Title: Reward omissions variably augment racial bias along political ideology

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Abstract

Humans tend to become angry whenever a reward they were expecting is 'unfairly' taken away. We presently tested whether situational anger induced by unfair reward omissions may influence (pre-existing) racial biases across self-identified Liberals (n = 119) and Conservatives (n = 115). In the study, participants were exposed to a frustration induction task (or a control variant), followed by implicit and explicit evaluations of White and Black male targets. Frustrated Conservatives were more likely to exhibit implicit anti-Black bias relative to non-frustrated Conservatives, but not significantly so (p's > .2). Frustrated Liberals became significantly anti-White relative to both non-frustrated Liberals and Frustrated Conservatives (p's < .006). Both Liberals and Conservatives became equally angered following reward omissions, but only the former became significantly anti-White. The present work highlights Liberals are more likely to exhibit frustration-augmented racial bias relative to Conservatives.

Keywords: frustration; racial bias; political ideology; implicit evaluation

Much of daily life involves instrumental activities in expectation of positive outcomes, from going to work and expecting to receive a fair wage, to reading an article and expecting to cite a specific page (Skinner, 1981). Yet, if showing up to work results in an unexpected termination, and checking the bibliography shows a missing citation, the consequent 'frustration' may incline conscious agents towards displays of aggression (Amsel, 1992; Bessiere, Newhagen, Robinson, & Shneiderman, 2006; Miller, Mowrer,Doob, Dollard, & Sears, 1958; Tam & Taki, 2007). When humans experience reward omissions without having an attribution target – e.g., when losing change to a vending machine (Killeen, 1994), or when losing earnings due to presumed programming errors during an instrumental earnings task (Morillo-Rivero, Ibáñez-Molina, & Torres, 2020; Yu, Mobbs, Seymour, Rowe & Calder, 2014), anger may be subjectively experienced anger without necessarily manifesting publicly observable displays of aggression (Krieglmeyer, Wittstadt, & Strack, 2009). However, anger-associated aggression need not be public to have significant social consequences – in the case of racial bias for example, simply recollecting one's negative experiences may induce anger to the point of amplifying pre-existing biases (Dasgupta, DeSteno, Williams, & Hunsinger, 2009; Experiment 3; also see Dasgupta, 2013, pp. 241-242). Discriminating individuals by race has been associated with negative social consequences, from ethnocentric hiring practices (Yogeeswaran & Dasgupta, 2010) to excessive use of non-lethal force (Fryer, 2016).

Assuming that subjectively experienced anger can amplify pre-existing racial bias (Dasgupta, 2013), we presently inquired whether arbitrary reward omissions may also induce anger to the point of amplifying pre-existing bias. To replicate the arbitrary and instrumental nature of naturally occuring reward omissions (Amsel, 1992), we implemented a so-called 'frustration induction task', or *FIT*[1]*,* to induce anger without requiring appraisal of complex narratives or associations with constitutively negative events (e.g., Pavlovian contingencies – cf., Marcusson-Clavertz, Kjell, Persson, & Cardeña, 2019; Out, Goudbeek, & Krahmer, 2020). To measure racial bias, we incorporated brief implicit association tests (*BIAT* - Sriram & Greenwald, 2009) and

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[1] The *FIT* was based on the goal-gradient principle, which states that the magnitude of reward omission effects is inversely related to perceived reward proximity (Hull, 1932). That is, the closer one reaches an expected reward before the latter is unexpectedly terminated, the greater the experienced frustration (Amsel, 1992). The *FIT* applied a fixed ratio schedule across timed trials involving instrumental colour discriminations where, across the frustrated group, all earnings were unexpectedly terminated during expected reward trials (Figure 1; also see Yu et al. 2014, p. 173).

Likert evaluation scales to respectively assess 'implicit' and explicit evaluations towards White and Black targets. We describe our study in more detail after highlighting our sampling criterion.

The present sample constituted of self-identified Liberals and Conservatives who were demographically matched along ethnicity composition, income, age, education, sex and religious affiliation. We recruited along political lines given well-established group differences along the Liberal-Conservative ideological spectrum (Jost, 2006). For example, Conservatives are typically more anti-Black and pro-White relative to Liberals, and Liberals are typically more pro-Black than Conservatives (Greenwald, Smith, Sriram, Bar-Anan, & Nosek, 2009; Krosch, Berntsen, Amodio, Jost, & Van Bavel, 2013; Payne, Krosnick, Pasek, Lelkes, Akhtar, & Tompson, 2010; although also see Winegard, Clark, Hasty, & Baumeister, 2018). By sampling participants along political ideology, we aimed to demonstrate whether biases *specific* to an ideology would be influenced by reward omissions (e.g., do Conservatives become more anti-Black when frustrated?). Implicit racial bias is global and cross-cultural (Coutts, 2020), but it is typically the 'angry few' who manifest their bias with physical violence (duMond, 2020). No previously published work has asked whether situational anger induced by arbitrary reward omissions influences pre-existing bias, let alone along political ideology, rendering the present study novel and important.

In our experiment, 240 participants were exposed to the *FIT* (or a control variant - Figure 1), followed by *BIAT*. Across the latter, participants rapidly categorized White/Black targets with positive/negative attributes. Next, participants evaluated White and Black targets along trustworthiness, suspicion, desire-to-meet, and desire-to-avoid using discrete Likert scales. Targets were White and Black male faces with neutral expressions. We selected White and Black male targets as these categories have been reliably shown to emit contrasting evaluations (e.g., Coutts, 2020; Shapiro, Ackerman, Neuberg, Maner, et al., 2009). We recruited a demographically representative sample of Liberals and Conservatives from the United States. We expected frustrated Conservatives would become more anti-Black relative to non-frustrated Conservatives. We also explored whether pro-Black/pro-White/anti-White bias credibly differed between and across political ideologies. One confirmatory and two exploratory hypotheses were tested, using a combined frequentist and Bayesian approach (Amd & Passarelli, 2020). We first confirmed whether unexpected reward omissions could reliably induce negative mood (Hypothesis 1). We next explored whether implicit (Hypothesis 2) and explicit (Hypothesis 3) evaluations of White and Black targets credibly differed between frustrated and non-frustrated participants.

Method

A pre-registered pilot ($n = 30$) demonstrated our *FIT* could augment negative moods with 99% power. Initial hypotheses, analysis plans, and results from that 'proof of concept' pilot had been preregistered at https://osf.io/gzpek/?view_only=f62e73aed29f4a20b9918f2237d630ea before data collection, following van't Veer and Giner-Sorolla's (2016) suggestions. Data and analysis scripts for replicating reported results, along with the blinded ethical approval statement, can be found at https://osf.io/w6rnz/?view_only=c51454c99bf940089cafdb03d9641ccf. All procedures reported were approved by the local IRB-equivalent and corresponds with the Helsinski declaration.

Participants

A representative sample of 260 adult volunteers from the United States, pre-screened along political affiliation (Liberal, Conservative) were recruited from the academic site Prolific. Political ideology was re-affirmed before the main experiment (see Materials). A prospective power analysis for a two-sided two-sample test had recommended a sample size of $N = 210$ for detecting a moderate effect ($d = .5$) with 95% power and alpha set to .05 (Faul, Erfelder, Lang, & Buchner, 2007). Due to unforeseeable attrition circumstances, it was decided to keep recruitment ongoing until 260 participants had completed the study. Following initial data inspection, 20 participants were excluded for failing preregistered attention checks, leaving a final sample of 240. These had been randomly assigned to become frustrated ($n = 115$; 35 ± 13.7 years; 53 Females; 81 Whites; 56 Liberals & 57 Conservatives) or not ($n = 125$; 32.3 ± 11.2 years; 50 Females; 87 Whites; 58 Liberals & 63 Conservatives) during our instrumental earnings task.

Materials

All tasks were designed and implemented on www.gorilla.sc (Anwyl-Irvine, Massonnié, Flitton, Kirkham, & Evershed, 2020). All materials and procedures, with the exception of the BF10 personality survey (Rammstedt & John, 2007), are available at https://gorilla.sc/openmaterials/100671. Evaluation tests used four Black and four White male faces from the Chicago Faces Database (CFD-IDs: BM-230, BM-224, BM-233, BM-213, WM-220, WM243, WM-010, WM-019 - Ma, Correll, & Wittenbrink, 2015). In a demographic survey run prior to the main experiment, participants indicated their political affiliation along a 10-point scale anchored by *Strongly Liberal* (left - 0) and *Strongly Conservative* (right - 10) in response to the question *How do you politically self-identify?* Each trial commenced with the slider at center

(5). Participants who moved the slider left (<5) or right (>5) were categorized respectively as Liberal or Conservative. Participants additionally completed a brief personality measure before the main experiment (Rammstedt & John, 2007). Data analyses were run on *R* using the packages *dplyr* (Wickham et al., 2015), *BayesianFirstAid* (Bååth, 2014), *ggplot2* (Wickham, 2011), and *effectsize* (Ben-Shachar, Makowski, & Lüdecke, 2020).
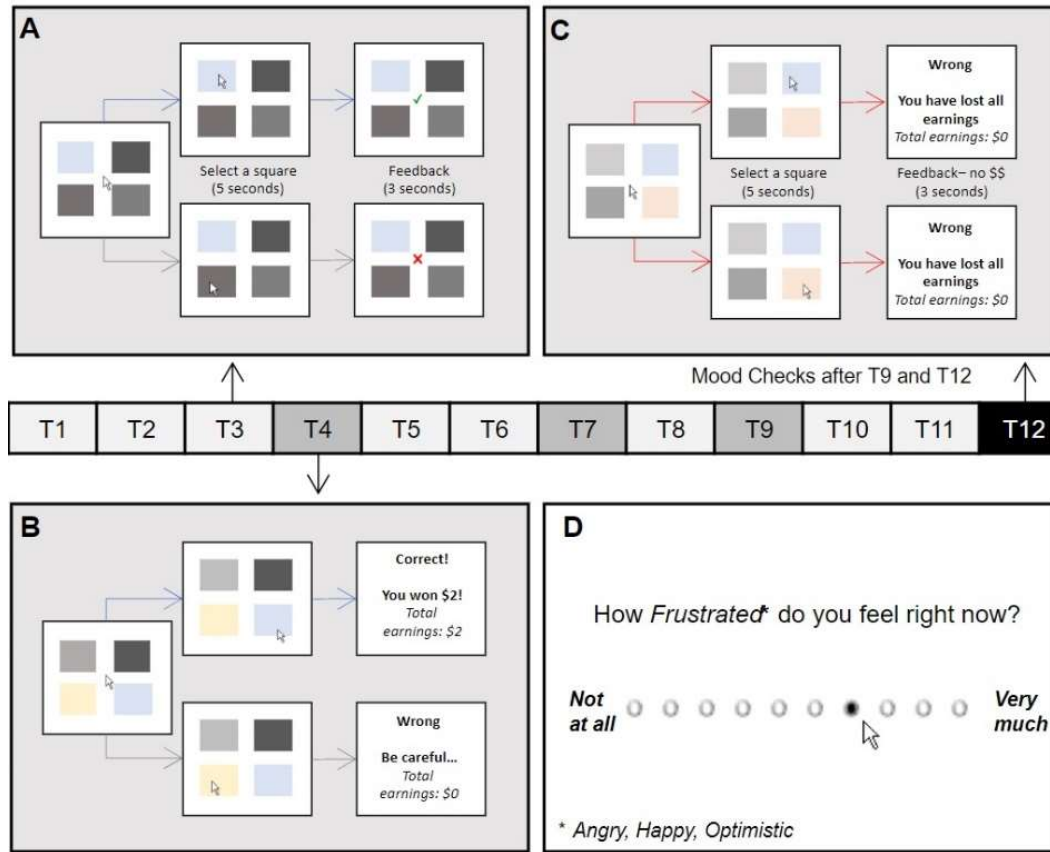
Figure 1. Schematic of the instrumental frustration induction task *(FIT)*. Participants had to select from four squares across each trial. Across trials 1/2/3/5/6/8/10/11, participants viewed a green checkmark (or red x) for correct (or incorrect/slow) selections, which was always the blue square (Panel A). Across Trials 4/7/9, participants could 'win' $2/$3/$4 for correct selections (Panel B). Across the frustrated group, the final trial registered any response as incorrect and penalized all earnings (Panel C). Mood checks were implemented before and after reward omission (Panel D).

Procedure

    Frustration induction task: After providing consent and completing surveys, participants viewed instructions screen describing the upcoming earnings task, where they could possibly "win (or lose) $$$ for some correct (or incorrect) responses". During each of the 12 ensuing *FIT* trials, participants had to select the 'correct' square out of four options within a timed window. One square was always light blue and always the correct choice. Remaining squares varied between shades of grey, orange and green. Selecting the blue square produced a green checkmark. If any other square

was selected, or no responses were detected within 5 seconds of target onset, a red x appeared (Figure 2, Panel A). Participants viewed the statements *You have won $2/$3/$4* for correct responses emitted during the 4th/7th/9th trials respectively (Panel B). Across the frustrated group, the final trial registered any response as incorrect, penalizing all earnings to that point (Panel C). Across the non-frustrated group, the final trial proceeded as normal. Participants completed Likert mood checks after the 9th and 12th trials (before and after reward omission respectively - Panel D).

Brief implicit association test: A brief *IAT* with four 20 trial blocks was administered to all participants. Across any given *BIAT* trial, participants could view a White or Black face, or a positive (*GOOD, NICE, PLEASANT, APPEALING*) or negative (*BAD, DISGUSTING, UNPLEASANT, UGLY*) attribute, in the center of the screen. Across half the blocks, correct categorizations required pressing 'k' when Black faces or positive attributes appeared (classified under *BLACK ~ POSITIVE*), otherwise 'd' if White faces or negative attributes appeared (*WHITE ~ NEGATIVE*). This mapping was reversed for the remaining blocks (*BLACK ~ NEGATIVE, WHITE ~ POSITIVE*). A correct (incorrect) categorization within 3000 ms of stimulus onsets produced a green checkmark (red x) for 300 ms before the following trial. If no response was detected within 4000 ms, a message stating 'too slow' appeared for 300 ms before the next trial. The first two trials of each block, along with errors and responses recorded <500 and >3000 milliseconds after stimulus onsets, were excluded during analysis. Reaction times for remaining responses were classified under four *TARGET~ATTRIBUTE* conditions (*WHITE~POSITIVE, WHITE~NEGATIVE, BLACK~POSITIVE, BLACK~NEGATIVE*).

Explicit Evaluations: In the final phase, participants evaluated individual faces along 10 point Likert scales (scored from '0' – *not at all* to 10 – *very much*) along trustworthiness, suspicion, desire-to-meet, and desire-to-avoid Black and White targets. Each question appeared with Black and White faces an equal number of times across 20 trials. Completion of 20 trials produced a debriefing message, signalling task completion.

Data Analysis

Before (T1) and after (T2) reward omission, participants described current levels of frustration, anger, happiness and optimism using 10 point scales. These scores were normalized (T2-T1/T2+T1) and subjected to one-sample Welch's tests to confirm whether moods significantly shifted from null estimates. Next, two-sample Welch's tests confirmed whether moods shifted significantly between frustrated and non-frustrated groups. All frequentist effects are reported with

99% confidence intervals (*Conf.*). Two-sample Welch's tests and their *BEST* counterparts (*Bayesian estimation supersedes the t-test* - Kruschke, 2013) determined whether differences in *TARGET~ATTRIBUTE* categorization speeds differed significantly ($p < .01$) and credibly ($L > 90\%$) across the four *BIAT* conditions. A third battery of frequentist and Bayesian tests explored whether Likert evaluations for White and Black targets differed between frustrated and non-frustrated groups. Kruschke's *BEST* estimates meaningful likelihoods (*L*) across competing hypotheses, even when observed parameter distributions overlap with null priors, being thus well suited for exploratory analyses (Kruschke & Liddell, 2018). All *BEST* estimates were derived following a 10000 Monte Carlo Markov Chain and reported using 99% credibility intervals (*Cred.*).
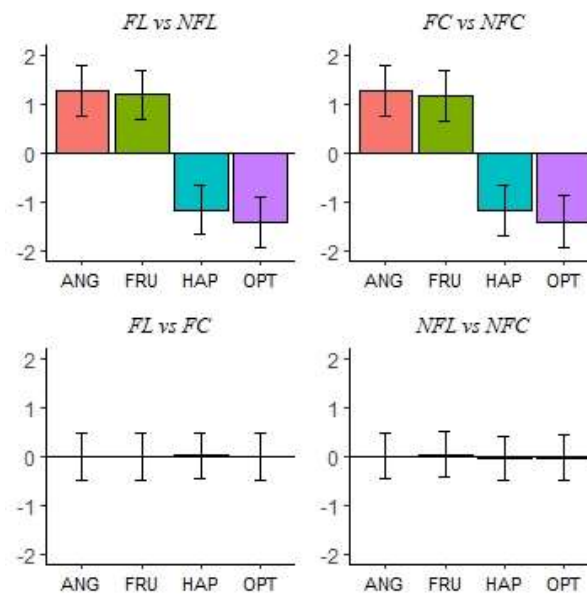
Figure 2. Two-sample frequentist test summaries across normalized anger (ANG), frustration (FRU), happiness (HAP) and optimism (OPT) represented along the *x*-axis, with Cohen's difference scores represented along the *y*-axis. Error bars indicate 99% confidence intervals. The four contrast conditions were Frustrated Liberals vs Non-Frustrated Liberals (top left; *FL vs NFL*), Frustrated Conservatives vs Non-Frustrated Conservatives (top right; *FC vs NFC*), Frustrated Liberals vs Frustrated Conservatives (bottom left; *FL vs FC*), and Non-Frustrated Liberals vs Non-Frustrated Conservatives (bottom right; *NFL vs NFC*). Both groups became significantly more angry, more frustrated, less happy and less optimistic than their non-frustrated counterparts (top row; all *p*'s <.001). No within-group mood differences appeared across frustrated and non-frustrated groups (bottom row).

Table 1. Mood shifts relative to null estimates following one-sample tests

		All Frustrated (n = 115)		
Condition	p-value	Cohen's d	99% Conf. Lo	99% Conf. Hi
Anger	<.001	0.913	0.633	1.201
Frustration	<.001	0.955	0.670	1.247
Happiness	<.001	-1.004	-1.300	-0.714
Optimism	<.001	-0.985	-1.280	-0.697

All Non-frustrated (n = 125)			
Anger	0.341	-0.084	-0.313	0.144
Frustration	0.045	-0.178	-0.409	0.051
Happiness	0.041	-0.182	-0.413	0.047
Optimism	0.907	0.010	-0.218	0.238
Frustrated Liberals (n = 56)			
Condition	p-value	Cohen's d	99% Conf. Lo	99% Conf. Hi
Anger	**<.001**	**0.934**	**0.536**	**1.345**
Frustration	**<.001**	**0.836**	**0.450**	**1.233**
Happiness	**<.001**	**-0.889**	**-1.294**	**-0.497**
Optimism	**<.001**	**-1.020**	**-1.444**	**-0.611**
Non-frustrated Liberals (n = 58)			
Anger	0.519	-0.079	-0.398	0.239
Frustration	0.828	-0.027	-0.345	0.291
Happiness	0.823	-0.028	-0.346	0.290
Optimism	0.094	0.209	-0.112	0.531
Frustrated Conservatives (n = 57)			
Condition	p-value	Cohen's d	99% Conf. Lo	99% Conf. Hi
Anger	**<.001**	**0.927**	**0.527**	**1.341**
Frustration	**<.001**	**0.831**	**0.443**	**1.231**
Happiness	**<.001**	**-0.898**	**-1.307**	**-0.500**
Optimism	**<.001**	**-1.010**	**-1.437**	**-0.599**
Non-frustrated Conservatives (n = 63)			
Anger	0.476	-0.091	-0.423	0.240
Frustration	0.624	-0.063	-0.394	0.268
Happiness	0.933	0.011	-0.320	0.342
Optimism	0.084	0.224	-0.110	0.560

*Effects reliable with 99% power marked in **bold**. Reward omission reliably influenced mood across all groups and subsets.

Table 2. Two-sample tests of mood differences

All Frustrated (n = 115) vs All Non-Frustrated (n = 125)			
Condition	p-value	Cohen's d	99% Conf. Lo	99% Conf. Hi
Anger	**<.001**	**1.211**	**0.850**	**1.570**
Frustration	**<.001**	**1.378**	**1.009**	**2.047**
Happiness	**<.001**	**-1.134**	**-1.490**	**-0.778**
Optimism	**<.001**	**-1.241**	**-1.601**	**-0.879**
Frustrated (n = 56) vs Non-Frustrated (n = 58) Liberals			
Anger	**<.001**	**1.285**	**0.771**	**1.794**
Frustration	**<.001**	**1.192**	**0.685**	**1.695**
Happiness	**<.001**	**-1.163**	**-1.665**	**-0.658**
Optimism	**<.001**	**-1.433**	**-1.954**	**-0.909**
Frustrated (n = 57) vs Non-Frustrated (n = 63) Conservatives			
Anger	**<.001**	**1.272**	**0.747**	**1.793**
Frustration	**<.001**	**1.182**	**0.663**	**1.697**
Happiness	**<.001**	**-1.179**	**-1.694**	**-0.661**
Optimism	**<.001**	**-1.414**	**-1.946**	**-0.879**

Frustrated Liberals (n = 56) vs Frustrated Conservatives (n = 57)			
Anger	0.991	-0.002	-0.479	0.475
Frustration	0.988	-0.003	-0.480	0.475
Happiness	0.945	0.013	-0.464	0.490
Optimism	0.999	0.000	-0.477	0.477
Non-Frustrated Liberals (n = 58) vs Non-Frustrated Conservatives (n = 63)			
Anger	0.947	0.012	-0.450	0.474
Frustration	0.837	0.037	-0.425	0.499
Happiness	0.830	-0.039	-0.500	0.423
Optimism	0.892	-0.024	-0.486	0.438

Results

1. Reward Omission and Mood Induction

Summaries of all one- and two-sample tests across normalized moods are provided in Tables 1 and 2. Negative moods were reliably induced by reward omission, with frustrated participants becoming significantly angrier (all Cohen's d's > .91) and frustrated (d's > .91), while becoming less happy (d's > .88) and optimistic (d's > .98), relative to non-frustrated controls (Figure 2, top row). Mood induction effects were practically equivalent for Liberals and Conservatives (all p's > .94 – Figure 2, bottom row).
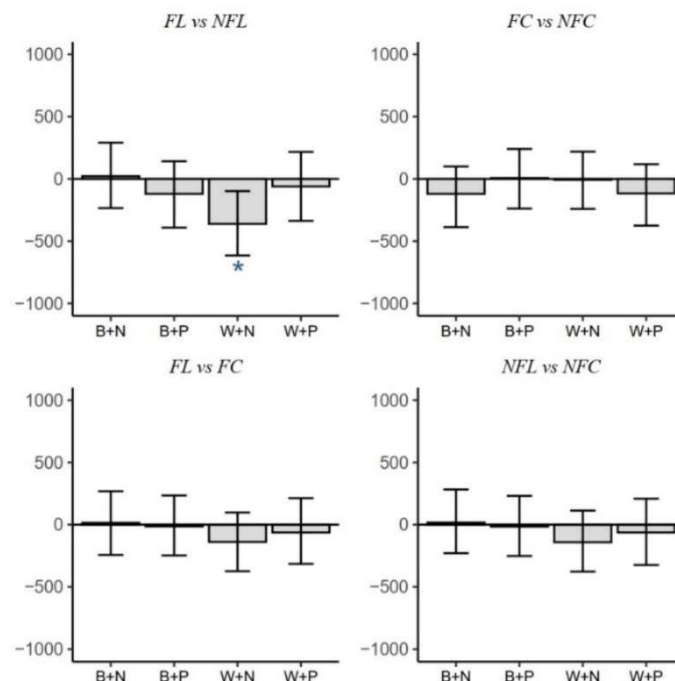
Figure 3. Differences in mean categorization speeds in milliseconds (*y*-axis) across four *BIAT* conditions; these were *BLACK~POSITIVE*, *BLACK~NEGATIVE*, *WHITE~POSITIVE* and *WHITE~NEGATIVE*, respectively B+P, B+N, W+P, and W+N along the *x*-axis. Negative (positive) values indicated frustrated participants categorized the *TARGET~ATTRIBUTE* faster than non-frustrated counterparts. All error bars indicate 99% credibility intervals. Asterisks indicate statistical significance (p < .001).

Table 3. Frequentist and *BEST* summaries across four *BIAT* conditions

Target~Attribute	Mean RT diff*	99% Cred.Lo	99% Cred.Hi	L(F>NF)**	Cohen's d	p-value
All Frustrated (n = 115) vs All Non-Frustrated (n = 125)						
Black~Negative	-44.4	-219.9	132.4	74%	-0.064	0.529
Black~Positive	-41.9	-214.9	134.6	72%	-0.061	0.536
White~Negative	**-138.1**	**-313.6**	**31.4**	**98%**	**-0.204**	**0.039**
White~Positive	-73.0	-254.9	102.2	85%	-0.104	0.303
Frustrated (n = 56) vs Non-Frustrated (n = 58) Liberals						
Black~Negative	21.8	-234.3	291.4	42%	0.026	0.865
Black~Positive	-119.8	-390.9	141.7	88%	-0.175	0.242
White~Negative	**-361.6**	**-615.0**	**-97.9**	**100%**	**-0.567**	**<.001**
White~Positive	-60.5	-336.2	216.7	72%	-0.089	0.565
Frustrated (n = 57) vs Non-Frustrated (n = 63) Conservatives						
Black~Negative	-119.9	-387.1	99.7	90%	-0.176	0.210
Black~Positive	7.1	-238.3	240.7	47%	0.007	0.960
White~Negative	-7.2	-240.7	218.8	53%	-0.009	0.945
White~Positive	-116.2	-375.2	118.7	89%	-0.167	0.215
Frustrated Liberals (n = 56) vs Frustrated Conservatives (n = 57)						
Black~Negative	14.5	-242.7	268.6	44%	0.018	0.902
Black~Positive	-13.8	-247.0	234.2	56%	-0.016	0.905
White~Negative	-138.3	-374.1	98.2	93%	-0.213	0.119
White~Positive	-62.8	-315.1	213.3	73%	-0.092	0.528
Non-Frustrated Liberals (n = 58) vs Non-Frustrated Conservatives (n = 63)						
Black~Negative	16.5	-229.0	282.5	44%	0.018	0.902
Black~Positive	-15.5	-251.2	230.9	56%	-0.016	0.905
White~Negative	-141.0	-377.2	112.9	93%	-0.213	0.119
White~Positive	-62.6	-324.3	208.9	73%	-0.092	0.528

* MCMC estimates of mean reaction time differences.
** Likelihood of frustrated (*F*) participants categorizing the *Target~Attribute* faster than their non-frustrated (*NF*) counterparts. Extremely likely (*L*=>90%) effects are underlined, with statistically significant differences in **bold**.

1. Reward Omission and Implicit Bias

Estimated mean differences in categorization speeds across four *BIAT* conditions are provided in Table 3. Frustrated participants were extremely likely (*L* = 98%) to categorize *WHITE~NEGATIVE* significantly faster overall (*p* = .039; 99% *Cred*: -313.6 to 31.4). When split along political lines, the direction of bias reversed for frustrated vs non-frustrated Conservatives. Specifically, Conservatives were very likely to categorize *BLACK~NEGATIVE* faster, but not significantly so (*L* = 90%; *p* = .21). Alternatively, frustrated Liberals were extremely likely to categorize *WHITE~NEGATIVE* faster relative to non-frustrated non-frustrated Liberals (*p* < .001; 99% *Cred*: -615 to -97.9). No significant differences appeared between Liberals and Conservatives along *BLACK ~ POSITIVE*, *BLACK ~ NEGATIVE* or *WHITE ~ POSITIVE* categorizations across frustrated and non-frustrated conditions (*p*'s > .5).
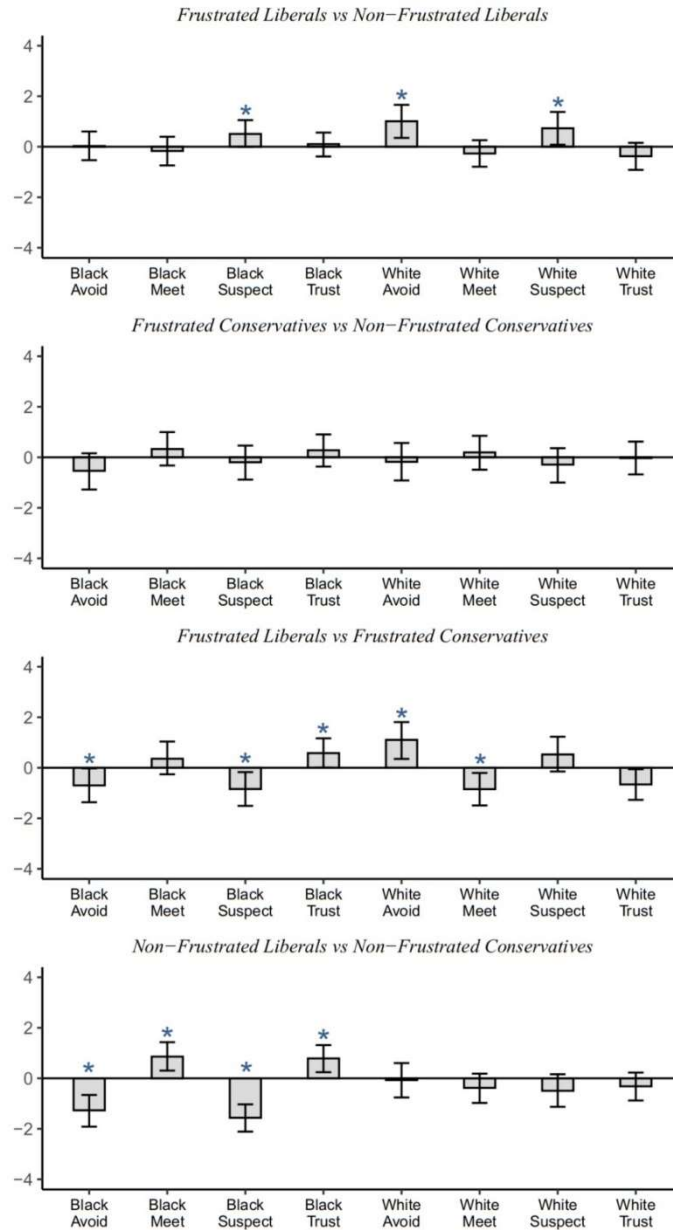
Figure 4. BEST estimated differences across evaluation scores (*y*-axis) desire to avoid, desire to meet, perceived trustworthiness and perceived suspicion of Black and White targets (*x*-axis). All error bars indicate 99% credibility intervals. Asterisks indicate statistical significant effects ($p < .01$).

Table 4. Confirmatory and *BEST* summaries across explicit Likert evaluations

Race	Characteristic	Cohen's d	p-value	Mean diff*	99% Cred. Lo	99% Cred. Hi	L[F>NF]*
	*All Frustrated (n = 115) vs All Non-Frustrated (n = 125)*						
Black	Trustworthy	0.046	0.487	0.125	-0.247	0.518	79%
	Meet	0.011	0.870	0.028	-0.401	0.467	57%
	Suspicious	0.099	0.134	0.239	-0.183	0.669	92%
	Avoid	-0.061	0.353	-0.175	-0.637	0.256	16%
White	Trustworthy	-0.112	0.091	-0.270	-0.676	0.128	4%
	Meet	-0.041	0.531	-0.100	-0.507	0.330	27%
	Suspicious	0.113	0.085	0.309	-0.142	0.794	96%
	Avoid	**0.181**	**0.006**	**0.526**	**0.025**	**0.997**	**>99%**
	*Frustrated (n = 56) vs Non-Frustrated (n = 58) Liberals*						
Black	Trustworthy	0.028	0.758	0.106	-0.385	0.560	72%
	Meet	-0.068	0.458	-0.166	-0.738	0.397	22%
	Suspicious	**0.239**	**0.010**	**0.506**	**-0.004**	**1.053**	**99%**
	Avoid	0.019	0.838	0.028	-0.532	0.604	55%
White	Trustworthy	-0.167	0.070	-0.374	-0.916	0.155	4%
	Meet	-0.116	0.207	-0.267	-0.791	0.257	10%
	Suspicious	**0.262**	**0.004**	**0.731**	**0.081**	**1.377**	**>99%**
	Avoid	**0.356**	**<.001**	**1.009**	**0.351**	**1.659**	**>99%**
	*Frustrated (n = 57) vs Non-Frustrated (n = 63) Conservatives*						
Black	Trustworthy	0.108	0.265	0.279	-0.368	0.904	87%
	Meet	0.123	0.208	0.327	-0.325	0.996	90%
	Suspicious	-0.071	0.466	-0.197	-0.884	0.462	23%
	Avoid	-0.183	0.061	-0.536	-1.278	0.156	3%
White	Trustworthy	-0.016	0.870	-0.033	-0.680	0.620	45%
	Meet	0.071	0.468	0.192	-0.492	0.851	77%
	Suspicious	-0.103	0.290	-0.289	-1.001	0.359	14%
	Avoid	-0.060	0.536	-0.180	-0.918	0.567	26%
	*Frustrated Liberals (n = 56) vs Frustrated Conservatives (n = 57)*						
Black	**Trustworthy**	**0.252**	**0.010**	**0.580**	**0.003**	**1.165**	**99%**
	Meet	0.141	0.146	0.357	-0.259	1.040	92%
	Suspicious	**-0.316**	**0.001**	**-0.841**	**-1.506**	**-0.170**	**0%**
	Avoid	**-0.261**	**0.008**	**-0.697**	**-1.365**	**-0.020**	**0%**
White	**Trustworthy**	**-0.266**	**0.006**	**-0.658**	**-1.270**	**-0.054**	**0%**
	Meet	**-0.334**	**0.001**	**-0.846**	**-1.490**	**-0.205**	**0%**
	Suspicious	0.187	0.054	0.527	-0.146	1.229	98%
	Avoid	**0.382**	**<.001**	**1.105**	**0.350**	**1.809**	**>99%**
	*Non-Frustrated Liberals (n = 58) vs Non-Frustrated Conservatives (n = 63)*						
Black	**Trustworthy**	**0.356**	**<.001**	**0.785**	**0.241**	**1.314**	**100%**
	Meet	**0.355**	**<.001**	**0.858**	**0.305**	**1.430**	**100%**
	Suspicious	**-0.683**	**<.001**	**-1.563**	**-2.111**	**-1.030**	**0%**
	Avoid	**-0.491**	**<.001**	**-1.267**	**-1.913**	**-0.660**	**0%**
White	Trustworthy	-0.141	0.128	-0.317	-0.878	0.225	7%
	Meet	-0.166	0.074	-0.380	-0.976	0.183	4%
	Suspicious	**-0.180**	**0.049**	**-0.493**	**-1.129**	**0.160**	**3%**
	Avoid	-0.026	0.778	-0.072	-0.757	0.603	39%

* Likelihoods (*L*) of mean evaluation differences being greater (>0) for frustrated relative to non-frustrated participants.

1. Reward Omission and Explicit Bias

Two-sample tests across explicit evaluations of White and Black targets are summarized in Table 4. Desire to avoid White targets increased overall across frustrated participants as a whole ($p = .006$; 99% *Cred*: .025 to .997). Split along political lines, no significant changes in evaluations towards Blacks or Whites were found across Conservatives (all p's > .06). Alternatively, frustrated Liberals became significantly more suspicious of both White ($p = .004$; 99% *Cred*: .081 to 1.377) and Black targets ($p = .01$; 99% *Cred*: -.004 to 1.053). Frustrated Liberals indicated increased desire to avoid White targets ($p < .001$; 99% *Cred*: .351 to 1.659). Comparing between frustrated Liberals and Conservatives, Liberals found Blacks more trustworthy ($p = .010$; 99% *Cred*: .003 to 1.165) and less suspicous ($p = .001$; 99% *Cred*: -1.506 to -0.170), and desired to avoid Blacks less ($p = .008$; 99% *Cred*: -1.365 to -0.020). Frustrated Conservatives evaluated Whites as more trustworthy ($p = .006$; 99% *Cred*: -1.270 to -.054), desired to meet Whites more ($p = .001$; 99% *Cred*: -1.490 to -0.205) and avoid Whites less ($p < .001$; 99% *Cred*: -1.913 to – 0.660). Similar patterns of pro-Black, anti-White and anti-Black biases were observed when contrasting between non-frustrated Liberals and Conservatives, with only levels of pro-White bias being practically equivalent (p's > .07).

Table 5. Two-sample tests of personality differences

Personality trait*	p-value	Cohen's d	99% Conf. Lo	99% Conf. Hi
Frustrated (n = 56) vs Non-Frustrated (n = 58) Liberals				
Extraversion	0.455	0.138	-0.338	0.614
Neuroticism	0.672	0.078	-0.397	0.553
Agreeableness	0.312	-0.187	-0.663	0.289
Conscientiousness	0.168	-0.256	-0.732	0.222
Openness	0.080	-0.325	-0.803	0.154
Frustrated (n = 57) vs Non-Frustrated (n = 63) Conservatives				
Extraversion	0.966	0.008	-0.471	0.487
Neuroticism	0.568	-0.107	-0.586	0.373
Agreeableness	0.343	0.177	-0.303	0.657
Conscientiousness	0.583	0.102	-0.377	0.582
Openness	0.790	-0.050	-0.529	0.430
Frustrated Liberals (n = 56) vs Frustrated Conservatives (n = 57)				
Extraversion	0.979	0.005	-0.472	0.482
Neuroticism	**0.002**	**0.574**	**0.086**	**1.060**
Agreeableness	0.628	-0.09	-0.567	0.388
Conscientiousness	0.732	-0.064	-0.541	0.414
Openness	0.922	-0.018	-0.495	0.459
Non-Frustrated Liberals (n = 58) vs Non-Frustrated Conservatives (n = 63)				

Extraversion	0.519	-0.12	-0.597	0.358
Neuroticism	**0.033**	**0.402**	**-0.081**	**0.883**
Agreeableness	0.127	0.286	-0.195	0.765
Conscientiousness	0.153	0.267	-0.213	0.746
Openness	0.162	0.261	-0.219	0.739

* As described in Rammstedt and John (2007)

1. *Personality differences*

All participants had completed a 10-item personality measure before commencing with the main study. The latter were collated along the 'big five' dimensions of Extraversion, Neuroticism, Openness, Conscientiousness, and Agreeableness (Rammstedt & John, 2007). Two-sample frequentist tests confirmed whether Liberals and Conservatives significantly differed across and between each other along any the five dimensions (Table 5). There were no significant differences within Liberals (all p's > .17) or within Conservatives (all p's > .34) across any of the five dimensions. Between Liberals and Conservatives, there were no differences across Extraversion, Openness, Conscientiousness, or Agreeableness dimensions – the single dimension where Liberals scored signicantly higher than Conservatives was Neuroticism across both frustrated (p = .002, 99% *Conf*: .086 to 1.060) and non-frustrated (p = .033, 99% *Conf*: -.081 to .883) conditions.

Discussion

The present work confirms how 'unfairly' penalizing earned rewards induces subjective frustration (Amsel, 1992). The resulting anger was sufficiently salient to amplify pre-existing biases. Our sample was split along political lines to explore whether reward omission augments ideology-specific bias (Jost, 2006). We found credible evidence for this claim, as increased anti-White and anti-Black bias was very likely across Liberals and Conservatives respectively. Comparing between groups revealed that Conservatives evaluate Black targets more negatively and White targets more positively relative to Liberals as a rule, with the latter tending to evaluate Black targets more positively, replicating earlier reports (Greenwald et al., 2009). This difference was observed across both frustrated and non-frustrated conditions.

When parsed along political ideology, we found non-frustrated Liberals and Conservatives were practically equivalent in their evaluations towards Whites. Following reward omission however, Liberals became significantly anti-White whereas Conservatives performances did not significantly change. Following Dasgupta's (2013) reasoning, Liberals may have been previously biased against Whites to begin with. On balance, this claim does not appear to apply to

Conservatives, at least to the same (significant) extent. Even though Conservatives became just as angry as Liberals following reward omission, they did not become significantly more anti-Black as a result. Bayesian estaimation provided credible evidence for faster *BLACK~NEGATIVE* categorizations across frustrated Conservatives, suggesting anti-Black bias may have been implicitly augmented. This is contrasted by performances across explicit evaluations, where highly credible (but still non-significant) evidence was found that frustrated Conservatives became somewhat pro-Black. Restricting our conclusions to confirmatory effects, unexpected reward omissions significantly augmented anti-White bias across Liberals exclusively.

The latter partially supports earlier claims regarding the bias-amplifying effects of situational anger (e.g., Dasgupta, 2013). We say 'partially' since frustration induced bias appeared to significantly amplify bias across Liberals, but not (significantly) for Conservatives. One possible explanation may be that Conservatives tend to be more conscientious (Hirsh, Colin, DeYoung, Xu, & Peterson, 2010) and self-controlled (Clarkson, Chambers, Hirt, Otto et al., 2015) than Liberals. This former was not presently observed, as Liberals and Conservatives were practically equivalent in terms of conscientiousness, extraversion, openness to new experiences and agreeableness. On balance, Liberals were significantly more neurotic than Conservatives, which does correspond with earlier claims (cf., Burton, Plaks, & Peterson, 2015). It remains to be seen the extent to which neuroticism *per se* may have contributed to the present effects, but this does not seem a significant concern given augmented biases were target *specific*. If increased bias had been observed in general viz., towards both White and Black targets, one could make the case for a neurotic disposition amplifying bias, but this was not the case here.

It may also have been the case that augmented biases experienced by Conservatives were deliberately inhibited (recall Clarkson et al., 2015). This could explain why anti-Black bias appeared likely across implicit evaluations, whereas explicit evaluations paradoxically indicated pro-Black bias across Conservatives. On balance, a lack of significant effects may indicate bias had not been significantly augmented in the first place (Byrd, 2019; Gawronski, 2019). One way to resolve this query could involve measurement of affect-associated neural components following the presentation of White or Black targets post reward frustration (Yu et al., 2014). Response topographies associated with affect can be detected neurally before they can be deliberately modulated (e.g., Amd & Baillet, 2019; Amd & Roche, 2017; Kuchinke & Mueller, 2019). The extent to which the present effects were moderated by self-control *per se* remains to be seen in a

future work. In the present case, our take-away claim is that Liberals are prone to frustration-induced amplification of pre-exisiting biases. Assuming aggressive displays towards a stereotyped group become likely when condoned by the aggressor's social network (Leander, Agostini, Stroebe, Kreienkamp, et al., 2020), Liberals may feel justified in exhibiting anti-White bias, given increasing acceptance of anti-White discourse in some Liberal circles (Corey, 2019). Normalizing discord against any ethnic group is unlikely to benefit race relations (e.g., Kushner, 2020). However, these claims are limited to a single study and require future replications for increasing confidence in our findings. It could also be useful to supplement evaluation tasks with behavioral measures of aggression, such as the allocation of 'hot sauce' across White and Black targets (cf., Lieberman, Solomon, Greenberg, & McGregor, 1999). This would inform the extent to which frustration-induced bias may correlate with overt aggression across Liberal and Conservative participants.

We conclude our work by noting some limitations of our design. First, as all evaluations here were collected across White and Black male targets, our results are necessarily limited to that particular demographic. Future replications should examine whether reward omissions augment biases across racial divides specific to individual cultures (e.g., do I-Taukei become more anti-Indo-Fijian when frustrated? – cf., Johnson, Lakhan, Lecci, Dovidio, & Schellhaas, 2020), or across different gender categories (e.g., do Conservatives become more anti-Trans when frustrated? – cf., Wang-Jones, Alhassoon, Hattrup, Ferdman & Lowman, 2017). The present work constitutes a template for exploring other social biases that may be augmented by arbitrary reward omissions (Amsel, 1992).

Another limitation is that we do not know whether frustration-augmented biases may be transient. A future work could adminster bias measures along spaced intervals, similar to the procedure described in Amd and colleagues (2019). In that work, affectively conditioned symbols were evaluated along pre-determined intervals, and were reported to have retained their affective properties (valences) for approximately a week (p. 6). An extension of that procedure could be applied to variants of the *FIT* described here, with evaluation phases of White and Black targets staggered across varying interevals, and note whether frustration-augmented biases persist over time.

Finally, it remains unknown as to whether participants' subjective expectations regarding (say) the experimenter's assumed ethnicity may have significantly confounded the present

findings. In other words, perhaps frustrated participants became biased against Whites *because* they may have (incorrectly) assumed the experimenter penalizing their rewards was White (Orquin, personal communication). In response, our design renders it unlikely that group contingent expectations, such as those presuming the experimenter's ethnicity, significantly influenced the present findings. To see why, let us first recall that *across* political ideologies in the present sample, frustrated and non-frustrated participants were practically equivalent along all demographic and personality dimensions. Now, suppose both Liberals and Conservatives judged the experimenter to be White – it still remains adherents of the former ideology who showed increased anti-White bias. Alternatively, if only Liberals assumed the experimenter was White, it was frustrated Liberals who became more anti-White relative to non-frustrated Liberals. Finally, even if *only* Liberals thought the experimenter was White *because* of the unfair reward omission and then evaluated Whites more negatively, our claim of frustrated Liberals becoming more anti-White remains valid. A future investigation could attempt to manipulate experiementers' identification parameters, perhaps along gender as well as ethnicity, to explore whether frustration-induced biases may be influenced. In any case, the present work presents a compelling template for exploring how arbitrary reward omissions may significantly amplify pre-existing biases.

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