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# Seeing Storms Behind the Clouds

## Biases in the Attribution of Anger

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## Abstract

Anger-prone individuals are volatile and frequently dangerous. Accordingly, inferring the presence of this personality trait in others was important in ancestral human populations. This inference, made under uncertainty, can result in two types of errors: underestimation or overestimation of trait anger. Averaged over evolutionary time, underestimation will have been the more costly error, as the fitness decrements resulting from physical harm or death due to insufficient vigilance are greater than those resulting from lost social opportunities due to excessive caution. We therefore hypothesized that selection has favored an upwards bias in the estimation of others' trait anger relative to estimations of other traits not characterized by such an error asymmetry. Moreover, we hypothesized that additional attributes that i) make the actor more dangerous, or ii) make the observer more vulnerable increase the error asymmetry with regard to inferring anger-proneness, and should therefore correspondingly increase this overestimation bias. In Study 1 ($N$ = 161), a fictitious individual portrayed in a vignette was judged to have higher trait anger than trait disgust, and trait anger ratings were more responsive than trait disgust ratings to behavioral cues of emotionality. In Study 2 ($N$ = 335), participants viewed images of angry or fearful faces. The interaction of factors indicating target's formidability (male sex), target's intent to harm (direct gaze), and perceiver's vulnerability (female sex or high belief in a dangerous world) increased ratings of the target's trait anger but not trait fear.

# Seeing Storms Behind the Clouds: Biases in the Attribution of Anger

## 1.0. Introduction

Assessing others' personality traits is a key adaptive problem that social cognition evolved to address. Understanding people's personalities allows us to predict others' future behavior and facilitates navigating complex social interactions (Ross, 1977). However, because personality is invisible, it is difficult to assess. Past behavior may reveal underlying traits, but inferences about them (especially from a single observation) are highly uncertain, for two reasons. First, behaviors are produced not only by enduring dispositions, but also by fleeting situations. Proper discounting of situational influences requires repeated observations of an individual across multiple situations (Kelley, 1972), and this cannot always be achieved. Second, people strategically manage their behaviors, at times actively inhibiting the expression of negative traits and compromising observers' ability to discern personal characteristics.

Here, we explore the hypothesis that assessments of an individual's propensity to become angry are adaptively biased. Given that i) conspecifics were a primary source of danger for ancestral humans (Keeley, 1996), and ii) anger motivates violence (Fessler, 2010; Frank, 1988; Sell, 2009), an important adaptive challenge was predicting an individual's enduring inclination to become angry (i.e., trait anger), a process we term "anger attribution". Importantly, anger attribution is inherently imperfect, making complete accuracy unlikely, if not impossible.

## 1.1. Adaptive Rationality and Error Management

The "adaptive rationality" approach contends that the mind was shaped by selection to enhance fitness in ancestral environments rather than to yield accurate judgments (Haselton et al., 2009; see also Funder, 1995, and Krueger & Funder, 2004). Therefore, human cognition can manifest seemingly irrational biases that are, in fact, "adaptively rational." Anger attribution is one domain in which this might occur. Perceivers can commit one of two errors: underestimate an individual's trait anger (false negative) or overestimate it (false positive). On average, underestimations will have been costlier than overestimations in ancestral populations: assuming that an anger-prone individual was temperate placed the perceiver at risk of assault, whereas assuming that a temperate individual was anger-prone merely led to foregoing potentially profitable interactions. Thus, overall accuracy (i.e., committing false negative and false positive errors with equal frequency) did not maximize fitness over evolutionary time. Rather, in line with error management theory (Haselton & Buss, 2000; Haselton & Nettle, 2006), we hypothesize that selection favored a biased tendency to commit the less costly false positive – overestimating trait anger. Although the same logic applies to the estimations of *state* anger, our predictions focus squarely on *trait* anger because traits predict future behavior, and it is costly not only to underestimate an individual's anger in the moment, but also in future interactions.

Absent objective baselines, investigating a hypothesized bias in judgment requires points of comparison; we employed other negative emotional dispositions, for which we predicted either no biases, or reverse biases (trait *underestimation*). For instance, in the case of fear directed toward the perceiver, there is no clear asymmetry in the costs of underestimating or overestimating another's propensity to experience fear. Therefore, we do not expect an evolved

bias for perceptions of trait fear. If a target displays fear or disgust toward something or someone other than the perceiver, it was likely to have been adaptive to over-attribute their emotions to the situation (and underestimate the corresponding trait), since this enhances alertness to potential hazards. More formally:

*Hypothesis 1: Behaviors indicative of anger will be attributed to personality to a greater degree than behaviors indicative of other negative emotions*.

Ancestral error cost asymmetries were not static, but instead varied by context (Haselton & Galperin, in press; Johnson, Blumstein, Fowler, & Haselton, in press;). Psychological adaptations formed by these variable asymmetries should therefore be influenced by contextual cues. Specifically, cues that a person is able or likely to aggress against the perceiver increase the costs of underestimating trait anger. In turn, this exaggerated error asymmetry would have made erring on the side of caution (i.e., overestimating trait anger) even more beneficial, leading to an exaggerated dispositional bias. Cues that someone poses a threat include attributes of the target individual (e.g., formidability; gaze direction), attributes of the perceiver (e.g., self-perceived vulnerability), or a combination thereof. These factors should not affect assessments of other emotion traits because they do not affect the relevant error cost asymmetries. More formally:

*Hypothesis 2: Increasing the danger that the target poses to the perceiver will increase dispositional attributions of angry behaviors but will not increase dispositional attributions of behaviors associated with other negative emotions*.

## 2.0. Study 1

We tested the possibility that, ceteris paribus, an unfamiliar individual would be viewed as more dispositionally prone to anger than to another negative emotion (disgust). Participants read vignettes about a fictitious man who reacted with anger and disgust to situations commonly eliciting each emotion, then rated the protagonist's trait anger and disgust. We predicted that the man's trait anger would be rated higher than his trait disgust. In testing this prediction, we sought to address an alternative explanation: compared to a single display of disgust, a single display of anger may indeed be more informative about an individual's personality, such that the predicted pattern of results is potentially explicable in terms of the accuracy of folk psychology. This is plausible because, being more proscribed than disgust displays, anger displays must overcome a higher inhibitory threshold, hence someone who is angry enough to show it might be anger-prone. However, this logic no longer holds when the observer views the eliciting situation as meriting an angry response. We therefore measured and controlled for the protagonist's perceived "overreaction," thus leveling the playing field for anger and disgust.

Hypothesis 1 thus translates as *Prediction 1: The target's trait anger will be rated higher than his trait disgust, and will remain so even after controlling for any systematic discrepancy between the perceived appropriateness of his anger and disgust reactions*.

We predicted that perceived trait anger would positively scale with perceived state anger in a seemingly irrational manner. If someone overreacts to a situation and becomes enraged, this is objectively informative about their underlying trait anger. However, if an angry response is

merited, the event is not dispositionally informative: there is no rational reason to attribute the anger to disposition because any normal person would have acted thusly. We predicted that, because of the greater cost of underestimating anger, observers would nevertheless produce overly dispositional attributions, as it is safer to assume that the anger, though justified, is dispositional. We therefore predicted that even justified anger would lead to dispositional attribution, whereas disgust would lead to dispositional attribution only to the extent that it was seen as an unjustified overreaction.

Hypothesis 2 therefore translates as *Prediction 2: Ratings of "overreaction" will fully mediate the positive association between state and trait ratings for disgust, but will not fully mediate this association for anger (i.e., there will be residual bias in attributions of anger but not disgust)*.

We predicted full, rather than merely partial-but-stronger mediation for disgust because anything less than full mediation indicates a bias. If judgments are normatively rational, and the target is perceived to be reacting appropriately to the stimulus, there should be zero correlation between states and corresponding traits. Since we proposed that disgust should follow this normative rule, we expected any positive correlation between perceived state and trait disgust to be entirely indirect (i.e., fully mediated by the overreaction factor).

## 2.1. Methods

**Participants and procedure.** To prevent trait and state ratings from being artificially similar, participation occurred in two sessions held on different days. In exchange for course credit, 441 UCLA undergraduates from two Introductory Psychology classes completed the first session and were provided with a unique identifier. They were subsequently invited to participate in the second session online. Over the next two months 161 of the participants completed the online survey; these individuals constitute the sample. Participation in the second session ranged from 15 to 66 days after the first session ($M$ = 24.8, $SD$ = 14.5); the time elapsed between sessions was not associated with any variables of interest ($p$s > .11). Participant sex and other demographics were not assessed (a limitation addressed in Study 2).

**Materials.** In Session 1, participants read two of four vignettes describing a fictitious male college student. A male target was chosen to provide a strong initial test of the trait attribution bias hypothesis. Men are disproportionately responsible for violence (Daly & Wilson, 1988), hence error management effects in judging trait anger should be most pronounced for male targets.

Vignettes described the protagonist in situations that would provoke reactions of both anger and contamination disgust in most people (see ESM). Each participant read one "weak" vignette, in which the protagonist reacted to a mildly anger- and disgust-provoking situation with mild anger and disgust. Each participant also read one "strong" vignette, in which the protagonist reacted to more serious provocations of anger and disgust with appropriately intense anger and disgust. Thus, the individual was implicitly portrayed as an average, reasonable person in terms of how easily he becomes angered or disgusted in a range of situations. No vignette contained

158 the words “anger,” “disgust,” or synonyms thereof. Half of the participants read one pair of weak
159 and strong vignettes (in randomized order); the other half read the other pair of weak and strong
160 vignettes. Participants then rated the target’s trait anger and disgust (in randomized order)
161 relative to the average person on 1-9 scales, anchored by “much less angry (disgusted) than the
162 average person” and “much more angry (disgusted) than the average person.” Instructions
163 specified rating contamination disgust and not moral outrage (Rozin, Haidt, & McCauley, 2000;
164 Tybur, Lieberman, & Griskevicius, 2009).
165
166 In Session 2, which occurred between two and eight weeks after Session 1, participants
167 read the same vignettes as before. They rated the absolute degree of the target’s state anger and
168 disgust on 1 to 9 scales, ranging from “not at all” to “extremely.” They also rated how justified
169 his reaction was, given the situation, on a -3 to 3 scale, ranging from “extreme underreaction” to
170 “extreme overreaction.” The latter measure allowed us to assess the degree to which participants
171 viewed the target’s reaction as justified, as well as to control for any unintended bias in the
172 vignettes (e.g., having inadvertently portrayed the individual as easily disgusted rather than
173 average).
174
175 **2.2. Results**
176
177 Participants judged the target to have displayed state anger and disgust at just above the
178 scale midpoint (anger, $M = 6.08$, $SD = 1.35$; disgust, $M = 5.95$, $SD = 1.32$); these means did not
179 statistically differ, $t(159) = 1.85$, $p = .07$. Participants also rated the target as mildly overreacting
180 in terms of both anger ($M = .55$, $SD = 1.00$; one-sample against 0 $t(160) = 7.01$, $p < .001$) and

disgust ($M$ = .25, $SD$ = .90; one-sample against 0 $t(160) = 3.47$, $p < .001$). The anger overreaction was stronger than the disgust overreaction, paired-samples $t(160) = 5.36$, $p < .001$.

*Prediction 1: The target's trait anger will be rated higher than his trait disgust, and will remain so even after controlling for any systematic discrepancy between the perceived appropriateness of his anger and disgust reactions*.

Before controlling for overreaction, ratings of trait anger ($M$ = 5.94, $SD$ = 1.24) were higher than those of trait disgust ($M$ = 5.57, $SD$ = 1.16), $t(160) = 3.88$, $p < .001$. Because measures were nested within participants, we used multilevel regression (HLM 7.0) to examine whether this difference remained significant after controlling for perceived overreaction. We regressed Trait Emotion Ratings onto Level 1 predictors that included Emotion Type (anger or disgust; dummy coded) and perceptions of the protagonist's Behavioral Overreaction. Unsurprisingly, the more that participants perceived the target as overreacting in terms of either emotion, the more they rated him as dispositionally inclined to experience that emotion ($B$ = 0.48, $SE(B) = .09$, $t(160) = 5.51$, $p < .001$). Nevertheless, supporting Prediction 1.1, even with this variable controlled, the type of emotion was still significantly associated with the magnitude of the trait rating ($B$ = 0.21, $SE(B) = .10$, $t(160) = 2.01$, $p = .046$), such that ratings were higher for marginal trait anger than for marginal trait disgust.

*Prediction 2: Ratings of "overreaction" will fully mediate the positive association between state and trait ratings for disgust, but will not fully mediate this association for anger (i.e., there will be residual bias in attributions of anger but not disgust)*.

Two mediational models were run per standard techniques (Kenny, Kashy, & Bolger, 1998). Supporting Prediction 2.1, overreaction only partially mediated the total effect of state on trait ratings for anger ($c' = .21$, sobel $z = 3.20$, $p = .001$), but fully mediated this effect for disgust ($c' = .01$, sobel $z = 4.44$, $p < .001$); see Figure 1. Thus, even after accounting for overreaction, participants continued to scale their trait anger ratings with their state anger ratings (which constitutes a bias), but did not do so for disgust.

### 2.3. Discussion

Supporting Hypothesis 1 – that displays of anger will be viewed as more revealing of disposition than displays of other emotions – participants attributed more enduring anger than enduring disgust to a male protagonist, even after we accounted for systematic differences between perceptions of his state anger and disgust. In Study 2, to examine how the target's gender interacts with this main effect, we used female as well as male targets.

Supporting Hypothesis 2 – that the bias toward attributing anger to disposition will increase with the danger posed by the given individual – participants made increasingly dispositional attributions as the perceived level of anger displayed by the individual increased, regardless of how justified his emotional reaction was seen as being; the same was not true of disgust. These patterns are consonant with an evolved error management bias.

As noted earlier, absent objective baselines, tests of error management hypotheses rely on points of comparison in testing for predicted biases. Disgust, a negative emotion that resembles anger in multiple respects (Smith and Ellsworth, 1985), performed this role in Study 1. To demonstrate that the supportive evidence obtained in Study 1 was not an artifact of one particular comparison emotion, in Study 2 we used fear – which differs greatly from both anger and disgust (Smith and Ellsworth, 1985) – as the negative emotion control.

A main effect comparison of scale ratings of trait anger and any other negative emotion can be difficult to interpret. Although we controlled for perceived overreaction in Study 1, this may be imperfect, since participants might have difficulty translating the relevant cognitions into propositional statements regarding the degree of overreaction. This underscores the importance of introducing additional manipulations hypothesized to affect the ratings of trait anger but not of other negative emotions, a key piece of our framework explored in Study 2.

## 3.0. Study 2

In Study 2, we tested Hypothesis 1 using a new comparison emotion (fear), and tested Hypothesis 2 by manipulating the danger posed by the target to the perceiver. Participants viewed photographs of faces that varied by sex, eye gaze direction (direct/averted), and emotion (anger/fear). Participants rated the trait and state levels for each emotion. This allowed us to test multiple subsidiary predictions. Per Hypothesis 1, we expected that, collapsed across manipulations, dispositional anger ratings would be higher than dispositional fear ratings. Moreover, as in Study 1, we expected this difference to be significant even after accounting for

the perceived strength of the anger and fear expressions. Controlling for this source of normatively logical inferences about the targets' emotional traits ensures that any remaining difference between the ratings of trait anger and trait fear constitutes a bias. Hypothesis 1 thus translates as *Prediction 1: Across conditions, dispositional anger ratings will be higher than dispositional fear ratings even after controlling for any systematic differences in the perceived state intensity of the anger and fear expressions*.

Hypothesis 2 specifies that the degree of bias in anger attribution will be contingent on the danger posed by the target. Men generally pose a greater threat of violence than do women (Daly & Wilson, 1988) and are treated accordingly by hazard-avoidance mechanisms: for instance, fear learned in conjunction with an outgroup face is less easily extinguished when the face is male (Navarrete et al., 2009). On average, underestimating a man's propensity to experience anger will be especially costly; the same is not true of fear. Hypothesis 2 thus translates as *Prediction 2a: The difference between dispositional anger and dispositional fear ratings will be higher for male than for female targets even after controlling for any systematic differences in the perceived state intensity of the anger and fear expressions*.

Although, empirically, men do not become angry more frequently or more intensely than women, folk models nevertheless depict this, along with corresponding dispositional differences (Fischer & Evers, 2010). A positive result for Prediction 2a could therefore reflect the influence of gender stereotypes, hence it is important to augment tests of Hypothesis 2. An emotional expression coupled with direct gaze usually signals that the emotion is directed *toward* the perceiver (Adams & Kleck, 2003). In the case of anger, direct gaze indicates that the target likely

harbors harmful intentions toward the perceiver – a possibility that is hazardous for the perceiver to ignore both in the moment and in future interactions. In such circumstances, it is especially costly for the perceiver to underestimate the target's anger-proneness. The same is not true, however, for fearful expressions. Per Hypothesis 2, we therefore expected that direct gaze would enhance the bias toward a dispositional interpretation when paired with anger expressions, but not when paired with fear expressions. (Note that a shift in gaze is a transient behavior and provides no normative information about the target's enduring traits. Thus, if anger attribution were affected by gaze as predicted, this would constitute evidence for a bias.)

Target's sex and eye gaze should interact to influence judgments of dispositional anger, as a potentially dangerous man indicating via direct gaze that he is angry at the observer presents an especially potent combination of danger cues. Furthermore, the impact of these factors should vary with the perceiver's vulnerability to assault. Because women are less physically formidable than men, they should be especially sensitive to interpersonal cues of danger. Hypothesis 2 thus translates as *Prediction 2b: There will be a four-way interaction between emotion condition (anger or fear), the participant's sex, the target's sex, and the target's eye gaze, such that, to a greater extent than male participants, female participants will rate male targets expressing anger with direct gaze as more predisposed toward anger than male targets expressing anger with averted gaze. This contrast will not be significant in the fear condition.*

More generally, because natural selection weighs the benefits of precaution against its costs, psychological adaptations that serve to protect against violence can be expected to calibrate to individual differences in the susceptibility to aggression (cf. Snyder et al., 2011).

*Self-perceived* vulnerability in particular is crucial. This is because the costs of encountering an antagonist depend in part on the individual and social resources that the actor brings to bear in coping with the hazard. Because individuals differ in these regards, the asymmetry in the costs of errors in anger attribution will vary as a function of both the objective baseline risk of assault in the individual's environment and the individual's capacity for coping with that risk. Subjective perceptions of the level of danger in the world plausibly reflect the combination of past encounters with danger and self-assessed capabilities for addressing it (Johns, 2011; Snyder et al., 2011). Accordingly, if the bias at issue is adjusted as a function of its utility for the individual, then this trait should be positively correlated with the extent to which the individual perceives the world to be dangerous. This generates *Prediction 2c: There will be a four-way interaction between emotion condition (anger or fear), the participant's self-perceived vulnerability, the target's sex, and the target's eye gaze such that, to a greater extent than less vulnerable individuals, more vulnerable individuals will rate male targets expressing anger with direct gaze as more predisposed toward anger than male targets expressing anger with averted gaze. This contrast will not be significant in the fear condition.*

### 3.1. Methods

**Participants.** Via Amazon.com's Mechanical Turk, 372 U.S. participants (200 women, 147 men, 25 who did not specify their sex) were recruited for a 10-minute online study of "perceptions of individuals" in exchange for $0.20. Software prevented repeat participation from any given computer. The anger condition (N = 161) was run in its entirety prior to the fear

317 condition (N = 211), with identical recruitment procedures. The average age was 34.8 (*SD* =
318 12.8); 73% of participants were White.
319
320 **Stimuli.** Images were selected from the NimStim face set (Tottenham et al., 2009), which
321 contains angry, fearful, and neutral faces posed by the same individuals. We selected four female
322 and four male targets from faces identified by Tottenham et al. as having the most readily
323 identifiable anger expressions. The same targets were later used in the fear condition.
324
325 Using the website www.faceresearch.org, we manipulated the extremity of the facial
326 expressions by blending varying doses of the target's angry or fearful expression and the target's
327 neutral expression; participants viewed these blended images, not the original images.
328
329 To create averted gaze, angry, fearful, and neutral images were digitally altered by
330 moving the irises and pupils to the right side of each eye. These images and the unaltered images
331 were then duplicated and flipped along the Y-axis for counterbalancing. Participants saw one of
332 four image types: direct-gaze original, direct-gaze flipped, averted-gaze right, and averted-gaze
333 left (i.e., averted-gaze right flipped). In all analyses, the two direct-gaze conditions were
334 collapsed into one condition, as were the two averted-gaze conditions.
335
336 **Design and Measures.** The design of the study was 2 (angry or fearful faces: between-
337 subjects) x 2 (direct or averted gaze: between-subjects) x 2 (target sex: within subjects). To avoid
338 arousing suspicion regarding the nature of our manipulations, emotion and gaze varied between
339 subjects. Each participant thus viewed and rated each of the eight target individuals' images in

randomized order, all of which were either angry or fearful, and all of which displayed either direct or averted gaze. All measures and tasks were completed for each target individual before the participant saw an image of the next target; see ESM for a sample image set and trial.

*Image ratings*. Each of the eight images was presented individually and appeared on screen for the duration of the participant's ratings of the respective target individual. The degree of anger or fear in the image was randomized among 70%, 80%, or 90% of the original angry or fearful expression. Using 9-point scales anchored by "not at all" and "extremely," participants first provided an explicit assessment of each target's current emotional state ("How angry/scared does the person look in this picture?"). Then, on 9-point scales anchored by "much less than average" and "much more than average", participants inferred each target's enduring emotional trait ("Compared to the average person, how *often* do you think this person becomes angry/scared in real life?; Compared to the average person, how *easily* do you think this person becomes angry/scared in real life?"; $\alpha = 0.91$).

*Frame-matching task*. Next, participants completed an exploratory perceptual matching task tangential to the current topic (see ESM).

*Demographics*. Participants next reported their sex, age, and ethnicity. To assess self-perceived vulnerability to threat, participants then completed the Belief in a Dangerous World scale (BDW; Altemeyer, 1998), which contains 12 items ($\alpha = 0.89$) probing the extent to which the respondent thinks others are violent and life is full of hazards, on 5-point disagree-agree scales.

## 3.2. Results

*Prediction 1: Across conditions, dispositional anger ratings will be higher than dispositional fear ratings even after controlling for any systematic differences in the state intensity of the anger and fear expressions*.

Collapsing across conditions, we conducted a one-way ANCOVA predicting the trait rating (averaged across all eight targets) from the emotion condition (anger or fear) while controlling for averaged state emotion rating as a continuous covariate. Controlling for the state rating was necessary because it was higher for the anger images ($M = 5.16$, $SD = 1.15$) than for the fear images ($M = 4.54$, $SD = 1.06$), $t(370) = 5.45$, $p < .001$, and, as expected, state ratings were positively associated with the trait ratings in the ANCOVA, $F(1, 331) = 158.82$, $p < .001$. After controlling for the state ratings, the difference between the marginal means for ratings of trait anger ($M = 5.17$) and trait fear ($M = 4.85$) remained robust, $F(1, 368) = 17.53$, $p < .001$, supporting Prediction 1.2.

*Prediction 2a: The difference between dispositional anger and fear ratings will be higher for male than for female targets even after controlling for any systematic differences in the state intensity of the anger and fear expressions*.

Each participant's trait ratings were averaged across the four female targets and the four male targets. To test whether the differences between the ratings of trait anger and trait fear

differed in magnitude for female and male targets, we ran a multilevel analysis. Trait Rating was regressed on Emotion Type (Level 2: fear = 0, anger = 1), Target Sex (Level 1: female = 0, male = 1), State Rating (Level 1, grand-mean centered), and the cross-level interaction of Emotion Type X Target Sex. This cross-level interaction was significant ($B$ = .81, $p$ < .001). Simple slopes for the association between Emotion Type and Trait Rating differed for female and male targets. The association between Emotion Type and Trait Rating was not significant for female targets ($B$ = -.08, $p$ = .30) but was positive and significant for male targets ($B$ = .73, $p$ < .001). This indicates that ratings of trait anger were higher than ratings of trait fear for male targets but not for female targets (see Figure 2). Hence, these analyses qualified the results under Prediction 2.2a as not only being stronger for male targets as predicted, but, moreover, as being true *only* for male targets.

*Prediction 2b: There will be a four-way interaction between emotion condition (anger or fear), the participant's sex, the target's sex, and the target's eye gaze, such that, to a greater extent than male participants, female participants will rate male targets expressing anger with direct gaze as more predisposed toward anger than male targets expressing anger with averted gaze. This contrast will not be significant in the fear condition.*

We conducted a 2x2x2x2 repeated-measures ANOVA to examine the effects of the manipulations. The dependent measure again consisted of trait ratings averaged across the four same-sex targets. Emotion condition (anger or fear), gaze condition (direct or averted) and participant's sex were between-subjects variables, and target's sex was the repeated measure within participants.

The predicted 4-way interaction was not significant, $F(1, 338) = .49$, $p = .48$. However, to examine whether lower-order patterns were nonetheless consistent with the prediction, we followed this analysis with a 2 (gaze: direct or averted) x 2 (participant's sex) x 2 (target's sex) repeated-measures ANOVA run separately for the anger and fear conditions. Importantly for Prediction 2.2b, within the anger condition, the 3-way interaction between gaze, target's sex, and participant's sex was significant, $F(1, 147) = 5.23$, $p = .024$. Pairwise contrasts revealed that female participants judged male targets to be more dispositionally angry with direct gaze than with averted gaze ($F(1,147) = 3.91$, $p = .05$). No other contrasts within this 3-way interaction approached significance (all $p$s > .35). The 3-way interaction was not significant in the fear condition, $F(1, 191) = 1.81$, $p = .18$, and no contrast pairings within it were significant (all $p$s > .10; see Figure 3). Thus, although this finding needs to be interpreted with caution, the pattern of results was consistent with Prediction 2b: the 3-way interaction emerged for anger but not for fear.

*Prediction 2c: There will be a four-way interaction between emotion condition (anger or fear), the participant's self-perceived vulnerability, the target's sex, and the target's eye gaze such that, to a greater extent than less vulnerable individuals, more vulnerable individuals will rate male targets expressing anger with direct gaze as more predisposed toward anger than male targets expressing anger with averted gaze. This contrast will not be significant in the fear condition.*

To test this prediction, BDW was dichotomized at the median and substituted for participant sex into the earlier repeated-measures ANOVA. As before, the other three factors were Emotion Type, Gaze, and Target Sex. The 4-way interaction was significant, $F(1, 338) = 4.29$, $p = .039$. A pairwise contrast revealed that participants who were high in BDW and rated angry male faces provided higher ratings for trait anger with direct gaze than with averted gaze, $F(1, 338) = 4.00$, $p = .046$, $d = .22$. However, this was not the case for participants who were low in BDW, $F(1, 338) = .01$, $p = .98$. This was also not the case for any judgments involving fear expressions – indeed, a pairwise contrast showed that there was a marginal opposite trend wherein participants high in BDW rated direct-gaze male fear faces as *less* dispositionally fearful than averted-gaze faces, $F(1, 338) = 3.23$, $p = .073$. Besides these, no other pairwise contrasts in the model approached significance ($p$s > .13). Therefore, Prediction 2c was supported (see Figure 4).

Prediction 2b concerns participant sex, whereas Prediction 2c concerns self-perceived vulnerability. Tests of these predictions are distinct only if sex is not determinative of self-perceived vulnerability. Critically, the respective representation of the sexes in the high-BDW group did not differ significantly (51.3% of women, 41.8% of men, $\chi^2[1, N = 345] = 3.03$, $p = .08$), indicating that tests of Predictions 2b and 2c are independent of one another.

### 3.3. Discussion

Study 2 accomplished two goals. First, it replicated and qualified our earlier results, showing that trait anger is judged to be higher than another negative emotional trait (fear) when

all else is equal. As in Study 1, across manipulations, targets were judged to be more prone to becoming angry than to feeling another negative emotion even when the images' emotional state intensity was held constant. This replication was qualified by showing that it is only true for male targets: men, but not women, were judged to be more predisposed to anger than to fear above and beyond any rational indications from the images that this was the case. This reveals an attribution process that is irrational in the classic sense (Kelley, 1972) but adaptively rational in its bias toward the error that has likely been consistently less costly over evolutionary time.

Figure 3 shows the significant interaction indicating that this result was driven by lower ratings of women's marginal trait fear, relative to men. The most direct support for our prediction concerning dangerous individuals would have been to find that this difference was driven by higher ratings of men's marginal trait anger, relative to women. Although we did not find this pattern, the results of these studies still provide important insights. Indeed, direct comparisons between judgments made for male and female targets can be difficult to interpret because people might have different standards for each sex (Biernat, 2009). For instance, men are stereotyped as easily angered (Fischer & Evers, 2010) and women as easily frightened (Hess, Blairy, & Kleck, 2000). Likewise, independent of actual emotional state, by virtue of dimorphic features, male faces appear angrier than female faces (Becker, Kenrick, Neuberg, Blackwell, & Smith, 2007). Any or all of these factors might inform how men's and women's respective emotional expressions are interpreted. In contrast, direct comparisons of dispositional anger and fear *within* target sex are relatively unproblematic, because men's and women's fearful images are natural controls for their own angry images in terms of morphology and skill in posing emotions. Such comparisons indeed support Prediction 2a, that the difference between

dispositional anger and dispositional fear ratings will be higher for male than for female targets (see Figure 2).

Second, because these findings are also potentially explicable in terms of gender stereotypes or morphological influences on perceived expressions, additional features of Study 2 provide critical evidence supporting the notion that the danger posed by the target shapes the degree of bias in anger attribution. Even if the *manifestation* of certain personality traits might be increased by the characteristics of other people in the environment (e.g., individuals prone to violence are more likely to express this trait with victims who appear vulnerable, Buss & Duntley, 2008), in reality an individual's enduring personality does not change with shifting gaze or when examined by a more vulnerable observer. Nevertheless, participants' ratings of male targets' anger-proneness *did* appear to change based on these factors. Results showed that the dispositional attribution of angry expressions appears to be increased by a combination of the target's danger cues (direct gaze, male target) and the participant's elevated vulnerability (if the participant is female or believes that the world is dangerous). These findings echo prior findings that fear of sexual coercion motivates women's fear of, and bias against, outgroup male targets in particular (Navarrete, McDonald, Molina, & Sidanius, 2010). These nuanced results, inconsistent with an account based solely on gender stereotypes, provide additional support for the notion that the estimation of trait anger involves a true bias rooted in adaptive error management.

## 4.0. General Discussion

These studies provide the first evidence that the estimation of trait anger is biased in an adaptively rational way. In Study 1, perceivers interpreted angry behaviors as a reflection of an actor's personality regardless of how justified these behaviors were, especially when the behaviors were intense. This pattern was not obtained for another negative emotion, disgust. Study 2 replicated and extended this general finding with a different comparison emotion, fear. In Study 2, perceivers' overestimation of trait anger was enhanced by combinations of factors associated with the target's capability and likelihood of aggressing against the observer and the observer's vulnerability to such aggression. Specifically, female participants and participants who considered the world dangerous saw more anger in the personalities of targets who were male and looking directly at them. These nuanced findings provide support for the core hypothesis and are difficult to explain under alternative accounts.

### 4.1. Theoretical Implications

*Cognitive Versus Behavioral Biases*. The current research adds to the growing list of documented cognitive biases rooted in error management (Haselton & Galperin, in press; Johnson et al., in press). Some researchers have argued that such biases are unnecessary (and therefore unlikely to exist) because adaptive behavior, not cognition, is what ultimately affects fitness; therefore, people can theoretically "decide" to behave in adaptively biased ways without having to make systematically biased judgments (McKay & Dennett, 2009; McKay & Efferson, 2010). For instance, a woman could decide to avoid a man who has expressed anger toward her in the past without overestimating his trait anger. Indeed, there might be downstream costs to

psychological biases, if, for example, a mechanism's biased output is used by other mechanisms to which the same cost asymmetry does not apply.

While behavior is the ultimate determinant of fitness, the extent to which biased behavior is produced by biased cognition remains an empirical question. The corpus to which our results contribute reveals cognitive biases in a variety of judgment domains (Haselton et al., 2009; Haselton & Buss, 2009), suggesting that biased behavior frequently does flow from biased cognition (see Johnson et al., in press, for discussion).

*Ingroups and Outgroups*. For ancestral humans, the consequences of dealing with an anger-prone individual were not always negative, but rather depended on whether the individual was an assailant or an ally. A propensity for aggression would often have been a valued quality in allies, as long as it was directed toward outgroups and facilitated successful intergroup competition. The tests conducted in the current study were not designed to apply to allies in situations of intergroup conflict, and indeed, our findings suggest that participants implicitly treated unfamiliar individuals as non-allies by default. In the absence of readily observed cues of shared group membership (Boyd & Richerson, 2009; Henrich, 2004; Kurzban, Tooby, & Cosmides, 2001), it might generally have enhanced fitness to evaluate strangers with caution, as our participants did.

*The Correspondence Bias and Negativity Bias*. The correspondence bias (Gilbert & Malone, 1995; Ross & Nisbett, 1991) occurs whenever, to a logically unwarranted extent, people attribute others' behaviors to the target's enduring traits rather than to the situation. This bias has

been documented across many judgment domains, including attitudes, moral character, competence, and emotionality. Researchers have typically focused on examining the mechanisms through which this bias operates across domains, rather than examining its ultimate cause (but see Andrews, 2001) or testing theoretically-driven hypotheses about how it might differ between domains. While our results could be classified as an instance of the correspondence bias, our research speaks directly to the latter issues, as domain-general or purely proximate explanations of the correspondence bias do not predict that angry behaviors will be attributed to enduring traits to a greater extent than disgusted or fearful behaviors.

An overarching pattern characterizing both our results and a majority of findings regarding the correspondence bias is that, when people evaluate others, bad looms larger than good (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Rozin & Royzman, 2001; Ybarra, 2002). This "negativity bias" facilitates adaptively attending to and addressing threats (Rozin & Royzman, 2001), and is manifested in people's tendency to attribute negative or socially undesirable behaviors especially strongly to enduring traits (e.g., Reeder & Spores, 1983; Ybarra, 2002). While the current results for anger (a generally socially undesirable trait) are consistent with this phenomenon, they also move beyond it by illustrating the adaptively rational ways in which context affects the degree of the bias for anger but not for other negative emotions.

### 4.2. Practical Implications

Because people tend to see the bad in others, they are likely to avoid interacting or forming relationships with individuals who made a bad first impression even if they were situationally induced to behave this way. The specific case of the overestimation of trait anger suggests that people may avoid new acquaintances after a single instance of angry behavior, even if it was justified in the eyes of the perceiver. Moreover, this is especially likely when the target is formidable (e.g., a muscular man) and when the observer is either chronically vulnerable or feels temporarily unsafe. Although these patterns were adaptive in the social environments of our ancestors, modern humans live in a much safer world (Pinker, 2011). Hence, the biased overestimation of trait anger may lead people to mistakenly form negative impressions, eschewing relationships with others who might otherwise have become valued social partners. More broadly, our results potentially speak to the origins of stereotypes, particularly those linking gender and emotion. As noted earlier, folk models attribute greater trait anger to men. That such stereotypes arise and persist despite ready opportunities to observe that they are inaccurate is potentially explained by adaptively biased attributions, given that angry men pose a much greater threat of violence than do angry women.

581

582 **References**

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707

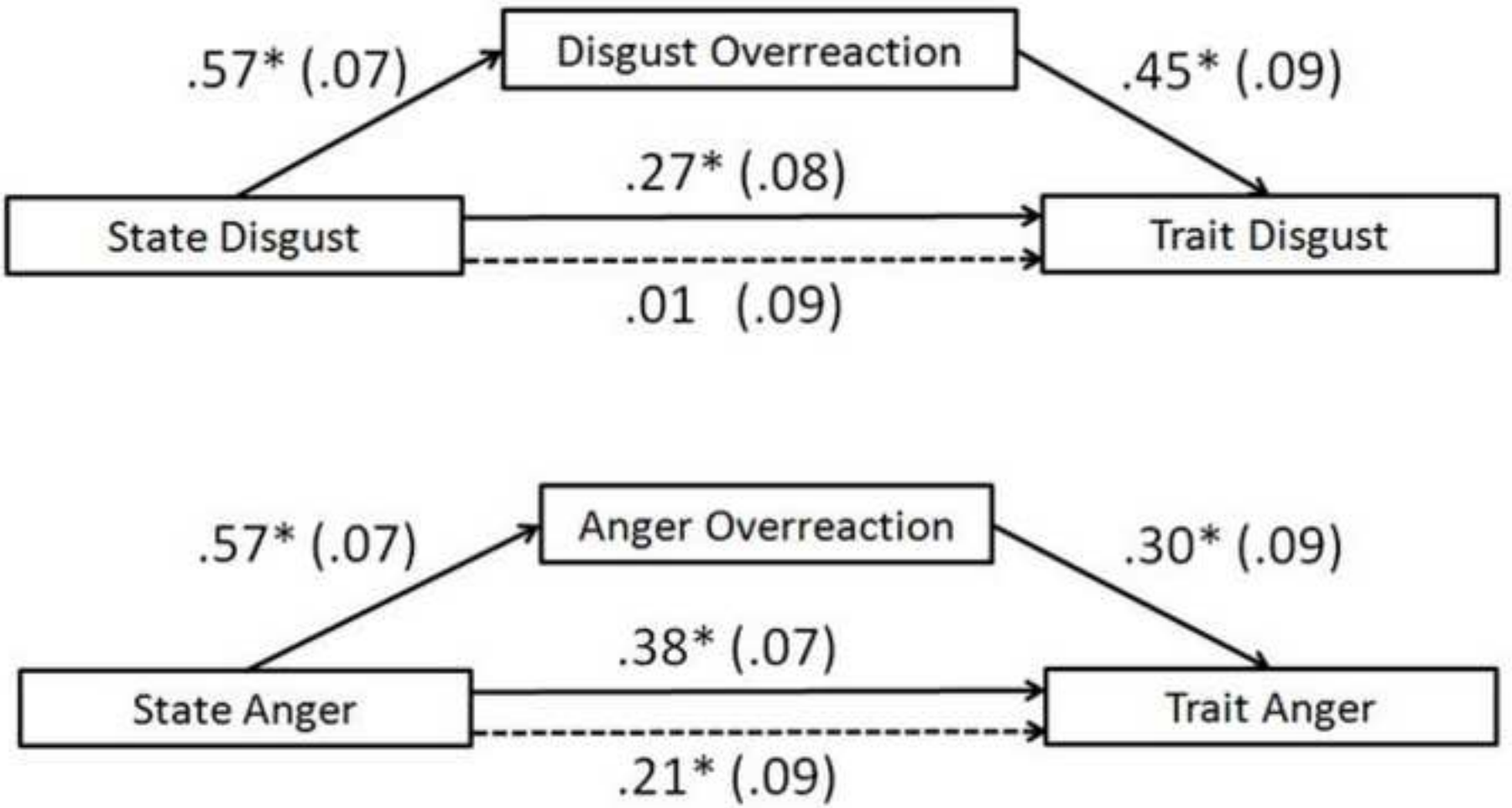
Figure 1. Standardized regression coefficients for the relationship between ratings of state and trait emotion as mediated by perceived overreaction.

Figure 2. The effects of targets' sex on participants' dispositional anger and fear ratings, controlling for participants' explicit ratings of state emotional intensity in the images in Study 2.

Figure 3. The effects of gaze, target's sex, and participant's sex on participants' ratings of targets' predisposition toward becoming angry in Study 2.

Figure 4. The joint effects of participants' Belief in a Dangerous World and gaze direction on ratings of male targets' dispositional anger and fear in Study 2.

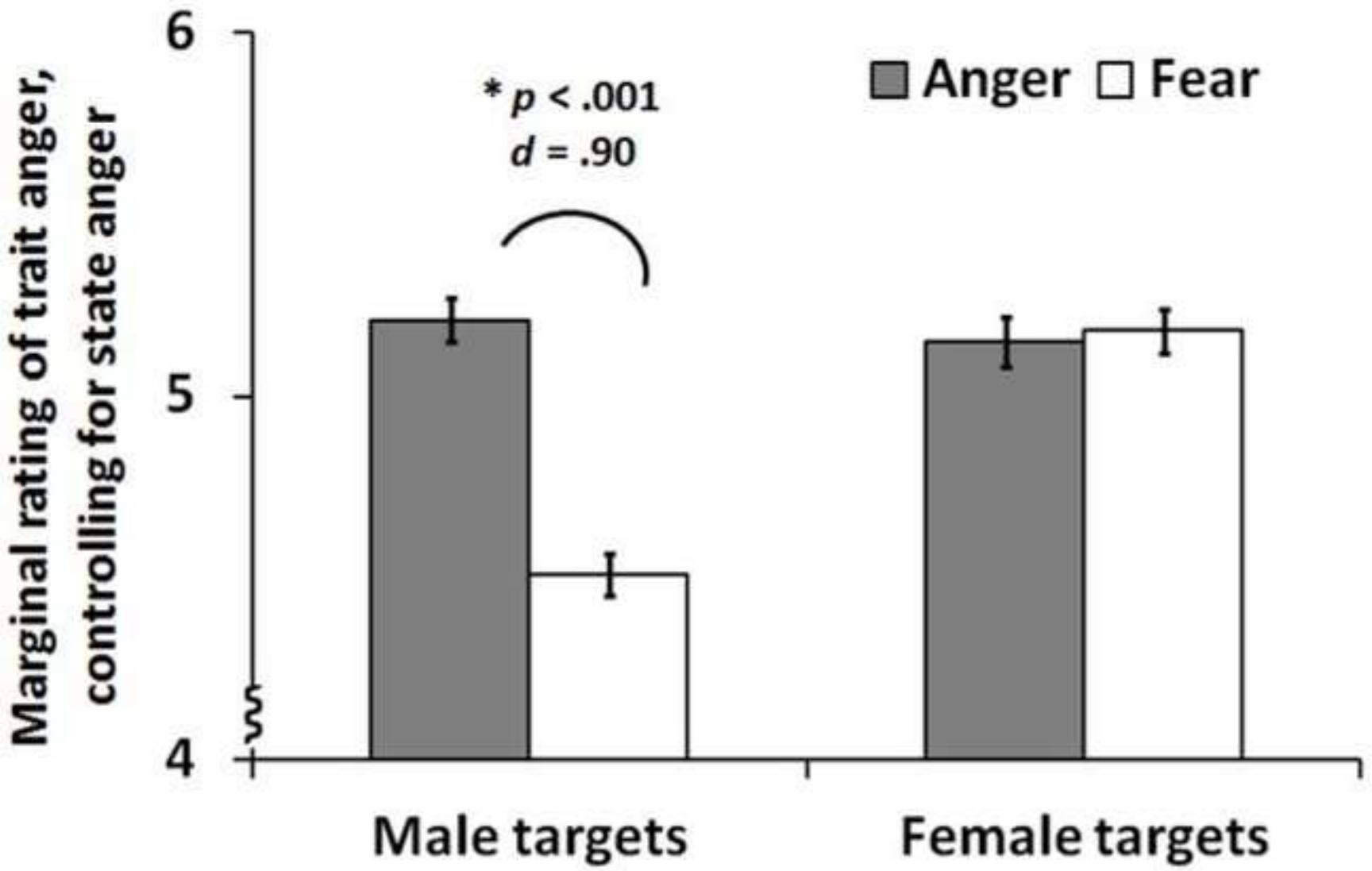
Figure 1
Click here to download high resolution image




*Note.* The standard errors of the regression coefficients are in parentheses.
* $p < .05$

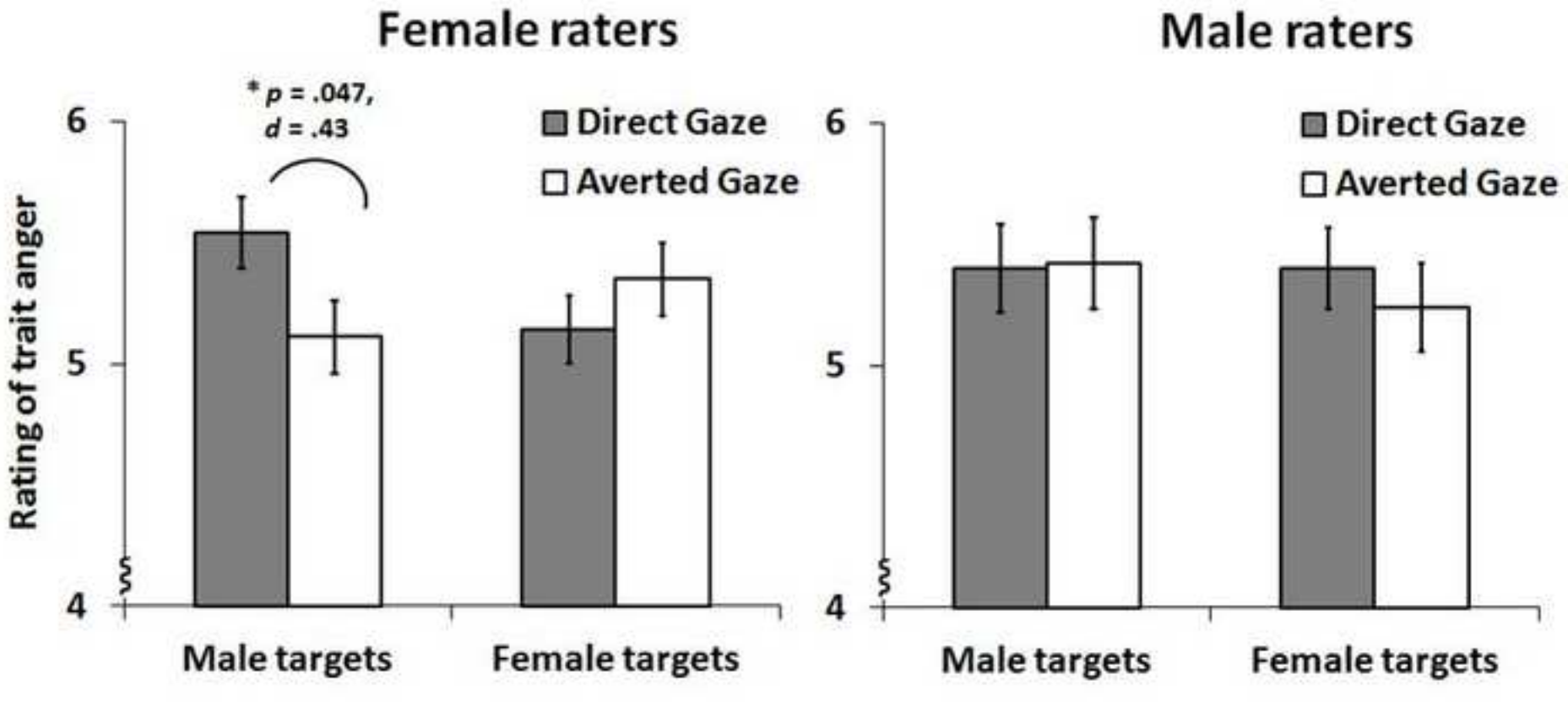
Figure 2

Click here to download high resolution image



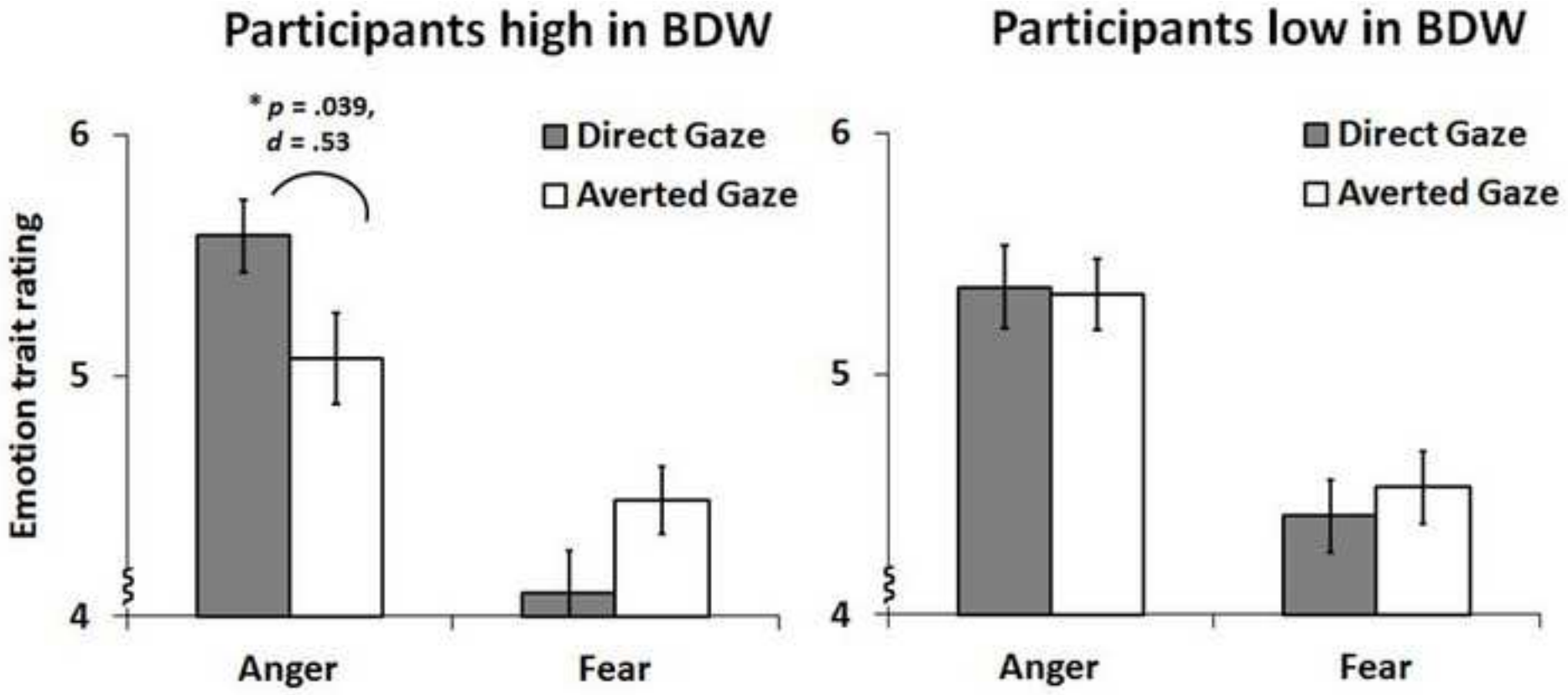

*Note*. The difference between ratings of male targets' dispositional anger and dispositional fear was significant, $F(1,331) = 64.74$, $p < .001$, $d = .90$.

Figure 3
Click here to download high resolution image




*Note.* The 3-way interaction of gaze, target's sex, and participant's sex was significant for anger ($p = .022$); the same 3-way interaction for fear (not pictured here) was not significant ($p = .38$). The leftmost contrast between women rating male targets with direct vs. averted gaze was significant ($p = .047$, $d = .43$). No other contrast in this figure was significant ($ps > .30$).

Figure 4
Click here to download high resolution image




*Note.* The 4-way interaction between emotion condition, gaze, target sex, and BDW was significant ($p$ = .022). The leftmost contrast between high-BDW participants rating angry male targets with direct vs. averted gaze was significant ($p$ = .039). No other simple contrast in this figure was significant ($ps$ > .086), and no simple contrasts were significant for participants rating female targets ($ps$ > .19; not pictured here).

**Appendix A:**
**Vignettes Used in Study 1**

*Note*. Albert's angry reactions are bolded, and his disgusted reactions are underlined.

VIGNETTE 1 (WEAK)

Albert was out with several friends, having dessert at a restaurant. He briefly left the table to go to the bathroom, and when he came back, he saw that one of his friends had put ketchup on his ice cream, which Albert had not finished eating. **Seeing this, Albert did not look very happy.** To make up for his prank, the friend who did it proceeded to eat the ice cream with the ketchup on it. At this point, Albert became somewhat amused but made a face and said "That's nasty, man."

VIGNETTE 2 (STRONG)

Albert's roommate managed to clog their toilet and proceeded to flush it multiple times, hoping it would unclog itself. However, the toilet ended up overflowing, sending dirty water all over the bathroom floor. As this was happening, the roommate ran out of the bathroom, clearly panicked. Albert came over to see what all the commotion was about, and as he realized what happened, he covered his nose with his shirt and quickly closed the bathroom door. The roommate seemed reluctant to start cleaning up and suggested they just leave it alone for several hours until maintenance gets there. **Incredulous, Albert yelled at the roommate, "Dude, you're the one that made this mess, so it's your job to clean it up!"**

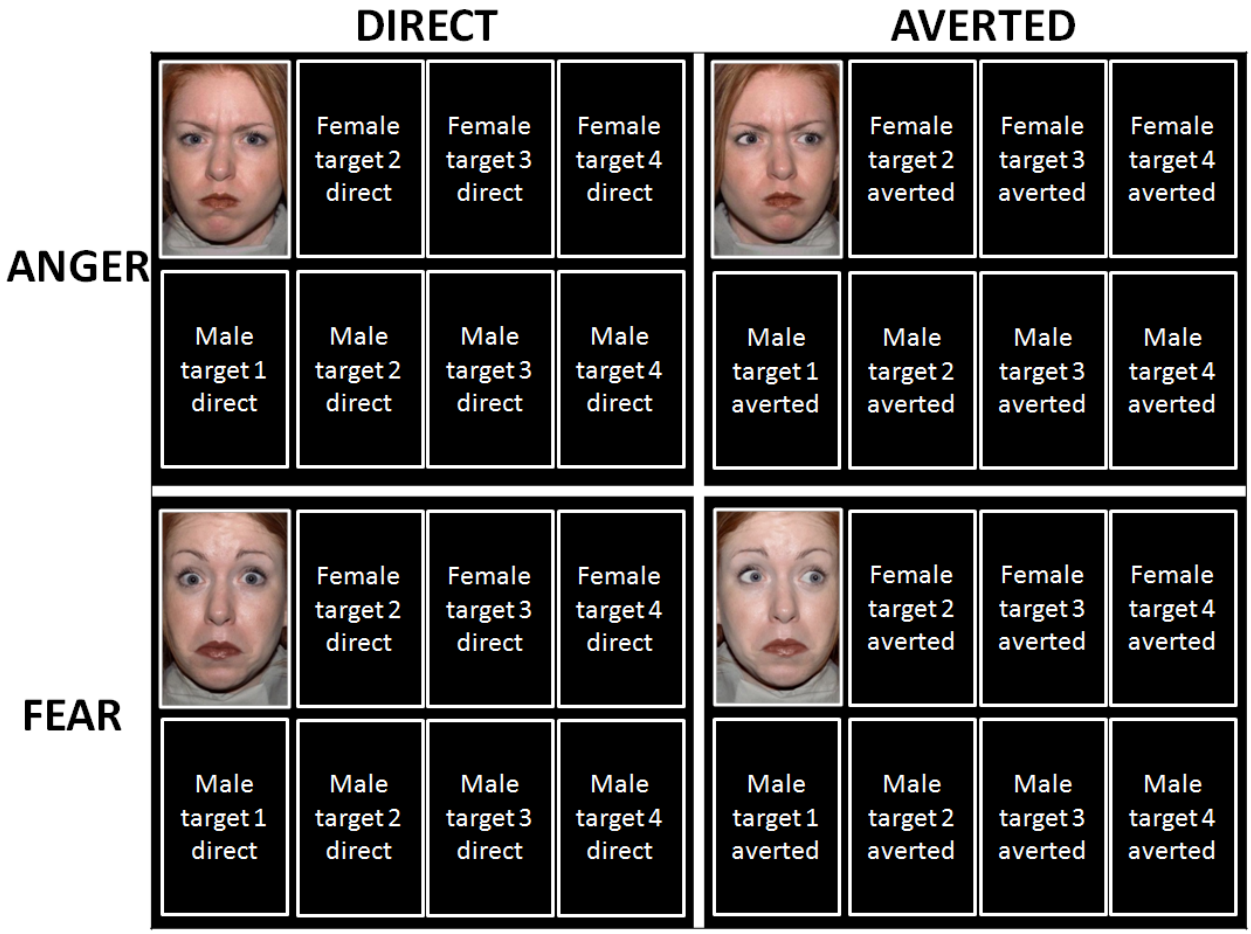
VIGNETTE 3 (WEAK)

Albert was at a party when a drunk, rowdy guy bumped into him and spilled beer all over his shirt. The guy was clearly not being careful or paying attention to his surroundings. **Albert yelled, "Hey, watch where you're going next time!" as the other guy started apologizing.** While cleaning himself up, Albert complained to one of his friends that his shirt smells awful, and eventually he went back to his dorm room to change.

VIGNETTE 4 (STRONG):

Albert ordered a chicken sandwich at a fast food restaurant. When he bit into it, he noticed that it was unusually chewy, and upon closer examination, it turned out that the chicken was almost raw on the inside. Recoiling, Albert spit out the sandwich, immediately grabbed his soda and gulped down half of it. He went back to the counter, explained what happened, and asked to speak to the manager. However, the manager seemed like he didn't care and even remarked that "a little bit of undercooked chicken won't kill you." **Albert got red in the face, raised his voice and told the manager that with that attitude, his restaurant will go out of business in no time. Albert then stormed out of the restaurant.**

**Appendix B:**
**Face Stimuli in Study 2**




*Note.* Each participant saw and rated all eight faces (one at a time) in one of the four quadrants. Only one of the eight models we used gave permission to publish her image. Her face as depicted here is a 90% blend of neutral and angry (top two images) or neutral and fearful (bottom two images) – that is, 10% less emotional than the original images in the Nimstim set. In the actual study, each target image was randomly selected to look 70%, 80%, or 90% angry or fearful.

For both the male and female targets, two of the models were White and two were Black. Although targets' ethnicity was not a consideration when the stimuli were selected, it may have played a role in the results, given stereotypes depicting Black men as dangerous. We therefore conducted additional analyses to determine whether the ethnicity of the target was responsible

for the trait anger effects reported in the paper, but found that this was not the case. We conducted a 2x2x2x2 repeated-measures ANOVA with trait ratings as the dependent measure. Emotion Type and Gaze condition were the between-subjects variables, and Target Sex and Target Ethnicity were the repeated measures within participants. There was a significant 3-way interaction of Emotion Type X Target Sex X Target Race, $F(1, 359) = 49.31$, $p < .001$. Pairwise comparisons revealed that this interaction was driven by White men's significantly lower rated Trait Fear ($M = 3.78$, $SD = 1.19$) relative to White women ($M = 5.20$, $SD = 1.11$, $F(1, 361) = 219.12$, $p < .001$) and relative to Black men ($M = 4.97$, $SD = 1.26$, $F(1, 361) = 149.79$, $p < .001$). No other contrasts within this 3-way interaction were significant (all $p$s $> .08$), and trait anger was not rated higher for Black men than for Black women, $F(1, 361) = .68$, $p = .41$, or for White men, $F(1, 361) = 1.16$, $p = .28$.

**Appendix C:**
**Sample Trial in Study 2**

Study this image briefly, answer the questions below, and then go on to the next page.

How angry does the person look in this picture?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| Not at all angry | | Somewhat angry | | Moderately angry | | Very angry | | Extremely angry |

Compared to the average person, how <u>often</u> do you think this person becomes angry in real life?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| Much less often than average | | Somewhat less often than average | | About average | | Somewhat more often than average | | Much more often than average |

Compared to the average person, how <u>quickly</u> do you think this person becomes angry in real life?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| Much less quickly than average | | Somewhat less quickly than average | | About average | | Somewhat more quickly than average | | Much more quickly than average |

Which of these images is the same one you just saw?

○ ○ ○ ○ ○ ○ ○

## Appendix D:
## Frame-Matching Task

As seen above in Appendix C, after viewing the single image and filling out all scale measures, on the next web page participants viewed an array of seven image blends of the same target individual which varied in the extremity of facial expression in 10% intervals, from 50% to 110%. Participants were asked to identify which image they had seen previously. Our intention was primarily to assess the face validity of this novel method for this and other research, and, secondarily, to use perceptual errors on this task to measure cognitive representations of the extremity of state anger/fear in each face. This variable could have been an alternative to scale state ratings, to be used as a control variable for Study 2, Predictions 1 and 2a. However, this exploratory measure did not correlate with either the state or trait ratings ($|rs| < .06$, $ps > .31$ for female targets; $|rs| < .05$, $ps > .34$ for male targets), indicating that it was not a face-valid measure of perceived state emotion.