Intergroup Contact and Implicit Racial Attitudes: Contact is Related to Less Activation of
Biased Evaluations but is Unrelated to Bias Inhibition

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Abstract

Two preregistered studies examined whether, why, and for whom intergroup contact is associated with more egalitarian implicit racial attitudes. Performance on implicit attitude measures depends on both the activation of group-relevant evaluations (e.g., positive ingroup and negative outgroup evaluations) and the inhibition of those evaluations. We used the Quad model to estimate the contributions of spontaneous evaluation and inhibition processes in the race attitude Implicit Association Test. In large samples of White and Black Americans (total $N = 10,000$), we tested which cognitive processes were related to respondents' contact experiences and whether respondent race moderated these relationships. Results showed that intergroup contact was associated with less activation of both negative outgroup evaluations and positive ingroup evaluations, but not with the inhibition of those evaluations. Respondent race did not moderate these associations. Our findings help explain the cognitive processes by which contact experiences improve implicit attitudes in minority and majority groups.

Keywords: implicit cognition, intergroup contact, implicit bias, Implicit Association Test, Quadruple Process Model

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The contact hypothesis (Allport, 1954)—which proposes that positive interactions between groups reduce prejudice—has accumulated over 60 years of longitudinal (Swart et al., 2011), experimental (Page-Gould et al., 2008), and meta-analytic (Pettigrew & Tropp, 2006) evidence. This makes it one of the most promising interventions to reduce prejudice (Paluck & Green, 2009). Narrative (Brown & Hewstone, 2005; Pettigrew, 1998) and meta-analytic (Pettigrew & Tropp, 2006, 2008) reviews have also detailed when and why contact reduces prejudice. Most studies, however, have investigated how contact improves majority-group members' explicit attitudes. Instead, we examine whether intergroup contact predicts *implicit* attitudes, which cognitive processes underlie that relationship, and whether that relationship differs between majority- and minority-group members.

Explicit measures ask people to directly report their attitudes. However, people are sometimes unwilling to report their attitudes about socially-sensitive topics (Fazio et al., 1995). To address this issue, implicit measures have been developed to indirectly infer attitudes from the speed and/or accuracy of people's responses, rather than the contents of responses alone. Because responses on implicit measures are difficult to fake, they can be interpreted as assessing attitudes less influenced by social desirability or self-presentation motivations (Banse et al., 2001; Kim, 2003). Few studies on intergroup contact have used both explicit and implicit measures to measure intergroup attitudes. Some of these studies suggest that contact is associated with more favorable implicit attitudes (e.g., Aberson & Gaffney, 2009; Dasgupta & Rivera, 2008; Keith et al., 2015; MacInnis et al., 2017; Turner et al., 2007). For example, among White university freshmen, those who were randomly assigned to Black roommates had more favourable implicit outgroup attitudes after a semester than those assigned to White roommates (Shook & Fazio, 2008). Similarly, non-Black physicians' quality of contact with Black people during medical school predicted

less implicit bias two years later (Onyeador et al., 2020). These studies did not, however, investigate the psychological mechanisms underlying the link between intergroup contact and implicit attitudes.

Intergroup contact may improve intergroup attitudes by reducing biased evaluations, that is, positive ingroup evaluations, negative outgroup evaluations, or both (Brewer, 1999). Research on explicit attitudes suggests that contact may lead people to revise negative beliefs about outgroups (Allport, 1954; Pettigrew & Tropp, 2006) as well as overly optimistic beliefs about one's ingroup (Pettigrew, 1998)—though the evidence for ingroup reappraisal is limited (Verkuyten et al., 2010) and mixed (Eller & Abrams, 2004). Extrapolating to implicit attitudes, contact may reduce the biased evaluations that underlie implicit bias.

Changes in evaluations may not be the only mechanism by which contact improves implicit attitudes. Previous research showed that egalitarian motivations can moderate implicit attitudes and stereotypes (e.g., Monteith et al., 2002; Moskowitz et al., 1999; Moskowitz & Li, 2011). Such motivations are not assumed to change evaluations, but instead regulate the influence of spontaneous evaluations on responses to implicit measures. For example, egalitarian people who respond with prejudice may feel guilty, which leads to future efforts to regulate their expression of implicit prejudices (Monteith et al., 2002). To the extent that contact motivates people to think and behave in egalitarian ways (Lemm, 2006; Plant, 2004), it may similarly motivate the inhibition of biased evaluations.

Taken together, intergroup contact may influence implicit attitudes through two non-exclusive mechanisms: (a) by reducing positive ingroup and/or negative outgroup evaluations and (b) by constraining the expression of biased evaluations. By testing both mechanisms, we advance research in several ways. Identifying the psychological processes explaining *why* intergroup contact works is necessary to develop effective contact-based interventions to improve implicit attitudes. If, on the one hand, contact is related to the inhibition of biased evaluations, contact-based interventions might focus on making

egalitarian people aware of their biased responses (Burns et al., 2017; Monteith et al., 2002) to prompt future efforts to self-regulate biased responding. If, on the other hand, contact is related to less biased evaluations, contact-based interventions might focus on facilitating positive intergroup contact and not on bias awareness. Another contribution of the present research is that, unlike most research on the subject, it examines the relation between intergroup contact and *ingroup* evaluations. None of the 1,351 effect sizes in Pettigrew and Tropp's (2006) meta-analysis used ingroup favoritism as the dependent variable. Some argue that ingroup favoritism, more so than outgroup hostility, is responsible for present-day discrimination (Greenwald & Pettigrew, 2014; see also Brewer, 1999). By testing how intergroup contact relates to ingroup favoritism, the present research helps us understand role in reducing discrimination.

Whilst understanding the mechanisms underlying contact effects is important, it is also important to understand *for whom* contact is more or less beneficial. On the one hand, meta-analytic evidence indicates that the relationship between contact and explicit attitudes is weaker for minority- than for majority-group members (Tropp & Pettigrew, 2005), which suggests that the same is true for implicit attitudes. On the other hand, Henry and Hardin (2006)—in the only research to date examining the joint effects of contact and group status on implicit attitudes—observed that contact had stronger effects on two minority groups—Black Americans ($N = 32$) and Christians in Lebanon ($N = 47$)—than on their majority-group counterparts. We not only examine, with much larger samples, whether group status moderates the relationship between contact and implicit attitudes, but also whether it does so by shaping the activation of biased evaluations, the inhibition of those evaluations, or both. Identifying which of these mechanisms underlies the differential effects across groups will be useful for theory building and designing interventions tailored to different populations (see Levy, 1999).

Present Research

The present research addresses two research questions. First, we examined to what extent intergroup contact is related to reducing the activation of biased intergroup evaluations and/or the inhibition of those evaluations—and thus to reducing implicit intergroup attitudes. Second, we tested whether these relationships differ between majority- and minority-group members. To that end, we applied the Quadruple Process model (Quad model), a cognitive model that disentangles the processes underlying implicit task performance (Conrey et al., 2005; Sherman et al., 2008), to the race attitude version of the Implicit Association Test (IAT; Greenwald et al., 1998). The construct validity of the Quad model has been extensively demonstrated (for reviews, see Calanchini & Sherman, 2013; Sherman et al., 2008). We sought to answer these research questions by using a correlational study design since the predictor variable, intimate intergroup contact, is not easily amenable to random assignment into conditions. To the limited extent that intergroup interactions can be recreated in a laboratory experiment, it is unclear how well they capture the phenomenon of intergroup contact which requires a degree of time and intimacy that is difficult to achieve in laboratory settings (MacInnis & Page-Gould, 2015). We conducted two preregistered studies: Study 1 provided first answers to our research questions while Study 2 was a direct replication of Study 1. We report results from both studies as well as an analysis of the combined samples.

Study 1

Method

Preregistration. For both studies, we preregistered hypotheses, sample sizes, exclusion criteria, measures, as well as our analysis strategy. Preregistrations, data, and analysis scripts for both studies are available online.¹ In Study 1, we tested two preregistered

¹ https://osf.io/3qnmx/?view_only=4c3512d641664768a86b2e1f27573e44

hypotheses: (1) that respondents with more intergroup contact would show less positive ingroup evaluations, less negative outgroup evaluations, and greater inhibition of these evaluations; and (2) that these relationships would be weaker for Black compared to White respondents (see Tropp & Pettigrew, 2005). As preregistered, we included only participants with ingroup-favoring IAT scores. We had to exclude participants with outgroup-favoring IAT scores because, as explained further in the Results section, the Quad model assumes consistent patterns of bias in the sampled responses. In the preregistered analyses, we focused on ingroup favoritism which is the normative response among White respondents (Jost et al., 2004; Nosek et al., 2007) and because most research on intergroup contact has focused on improving outgroup attitudes, which are, as a default, less positive than ingroup attitudes. We report exploratory analyses for outgroup-favoring respondents in the Supplemental Materials, where we also discuss deviations from our preregistration.²

Respondents. Respondents were drawn from a large sample collected by Project Implicit (Xu et al., 2014), a website on which people complete IATs and corresponding self-report measures. Respondents were included if they (a) identified as White (non-Hispanic) or Black; (b) were not flagged for removal by the standard IAT scoring algorithm (Greenwald et al., 2003); (c) had at least 70% accuracy; (d) resided in the US; and (e) participated between February 2, 2015 and December 31, 2016 (when contact measures were included). In total, 90,592 respondents met these preregistered criteria ($N_{White} = 77,171$; $N_{Black} = 13,421$). Because our analytic approach was computationally demanding, we analyzed a random sample of 2,500 Black and 2,500 White ingroup-favoring respondents.

Measures. *Implicit Association Test (IAT).* The IAT is a computer-based dual-categorization task, in which respondents classify paired concepts (White vs. Black) and

² In Study 1, we deviated from the preregistration by randomly sampling 10,000 participants instead of including all eligible participants. Doing so was necessary as our analytic strategy was too computationally demanding to be applied to the whole sample. In Study 2, we preregistered the updated sampling strategy. All other deviations from the preregistration were minor.

attributes (good vs. bad). Respondents use two keys to rapidly classify White and Black faces and good and bad words (Greenwald et al., 1998, 2003)³ across trials in which *White-good* and *Black-bad* share one response key and trials in which *White-bad* and *Black-good* share the other response key. IAT responses are faster when concepts and attributes that are strongly associated in memory share a response key. For example, respondents who respond more quickly and accurately when good stimuli share a response key with White versus Black faces are assumed to have an evaluative preference for White over Black people. Using a standard scoring algorithm, response latencies are converted into a standardized difference score (“D-score”) indexing each respondent’s ingroup preference (Greenwald et al., 2003).

Intergroup Contact. Six items assessed intergroup contact. For a list of racial/ethnic groups, respondents indicated whether they have or have had family members (three items), friends (two items), or romantic partners (one item) from each group (for all items, see Supplemental Materials). We created a count variable by summing the number of items for which respondents selected “Black” or “White”. Scores ranged from 0 to 6, with higher scores indicating more contact with outgroup members.

Demographics. Respondents provided information about their race/ethnicity, sex, age, education, and political identity (see Supplemental Material). Table 1 shows demographic characteristics of all respondents.

Missing data. We used multiple imputation to handle missing survey responses (see Supplemental Materials).

Results

Our analysis strategy involved three steps: First, we applied the Quad model to generate respondent-level estimates of the cognitive processes underlying respondents’ IAT

³ For all stimuli, see <https://osf.io/jrvg8/>.

Table 1

Demographic characteristics for all respondents.

Variables	Study 1				Study 2			
	Mean	SD	Min	Max	Mean	SD	Min	Max
White Respondents								
Age	29.12	13.25	11.34	85.41	29.89	13.54	10.75	81.17
Sex	0.41	0.49	0.00	1.00	0.40	0.49	0.00	1.00
Political Identity	4.59	1.77	1.00	7.00	4.69	1.77	1.00	7.00
Education	72.43	22.86	0.00	100.00	71.87	22.66	0.00	100.00
Black Respondents								
Age	27.86	11.82	12.18	71.97	27.81	12.11	11.62	74.71
Sex	0.33	0.47	0.00	1.00	0.33	0.47	0.00	1.00
Political Identity	4.95	1.38	1.00	7.00	4.88	1.41	1.00	7.00
Education	71.94	22.34	0.00	100.00	71.02	22.76	0.00	100.00

Note. Respondent age is in years. The mean for respondent sex (0 = Female; 1 = Male) is the percentage of male respondents in the study. Respondents reported their political identity on a 1 (strongly conservative) to 7 (strongly liberal) scale. Education was on percentage metric with 0 indicating the lowest response option and 100 indicating the highest.

performance. Second, we fit a series of statistical models to these respondent-level estimates, compared them, and selected the model that made the most accurate predictions. Third, we inspected estimates from the selected model to test whether they were in the hypothesized direction.

Quad Model. In the IAT, respondents face congruent trials, in which key mappings correspond to ingroup-favoring associations (e.g., *Black-good* and *White-bad* for Black respondents), and incongruent trials, in which key mappings correspond to outgroup-favoring associations (e.g., *Black-bad* and *White-good* for Black respondents). For each respondent, the Quad model estimates four cognitive processes that explain how often the respondent makes correct classifications in congruent and incongruent trials (for an accessible introduction, see Calanchini & Sherman, 2013). First, the ACTivation of biased evaluations (AC) reflects the extent to which ingroup-favoring and outgroup-derogating evaluations influence responses. We estimated two AC parameters, one reflecting positive ingroup evaluations ($AC_{\text{ingroup-good}}$; i.e., *White-good* for White respondents and *Black-good* for Black respondents) and another reflecting negative outgroup evaluations ($AC_{\text{outgroup-bad}}$; i.e., *Black-bad* for White respondents and *White-bad* for Black respondents). Second, the Detection of correct responses (D) parameter reflects respondents' ability to differentiate correct from incorrect responses. Third, the Overcoming Bias (OB) parameter reflects an inhibitory control process that overrides activated evaluations, preventing them from influencing respondents' behavior when they conflict with a detected correct response. Fourth, the Guessing (G) parameter reflects a general response tendency that guides responses in the absence of influence from AC, D, or OB.

The Quad model is a multinomial processing tree model consisting of a system of equations that estimates the influence of the four cognitive processes, described above, from the pattern of correct and incorrect responses to the different trial types in the IAT (Figure 1). Parameters are estimated on a likelihood scale, ranging [0,1]. For the AC, D, and OB parameters, higher values reflect greater activity in the corresponding mental process. The G

parameter is anchored at .5, such that values $>.5$ reflect a bias to respond with the positive key, values $<.5$ reflect a bias to respond with the negative key, and values $=.5$ reflect no response bias. To estimate these parameters, the Quad model needs to assume *consistent* patterns of bias in the sampled responses. For parameter estimates to reflect the processes described in the previous paragraph, we only included ingroup-favoring participants in our preregistered analyses. We excluded outgroup-favoring participants because not doing so would violate the mathematical assumptions of the Quad model which would, at best, produce noisier parameter estimates and, at worst, systematically bias parameter estimates. Past research (e.g., Calanchini et al., 2020) has been able to avoid excluding outgroup-favoring participants as they included only non-Black participants for whom ingroup favoritism is the modal response. We used the *TreeBUGS* R package (Heck et al., 2018) to implement hierarchical multinomial modeling (Klauer, 2010) to generate respondent-level estimates for each Quad parameter (for technical details, see the Supplemental Materials).⁴

Analytic Approach. We used Bayesian statistical methods which require choosing a likelihood function and prior distributions. The *likelihood function* links the observed data to model parameters (e.g., regression coefficients) and states how likely the observed data are given different values of said model parameters. As Quad parameters are constrained to fall between 0 and 1, we used a beta likelihood with a logit link function (Ferrari & Cribari-Neto, 2004). *Prior distributions* represent how plausible different values of said model parameters are before considering the observed data. We used weakly informative prior distributions (Gelman et al., 2014), which help guide parameter estimates away from implausible values.⁵ Bayesian inference applies Bayes’ theorem to update prior distributions in light of the

⁴ The difference between observed and predicted response frequencies can be evaluated with goodness-of-fit statistics. As preregistered, we excluded respondents with significant model misfit (i.e., those with $p < .05$), which removed data from 3.4% of respondents ($n = 170$).

⁵ We used $\beta \sim N(0, 5)$ for regression coefficients and $\phi \sim \Gamma(.01, .01)$ for the ϕ parameter.

Figure 1. The Quad model of implicit task performance. Each path represents a likelihood. Parameters with lines leading to them are conditional upon all preceding parameters (AC = Activation of biased evaluations; D = Detection; OB = Overcoming Bias; G = Guessing). The two columns on the right side of the figure indicate which paths lead to correct and incorrect responses on congruent and incongruent trials.

observed data to produce posterior distributions. *Posterior distributions* state how plausible different values of the model parameters are given the observed data. We used medians and 95% highest density intervals (HDIs) to summarize posterior distributions and to draw inferences about model parameters. A 95% HDI = [.05, .10], for example, implies that the 95% most plausible values for a model parameter fall between .05 and .10 and that there is less than a 5% chance that the model parameter is ≤ 0 . Unlike confidence intervals, Bayesian statistics does not require binary decisions. A 95% HDI = [−.01, .15], for example, suggests that, even though there might be more than a 5% chance of a negative effect, values > 0 are still more plausible than values ≤ 0 and there is *some* evidence for a positive effect.

To test our hypotheses, we fit and compared a series of multivariate regression models that simultaneously estimated $AC_{\text{ingroup-good}}$, $AC_{\text{outgroup-bad}}$, and OB as outcome variables.⁶ Model 1 ($\mathcal{M}_1$) included only an intercept and served as a baseline model. $\mathcal{M}_2$ included intergroup contact as the sole predictor of the Quad parameters; $\mathcal{M}_3$ included respondent race as the sole predictor; $\mathcal{M}_4$ included both contact and race as predictors; and $\mathcal{M}_5$ included contact, race, and the interaction between the two as predictors. To test whether demographics would affect our results (see Simmons et al., 2011), we fit another model that included sex, age, education, and political orientation as predictors. As unadjusted and covariate-adjusted estimates were highly similar, we report covariate-adjusted estimates in the Supplemental Materials. We used the *brms* R package (Bürkner, 2017) to fit models.

To compare fitted models, we used cross-validation to estimate how accurately each model would predict observations in a new sample (see Yarkoni & Westfall, 2017). We used the *loo* R package to implement Bayesian leave-one-out cross-validation (Vehtari et al., 2017), which approximates fitting a model to all observations except one, estimating the model’s prediction accuracy on the left-out observation, and repeating these steps until every observation has been the left-out observation. We used the resulting expected log predictive densities to calculate pseudo Bayesian Model Averaging weights (with the Bayesian bootstrap method; Yao et al., 2018). A pseudo-BMA weight can be interpreted as the probability that, of all candidate models, a given model will make the most accurate predictions for new data. Model weights reflect each model’s combined prediction accuracy across all outcome variables. We used pseudo-BMA weights to select a preferred model.

Comparing models provided a first test of our hypotheses. If, for example, a model that includes contact as a predictor made more accurate predictions than a model that does not, we would interpret that as support for our hypothesis *that* contact is associated with the

⁶ As preregistered, D and G were not relevant to our hypotheses. As reported in the Supplemental Material, we found no main or interactive effects of contact on these parameters.

Table 2

Pseudo Bayesian model averaging (pseudo-BMA) weights (with the Bayesian bootstrap method) for Study 1, Study 2, and combined data from both studies.

Model	Predictors in Model	Pseudo-BMA Weights		
		Study 1	Study 2	Combined
$\mathcal{M}_1$	Intercept Only	0.00	0.00	0.00
$\mathcal{M}_2$	Contact	0.00	0.00	0.00
$\mathcal{M}_3$	Race	0.03	0.08	0.02
$\mathcal{M}_4$	Contact + Race	0.23	0.31	0.60
$\mathcal{M}_5$	Contact + Race + (Contact $\times$ Race)	0.74	0.62	0.39

Note. Weights can be interpreted as the probability that the model makes the most accurate out-of-sample predictions, given the data and the set of considered models.

outcome variables. However, we predicted different effects for different Quad model parameters. For example, we hypothesized that more intergroup contact would predict *less* activation of biased evaluations but *greater* inhibition of these evaluations. Therefore, we followed model comparisons by examining medians and 95% HDIs for parameters in the selected model to test whether they were in the hypothesized direction.

Model Comparisons and Parameter Estimates. Comparing models, we found that $\mathcal{M}_5$ (which included a contact–race interaction) had a 74% probability of being the best model (see Table 2). $\mathcal{M}_4$ (which included only main effects of contact and race) had a 23% probability of being the best model, while no other models had weights greater than 3%. $\mathcal{M}_5$ was about 3.29 times more likely than $\mathcal{M}_4$ to be the best model ($3.29 = 74\%/23\%$), suggesting that group status moderated at least one of the relationships between intergroup contact and the Quad parameters ($AC_{\text{ingroup-good}}$, $AC_{\text{outgroup-bad}}$, or OB).

Examining regression coefficients from the selected model ($\mathcal{M}_5$), we found evidence for the predicted main effects of contact on biased evaluations: Respondents who reported having more intergroup contact tended to have less positive ingroup ($b = -0.07$, 95% HDI = $[-0.11, -0.03]$) and less negative outgroup ($b = -0.08$, 95% HDI = $[-0.12, -0.03]$) evaluations. Contrary to our hypothesis, respondents with more contact did not show greater inhibition of biased evaluations ($b = -0.04$, 95% HDI = $[-0.09, 0.01]$). We found evidence for main effects of race such that White (compared to Black) respondents tended to have more positive ingroup evaluations ($b = 0.67$, 95% HDI = $[0.63, 0.71]$), less negative outgroup evaluations ($b = -0.06$, 95% HDI = $[-0.10, -0.02]$), and less inhibition of biased evaluations ($b = -1.20$, 95% HDI = $[-1.26, -1.15]$).

As noted above, a model that included a contact–race interaction term ($\mathcal{M}_5$) made more accurate predictions than a model that included only main effects ($\mathcal{M}_4$). When examining regression coefficients, however, we found little evidence for an interaction between intergroup contact and respondents’ race for ingroup ($b = -0.04$, 95% HDI = $[-0.12, 0.04]$) and outgroup ($b = -0.07$, 95% HDI = $[-0.16, 0.02]$) evaluations. We found little evidence for an interactive effect on the inhibition of biased evaluations ($b = -0.10$, 95% HDI = $[-0.20, 0.00]$) as zero was among the most plausible values. Looking closer, we found that, contrary to predictions, White respondents with more contact showed *less* inhibition of biased evaluations ($b = -0.09$, 95% HDI = $[-0.17, -0.01]$) while, for Black respondents, there was no evidence for any association between contact and inhibition ($b = 0.01$, 95% HDI = $[-0.05, 0.07]$).

In summary, we found partial support for our hypotheses as respondents with more contact experiences tended to show less activation of positive ingroup and negative outgroup evaluations. Contrary to predictions, we did not find consistent evidence that respondent race moderated the relationships between intergroup contact and biased evaluations. We found some evidence that, for White but not Black respondents, intergroup contact was

associated with *less* inhibition of biased evaluations.

Study 2

Study 2 was a direct replication of Study 1 testing whether our findings were replicable. Our hypotheses were the only difference to Study 1. We sought to replicate the main effects from Study 1, predicting that intergroup contact would be associated with less positive ingroup and less negative outgroup evaluations. We discuss deviations from our preregistration in the Supplemental Materials. We sampled 2,500 White and 2,500 Black respondents not included in Study 1.⁷

Results

We found that, mirroring our earlier findings, $\mathcal{M}_5$ had a 62% probability of being the best model whereas $\mathcal{M}_4$ had a 31% probability of being the best model and all other models had weights below 8% (Table 2). The relative superiority of $\mathcal{M}_5$ suggests that respondent race moderated the relationship between intergroup contact and Quad parameter estimates. Selecting $\mathcal{M}_5$ as our preferred model, we next examined the main effects and interactions to determine whether they supported our hypotheses.

Consistent with our hypothesis and results of Study 1, we found evidence that respondents who reported having more intergroup contact tended to have less positive ingroup evaluations ($b = -0.05$, 95% HDI = $[-0.09, -0.01]$). Contrary to our hypothesis about outgroup evaluations, however, we found little evidence that intergroup contact was related to less negative outgroup evaluations ($b = -0.04$, 95% HDI = $[-0.07, 0.01]$). Replicating Study 1, we again found little evidence that respondents with more intergroup contact showed greater inhibition of biased evaluations ($b = 0.04$, 95% HDI = $[-0.01, 0.09]$). We again found main effects of race as White (compared to Black) respondents tended to have more positive ingroup evaluations ($b = 0.57$, 95% HDI = $[0.53, 0.61]$), less negative outgroup evaluations (b

⁷ As in Study 1, we removed respondents with significant model misfit (3.3%; $n = 166$).

= -0.12, 95% HDI = [-0.16, -0.08]), and less inhibition of biased evaluations ($b = -0.86$, 95% HDI = [-0.91, -0.81]). Even though $\mathcal{M}_5$ made the most accurate out-of-sample predictions, we found little evidence for an interaction between contact and race for either ingroup ($b = 0.06$, 95% HDI = [-0.01, 0.15]) or outgroup ($b = 0.03$, 95% HDI = [-0.05, 0.11]) evaluations, or for the inhibition of biased evaluations ($b = 0.05$, 95% HDI = [-0.06, 0.15]).⁸ In summary, we found support for one of two hypotheses as intergroup contact was associated with less positive ingroup evaluations, but not with less negative outgroup evaluations.

Combined Results

As some results were inconsistent across Studies 1 and 2, we pooled the data across studies and re-ran analyses to assess the cumulative evidence from both studies.

Results

We found that, when comparing models fit to the combined data, $\mathcal{M}_4$ made the most accurate predictions, having a 60% probability of being the best model (Table 2). $\mathcal{M}_5$ —the selected model in Studies 1 and 2—had only a 39% probability of being the best model. The relative superiority of $\mathcal{M}_4$ provides evidence for two main effects, but against a contact–race interaction. Selecting $\mathcal{M}_4$ as our preferred model, we found that, consistent with hypotheses in both studies, respondents with more intergroup contact tended to have less positive ingroup ($b = -0.06$, 95% HDI = [-0.09, -0.03]) and less negative outgroup ($b = -0.05$, 95% HDI = [-0.08, -0.03]) evaluations. Replicating Studies 1 and 2, we found no evidence that respondents with more intergroup contact showed greater inhibition of biased evaluations ($b = -0.01$, 95% HDI = [-0.04, 0.03]). We also found that White (compared to Black) respondents had, on average, more positive ingroup evaluations ($b = 0.62$, 95% HDI = [0.60, 0.65]), less negative outgroup evaluations ($b = -0.09$, 95% HDI = [-0.12, -0.06]), and less

⁸ What might explain why $\mathcal{M}_5$ still made more accurate predictions is that, when averaging interaction effects across the three outcome variables, there is some evidence for an overall contact–race interaction ($b = 0.15$, 95% HDI = [0.00, 0.30]).

Figure 2. Posterior distributions from $\mathcal{M}_5$ for estimates from Study 1, Study 2, and the combined data across studies. Point estimates and intervals represent posterior distributions for the combined data. Note that the scale for the x-axis is different in the middle panel. Race was dummy coded (0 = Black, 1 = White).

inhibition of biased evaluations ($b = -1.03$, 95% HDI = $[-1.07, -1.00]$). Figure 2 shows that, while Studies 1 and 2 provided some evidence for a contact–race interaction, the direction of these effects was inconsistent between studies, explaining why we found no evidence in the combined samples.

Discussion

Over 60 years of research have examined how and when intergroup contact improves majority-group members’ explicit attitudes. Instead, we investigated how contact relates to *implicit* attitudes, which processes explain *why* contact might improve implicit attitudes, and whether these processes differ between *minority-* and *majority-group* members. We collected large samples of Black and White Americans ($N = 10,000$) and applied the Quad model to disentangle how intergroup contact related to the spontaneous evaluation and inhibition processes underlying performance in the Race IAT. Results from two preregistered studies and a meta-analysis of the combined data provided strong evidence that contact is

associated with less activation of positive ingroup and negative outgroup evaluations—but not with the inhibition of those evaluations. While we found that, on average, White respondents showed more biased evaluations and less inhibition of those evaluations than Black respondents, we did not find race to moderate the effects of intergroup contact. Taken together, these results suggested that (a) reduced activation of ingroup-favoring and outgroup-derogating evaluations drive the relationship between intergroup contact and implicit racial attitudes and (b) group status does not affect the relationships between intergroup contact and processes underlying implicit racial attitudes.

Our findings have implications for understanding intergroup contact. Building on previous work showing that contact is related to favorable implicit attitudes, our research clarified the psychological mechanisms underlying this relationship. We showed that the contact–attitude relationship is best understood as resulting from contact being associated with less implicit ingroup favoritism and outgroup derogation. By differentiating between ingroup favoritism and outgroup derogation, our research also added to the small number of studies (Eller & Abrams, 2004; Verkuyten et al., 2010) examining whether contact leads people to revise positive ingroup attitudes (Pettigrew, 1998). As ingroup favoritism is arguably more important for contemporary discrimination (Greenwald & Pettigrew, 2014), our finding that intergroup contact is associated with less ingroup favoritism highlights its potential for reducing discrimination.

Contrary to predictions, we did not find consistent evidence that intergroup contact was associated with the inhibition of biased intergroup evaluations. Past research had demonstrated that contact motivates people to act and think in egalitarian ways (Lemm, 2006; Plant, 2004) which, in turn, can inhibit the expression of implicit stereotypes and attitudes (Monteith et al., 2002; Moskowitz et al., 1999; Moskowitz & Li, 2011). What might explain the seeming discrepancy between past and present findings is that the Quad model conceptualizes bias inhibition as the specific self-regulatory process that constrains the

expression of activated biased evaluations (Sherman et al., 2008). This process, however, does *not* seem to be related to egalitarian motives (Gonsalkorale et al., 2011; see also Calanchini et al., 2014). As such, our findings allow for the possibility that egalitarian motives resulting from intergroup contact can influence implicit attitudes via some other mental process. Future research should seek to clarify how egalitarian motives affect implicit attitudes.

Contrary to past research showing the relationship between intergroup contact and *explicit* attitudes to be weaker for minority-group members (Tropp & Pettigrew, 2005), we did not find consistent evidence that respondent race moderated the relationships between contact and the processes underlying *implicit* attitudes. What might explain this discrepancy is that explicit attitudes are subject to socially desirable responding and thus influenced by social norms. Black Americans tend to report more explicit racial ingroup bias than White Americans (Nosek et al., 2002), suggesting that Black Americans experience less normative pressure to appear unbiased—and might even have norms to express ingroup favoritism. Therefore, Black Americans’ explicit (but not implicit) attitudes might be less amenable to contact effects than White Americans’. Our research also contradicted past findings that the effect of contact on implicit attitudes was *stronger* for minority-group members (Henry & Hardin, 2006), though this research used D-scores as dependent variable and had much smaller samples ($N = 79$). Future research should continue to recruit minority- and majority-group samples to clarify whether group status moderates contact effects on implicit attitudes.

Our research followed recommendations to improve the replicability of psychological research (Munafò et al., 2017) by preregistering our studies (Nosek et al., 2018), conducting a direct replication (Simons, 2014), and recruiting large samples (Button et al., 2013). This allowed us to distinguish between replicable (main effects of contact and race) and non-replicable (contact–race interaction) findings. Despite these strengths, our findings were qualified by two limitations. First, the mathematical assumptions of the Quad model require

consistent patterns of bias in the sampled responses. This required us to sample only respondents with ingroup-favoring implicit attitudes (e.g., *White-good* and *Black-bad* for White respondents). One might argue that by conditioning on respondents' implicit attitudes we were unable to infer whether contact is, in general, associated with less biased evaluations. This argument, however, is less troubling than it may appear because (a) it applies more readily to Black respondents, of whom 45% had outgroup-favoring D-scores, than to White respondents, of whom only 20% had outgroup-favoring D-scores, and (b) other studies (reviewed above) have already documented sample-wide associations between intergroup contact and implicit attitudes. Second, our study design was correlational which precluded strong conclusions about the causal direction of the observed relationships. An alternative explanation would be, for example, that people with less biased intergroup evaluations tend to seek out intergroup contact. Longitudinal evidence (e.g., Binder et al., 2009) suggests, however, that the association between contact and bias cannot be explained by contact-seeking behavior alone. Experimental studies, which could provide definitive evidence about the causal direction of the observed effects, tend to create short-term “intergroup interactions” rather than long-term “intergroup contact” (MacInnis & Page-Gould, 2015; for rare exceptions, see Mousa, 2020; Shook & Fazio, 2008), limiting their ecological validity. Future research should, if funding and opportunity allows, replicate our findings in field experiments (cf. Shook & Fazio, 2008).

In conclusion, we found cumulative evidence that intergroup contact is associated with the reduced activation of positive ingroup and negative outgroup evaluations. We also found that group status does not moderate the relationships between intergroup contact and the processes underlying performance on the Race IAT. These findings identify potential mechanisms explaining *how* intergroup contact might improve implicit attitudes.

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