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Proactive Control of Implicit Bias: A Theoretical Model and Implications for Behavior Change

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Four experiments examined the effect of proactive control on expressions of implicit racial bias. Whereas reactive control is engaged in response to a biasing influence (e.g., a stereotype, temptation, or distraction), proactive control is engaged in advance of such biases, functioning to strengthen task focus and, by consequence, limiting the affordance for a bias to be expressed in behavior. Using manipulations of response interference to modulate proactive control, proactive control was found to eliminate expressions of weapons bias, prejudice, and stereotyping on commonly used implicit assessments. Process dissociation analysis indicated that this pattern reflected changes in controlled processing but not automatic associations, as theorized, and assessments of neural activity, using event-related potentials, revealed that proactive control reduces early attention to task-irrelevant racial cues while increasing focus on task-relevant responses. Together, these results provide initial evidence for proactive control in social cognition and demonstrate its effectiveness at reducing expressions of implicit racial bias. Based on these findings and past research, we present a model of proactive and reactive control that offers a novel and generative perspective on self-regulation and prejudice reduction.

Keywords: prejudice, stereotype, implicit, control, proactive

For someone with egalitarian beliefs, the goal of most interracial interactions is to engage in the content of the interaction without being influenced by the prejudices and stereotypes associated with a partner's race. Yet despite even strong egalitarian beliefs, implicit racial associations can be activated automatically, without one's awareness or intention (Devine, 1989; Devine, Plant, Amodio, Harmon-Jones, & Vance, 2002). Once activated, these biases may influence a broad range of responses (Greenwald, Poehlman, Uhlmann, & Banaji, 2009), from medical decisions (Green et al., 2007) and policing (Goff & Kahn, 2012; Swencionis & Goff, 2017), to more subtle nonverbal behaviors (Bergsieker, Shelton, & Richeson, 2010; Dovidio, Kawakami, & Gaertner, 2002) and evaluations (Fazio & Olson, 2003)—almost always to the detriment of lower status groups (e.g., Black Americans).

How can the influence of such biases be reduced? At the societal level, interventions may consider the historical impact of race on factors such as health, education, housing, and employment, and take initiative to redress disparities through affirmative action and other equal-opportunity policies. But in most individual-level interactions—when negotiating a contract, working on a class project, interviewing a job candidate, or simply asking for directions—such large-scale strategies are not applicable. In these situations, the most effective way to respond without prejudice is to prevent race from influencing one's behavior, using cognitive control.

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To date, virtually all research on the control of intergroup bias has focused on a *reactive* form of control, in which control is engaged in response to an activated bias (i.e., after its occurrence) and then directed at the source of bias itself. This perspective on control underlies most existing research on the inhibition, suppression, and unlearning of racial associations (e.g., Bodenhausen & Macrae, 1998; Devine, 1989; Fazio, 1990; Kawakami, Dovidio, Moll, Hermsen, & Russin, 2000; Monteith, Sherman, & Devine, 1998). However, the reactive control strategy is limited by some formidable obstacles: The influence of racial bias is often difficult to detect in the first place (Amodio, Devine, & Harmon-Jones, 2008; Amodio et al., 2004), and even when detected, correction for bias is resource intensive and prone to failure (Devine, 1989; Gilbert & Hixon, 1991). Moreover, even if biased racial associations in the mind are temporarily weakened through interventions, their constant reinforcement in society makes them virtually impossible to eliminate, and thus reactive strategies that target the source of bias in the mind are generally unsustainable (Bargh, 1999; Lai et al., 2016).

In this article, we propose an alternative strategy: a proactive form of control that functions to promote one's intended, nonbiased task goals (e.g., conducting a job interview) prior to encounters with biasing cues (e.g., a job candidate's race), as opposed to targeting the source of bias itself. Indeed, most, if not all, expressions of implicit bias occur in the context of an intended response for which race is irrelevant. To the extent that performance of one's intended task is strengthened, the affordance for activated racial associations in the mind to influence behavior is reduced. This strategy acknowledges the dual-task nature of expressions of implicit bias; that is, that a bias represents an implicit tendency that operates alongside one's primary and presumably race-irrelevant interaction goal. By enhancing focus on one's primary task prior to an encounter with bias-eliciting cues, a proactive control strategy can function preemptively to preclude expressions of bias. This perspective suggests an expanded theory of control and a promising new direction for intervention, but it has not yet been tested directly. Thus, the aim of the present research was to develop a model of proactive control and to test its effectiveness in reducing expressions of implicit bias.

Reactive Control of Prejudice

Traditionally, theoretical models of prejudice control have emphasized a reactive form of control—a process that is engaged when bias is detected and that functions to correct for the bias's influence on a response (Devine, 1989; Fazio, 1990; see also Amodio et al., 2004; Payne, 2005; Sherman et al., 2008). This conceptualization of control involves two key features. First, because reactive control occurs in reaction to a bias, it comes online only after the bias has begun to influence a response (Braver, 2012; see also *late correction* models of control in Jacoby, 1991). Second, reactive control is assumed to operate on the source of bias (e.g., the activated stereotype or attitude in one's mind) as opposed to operating on one's intended action.

Consider the operation of reactive control in the Weapons Identification Task (Payne, 2001). In this task, the participant's goal is to classify target images of handguns and handtools without being influenced by a preceding image of a White or Black face. Because White Americans are associated with neither handguns nor handtools, the White face prime should create little interference in these classifications. By contrast, given the pervasive stereotype of African American men as criminal (Devine & Elliot, 1995), Black faces tend to facilitate the classification of guns and interfere with the classification of tools (Payne, 2001). Reactive control is activated specifically in response to race-based interference, such as on Black-tool trials in the weapons task (Amodio et al., 2004). Once activated, it operates by inhibiting the biased tendency while correcting course on the current response. Research examining rapid shifts in neural activity associated with reactive control has demonstrated its *phasic* nature, such that conflict-related anterior cingulate activity is selectively engaged for Black-tool trials relative to other trial types (e.g., Amodio et al., 2004, 2008; Amodio, Kubota, Harmon-Jones, & Devine, 2006; see also Bartholow, Dickter, & Sestir, 2006; Beer et al., 2008). That is, reactive control is engaged and disengaged quickly for each instance of bias without changing one's overall response strategy.

Although reactive control provides a mechanism for regulating bias, its effectiveness is inherently limited given that it is engaged only after the bias has emerged. For this reason, people often fail to correct course before completing their response. Indeed, this failure has been implicated in unwanted expressions of bias among self-avowed egalitarians (Amodio et al., 2008; Devine et al., 2002; Gonsalkorale, Sherman, Allen, Klauer, & Amodio, 2011; Monteith, Ashburn-Nardo, Voils, & Czopp, 2002). Moreover, reactive control may be impaired by situational factors that disrupt a person's attention or cognitive resources, such as social anxiety (Amodio, 2009; Lambert et al., 2003; Richeson & Shelton, 2003), alcohol intoxication (Bartholow et al., 2006; Bartholow, Henry, Lust, Saults, & Wood, 2012; Schlauch, Lang, Plant, Christensen, & Donohue, 2009), and time pressure (Correll, Urland, & Ito, 2006; Kawakami, Dion, & Dovidio, 1998; Payne, 2001). Thus, although reactive control provides an important mechanism for overcoming bias, many factors conspire to undermine its efficacy.

Proactive Control

Proactive control refers to a very different conceptualization of control that targets one's intended response rather than the source of bias. Proactive control is engaged by the experience of task difficulty or increased motivation regarding one's intended behavior rather than by the activation of a bias itself. Building on earlier research on cognitive control (e.g., Gratton, Coles, & Donchin, 1992) and working memory (e.g., Braver, Paxton, Locke, & Barch, 2009; Jacoby, Kelley, & McElree, 1999), this conceptualization acknowledges that biased responses always occur in the broader context of a goal-directed behavior (i.e., one for which race should be irrelevant). To the extent that a goal-directed behavior is performed as intended, there is, by definition, no expression of bias. Furthermore, because proactive control concerns goal-directed behavior, it is initiated prior to or otherwise independently of encounters with a biasing influence (Braver, 2012; Braver et al., 2009; Schmid, Kleiman, & Amodio, 2015). For example, when an egalitarian employer prepares to make a difficult hiring decision, her hiring goals and the anticipated difficulty of her task engage a careful, task-focused approach. This increase in proactive control occurs before she encounters a potential biasing influence, such as an applicant's race-revealing name, and thus independently of and prior to the activation of stereotypes. To the extent that proactive control is engaged, the employer should be able to maintain goal focus (e.g., adhering to standard review criteria), and thus the affordance for any implicit stereotypes to influence her performance is limited.

Importantly, because proactive control promotes performance of one's main task, its effects do not target the source of bias itself (e.g., a stereotype association activated in the mind). Rather, by enhancing goal focus and performance on one's central task, proactive control indirectly mutes the expression of biasing factors in behavior.

In the cognitive psychology literature, this proactive form of control has alternatively been referred to as "strategic control" and "focused mode" processing (Gratton et al., 1992), or "early selection" (Jacoby et al., 1999). Because proactive control is engaged to support one's main task, rather than a specific instance of bias, its effect should be sustained across a task set. In this way, proactive control involves a *tonic* enhancement of controlled processing in contrast to the phasic operation of reactive control.

Early evidence for proactive control emerged from research on the conflict adaptation effect (Gratton et al., 1992). On classic cognitive control tasks, such as the Stroop (1935) or flanker (Eriksen & Eriksen, 1974) tasks, participants classify target stimuli in the context of congruent or incongruent distractor stimuli. For example, in the flanker task, the participant's goal is to classify the center figure in a letter string. On some trials, this target letter is "flanked" by congruent stimuli, which facilitate the intended response (HHHHH or SSSSS); on others, the target is flanked by incongruent stimuli, which interfere with and slow the intended response (SSHSS or HHSHH). This pattern is known as the *compatibility effect* in cognitive control tasks, and it illustrates the engagement of reactive control when a subject encounters an incongruent flanker trial. Interestingly, however, Gratton et al. (1992) found that this compatibility effect depended on whether cognitive control had been engaged on the previous trial in the task. That is, when examining only responses that followed a congruent flanker trial, the typical compatibility effect was observed. But when responses followed incongruent trials, the compatibility effect was eliminated; that is, the distractor stimuli no longer influenced responses—an effect dubbed the *conflict adaptation effect*, or the *Gratton effect*. Gratton et al. suggested that the experience with response conflict activated control, which engaged a more careful, and thus more accurate, response on the subsequent trial. Although initially conceived as a reactive control effect, conflict adaption illustrated how control elicited by one experience could enhance performance proactively on subsequent trials.

In further experiments, Gratton et al. (1992) expanded this idea to propose the *strategic control hypothesis*, whereby the repeated experience of interference (i.e., processing conflict) would cause a sustained shift into a "focused mode" of processing. Indeed, Gratton et al. demonstrated that the conflict adaptation effect could be induced tonically, sustained across a block of trials, by manipulating the general experience of interference in a block. When the degree of interference was low in a task set (e.g., in blocks with only 25% incongruent trials), a strong flanker incompatibility effect was observed, indicating a strong effect of distractors and a reactive mode of control. But when the degree of interference across a block was high (e.g., with 75% incongruent trials), the flanker incompatibility effect was substantially reduced, indicating a decreased influence of distractors and a more proactive mode of control. In essence, when a task set was experienced as relatively easy, participants relied on a reactive mode of control, deploying control only as distractors were encountered. But when the task set was experienced as relatively difficult, participants shifted to a proactive mode of control, enhancing their focus on their explicit task goals prior to encounters with distractors. Hence, when a distractor was eventually encountered, it had little effect on performance. Perhaps ironically, although high-interference task sets were more difficult, the engagement of proactive control yielded better overall performance. By contrast, although low-interference task sets were easier, the reliance on reactive control meant that greater performance costs were incurred when distractors were encountered.

Similar effects have been observed in studies of task switching, such that blocks of trials that require a participant to switch between tasks (e.g., alternating between Stroop and flanker trials) elicit greater sustained cognitive control than blocks that do not require task switching (Braver, Reynolds, & Donaldson, 2003). Indeed, this pattern has been proposed as an account of the Implicit Association Test (IAT) effect, such that the response slowing typically observed during stereotype-incompatible blocks of the IAT may reflect heightened vigilance and goal focus associated with a more proactive mode of responding (Hilgard, Bartholow, Dickter, & Blanton, 2015; Mierke & Klauer, 2003). With regard to our present aims, these findings suggest that the experience of interference should induce a sustained proactive mode of control, which should enhance an individual's focus on their main task goals and, as a result, limit the influence of implicit racial bias on behavior.

Proactive Control of Prejudice

A proactive model of control offers a new theoretical perspective on implicit bias reduction. The key to proactive control is that it is elicited by increased motivation to perform one's primary task (e.g., in response to task difficulty) and is thus directed at intended task behavior, which may be unrelated to race. To the extent that focus on one's main task is increased, the potential influence of racial bias should be reduced (see Figure 1). As already noted, this model of control differs from prior conceptualizations that involve the direct inhibition or suppression of implicit stereotypes and prejudices, in which control operates directly on race-biased mental associations (e.g., Bodenhausen & Macrae, 1998; for reviews, see Amodio & Devine, 2010; Bartholow, 2010). In traditional models of prejudice control, control is assumed to focus on the source of bias, and the fact that bias occurs in the broader context of an intended response is not considered. Proactive control also differs from perspective taking or reappraisal interventions, which operate by altering one's perception of a social target (e.g., changing one's interpretation of an elderly person's behavior or an outgroup member's facial expression), rather than by enhancing control during task performance (Galinsky & Moskowitz, 2000; Todd, Bodenhausen, Richeson, & Galinsky, 2011). Finally, proactive control does not imply a color-blind strategy (Norton, Sommers, Apfelbaum, Pura, & Ariely, 2006), which entails an explicit effort to ignore a person's race. Rather, a proactive control strategy involves increased focus on one's primary task and not an explicit effort to ignore or avoid race.

Although the effect of proactive control on expressions of implicit prejudice has not been tested previously, prior research suggests strategies relevant to the model proposed here. Most notably, Monteith's (1993; Monteith et al., 2002) self-regulation model posits that when an egalitarian person responds with prejudice, they feel guilty and become vigilant for future race cues. When such a cue is encountered, the individual is prepared to inhibit bias and implement a prepared egalitarian response. Similarly, in Mendoza, Gollwitzer, and Amodio (2010), participants

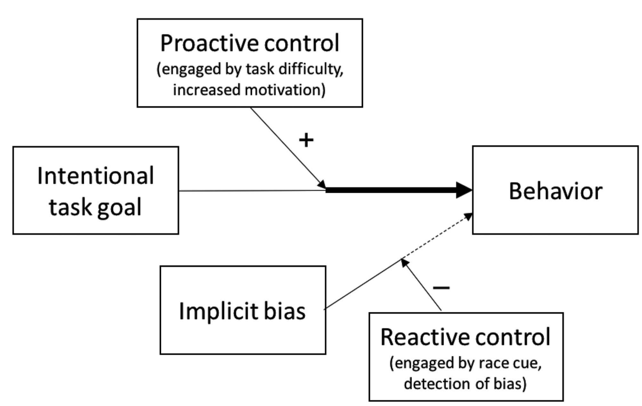

Figure 1. Schematic model of reactive and proactive control. Reactive control is engaged in response to a racial cue or the detection of bias and operates to inhibit the influence of bias on behavior. Proactive control is engaged prior to and independently of any activations of implicit bias and functions to enhance task focus and motivation toward intended behavior. In doing so, it limits the affordance for implicit bias in the mind to be expressed in behavior.

given the implementation intention "If I see a Black person, then I will ignore his race" during a First Person Shooter Task (Correll, Park, Judd, & Wittenbrink, 2002) performed more accurately, and hence with less racial bias, in their rapid-shoot/do-not-shoot decisions than subjects in a control condition. Like Monteith et al. (2002), this implementation intention strategy linked the vigilance for racial cues with a plan to respond without bias in a proactive manner. In a different experiment, in which participants completed the Weapons Identification Task while brain activity was monitored (Amodio, 2010), greater control-related engagement of the prefrontal cortex during the task was associated with enhanced attention to race cues, which, in turn, facilitated participants' ability to control expressions of bias in their task behavior. Finally, individual differences in "chronic egalitarianism" may represent a trait-like form of proactive control, such that people high in chronic egalitarianism are continuously vigilant for opportunities to respond in an egalitarian manner (Moskowitz & Li, 2011; Moskowitz, Salomon, & Taylor, 2000). In each of these cases, cue-activated or chronic vigilance was shown to help individuals avoid the influence of racial bias on their behavior. However, a key distinction between these approaches and the proactive model proposed here is that in these prior studies, control was initiated by a racial cue and, in most cases, directed at race-relevant behavior. By contrast, the form of proactive control proposed here is engaged independently of intergroup concerns, and it targets one's primary task behavior rather than the source of racial bias.

Interestingly, the effect of processing interference on racial associations has been reported in three prior reports, although these were not designed to test the proactive control model proposed here. In research by Bartholow and Dickter (2008; Dickter & Bartholow, 2010), the frequency of high-conflict and low-conflict trials within a race categorization task was manipulated, as in Gratton et al. (1992), in order to examine the role of conflict processing and anterior-cingulate activity in stereotype categorization. These studies revealed that stereotype-biased responses observed in race categorization tasks are largely driven by response conflict, and not merely implicit mental associations, consistent with the notion that expressions of implicit bias reflect both automatic and controlled processes (Payne, 2001). Although not the focus of their research, their results revealed that the high-interference block produced an attenuated pattern of stereotype conflict relative to a baseline condition, whereas the low-interference block produced a stronger pattern of stereotype conflict relative to the baseline condition. According to the present theoretical analysis, the high-conflict block may have induced a proactive mode of control that enhanced participants' focus on task goals. However, this idea has not been tested directly.

In a different set of studies, Kleiman, Hassin, and Trope (2014) exposed participants to a race-unrelated flanker task trial immediately before each trial of a stereotype priming task. In responses following congruent flanker trials, the typical pattern of racial bias was observed. However, in responses immediately following incongruent flankers, this pattern of bias was eliminated. Although Kleiman et al. did not present their research in terms of a proactive model of control as proposed here, their results may reflect a similar process. Together, these studies suggest preliminary evidence for a link between conflict processing and sustained control in the context of implicit bias, consistent with our proactive control hypothesis.

Study Overview and Predictions

In the present research, we examined the effect of proactive control on the expression of implicit racial bias. Our aim was to examine the role of proactive control in situations in which race information was present in one's main task but not directly relevant to the performance goal. To this end, we adapted the established and widely used approach of manipulating task interference to induce a proactive mode of control (Coles, Gratton, Bashore, Eriksen, & Donchin, 1985; Gratton et al., 1992; see also Appelbaum, Boehler, Davis, Won, & Woldorff, 2014; Bartholow et al., 2005; Kane & Engle, 2003; Nieuwenhuis, Ridderinkhof, Blom, Band, & Kok, 2001). Using sequential priming tasks, in which race primes were either stereotype-congruent or stereotype-incongruent with target classifications (e.g., of guns vs. tools), we could test the extent to which target classifications are biased by racial associations under conditions of high or low interference. Following these past studies, the manipulation of interference was accomplished by varying the proportion of congruent and incongruent prime-target pairings within a block of trials. This manipulation alters the experience of task difficulty regarding the explicit goal of correct target classification, such that the main task is experienced as more difficult during blocks with a higher proportion of stereotype-incongruent pairings.

A critical feature of this design is that, in each condition, exposure to Black and White face primes and targets is held constant; it is only the nature of the pairings that differs. Therefore, interference is manipulated independently of exposure to racial cues. A second critical feature is that the manipulation of interference and the influence of racial cues are embedded within the same task. If the interference manipulation and racial cues were separate (e.g., induced by a preceding flankers trial, as in Kleiman et al., 2014), then participants could approach each task independently. By using a manipulation in which the interference is caused by racial cues inherent in the main task, it more closely models real-life situations in which an individual engages, for example, in a meaningful social exchange or an egalitarian review of job applications while potentially being influenced by a person's race. In this way, proactive control is integral to the main task rather than incidental to it.

Across studies, we proposed that high interference should engage a proactive processing mode that enhances focus on one's main task while limiting the expression of racial associations in behavior, thereby reducing bias. By comparison, low interference should reduce proactive control, thereby yielding an exaggerated expression of racial bias.

Study 1

Study 1 examined proactive control in performance of the Weapons Identification Task (Payne, 2001), given its established sensitivity to implicit stereotype associations and utility for assessing controlled processing. We predicted that implicit bias would be exaggerated in low-interference blocks but attenuated in high-interference blocks relative to baseline. Moreover, this pattern should reflect greater engagement of controlled processing during high-interference blocks than low-interference blocks without affecting automatic processing.

Method

Participants and design. Participants included 54 native-English-speaking psychology students who self-identified as White (72% female) who took part individually in the laboratory in exchange for course credit. We initially aimed to include 50 participants and then included all who had signed up for the study at the time this goal was met. The experimental design was fully within-subjects.[1]

Procedure. After providing informed consent, participants received instructions for the Weapons Identification Task and then completed the task in private while the experimenter waited outside of the experiment room. Participants then received a funneled debriefing and were thanked, awarded credit, and dismissed. Session duration was approximately 30 min.

Weapons Identification Task. Stimuli and instructions were adapted from Payne (2001). Stimuli included pictures of two Black and two White male faces, four handguns, and four hand tools (drill, ratchet, wrench, pliers), digitized at 228 × 172 pixels. Stimuli were presented sequentially in the center of the computer screen, and trial order was randomized within each block of trials. Each trial began with a cross-hatched pattern mask (1 s), followed by the prime (Black or White face; 200 ms), the target (gun or tool; 200 ms), and then a second pattern mask (all stimuli are available from the authors upon request). Participants were instructed to quickly and accurately classify targets as guns or tools using buttons labeled "gun" and "tool." The second mask remained onscreen until the participant responded or until 2 s had elapsed. Following responses that exceeded 500 ms, participants received a warning to respond more quickly. This instruction was designed to optimize analysis of accuracy rates (at the cost of sensitivity to response latency effects), because accuracy-based analyses permit more direct inferences about response control. Participants were seated approximately 3 ft from a 17-in. CRT monitor refreshing at 85 Hz. Stimuli were presented using DMDX (Forster & Forster, 2003).

Participants completed six blocks of 40 experimental trials (240 trials total), receiving a 15-s break after each block. These blocks varied in their proportion of stereotype-congruent and stereotype-incongruent trials. Hence, low-interference blocks comprised 80% stereotype congruent trials (Black–gun and White–tool) and 20% incongruent trials (Black–tool and White–gun). High-interference blocks comprised 80% incongruent trials and 20% congruent trials. Baseline blocks comprised equal proportions of congruent and incongruent trials. In this design, the number of Black/White face primes and gun/tool targets was held constant across blocks; only the proportion of congruent/incongruent prime-target pairings was varied. The order of blocks was counterbalanced across participants, presented in quasi-random order, and all participants completed two nonconsecutive blocks of each type (baseline, low-interference, high-interference).

Accuracy scores were quantified as the percentage of correct responses among valid trials (i.e., on which responses occurred between 200 and 1,200 ms; 97.6% of trials) for each trial type, separately for each block type. Although the use of a response deadline restricted variance of response latencies, limiting their validity as an outcome, they were examined for the sake of completeness. Correct response latencies occurring between 200 ms and 1,200 ms were natural-log transformed and averaged within trial type, separately for each block type (mean latencies are presented in raw ms).

Exclusions. Data were excluded from seven participants. Two were excluded because of outlying task performance, suggesting failure to follow task instructions, one had missing data, three misunderstood task instructions, and one's session was interrupted by a fire drill. The final sample included 47 participants.

Results

Main analyses. We predicted that the typical pattern of weapons bias would emerge in baseline blocks, but that this pattern would be enhanced in the low-interference blocks and attenuated in the high-interference blocks. Accuracy scores were submitted to a 3 (block: high-interference vs. baseline vs. low-interference) × 2 (prime: White vs. Black) × 2 (target: gun vs. tool) analysis of variance (ANOVA). This analysis revealed significant effects of prime, $F(1, 46) = 9.65$, $p = .003$, block, $F(2, 92) = 8.49$, $p < .001$, $\eta_p^2 = .17$, and a Prime × Target interaction replicating the weapons bias effect, $F(1, 46) = 39.33$, $p < .001$, $\eta_p^2 = .46$. Importantly, these effects were qualified by the predicted Block × Prime × Target interaction, $F(2, 92) = 24.52$, $p < .001$, $\eta_p^2 = .35$ (see Figure 2).

To decompose this three-way interaction, we conducted separate 2 (Prime) × 2 (Target) ANOVAs for each of the three block types. In the baseline condition, the Prime × Target interaction was significant, $F(1, 46) = 17.17$, $p < .001$, $\eta_p^2 = .27$, revealing the typical pattern of racial bias: Gun images were classified more accurately when they followed Black faces ($M = .87$, $SD = .11$) than White faces ($M = .79$, $SD = .14$), $t(46) = 3.95$, $p < .001$, whereas tool images were classified more accurately following White faces ($M = .88$, $SD = .12$) than Black faces ($M = .84$, $SD = .13$), $t(46) = 5.24$, $p < .001$.

As expected, responses in the low-interference condition showed an exaggerated weapons bias effect: Prime × Target interaction, $F(1, 46) = 50.44$, $p < .001$, $\eta_p^2 = .52$. Gun images were categorized more accurately when they followed Black faces ($M = .90$, $SD = .10$) than when they followed White faces ($M = .70$, $SD = .20$), $t(46) = 6.29$, $p < .001$. Conversely, tool images were categorized more accurately following White faces ($M = .91$, $SD = .09$) than Black faces ($M = .75$, $SD = .22$), $t(46) = 5.24$, $p < .001$.

By contrast, and as predicted, in the high-interference condition, the typically observed Prime × Target pattern of racial bias was eliminated, $F(1, 46) = .03$, $p = .86$, $\eta_p^2 = .00$. The only significant effect to emerge was for the prime, $F(1, 46) = 6.82$, $p = .01$, which indicated greater accuracy on trials with Black primes ($M = .87$, $SD = .12$) than with White primes ($M = .84$, $SD = .15$).

Finally, to directly compare the magnitudes of bias effects observed in each block, a bias difference score was created to represent the Prime × Target interaction effect in each condition

[1] Because the true effect size for our predicted effect was unknown, a priori power analysis was not conducted. Instead, a sensitivity analysis using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) was conducted based on actual sample sizes ($\alpha = .05$, power = .80, average intercorrelation of repeated measures = .50–.80) to estimate the minimally detectable effect size of the highest level within-subjects interaction in each study. Across studies, the estimated minimal detectable effect size ranged from .10 to .13; the observed effect sizes ranged from .12 to .60.

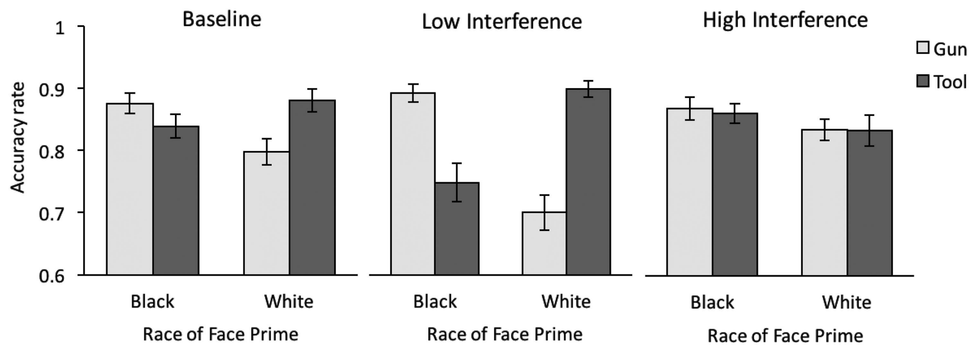

Figure 2. Accuracy rate (proportion correct) in target classification as a function of prime race and degree of interference.

(proportion correct for [Black-gun–Black-tool] – [White-gun–White-tool]). These comparisons confirmed that the degree of bias was significantly weaker in the high-interference condition (M = .01, SD = .24), $t(46) = 2.63$, $p = .01$), and significantly stronger in the low-interference condition (M = .35, SD = .34), $t(46) = 5.28$, $p < .001$, compared with baseline scores (M = .12, SD = .20). These results provided direct initial support for the proposed effect of proactive control.

In addition, investigation of the block main effect revealed that average accuracy across trial types was significantly higher in the high-interference blocks (M = .86, SD = .10) than in the low-interference blocks (M = .82, SD = .10), $t(46) = 3.96$, $p < .001$. Accuracy on baseline blocks fell in between (M = .85, SD = .10); though not significantly different from high-interference blocks, $p = .34$, accuracy on baseline blocks was significantly greater than on the low-interference blocks, $t(46) = 2.90$, $p = .006$. Thus, as predicted, but perhaps counterintuitively, participants performed best in blocks with high interference and worst in blocks with low interference.[2]

Process dissociation analysis. We used the process dissociation procedure (PDP) to further test our prediction that response interference—our manipulation of proactive control—would primarily affect controlled processing rather than automatic processing (Jacoby, 1991; Payne, 2001). The PDP is a method for estimating the unique contributions of controlled (i.e., task goal-consistent) and automatic (i.e., stereotype bias-consistent) processes to task performance from patterns of behavior. In the PDP framework, the estimate of control (PDP-C) represents the probability that one will respond in an accurate, goal-consistent manner, without stereotype-driven bias caused by racial primes (P[correct response on congruent trials] – P[incorrect response on incongruent trials]). The estimate of automaticity (PDP-A) represents the probability that, to the extent control fails, one's responses will be biased by racial primes because of the stereotypic association with targets (P[stereotypic error/(1 – control)]; Payne, 2001). Although PDP-C is not a pure index of proactive control and may also reflect a degree of reactive control, it provides additional evidence regarding the role of controlled processing. Our main prediction was that controlled processing would be enhanced in high-interference blocks relative to baseline and low-interference blocks.

A 3 (Block) × 2 (race) ANOVA of PDP-C estimates revealed the predicted main effect of block, $F(2, 92) = 8.49$, $p < .001$, $\eta_p^2 = .16$, and this effect did not vary by race, as indicated by the nonsignificant interaction, $F(2, 92) = .27$, $p = .76$, $\eta_p^2 = .01$. This effect demonstrated that the high-interference block elicited the highest degree of controlled processing (M = .72, SD = .21), and low-interference the least control (M = .63, SD = .20), $t(46) = 3.96$, $p < .001$, with the baseline block in the middle (M = .70, SD = .20), differing significantly from the low-interference block, $t(46) = 2.90$, $p = .006$, but not the high-interference block, $t(46) = .97$, $p = .34$. This analysis is virtually identical to the main effect of block on accuracy rates reported in the previous section as PDP-C essentially represents average accuracy within a block as a function of prime race. This pattern supported our hypothesis, and it also suggested the inclusion of 50% incongruent trials in the baseline condition is sufficient to induce a substantial degree of proactive control. A main effect for race also emerged, $F(1, 46) = 9.65$, $p = .003$, $\eta_p^2 = .17$, such that control was greater for Black than White prime trials, but this effect was not moderated by interference condition.

PDP-control estimates derived from Black and White trials are typically highly correlated, consistent with the idea that controlled processing reflects a domain-general mechanism for responding to targets that should not be influenced by primes (e.g., Amodio et al., 2008; Payne, 2005). Our theoretical analysis suggests that when proactive control is engaged, control should be applied across the entire task set—which includes both Black and White prime trials—and therefore estimates of control for Black and White trials should be very highly correlated. By contrast, when proactive control is low, control should be applied more reactively to individual trials—particularly on Black trials, which should produce greater activation of implicit bias during low-interference blocks—and thus we would expect a relatively weaker correlation between Black and White control estimates. Consistent with this theorizing, correlations between Black and White PDP-control estimates were very strong in high-interference blocks, $r(45) = .74$, $p < .001$, and baseline blocks, $r(45) = .81$, $p < .001$, but the correlation was

[2] Although our methods were optimized for analysis of accuracy rates, we conducted a supplementary analysis of response latencies. An ANOVA produced the expected Block × Prime × Target interaction, $F(2, 92) = 22.92$, $p < .001$. Consistent with effects on accuracy, the baseline block indicated the typical pattern of racial bias in RTs, $F(1, 46) = 39.03$, $p < .001$. This pattern was exaggerated in the low-interference block, $F(1, 46) = 66.93$, $p < .001$, and eliminated in the high-interference block, $F(1, 46) = .10$, $p = .75$.

relatively smaller in low-interference blocks, $r(45) = .48$, $p = .001$—a significant decrease compared with both the high-interference ($z = 2.30$, $p = .02$) and baseline ($z = 3.17$, $p = .002$) blocks.

Finally, we analyzed PDP-automatic estimates to test our prediction that greater automatic processing would be evident for Black than White trials, as in past research, but that the degree of automaticity would not differ as a function of block type. Because the formula for PDP-A cannot be solved when PDP-C equals 1 (i.e., when accuracy was 100% on one or more trial types), some subjects had missing values for PDP-A. Thirty-nine subjects had valid PDP-automatic scores across all conditions, and these were included in the present analysis. As expected, a 2 (race) × 3 (block) ANOVA produced only a main effect for race, $F(1, 37) = 34.77$, $p < .001$, $\eta_p^2 = .48$, such that the automatic estimate was higher for Black trials ($M = .64$, $SD = .20$) than for White trials ($M = .34$, $SD = .20$). PDP-automatic estimates did not vary by block, $F(2, 74) = 1.03$, $p = .36$, $\eta_p^2 = .03$, and the interaction was marginal, $F(2, 74) = 2.38$, $p = .10$, $\eta_p^2 = .06$. This pattern is consistent with the proposal that interference effects should modulate the engagement of controlled processing without affecting implicit associations.

Tests of alternatives. Although our main analyses supported our predictions, we considered alternative explanations for these results. One potential alternative is that the observed changes reflected new associative learning as a result of the pairings, such that on each block, participants learned the new predictive probabilities of prime-target pairs. According to this alternative, when participants begin a new block type, they would learn new prime-target associations. This pattern would be characterized by a gradual increase in accuracy across the block. To assess this possibility, we tested whether accuracy increased from the first half to second half within each block type. Accuracy rates were thus submitted to a 3 (Block type) × 2 (Prime) × 2 (Target) × 2 (block half: 1st vs. 2nd) repeated measures ANOVA. The main effect of block half was nonsignificant ($F < 1$, $p = .40$), and block half did not moderate the predicted Block × Prime × Target interaction, ($F < 1$, $p = .70$). Thus, it is unlikely that the observed effects reflected learning new prime-target associations.

A second, related possibility is that any change in probability incurs a switch cost. This suggests that when a new block is encountered, any unexpected change in trial probabilities would engage proactive control, such that the proactive pattern would be observed at the beginning of a new block regardless of whether it involves high or low interference. This alternative would predict a similar degree of proactive control in each block type. However, this explanation is contradicted by the results already presented, which show different degrees of accuracy depending on a block's degree of interference.

A third possibility is that this pattern was driven by participants' explicit expectancies about changing base rates of prime-target pairings. That is, participants may have noticed the change in pairing probabilities and then, based on their revised expectancy for prime-target pairings, changed their response strategy. We view this possibility as unlikely because the changes in pairing probabilities were never made explicit to participants, and none reported noticing such a change in debriefings. Moreover, this account would predict that, in the high-interference condition, accuracy would be greater on stereotype-incongruent trials (i.e., the expected pairing) than stereotype-congruent trials—a pattern that did not emerge.

Nonetheless, to further evaluate this alternative, we conducted an additional study in which participants ($N = 63$) completed a similar six-block version of the Weapons Identification Task used in Study 1. In this version, the prime-target probabilities in each block were always equal (50% stereotype-congruent, 50% stereotype-incongruent), but participants were explicitly instructed that prime-target probabilities would differ for each block. Thus, participants learned that two blocks contained 80% stereotype-congruent trials, two blocks contained 80% stereotype-incongruent trials, and two blocks contained an equal proportion. At the beginning of each block, participants viewed a screen clearly depicting each prime-target pairing and the number of trials during which it would be shown in the upcoming block; no participant expressed confusion about the instructions or procedure. A repeated measures ANOVA testing the effects of block instructions, prime (Black vs. White), and target (gun vs. tool) produced only the Prime × Target interaction, $F(1, 62) = 31.80$, $p < .001$, $\eta_p^2 = .34$, replicating the typical Weapons Identification Task effect. Importantly, this effect was not moderated by expectancy instruction, $F(2, 124) = .05$, $p = .95$, $\eta_p^2 = .00$. Hence, an experimental manipulation of explicit expectancy did not influence the expression of implicit bias. The same pattern emerged in analyses of response latencies. These results suggest that explicit expectancies regarding base rates are not sufficient to elicit proactive control; in the present study, the direct experience of task difficulty was necessary.

Discussion

Study 1 tested the hypothesis that a context of strong response interference would elicit increased proactive control and a reduction in expressed implicit bias relative to a context of weak response interference. As expected, the low-interference condition elicited an exaggerated pattern of implicit bias relative to the baseline condition, whereas in the high-interference condition, this pattern of implicit bias was completely eliminated. By comparison, in a multilab test of 17 interventions to reduce implicit bias (Lai et al., 2014), the most successful intervention of 53 tests could only reduce prejudice but did not eliminate it (postintervention IAT mean D score = .16). In the present study, the effect size for implicit bias in the proactive control condition was zero.

Process dissociation analysis confirmed that these results represented changes in controlled processing and not in the activation or accessibility of stereotype associations. Consistent with prior evidence that high-interference contexts elicit a mode of proactive control (e.g., Gratton et al., 1992), PDP modeling indicated greater controlled processing during the high-interference condition relative to the low-interference condition (with control estimates during baseline being intermediate). This pattern was reflected in the higher degree of accuracy across trial types in the high-interference blocks compared with the low-interference blocks (with baseline accuracy being intermediate). Indeed, the finding that stronger interference led to increased accuracy may be counterintuitive, but it is directly consistent with a proactive control mechanism as well as with past research. That is, an encounter with high interference engages proactive control, which serves to enhance goal-directed responding and, across the entire task set, yields better performance. By contrast, the exaggerated pattern of bias observed in the low-interference condition is consistent with a greater reliance on reactive control, which is engaged only after a response conflict is encountered and, as seen here, is more prone to failure than proactive control. This pattern is further consistent with the idea that proactive and reactive control serve complementary functions depending on situational demands.

Although the expression of weapons bias in task behavior was significantly reduced in the high-interference condition compared with baseline, PDP-control estimates did not differ significantly between these conditions. This pattern suggests that 50% incongruent trials was sufficient to engage heighten controlled processing, even if this moderate level of interference did not produce the same degree of bias reduction as the high interference condition. This finding is not surprising, given prior research noting the role of controlled processing in behavioral assessments of implicit bias (e.g., Bartholow & Dickter, 2008; Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005; Hilgard et al., 2015; Payne, 2001), yet it underscores the importance of considering the role of controlled processing in commonly used tasks that include equal proportions of congruent and incongruent trials.

Finally, and as predicted, the manipulation of response interference did not affect automatic processing. This finding further supports our proposal that the effects of proactive and reactive control operate on the behavioral expression of implicit bias and not on the source of bias itself (e.g., automatically activated stereotypes). This interpretation is also supported by the fact that interference effects did not strengthen over time within a block, indicating that the engagement of proactive control had nearly immediate effects on behavior and did not involve a gradual, strategic learning of predictive prime-target associations or a shift in experienced base rates. Moreover, these results could not be attributed to explicit expectancies regarding prime-target pairings.

It is notable that current theories of implicit social cognition would not predict the observed pattern. That is, most current research assumes that implicit task behavior provides a direct readout of an individual's implicit racial associations. If this were true, then a pattern of implicit bias should have been evident regardless of trial proportions and response interference. Our results did not support this conventional assumption. Instead, these results emphasize the idea that task performance represents expressed behavior rather than a direct readout of implicit associations, and that changes in proactive control can modulate the expression of implicit associations. In this way, proactive control enhances goal-directed responding (i.e., a focus on task-relevant targets as opposed to task-irrelevant primes), which, in turn, limits the expression of stored stereotype associations.

Study 2

Whereas Study 1 was designed to examine accuracy rates, in part to permit a valid process dissociation analysis, the use of a response deadline limited our ability to examine response latency effects caused by our manipulation. Thus, in order to examine the effects of proactive control in terms of response latencies, Study 2 repeated the Study 1 procedure without the use of a 500-ms response deadline. We expected to observe the same pattern of results as in Study 1, but with a stronger expression of this effect in response latencies.

Method

Sixty-four White psychology subject pool volunteers participated in exchange for partial course credit. The procedure and task design were identical to those of Study 1, with the exception that a response deadline was not used in the Weapons Identification Task. Instead, participants could respond within 2 s following target onset. Data from one participant who failed to follow instructions (i.e., pressed the same key throughout task) were excluded from analysis. Response latency and accuracy scores were computed as in Study 1.

Results

To test our central prediction that the typical pattern of implicit stereotyping observed in in equal-probability blocks would be enhanced in low-interference blocks but eliminated in high-interference blocks, we submitted natural-log-transformed response latencies to a Block (high-interference vs. baseline vs. low-interference) × Prime (Black vs. White) × Target (gun vs. tool) repeated measures ANOVA. This analysis produced a marginal effect for block, $F(2, 124) = 2.76$, $p = .067$, $\eta_p^2 = .04$, indicating a general slowing of responses during the high-interference block relative to the low-interference block, a significant main effect for target, $F(1, 62) = 66.34$, $p < .001$, $\eta_p^2 = .52$, and the expected Prime × Target interaction, $F(1, 62) = 43.98$, $p < .001$, $\eta_p^2 = .42$.

Importantly, the three-way interaction was significant, $F(2, 124) = 38.78$, $p < .001$, $\eta_p^2 = .39$, replicating the pattern observed in Study 1 with response latencies instead of accuracy rates (see Figure 3). As in Study 1, the Prime × Target interaction was significant in the baseline block, $F(1, 62) = 16.16$, $p < .001$, $\eta_p^2 = .21$, exaggerated in the low-interference block, $F(1, 62) = 73.42$, $p < .001$, $\eta_p^2 = .54$, and reduced to marginal significance in the high-interference block, $F(1, 62) = 3.01$, $p = .09$, $\eta_p^2 = .05$.

In this study, the target main effect (i.e., categorizing guns faster than tools) was significant in each case, Fs < 31.00, ps < .001, remaining significant in the high-interference condition despite the reduction in the influence of racial prime, as indicated by the lack of a prime main effect or interaction. This pattern is consistent with the idea that the engagement of proactive control shifts attention away from task-irrelevant cues (e.g., the race primes) while retaining a focus on task-relevant cues (targets).

Finally, an ANOVA testing effects on accuracy rates produced the same pattern of results, including the predicted three-way interaction, $F(2, 124) = 13.05$, $p < .001$, $\eta_p^2 = .17$, as in Study 1.

Discussion

The aim of Study 2 was to replicate Study 1 using a procedure better suited for an examination of response latencies, which could provide converging evidence for proactive control alongside the accuracy results in Study 1. As in Study 1, we observed the typical pattern of racial bias on the Weapons Identification Task in the baseline condition. This pattern was exaggerated in the low-interference condition but attenuated in the high-interference condition. Once again, this pattern is not strictly predicted by traditional theories of implicit bias, which would posit that behavior on such tasks represents implicit mental associations without being

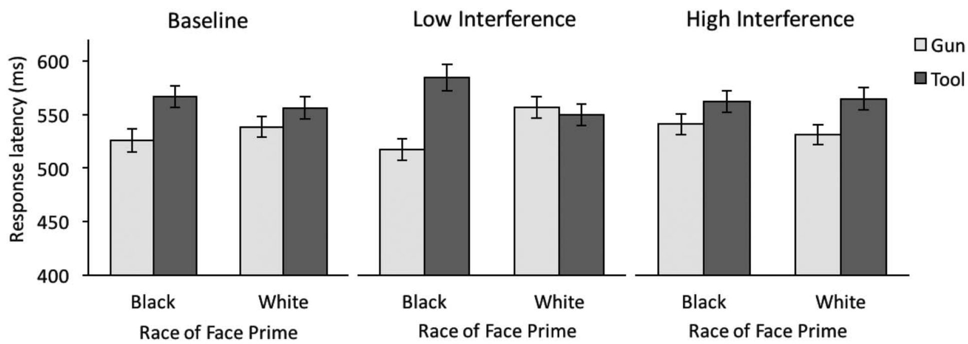

Figure 3. Response latencies for target classification as a function of prime race and degree of interference.

affected by task features such as response fluency or varying trial probabilities. By contrast, our results show that proactive control, which we propose is elicited by the engagement with response interference (Gratton et al., 1992), substantially altered the expression of implicit bias, reducing it to nonsignificance.

Study 2 results also addressed the possibility that the implicit bias reductions observed in the high-interference conditions might be caused by response slowing—that is, the possibility that responses would be slower, on average, in the high-interference condition and that this extra time would permit participants to control their implicit bias (e.g., through a reactive process). Our results cast doubt on this possibility. While we observed a marginally significant main effect of block on response latencies, the predicted three-way interaction effect was extremely large. Considered alongside the results of Study 1, in which potential response slowing effects were controlled for with the use of a response deadline, these results rule out the possibility that the reduction in bias observed in high-interference blocks could be caused by response slowing alone.

Our analysis begins to reveal a mechanism through which the experience of interference leads to a reduction in bias. We found that in high-interference blocks, responses differed as a function of target but not race prime, consistent with the idea that proactive control increases the processing of task-relevant cues while reducing attention to task-irrelevant secondary cues. We return to this idea directly in Study 4.

Study 3

Proactive control is proposed to function in a domain-general manner, supporting goal-directed responses regardless of the specific nature or source of bias. For example, previous research has linked evaluative (prejudice) and conceptual (stereotype) associations to different underlying learning and memory systems that vary in their affordance for change (Amodio & Devine, 2006; Amodio & Ratner, 2011a). This research raises the possibility that implicit prejudice might be more resistant to control than implicit stereotyping. However, because proactive control is theorized to be a domain-general process, operating primarily on response outputs, we hypothesized that proactive control should be equally effective in reducing expressions of implicit prejudice and stereotyping. Thus, Study 3 was designed to replicate Study 1 on tasks assessing implicit prejudice and implicit stereotyping, while also comparing the effects of proactive control between these two forms of implicit racial bias.

Method

Participants and design. Forty-nine White native-English-speaking psychology students (67% female) participated in exchange for course credit. Participants were randomly assigned to complete either the evaluative (i.e., prejudice) or stereotyping task during individual laboratory sessions. Each task included six blocks of trials in one of three different counterbalanced orders. The procedure was identical to that of Study 1 but included separate tasks to assess evaluative or stereotype associations.

Tasks. Participants completed either an evaluative priming task or a stereotype priming task. In the evaluative priming task, Black or White face primes were followed by positive (e.g., "happy," "pleasure") or negative (e.g., "rotten," "awful") target words, which were categorized as either pleasant or unpleasant. Importantly, target stimuli in the evaluative priming task were unrelated to known racial stereotypes.

In the stereotype priming task, Black and White face primes were followed by target words related to intelligence (e.g., "math," "scientist") or athleticism (e.g., "muscular," "basketball"), which were categorized as either mental or physical, respectively. This classification scheme permitted categorization along a single dimension to structurally match the evaluative task. Furthermore, all target words were neutral to positive (see Amodio & Devine, 2006), and therefore categorization could not be made on the basis of valence. Thus, these two tasks assessed unique evaluative and conceptual aspects of implicit racial bias, respectively.

Face prime stimuli and the timing of all stimulus events were identical to those in Study 1. The design of these tasks was also identical to that of Study 1, with three different block types representing baseline (equal proportions of bias-consistent and bias-inconsistent prime-target pairings), low interference (80% bias-consistent), and high interference (80% bias-inconsistent). Two blocks of each type were included, for a total of six blocks. As in Study 1, a reminder to respond more quickly was shown immediately following responses exceeding 500 ms.

Accuracy rates were computed by dividing the number of correct trials by the total number of valid trials within each trial type, and latencies for correct responses occurring between 200 ms and

1,200 ms were natural-log transformed and averaged within trial type for analysis.

Exclusions. Data from five participants were excluded: two with missing data, and three with outlying scores on one or more measures suggesting failure to follow task instructions. The final sample included 44 participants.

Results

Accuracy scores were submitted to a 2 (task: evaluative vs. stereotype) × 3 (block type: high-interference vs. baseline vs. low-interference) × 2 (prime: Black vs. White) × 2 (target: bias consistent vs. bias inconsistent) mixed ANOVA. This analysis produced a significant effect for task, indicating higher overall accuracy on the evaluative task (M = .89) than the stereotyping task (M = .79), $F(1, 42) = 15.52$, $p < .001$, $\eta_p^2 = .27$. This effect may have reflected the simpler classification scheme used in the evaluative task.

Importantly, the predicted Block × Prime × Target interaction was again significant, $F(2, 84) = 12.74$, $p < .001$, $\eta_p^2 = .23$, replicating the proactive control effect observed in Studies 1 and 2. This effect was not moderated by task type (four-way interaction: $F[2, 84] = 1.88$, $p = .16$, $\eta_p^2 = .04$), suggesting that the effect of proactive control on expressions of implicit prejudice and stereotyping did not differ significantly. To illustrate the similar effects of proactive control across tasks, the three-way interaction pattern is presented separately for each task in Figure 4.

As in Study 1, we decomposed the significant three-way interaction as a function of block type, combining data from the evaluative and stereotyping tasks. For the baseline block, a 2 (prime) × 2 (target) ANOVA revealed the expected interaction, $F(1, 43) = 10.46$, $p = .002$, $\eta_p^2 = .20$: Negative/athletic words were classified more accurately following Black faces (M = .89, SD = .11) than White faces (M = .83, SD = .15), $t(43) = 2.58$, $p = .01$, whereas positive/intelligence words were categorized more accurately following White faces (M = .88, SD = .13) than Black faces (M = .83, SD = .12), $t(43) = 2.34$, $p = .02$. These effects replicate previous findings using similar tasks (Amodio & Devine, 2006; Amodio & Hamilton, 2012; Gilbert, Swencionis, & Amodio, 2012).

The low-interference condition produced an exaggerated Prime × Target interaction, $F(1, 43) = 29.47$, $p < .001$, $\eta_p^2 = .41$. Negative/athletic words were categorized more accurately following Black faces (M = .90, SD = .10) than White faces (M = .70, SD = .20), $t(43) = 4.97$, $p < .001$. Conversely, positive/intelligence words were categorized more accurately following White faces (M = .89, SD = .10) than Black faces (M = .77, SD = .21), $t(43) = 4.13$, $p < .001$.

Again, and as predicted, implicit bias was eliminated in the high-interference condition, as indicated by the absence of a Prime × Target interaction, $F(1, 43) = .02$, $p = .88$, $\eta_p^2 = .00$. Although main effects emerged for both prime, $F(1, 43) = 5.33$, $p = .03$, $\eta_p^2 = .11$, and target, $F(1, 43) = 5.45$, $p = .02$, $\eta_p^2 = .11$, indicating better accuracy on trials with White primes or positive/intelligence targets, respectively, neither main effect indicated a pattern consistent with racial bias (i.e., given the absence of the prime–target interaction).

The omnibus ANOVA also produced a main effect for block, $F(2, 84) = 3.28$, $p = .04$, $\eta_p^2 = .07$, such that accuracy was higher in the high-interference (M = .85, SD = .10) and baseline (M = .85, SD = .09) blocks than in the low-interference block (M = .83,

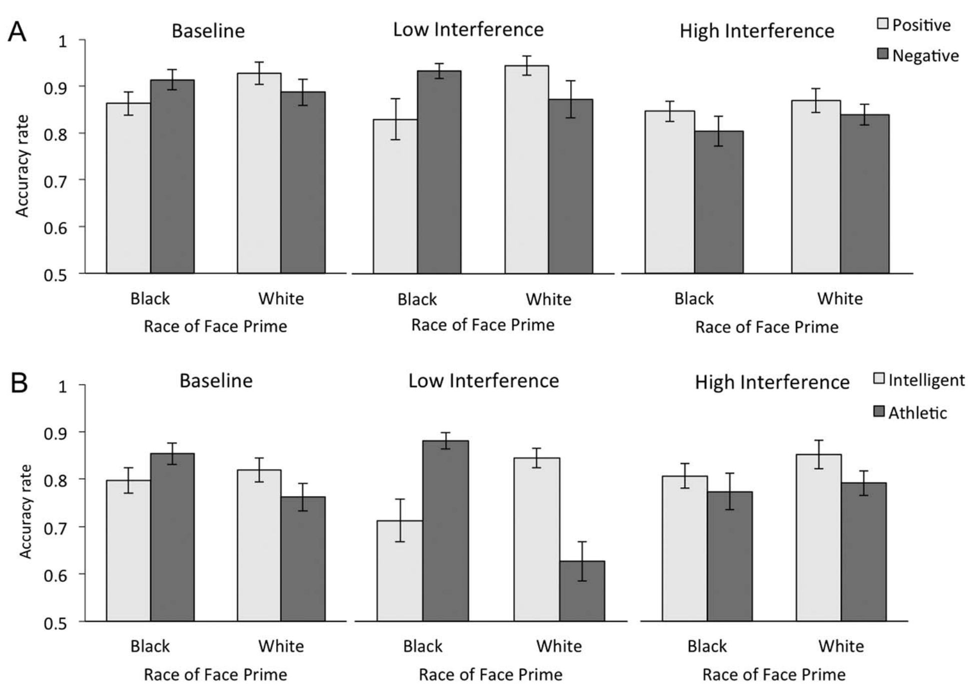

Figure 4. Accuracy rates in target classification as a function of prime race and degree of interference on sequential priming measures of implicit prejudice (Panel A) and implicit stereotyping (Panel B).

SD = .12). Similar to the pattern observed in Study 1, overall accuracy in the low-interference block was significantly lower than in the baseline block, $t(43) = 2.57$, $p = .01$, and nonsignificantly lower than the high-interference block, $t(43) = 1.35$, $p = .18$.

Finally, when data from each task were analyzed separately, the predicted Block × Prime × Target interaction was significant for both (evaluative: $F[2, 44] = 4.24$, $p = .02$, $\eta_p^2 = .16$; stereotyping: $F[2, 40] = 8.53$, $p < .001$, $\eta_p^2 = .30$).

Discussion

Study 3 revealed that proactive control, engaged by the experience of high response interference, eliminated expressions of implicit prejudice and implicit stereotyping. This finding replicates the effects on weapons bias seen in Studies 1 and 2, supporting our proposed model. By comparison, low-interference blocks produced behavior that is characteristic of reactive control, whereby control is only engaged after response conflict is encountered and, as a result, performance accuracy across the block is worse.

A secondary goal of this study was to compare the effects of proactive control on implicit prejudice and implicit stereotyping. Prior research suggests that implicit evaluative and stereotype associations may be rooted in different neurocognitive systems of learning and memory, raising the possibility that they may be differently affected by some bias reduction interventions (Amodio, 2014b; Amodio & Ratner, 2011a). However, we did not observe a significant difference in the effect of proactive control between expressions of implicit prejudice and stereotyping. This result is consistent with the idea that proactive control operates on a person's attention and action during task performance but not on their underlying mental associations (Amodio, 2014a; Amodio, Harmon-Jones, & Devine, 2003). That is, on both tasks, proactive control presumably led participants to focus more on primary task-relevant target stimuli and less on race primes—a domain general process that should be effective across domains of implicit associations. However, although this interpretation follows from our theoretical conceptualization of proactive control and fits well with our data, it remains speculative at this point. Study 4 was conducted to test this account more directly.

Study 4

Our broad proposal is that proactive control involves a preemptive shift in attention toward goal-relevant targets and away from task irrelevant cues (e.g., race primes). Study 4 was designed to test this hypothesis more directly in the context of the response interference manipulation used in Studies 1 to 3. Specifically, we predicted that during high-interference blocks, participants' attentional processing of race would be reduced relative to low-interference blocks. Moreover, this shift should be accompanied by a reduction in response conflict when the target is encountered, which, in turn, should correspond to better task performance (i.e., response accuracy). In order to test this account, we used an event-related potential (ERP) approach capable of assessing the predicted patterns of early attention and conflict processing during task performance. We did so in the context of an evaluative race priming task that included only high- and low-interference block types, omitting the baseline block to accommodate the greater number of trials needed for ERP analysis. Although we could have also tested this hypothesis in the context of implicit stereotyping or weapons bias, we chose to use an evaluative task given the strong interest in implicit prejudice in the field.

To assess the early attentional processing of race primes, we measured the frontal P2 component of the ERP in response to Black and White face primes. The P2 reflects early goal-directed attentional processing in the brain (Amodio, Bartholow, & Ito, 2014; Schutter, de Haan, & van Honk, 2004). When comparing responses between Black and White prime images, the P2 provides a precise index of race cue processing during the task. Previous research has shown that the P2 amplitude is typically larger in response to Black than White faces, presumably because Black faces constitute a more salient cue among participants concerned about appearing prejudiced (Amodio, 2010; Correll et al., 2006; Dickter & Bartholow, 2007; Ito & Urland, 2003). However, if proactive control involves a shift in attention away from race and toward primary task cues, we would expect the typical race effect on P2 amplitudes to be reduced in the high-interference condition, such that the P2 responses no longer differ between Black and White faces.

Additionally, if attention to race primes is reduced under proactive control, then the processing of target stimuli should unfold with less interference from racial associations. Past research has shown that the N2 component of the ERP is sensitive to conflict between an intended response and a countervailing tendency (van Veen & Carter, 2002). For example, when a Black face precedes a positive target word, the conflict between a prejudiced response (i.e., to classify the word as negative) and the intended correct response elicits an enhanced N2 amplitude (cf. Amodio et al., 2004; Bartholow & Dickter, 2008; Dickter & Bartholow, 2010). The N2 reflects activity in the dorsal anterior cingulate cortex, which functions to detect conflict between top-down and bottom-up impetuses for behavior and aid in the resolution of such conflict (Botvinick, Braver, Barch, Carter, & Cohen, 2001; van Veen & Carter, 2002). Hence, whereas racial cues typically create conflict with target processing in race priming tasks, the engagement of proactive control should be associated with a reduction in prejudice-based conflict, which, in turn, should be associated with the reduced influence of race primes on behavior. That is, proactive shifts in attention should attenuate prejudice-based conflict, and thus the N2 should become more responsive to target-relevant responses than to conflict between race primes and targets.

Method

Participants and design. Fifty right-handed, White native-English-speaking psychology students participated in exchange for course credit. Two participants were excluded because of missing data, and three because of extreme (i.e., outlier) electroencephalography (EEG) data, leaving data from 45 participants for analysis. The design was fully within-subjects.

Procedure. After providing informed consent, participants were fitted with an electrode cap for EEG recording. Participants completed the evaluative race priming task, as in Study 3, in which they were instructed to classify pleasant and unpleasant words. To maintain the psychological experience and behavioral effects of Studies 1 to 3, the timing of events within each trial was identical to Study 3. After completing this task, participants were given a funneled debriefing, thanked, awarded credit, and dismissed. Sessions lasted approximately 90 min.

Evaluative priming task. As in Study 3, the evaluative priming task presented participants with word targets to be categorized as either pleasant or unpleasant following Black or White face primes. However, in this study, face stimuli were grayscale images of Black and White faces that were equalized for luminance. It was important to control for this visual property to ensure that any differences in early neural responses to Black and White faces were caused by racial identity and not differences in theoretically irrelevant stimulus features (e.g., image luminance).

To simplify the study design in order to accommodate the demands of EEG recording sessions, we included only low-interference (80% congruent) and high-interference (80% incongruent) blocks of trials. Participants completed four blocks that each contained 80 experimental trials (two blocks of low-interference, two blocks of high-interference; 320 trials total), receiving a break after each block. The four blocks of trials were presented in two different orders, counterbalanced across participants.

Behavioral data processing. Accuracy rates were computed for each trial type as a function of block condition, as in prior studies.

ERP data processing. EEG was recorded from 15 Ag-AgCl electrodes embedded in a stretch-lycra cap (Fz, Fcz, Cz, Pz, Oz, F3, F4, F7, F8, P3, P4, P7, P8, PO9, PO10), with a left earlobe reference and forehead ground (Electrode Arrays, El Paso, TX). EEG data were passed through a .5–100 Hz filter and digitized at 1,000 Hz. Offline, EEG was rereferenced to average earlobes and scored for movement artifact. ERP analysis focused on data from the frontocentral site (Fcz), following past work (Amodio et al., 2014). EEG data from FCz were processed using a regression-based blink correction procedure, and frequencies below 1 Hz and above 15 Hz were digitally filtered to isolate the components of interest. A 1,200-ms stimulus-locked epoch of EEG, beginning 200 ms prior to prime onset, was selected for each artifact-free trial. A 200-ms prestimulus baseline average was subtracted from each epoch to normalize signals within trials.

Prime-locked P2. The stimulus-locked P2 component was quantified from average ERP waveforms, separately for Black and White face prime trials as a function of high- and low-interference blocks. P2 amplitudes were scored as the maximum voltage between 100 and 200 ms following onset of the face prime stimulus (Amodio, 2010).

Target-locked N2. The stimulus-locked N2 component indexed response conflict as participants prepared to respond to a positive or negative word target. Thus, the N2 component was quantified as the maximum negative-going voltage between 200 and 400 ms following target onset (Bartholow & Dickter, 2008), as a function of prime race, target valence, and block (high vs. low interference).

Results

Behavioral effects. We first examined participants' behavioral responses to test whether they replicated the pattern found in Studies 1 to 3. Accuracy scores were submitted to a 2 (block: high vs. low interference) × 2 (prime: Black vs. White face) × 2 (target: positive vs. negative word) ANOVA. This analysis produced a significant Prime × Target interaction, $F(1, 44) = 7.29$, $p < .01$, $\eta_p^2 = .14$, which was qualified by the predicted three-way interaction, $F(1, 44) = 13.21$, $p < .001$, $\eta_p^2 = .23$ (see Figure 5).

Simple effects were tested separately for responses in the low- and high-interference blocks. In the low-interference block, a 2 (prime) × 2 (target) ANOVA indicated a significant interaction, $F(1, 44) = 17.65$, $p < .001$, $\eta_p^2 = .27$, representing a pattern of implicit prejudice: positive target words were categorized more accurately following White faces ($M = .96$, $SD = .05$) than Black faces ($M = .90$, $SD = .13$), $t(44) = 3.78$, $p < .001$; conversely, negative target words were categorized more accurately following Black faces ($M = .95$, $SD = .06$) than White faces ($M = .91$, $SD = .13$), $t(44) = 2.77$, $p = .008$.

In the high-interference block, by contrast, the 2 (prime) × 2 (target) ANOVA did not produce any significant effects. Importantly, the Prime × Target interaction was not significant, $F(1, 45) = 0.01$, $p = .96$, $\eta_p^2 = .00$, indicating the elimination of expressed bias, replicating Studies 1 to 3.

P2 effects. Our central question concerned effects of interference condition on early attention to race primes. We hypothesized that the relatively greater attentional processing of Black compared with White faces typically observed in race priming tasks would be diminished or eliminated during the high-interference block. This pattern would reflect a shift in attention away from the racial significance of the primes, and presumably toward targets, during proactive control.

To test this hypothesis, P2 scores, derived from the waveform shown in Figure 6, were submitted to a 2 (Race) × 2 (Block) ANOVA. This analysis produced a main effect of race, $F(1, 44) = 5.10$, $p = .03$, $\eta_p^2 = .10$, which was qualified by the predicted interaction, $F(1, 44) = 6.14$, $p = .02$, $\eta_p^2 = .12$ (mean scores shown in Figure 7).

Simple effects analysis revealed that, during low-interference blocks, the P2 response was larger to Black faces ($M = 5.36$, $SD = 2.64$) than White faces ($M = 4.49$, $SD = 2.76$), $t(44) = 3.37$, $p = .002$, replicating several previous studies (Amodio, 2010; Dickter & Bartholow, 2007; Ito, Willadsen-Jensen, & Correll, 2007). By contrast, during high-interference blocks, in which proactive control is putatively engaged, P2 responses to Black faces ($M = 4.83$, $SD = 3.53$) and White faces ($M = 4.79$, $SD = 2.88$) did not differ, $t(44) = 0.16$, $p = .88$. This pattern supports the hypothesis that proactive control operates, in part, by shifting attention away from the racial content of the primes, which are irrelevant to the stated task goals, and presumably toward the task-relevant targets.

This interpretation was further supported by the relationship between the P2 response to race and expression of implicit bias

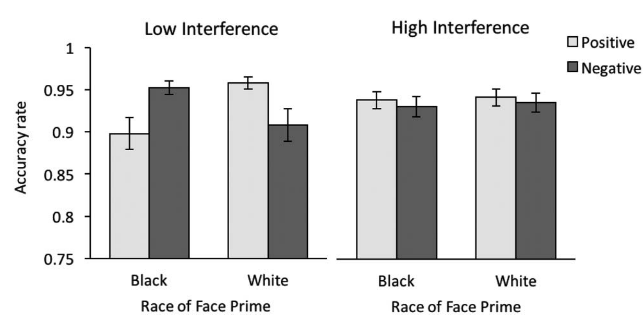

Figure 5. Accuracy rates in target classification as a function of prime race and degree of interference.

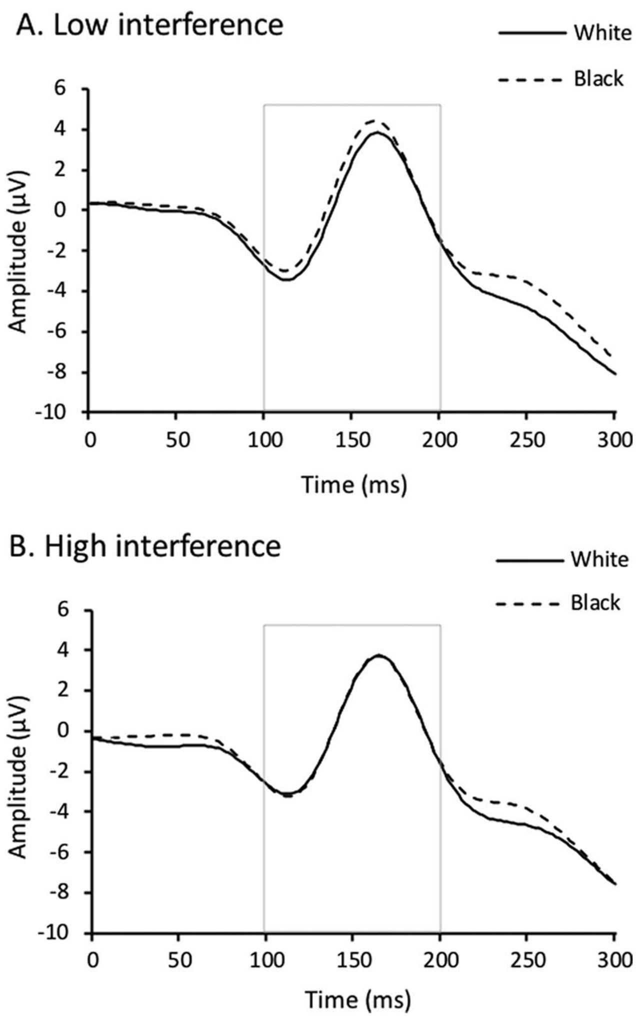

Figure 6. Prime-locked event-related potential waveforms, depicting neural activity recorded at the frontocentral site (Fcz) in response to the onset of White and Black face primes, on low-interference blocks (Panel A) and high-interference blocks (Panel B). The box indicates the P2 scoring window.

toward Black targets. In the low-interference condition, larger P2 responses to Black relative to White faces were associated with stronger anti-Black bias (difference in accuracy between Black-positive and Black-negative trials), adjusting for responses on White trials, ß = .32, $t(44) = 2.18$, $p = .03$. As expected, this relationship was not evident in the high-interference condition, ß = −.10, $t(44) = 0.67$, $p = .51$.

N2 effects. If proactive control shifts attention away from race cues to facilitate task-relevant responses, then it should also be associated with a reduction in cognitive conflict when responding to target stimuli. Thus, we predicted that in low-interference blocks, we would observe the typical pattern of conflict-related N2 responses to prejudice-incongruent trials (e.g., Black-positive and White-negative) compared with prejudice-congruent trials (Black-negative and White-positive). By contrast, in high-interference blocks, this pattern of conflict should be reduced and, if anything, conflict processing should relate more strongly to the processing of word targets.

N2 scores were submitted to a 2 (block: high vs. low interference) × 2 (prime: Black vs. White) × 2 (target: positive vs. negative) repeated measures ANOVA (full waveforms shown in Figure 8). A main effect for target, $F(1, 44) = 17.45$, $p < .001$, $\eta_p^2 = .28$, indicated stronger N2 responses to negative targets ($M = -4.54$, $SD = 2.27$) than positive targets ($M = -3.36$, $SD = 3.12$). Each two-way interaction in this model was also significant, Fs = 4.16 to 9.61, ps < .05, but these were qualified by a significant three-way interaction, $F(1, 44) = 66.35$, $p < .001$, $\eta_p^2 = .60$ (mean scores shown in Figure 9). This interaction was decomposed as a function of block to test our specific predictions.

In the low-interference block, a 2 (prime) × 2 (target) ANOVA produced only a significant interaction, $F(1, 44) = 51.96$, $p < .001$, $\eta_p^2 = .54$, which revealed a strong effect of prime-target incongruency associated with implicit prejudice. N2 amplitudes were stronger to positive targets following Black primes ($M = -4.80$, $SD = 4.11$) than White primes ($M = 2.76$, $SD = 3.04$), $t(44) = 4.29$, $p < .001$, but stronger to negative targets following White primes ($M = -5.91$, $SD = 3.54$) than Black primes ($M = -2.92$, $SD = 2.43$), $t(44) = 5.82$, $p < .001$. These results reveal that conflict processing was driven by the relation of racial cues with target responses. This pattern is characteristic of a reactive control process, which is supported by the ACC and engaged only in response to the activation of an incongruent response tendency (Amodio et al., 2004).

In the high-interference block, the 2 (prime) × 2 (target) ANOVA produced a main effect of target, $F(1, 44) = 28.52$, $p < .001$, $\eta_p^2 = .39$, indicating significantly larger N2 responses to negative targets ($M = -4.66$, $SD = 2.89$) than positive targets ($M = -2.94$, $SD = 3.36$), $t(44) = 5.34$, $p < .001$. The interaction was also significant, $F(1, 44) = 8.38$, $p = .006$, $\eta_p^2 = .16$, but it was smaller in magnitude than the target main effect and depicted a different pattern than in the low-interference condition, driven most strongly by conflict associated with Black-negative trials. More importantly, this pattern revealed that conflict processing in the high-interference condition was primarily associated with target type, consistent with the idea that proactive control should

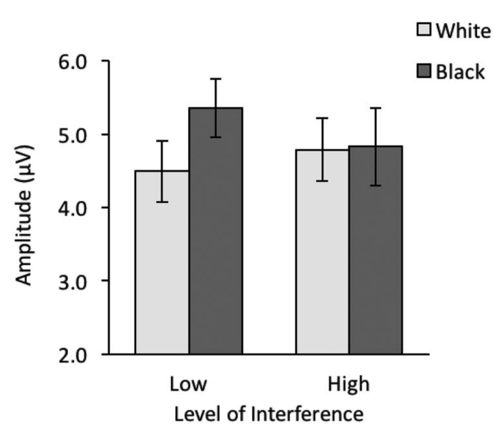

Figure 7. Mean P2 amplitude scores (at Fcz) in response to the onset of White and Black face primes, as a function of task interference. The difference in P2 amplitudes to White versus Black face primes observed during low-interference blocks was no longer evident during high-interference blocks.

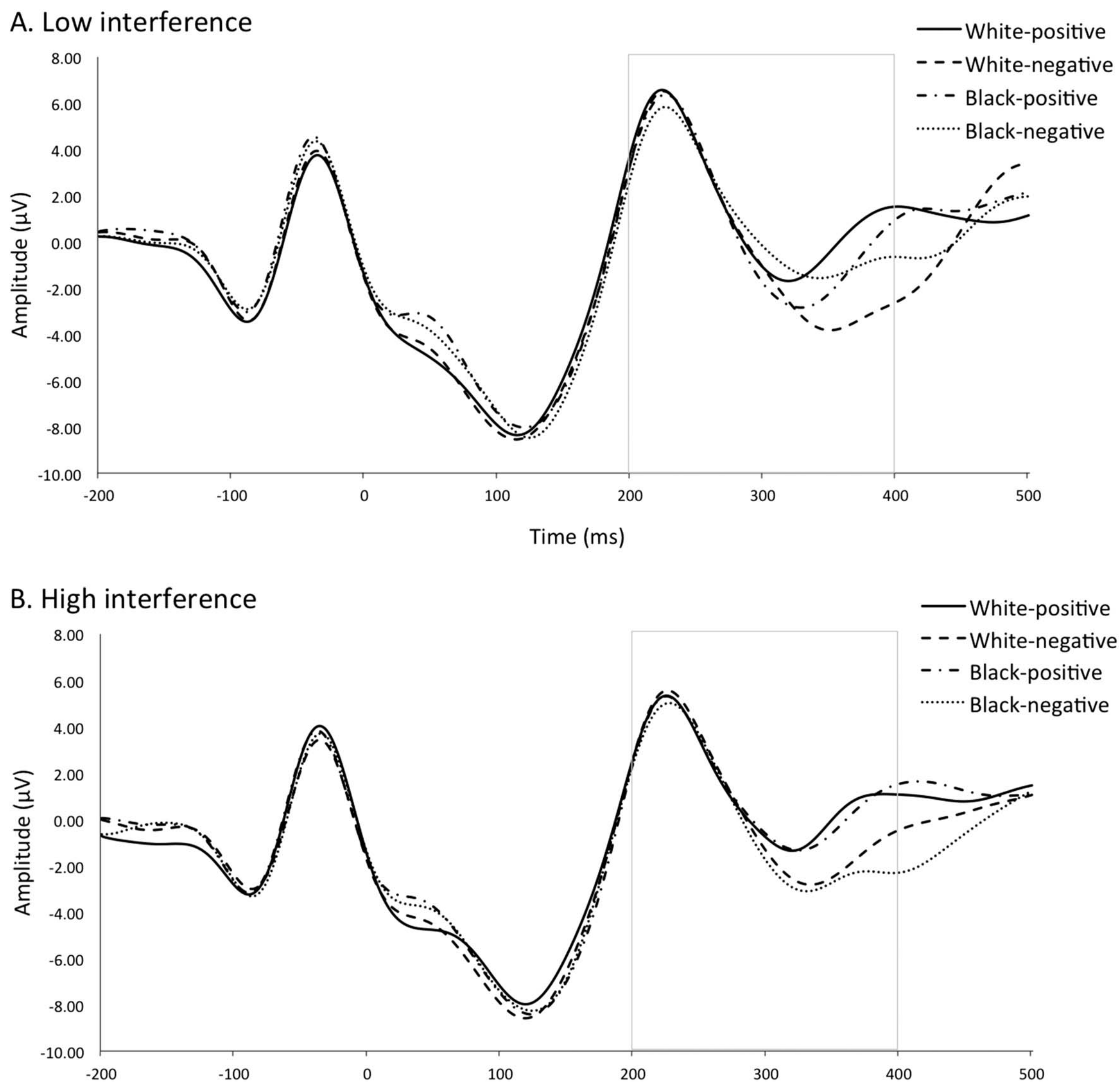

Figure 8. Target-locked event-related potential waveform, depicting neural activity recorded at the frontocentral site (Fcz), in response to the onset of positive and negative target words, as a function of White versus Black prime conditions, on low-interference blocks (Panel A) and high-interference blocks (Panel B). The box indicates the N2 scoring window; N2 peaks emerge at approximately 325 ms.

facilitate task-relevant processing of target features rather than task-irrelevant prime features.

If the patterns of N2 effects observed in the low- and high-interference conditions correspond to reactive and proactive modes of processing, respectively, then they should also relate to the degree of bias expressed in behavior during each block. That is, in the low-interference condition, the N2 response should relate to implicit bias expressed in behavior. By contrast, in the high-interference condition, in which racial cues no longer influenced behavior, this relationship should be diminished. To test these predictions, we computed the N2 effect for each block, expressed as ([Black-positive–White-positive] – [Black-negative–White-negative]), such that higher scores reflected greater race-biased conflict. An analogous difference score was computed for response accuracy in each condition. Correlation analysis revealed that in low-interference blocks, stronger race-induced conflict processing, indexed by the N2, was associated with greater expression of implicit bias in behavior, $r(44) = .42$, $p = .004$. By contrast, in the high-interference condition, conflict processing was no longer associated with implicit bias, $r(44) = .11$, $p = .47$. This overarching pattern of results supports the hypothesized links between race processing, response conflict, and behavioral expressions of bias.

Discussion

The aim of Study 4 was to directly test the proposed mechanism through which proactive control reduces the expression of implicit bias. Using ERP indices of early attention and conflict processing, our findings demonstrated that differences in the early attentional

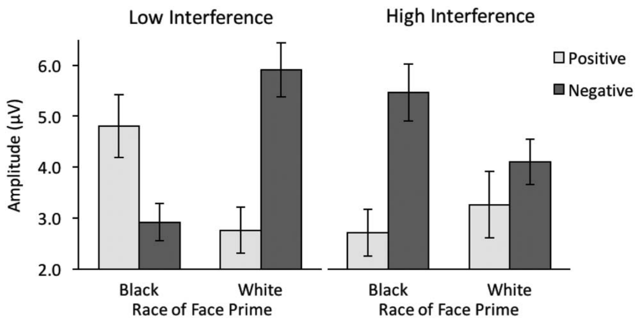

Figure 9. Mean peak N2 scores (at Fcz) in response to positive and negative target words (i.e., stimulus-locked) as a function of prime race and task interference. During low-interference blocks, N2 amplitudes reflected stereotype-driven prime-target conflict processing. During high interference, the degree of prime-target conflict processing was reduced.

processing of Black versus White faces, observed in the low-interference condition and in many prior studies, were significantly reduced in the high-interference condition. This pattern is consistent with our proposal that proactive control operates by shifting attention away from task-irrelevant distractors (i.e., race) to facilitate the processing of task-relevant targets. Study 4 results clarify that proactive control involves a goal-directed shift in attention and does not merely reflect response slowing.

One limitation was that our methods did not permit a direct assessment of early attention to target stimuli; this was because the target-related P2 component was partially convolved with ERP activity triggered by primes because of the close temporal proximity between primes and targets. However, by examining the target-related N2 ERP component, we were able to directly assess target processing in the context of prime effects. The observed pattern of N2 responses supported our theorizing: In the low-interference condition, the N2 revealed strong conflict processing for targets preceded by prejudice-processing of the task-relevant target was influenced by the task-irrelevant race cue. But in the high-interference condition, this conflict was reduced. These results are consistent with the hypothesized shift between a greater reliance on reactive control in the low-interference condition and a greater reliance on proactive control in the high-interference condition.

Finally, whereas race-based conflict processing was associated with the expression of racial bias in the low-interference condition (e.g., as in Amodio et al., 2004, 2008; Bartholow, Riordan, Saults, & Lust, 2009), these associations were nonsignificant in the high-interference condition. This pattern further supports our proposal that proactive control reduces the influence of task-irrelevant racial cues, both in the formation and the implementation of behavior.

Considered together, the results of Study 4 provide strong direct support for our proposal that proactive control operates by shifting attention to task-relevant stimuli, which reduces the influence of race on cognitive processing and thus facilitates goal-directed behavior. It is through this process that proactive control reduces the expression of implicit bias.

General Discussion

For someone with egalitarian beliefs, the goal of most interracial interactions is to engage in the content of the interaction without being influenced by implicit stereotypes and prejudices associated with the partner's race. We proposed that nonbiased responding can be promoted through proactive control—a mode of self-regulation that enhances goal-relevant processing and behavior and, as a consequence, limits the affordance for goal-irrelevant factors, such as unintended implicit biases, to influence responses. Proactive control may be contrasted with reactive control—the mode of control examined in virtually all prior research on self-regulation of racial bias—which is engaged only after a bias has been detected and requires additional cognitive resources for its operation. Across four studies, we demonstrated that proactive control was effective at promoting goal-directed responses while attenuating or eliminating the influence of racial bias on behavior.

In these studies, proactive control was engaged by the experience of response interference within a block of trials, using a method previously established in the cognitive control literature (e.g., Gratton et al., 1992). In each of these tasks, the explicit goal is to classify target words or images. Although the images of Black and White faces were incidental and extraneous to this main goal, many prior studies have shown that implicit racial associations nevertheless influence these classifications. Indeed, in the present studies, performance in baseline conditions revealed strong implicit associations of Black people with guns, athletic stereotypes, and negative evaluations relative to White people. However, in proactive control conditions, in which response interference was heightened, the influence of race primes was eliminated, and behavior showed no evidence of implicit bias. This effect was robust and consistent across studies.

Although our main focus was on the reduced expression of implicit bias observed under conditions of high interference, it is notable that low-interference conditions produced marked increases in expressions of racial associations relative to baseline. We speculate that the lowering of interference in such blocks may have increased participants' reliance on reactive control relative to baseline. That is, reactive and proactive control processes are theorized to be continuously active, but the degree of their relative engagement can shift as a function of the situation or the person (Braver, 2012; Schmid et al., 2015). In the present studies, the manipulation of response interference likely shifted this balance, from a greater reliance on reactive control in the low-interference condition to greater reliance on proactive control in the high-interference condition (cf. Gratton et al.'s (1992) notion of shifting between parallel and focused response strategies).

A Model of Proactive Control

More broadly, this research supports a new perspective on self-regulation, applied here to the domain of intergroup social cognition. Although the concept of proactive control has been invoked to describe aspects of social cognition, such as the operation of implicit attitudes measures (Hilgard et al., 2015; Mierke & Klauer, 2003) or the effects of egalitarian goal priming on stereotype expression (Moskowitz, Gollwitzer, Wasel, & Schaal, 1999; Moskowitz & Li, 2011), research has not previously examined the mechanistic operation of proactive control in social cognition. In this section, we integrate the present findings with existing research to present a broader theoretical model of proactive and reactive control, drawing on ideas from cognitive psychology and neuroscience and with a focus on implications for social cognition and intergroup behavior. Our theoretical framework emphasizes two major features: The operation of multiple forms of proactive control, and the interplay of proactive and reactive control processes.

Multiple forms of proactive control. The defining feature of proactive control is that it is engaged prior to a goal conflict (e.g., a temptation, bias, or distraction), whereas reactive control is engaged in response to a conflict. However, the existing literature suggests multiple forms of proactive control with different functions and complementary operations. Currently, the literature suggests three forms of proactive control, which we describe here.

Tonic proactive control. The present research focused on the tonic engagement of proactive control—a mode of controlled processing that is engaged by task interference or enhanced motivation and sustained for the duration of the task. In early research, proactive control was modulated by the experience of response interference across a series of responses, such that the engagement of proactive control was tonically elevated or reduced relative to baseline throughout a block of trials (e.g., Gratton et al., 1992). In other words, the engagement of control in response to one form of conflict is sustained and applied to subsequent, potentially unrelated responses. In the present research, this tonic engagement of proactive control occurred across full blocks of trials. In these cases, the elicitor of proactive control is completely unrelated to the source of bias, in contrast to most existing conceptualizations of prejudice control.

Although manipulations of interference represent the most established and long-studied elicitor of proactive control, a more controlled response strategy can be tonically engaged by other means. Most notably, expectancy may engage proactive control to facilitate vigilance and response preparation. A particular context, such as an academic exam room, may also prime goals that heighten one's general degree of controlled processing beyond concerns about test questions. Situations that elicit anxiety may have similar effects (e.g., Amodio, 2009).

Cued proactive control. Cued proactive control is engaged by a specific event. For example, Monteith showed that the realization of one's own bias triggers self-regulatory processes associated with introspection (i.e., behavioral inhibition, a reactive control process), and then proactive vigilance for racial cues that elicit more careful intergroup responding (Monteith et al., 2002). A similar process was demonstrated by Amodio, Devine, and Harmon-Jones (2007): After being induced to feel guilty about appearing prejudiced, participants exhibited increased approach-related brain activity when cued with the potential opportunity to reduce their bias. In Amodio (2010; see also Ofan, Rubin, & Amodio, 2011), Black face primes appeared to serve as cues, registered rapidly in the brain, to engage proactive control in Weapons Identification Task behavior. Cued proactive control is also represented by some forms of implementation intentions, in which a prespecified cue triggers a controlled response strategy (e.g., Mendoza et al., 2010; Stewart & Payne, 2008). In these examples, an expected cue engages proactive control.

Chronic proactive control. Chronic proactive control refers to the continuous or trait-like vigilance regarding a particular situation or response. For example, individual differences in self-control likely reflect a chronic form of proactive control, such that some people approach situations more carefully and deliberately. Chronic proactive control may also reflect goals or beliefs, such as egalitarianism (Moskowitz et al., 1999) or motivations to respond without prejudice (Devine et al., 2002; Plant & Devine, 1998), that remain active across situations and are thus engaged prior to any encounters with bias. Similarly, expectancies may also function as a form of chronic proactive control, in that they continuously direct attention and cognitive processing to a particular event that may require action.

Interactive effects of tonic, cued, and chronic proactive control. Although not a focus of the present research, these different forms of proactive control appear to have interactive effects. For example, a person with egalitarian beliefs may be especially responsive to racial cues for control, suggesting an interplay of chronic and cued proactive control processes (e.g., as in Amodio, 2010; Amodio et al., 2007; Monteith, 1993; Monteith et al., 2002). In the food choice domain, Kleiman, Trope, and Amodio (2016) found that participants who reported chronic eating conflict were more likely than those without such conflicts to engage proactive control on food choices that followed high-interference Stroop trials, suggesting an interplay between chronic and tonic forms of proactive control related to eating behavior. An important goal of future research will be to systematically investigate the distinct and interactive functions of these different forms of proactive control.

Proactive control and reactive control operate in concert. Following past theorizing (e.g., Botvinick et al., 2001; Braver et al., 2009; Gratton et al., 1992; Schmid et al., 2015), we propose that proactive and reactive forms of control serve complementary functions in the regulation of behavior. In essence, proactive control represents "Plan A"—a set of processes guided by one's main task goals, engaged when a goal is activated, and modulated according to interference encountered during goal pursuit. By comparison, reactive control represents "Plan B"—a backup strategy for when proactive control fails, triggered by the unexpected activation of alternative goals, such as distractions, temptations, or, as in the present case, racial biases that have a competing influence on one's response. Reactive control operates first by inhibiting the unwanted response, and then by engaging tonic proactive control to promote goal-consistent responses in subsequent behaviors. One's relative reliance on proactive and reactive control may depend on situational demands, such as the experience of task difficulty (e.g., Gratton et al., 1992; and the present studies) or individual differences such as social anxiety (Schmid et al., 2015).

The interplay of proactive and reactive control may also inform our understanding of how emotions, such as intergroup anxiety, affect the expression of bias. For example, based on prior findings (Schmid et al., 2015), this perspective suggests that intergroup anxiety may increase an individual's reliance on reactive control relative to proactive control—a strategy that permits greater responsiveness to unexpected threats but is more prone to failure. Although this theoretical account has not been tested directly, it is consistent with past findings that prejudice-related anxiety increases attentional processing of racial cues (Bean et al., 2012; Ofan, Rubin, & Amodio, 2014) while undermining performance on race-irrelevant tasks (e.g., gun/tool classifications after instructions to ignore race; Amodio, 2009; Amodio et al., 2006; Lambert et al., 2003). It is possible that other emotions can also influence the relative reliance on proactive and reactive control, in ways that increase or decrease expressions of bias. An important task for future research will be to understand the interplay of proactive and reactive control, emotion effects on this interplay, and its implications for self-regulation.

In summary, the model of control emerging from our analysis suggests at least three distinct forms of proactive control—tonic, cued, and chronic—which broadly function to promote intentional responses in the face of biases, temptations, or distractions. These proactive processes are distinguished from a reactive process, which is activated by the presence of a bias and operates primarily to inhibit the influence of the bias. These components of control likely operate in concert, adjusting their relative engagement online as a response proceeds. Although preliminary and still largely speculative, this model provides a theoretical framework for the present findings and outlines an important program of future research.

Limitations of Proactive Control and Implications for Intervention

Although proactive control can be extremely effective in reducing the expression of implicit bias, as demonstrated by our results, its operation is limited to situations in which the criteria for an intended response are very clear. For example, in typical laboratory assessments of implicit bias, there is a clear performance goal criterion—to accurately classify unambiguous target stimuli. The same would be true in the case of an employer reviewing job applications according to very clear procedures. When performance criteria are clear, proactive control can be deployed effectively to guide behavior toward these criteria. However, when performance criteria are not clear, as when evaluation procedures for hiring are vague or the objectives of an interaction are ambiguous, proactive control is unable to function. Indeed, it is precisely these ambiguous situations in which implicit biases are most likely to be expressed (Dovidio & Gaertner, 2000), likely because they preclude the role of proactive control.

A second feature of proactive control is that it does not directly aim to alter racial associations in the mind. That is, although proactive control reduces bias in behavior, Study 1 analyses showed that it did not alter automatic stereotype processing. This pattern is consistent with our theorizing, such that proactive control targets one's intended behavioral responses and not internal sources of bias. This feature could be considered a limitation given the broader goal of reducing prejudice. However, eliminating the expression of bias in behavior is an important first step, and one that is most critical for promoting equality and preventing racial discrimination (Amodio & Devine, 2005). Given the many forces in society that continuously promote and maintain implicit bias in people's minds, attempts to alter mental associations through person-level interventions may be ultimately futile. Until society and its institutions change, implicit group-based biases may continue to resist change. Yet a proactive control strategy—one that does not eradicate bias in the mind but eliminates its expression in behavior—presents a promising path forward in prejudice reduction efforts. This view is consistent with prior theory and research suggesting that the most effective strategy to reduce implicit bias is to regulate its influence on behavior (e.g., Amodio & Ratner, 2011b; Devine, 1989; Mendoza et al., 2010; Monteith, 1993).

In the past, control-based approaches to prejudice reduction were criticized as being ineffective, given their reliance on cognitive resources and susceptibility to distraction, depletion, and other forms of cognitive load (e.g., Bargh, 1999). However, these limitations pertain to reactive control. Proactive control does not appear to be susceptible to these limitations; rather, response interference and cognitive demand are factors that elicit proactive control processing. Thus, our model of proactive control suggests new avenues for prejudice reduction strategies that are robust to many of the factors that undermine the reactive control strategies considered in the past.

A Proactive Control Perspective on Existing Prejudice Reduction Approaches

Implicit bias is notoriously difficult to eliminate. Indeed, implicit associations regarding racial and ethnic groups are pervasive in American culture and propagated by institutions, and they become engrained in the mind over a lifetime of exposure. Not surprisingly, eradicating implicit associations from the mind is a fraught, if not impossible, endeavor. Research testing interventions to weaken implicit associations, such as stereotype negation (e.g., Kawakami et al., 2000), evaluative conditioning (Olson & Fazio, 2006), and exposure to counterstereotypic exemplars (Blair, Ma, & Lenton, 2001; Dasgupta & Greenwald, 2001), among many others, has reported at least temporary changes in behavioral assessments of implicit bias. However, methodological limitations prevent a direct test of whether such associations have actually changed in the mind or are expressed differently in behavior.

In light of the present findings, it is possible that such interventions do not actually change associations but instead work by enhancing proactive control, leading to more careful responding on implicit bias tasks or the temporary activation of egalitarian mental concepts. In such cases, proactive control could be engaged by exposure to race-related cues (e.g., in most implicit prejudice tasks, the relevance of race is almost always immediately apparent to participants), other features of the environment (e.g., returning to a lab testing room), or the creation of new goals and strategies following the intervention (e.g., Devine, Forscher, Austin, & Cox, 2012). To the extent that this interpretation is correct, a proactive control perspective on such interventions could help to elucidate why exactly they work, what their limitations are, and how they can be applied most effectively.

For example, our research provides a theoretical basis for understanding why interventions that include clear response criteria, such as implementation intentions, tend to be more effective than interventions aimed at directly reducing the source of bias (Lai et al., 2014). Moreover, interventions aimed at reducing the sources of bias are often short-lived, given the many societal forces that reinforce racist associations in the mind. By contrast, a proactive control strategy does not fade away with time; it is activated whenever a task elicits strong focus and should always be effective when employed. Thus, our results highlight the importance of creating new interventions that (a) include clear response criteria, and (b) induce a degree of difficulty in or intensified focus on reaching the criteria in order to more strongly engage a proactive mode of processing. These features are consistent with findings from the procedural justice literature, which emphasize the importance of clear procedures and guidelines for preventing discrimination in behavior (Lind & Tyler, 1988).

A Goals Perspective on Implicit Racial Bias

At a broader level, our theorizing emphasizes a motivational conceptualization of prejudice and implicit bias. According to this view, implicit bias occurs in the context of a person's primary task goal—for example, conversing with another person, negotiating a contract, grading an exam, or classifying words in a laboratory computer task—for which race is explicitly irrelevant. From this perspective, implicit bias represents a goal-irrelevant distractor—an unwanted influence on behavior that can interfere with one's intended response. Furthermore, although representing a distractor with regard to one's intended task, an implicit racial prejudice or stereotype may itself have a goal-like effect, such that it motivates avoidance behavior, harm, or prescriptive stereotyping, even if not consciously intended. It is important to note that the construal of implicit bias as a distractor, with regard to one's intended response, does not minimize the significance of racial bias; indeed, implicit racial biases can have serious consequences in many real-world contexts. But a consideration of implicit bias as a distractor in a goal theory framework can help us understand how and when racial associations will affect behavior.

Of course, there are also many situations in life in which race is central to one's primary task goals. Efforts to improve diversity, explicit intentions to avoid prejudice, and any other situation in which race is explicitly relevant would represent such a case. Additionally, for individuals who seek to respond *with* prejudice (Forscher, Cox, Graetz, & Devine, 2015), race (or other relevant social attributes) would also be relevant to one's main goals. Nevertheless, implicit racial associations may still play a role, either facilitating or interfering with one's intended responses, and proactive control may still function to promote one's goals.

Importantly, the conceptualization of social behavior and implicit bias in terms of primary goals and task-irrelevant distractors may illuminate new aspects of how implicit bias operates and how its expression may be regulated. The present research on proactive control represents an initial step in exploring new ideas suggested by this theoretical perspective.

Conclusion

To date, research on the regulation of prejudice has focused on a reactive form of control, which is engaged only after a bias emerges and is prone to failure. Here, we described a complementary *proactive* form of control that is engaged prior to the emergence of bias and may be more effective in promoting goal-directed unbiased responses. In four experiments, the engagement of proactive control was associated with eliminated expressions of implicit prejudice, stereotyping, and weapons bias in behavior. These results provide initial evidence for the effectiveness of proactive control interventions for reducing the expression of prejudice and, when considered alongside prior research on the control of prejudice, begin to suggest a broader theory of the self-regulation of social behavior.

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Correction to Trötschel et al. (2015)

In the article “Procedural Frames in Negotiations: How Offering My Resources Versus Requesting Yours Impacts Perception, Behavior, and Outcomes” by Roman Trötschel, David D. Loschelder, Benjamin P. Höhne, and Johann M. Majer (*Journal of Personality and Social Psychology,* 2015, Vol. 108, No. 3, pp. 417–435. http://dx.doi.org/10.1037/pspi0000009), rounding errors in *p* values occur in the Results under the *Concession rate* section of Experiment 4a and in the Outcome profits section of Experiment 5. The second sentence of the Discussion section of Experiment 4a should read as follows: Averaged across roles (i.e., buyers and sellers) parties made lower concessions and achieved higher individual outcomes when offering rather requesting resources. The last sentence of the *Concession rates* section of Experiment 5 should read as follows: This pattern was reversed when animals from zoo Y were addressed first, although this contrast effect did not reach significance.

The online version of this article has been corrected.

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