Individual Differences in the Regulation of Intergroup Bias: The Role of Conflict Monitoring and Neural Signals for Control

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Low-prejudice people vary considerably in their ability to regulate intergroup responses. The authors hypothesized that this variability arises from a neural mechanism for monitoring conflict between automatic race-biased tendencies and egalitarian intentions. In Study 1, they found that low-prejudice participants whose nonprejudiced responses are motivated by internal (but not external) factors exhibited better control on a stereotype-inhibition task than did participants motivated by a combination of internal and external factors. This difference was associated with greater conflict-monitoring activity, measured by event-related potentials, when responses required stereotype inhibition. Study 2 demonstrated that group differences were specific to response control in the domain of prejudice. Results indicate that conflict monitoring, a preconscious component of response control, accounts for variability in intergroup bias among low-prejudice participants.

Keywords: prejudice, control, ERP, ERN, conflict monitoring

> Especially when inner conflict is present, people put brakes upon their prejudices. They do not act them out—or they act them out only up to a certain point. Something stops the logical progression somewhere. (Allport, 1954, p. 332)

Since the publication of *The Nature of Prejudice* in 1954, Allport's observation that intergroup responses often require regulation has received volumes of empirical support (Devine & Monteith, 1999). Yet half a century later, the mechanisms through which regulatory processes inhibit unwanted racial biases remain unclear. The present research builds on recent advances in cognitive neuroscience to illuminate this mechanism and to apply it to an issue that has long perplexed researchers of prejudice: Why are some egalitarians better than others at responding without prejudice? To date, the prejudice and stereotyping literature has paid little attention to individual differences among low-prejudice people's ability to respond without bias and has been virtually silent on the mechanism that underlies these differences.

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Individual Differences in Responding Without Prejudice

Social psychological research on prejudice control has traditionally focused on how attitudes of high- versus low-prejudice people affect their behaviors. In this literature, *prejudice control* refers to responding with one's egalitarian intention despite the activation of countervailing racial stereotypes. Generally speaking, low-prejudice people are motivated to exert control in their intergroup responses, whereas high-prejudice people are not (Devine, 1989). However, growing evidence suggests that low-prejudice people vary substantially in their effectiveness in regulating expressions of race bias (Devine, Monteith, Zuwerink, & Elliot, 1991; Dovidio, Kawakami, & Gaertner, 2002; Gaertner & Dovidio, 1986). For example, when asked how one *should* respond toward a Black person versus how one actually *would* respond in an interaction, many low-prejudice people reveal substantial discrepancies between how they should and would behave (Devine et al., 1991). Low-prejudice participants with large should/would discrepancies are more prone to unintentional expressions of bias, especially in situations involving high cognitive load, in which regu-

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lation is difficult (Monteith & Voils, 1998). These studies provided strong evidence that many low-prejudice people lack the regulatory abilities to inhibit effects of implicit racial bias, especially in situations that limit their opportunity to deliberate when making a response.

Internal and External Motivations to Respond Without Prejudice

Recent research on issues of prejudice control suggests that differences in regulatory ability among low-prejudice people may be linked to their motivations to respond without prejudice. Plant and Devine (1998) observed that nonprejudiced responses are typically driven by a combination of two independent sources of motivation: *internal* (personal) and *external* (normative; see also Dunton & Fazio, 1997). Plant and Devine developed the internal motivation scale (IMS) and external motivation scale (EMS) to assess these two motivations and found scores on the IMS and EMS to be uncorrelated across several samples. IMS was strongly associated with low-prejudice attitudes and predicted participants' explicit responses when in private. Although EMS was not associated with domain-general measures of social desirability (e.g., Social Desirability Scale, Crowne & Marlowe, 1960; Self-Monitoring Scale, Snyder & Gangestad, 1986), it predicted higher anxiety and less-biased behavior when intergroup responses were to be made in public. Additional research has addressed the possibility that people who report strong external motivations are not sincere when they also report strong internal motivations. However, these studies demonstrated that high-IMS/high-EMS participants' intentions to respond in an egalitarian manner are experienced as a moral responsibility that cuts across situations and leads to efforts to control bias even in the absence of external pressure (Plant & Devine, 1998; Plant, Devine, & Brazy, 2003; Plant, Vance, & Devine, 2007). The overarching program of research conducted by Plant, Devine, and their colleagues has shown that the IMS/EMS framework is able to explain a wider range of intergroup behaviors than traditional attitude measures of prejudice. For the present purposes, the IMS/EMS framework is useful for understanding why some low-prejudice people are more effective regulators of intergroup responses than are others.

According to the IMS/EMS framework, all low-prejudice people are highly internally motivated to respond without prejudice, but they vary in their sensitivity to normative proscriptions of bias. Research by Devine, Plant, Amodio, Harmon-Jones, and Vance (2002) explored the possibility that the variance in external motivations among high-IMS participants is associated with differences in their ability to regulate intergroup response. Devine et al. (2002) theorized that different combinations of internal and external motivations corresponded to people's internalization of nonprejudiced standards into their automatic response tendencies. In building their proposal, they drew upon theorizing in the goals and motivation literature that describes how an extrinsically motivated behavior transitions to being one that is intrinsically motivated. According to self-determination theory (Deci & Ryan, 2000), behaviors motivated by purely extrinsic reasons are implemented only under external pressures. Thus, extrinsic behaviors are not internalized and tend to be inconsistent across situations. As an individual begins to adopt an intrinsic motivation for the same behavior, their behavior becomes motivated by a combination of extrinsic and intrinsic motives. This dual-motive state is characterized by having a behavioral intention that is held consciously and implemented in highly deliberative responses but not entrained at more automatic levels and thus not effectively implemented in less deliberative responses. Finally, behaviors motivated by purely intrinsic reasons are characterized as highly internalized and well-rehearsed and are effectively implemented and highly stable across situations. The motivational profiles provided by self-determination theory correspond closely with the IMS/EMS framework and suggest that low-prejudice people motivated primarily for internal reasons should be more effective regulators of intergroup responses than those motivated for a combination of internal and external reasons.

Consistent with this hypothesis, Devine et al. (2002) found that among low-prejudice people, those who were primarily internally motivated (high-IMS/low-EMS participants) were effective in responding without prejudice when their responses were easy to control (e.g., self-report) as well as those that are difficult to control (e.g., physiological and reaction-time measures of bias; Amodio et al., 2003; Devine et al., 2002). By contrast, those motivated by a combination of internal and external motivations (high-IMS/high-EMS participants) were effective in responding without prejudice when their responses were easy to control but showed unintentional expressions of bias when their responses were more difficult to control. A third group of individuals, who were not internally motivated (low-IMS participants), exhibited bias on all measures, irrespective of their external concerns (given that responses were made privately). With regard to our central question, this research suggests that high-IMS/low-EMS individuals are good regulators across measures because they have a strong internalized sense for when control is needed, whereas high-IMS/high-EMS individuals are comparatively poor regulators because this internal impetus to control is weaker. This is consistent with the self-determination-theory position that these individuals are still in the process of internalizing egalitarian responses into their dominant response set.

The findings and theoretical analysis of Devine et al. (2002; also Amodio et al., 2003) imply that low-prejudice people who are poor regulators of intergroup responses may have trouble determining when control is needed, particularly in situations that do not afford deliberative responding. This analysis suggests that these individuals may be impaired in a nondeliberative aspect of control that is not addressed in extant social psychological models (e.g., Wegener & Petty, 1997; Wilson & Brekke, 1994). In the next section, we describe a neurocognitive model of control that distinguishes between a nondeliberative process of determining the need for control and a more deliberative process of implementing control.

Neurocognitive Model of Control

Recent theorizing in the cognitive neuroscience literature suggests that response control involves two distinct processing components, each associated with activity of separate neural structures (Botvinick, Braver, Barch, Carter, & Cohen, 2001). The first is an *evaluative* component that monitors ongoing responses and is sensitive to conflict between alternative response tendencies. Research suggests that this *conflict-monitoring* process is constantly active, requires few cognitive resources, and operates below conscious awareness (Berns, Cohen, & Mintun, 1997; Nieuwenhuis, Ridderinkhof, Blom, Band, & Kok, 2001). When conflicting response tendencies are activated, this process alerts a second, resource-dependent *regulative* component to override the unwanted tendency with an intentional response. The activity level of the conflict-monitoring process is commensurate with the degree of response conflict, and as such, this model represents a "nonhomuncular" mechanism for signaling the need for control. Event-related potential (ERP) and functional magnetic resonance imaging research have associated the conflict-monitoring process with activity in the dorsal anterior cingulate cortex (ACC) and the regulative component with activity in the dorsolateral prefrontal cortex (Botvinick, Nystrom, Fissel, Carter, & Cohen, 1999; Carter et al., 1998). Tests of this model have shown that activation of the ACC is high when prepotent responses are at odds with one's consciously intended response, such as in the color-naming Stroop task (MacDonald, Cohen, Stenger, & Carter, 2000), the go/no-go task (Kiehl, Liddle, & Hopfinger, 2001), and the Eriksen flankers task (Botvinick et al., 1999).

When applied to the question of why high-IMS/high-EMS individuals have difficulty regulating their intergroup responses, the neurocognitive model suggests the possibility that the conflict-monitoring process of these individuals is not sufficiently engaged when an automatic stereotyping tendency is activated. A lack of conflict at this basic neural level would occur if egalitarian intentions are not strongly represented at a basic, automatic level and thus do not come into competition with the automatic-level stereotyping tendency. It is also possible that the regulative component of control may contribute to regulatory failures. However, this system tends to be linked to more deliberative, consciously guided behaviors. Given past work showing that high-IMS/high-EMS participants and high-IMS/low-EMS participants are equally effective at regulating intergroup responses when deliberation is possible, it is unlikely that the regulative component would explain differences in their ability to regulate nondeliberative behaviors, as observed by Devine et al. (2002) and Amodio et al. (2003). Following this line of reasoning, we hypothesized that differential sensitivity of the conflict-monitoring process to stereotype-related conflict may account for differences in intergroup response regulation between low-prejudice people characterized by high IMS/low EMS and those characterized by high IMS/high EMS.

Measuring Conflict Monitoring With ERPs

Conflict-monitoring processes associated with the ACC may be measured in real time with ERPs. ERPs are electroencephalographic (EEG) signals that reflect a concerted firing of neurons associated with a discrete psychological event (Coles, Gratton, & Fabiani, 1990). The high temporal resolution of ERPs, when measured at high sampling rates, permits researchers to examine the neural activity of a psychological response as it unfolds over milliseconds. The error-related negativity (ERN) component of the ERP has been used as an index of conflict monitoring in much research (Gehring & Fencsik, 2001; Luu, Collins, & Tucker, 2000; Yeung, Botvinick, & Cohen, 2004). The ERN is a response-locked negative-polarity wave that peaks approximately at the time a response is made (Gehring, Goss, Coles, Meyer, & Donchin, 1993). It is most strongly pronounced at the frontocentral midline scalp region and has been demonstrated to originate from the dorsal ACC (Dehaene, Posner, & Tucker, 1994; van Veen & Carter, 2002). ERNs are sensitive to conflicts resulting in errors (i.e., failed control) and are therefore useful for examining the role of conflict monitoring when attempts to respond without bias fail. The ERN reflects neural sensitivity to conflict between an intended response and an alternative (incorrect) response that is in the process of being executed. The conflict-monitoring signal is stronger for errors than for correct responses, because for an error, the conflicting behavior is further along in its implementation, and the net level of conflict is therefore much greater (Yeung et al., 2004).

The Role of Conflict Monitoring in Race-Bias Control

Amodio et al. (2004) identified the conflict-monitoring process as an important mechanism for regulating racial responses. Participants in their study completed a sequential priming task designed to assess stereotypic associations, called the weapons identification task (Payne, 2001), while EEG was collected. On each trial of the weapons identification task, a Black or a White face prime was presented briefly, followed by a target picture of either a handgun or a hand tool. Participants' task was to quickly categorize targets as a gun or tool within a 500-ms response deadline. As in past research involving this task, Black face primes facilitated responses to guns and interfered with responses to tools, suggesting the automatic activation of the violence-related African American stereotype (Lambert et al., 2003; Payne, 2001; Payne, Lambert, & Jacoby, 2002). Given the prepotent tendency to choose "gun" following a Black face, enhanced response control was needed to override this tendency when the target was a tool. To examine the role of conflict monitoring in behavioral control, we computed independent estimates of automatic and controlled processing using the process-dissociation (PD) procedure (Payne, 2001; Jacoby, 1991) and compared these behavioral indices with ERNs associated with responses on high-stereotype-conflict (e.g., Black–tool) versus low-stereotype-conflict (Black–gun) trials. Results showed that ERNs were larger on Black–tool trials, in which stereotype inhibition was required, compared with Black–gun trials, in which the correct response was congruent with the stereotype (and thus, inhibition was not needed). In addition, greater sensitivity of the conflict-monitoring system to race-bias conflict, as indicated by larger ERNs on Black–tool trials, was correlated with higher PD estimates of control but was unrelated to PD estimates of automatic stereotyping (see also Amodio, Kubota, Harmon-Jones, & Devine, 2006). For the present purposes, Amodio et al. (2004, 2006) established a paradigm for examining the conflict-monitoring process in the context of intergroup bias. Here, we applied this paradigm to test our hypothesis that differences in regulatory ability among low-prejudice people are due to differences in the ability of neural systems to detect race-biased conflict.

Study 1

We examined ERNs associated with stereotype-response control among low-prejudice participants characterized by high internal motivation (but low external motivation) versus those with a combination of high internal and high external motivation, as well as high-prejudice participants characterized by low internal motivation. To create groups that were highly representative of these profiles, we recruited participants with IMS and EMS scores in the upper or lower thirds of the participant pool (Alloy, Abramson, Raniere, & Dyller, 1999; Amodio et al., 2003). The extreme-groups approach was critical for obtaining a true low-IMS group, because IMS scores were highly positively skewed in this sample. In addition, we combined low-IMS participants who reported either high or low levels of EMS, because their responses, which were to be made in private (i.e., without external pressures), were not theorized to differ (Amodio et al., 2003; Devine et al., 2002; Plant & Devine, 1998). We predicted that high-IMS/low-EMS and high-IMS/high-EMS participants would report similar pro-Black attitudes, yet high-IMS/low-EMS participants would exhibit greater response control on the weapons-identification task relative to high-IMS/high-EMS participants. Furthermore, we predicted that this difference would be explained by the degree of conflict-monitoring activity during responses in which automatic stereotypes conflicted with intentions. We expected to observe relatively low activity of the conflict-monitoring process among high-IMS/high-EMS participants when automatic stereotypes are activated, because their egalitarian intentions are not believed to be represented at the same automatic level of processing and thus would not create conflict. Last, low-IMS participants were expected to show a low degree of response control, coupled with low engagement of conflict-monitoring processes on stereotype-related trials. A low degree of conflict was expected because stereotypic responses are consistent with their prejudiced beliefs.

To conduct a strong test of our hypothesis, it was important to use a task that would elicit similar levels of automatic race-biased tendencies across groups. Our past work showed that high-IMS/low-EMS participants exhibited lower levels of implicit bias than other groups on measures assessing affective/evaluative forms of bias (Amodio et al., 2003; Devine et al., 2002). However, high-IMS/low-EMS participants did not differ from other participants when implicit stereotype associations were measured (Amodio, Stahlhut, & Devine, 2002). This distinction is consistent with research suggesting that implicit stereotyping reflects different underlying neurocognitive mechanisms than do affect-driven forms of implicit bias (Amodio & Devine, 2006). Because the weapons identification task elicits response biases that are driven primarily by stereotype associations rather than by affective responses, it was particularly well-suited for testing our hypothesis (Judd, Blair, & Champleau, 2004). In addition, we chose to focus on PD estimates of automaticity and control as our primary behavioral outcomes. Although reaction times and error rates have been used to indicate automatic and controlled response patterns in much past work, it is likely that any given response involves some combination of automatic and controlled processes, and thus raw measures of reaction time and accuracy do not provide process-pure indicators of automaticity and control (Jacoby, 1991). The validity of the PD procedure in the context of prejudice has been established in several published articles (e.g., Amodio et al., 2004; Judd et al., 2004; Payne et al., 2002; Lambert et al., 2003), and the assumption of independent processes for automaticity and control is consistent with research identifying their separate neural substrates (e.g., Amodio et al., 2004, 2006; Cunningham et al., 2004).

Method

Participants

Seventy-three psychology students at the University of Wisconsin—Madison participated individually in exchange for extra course credit. We selected right-handed female participants to control for variability in physiological responses associated with sex and handedness (Heller & Levy, 1981). Participants were White Americans, except for one Asian American.

Procedure

After they provided consent, participants were prepared for physiological recording and were given instructions for the weapons identification task. They were told that certain responses (i.e., errors on Black–tool trials) would reveal race bias but that their responses would be private and confidential. These instructions were designed to activate any internal motivations to respond without prejudice while minimizing concerns over external pressures to appear nonprejudiced (as in Amodio et al., 2004). After completing the task, participants received a funneled debriefing and were thanked, awarded extra credit, and dismissed. Sessions took approximately 2.5 hr.

Materials

IMS and EMS. Participants completed Plant and Devine's (1998) IMS ($\alpha = .84$) and EMS ($\alpha = .89$) confidentially in a previous mass testing session. Responses ranged from 1 (*strongly disagree*) to 9 (*strongly agree*). The IMS includes items such as "I attempt to act in nonprejudiced ways toward Black people because it is personally important to me." The EMS includes items such as "I attempt to appear nonprejudiced toward Black people in order to avoid disapproval from others." Plant and Devine (1998) found scores on the IMS and EMS to be independent across seven samples (average $r = -.14$), and therefore, individuals with similar degrees of internal motivation can vary in their external motivations (Amodio et al., 2003; Devine et al, 2002; Plant & Devine, 1998; Plant, Devine, & Brazy, 2003).

Attitude Towards Blacks (ATB) scale. Participants completed the ATB scale ($\alpha = .87$) in the same mass testing session. The ATB scale (Brigham, 1993) assesses positivity of attitudes toward Black people, scored on a 1–7 scale on which higher scores indicate more positive attitudes.

Weapons identification task. The stimuli and instructions were taken from Amodio et al. (2004; originally 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. 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 (see Figure 1). Participants were instructed to classify targets as guns or tools as quickly and accurately as possible using buttons labeled "gun" and "tool." The second mask remained onscreen until the participant responded or until 2 s had elapsed. Participants received a warning to respond more quickly following responses exceeding 500 ms. Reaction times for all responses were recorded, even when they exceeded the deadline. Intertrial intervals ranged from 2.5 s to 4 s. Participants were seated 4 feet (1.22 m) from a 19-in. (48.26-cm) CRT monitor refreshing at 100 Hz. Stimuli and physiological recording triggers were presented with DMDX (Forster & Forster, 2003).

Participants completed 16 practice trials in which targets (gun or tool pictures) were presented one at a time and remained until the

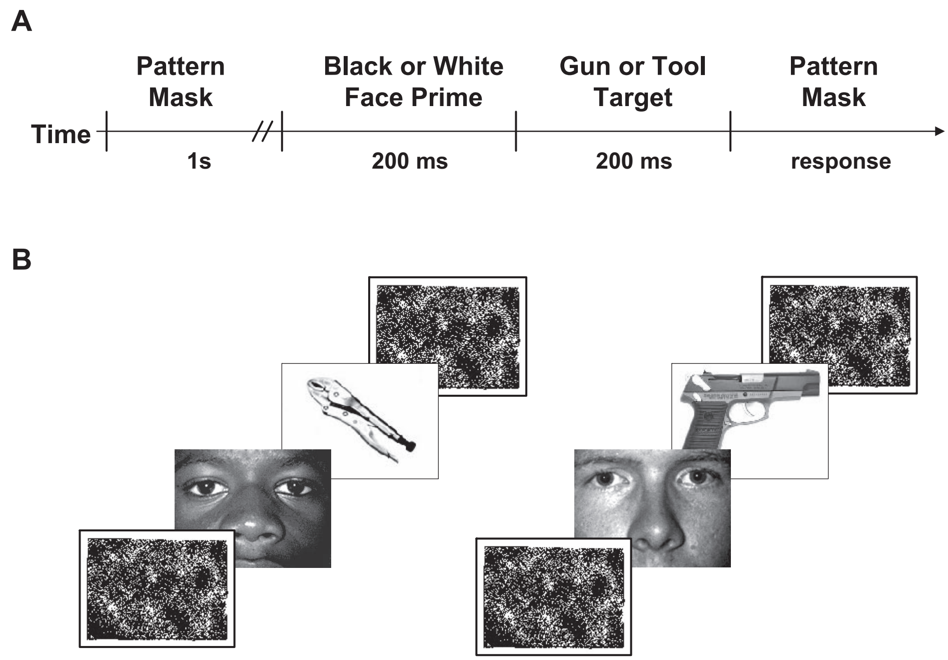

Figure 1. Schematic of weapons identification task, which we adapted from Payne (2001), illustrating the timecourse of events (A) and sample stimuli (B).

participant categorized them correctly, followed by 10 practice trials in which the targets were preceded by face primes. Participants then completed 288 experimental trials, receiving a 2-min break after 144 trials. Accuracy feedback was given on practice trials but not on experimental trials.

Behavioral-Data Processing

Correct response latencies occurring between 250 ms and 1,500 ms were natural-log transformed and averaged within trial type for analysis (mean latencies are presented in raw ms). Because response-deadline feedback was displayed only after a response was made, response-latency data were not contaminated by the presentation of the warning message. We therefore included response latencies exceeding 500 ms in our analyses to avoid a restricted range of data known to attenuate response-latency effects (Amodio et al., 2004, 2006; Payne, 2001). Error rates were computed by dividing the number of errors by the total number of trials within each trial type.

The PD estimate of control was computed by subtracting participants' error rates on Black–tool trials from their accuracy rates on Black–gun trials (see Payne, 2001). The PD estimate of automaticity was computed by dividing participants' error rates on Black–tool trials by the reciprocal of their control-estimate scores.

EEG Recording and Processing

EEG was recorded from 27 tin electrodes embedded in a stretch-lycra cap (ElectroCap; Eaton, OH), which we positioned according to the 10-10 system using known anatomical landmarks. We referenced scalp electrodes online to the left earlobe (referenced to average earlobes offline), with a forehead ground, using Electro-Gel (Eaton, OH) as the conducting medium. All impedances were below 5 kΩ. Vertical and horizontal eye movements were recorded to facilitate artifact scoring of the EEG. Signals were amplified with Neuroscan Synamps (Sterling, VA) with a direct-current coupling, low-pass filtered at 100 Hz, digitized at 2,500 Hz, and stored to a computer hard drive.

Offline, EEG was scored for movement artifact, submitted to a regression-based blink-correction procedure (Semlitsch, Anderer, Schuster, & Presslich, 1986), and then submitted to a 1–15 Hz bandpass filter (96 dB, zero-phase shift). To quantify ERN amplitudes, we selected an 800-ms response-locked epoch of EEG signal for each artifact-free trial associated with a valid reaction time (250–1500 ms), to exclude ERNs associated with impulsive errors or inattentiveness. Baseline correction procedures subtracted the average voltage occurring from 400–50 ms preresponse from each entire epoch. Waveforms derived from correct and incorrect trials were then averaged within their respective trial types. On the basis of past work and visual inspection of waveforms, ERN amplitudes were scored as the peak negative deflection occurring between −50 ms and 150 ms at the frontocentral site (Fcz).

Results

To ensure reliable ERN indices, it was necessary to exclude cases with fewer than five valid error responses on a given trial type. Of the original 73 participants, 21 were excluded because they made fewer than five errors on at least one of the four trial types (6 high-IMS/low-EMS, 9 high-IMS/high-EMS, and 10 low-IMS participants). Additional participants were excluded because of excessive EEG artifact (5) or extreme scores on one or more variables (2) that exceeded three standard deviations. These exclusions yielded 45 participants with full sets of valid responses

(12 high-IMS/low-EMS, 17 high-IMS/high-EMS, and 16 low-IMS participants). For this sample, ERNs were composed of the following average epochs per trial type: 18.80 (Black–tool), 12.71 (Black–gun), 14.64 (White–tool), and 18.38 (White–gun). Mean IMS, EMS, and ATB scores for each regulatory group are presented in Table 1. Scores on the IMS and EMS were not significantly correlated, $r(43) = .14$, $p = .36$, consistent with past findings. ATB scores were correlated with IMS scores, $r(41) = .64$, $p < .001$, but were not significantly correlated with EMS scores, $r(41) = -.26$, $p = .11$. Preliminary analyses showed that excluded participants did not differ from included participants on primary behavioral measures, Fs < 1.

Weapons Identification Task Performance

Preliminary analyses were conducted to establish that the weapons identification task was successful in eliciting a stereotype-driven pattern of responding, which in turn created the need for response control on high-conflict trials (Black–tool) but not on low-conflict trials (Black–gun). A 2 (Prime: Black vs. White) × 2 (Target: gun vs. tool) analysis of variance (ANOVA) on response latencies produced the expected interaction, $F(1, 44) = 20.92$, $p < .001$. It indicated that Black faces facilitated responses to guns but interfered with responses to tools, compared with White faces (see Figure 2A). A 2 (Prime) × 2 (Target) ANOVA of error rates also produced the expected interaction, $F(1, 44) = 20.64$, $p < .001$. It indicated that participants had more difficulty responding to tools than guns when preceded by a Black face, compared with White prime trials (see Figure 2B). Together, these analyses showed that the task created race-biased response conflict on Black–tool trials and thus a need for greater control on such trials, compared with Black–gun trials, replicating previous research (e.g., Amodio et al., 2004, 2006; Payne, 2001, 2005).

Hypothesis Testing Strategy

To establish support for our primary hypothesis that regulatory-ability differences among low-prejudice people are due to conflict-monitoring effects, we tested a specific set of predictions. All statistical tests were two-tailed.

Prediction 1. High-IMS/low-EMS and high-IMS/high-EMS participants should not differ in explicit prejudice (i.e., ATB scores). Both groups should report more positive attitudes toward Blacks than low-IMS participants.

Prediction 2. All groups are expected to show a similar degree of automatic stereotype activation, as revealed by stronger PD-automatic estimates associated with Black than with White faces on the weapons identification task.

Prediction 3. High-IMS/low-EMS participants should demonstrate higher levels of control than high-IMS/high-EMS participants, and both groups should show greater control than low-IMS participants, as revealed by PD-control estimates associated with both Black and White faces.

Prediction 4. Compared with high-IMS/high-EMS and low-IMS participants, high-IMS/low-EMS participants should exhibit greater conflict-monitoring-related brain activity (i.e., ERNs) on trials requiring stereotype inhibition (e.g., Black–tool trials). No group differences are expected when responses do not require inhibition (i.e., Black–gun trials).

Prediction 5. Across participants, ERN scores should be associated with greater behavioral control, as indicated by PD-control scores. ERNs should not relate to automatic stereotyping (i.e., PD-automatic scores).

Prediction 6. Group differences in PD-control should be mediated by conflict-related ERN amplitudes (i.e., from Black–tool trials).

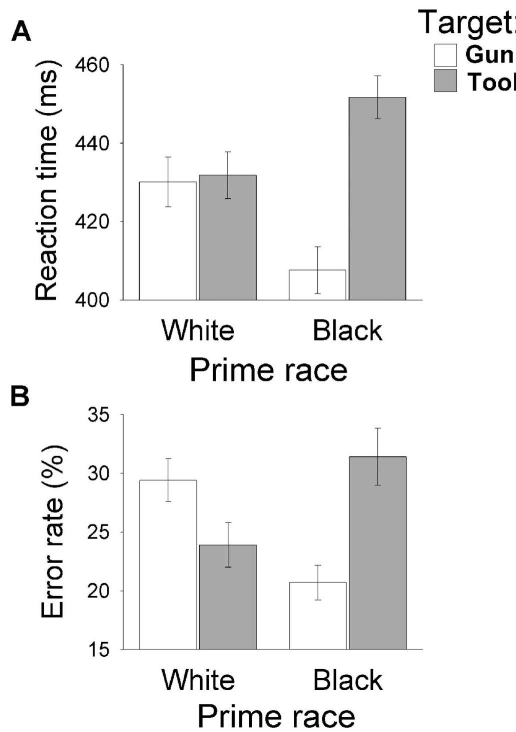

Figure 2. Behavioral results from the weapons identification task, including raw response latencies (A) and error rates (B) by trial type.

Table 1
Mean Scores on the IMS, EMS, and ATB as a Function of Group for Study 1

Measure	Low IMS *M*	Low IMS *SD*	High IMS/high EMS *M*	High IMS/high EMS *SD*	High IMS/low EMS *M*	High IMS/low EMS *SD*
IMS	8.85_a	0.17	8.89_a	0.16	6.01_b	1.62
EMS	2.70_a	1.06	7.01_b	0.93	4.76_c	2.46
ATB	6.19_a	0.50	5.88_a	0.51	5.22_b	1.14

Note. The low-IMS group includes participants reporting high and low levels of external motivation to respond without prejudice. Differing subscripts indicate significantly different means within rows ($p < .05$), as determined by groupwise *t* tests. IMS = Internal Motivation Scale; EMS = External Motivation Scale; ATB = Attitude Towards Blacks scale.

Prediction 1: Explicit Prejudice

A one-way ANOVA indicated differences among regulator groups' ATB scores, $F(2, 42) = 4.90$, $p = .01$. High-IMS/low-EMS and high-IMS/high-EMS participants both reported more positive attitudes toward Black people than did low-IMS participants (see Table 1). It is important to note that ATB scores did not differ between high-IMS/low-EMS and high-IMS/high-EMS participants, replicating past work and directly supporting Prediction 1.

Prediction 2: Automatic Race Bias

PD-automatic estimates associated with Black and White faces were submitted to a 3 (Group: high IMS/low EMS vs. high IMS/high EMS vs. low IMS) × 2 (Prime Race: White vs. Black) mixed-factorial ANOVA. A significant effect for prime race emerged, $F(1, 42) = 19.19$, $p < .001$, indicating greater automatic stereotyping bias for Black faces than for White faces (see Table 2). Significant effects were not obtained for group, $F(2, 42) = 1.60$, $p = .21$, or for the interaction, $F < 1$. PD-automatic estimates for Black and White faces were not significantly correlated (see Table 3). This pattern of results revealed that automatic race biases were activated at similar levels across groups, supporting Prediction 2 and replicating past work. Given the positive attitudes toward Black people reported by high-IMS/low-EMS and high-IMS/high-EMS participants, these results revealed an inherent conflict between their consciously held beliefs and their automatic tendencies.

Prediction 3: Race-Bias Control

The hallmark of successful control is intention-driven behavior that is not affected by extraneous countervailing influences (Baddeley, 1986; Shallice, 1982). In the context of the weapons identification task, control should be evident in accurate classification of targets, despite the presence of automatic stereotyping associated with Black faces (e.g., Amodio et al., 2004; Lambert et al., 2003; Payne, 2001, 2005; Payne et al., 2002). In contrast to the stimulus-driven automatic responses to Black and White faces, which yielded uncorrelated PD-automatic estimates, PD control for both Black- and White-face trials reflects the engagement of an accuracy goal in the task. Because the accuracy goal applies across Black- and White-face trials, the two PD-control estimates should be strongly associated (Amodio et al., 2004, 2006; Payne, 2005). Indeed, these estimates were highly correlated (see Table 3).

To test Prediction 3, PD-control scores were submitted to a 3 (Group) × 2 (Prime Race) mixed-factorial ANOVA. A significant effect for group emerged, $F(2, 42) = 15.09$, $p < .001$. Neither effects for prime race or the interaction reached significance, $F\text{s} < 1$. Simple analyses confirmed that PD-control scores for high-IMS/low-EMS participants were significantly larger than those of high-IMS/high-EMS participants, who exhibited greater control than did low-IMS participants (see Table 2). These analyses supported Prediction 3. Given that PD-control scores for Black and White trials were collinear (see Table 3) and appeared to reflect a common goal of response accuracy irrespective of race, they were averaged together to form a single index of control for subsequent analyses (Tabachnick & Fidell, 2001).

Table 2
Process Dissociation (PD) Indexes of Automatic and Controlled Response Processes as a Function of IMS/EMS Group for Study 1

	High IMS/ low EMS		High IMS/ high EMS		Low IMS	
Process estimate	*M*	*SD*	*M*	*SD*	*M*	*SD*
PD automatic						
Black	$.58_a$	.10	$.56_a$	.12	$.64_a$	.15
White	$.42_a$	.13	$.44_a$	.17	$.48_a$	.14
PD control						
Black	$.64_a$	.13	$.52_b$	.17	$.32_c$	.17
White	$.62_a$	.14	$.49_b$	.14	$.32_c$	.18

Note. PD estimates are probability scores. Differing subscripts indicate significantly different means within rows ($p < .05$), as determined by groupwise t tests.

Table 3
Correlations Between ERN Amplitudes and Indexes of Control and Automaticity for Study 1

Variable	1	2	3	4	5	6
1. Black-tool ERN	—					
2. Black-gun ERN	$.49^{*}$	—				
3. PD (C) Black	$-.61^{**}$	$-.43^{*}$	—			
4. PD (C) White	$-.58^{**}$	$-.45^{*}$	$.87^{**}$	—		
5. PD (A) Black	.21	.15	−.26	−.29	—	
6. PD (A) White	.10	−.18	−.17	−.03	−.22	—
7. Posterror accuracy	$-.64^{**}$	$-.46^{*}$	$.89^{**}$	$.90^{**}$	−.29	−.07

Note. $N = 45$. Larger error-related negativity (ERN) waves are represented by larger negative values. PD refers to process dissociation estimates of automatic (A) and controlled (C) processing for responses associated with Black and White faces. PD scores represent probability estimates, ranging from 0 to 1.
$^{*}p < .01$. $^{**}p < .001$.

Prediction 4: Group Differences in Race-Bias Conflict Monitoring

Neural signals for conflict-monitoring processes were indexed by ERN amplitudes. ERN amplitudes were submitted to a 3 (Group: high IMS/low EMS vs. high IMS/high EMS vs. low IMS) × 2 (Prime Race: Black vs. White) × 2 (Target: gun vs. tool) × 2 (Accuracy: correct vs. incorrect) mixed-factorial ANOVA. This analysis produced a significant four-way interaction, $F(2, 42) = 3.02$, $p = .05$. Because our predictions pertained specifically to responses to Black targets, we examined lower-order effects separately for Black and White faces.

A 3 (Group) × 2 (Target) × 2 (Accuracy) ANOVA for trials involving Black faces produced a main effect for accuracy, $F(1, 42) = 171.66$, $p < .001$, indicating that ERNs were larger (i.e., more negative) when responses were incorrect ($M = -9.69$, $SD = 4.28$) than when they were correct ($M = -1.69$, $SD = 2.43$). This effect was qualified by a significant three-way interaction, $F(2, 42) = 3.70$, $p < .04$ (see Figure 3A). To understand this interaction, we analyzed ERNs associated with correct versus incorrect responses separately. The analysis of correct responses did not produce significant effects, $F\text{s} < 1.35$, $p\text{s} > .25$. However, for incorrect responses, the predicted Group × Target interaction was significant, $F(2, 42) = 4.86$, $p < .02$. Simple-effect analyses revealed a group effect for Black–tool trial ERNs, $F(2, 42) = 6.64$, $p < .005$), but not for Black–gun trials, $F < 1$. Black–tool ERNs were larger among high-IMS/low-EMS participants ($M = -14.15$, $SD = 4.31$) than high-IMS/high-EMS participants ($M = -9.48$, $SD = 3.36$), $F(1, 42) = 10.76$, $p < .005$, and low-IMS participants

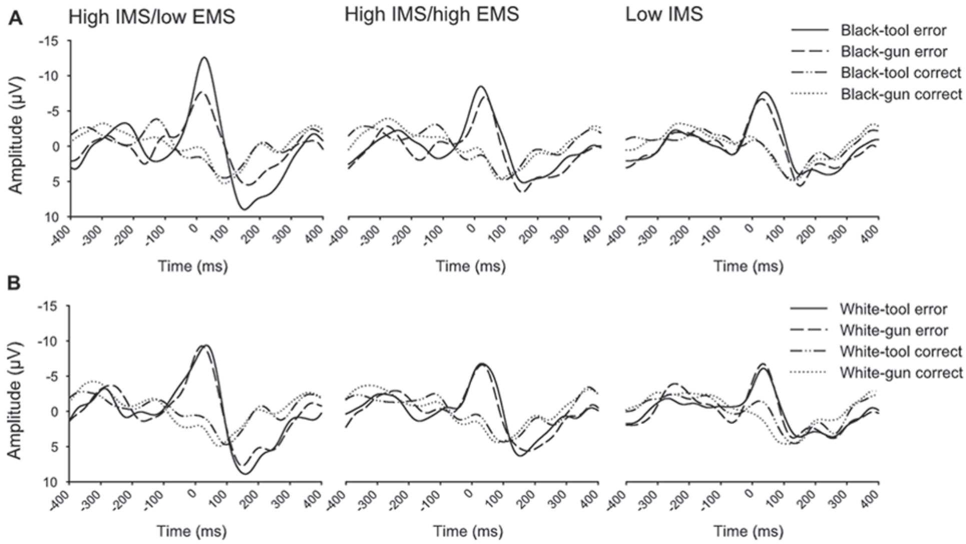

Figure 3. Response-locked waveforms depicting the error-related negativity (ERN) component associated with Black-prime (A) and White-prime trials (B), as a function of internal motivation scale/external motivation scale (IMS/EMS) group, target, and accuracy. Larger ERN effects are reflected by larger negative-polarity values. Zero represents the time of key-press response.

($M = -8.65$, $SD = 4.83$), $F(1, 42) = 9.75$, $p < .005$. Additional analyses revealed a significant difference between Black–tool and Black–gun ERNs for high-IMS/low-EMS participants, $F(1, 42) = 9.99$, $p < .005$, but not for either of the other groups, Fs < 1. Hence, only high-IMS/low-EMS participants exhibited enhanced ERNs when automatic stereotyping tendencies were inconsistent with their intended responses. This pattern of results supported Prediction 4.[1]

We next examined ERN responses to White faces. However, it is important to note that White people are not associated with either guns or tools. This is reflected by the lack of reaction time differences on White–gun and White–tool trials. Given the reaction-time results, the differential error rates found for White–gun versus White–tool trials appear to be artifacts of the gun (vs. tool) associations with Black faces. Thus, it is not clear how to interpret error-related ERP effects for White-face trials. With these interpretational ambiguities in mind, we examined ERN amplitudes on trials involving White faces (see Figure 3B). A 3 (Group) × 2 (Target) × 2 (Accuracy) mixed-factorial ANOVA produced a main effect for accuracy, $F(2, 42) = 202.33$, $p < .001$, indicating larger negative amplitudes on error trials ($M = -9.42$, $SD = 4.40$) than on correct trials ($M = -1.51$, $SD = 2.48$). This effect was qualified by a Group × Accuracy interaction, $F(2, 42) = 4.61$, $p < .02$. Simple-effect analyses suggested that the groups' ERN amplitudes differed on incorrect trials only, $F(2, 42) = 7.01$, $p < .005$, such that ERNs were larger for high-IMS/low-EMS participants ($M = -12.35$, $SD = 3.91$) than for high-IMS/high-EMS participants ($M = -9.08$, $SD = 2.69$), $F(1, 42) = 6.79$, $p < .02$, and low-IMS participants, ($M = -7.60$, $SD = 3.34$), $F(1, 42) = 11.56$, $p < .005$. The ERN amplitudes of high-IMS/high-EMS participants did not differ significantly from those of low-IMS participants, $F(1, 42) = 1.99$, $p = .17$. These effects were not moderated by target (i.e., guns vs. tools), however, and therefore could not be interpreted as evidencing conflict monitoring related to stereotyping. Additional analyses compared ERNs on critical Black–tool trials with ERNs of the other trial types. These analyses revealed a significant difference among high-IMS/low-EMS participants, $F(1, 42) = 9.61$, $p < .005$, but not among the other groups, Fs < 1.03.

This set of analyses showed that conflict-monitoring processing is more strongly engaged in response to race-biased tendencies

[1] Recently, the correct-related negativity (CRN) component of the ERP has been used to measure conflict-monitoring processes that lead to successful response control (i.e., correct responses on high-conflict trials; e.g., Bartholow et al., 2005; see also $N2_{correct}$; Yeung et al., 2004). The CRN is a negative-polarity waveform that is strongest at frontocentral midline scalp sites and, like the ERN, has been associated with an ACC neural generator (van Veen & Carter, 2002). CRN effects tend to be more subtle than those of ERNs and thus do not provide as strong of an indicator of conflict monitoring, but we include analyses of the response-locked CRN as a supplement.

The CRN has been examined as both a response-locked and stimulus-locked component. Here, CRN amplitudes were scored as the peak negative deflection occurring 75–150 ms prior to correct responses and were submitted to a 3 (Group: high IMS/low EMS vs. high IMS/high EMS vs. low IMS) × 2 (Prime: Black vs. White) × 2 (Target: gun vs. tool) ANOVA. A significant Prime × Target interaction, $F(1, 42) = 13.75$, $p < .001$, indicated larger CRN amplitudes for Black–tool trials than for each of the other trial types, $ts(44) > 2.42$, $ps < .02$, replicating Amodio et al. (2004). This effect was not moderated by group. However, planned comparisons following from ERN analyses indicated that the CRN enhancement on Black–tool trials, relative to Black–gun trials, was significant for high-IMS/low-EMS participants (Ms $= -5.90$ and -3.20, respectively), $F(1, 42) = 7.74$, $p < .01$, and high-IMS/high-EMS participants (Ms $= -5.75$ and -3.47, respectively), $F(1, 42) = 12.32$, $p < .01$, but not for low-IMS participants (Ms $= -5.12$ and -3.84, respectively), $F(1, 42) = 2.42$, $p = .13$. Finally, Black–tool CRN amplitudes were associated with accuracy on tool trials, $r(43) = -.33$, $p < .03$, and PD control, $r(43) = -.33$, $p < .03$, in partial correlations covarying Black–gun CRN amplitudes. These results suggest that when highly internally motivated individuals (irrespective of external motivation) succeed in overriding stereotyping effects, their success may be attributed to effective conflict-monitoring activity.

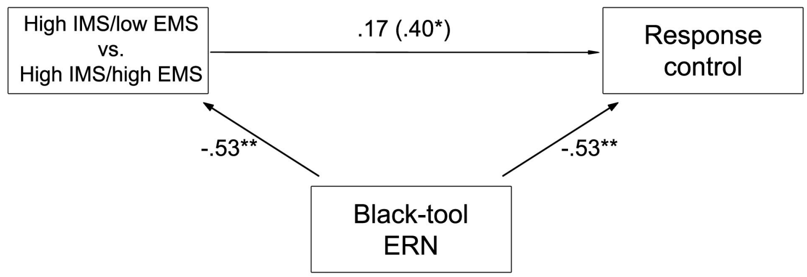

Figure 4. Mediation model illustrating how the difference between high-IMS/low-EMS and high-IMS/high-EMS participants' response accuracy on trials requiring the inhibition of automatic stereotyping (Black–tool trials) was accounted for by error-related negativity (ERN) amplitudes on Black–tool trials. Betas are reported (beta in parentheses represents the effect of group on response accuracy before ERN scores were included in the regression model). Larger ERNs are represented by more negative values. $^{*}p < .05$. $^{**}p < .01$.

among high-IMS/low-EMS participants than among high-IMS/high-EMS and low-IMS participants, supporting Prediction 4.

Prediction 5: Relationship Between Race-Bias ERNs and Behavior

Correlational analyses revealed that larger ERN amplitudes were significantly associated with greater PD control, as well as posterror accuracy, an additional behavioral indicator of control used in past work (Rabbit, 1966; see Table 3). Black–gun ERN amplitudes were covaried from Black–tool ERN amplitudes so that partial correlations could be examined. These analyses indicated that Black–tool ERN amplitudes predicted higher PD-control scores, $r(42) = -.51$, $p < .001$, and greater posterror accuracy, $r(42) = -.54$, $p < .001$, beyond any effect of Black–gun ERNs. Black–tool ERNs were not correlated with the PD-automatic estimates for Black or White faces.

Additional analyses indicated that greater control across trials was predicted uniquely by ERNs associated with Black faces but not with White faces. After partialling the ERN amplitude from White–tool trials, larger Black–tool ERNs predicted greater PD-control estimates for both Black and White faces, *r*s $> .42$, *p*s $<$ .005. By contrast, after partialling Black–tool ERNs, White–tool ERNs were not significantly associated with PD-control estimates for Black or White faces, *r*s $< .21$, *p*s $> .18$. These results demonstrated that conflict-monitoring signals were activated specifically in response to the need for stereotype inhibition (i.e., on Black–tool trials) and subsequently engaged a control mechanism that enhanced response regulation across trials, supporting Prediction 5.

Next, using regression with dummy codes, as recommended for the analysis of categorical group data (Cohen, Cohen, West, & Aiken, 2003), we examined whether the relationship between ERN amplitude and response control varied as a function of group. These analyses revealed that the association of ERN amplitudes and PD control did not differ significantly between high-IMS/low-EMS and high-IMS/high-EMS participants, $B = -0.09$, $t(39) = -1.45$, $p = .16$, high-IMS/low-EMS and low-IMS participants, $B = -0.08$, $t(39) = -1.49$, $p = .15$, or high-IMS/high-EMS and low-IMS participants, $B = .01$, $t(39) = 0.18$, $p = .87$. These findings suggest that, although the absolute level of activity of the conflict-monitoring system differed by group, greater conflict-monitoring activity was tightly linked to enhanced behavioral control across groups.

Prediction 6: Mediation Analyses

Our central hypothesis was that the conflict-monitoring process explains individual differences in regulatory ability among low-prejudice people. This hypothesis was directly tested with a mediation analysis. As an initial test of mediation, we created a group contrast whereby high-IMS/low-EMS participants were assigned a value of 1, and the other two groups were each assigned a value of −.5. Mediation was assessed by testing four regression models (Baron & Kenny, 1986). These revealed that (a) the group contrast predicted Black–tool ERN amplitude, $\beta = .48$, $t(43) = 3.63$, $p < .001$ (see Prediction 4), (b) the group contrast predicted PD control, $\beta = .49$, $t(43) = 3.69$, $p < .001$, and (c) Black–tool ERN amplitude predicted accuracy on PD control, $\beta = -.59$, $t(43) = 4.73$, $p < .001$. When ERN amplitude was included as a covariate, the group contrast was reduced to marginal significance, $\beta = .25$, $t(42) = 1.88$, $p = .07$; Sobel's $z = 2.45$, $p < .04$.

To more directly test our main hypothesis regarding high-IMS/low-EMS participants versus high-IMS/high-EMS participants, we created a group contrast comparing these groups (coded 1 vs. −1, respectively). Regression analyses indicated that (a) the contrast predicted Black–tool ERN amplitudes, $\beta = -.53$, $t(27) = -3.28$, $p < .005$ (see Prediction 4 results), (b) the contrast predicted PD control, $\beta = .40$, $t(27) = 2.29$, $p < .02$, and (c) Black–tool ERN amplitude predicted PD control, $\beta = -.53$, $t(26) = -3.24$, $p < .005$. A final regression supported the mediation hypothesis, such that this contrast variable no longer predicted PD control when race-bias ERN amplitudes were covaried, $\beta = .17$, $t(26) = 0.87$, $p = .39$, Sobel's $z = 1.79$, $p = .07$ (see Figure 4). However, the contrast effect on PD control was not mediated by ERNs from Black–gun trials, Sobel's $z = .37$, $p = .71$. These results supported our main hypothesis that the conflict-monitoring processes could explain differences in prejudice control between high-IMS/low-EMS and high-IMS/high-EMS participants.

Discussion

In Study 1, we tested a specific set of hypotheses to determine whether conflict-monitoring process might account for why some low-prejudice people are more effective at regulating intergroup responses than others (e.g., Amodio et al., 2003; Devine et al., 2002). As in past work, we found that high-IMS/low-EMS and high-IMS/high-EMS participants reported positive explicit attitudes toward Black people while also exhibiting automatic stereotyping effects. Despite an equivalent discrepancy between automatic and intentional responses, high-IMS/low-EMS participants exhibited significantly greater control over stereotype-driven tendencies on the weapons identification task than did high-IMS/high-EMS participants. Measures of neural activity revealed that these differences in control were due to differential conflict-monitoring activity. That is, high-IMS/high-EMS participants were less effective in regulating their behavior because their conflict-monitoring systems were not engaged in response to unwanted stereotyping tendencies. Low-IMS participants did not show enhanced conflict monitoring or behavioral control when responses held the potential for revealing race bias, as was expected given their highly prejudiced attitudes. In addition, although low-IMS participants who reported high versus low EMS were combined for theoretical reasons, analyses comparing these two subgroups found no differences on key variables, including Black–tool ERNs (-8.71 vs. -8.60), $F < 1$, and PD-control scores (.37 vs. .28), $F(1, 14) = 1.20$, $p = .29$. In sum, this study identified the conflict-monitoring process as a mechanism that explains variability in low-prejudice people's ability to effectively regulate race-biased behavior.

Our interpretation of the ERN as representing a conflict-monitoring function is in line with the predominant view of current theorists, although alternative interpretations exist. One is that the ERN represents the conscious detection that an error was made (e.g., Falkenstein, Hohnsbein, Hoorman, & Blanke, 1991; Gehring et al., 1993). However, subsequent research has shown that the ERN is not dependent on awareness (Nieuwenhuis et al. 2001) and that an ERN-like deflection with a similar ACC substrate is also seen for correct responses to high-conflict stimuli (see Footnote 1; also, Bartholow et al., 2005). Furthermore, because high-IMS/low-EMS and high-IMS/high-EMS participants would presumably both be sensitive to errors, this error-detection interpretation does not fit our data. Another interpretation of the ERN is that it represents a feedback signal for surprising events, which functions to tune learning systems linked to the mesencephalic dopamine system (Holroyd & Coles, 2002). This feedback interpretation is complementary to the conflict-monitoring account, and it is possible that both functions characterize individuals with high internal motivation and low external motivation. Although our research was not designed to test the feedback account, it would be fruitful to examine the interplay of these functions in future work.

We were careful in Study 1 to address several alternative explanations. Our hypothesis was that enhanced conflict-monitoring processes should be triggered specifically on trials on which automatic biases and intentions were incongruent (Black–tool trials) but not on trials on which they were congruent (Black–gun trials), and that this effect would be especially evident for individuals with high internal/low external motivation. On the basis of theories of cognitive control (e.g., Baddeley, 1986; Shallice, 1982), we further hypothesized that, once triggered, this mechanism of control should affect responses across trials (Payne, 2005). Indeed, ERN amplitudes were uniquely enhanced on Black–tool trials among high-IMS/low-EMS participants but predicted the implementation of response control across all trial types, suggesting a shift toward an accuracy-based (i.e., individuated) processing style (Fiske & Neuberg, 1990). Nevertheless, it may still be possible that patterns of conflict monitoring observed in Study 1 were related to more general differences in cognitive-control abilities between groups. The strongest test of this alternative hypothesis would be to examine whether these groups differ in their performance on a basic cognitive task commonly used to assess general conflict processing and cognitive control. If the group differences observed in Study 1 on the weapons identification task reflect domain-general effects, we would expect to find the same group differences on a general cognitive-control task. We tested this possibility in Study 2, in which participants completed the Eriksen flankers task (Eriksen & Eriksen, 1974), a widely-used behavioral measure of response-conflict processing, in addition to the weapons identification task. The flankers task was chosen because it is conceptually similar to the weapons identification task in that it requires responses that are either congruent or incongruent with prepotent response tendencies. Our primary hypothesis focused on the responses of high-IMS/low-EMS versus those of high-IMS/high-EMS participants, such that they were expected to differ in controlled processing on the weapons identification task, as in Study 1, but not on the flankers task.

Study 2

Method

Participants

Fifty-nine introductory-psychology students at New York University volunteered to participate in exchange for course credit. Participants were selected on the basis of their IMS and EMS scores to match those of good regulators, poor regulators, and nonregulators in Study 1.

Procedure

After providing consent, participants completed the weapons identification task and then the flankers task on a computer. Next, participants completed the IMS/EMS scale and then questionnaires unrelated to this study. One to five participants took part in a given session, and all measures were completed privately at separate computer workstations. Upon completing the study, participants were debriefed, awarded extra credit, thanked, and dismissed.

Behavioral Tasks

The weapons identification task was identical to that used in Study 1, except that it included 196 trials. Fewer trials were required without the constraints of the ERN assessment. PD estimates of automaticity and control were computed as in Study 1.

The Eriksen flankers task is commonly used to measure the ability to regulate responses in the midst of competing prepotent response tendencies. On a given trial, a row of five arrows is presented, and the participant's task is to press a button indicating whether the center arrow points left (<<<<<) or right (>>>>>) while ignoring the outer arrows (i.e., the "flankers").

On 60% of the trials (congruent condition), the center arrow pointed in the same direction as the flankers. On 20% of the trials (incongruent condition), the center arrow pointed in the opposite direction (e.g., <<><< or >><>>). Another 20% of the trials were designated *no-go* trials (<<X<< or >>X>>), on which the participant withholds a response. We included no-go trials to examine hypotheses unrelated to issues of intergroup bias, and they are therefore not discussed further (although regulation groups did not differ in no-go accuracy, $F < 1$). The discrepancy in trial frequencies was designed to entrain a habitual congruent-flankers response, so that incongruent trials created response conflict and required control. In this way, the task modeled stereotype-driven effects observed with the weapons identification task. As with the weapons identification task, participants were instructed to respond within 500 ms of target presentation. Response latencies and error rates were computed for congruent and incongruent trials, collapsing across direction of the target arrow. Raw response latencies were natural-log transformed for analyses. PD estimates of control and automaticity were computed from error rates on congruent and incongruent trials, as in Study 1.

Exclusions

Data from one African American participant were excluded because it was not appropriate to examine her IMS/EMS scores. Of the remaining cases, data were excluded if the participant's error rate on incongruent flankers trials was very high (above 85%; 5 cases) or if scores on one or more measures exceeded three standard deviations (5 cases). Forty-eight participants (57% female, 43% male; 71% White, 25% Asian, 4% Hispanic) survived these criteria, and the distribution of participants into the three groups was similar to that of Study 1: 16 high-IMS/low-EMS, 15 high-IMS/high-EMS, and 17 low-IMS participants. IMS and EMS scores closely matched those of Study 1 for good regulators, poor regulators, and nonregulators (M_{IMS} = 8.39, 8.45, and 4.41, respectively; M_{EMS} = 3.74, 6.85, and 5.16, respectively). Sex distribution did not differ between IMS/EMS groups, $\chi^2 = 2.70$, $p = .26$.

Results

The main goal of Study 2 was to test whether the group effects observed on the race-specific weapons identification task would be found for the domain-general flankers task. In particular, we wanted to determine whether high-IMS/high-EMS participants' difficulty in responding without bias reflected a general cognitive impairment, relative to high-IMS/low-EMS participants. Average PD-control and PD-automatic estimates for both tasks are presented in Table 4. A preliminary set of analyses examining sex effects did not produce any significant main effects or interactions involving sex for any dependent measure, and therefore, all analyses collapsed across this variable.

Regulation Group Effects

We first conducted a 3 (Group: high IMS/low EMS vs. high IMS/high EMS vs. low IMS) × 2 (Race Prime: Black vs. White) ANOVA for PD-automatic estimates to validate that the task elicited a pattern of automatic stereotyping. Replicating Study 1, a main effect for race prime emerged, $F(1, 45) = 22.68$, $p < .001$. It indicated stronger automatic stereotyping effects for Black faces ($M = .59$, $SD = .20$) than White faces ($M = .41$, $SD = .20$). There were no effects for group or the interaction, Fs < 1.

A 3 (Group) × 2 (Race Prime) ANOVA for PD-control estimates associated with race bias produced a main effect for group, $F(2, 45) = 4.36$, $p = .02$, replicating the findings of Study 1. PD control was significantly higher among high-IMS/low-EMS participants than among high-IMS/high-EMS participants, $t(29) = 2.38$, $p = .02$, and low-IMS participants, $t(31) = 2.79$, $p < .01$. PD-control between high-IMS/high-EMS and low-IMS participants did not differ significantly, $t(30) = 1.01$, $p = .31$. The main effect for race prime, $F(1, 45) = 2.11$, $p = .15$, and the interaction, $F(2, 45) = 1.88$, $p = .17$, were not significant.

Table 4
Process-Dissociation (PD) Indexes of Automatic and Controlled Response Processes From the Weapons-Identification and Flankers Tasks as a Function of IMS/EMS Group for Study 2

	High IMS/ low EMS		High IMS/ high EMS		Non-low IMS	
Process estimate	*M*	*SD*	*M*	*SD*	*M*	*SD*
Automatic						
Weapon/Black	$.56_a$	.22	$.65_a$	.17	$.56_a$	.21
Weapon/White	$.44_a$	.16	$.43_a$	.24	$.36_a$	.20
Flanker	$.95_a$	.13	$.92_a$	.17	$.93_a$	.17
Control						
Weapon/Black	$.79_a$	.09	$.68_b$	.12	$.59_b$	.23
Weapon/White	$.73_a$	.11	$.65_{a,b}$	.17	$.61_b$	.22
Flanker	$.46_a$	.13	$.52_a$	.17	$.40_a$	.17

Note. PD estimates are probability scores. Differing subscripts indicate significantly different means within rows ($p < .05$), as determined by groupwise t tests.

Flankers Effects

We examined response latencies and error rates to establish the validity of the flankers task. As expected, responses were slower on incongruent trials ($M = 474$ ms) than on congruent trials ($M = 354$ ms), $t(47) = 21.75$, $p < .001$. Similarly, higher error rates were observed for incongruent trials ($M = 51\%$) than for congruent trials ($M = 3\%$), $t(47) = 15.63$, $p < .001$. This pattern indicated that the flankers task created a domain-general regulatory challenge that permitted appropriate comparison to the race-specific weapons identification task.

One-way ANOVAs examining group effects on PD estimates of control and automaticity for the flankers task were not significant, Fs < 1, indicating no group differences on this general measure of response control.

Comparison of Weapons Identification and Flankers Effects

Our primary hypothesis in Study 2 was that high-IMS/high-EMS participants' egalitarian intentions were not internalized sufficiently to create competition with automatic stereotyping tendencies at the level of conflict monitoring, compared with high-IMS/low-EMS participants; and thus, this effect should be specific to the domain of intergroup bias. A preliminary omnibus 3 (Group:

high IMS/low EMS vs. high IMS/high EMS vs. low IMS) × 2 (Task: weapons vs. flankers) ANOVA on PD-control estimates from the two tasks produced a marginal interaction, $F(2, 45) = 2.15$, $p = .13$. An inspection of simple effects suggested that, although high-IMS/low-EMS and high-IMS/high-EMS participants differed in their responses on the weapons identification task, they did not differ in responses on the flankers task (see Table 4). By comparison, low-IMS participants showed a tendency for lower control on both tasks, and this tendency likely weakened the expected interaction effect. Given that our hypotheses pertained specifically to patterns of control among high-IMS/low-EMS and high-IMS/high-EMS participants, we conducted a more focused 2 (Group: high IMS/low EMS vs. high IMS/high EMS) × 2 (Task: weapons vs. flankers) ANOVA on PD-control estimates. The critical interaction was significant, $F(1, 31) = 5.14$, $p = .03$, providing more direct support for the hypothesis that these two groups of low-prejudice participants would differ in PD control on the weapons identification task but not on the flankers task.

Race-Specific Versus Domain-General Components of Control

Past research has shown that controlled processing in the context of prejudice involves a combination of general regulatory abilities and domain-specific abilities (Payne, 2005). Thus, we expected that PD control from the flankers task and the weapons identification task should be related and that the degree of relation between scores on these measures would reflect participants' general regulatory abilities. However, the hypothesized IMS/EMS group differences should be evident in the variance of PD control on the weapons identification task that is attributable only to the race-specific component of control. To test this hypothesis, we conducted an analysis of covariance (ANCOVA) examining regulation-group differences in race-specific controlled processing while controlling for domain-general aspects of controlled processing. PD-control scores from the weapons identification task were submitted to a 3 (Group: high IMS/low EMS vs. high IMS/high EMS vs. low IMS) × 2 (Race Prime: Black vs. White) ANCOVA, with PD-control scores from the flankers task included as the covariate. This analysis produced a significant effect for the covariate, $F(1, 44) = 12.37$, $p = .001$, which reflected a significant degree of overlap in controlled processing on the two tasks that is attributable to domain-general regulatory ability. However, the group difference in PD control on the weapons identification task continued to be significant, $F(2, 44) = 4.53$, $p = .02$, indicating that the observed IMS/EMS group differences in the control of race-related responses were independent of general regulatory abilities.

Discussion

The results of Study 2 showed that although the groups differed in their degree of response control in the context of race, as in Study 1, they did not differ on a domain-general measure of response control. Thus, the individual differences in conflict monitoring observed in Study 1 likely reflected regulatory abilities specific to nonprejudiced intentions and the context of race and were not due to more fundamental differences in cognitive abilities.

General Discussion

Theorists have long acknowledged the challenges associated with regulating race-biased responses. Allport (1954) wrote that "prejudiced attitudes are almost certain to collide with deep-seated values that are often equally or more central to the personality," and as a result, many Americans live in a "state of conflict" (p. 326). Since Allport made this prescient observation, researchers have accumulated numerous examples of conflict between automatic race biases and consciously held egalitarian beliefs. The present research is the first to examine the way this conflict plays out in neural processes over the course of a race-biased response among different individuals.

Consistent with past research (Amodio et al., 2003; Devine et al., 2002), we found that high-IMS/low-EMS participants were more effective regulators of behavior on a stereotype-inhibition task than were high-IMS/high-EMS participants, despite their equally low-prejudice attitudes and equivalent baseline levels of automatic stereotyping. Here, we extended past findings by showing that neural conflict-monitoring processes accounted for the difference in control between these groups. These findings were consistent with the hypothesis that individuals with high internal motivation and high external motivation are less effective in responding without bias because the conflict between automatic stereotypes and egalitarian intentions is not strongly represented at the neural level while individuals form their responses.

Although the present findings show strong support for the hypothesis that differences in conflict monitoring explain why some egalitarians are worse regulators of bias than others, some potential limitations are worth considering. Our use of an all-female sample in Study 1 raises the possibility that our results would not have been observed for men. However, the behavioral effects of Study 1 were replicated in Study 2, in which gender effects were not observed. Furthermore, there are no known gender effects on ACC processing or on the ERN, and it is therefore unlikely that the results of Study 1 only pertain to women. A second potential limitation is that by telling participants that the weapons identification task could affect their use of stereotypes (albeit confidentially, to boost motivation to respond accurately), our results may have been driven by external motivations. This possibility would predict that high-IMS/high-EMS participants and a subset of low-IMS participants (those with high EMS) would have shown a high degree of behavioral control and large ERNs, but they did not.

Comparing Social Psychological and Neuroscientific Models of Control

Previous social psychological models have identified bias detection as an important step toward regulating behavior but differ from the present approach in their explanation for how the detection of bias is accomplished. Most previous models (e.g., Wegener & Petty, 1997; Wilson & Brekke, 1994) focus on the deliberative process of detecting the presence of bias and deciding to initiate control (but see Gollwitzer, 1999). In contrast, the neurocognitive model proposes that control is elicited when activations in an associative network come into conflict, requiring neither the conscious awareness of bias nor a homunculus who "just knows" when control is needed (Botvinick et al., 2001; Miller & Cohen, 2001). This model is consistent with data showing that mechanisms of control are set in motion very early in the response stream and do not require conscious appraisals (Berns et al., 1997; Nieuwenhuis et al., 2001; see also Moskowitz, Gollwitzer, Wasel, &

Schaal, 1999). By using ERPs to track this process, we were able to show evidence of conflict-processing before a response was actually made. In cases where automatic race-biased tendencies were detected and quickly inhibited during the course of a single response, conflict processing was observed approximately 100 ms before a successfully regulated response (see Footnote 1; also Amodio et al., 2004). These findings show that effective response control may be deployed without a person's awareness that a race-biased response was averted.

Our focus on the conflict-monitoring component of control complements other research on the regulative component of control that is signaled by conflict-monitoring activity (Kerns et al., 2004). For example, Bartholow, Dickter, and Sestir (2006) examined the regulative component of control in the context of race bias using an ERP component called the *negative slow wave* that is believed to reflect prefrontal cortical activity. The authors observed higher negative slow-wave amplitudes on trials in which stereotyping tendencies were successfully inhibited. This research extended the findings of Amodio et al. (2004) to demonstrate that control of racial bias involves both conflict-monitoring and regulative aspects of control, associated with the ACC and prefrontal cortex, respectively. However, researchers have not examined individual differences in the role of the regulative component of control in the context of race bias. Although the ERN mediated behavioral differences between high-IMS/low-EMS and high-IMS/high-EMS participants in Study 1, it is possible that a measure of the regulative component might further account for this group difference.

Our findings also complement research on more "downstream" aspects of race-bias regulation, such as the thoughts and feelings experienced after the commission of prejudice and their effects on future behavior (e.g., Amodio, Devine, & Harmon-Jones, 2007; Monteith, 1993; Monteith, Ashburn-Nardo, Voils, & Czopp, 2002). For example, Monteith's (1993) model of prejudice control was designed to predict patterns of cognitive, affective, and behavioral processes that are elicited when an individual becomes aware of having made a prejudiced response. More recent work by Amodio et al. (2007) demonstrated the role of prefrontal cortical activity in the regulation of behavior following awareness that one has responded with prejudice. Thus, the present work and the research of Monteith and colleagues focuses on two different stages of prejudice control, namely, pre- and postconscious processing. Whereas the present analysis focuses on the rapid processes that function to regulate a potentially race-biased response as it unfolds, Monteith's (1993) model focuses primarily on how people regulate future race-related behavior after a race-biased response has been committed (see also Amodio et al., 2007). However, because efforts to regulate future behaviors are typically more deliberative, our theoretical analysis suggests that individuals with both high internal/low external and high internal/high external motivational profiles would be effective in implementing this form of control.

Strategies for Increasing Race-Bias Control

By using ERP measures and applying a neurocognitive model of control, we provide unique insights into methods of prejudice reduction. For example, our findings suggest that the regulation of intergroup responses could be improved by enhancing the sensitivity of the conflict-monitoring system in situations in which bias may occur. Techniques have previously been shown to reduce the effect of automatic stereotyping on behavior, although not with the conflict-monitoring model in mind. For example, Kawakami, Dovidio, Moll, Hermsen, and Russin (2000) showed that stereotyping effects on behavior could be reduced by training participants to negate stereotypic associations with African Americans across hundreds of trials. In light of the present findings, we suggest that Kawakami et al.'s negation training may have amplified the conflict-monitoring process by producing concurrent activation of stereotypic and counterstereotypic responses when participants viewed a Black face, in addition to the authors' interpretation that the training weakened participants' automatic stereotyped associations. Given the present findings that individuals with a profile of high internal motivation and high external motivation may lack concurrent activation of automatic stereotypic and counterstereotypic responses, the prejudice-reduction strategies used by Kawakami et al. (2000) would be especially effective for enhancing conflict-monitoring responses in these individuals.

Conclusion

Understanding the intrapsychic conflict between countervailing prepotent and intended responses has captured psychologists' attention for much of the field's history. In the present research, we employed a measure of neural activity to assess the role of conflict monitoring in people's efforts to respond without race bias toward Black people. Our results indicate that prejudice control depends on the sensitivity of the conflict-monitoring system to unwanted race bias and suggests that a proneness to unintentional expressions of prejudice among some low-prejudice people is due in part to a deficit in this system.

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