Experiencing Discrimination Increases Risk Taking

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Abstract

Prior research has revealed racial disparities in health outcomes and more health-compromising behaviors, such as smoking and drug abuse. It has been suggested that discrimination may contribute to such disparities, but the mechanisms through which this occurs are not well understood. Here, we examined whether the experience of discrimination affects acute physiological stress responses and increases risk-taking behavior. Black and White participants received rejecting feedback from partners who were either the same race (in-group rejection) or a different race (out-group rejection/discrimination). Physiological (cardiovascular and neuroendocrine) changes, cognitive processes (memory and attentional bias), and risk-taking behavior were assessed. Significant participant-race by partner-race interactions were observed. Cross-race, compared to same-race, rejection was associated with lower cortisol, increased cardiac output, decreased vascular resistance, greater anger, and more risk-taking behavior. These data suggest distinct profiles of physiological reactivity, cognitive processing, and risk-taking in response to discrimination implicating direct and indirect pathways to health disparities.

Experiencing discrimination increases risk-taking

Being rejected is a powerful aversive experience. In the short-term it affects emotions, thoughts, and behavior (Williams, 2001), and in the long-term can influence physical (Cacioppo, Hawkley, & Berntson, 2003) and mental health (Williams, 2001). However, not all types of social rejection affect us similarly. Rejection by out-group members (persons from different social categories) can be interpreted as discrimination, which may set in motion a distinct set of attributions, emotions, and behaviors compared to when rejection comes from in-group members (Crocker, Voelkl, Testa, & Major, 1991; Mendes, Major, McCoy, & Blascovich, 2008). We explored the effects of in-group compared to out-group social rejection with two specific goals. The first goal was to measure the physiological consequences of in-group compared to out-group rejection. The second goal was to examine how rejection influenced risk-taking behavior with the prediction that because discrimination typically evokes anger and approach-motivation, out-group rejection would lead to more risk-taking relative to in-group rejection.

Several lines of research have examined the physiological consequences of discrimination in an attempt to understand health disparities between European- and African-Americans (Pascoe & Smart-Richman, 2009). In large scale epidemiological studies, for example, African-Americans tend to have higher resting blood pressure than their age-matched European-American counterparts (Krieger & Sidney, 1996), and Black and lower socioeconomic status adults, on average, have flatter (more dysregulated) diurnal cortisol cycles than Whites and higher socioeconomic status adults (Fuller-Rowell, Doan, & Eccles, 2011). Laboratory based studies have shown that participants who experience, view, or recall an episode of discrimination are angrier, exhibit a stronger cardiac reaction, and have a slower recovery profile than those not exposed to discrimination (e.g., Guyll, Matthews, & Bromberger, 2001; Mendes et al., 2008).

However, the data on acute responses to discrimination are not always straightforward, with some studies showing inconclusive results (e.g., Brondolo, Rieppi, Kelly, & Gerin, 2003). Even less consistent are the studies attempting to link experiences of discrimination with HPA activation, specifically cortisol responses. For example, in the Fuller-Rowell study cited above, African-Americans who perceived more discrimination had *healthier* diurnal cortisol cycles than those who perceived less discrimination.

There is certainly reason to speculate that discrimination would acutely activate the HPA system – one of two primary stress systems. For example, non-human primate studies find that in stable hierarchies subordinate compared to dominant baboons exhibit greater HPA reactivity, higher basal cortisol levels, and impaired sensitivity of the HPA to negative feedback regulation (Sapolsky, 1982). In humans, HPA activation has been linked to loss of social standing (Mehta, Jones, & Josephs, 2008), negative social feedback (Koslov, Mendes, Patjas, & Pizzagalli, 2011), and with feelings of shame (Dickerson & Kemeny, 2004). Indeed, in a meta-analysis of cortisol reactivity the situational factors most consistently linked to cortisol increases were situations when "an important aspect of the self-identity is or could be negatively judged by others" (Dickerson & Kemeny, 2004, p. 358).

Sapolsky's baboon research and the cortisol meta-analysis suggest that perceptions and experiences of discrimination might activate the HPA, which may be implicated in the observed racial health disparities; however, we view this perspective as tenuous. For one, though rejection clearly engenders feelings of shame, discrimination based on uncontrollable factors (e.g., race) typically does not elicit shame but rather anger (Gibbons, Etcheverry, Stock, Gerrard, Weng, et al., 2010; Smart-Richman & Leary, 2009). At a neurobiological level, although shame might activate HPA responses (Dickerson & Kemeny, 2004) anger tends to elicit activation of the

sympathetic adrenal-medullary axis (SAM) (Stemmler, 2004). Though these two systems (HPA and SAM) are relatively independent, increases in cortisol tend to be associated with reduced sympathetic nervous system activity (Golczynska, Lenders, & Goldstein, 1995; Pavcovich & Valentino, 1997).

Secondly, previous data suggest that an acute experience of out-group rejection (i.e., discrimination) is associated with increased cardiac activity (specifically cardiac output) and a decline in vasculature resistance (the primary determinant of blood pressure) – a profile of responses linked to *challenge* states (Mendes, et al., 2008). In contrast, same-race rejection was associated with lower cardiac output (less cardiac efficiency) and an increase in vasculature resistance – a profile of responses linked to *threat* states. Though these cardiovascular profiles are not perfect proxies for neuroendocrine activity, theoretically the *threat* pattern is more likely to be associated with cortisol increases than the *challenge* pattern. Therefore, we anticipated that social rejection from same-race compared to cross-race partners would activate the HPA, increase feelings of shame, and show cognitive consequences of HPA activation, like impaired short term memory.

The second goal of this work was to examine how discrimination influences behavior, specifically risk-taking. A large corpus of research on racial health disparities suggests African-Americans exhibit worse health outcomes and engage in riskier behaviors, such as substance abuse, overeating, and smoking, compared to their European-American counterparts (e.g., Gibbons, Gerrard, Cleveland, Wills, & Brody, 2004; Hertz, Unger, Cornell, & Saunders, 2005; Williams, Neighbors, & Jackson, 2008). For instance, in a longitudinal study African-American adolescents' self-reported experiences of discrimination predicted their substance use over time, and this relation was mediated by anger (and reduced self-control) (Gibbons et al., 2010). In a

complementary lab study, imagining an experience of discrimination increased the accessibility of words associated with substance use. And again, anger mediated this effect.

Anger may be an especially important emotion when examining behaviors associated with risk-taking. For example, dispositionally angry people and those made angry via writing vignettes express optimistic risk estimates and choose riskier options compared to fearful individuals (Lerner & Keltner, 2001). Furthermore, approach motivation resulting from the experience of anger can lead to performance improvements (Lerner & Tiedens, 2006). In the race-rejection study cited above (Mendes, et al., 2008), participants who experienced out-group rejection (i.e., discrimination) showed more anger and performed *better* on a word-finding task compared to participants receiving in-group rejection, indicating more approach-oriented behavior.

In the current study, we examined the effects of in-group and out-group social rejection on physiological reactivity, cognitive and affective outcomes, and risk-taking. We anticipated that in-group compared to out-group rejection would be associated with larger cortisol increases, *threat* reactivity, and memory impairments, whereas out-group, relative to in-group, rejection would be associated with more approach/challenge responses, expressed anger, greater vigilance for danger, and more risk-taking behavior.

To test predictions, we induced social rejection by giving participants negative feedback during a computer interaction task. We manipulated whether Black and White participants thought they were interacting with same- or different-race partners and all participants received rejecting social feedback. Immediately after the interaction, participants completed cognitive tasks and a risk-behavior measure. Cortisol and cardiovascular reactivity were measured throughout the study and we coded behavior for displays of anger and shame.

Method

Participants

Ninety-one participants (55% females; 49 Caucasian, 42 African-American; 50 students, 41 community members; race and student status were unrelated [$p > .50$]) were recruited from the Cambridge, MA area and were compensated two credit-hours or $30. Participants ($M_{age}$ = 24.11 years, SD = 6.11; range 18-39) were excluded for hypertension, pacemakers, cardiac medications, and/or pregnancy.

Procedure

Upon arrival participants provided consent, completed an initial memory task, and then selected one of six avatars from their race/sex category to represent them during the study (Figure 1). The experimenter collected the first saliva sample, attached sensors and the participants relaxed for a 5-min baseline. After, the experimenter explained that the study examined "how the nature of communication has changed now that our social lives are increasingly moving online." Participants were told that two other participants in different rooms were also completing the study and they would be communicating via a "chat" (Gmail) program. The partners' responses were controlled by research assistants in an adjacent room. The "partners" were always the same-sex as the participant, but partner race was manipulated via their avatars, which were depicted as either Black or White individuals based on random assignment.

At this point the experimenter explained that two of the individuals would give 5-min speeches about their strengths and weaknesses followed by four 2-min discussions about their opinions regarding various topics while the non-speech-giving participants listened and provided feedback via the chat program. The experimenter further indicated that the participant not chosen

to speak would be the moderator, whose role it was to choose who spoke first and to score performances. Fictitious Participant #3 was always "randomly selected" to be the moderator, and the moderator always chose Participant #2 – the actual participant – to speak first.

The participants had 3-min to prepare and then were instructed to begin. Throughout the speech participants received rejecting feedback via the chat program. We developed a list of negative statements that were typed in real-time, but also in the interest of believability we tailored comments to be responsive to the content of participants' speeches (e.g., "Someone's a little high on themselves" when the participant said something positive about themselves; Figure 1). After the speech, participants completed attribution questionnaires. Next, the "partners" selected current event "hot topics" for the participant to discuss (e.g., "Are big box stores like Walmart good or bad for a community?"). The topics appeared in the chat program one at a time and the participant was instructed to discuss the topic identified for two-minutes until a new topic appeared. Again, negative feedback was typed in real time, presumably from the partners, which questioned the rationale of the argument, the quality of the participant's speaking style, and the persuasiveness of the participant's speech.

When the speech and discussion-topics were completed, participants provided the second saliva sample (20-min after speech onset), and the experimenter explained that all participants would perform a set of cognitive tasks before Participant #1 began his/her speech. At this point, participants completed the delayed recall measure, emotional Stroop (to measure vigilance), and Columbia Card Task (in fixed order) followed by the final saliva sample (40-min after speech onset). The experimenter then informed participants that the study was over, probed for suspicion, and fully debriefed them.

Measures

Additional detail can be found in the supplementary online material.

Cardiovascular reactivity. Electrocardiography (ECG) and impedance cardiography (ICG) signals were collected, and reactivity scores were computed by subtracting responses from the final baseline minute (the "most relaxed" period) from those collected during the first minute of the speech and discussion tasks (the "most reactive" period). Analyses focused on two measures that best distinguish approach (challenge) and inhibitional (threat) states: cardiac output (CO) and total peripheral resistance (TPR) (Mendes, 2009).

Neuroendocrine reactivity. Participants provided 1 ml saliva samples three times. Reactivity scores were computed by subtracting cortisol levels after the speech and recovery from those measured at baseline.

Affective displays. Three female research assistants (two White, one bi-racial African-American/White) unaware of the partners' race coded the videotaped speech and discussion topics. Coding categories were developed to determine the level of observable *anger/approach* and *shame/withdrawal* behavior. Inter-rater reliability was good to excellent (αs .75 to .89). Three items were used to compute the anger and shame composites. The anger composite included how hostile and tense participants appeared and "general anger behavior" (α =.72). The shame composite included measures of disengagement, how apologetic participants were, and "general shame behavior" (α =.81).

Recall memory. Delayed recall was measured by having participants freely recall a story (Wechsler Memory Scale WMS-III) they were read at the beginning of the experiment after the rejection manipulation (timed to be 1-hour after the initial reading). Responses for details and themes were coded.

Attentional bias. An emotional Stroop task (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002) measured vigilance for emotionally-negative information. Participants were asked to name the font color (red, green, or blue) of words as quickly and accurately as possible. Words were presented in two lists (a negative and a neutral list) of 100. An experimenter unaware of condition assignment recorded errors and how long it took participants to read each list. Interference scores were computed by subtracting the time it took participants to read the neutral list from their time on the negative list.

Risk task. Participants completed the Columbia Card Task (CCT) (Figner, Mackinlay, Wilkening, & Weber, 2009), a computerized card game that has been validated as a measure of risk-taking. In this task, participants earned points by turning over as many gain cards as possible without turning over a loss card. The task manipulates probability of loss, amount of loss, and amount of gain by independently randomizing these pieces of information over 24 trials. If a loss card was chosen, the loss amount was subtracted from their score, and the trial ended. Because the loss cards represent an artificial ceiling on behavior, the number of cards turned over on non-loss trials was analyzed. Risk was operationalized as the greater number of cards turned over during non-loss trials.

Data analysis

Due to computer problems, two participants' cardiovascular data and eight participants' risk data were lost. Additionally, two colorblind participants did not complete the Stroop. Data were analyzed in 2 (Participant race: White or Black) x 2 (Partners' Race: White or Black) ANCOVAs with the race variables as between-subjects factors and sex as a covariate. We predicted that participants' and partners' race would interact such that cross-race interactions would differ from same-race interactions. When we observed interactions without race main

effects, in the interest of space and interpretability, we present means by same- and cross-race conditions.

Results

Physiological reactivity

Cardiovascular responses. ANCOVAs examining CO reactivity during the two tasks yielded no main effects, but significant interactions, Speech: $F(1,84) = 4.32$, $p = .041$, $d = .45$; Discussion: $F(1,84) = 4.56$, $p = .036$, $d = .47$. Participants rejected by different race partners (Whites rejected by Black partners; Blacks rejected by White partners) exhibited larger CO increases relative to participants rejected by same-race partners (Figure 2a). Analysis of TPR reactivity also produced significant interactions, Speech: $F(1,84) = 6.26$, $p = .014$, $d = .55$, Discussion: $F(1,84) = 8.19$, $p = .005$, $d = .63$. Again, cross-race rejection participants exhibited significantly *lower* TPR reactivity versus same-race rejection participants (Figure 2b). Taken together, out-group rejection was associated with lower TPR and greater CO reactivity than in-group rejection indicating a *challenge/approach* pattern of physiological responding to discrimination.

Neuroendocrine reactivity. We then examined cortisol changes as a function of participant and partners' race. Again, there was a significant interaction, $F(1,86) = 4.51$, $p = .037$, $d = .46$. Participants rejected by in-group members had significantly greater increases in cortisol after the interaction tasks compared to participants receiving out-group rejection (Figure 2c). This effect persisted, albeit with smaller effect sizes and a non-significant difference, into the recovery period, $F(1,86) = 2.72$, $p = .10$, $d = .36$.

Affective Displays

Displays of anger and shame were analyzed in a 2 (Emotion: anger vs. shame) x 2 (Participant Race) x 2 (Partners' Race) mixed ANOVA with emotion type as a within-subjects variable. This analyses produced a significant 3-way interaction, $F(1,86) = 7.30$, $p = .008$, $d = .58$, that we deconstructed by emotion (Figure 3).

As predicted, the anger index produced a significant interaction, $F(1,86) = 5.64$, $p = .020$, $d = .51$. Consistent with our predictions, cross-race rejection led to more observed anger than did same-race rejection. Analysis of shame displays produced a significant main effect for participant race, White participants displayed more shame than Black participants, $F(1,86) = 6.45$, $p = .013$, $d = .55$, and an interaction trend, $F(1,86) = 2.61$, $p = .109$, $d = .35$. We had predicted that same-race rejection would be associated with more shame behavior than cross-race rejection. Using simple contrasts, consistent with the prediction Black participants exhibited more displays of shame when rejected by same-race ($M = .86$, $SD = .29$) versus cross-race ($M = .64$, $SD = .28$) partners, $F(1,86) = 4.10$, $p = .046$, $d = .44$, but White participants exhibited no differences as a function of partners' race, $F < 1$ (overall $M = .97$, $SD = .43$).

WMS recall

Analysis of story recall yielded no main effects but a marginal interaction, $F(1,86) = 3.41$, $p = .07$ $d = .40$. Participants rejected by same-race partners recalled marginally less story content ($M = 16.49$, $SD = 5.37$) than their cross-race rejection counterparts ($M = 18.41$, $SD = 5.36$). This pattern is consistent with previous findings showing that increases in cortisol affect low affinity receptors in the hippocampus impairing memory (e.g., Sapolsky, 1996; Lovallo & Thomas, 2000). Indeed, cortisol reactivity at time 3 was correlated with worse recall, $\beta = -.21$, $p = .043$.

Attentional bias

Performance on the emotional Stroop task yielded a significant interaction, $F(1,84) = 4.05$, $p = .047$, $d = .44$. Consistent with the idea that discrimination may engender more vigilance, cross-race rejection was associated with greater attentional bias ($M = 2.54$, $SD = 6.52$) compared to those rejected by in-group members ($M = -0.52$, $SD = 7.12$). Thus, being rejected by out-group partners increased vigilance for emotionally-negative information as demonstrated by greater attentional capture for emotionally-negative words. Furthermore, this finding cannot be attributed to a speed-accuracy tradeoff as neither participant nor partner race impacted error rates on either list (negative list $M = 0.80$, $SD = 0.93$; neutral list $M = 0.91$, $SD = 0.97$), ps > .20.

Risk taking

We expected that cross-race rejection, which was associated with more approach/challenge responses, would be associated with increased risk-taking relative to same-race rejection. To test this hypothesis, we analyzed the mean number of cards participants turned over on the CCT. This analysis produced an interaction, $F(1,78) = 4.93$, $p = .029$, $d = .50$. Participants rejected by cross-race partners were riskier (i.e. turned over more cards) ($M = 12.06$, $SD = 4.87$) than those rejected by same-race partners ($M = 10.18$, $SD = 3.37$).

To further explore the processes underlying risk-taking, we regressed the number of cards participants turned over on the cost/reward information (loss amount, loss number, and gain amount) nested within participants. We then examined which piece(s) of information influenced decisions. For ease, data are organized by same-race and cross-race rejection groups.

Same-race rejection. Participants rejected by same-race partners turned over fewer cards when there were more loss cards in the array (3 vs. 1), $\beta = -.42$, $p < .001$, and when the loss amount (-750 vs. -250) was higher, $\beta = -.18$, $p = .002$. Differences in gain amount did not significantly influence decisions, $\beta = .08$, $p = .23$.

Cross-race rejection. Similar to those rejected by same-race partners, participants rejected by cross-race partners turned over fewer cards when loss probability, $\beta = -.39$, $p < .001$, and loss amount were higher, $\beta = -.15$, $p = .012$. Unlike the same-race rejection, however, the gain amount was associated with increased risk behavior, $\beta = .15$, $p = .012$. When cards were of higher value, participants who experienced cross-race rejection were riskier (i.e., turned over more cards). Compared to same-race rejection participants, those who were rejected by cross-race partners were more sensitive to rewards (gain amount), $Z = 1.95$, $p = .051$, but the type of rejection had no impact on attention to costs (loss amount or loss number), ps > .24 (Meng, Rosenthal, & Rubin, 1989). Thus, cross-race rejection participants took more risks than same-race rejection participants and also exhibited increased reward sensitivity.

Discussion

There are three noteworthy findings from this work. First, cross-race compared to same-race rejection elicited a distinct profile of physiological reactivity, specifically lower cortisol reactivity, larger increases in cardiac output, and decreased vascular resistance. Observers unaware of partners' race coded more anger behavior following cross-race rejection compared to same-race rejection. These findings are consistent with intergroup and discrimination research highlighting that anger, not shame, is the dominant emotional response following perceptions and experiences of racial bias. Second, we show that reactions to cross-race rejection, compared to same-race, extend to cognitive processes like attentional bias and *better* memory. The latter finding is consistent with decades of research showing that cortisol increases can impair memory, and we observed significantly greater cortisol increases in same-race compared to cross-race rejection. Finally, cross-race versus same-race rejection led to increased risk-taking behavior. As an ancillary analysis, cross-race rejection was associated with greater reward

sensitivity, and these effects were at least partially mediated by the changes in CV reactivity (see supplemental online material for details). Consistent with previous work (e.g., Gibbons et al., 2010), this research shows that experiences of discrimination not only increase individuals' willingness to take risks but also can directly lead to risky behavior.

Cross-race rejection increased vigilance for emotionally-negative information. Functionally, vigilance facilitates the detection of danger and helps individuals respond effectively to stressors. However, attentional vigilance increases the likelihood that once discrimination is perceived, individuals may then experience increased sensitivity to threat cues, which in some cases may be adaptive but in others may lead to "false alarms" or detection of bias during ambiguous situations (Wang, Leu, & Shoda, in press). Considering that a bias for emotionally-negative information maintains feelings of anxiety and is linked to a host of clinical conditions (e.g., Mathews & MacLeod, 2002; McNally, et al., 1994), future research might consider the mental health consequences of vigilance resulting from perceptions of discrimination. Taken together, the data are consistent with the idea that out-group social rejection may influence physiological responses, behavior, and cognition.

It might seem surprising that social rejection affected physiological responses without any face-to-face interaction but rather with only minimal computer interaction. These findings are potentially important as our social lives are increasingly moving online with the popularity of social networking outlets like Facebook, Twitter, and Google+. One might think that instances of social rejection online (e.g. cyber-bullying) might be less potent than receiving the same feedback face-to-face. However, in this research rejection over a chat program produced similar patterns of physiological reactivity as are observed in face-to-face situations of negative evaluation (e.g., Mendes, et al., 2008). Because computers provide users with a degree of

anonymity, online negative feedback might be more frequent. This typically-anonymous feedback might be more vitriolic than what would be expected if the commentators were accountable for their feedback, as would be the case in a direct, face-to-face interaction. Thus, seemingly innocuous negative comments can potentially have deleterious effects for targets whether the feedback is given over a computer or during "real world" interactions.

It is important to not overlook the findings of same-race rejection, which were associated with distinct physiological and cognitive profiles. Participants rejected by members of their own race exhibited greater cortisol increases, less efficient cardiac output, increased vascular resistance, and impaired memory recall. From a physiological perspective this pattern of reactivity has been linked to accelerated "brain aging," cognitive decline, and early risk of Alzheimer's disease (Jefferson, et al, 2010). Thus, this research suggests that the attributions one makes for social rejection (self-blame or other-blame) might trigger different physiological pathways and possibly, over time, different diseases (Leventhal & Patrick-Miller, 2000). An important avenue for future research might be to examine the contexts, stigmas, and populations that are more likely to experience in-group compared to out-group rejection and how these responses differentially influence pathways to behaviors and mental and physical health outcomes.

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* denotes that the reference is cited in the supplementary online material

Figure 1. The top portion of the figure shows avatar examples for Black male participants and White female participants. The bottom portion shows an example of Black male interaction partners' chat program feedback during a participant's speech.

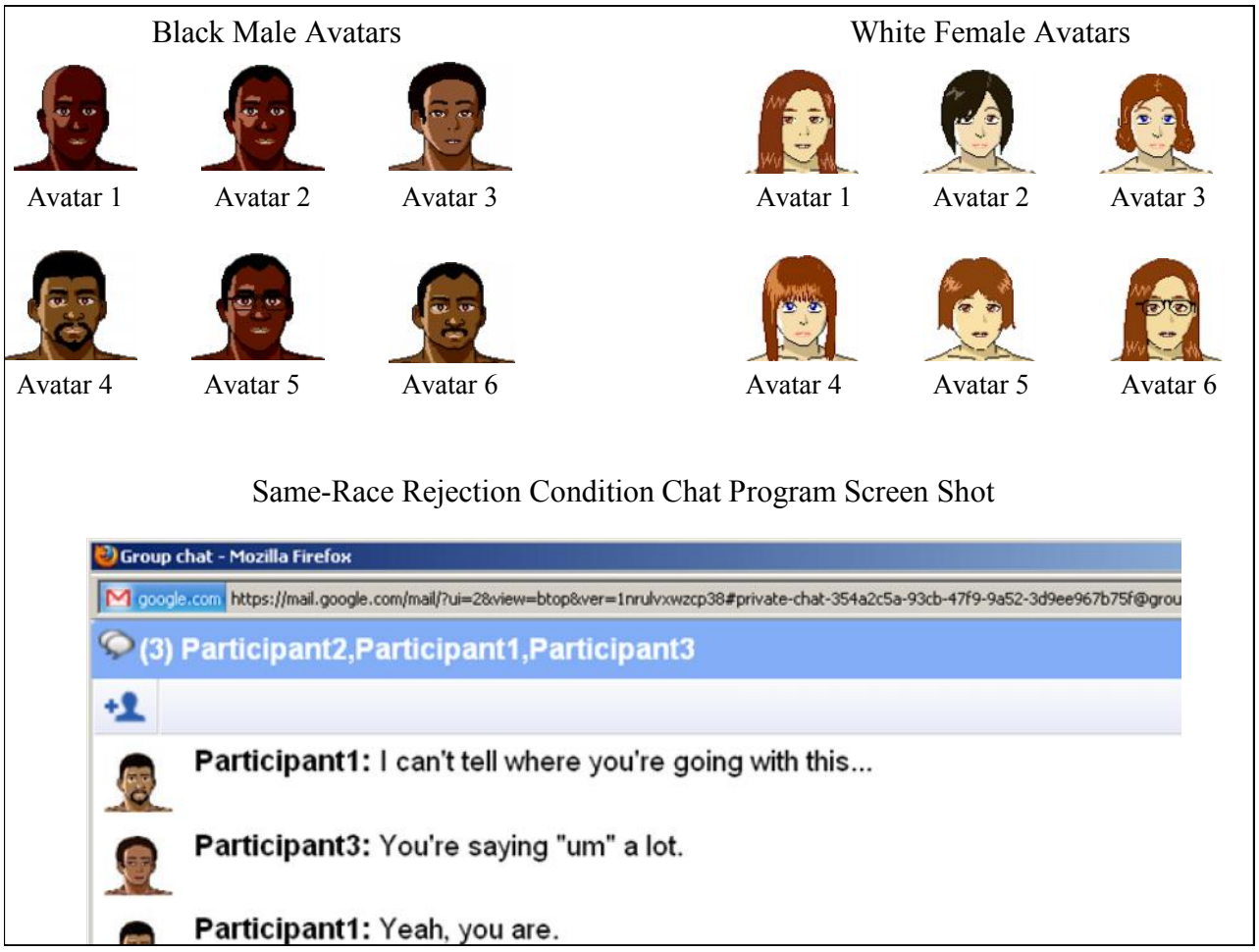


Figure 2. Physiological reactivity as a function of same-race versus cross-race partner rejection. Figure 2A: Cardiac output reactivity from the speech and discussion task; Figure 2B: TPR reactivity from speech and discussion task. Figure 2C: Cortisol reactivity from immediately following the speech/discussion task, and then 20 minutes later.

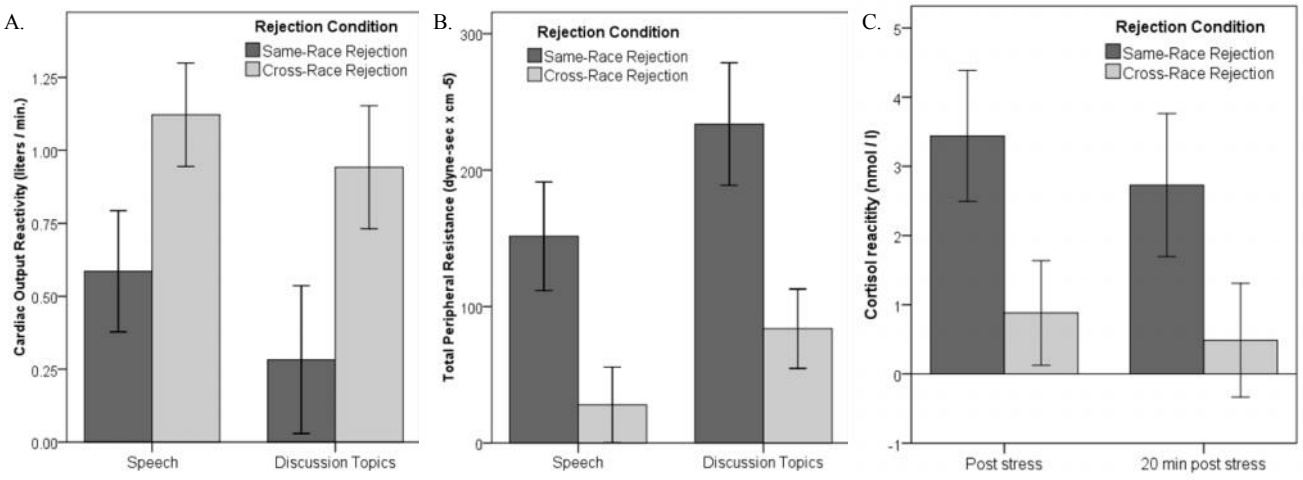
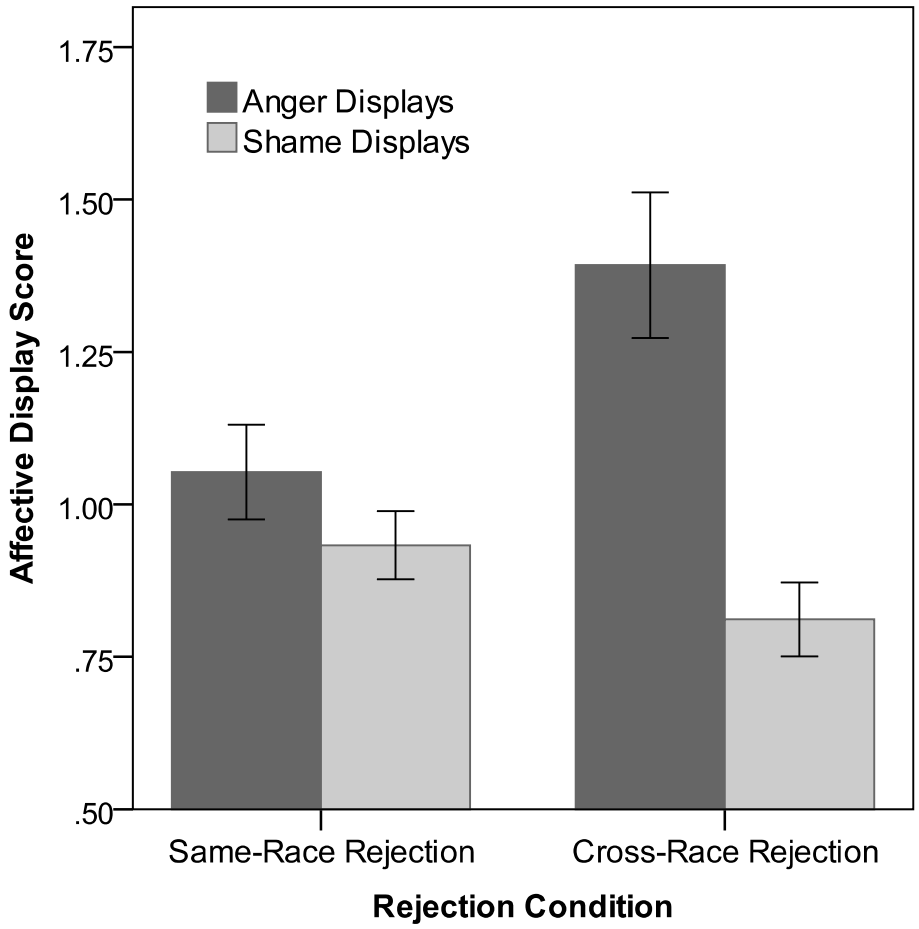


Figure 3. Anger and shame displays during the speech and discussion tasks as a function of same-race versus cross-race rejection.



Supplemental Method

Measures

Cardiovascular reactivity. We obtained cardiovascular responses using electrocardiography (ECG, Biopac, Goleta, CA), impedance cardiography (NICO, Biopac, Goleta, CA), and blood pressure (Colin Prodigy II, San Antonio, TX). ECG and ICG signals were integrated with Biopac hardware. Data were scored off-line by trained personnel. Signals were visually examined and the ensembled averages were analyzed using Mindware software (Gahanna, OH). Reactivity scores were computed by subtracting responses from the final baseline minute from those collected during the first minute of the speech and discussion topics so as to capture the "most relaxed" part of baseline and the "most reactive" parts of the evaluative tasks. Analyses focused on two measures that best distinguish activational (challenge) and inhibitional (threat) states: cardiac output (CO) and total peripheral resistance (TPR) (Mendes, et al., 2008).

Neuroendocrine reactivity. Participants provided 1 ml saliva samples at baseline after 30 minutes of acclimation to the lab and then again 20-min and 40-min post stress initiation. Samples were stored at least at −30° C until they were shipped overnight on dry ice to Dresden, Germany where they were assayed for salivary free cortisol using commercial immunoassay kits (IBL, Hamburg, Germany). Intra- and interassay coefficients were less than 10%. Reactivity scores were computed by subtracting cortisol levels at times 2 and 3 from those measured at time 1.

Attentional bias. An emotional Stroop task (MacLeod et al., 2002) was used to measure vigilance for emotionally-negative information. Participants were asked to name the color (red, green, or blue) words were printed in as quickly and accurately as possible. Words were

presented in two lists of 100. The "negative" list consisted entirely of emotionally-negative words, whereas the "neutral" list consisted of emotionally-neutral words. Words were sampled from the Stimulus Pairs list from MacLeod et al. (2002, Appendix A). This enabled us to match the words in each list for length and frequency of usage. List order was counterbalanced and participants completed a practice list (10 negative and 10 neutral words) before beginning. An experimenter unaware of condition assignment recorded errors and how long it took participants to read each list. Interference scores were computed by subtracting the time it took participants to read the neutral list from their time on the negative list.

Risk task. We assessed risk-taking with the Columbia Card Task (CCT) (Figner et al., 2009), which manipulates probability of loss, amount of loss, and amount of gain. Participants completed 24 CCT trials, each of which began with an array of 32 cards. The number of loss cards in the array (1 or 3), the amount of loss points (-250 or -750), and the amount of gain points (10 or 30) were displayed during each trial. These pieces of information were independently randomized trial-to-trial. Participants earned points by turning over as many gain cards as possible without turning over a loss card. If a loss card was chosen, the loss amount was subtracted from their score and the trial ended and a new trial began. Because the loss cards represent an artificial ceiling on choice behavior, the number of cards turned over on non-loss trials was analyzed. Participants completed 4 practice trials prior to beginning. To increase engagement, participants were told they could receive a $5 bonus if their score exceeded an unspecified threshold (everyone received the bonus). Participants were instructed that their final score would be based on 3 random trials so as to discourage "chasing" – increasing risk after loss.

Questionnaires. An attribution questionnaire given after the speech and discussion topics assessed perceptions of bias (e.g., "Participant 1 [or 3] had a bias against me"). All items were scored on a 1 (strongly disagree) to 7 (strongly agree) scale. To analyze perceptions of discrimination (i.e., bias), we first averaged partner ratings ($\alpha = .82$) and then combined across the two time points ($\alpha = .76$) for an overall composite.

Supplemental Results

Attributions of rejection

Analysis of perceptions of bias produced a main effect for partners' race, F (1, 86) = 9.08, $p = .003$, $d = .65$. Participants rejected by White partners perceived the rejection to be based on their partners' biases ($M = 3.71$, $SD = 1.38$) more so than participants rejected by Black partners ($M = 2.99$, $SD = 1.48$).

Cardiovascular reactivity

We plotted CV responses separately by participants' and partners' race for CO and TPR reactivity (Figure S1A-S1D). In addition to the main analyses we examined cardiac output and total peripheral resistance reactivity across the entire discussion task. As participants were confronted with a new question each 2-min, we construe these CV responses as reactions to a "new" task. Indeed, for all four discussion topics the interaction between participant race and partner race was significant. In a repeated measures ANOVA, CO reactivity yielded a significant participant by partner race interaction, F (1, 83) = 10.46, $p < .002$, and no main effects or interactions with time. Similarly, TPR reactivity yielded a significant participant by partner race interaction, F (1, 83) = 12.43, $p < .001$, and no effects or interactions with time. Taken together these analyses suggest that same race rejection was associated with more threat reactivity

whereas cross race rejection was associated with more challenge/approach reactivity and these effects were stable over the 8 minutes of the discussion task.

Neuroendocrine reactivity

We observed a main effect for participants' race for cortisol reactivity, F (1, 86) = 4.40, p < .04, such that White participants had a larger cortisol reactivity than Black participants, but this effect was qualified by the participant by partner race interaction (Figure S2E). We followed these analyses with targeted simple effects tests within participant race and observed significant effects for partners' race. Among Black participants, cortisol reactivity was significantly greater when paired with Black partners (M = 1.65, SD = 5.90) than when paired with White partners (M = 0.20, SD = 4.95), F (1, 86) = 4.15, p < .05. Similarly among White participants, cortisol reactivity was significantly greater when paired with same race (White) partners (M = 5.01, SD = 6.43) than when interacting with Black partners (M = 1.46, SD = 5.31), F (1, 86) = 4.56, p < .04. There were no main effects for cortisol recovery and the interaction was not significant (p < .11)/

Mediators linking discrimination to risk taking

We designed the study to allow us to explore candidate mechanisms linking outgroup rejection to increased risk-taking; specifically, we examined physiological mediators (CV reactivity and cortisol), memory and vigilance. Though all of these outcomes were related to cross race rejection, as predicted, the only response that mediated the link between rejection and risk-taking was CV reactivity. To explore this effect, we first computed a cardiovascular index by taking a composite of Z-scored CO and reverse Z-scored TPR reactivity across the speech and discussion topics, such that higher values corresponded to an increase in approach-oriented physiological responding (Kassam, Koslov, & Mendes, 2009). Then, we conducted a mediation analysis on attention for rewards (the beta weights for gain amount) (Kenny, Kashy, & Bolger,

1998). CV reactivity partially mediated the association between type of rejection (cross- vs. same-race) and attention for rewards, Goodman $Z = 1.97$, $p = .049$ (Figure S2). Thus more activational patterns of physiological reactivity were associated with increased reward sensitivity.

However, given that we tested all outcomes (memory, attentional bias, cortisol, and CV reactivity) as possible mediators and we only observed meditational support for CV reactivity we should consider these analyses preliminary and we did not adjust our *p*-level for multiple tests. The more conservative *p*-value given our multiple tests would be .0125 in which case these results would not be significant. Thus, caution should be used when interpreting these effects.

Figure S1. Physiological reactivity from stress tasks by participants' and partners' race. Figure S1A. Mean cardiac output (CO) reactivity from the speech task; Figure S1B. Mean cardiac output (CO) reactivity from the discussion task; Figure S1C. Mean total peripheral resistance (TPR) reactivity from the speech task; Figure S1D. Mean total peripheral resistance (TPR) reactivity from the discussion task; Figure S1E. Mean cortisol reactivity following stress tasks; Figure S1F. Mean cortisol reactivity 20 minutes after the stressor (recovery).

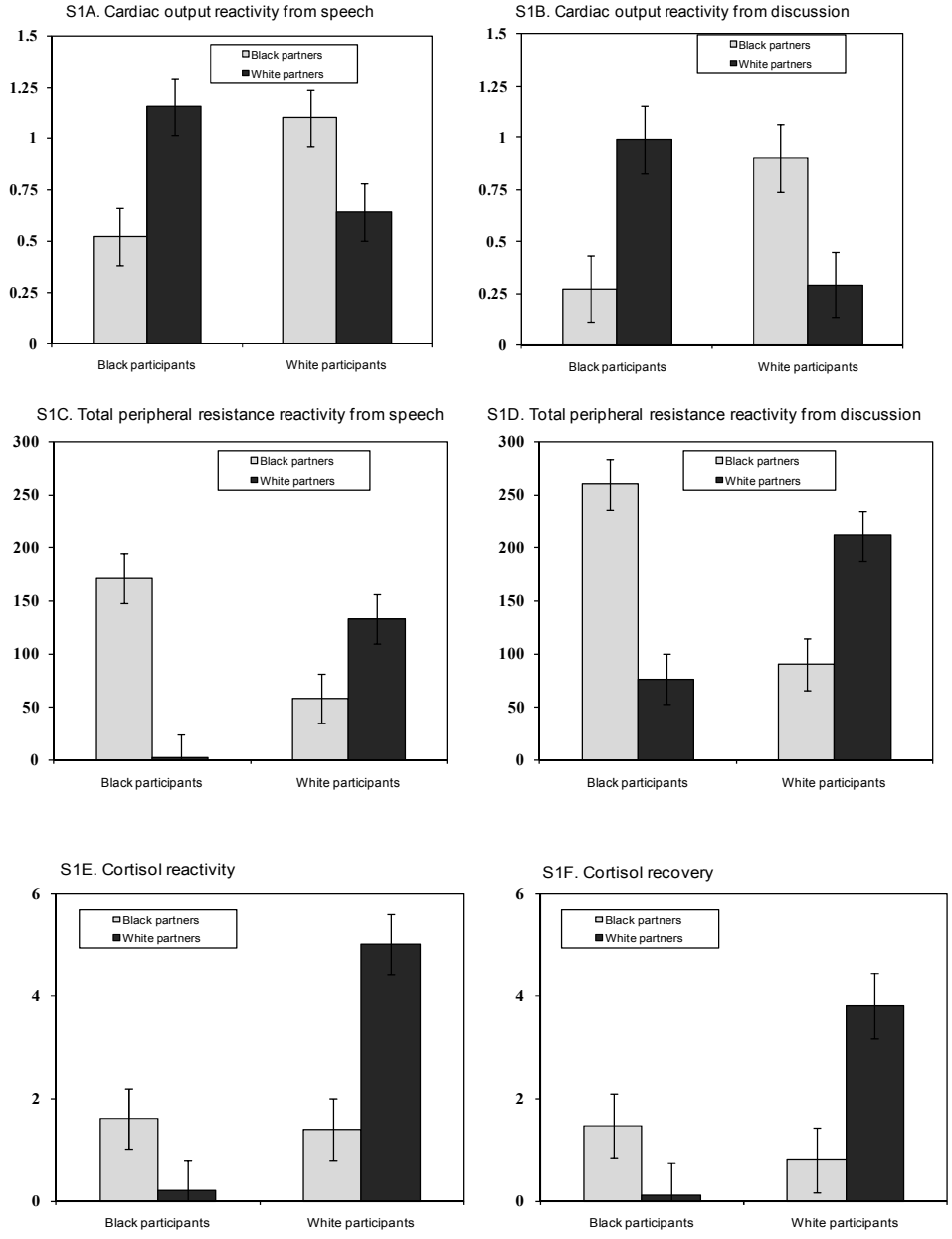


Figure S2. Meditational test of cardiovascular reactivity linking rejection condition to attention to reward information during the CCT.