comparability given that the cousin and friend categories include both men and women. With regard to objective closeness, participants in this subsample reported greater closeness to their friends ($M = 4.02$, $SD = 1.04$) than to their siblings ($M = 3.14$, $SD = 1.08$), or cousins ($M = 2.04$, $SD = 1.16$). With regard to subjective closeness, participants also reported greater closeness to their friends ($M = 3.43$, $SD = .71$) than to their siblings ($M = 2.72$, $SD = .86$), or cousins ($M = 1.94$, $SD = .95$). Finally, participants also reported greater subjective closeness to their friends ($M = 5.45$, $SD = 1.23$) than to their siblings ($M = 4.17$, $SD = 1.55$) or cousins ($M = 2.82$, $SD = 1.62$) when assessed according to the RCS. The same patterns obtained in follow-up analyses using larger subsamples of those whose ratings of closeness included only sisters or brothers ($ps < .001$ for all between-samples contrasts in all subsamples). In summary, participants reported substantially greater objective and subjective closeness to their friends than to their siblings and substantially greater closeness to their siblings than to their cousins.

Interaction between target identity and emotion. We next tested whether manipulating target identity influenced ratings of anger versus disgust, using a 5 (*Scenario Target*: between-subjects) x 2 (*Emotion*: within-subjects) analysis of variance (ANOVA). The interaction between scenario target and emotion was statistically significant (*facial*: $F(4, 858) = 3.71$, $p = .005$, $\eta_p^2 = .02$; *lexical*: $F(4, 858) = 4.89$, $p = .001$, $\eta_p^2 = .02$; see Table 1 for descriptive statistics).

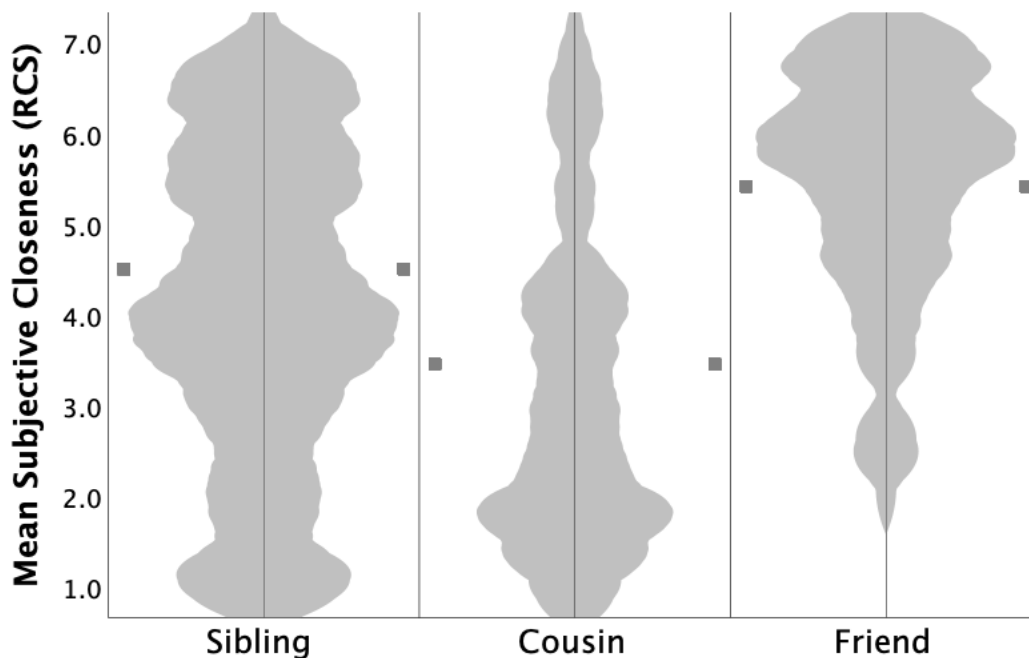


Figure 1. Mean ratings of subjective closeness by kin or friend condition as measured using the modified Relationship Closeness Scale (RCS; Dibble, Levine, & Park, 2012). The violin plot outlines illustrate kernel probability density; the width of the shaded area represents the proportion of data located there, and the squares indicate the means. Note: figure depicts subsample of participants who reported having both one or more brother and sister as well as first cousins ($N = 247$; see main text); comparable distributions obtain in the full sample.

Effect of target identity on feelings of anger. Follow-up ANOVAs with planned contrasts revealed that, as predicted, anger was significantly higher in both the Self condition (*facial*: $p = .031$, 95% CI [.023, .499]; *lexical*: $p = .001$, 95% CI [.141, .544]), and the Sibling condition (*facial*: $p = .001$, 95% CI [.177, .651]; *lexical*: $p = .001$, 95% CI [.143, .546]) relative to the Acquaintance condition. Anger was also significantly higher in the Cousin condition relative to the Acquaintance condition when assessed via facial arrays, $p = .046$, 95% CI [.004, .493] (but $p = .088$ [two-tailed] in the re-analysis; see SOM), but not using lexical items, $p = .375$, 95% CI [-.114, .301]). Likewise, ratings of anger were significantly higher in the Friend condition relative to the Acquaintance condition (*facial*: $p = .039$, 95% CI [.013, .491], *lexical*: $p = .025$, 95% CI [.030, .435]; see Table 1).

Planned contrasts revealed no significant differences between feelings of anger in the Self, Sibling, Cousin, and Friend conditions when assessed via facial arrays, $ps = .212 - .942$, nor did the lexical measures of anger in the Self, Sibling, and Friend conditions significantly differ, $ps = .283 - .981$. However, when assessed using lexical measures, state anger was significantly lower in the Cousin condition relative to the Self condition, $p = .020$, 95% CI [-.459, -.039] (but $p = .102$ [two-tailed] in the re-analysis; see SOM), or the Sibling condition $p = .019$, 95% CI [-.461, -.041] (but $p = .123$ [two-tailed] in the re-analysis; see SOM), with no difference between the Cousin and the Friend condition, $p = .198$.

Effect of target identity on feelings of disgust. Relative to the Acquaintance condition, facial array ratings of disgust were not significantly lower in any of the comparison conditions, although there were trends in this direction in both the Self ($p = .061$) and Sibling conditions ($p = .052$). There were no differences between the Self, Sibling, Cousin or Friend conditions in state disgust when assessed via facial arrays, $ps = .541 - .950$. However, when assessed lexically, state disgust was significantly higher in the Acquaintance condition than in the Sibling ($p = .010$, 95% CI [.124, .924]) or Cousin ($p = .001$, 95% CI [.268, 1.093]) conditions, with a similar trend for the Self condition ($p = .065$, 95% CI [-.024, .777]), but no difference between Friend and Acquaintance disgust, $p = .124$ (see Table 1).

Interaction between target identity and aggression. Effects of target identity on ratings of direct versus indirect aggression were assessed using a 5 (*Scenario Target*: between-subjects) by 2 (*Aggression type*: within-subjects) ANCOVA (see Table 1 for descriptives). As in both Lopez et al. (2019) and Molho et al. (2017), we controlled for participant sex in light of sex differences in tendencies to directly aggress (Archer, 2004). (Follow-up tests confirmed that including this covariate did not alter the pattern of results.) The interaction between scenario target and aggression was significant, $F(4, 857) = 3.47$, $p = .008$, $\eta_p^2 = .02$.

Effect of target identity on direct aggression. A follow-up ANCOVA with planned contrasts (controlling for sex and covarying preferences for indirect aggression) showed that, as predicted, ratings of direct aggression were significantly lower in the Acquaintance condition relative to all four contrast conditions: Self condition, $p < .001$, 95% CI [-1.034, -.462]; Sibling condition, $p < .001$, 95% CI [-1.142, -.572]; Cousin condition, $p < .001$, 95% CI [-.842, -.257]; and Friend condition, $p < .001$, 95% CI [-.837, -.264] (see Figure 2). Inclinations toward direct aggression were also significantly higher in the Sibling condition than in the Cousin condition, $p = .041$, 95% CI [.012, .602] (but $p = .160$ [two-tailed] in the re-analysis; see SOM), or Friend condition, $p = .038$, 95% CI [.018, .595] (but $p = .132$ [two-tailed] in the re-analysis; see SOM), whereas the Cousin and Friend conditions did not differ, $p = .996$. There were no significant differences in direct aggression ratings between the Self and the Sibling, Cousin, or Friend conditions, $ps .180 - .457$.

Table 1

Means Ratings of State Anger, State Disgust, Direct Aggression and Indirect Aggression by Condition

	Self <i>N</i> =175 <i>M</i> (<i>SD</i>)	Sibling <i>N</i> =176 <i>M</i> (<i>SD</i>)	Cousin <i>N</i> =157 <i>M</i> (<i>SD</i>)	Friend <i>N</i> =171 <i>M</i> (<i>SD</i>)	Acquaintance <i>N</i> =184 <i>M</i> (<i>SD</i>)
State anger (Facial arrays)	6.11 (1.10)	6.27 (1.07)	6.10 (1.18)	6.11 (1.12)	5.85 (1.25)
State anger (Lexical)	6.55 (.79)	6.56 (.91)	6.31 (1.14)	6.44 (1.05)	6.21 (.97)
State disgust (Facial arrays)	4.18 (1.79)	4.17 (1.83)	4.24 (1.87)	4.30 (1.87)	4.55 (1.87)
State disgust (Lexical)	3.85 (1.94)	3.70 (1.91)	3.55 (1.91)	3.91 (1.96)	4.23 (1.95)
Direct aggression	3.98 (1.59)	4.16 (1.67)	3.76 (1.65)	3.73 (1.59)	3.06 (1.59)
Indirect aggression	4.64 (1.56)	4.66 (1.60)	4.51 (1.56)	4.51 (1.57)	4.15 (1.55)

Note. $N = 863$. All ratings used 7-point scales (1 = *strongly disagree*, 7 = *strongly agree*). See main text for analyses of variance.

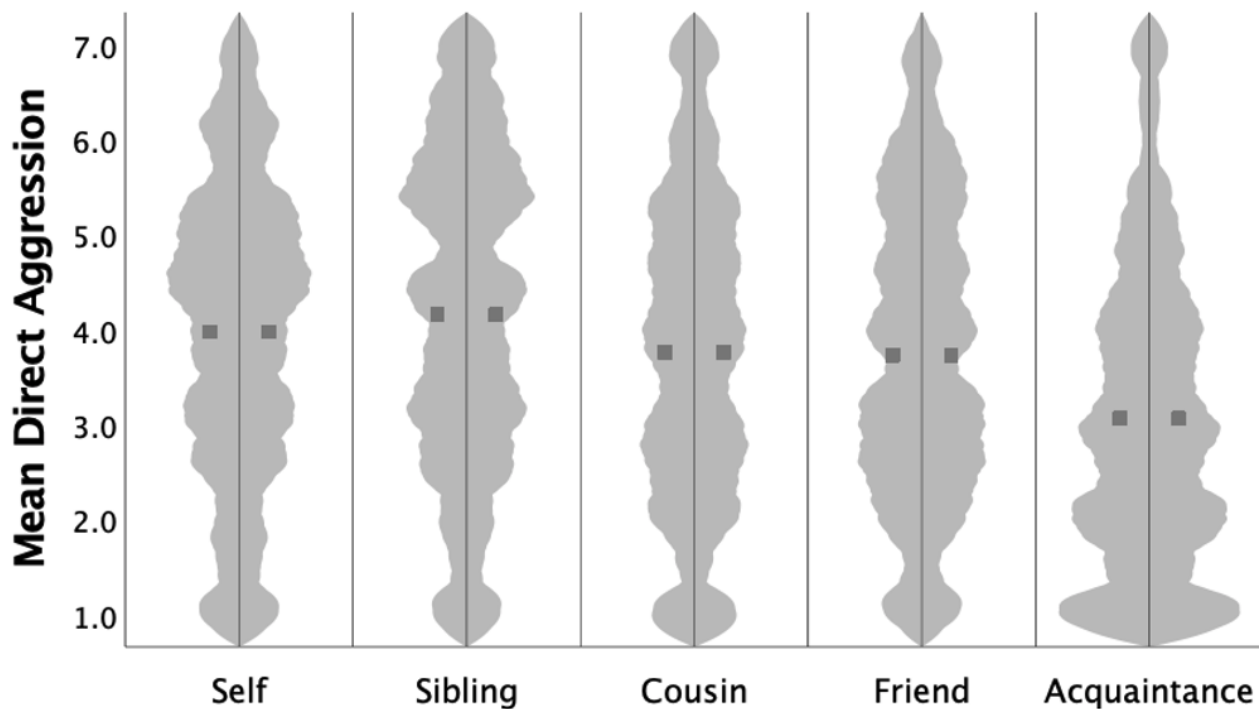


Figure 2. Mean ratings of direct aggression by transgression target condition. The violin plot outlines illustrate kernel probability density; the width of the shaded area represents the proportion of data located there, and the squares indicate the means. See main text for analyses of variance.

Effect of target identity on indirect aggression. As in Lopez et al. (2019, Study 3), an ANCOVA with planned contrasts (controlling for sex and covarying preferences for direct aggression) showed no main effect of condition on ratings of indirect aggression, $p = .998$ (see Table 1 for descriptives).

Correlations between emotion and aggression. State anger was positively correlated with both direct aggression (*facial*: $r(861) = .10$, $p = .005$; *lexical*: $r(861) = .20$, $p < .001$) and indirect aggression (*facial*: $r(861) = .13$, $p < .001$; *lexical*: $r(861) = .22$, $p < .001$). We therefore conducted exploratory partial correlations, finding that when controlling for indirect aggression, state anger remained significantly correlated with direct aggression when assessed lexically, but not using facial

arrays (*facial*: $p = .311$; *lexical*: $r(859) = .11, p = .001$). State anger remained significantly correlated with indirect aggression when controlling for direct aggression with regard to either facial or lexical measures (*facial*: $r(859) = .10, p = .003$; *lexical*: $r(859) = .14, p < .001$). Thus, departing from present predictions and from the findings of both Lopez et al. (2019) and Molho et al. (2017), state anger evinced positive associations with both direct aggression and indirect aggression. Also departing from predictions and prior findings, state disgust was positively correlated with direct aggression (*facial*: $r(861) = .14, p < .001$; *lexical*: $r(861) = .12, p = .001$) as well as indirect aggression (*facial*: $r(861) = .16, p < .001$; *lexical*: $r(861) = .10, p = .002$). State disgust remained significantly positively correlated with direct aggression when controlling for indirect aggression (*facial*: $r(859) = .08, p = .025$; *lexical*: $r(859) = .07, p = .029$), and only correlated with indirect aggression when controlling for direct aggression if assessed via facial arrays (*facial*: $r(859) = .10, p = .002$; *lexical*: $p = .104$).

Relative effects of kinship and emotional closeness on direct aggression. We conducted an exploratory test of the relative contributions of emotional closeness and kinship to direct aggression within the subsample of participants in the Friend, Cousin, and Sibling conditions for whom emotional closeness data had been collected ($N = 495$). In a model including both variables as simultaneous predictors, the kinship index variable ($b = 1.15, SE = .34, \beta = .15, p = .001$; 95% CI = [.49, 1.81]) and the RCS measure of emotional closeness ($b = .21, SE = .04, \beta = .22, p < .001$; 95% CI = [.128, .287]) each predicted tendencies toward direct aggression. Comparable results were obtained in models including the modified ASRQ measures of objective and subjective closeness (see SOM). (Follow-up tests including indirect aggression and gender as covariates did not alter the significance of either correlation.)

Table 2. Summary of Findings

Predictions	Supported?
<i>Kinship premium model</i>	
1. Sibling harm will elicit greater direct aggression than cousin harm	Partially *
2. Friend harm will not elicit greater direct aggression than kin harm	Yes
3. Sibling harm will elicit greater anger than cousin harm	Partially **
4. Friend harm will not elicit greater anger than kin harm	Yes
<i>Sociofunctional emotion model</i>	
5. Acquaintance harm will elicit less anger than all other conditions	Partially ***
6. Acquaintance harm will elicit greater disgust than all other conditions	No
7. Acquaintance harm will elicit less direct aggression than all other conditions	Yes
8. Anger will track direct, but not indirect, aggression	No
9. Disgust will track indirect, but not direct, aggression	No
10. Anger will be predominant emotion elicited by moral transgressions	Yes

Note. Unless otherwise noted, the lexical and facial array measures yielded comparable results. See main text for details. * Prediction not supported in the subsample re-analysis. ** Prediction supported using the lexical but not facial array measure (but only if using a one-tailed test in the subsample re-analysis, see SOM). *** Prediction supported using both the lexical and facial array measures across conditions, excepting the contrast in the Cousin condition when measured lexically (and only if using a one-tailed test in the subsample re-analysis, see SOM).

Discussion

In a pre-registered experiment contrasting angry and aggressive responses to moral transgressions inflicted on the self, kin, friends, or acquaintances, the predictions of the kinship premium hypothesis were broadly supported. Despite reporting substantially greater emotional closeness to friends, harm to cousins or friends elicited comparably intense state anger and inclinations to directly aggress against transgressors, and harm to siblings elicited comparable anger and significantly greater inclinations to directly aggress on their behalf relative to harm to close friends. These findings replicate those reported by Lopez and colleagues (2019, Study 3) and also

agree with the results of a conceptually similar study conducted by Fitzgerald and Ketterer (2011), who found significantly greater emotional closeness reported toward friends than kin, yet comparable motivation to physically retaliate against antagonists who verbally abused persons of either category. In partial further support of the kinship premium hypothesis, feelings of anger were observed to be greater when harms befell siblings than cousins, tracking genetic relatedness, although this result must be treated with considerable caution inasmuch as this contrast did not obtain when measured using the facial array, and was only marginally significant within the subsample of participants reporting having both a sibling and a first cousin (see SOM). Similarly, a small but significant difference between willingness to directly aggress on behalf of siblings relative to cousins was observed in the full sample, but not within the subsample of participants reporting having both a sibling and a first cousin. In sum, this work provides broad support for the psychological reality of a kinship premium applicable to rendering aid following moral violations, although siblings did not elicit robustly greater responses than first cousins.

The growing evidence for the kinship premium hypothesis should not be taken to imply that close kin will inspire greater anger and defensive aggression than friends irrespective of context. Consistent with reciprocal cooperation, harms to close friends elicited greater anger and aggression than harms to acquaintances, and the same adaptive logic entails that investment of costs should be proportional to the cooperative benefits of the friendship, such that a particularly valuable friendship will motivate greater help (e.g., direct aggression on a friend's behalf) than would be offered even to close kin, should the net benefits of helping the friend outweigh those derived by both reciprocity with and relatedness to the kin member. For example, would transgression against a materially valuable cooperative partner (e.g., a wealthy benefactor disposed to advance one's financial standing) evoke anger and aggression comparable to that evoked by transgression against an emotionally supportive but material resource-deficient cooperative partner? The social and material variables

which may operate as inputs to putative adaptive psychological mechanisms computing the cost/benefit incentives governing social interaction demand clarification (for further discussion see Delton & Robertson, 2016).

An apparent challenge to the kinship premium interpretation of the present findings of comparable anger and direct aggression on behalf of first cousins and close friends, despite a dramatic difference in closeness, could be that friends are selected on the basis of their capacity to defend themselves in contexts of interpersonal conflict. A cooperative partner who is relatively unable to defend themselves would not only potentially incur greater costs insofar as they would require more assistance, but also be less capable of reciprocally rendering aid. If the capacity for managing conflict is indeed a criterion used when forming friendships, and if individuals also take into account the needs of allies when computing the amount to directly aggress on their behalf, then perhaps friends evoked comparable anger and aggression as did cousins because they were represented as less in need of help than were cousins. On the other hand, such a needs-based dynamic, coupled with kin-selection, would plausibly lead transgressions against cousins to evoke greater anger and prosocial aggression than transgressions against friends—yet this was not observed either. The present data do not clearly gauge the impact, if any, of differences in the perceived abilities of friends versus kin to defend themselves against transgressors. This potential determinant warrants exploration in further research.²

Social norms prescribing aid to kin (Jones, 2016) are another plausible contributor to the kinship premium effects obtained here and in the prior cross-cultural literature focused on non-aggressive modes of helping (e.g., Booysen, Guvuriro, Munro, Moloji & Campher, 2018; Hackman, Danvers & Hruschka, 2015; Madsen et al., 2007). For example, to the extent that kin aid is normatively obligatory, individuals may be incentivized to render aid in part to avoid the reputational

costs of shirking. The extent to which perceived normative obligations to aid kin versus non-kin mediate kinship premium effects should also be explored in further work.

Beyond the kinship premium hypothesis, this study was also intended to test the sociofunctional model of the distinct roles of anger versus disgust (Molho et al., 2017; Lopez et al., 2019; Tybur et al., 2020). These results were notably mixed (see Table 2). In support of the sociofunctional account of anger, anger was the prevailing emotion reported in response to transgressions, and participants reported greater anger and motivation to directly aggress when the victim was framed as the self, kin, or a friend relative to an acquaintance, consistent with the incentive to risk direct aggression when harms incur greater costs. Departing from the sociofunctional account of disgust, ratings of disgust were not significantly lower in any of the comparison conditions relative to the Acquaintance condition when assessed via facial arrays (notwithstanding trends in this direction), although, somewhat consistent with the predictions of the sociofunctional model, lexical ratings of state disgust were significantly higher in the Acquaintance condition than in either kin condition, with a similar trend in the Self condition. Thus, the overall pattern of reported state disgust was weakly supportive of the prior findings of Molho and colleagues (2017) and Lopez et al. (2019).

In a stark divergence from both present predictions as well as the prior findings of multiple pre-registered studies (Lopez et al., 2019, Molho et al., 2017; Tybur et al., 2020), we failed to observe domain-specific associations between either anger and direct aggression or disgust and indirect aggression. Rather, both emotions were positively correlated with both modes of aggression, indicating that the previously documented sociofunctional distinctions between anger and disgust with regard to modes of aggression either no longer obtain or are no longer detectable using these measures. Speculatively, the circumstances of the COVID-19 pandemic and related social distancing practices in effect throughout most regions of the United States at the time of data collection may have contributed. Presuming that many or most of our participants were under lockdown, and

therefore as unable to personally confront a transgressor as they were unable to personally visit a loved one, the applicability of our measure of direct aggression, and its contrastiveness with our measure of indirect aggression, may have been weakened. For example, items such as “I would get in the face of the guy”, “I would insult the guy to his face”, or “I would yell at or argue with the guy” may have been conceptualized as transpiring in a screen-mediated context at geographic remove, perhaps in such a way that rendered indirect aggression a more effective, realistic strategy. Indeed, the counterfactual prospect of direct, in-person confrontation may have been muted given the prevailing imperative to maintain social distance. While plausible, this post-hoc interpretation must be confirmed by replicating the present (or a conceptually similar) design once pre-pandemic interpersonal proximity norms return.

Manipulating the identity of the target victim did not significantly alter tendencies toward indirect aggression, echoing results observed by Lopez et al. (2019, Studies 2 and 3), in a pattern of null results also at odds with the sociofunctional account proposed by Molho and colleagues (2017). However, target identity did influence direct aggression precisely as predicted by their model, and consistent with evolutionary perspectives on anger and aggression (e.g., Sell et al., 2017). Because direct aggression entails greater potential fitness costs (i.e., reputational or physical harm) as well as greater payoffs (i.e., deterrence of future harm by the transgressor specific to the self and one’s allies) than indirect aggression, the evolved psychology may be more attuned to factors that incentivize or de incentivize direct aggression.

One strength of the present study is the use of convergent facial array and lexical measures of emotion. Barring a few exceptions in which conventional significance levels were not reached in both modalities, the same overall patterns were detected either way. While the comparability of the results obtained using distinct methods is reassuring, both the lexical and facial array items relied on participant self-report. Future work might include behavioral observations, potentially incorporating

emerging technological solutions to facial emotion classification (e.g., Chen, Chen, Chi & Fu, 2014; Murugappan & Mutawa, 2021). Likewise, behavioral measures of aggression might be employed in place of hypothetical questions to reveal the extent to which kinship determines actual as opposed to counterfactual confrontation of transgressors.

Conclusion

Evolved psychological adaptations are characterized by their sensitivity to contingent individual and situational inputs (Holbrook & Hahn-Holbrook, 2022; Tooby & Cosmides, 2008). Here, the degree of anger and direct aggression elicited by moral violations was found to be contingent on victim-dependent fitness incentives predicted by both models of kin selection (kin > friends) and reciprocity (friends > acquaintances), illustrating the strategic nature of moral emotions. Although the present research has focused on testing the roles of kinship and reciprocity as determinants of moralized aggression, the results also speak to other motives for cooperation (e.g., shared coalitional identity) which may calibrate impulses to engage in moralized conflict (Nowak, 2006). Further work, particularly open science efforts to both replicate and extend prior pre-registered research, holds promise to reveal contextually contingent pathways to prosocial aggression.

References

- Archer, J. (2004). Sex differences in aggression in real-world settings: A meta-analytic review. *Review of General Psychology, 8*, 291–322.
- Balliet, D., Mulder, L. B., & Van Lange, P. A. (2011). Reward, punishment, and cooperation: a meta-analysis. *Psychological Bulletin, 137*(4), 594–615.
- Barclay, P. (2006) Reputational benefits for altruistic punishment. *Evolution and Human Behavior, 27*, 325–344.
- Barkow, J. H., Cosmides, L., & Tooby, J. (1992). *The Adapted Mind. Evolutionary Psychology and the Generation of Culture*. Oxford University Press.
- Baumard, N., André, J. B., & Sperber, D. (2013). A mutualistic approach to morality: the evolution of fairness by partner choice. *Behavioral and Brain Sciences, 36*(1), 59–78.
- Booyesen, F., Guvuriro, S., Munro, A., Moloji, T., & Campher, C. (2018). Putting a premium on altruism: A social discounting experiment with South African university students. *PLOS ONE, 13*(4): e0196175. <https://doi.org/10.1371/journal.pone.0196175>
- Boyd, R., & Richerson, P. J. (2009). Culture and the evolution of human cooperation. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences, 364*(1533), 3281–3288.
- Bressan, P., Colarelli, S. M., & Cavalieri, M. B. (2009). Biologically costly altruism depends on emotional closeness among step but not half or full siblings. *Evolutionary Psychology, 7*(1), 118–132.
- Brown, D. E. (1991). *Human universals*. New York, NY: McGraw-Hill.
- Carver, C. S., & Harmon-Jones, E. (2009). Anger is an approach-related affect: Evidence and implications. *Psychological Bulletin, 135*(2), 183-204. <https://doi.10.1037/a0013965>

- Chapman, H. A., Kim, D. A., Susskind, J. M. and Anderson, A. K. (2009). In bad taste: Evidence for the oral origins of moral disgust. *Science* 323(5918): 1222–1226, doi: <https://doi.org/10.1126/science.1165565>
- Chapman, H. A., & Anderson, A. K. (2013). Things rank and gross in nature: A review and synthesis of moral disgust. *Psychological Bulletin*, 139, 300–327. <https://doi.org/10.1037/a0030964>
- Chen, J., Chen, Z., Chi, Z., & Fu, H. (2014). Facial expression recognition based on facial components detection and HOG features. 64-69. Paper presented at Advances in Computer Vision.
- Curry, O., & Dunbar, R. I. M. (2013). Do birds of a feather flock together? The relationship between similarity and altruism in social networks. *Human Nature*, 24, 336-347.
- Curtis, V., & Biran, A. (2001). Dirt, Disgust, and Disease: Is hygiene in our genes? *Perspectives in Biology and Medicine*, 44(1), 17-31. <https://doi.10.1353/pbm.2001.0001>
- Delton, A. W., & Robertson, T. E. (2016). How the mind makes welfare tradeoffs: Evolution, computation, and emotion. *Current Opinion in Psychology*, 7, 12-16. <http://dx.doi.org/10.1016/j.copsyc.2015.06.006>
- Dribble, J. L., Levine, T. R., & Park, H. S. (2012). The Unidimensional Relationship Closeness Scale (URCS): Reliability and validity evidence for a new measure of relationship closeness. *Psychological Assessment*, 24, 565-572. <https://dx.doi.org/10.1037/a0026265>
- Fischer, A. H., & Roseman, I. J. (2017). Beat them or ban them: The characteristics and social functions of anger and contempt. *Journal of Personality and Social Psychology*, 83(1), 103-115. <https://doi:10.1037/0022-3514.93.1.103>

- Fessler, D. M. T., & Haley, K. J. (2003). *The strategy of affect: Emotions in human cooperation*. In P. Hammerstein (Ed.), *Dahlem workshop report. Genetic and cultural evolution of cooperation* (p. 7–36). MIT Press.
- Fessler, D. M., Barrett, H. C., Kanovsky, M., Stich, S., Holbrook, C., Henrich, J., Bolyanatz, A. H., Gervais, M. M., Gurven, M., Kushnick, G., Pisor, A. C., von Rueden, C., & Laurence, S. (2015). Moral parochialism and contextual contingency across seven societies. *Proceedings of the Royal Society of London. Series B, Biological Sciences*, 282(1813), 20150907.
- Fitzgerald, C. J., & Ketterer, H. L. (2011). Examining verbal and physical retaliation against kinship insults. *Violence and Victims*, 26(5), 580-592. <https://doi.10.1891/0886-6708.26.5.580>
- Gervais, M. M., & Fessler, D. (2017). On the deep structure of social affect: Attitudes, emotions, sentiments, and the case of "contempt". *Behavioral & Brain Sciences*, 40, e225.
<https://doi.org/10.1017/S0140525X16000352>
- Gesselman, A. N., & Webster, G. D. (2012). Inclusive fitness affects both prosocial and antisocial behavior: Target gender and insult domain moderate the link between genetic relatedness and aggression. *Evolutionary Psychology*, 10(4), 750-761
- Hackman, J.V., Danvers, A.F., & Hruschka, D. (2015). Closeness is enough for friends, but not mates or kin: Mate and kinship premiums in India and U.S. *Evolution and Human Behavior*, 36, 137-145.
- Hamilton, W. D. (1964). The genetical evolution of social behavior, II. *Journal of Theoretical Biology*, 7, 17-52.

- Holbrook, C. & Hahn-Holbrook, J. (2022). Evolved to learn: Emotions as calibrational adaptations. In D. Dukes, E. Walle, A. Samson (Eds.), *The Oxford Handbook of Emotional Development*. Oxford: Oxford University Press.
- IBM Corp. Released 2020. IBM SPSS Statistics for Macintosh, Version 27.0. Armonk, NY: IBM Corp.
- Kazak, A. E. (2018). Editorial: Journal article reporting standards. *American Psychologist*, 73(1), 1-2. <https://dx.doi.org/10.1037/amp0000263>
- Krasnow, M. M., Cosmides, L., Pedersen, E. J., & Tooby, J. (2012). What are punishment and reputation for? *PLOS ONE*, 7(9), e45662. <https://doi.org/10.1371/journal.pone.0045662>
- Jones, D. (2016). Socially enforced nepotism: How norms and reputation can amplify kin altruism. *PLOS ONE*, 11(6): e0155596. <https://doi.org/10.1371/journal.pone.0155596>
- Lanthier, R. P., & Stacker, C. (1992). *The Adult Sibling Relationship Questionnaire*. Denver, CO: University of Denver.
- Lopez, L. D., M., Moorman, K., Schneider, S., Baker, M. N., & Holbrook, C. (2019, December 12). Morality is relative: Anger, disgust, and aggression as contingent responses to sibling versus acquaintance harm. *Emotion*, Advance online publication. <https://dx.doi.org/10.1037/emo0000707>
- Madsen, E. A., Tunney, R. J., Fieldman, G., Plotkin, H. C., Dunbar, R. I., Richardson, J. M., & McFarland, D. (2007). Kinship and altruism: A cross-cultural experimental study. *British Journal of Psychology*, 98(2), 339–359.
- Molho, C., Tybur, J. M., Güler, E., Balliet, & Hofmann, W. (2017). Disgust and anger relate to different aggressive responses to moral violations. *Association for Psychological Science*, 28(5), 609-619. <https://doi.10.1177/0956797617692000>

- Molho, C., Tybur, J.M., Van Lange, P.A.M., & Balliet, D. (2020) Direct and indirect punishment of norm violations in daily life. *Nature Communications*, *11*, 3432
<https://doi.org/10.1038/s41467-020-17286-2>
- Murugappan, M, & Mutawa, A. (2021) Facial geometric feature extraction based emotional expression classification using machine learning algorithms. *PLoS ONE* *16*(2): e0247131.
<https://doi.org/10.1371/journal.pone.0247131>
- Nabi, R. L. (2002). The theoretical versus the lay meaning of disgust: Implications for emotion research. *Cognition and Emotion*, *16*, 695–703.
- Nowak M. A. (2006). Five rules for the evolution of cooperation. *Science*, *314*(5805), 1560–1563.
- Ocampo, D., Dayer, A., Holbrook, C., Betschart, N., Sullivan, J., & Palka, E. (2021, November 18). Moral Judgment, Kinship premium, Emotions. Retrieved from osf.io/vp4rh
- Pollet, T.V., Roberts, S.G.B., & Dunbar, R.I.M. (2013) Going that extra mile: Individuals travel further to maintain face-to-face contact with highly related kin than with less related kin. *PLOS ONE*, *8*(1): e53929. <https://doi.org/10.1371/journal.pone.0053929>
- Rachlin, H., & Jones, B. (2008). Altruism among relatives and non-relatives. *Behavioural Processes*, *79*(2), 120–3. <https://doi:10.1016/j.beproc.2008.06.002>
- Santos, M. D., Rankin, D. J., & Wedekind, C. (2011). The evolution of punishment through reputation. *Proceedings of the Royal Society B: Biological Sciences*, *278*(1704), 371-377.
- Schneider, T., Sauerland, M., Merckelbach, H., Puschke, J., & Cohrs, J. C. (2021). Self-reported voluntary blame-taking: Kinship before friendship and no effect of incentives. *Frontiers in Psychology*, *12*, 621960. <https://doi.org/10.3389/fpsyg.2021.621960>

- Seip, E. C., Van Dijk, W. W., & Rotteveel, M. (2014). Anger motivates costly punishment of unfair behavior. *Motivation and Emotion*, 38, 578-588. <https://doi.10.1007/s11031-014-9395-4>
- Sell, A., Sznycer, D., Al-Shawaf, L., Lim, J., Krauss, A., Feldman, A., Rascanu, R., Sugiyama, L., Cosmides, L., & Tooby, J. (2017). The grammar of anger: Mapping the computational architecture of a recalibrational emotion. *Cognition*, 168, 110–128.
- Stewart-Williams, S. (2007). Altruism among kin vs. nonkin: effects of cost of help and reciprocal exchange. *Evolution and Human Behavior*, 28(3), 193-198.
- Tooby, J. & Cosmides, L. (2008). The evolutionary psychology of the emotions and their relationship to internal regulatory variables. In M. Lewis, J.M. Haviland-Jones & L.F. Barrett (Eds.), *Handbook of Emotions* (pp. 114–137). New York, NY: Guilford Press.
- Trivers, R. L. (1971). The evolution of reciprocal altruism. *The Quarterly Review of Biology*, 46(1), 35-57.
- 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), 103-122. <https://doi.10.103/a0015474>
- Tybur, J. M., Molho, C., & Balliet, D. (2018). "Moralized Disgust versus Disgusting Immorality: An Adaptationist Perspective." *The Moral Psychology of Disgust*, edited by Victor Kumar and Nina Strohminger, Rowman & Littlefield International, pp. 11-24.
- Tybur, J. M., Molho, C., Cakmak, B., Das Dores Cruz, T. D., Deep Singh, G., & Zwicker, M. (2020). Disgust, anger, and aggression: Further tests of the equivalence of moral emotions. *Collabra: Psychology*, 6(1), [34]. <https://doi.org/10.1525/collabra.349>,

- Webster, G. D. (2008). The kinship, acceptance, and rejection model of altruism and aggression (KARMAA): Implications for interpersonal and intergroup aggression. *Group, Dynamics: Theory, Research, and Practice*, 12(1), 27-38. <https://doi.org/10.1037/1089-2699.12.1.27>
- West, S. A., El Mouden, C., & Gardner, A. (2011). Sixteen common misconceptions about the evolution of cooperation in humans. *Evolution and Human Behavior*, 32(4), 231–262.

Footnotes

¹ Altruistic acts are defined as net costly to the actor and net beneficial to the recipient(s) of the action, taking into account the full set of behaviors engaged in by both the actor and recipient(s) (Hamilton, 1964). Importantly, helpful acts which incur immediate short-term costs may yield greater long-term benefits to the actor (e.g., through reciprocation), and hence not technically qualify as altruistic (for further discussion, see West, El Mouden, & Gardner, 2011). In the present paper, we therefore refer to aggression on behalf of others as ‘prosocial aggression’ rather than ‘altruistic aggression’ inasmuch as punishing moral transgressors incurs short-term costs, but in some cases this behavior may produce greater long-term benefits.

² Although the present study did not include measures which directly assess perceptions of the extent to which kin versus friends would be equipped to defend themselves, we conducted an exploratory re-analysis to indirectly probe this issue by considering the age of the imagined individual, as youthful siblings may conceivably be deemed more in need of aid. Filtering out those participants who envisioned a younger sibling did not change the overall pattern of results, including a significantly greater tendency to directly aggress on behalf of siblings than friends. These results are presented in the SOM.

Supplementary Online Material

to accompany

Prosocial aggression tracks genetic relatedness distinctly from emotional closeness

Derrick Ocampo, James Sullivan, Alex Dayer, Elle Palka, Natalie Betschart & Colin Holbrook

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The full survey instruments and data are archived at <https://osf.io/vp4rh/>.

Table S1

Pearson's Correlation Matrices for State Anger, State Disgust, Indirect Aggression, and Direct Aggression

	1	2	3	4	5	6
1. Anger-F	-	.50	.08	.08	.13	.10
2. Anger-L		-	.08	.07	.22	.20
3. Disgust-F			-	.51	.16	.14
4. Disgust-L				-	.10	.12
5. Aggress-I					-	.49
6. Aggress-D						-

Note. $N = 863$. All correlations are significant at the .05 level, unless given in **bold**. *Anger* = State Anger, Facial Arrays; *Anger-L* = State Anger, Lexical; *Disgust-F* = State Disgust, Facial Arrays; *Disgust-L* = State Disgust, Lexical; *Aggress-I* = Indirect Aggression; *Aggress-D* = Direct Aggression.

Table S2

Mean Ratings of State Anger, State Disgust, Direct Aggression and Indirect Aggression by Condition
Among Participants with both Siblings and First Cousins

	Self	Sibling	Cousin	Friend	Acquaintance
	<i>N</i> =125	<i>N</i> =165	<i>N</i> =131	<i>N</i> =134	<i>N</i> =144
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)
State anger (Facial arrays)	6.20 (.93)	6.29 (1.05)	6.05 (1.23)	6.13 (1.13)	5.82 (1.29)
State anger (Lexical)	6.57 (.71)	6.55 (.93)	6.37 (1.05)	6.46 (1.01)	6.17 (1.00)
State disgust (Facial arrays)	4.10 (1.84)	4.17 (1.81)	4.24 (1.87)	4.18 (1.87)	4.52 (1.85)
State disgust (Lexical)	3.90 (1.95)	3.65 (1.91)	3.44 (1.89)	3.94 (1.95)	4.30 (1.93)
Direct aggression	3.89 (1.61)	4.13 (1.64)	3.82 (1.66)	3.80 (1.57)	3.05 (1.60)
Indirect aggression	4.53 (1.64)	4.67 (1.58)	4.52 (1.51)	4.57 (1.59)	4.20 (1.57)

Note. *N* = 699. All ratings used 7-point scales (1 = *strongly disagree*, 7 = *strongly agree*). See main text for analyses of variance. Descriptives restricted to the subsample of participants reporting having both adult siblings and first cousins.

Table S3

Pearson's Correlations for the Kinship Index, Relationship Closeness Scale, Adult Sibling Relationship Questionnaire, State Anger, State Disgust, Indirect Aggression, and Direct Aggression

	1	2	3	4	5	6	7	8	9	10
1. KI	-	-.12	-.17	-.13	.06	.06	-.03	-.03	.04	.12
2. RCS		-	.84	.75	.06	.10	.14	.15	.07	.21
3. ASRQ-S			-	.74	.09	.12	.08	.11	.08	.15
4. ASRQ-O				-	.06	.09	.03	.06	.10	.18
5. Anger-F					-	.48	.10	.14	.14	.09
6. Anger-L						-	.10	.10	.18	.18
7. Disgust-F							-	.46	.18	.11
8. Disgust-L								-	.11	.12
9. Aggress-I									-	.47
10. Aggress-D										-

Note. $N = 495$. Correlations within the subsample of participants assigned a condition including closeness measures (Cousin, Sibling, or Friend). All correlations are significant at the .05 level, unless given in **bold**. *KI* = Kinship Index; *RCS* = Relationship Closeness Scale; *ASRQ-S* = Adult Sibling Relationship Questionnaire, Subjective; *ASRQ-O* = Adult Sibling Relationship Questionnaire, Objective; *Anger-F* = State Anger, Facial Arrays; *Anger-L* = State Anger, Lexical; *Disgust-F* = State Disgust, Facial Arrays; *Disgust-L* = State Disgust, Lexical; *Aggress-I* = Indirect Aggression; *Aggress-D* = Direct Aggression.

Re-analysis Removing Participants Lacking both Adult Siblings or First Cousins

The design presented in the main text was unable to fully randomize assignment to condition, as participants who did not report possessing an adult sibling or first cousin were not eligible for assignment to the Sibling or Cousin conditions, and instead randomly assigned to one of the remaining conditions. Here, as a sensitivity check, we present a full re-analysis paralleling that reported in the main text, but only including the subsample of participants whose assignment to condition was fully randomized by dint of possessing both adult siblings and first cousins. Unless **explicitly noted using bold font**, the pattern of results obtained in these re-analyses are closely equivalent in descriptives and patterns of significance to those obtained in the results reported in the main text.

Participants. We recruited 960 adult participants on Amazon's Mechanical Turk online platform in exchange for \$1.25 compensation on April 29th, 2021. The sample size was increased relative to Lopez et al. (2019; Study 3) due to the addition of a between-subjects Cousin condition. We screened for incompleteness, failing attention-check questions, age, and reported sex, yielding a final sample reported in the main manuscript of 863 (49.4% female, $M_{\text{age}} = 41.02$, $SD = 12.66$), of whom 744 reported having a sibling, 801 reported having a first cousin. The subsample of participants with both an adult sibling or first cousin was made up of 699 participants (49.1% female, $M_{\text{age}} = 41.28$, $SD = 12.58$).

Results

The facial array and lexical results are presented side-by-side to facilitate comparison.

State emotions elicited by the moral transgression. Of the six facial array options, most participants endorsed anger (66.8%) or disgust (14.4%) as best reflecting their feelings, with relatively low selections of sadness (10.7%), surprise (4.0%), fear (3.4%), or happiness (0.6%). With regard to the six lexical options, most participants also endorsed anger (79.8%), but, departing from

the pattern observed using facial arrays, more participants selected sadness (10.6%) than disgust (lexicalized as “Grossed out / Disgusted”) (4.7%). (This pattern of greater endorsement of sadness when measured lexically than via facial arrays was also observed by Lopez et al. [2017, Study 3].) As with the facial arrays, relatively few participants selected lexical surprise or fear as best reflecting their feelings about the transgression.

With regard to participants’ mean ratings of each state emotion, anger was most strongly endorsed (*facial*: $M = 6.10$, $SD = 1.14$; *lexical*: $M = 6.42$, $SD = .96$), followed by sadness (*facial*: $M = 4.52$, $SD = 1.69$; *lexical*: $M = 5.12$, $SD = 1.53$), disgust (*facial*: $M = 4.25$, $SD = 1.85$; *lexical*: $M = 3.84$, $SD = 1.94$) and surprise (*facial*: $M = 3.77$, $SD = 1.73$; *lexical*: $M = 4.37$, $SD = 1.67$), with relatively low ratings for fear (*facial*: $M = 3.37$, $SD = 1.82$; *lexical*: $M = 2.75$, $SD = 1.65$) or happiness (*facial*: $M = 1.22$, $SD = .75$; *lexical*: $M = 1.19$, $SD = .61$).

When asked to dichotomously choose between anger or disgust, the majority of participants selected anger (*facial*: 86.1%; *lexical*: 92.8%) over disgust (*facial*: 13.9%; *lexical*: 7.2%), as predicted, and as in prior research by Molho et al. (2017) and Lopez et al. (2019).

Interaction between target identity and emotion. We next tested whether manipulating target identity influenced ratings of anger versus disgust, using a 5 (*Scenario Target*: between-subjects) x 2 (*Emotion*: within-subjects) analysis of variance (ANOVA). The interaction between scenario target and emotion was statistically significant (*facial*: $F(4, 694) = 3.65$, $p = .006$, $\eta_p^2 = .02$; *lexical*: $F(4, 694) = 4.89$, $p < .001$, $\eta_p^2 = .04$; see Table S2 for descriptive statistics).

Effect of target identity on feelings of anger. Follow-up ANOVAs with planned contrasts revealed that, as predicted, anger was significantly higher in both the Self condition (*facial*: $p = .006$, 95% CI [.108, .653]; *lexical*: $p = .001$, 95% CI [.174, .629]), and the Sibling condition (*facial*: $p < .001$, 95% CI [.217, .726]; *lexical*: $p < .001$, 95% CI [.167, .591]) relative to the Acquaintance condition. Likewise, ratings of anger were significantly higher in the Friend condition relative to the

Acquaintance condition (*facial*: $p = .024$, 95% CI [.040, .575], *lexical*: $p = .011$, 95% CI [.065, .512]; see Table S2). **However, whereas in the main text analyses anger was also significantly higher in the Cousin condition relative to the Acquaintance condition when assessed via facial arrays but not lexical items, this contrast was not significant in the present re-analysis for either facial arrays, $p = .088$, 95% CI [-.035, .503], or lexical items, $p = .486$, 95% CI [-.147, .310].**

Planned contrasts revealed no significant differences between feelings of anger in the Self, Sibling, Cousin, and Friend conditions when assessed via facial arrays, $ps = .074 - .605$, or lexical measures, $ps = .102 - .841$. **This pattern departs somewhat from the main text results, where state anger assessed lexically was significantly lower in the Cousin condition relative to the Self or Sibling conditions.**

Effect of target identity on feelings of disgust. Relative to the Acquaintance condition, facial array ratings of disgust were not significantly lower in any of the comparison conditions, although there were trends in this direction in both the Self ($p = .065$) and Sibling conditions ($p = .096$). There were no differences between the Self, Sibling, Cousin or Friend conditions in state disgust when assessed via facial arrays, $ps = .544 - .965$. However, when assessed lexically, state disgust was significantly higher in the Acquaintance condition than in the Sibling ($p = .003$, 95% CI [.219, 1.081]) or Cousin ($p < .001$, 95% CI [.407, 1.320]) conditions, with a similar trend for the Self condition ($p = .094$, 95% CI [-.067, .856]), but no difference between Friend and Acquaintance disgust, $p = .121$ (see Table S2).

Interaction between target identity and aggression. Effects of target identity on ratings of direct versus indirect aggression were assessed using a 5 (*Scenario Target*: between-subjects) by 2 (*Aggression type*: within-subjects) ANCOVA (see Table S2 for descriptives). As in both Lopez et al. (2019) and Molho et al. (2017), we controlled for participant sex in light of sex differences in tendencies to directly aggress (Archer, 2004). (Follow-up tests confirmed that including this covariate

did not alter the pattern of results.) The interaction between scenario target and aggression was significant, $F(4, 693) = 3.69, p = .006, \eta_p^2 = .02$.

Effect of target identity on direct aggression. A follow-up ANCOVA with planned contrasts (controlling for sex and covarying preferences for indirect aggression) showed that, as predicted, ratings of direct aggression were significantly lower in the Acquaintance condition relative to all four contrast conditions: Self condition, $p < .001$, 95% CI [-1.095, -.438]; Sibling condition, $p < .001$, 95% CI [-1.185, -.571]; Cousin condition, $p < .001$, 95% CI [-.977, -.330]; and Friend condition, $p < .001$, 95% CI [-.961, -.316]. There was no significant difference in direct aggression ratings between the Cousin and Friend conditions, $p = .928$, nor between the Self condition and the Sibling, Cousin, or Friend conditions, $ps .449 - .506$ (see Table S2). **Departing from the full sample analyses reported in the main text, inclinations toward direct aggression were not significantly higher in the Sibling condition relative to the Cousin condition, $p = .160$, 95% CI [-.089, .538], or the Friend condition, $p = .132$, 95% CI [-.072, .551].**

Effect of target identity on indirect aggression. As in Lopez et al. (2019, Study 3), an ANCOVA with planned contrasts (controlling for sex and covarying preferences for direct aggression) showed no main effect of condition on ratings of indirect aggression, $p = .963$ (see Table S2 for descriptives).

Correlations between emotion and aggression. State anger was positively correlated with both direct aggression (*facial*: $r(697) = .10, p = .006$; *lexical*: $r(697) = .21, p < .001$) and indirect aggression (*facial*: $r(697) = .12, p = .001$; *lexical*: $r(697) = .23, p < .001$). We therefore conducted exploratory partial correlations, finding that when controlling for indirect aggression, state anger remained significantly correlated with direct aggression when assessed lexically, but not using facial arrays (*facial*: $p = .179$; *lexical*: $r(694) = .12, p = .002$). State anger remained significantly correlated with indirect aggression when controlling for direct aggression with regard to either facial or lexical

measures (*facial*: $r(697) = .08, p = .034$; *lexical*: $r(697) = .14, p < .001$). Thus, state anger evinced positive associations with both direct aggression and indirect aggression. Similarly, state disgust was positively correlated with direct aggression (*facial*: $r(697) = .17, p < .001$; *lexical*: $r(697) = .12, p = .001$) as well as indirect aggression (*facial*: $r(697) = .17, p < .001$; *lexical*: $r(697) = .11, p = .003$). State disgust remained significantly positively correlated with direct aggression when controlling for indirect aggression (*facial*: $r(694) = .10, p = .010$; *lexical*: $r(694) = .08, p = .039$), and only correlated with indirect aggression when controlling for direct aggression if assessed via facial arrays (*facial*: $r(694) = .10, p = .011$; *lexical*: $p = .117$).

Discussion

The overall pattern of results in the re-analysis closely resembles that reported using the larger sample in the main text. However, notable differences were observed concerning contrasts with the Cousin condition. When confining the analysis only to participants with adult first cousins, imagined harm to cousins no longer elicited significantly less anger or direct aggression relative to harm to siblings. These shifts reduce support for the kinship premium hypothesis, as does the finding that, notwithstanding a mild trend, the significantly greater anger reported in the Cousin condition than in the Acquaintance condition observed in the full sample did not reach significance here. On the other hand, in line with the kinship premium hypothesis, the re-analysis found that neither state anger nor direct aggression were statistically different between the kin conditions (siblings or first cousins) and the friend condition, despite large differences in reported subjective and objective closeness. Thus, the overall pattern of results continues to bolster the kinship premium hypothesis, although the apparent correlation between the magnitude of the ‘premium’ and the degree of genetic relatedness (sibling versus cousin) was not robust in the re-analysis and should therefore be treated with caution.

Re-analysis of Direct Aggression Ratings Excluding Participants

Who Envisioned Younger Siblings

Siblings may be more likely than friends to be younger than the participant if individuals tend to befriend age-matched persons. If so, then youthful siblings may also be appraised as in greater need of aid, and hence elicit more direct aggression on their behalf. However, follow-up tests indicated that the mean age of siblings envisioned in the Sibling condition ($M = 40.30$; $SD = 13.09$) was closely comparable to that of friends envisioned in the Friend condition ($M = 40.76$; $SD = 13.04$), suggesting that the greater tendency to directly aggress on behalf of siblings than on behalf of friends was not likely to have been driven by the relative youth of siblings. To further rule out that the difference in direct aggression ratings was related to imagining harm to younger siblings, we filtered out those participants who envisioned a younger sibling and re-ran the ANCOVA with planned contrasts (controlling for sex and covarying preferences for indirect aggression). As previously (see main text), inclinations toward direct aggression remained significantly higher in the Sibling condition than in the Friend condition, $p = .020$, 95% CI [.065, .775], the Cousin condition, $p = .022$, 95% CI [.061, .781], or the Acquaintance condition, $p < .001$, 95% CI [.617, 1.319], with no significant difference between the Sibling and the Self conditions, $p = .998$.

**Exploratory Analysis of Potential Gender Effects in Direct Aggression
on Behalf of Siblings**

We tested whether participant sex interacted with the sex of their sibling to predict differences in direct aggression. In a test confined to the subsample of participants assigned to envision harm to their sibling, an ANCOVA (controlling for covarying preferences for indirect aggression) including Sibling Condition (sister [$N = 79$] versus brother [$N = 97$]), participant sex, and the interaction between Sibling Condition and participant gender, revealed no differences between direct aggression on behalf of sisters or brothers, $p = .490$, and no interaction between sibling sex and participant sex, $p = .349$. Consistent with the prior literature on sex differences in aggression (Archer, 2004), male participants were more prone to directly aggress ($M = 4.63$; $SD = 1.66$) than were female participants ($M = 3.62$; $SD = 1.53$), $F(1, 171) = 22.76$, $p < .001$, $\eta^2 = .12$.

Relative Effects of Kinship and Emotional Closeness on Direct Aggression Using the Modified Adult Sibling Relationship Questionnaire

In analyses parallel to the model including the Relationship Closeness Scale (RSD; Dibble, Levine, & Park, 2012) in the main text, we substituted the modified versions of the Adult Sibling Relationship Questionnaire (ASRQ; Lanthier & Stacker, 1992), revealing comparable patterns of association to those observed using the RSC.

Relative effects of kinship and subjective closeness on direct aggression. We conducted an exploratory test of the relative contributions of our modified ASRQ measure of subjective closeness and kinship to direct aggression within the subsample of participants in the Friend, Cousin, and Sibling conditions for whom emotional closeness data had been collected ($N = 495$). In a model including both variables as simultaneous predictors, the kinship index variable ($b = 1.12$, $SE = .34$, $\beta = .15$, $p = .001$; 95% CI = [.45, 1.78]) and the subjective closeness measure of emotional closeness ($b = .30$, $SE = .07$, $\beta = .18$, $p < .001$; 95% CI = [.16, .45]), each predicted tendencies toward direct aggression. (Follow-up tests including indirect aggression and gender as covariates did not alter the significance of either correlation.)

Relative effects of kinship and objective closeness on direct aggression. We conducted an exploratory test of the relative contributions of our modified ASRQ measure of objective closeness and kinship to direct aggression within the subsample of participants in the Friend, Cousin, and Sibling conditions. In a model including both variables as simultaneous predictors, the kinship index variable ($b = 1.04$, $SE = .33$, $\beta = .14$, $p = .002$; 95% CI = [.39, 1.70]) and the objective closeness measure of emotional closeness ($b = .24$, $SE = .06$, $\beta = .19$, $p < .001$; 95% CI = [.14, .35]), each predicted tendencies toward direct aggression. (Follow-up tests including indirect aggression and gender as covariates did not alter the significance of either correlation.)