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BRIEF REPORT

The Control-Freak Mind: Stereotypical Biases Are Eliminated Following Conflict-Activated Cognitive Control

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Numerous daily situations require control for successful goal attainment. An important question is whether control can adjust across situations, to create control readiness from one situation to the next. Using trial to trial control adjustment paradigms, previous research generally suggested that control adjustments are domain specific. However, this research typically used neutral stimuli (e.g., single letters) devoid of personally and socially relevant goals. We propose that personal relevance may be an important modulator of control adjustment and, hence, that personally relevant control tasks can benefit from control readiness, even if it is produced by a different task. In 2 experiments we test whether control over the expression of stereotypes, a highly meaningful and desirable goal for many, can benefit from control readiness evoked by a neutral unrelated Flanker task. Results suggest that stereotype-driven behavior is modulated by independently activated control and that personal relevance may facilitate control adjustments across domains.

Keywords: self-control, control readiness, conflict monitoring

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Trying to avoid a biased judgment, even though the stereotype is very salient, and ignoring flanking distractors in order to correctly identify the target in a classic Flanker task are obviously very different experiences; the former is personally and socially significant, whereas the latter is more neutral. Nonetheless, both are examples of numerous situations in which cognitive control is required for successful goal attainment. Given the major role cognitive control plays in modulating goal-directed behavior, an important question is whether it can adjust across situations, to create control readiness from one situation to the next. With some notable exceptions, previous research has generally suggested that control readiness is domain specific and that control adjustments between different domains are rather limited (see Egner, 2008; Hazeltine, Lightman, Schwarb, & Schumacher, 2011, for recent reviews). In the current article we bring social-cognitive insights to bear on what is usually thought of as a purely cognitive process: We propose that personal relevance may be an important modulator of control adjustment and, hence, that personally relevant control tasks can benefit from control readiness, even if it is produced by another, seemingly different task. We test whether control over the expression of stereotypes, a highly meaningful and desirable goal for many, can benefit from control readiness evoked by a neutral,[1] unrelated Flanker task.

Maintaining goal-directed behavior is one of the prominent functions of cognitive control, and it has been extensively studied using various stimulus–response compatibility (SRC) tasks. The Flanker task (Eriksen & Eriksen, 1974), in which participants are instructed to respond to the middle letter in an array, is a classic example. On congruent trials of this task (e.g., SSS) the target and distractors are mapped to the same response, and no cognitive control is required to maintain goal directed behavior. On incongruent trials (e.g., SHS) the target and distractors are mapped to conflicting responses, and cognitive control is activated to ensure goal attainment.

To account for how the need for control is signaled and how control is subsequently adjusted, conflict monitoring theory (CMT; Botvinick, Braver, Barch, Carter, & Cohen, 2001) proposed that detecting conflict and exerting control at time N-1, creates control readiness for time N. This readiness is manifested in biasing

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[1] We use the term *neutral* to refer to tasks in which the stimuli do not bear social, personal or emotional significance (e.g., letters, arrows).

information processing toward goal-relevant features (and away from goal-irrelevant distractors). This influential theory accounted for findings such as the Gratton effect (Gratton, Coles, & Donchin, 1992). Specifically, using the Flanker task Gratton et al. (1992) found that the magnitude of the congruency effect—longer response times on incongruent compared to congruent trials—depends on the nature of the preceding trial. On trials that follow congruent trials, the typically large congruency effect emerges. However, on trials that follow incongruent trials the congruency effect is substantially smaller. This finding has since been replicated using various SRC tasks (e.g., Kerns et al., 2004; Stürmer, Leuthold, Soetens, Schroter, & Sommer, 2002), demonstrating control readiness from one trial to the next.

CMT originally conceptualized the control readiness mechanism as domain general: Once conflict was detected and control activated, control could be applied to resolve any other conflict. The lion's share of research addressing the generality of control readiness, however, suggests that control adjustments are domain specific (e.g., Funes, Lupiáñez, & Humphreys, 2010a, 2010b; Hazeltin et al., 2011; Kiesel, Kunde, & Hoffmann, 2006; Notebaert & Verguts, 2008).[2] This research has typically used relatively neutral stimuli (e.g., letters), and thus the tasks did not directly relate to participants' needs and motivations outside the lab. One possible limitation of such tasks is that they may yield an underestimation of the potential for control adjustment (the cognitive system, if you wish, simply does not care enough). Real life goals that participants bring with them to the lab may facilitate the use of previously evoked control in the service of attaining these personally relevant goals (see Hassin, in press, for a similar argument regarding motivation as a facilitative force for implicit processes). In the current article, then, we aim to test whether the control over the expression of stereotypes, a core social phenomenon that evokes a highly important, real life goal may benefit from control activated by a neutral, unrelated task.

Research on the activation and expression of common stereotypes portrays a highly important role for cognitive control in modulating the expression of automatic stereotypical associations (e.g., Payne, 2001, 2005; Sherman et al., 2008). This research uses tasks that are similar in structure to classic SRC tasks, replacing the neutral stimuli with social ones (e.g., Bartholow & Dickter, 2008; Payne, 2001). Findings from various laboratories suggest that performance on these tasks correlates with independent cognitive control measures (Govorun & Payne, 2006; Payne, 2005) and that control is adjusted on a trial to trial basis to modulate responses within a specific task (a social Gratton type effect; Amodio et al., 2004; Bartholow & Dickter, 2008). To date, however, the question central to our concerns here, whether control readiness stemming from an unrelated task can be utilized to overcome the expression of stereotypes, has not been examined.

The modulating role cognitive control plays in the expression of implicit bias, coupled with the high social and personal significance of the goal not to be (or appear) biased, makes the assessment of implicit bias especially suitable for examining whether personal significance can facilitate adjustment of control across domains. In the current article we examine whether cognitive control recruited in a classic neutral cognitive control task (a Flanker task; Eriksen & Eriksen, 1974) can facilitate subsequent control over the expression of stereotypes, which are loaded with such significance. We report two experiments in which participants performed alternating single trials of the classic Flanker task and a task aimed at assessing Gender bias (Experiment 1) or Race bias (Experiment 2). In both experiments we predicted that the expression of common stereotypes would emerge following Flanker congruent trials but would be significantly reduced following Flanker incongruent trials.

Experiment 1

This experiment uses gender stereotypes that tie together females and weakness and males and strength (Banaji & Hardin, 1996; Gawronski, Deutsch, Mbirkou, Seibt, & Strack, 2008). As a first test of our hypothesis we intermixed trials of a classic Flanker task with trials of a Gender Flanker task, composed of stereotype congruent and stereotype incongruent stimuli. We predict that following congruent Flanker trials, responses to Gender Flankers will reflect the common stereotypes; namely, response times will be shorter for stereotype congruent versus stereotype incongruent stimuli. However, following incongruent Flanker trials, responses to Gender Flankers will not reflect these stereotypes.

Method

Participants. Twenty-five participants (68% female) took part in the experiment in exchange for course credit.

Experimental tasks and procedure. Each trial in the experiment consisted of two consecutive trials of two tasks (see Figure 1, for a schematic of an experimental trial). The first was a classic Flanker task (Eriksen & Eriksen, 1974), in which participants were instructed to identify the middle letter in a three-letters vertical letter string. Half of the trials in this task were congruent (SSS, HHH), and half were incongruent (SHS, HSH). The second task was a Gender/Trait Stereotype Flanker task (henceforth, Gender Flanker task). In this task participants saw a male name (Kevin, George, Andrew, Jason) or a female name (Karen, Dianne, Rachel, Janet) at the center of the screen. Crucially, flanker words appeared above and below each name. These flanker words (taken from Gawronski et al., 2008) were associated with either weakness (delicate, weak, fragile, tender) or strength (mighty, forceful, tough, strong). Hence, by combining names and traits we created 32 gender-stereotype congruent stimuli (e.g., the name Rachel surrounded by the trait Weak) and 32 gender-stereotype incongruent ones (e.g., the name Kevin surrounded by the trait Delicate). Participants had to indicate whether the name was a female or a male name by pressing the H or S keys (counterbalanced across participants). Each of the 64 Gender Flanker stimuli appeared after each of the four Flanker stimuli, resulting in 256 experimental trials that were fully randomized. Intertrial interval was 1,500 ms.

Results

Incorrect responses were excluded from further analysis (4.3% for the Flanker task and 6.4% for the Gender Flanker task) as well

[2] Some studies showed control adjustments across different types of conflict suggesting that control adjustments are domain general (e.g., Freitas, Bahar, Yang, & Banai, 2007; Kunde & Wuhr, 2006). But see also Egner (2008) and Funes et al. (2010a) for the argument that the conflicts in the tasks used in those studies may not have been sufficiently different.

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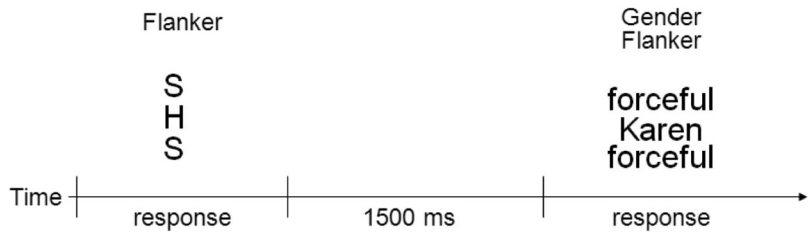

Figure 1. Schematic of a trial in Experiment 1, depicting a trial in which an incongruent Flanker trial preceded an incongruent Gender Flanker trial.

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as response latencies that deviated more than 3 standard deviations from the response time mean of each participant (1.8%). To ensure our results were not driven solely by response repetition effects (Mayr, Awh, & Laurey, 2003) we excluded response repetition trials (i.e., Flanker congruent trials that were followed by Stereotype congruent trials, both sharing the same correct response key, 12.3% of the trials) from the analysis; results remain the same if these trials are included. Before heading to our main analysis of interest we conducted a paired sample t test between response times to Flanker congruent ($M = 553.38$ ms, $SD = 121.80$) and Flanker incongruent trials ($M = 580.55$ ms, $SD = 127.63$), verifying that the classic Flanker effect is replicated in our data, which indeed was the case, $t(24) = 4.42$, $p < .0001$.

Response times to the male and female names in the Gender Flanker task were subjected to a 2 (preceding Flanker trial: Congruent vs. Incongruent) × 2 (Gender of target: Male vs. Female) × 2 (Trait flankers: Weak vs. Strong) repeated-measures analysis of variance (ANOVA). This analysis showed the predicted three-way interaction, $F(1, 24) = 6.08$, $p = .02$, $\eta^2 = .20$. The two-way interaction of Gender by Trait for trials preceded by congruent Flanker trials was significant, $F(1, 24) = 8.45$, $p < .01$, $\eta_p^2 = .26$. Response times to female names were facilitated by weakness-related compared to strength-related flankers, $t(24) = -1.78$, $p = .04$, one-tailed, and response times to male names were facilitated by strength-related compared to weakness-related flankers, $t(24) = 1.69$, $p = .05$, one-tailed; see Figure 2A. However, following incongruent Flanker trials the two-way interaction of Gender × Trait was not significant ($F < 1$), as responses to male and female names were not affected by the weakness- and strength-related flanked traits (see Figure 2B).

Discussion

Following congruent Flanker trials, participants' response pattern reflected common gender stereotypes. However, following incongruent Flanker trials participants' response pattern was not at all stereotypical; recognition of male and female names did not differ as a function of the trait flankers surrounding them.

Note that while both types of Flankers (the Letter Flankers and the Gender Flankers) had similar spatial distribution, they differed in a very important respect. While in the traditional Letter Flankers the target letters and flankers were mapped to competing task responses, this was not the case in the Gender Flanker task. The trait flankers (the weakness and strength related words) were not mapped to any task response; they were simply either congruent or incongruent stereotypical associations of the target (Bartholow & Dickter, 2008). Nevertheless, despite this difference, the conflict-activated cognitive control in the Flanker task affected control on the Gender stereotype task. This is a first step in demonstrating that control over stereotype-driven biases significantly benefits from independently activated previous control, as well as that the scope of control readiness may be extended within a personally significant task context.

Experiment 2

It may be argued that a general control readiness mechanism is not necessary to account for the results of Experiment 1, because

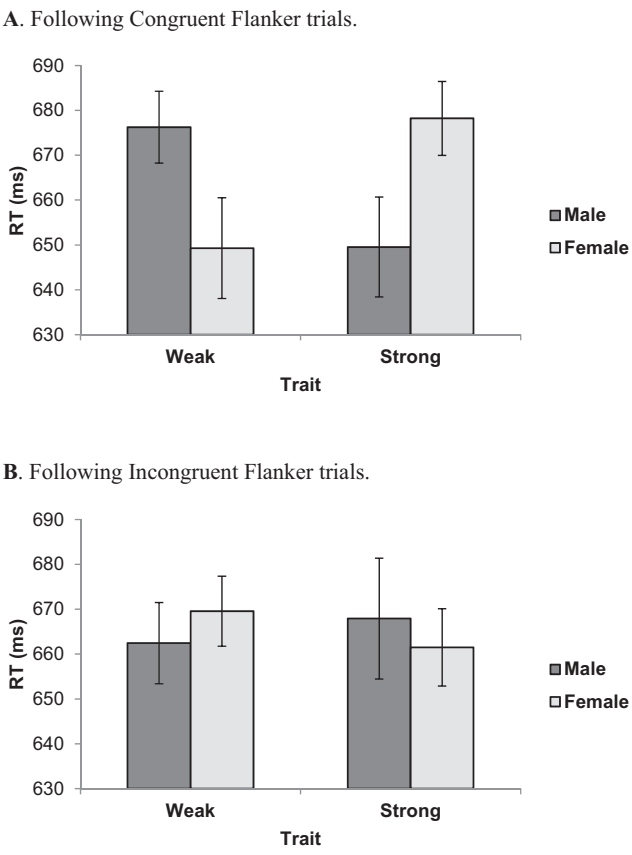

Figure 2. Response times (RTs) to Male and Female names as a function of the Trait flanker (Weak vs. Strong) for trials following Flanker congruent trials (A) and Flanker incongruent trials (B) in Experiment 1. Error bars represent standard errors.

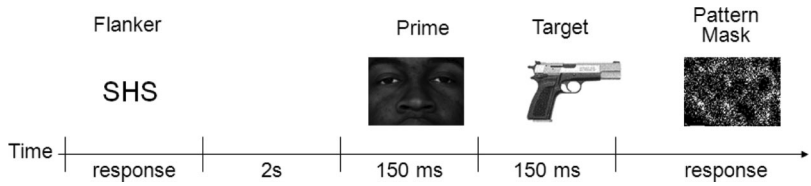

Figure 3. Schematic of a trial in Experiment 2, depicting a trial in which an incongruent Flanker trial preceded a congruent Weapon Identification Task trial.

the Letter and Gender Flanker trials had the same spatial distribution. Namely, keeping with the task set after an incongruent Flanker trial resulted in allocating attention to the central stimulus in the Gender Flanker task and thus eliminated stereotype driven responses. Hence, in Experiment 2 we used a sequential priming task in which both the distractors and the targets are presented in the same central location. In addition we used a different set of stereotypes—racial stereotypes as measured by the Weapon Identification Task (WIT; Payne, 2001). The WIT is a sequential priming task that measures implicit racial bias; by and large, participants is this task are quicker to identify guns and slower to identify hand-tools when they follow Black face primes compared to White face primes, reflecting a stereotype that associates Black individuals with violence and crime. We again predict racially biased responses following congruent Flanker trials but not following incongruent ones.

Method

Participants. Forty-five (61% females) non-Black (75% Caucasian, 18% Asian, 5% Hispanic, 2% Native Hawaiian) participants took part in the experiment for course credit.

Experimental tasks and procedure. Each trial in the experiment consisted of two consecutive trials of two tasks (see Figure 3 for a schematic of an experimental trial). The first was the Flanker Task (Eriksen & Eriksen, 1974). This task was similar to the one described in Experiment 1, except for a horizontal rather than a vertical layout of the letters. The second was the Weapon Identification Task (WIT; Payne, 2001). In each trial of the WIT, a face prime (either a Black or a White face) was presented for 150 ms. The face was immediately replaced by the target (either a Gun or a Tool), which was replaced by a pattern mask after 150 ms. The pattern mask remained on the screen until the participant responded. Participants had to indicate whether the target was a gun or a tool using the H and S keys (counterbalanced across participants). Each of the WIT stimuli appeared after each of the four Flanker stimuli, for a total of 256 experimental trials that were fully randomized. Intertrial interval was 2 s.

Results

The data of one participant who erred on 50% of the trials in the Flanker task were excluded from analyses. For the remaining 44 participants only trials with correct responses in both the Flanker and the WIT trials were included in the analysis (error rate was 4.3% in the Flanker task and 6.4% in the WIT). Response latencies that deviated more than 3 standard deviations from each participant's response time mean were excluded from further analysis (1.8% of the trials). As in Experiment 1 we removed repetition trials from the analysis (12.3% of the trials; results hold when these are included) and verified that the classic Flanker effect (M = 580.47 ms, SD = 108.36 and M = 631.84 ms, SD = 109.11 for congruent and incongruent Flanker trials, respectively) is replicated, $t(44) = 8.26$, $p < .0001$.

A 2 (preceding Flanker trial: Congruent vs. Incongruent) × 2 (Prime: Black vs. White face) × 2 (target: Gun vs. Tool) repeated-measures ANOVA on response times in the WIT task yielded the predicted three-way interaction, $F(1, 43) = 17.71$, $p < .001$, $\eta_p^2 = .29$.[3] For WIT trials that followed congruent Flanker trials the standard finding of an interaction between prime and target was replicated, $F(1, 43) = 12.71$, $p = .001$, $\eta_p^2 = .23$ (see Figure 4A). Participants were faster to identify guns, $t(43) = -2.35$, $p = .02$, and slower to identify tools, $t(43) = 3.97$, $p < .001$, following Black face primes compared to White face primes. However, following incongruent Flanker trials, this interaction vanished ($F < 1$). Participants' response times to either Gun or Tool targets did not differ as a function of the prime's race (see Figure 4B).

Discussion

Implicit Race biased responding as detected by the WIT (Payne, 2001) persisted following Flanker congruent trials. However, this bias disappeared altogether when WIT trials followed incongruent Flanker trials. Specifically, Black faces ceased to facilitate the identification of guns following flanker incongruent trials. Presumably, incongruent Flanker trials activated cognitive control, thus biasing judgments on subsequent trials toward target-relevant features (gun or tool) and away from the distracting, target-irrelevant ones (the color of the face prime). Importantly, distractors and targets in the WIT were both presented in the same central spatial location. Hence, control activated in a spatial selection task (the Flanker task) modulated control in a temporal selection task (the WIT). This finding lends further support to our suggestion that personal significance may modulate the application of control readiness, presumably by changing the context in which control activation and adjustment operate.

General Discussion

We tested whether cognitive control activated in a classic Flanker task can generalize to modulate biased responding on a trial to trial basis in implicit bias tasks. In two experiments ste-

[3] The Preceding Flanker type and Prime main effects as well as the Prime × Target two-way interaction were significant (all ps < .04). Importantly, these effects were qualified by the predicted three-way interaction.

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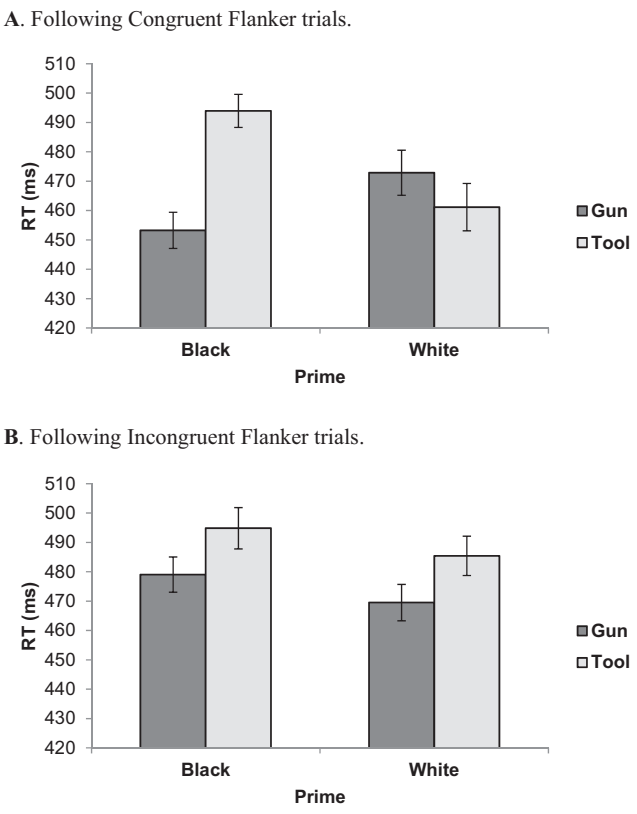

Figure 4. Response times (RTs) to Guns and Tools as a function of the face prime (Black vs. White) following Flanker congruent trials (A) and Flanker incongruent trials (B) in Experiment 2. Error bars represent standard errors.

reotypical biases (gender and race stereotypes in Experiments 1 and 2, respectively) emerged following congruent Flanker trials. However, following Flanker incongruent trials, responses were bias free; stereotypical associations ceased to affect overt behavior. Crucially, in both experiments, whereas in the Flanker task the need for control was created by specific ad hoc task response mapping, in the stereotype tasks it was "all in participants' heads"—stereotypical associations created by our culture.

Our findings complement recent research on implicit biases, emphasizing the crucial role cognitive control plays in modulating biased responses (e.g., Amodio, Devine, & Harmon-Jones, 2008; Amodio et al., 2004; Govorun & Payne, 2006; Payne, 2001, 2005; Sherman et al., 2008). We manipulated cognitive control on a trial by trial basis in a task exogenous to the one measuring stereotypical biases. This allowed us to demonstrate that incidental activation of control may be sufficient to eliminate biased behavior and that control need not necessarily stem from a specific motivation to control bias.

Our findings are also informative with respect to the question of the generality of control adjustment effects (e.g., Egner, 2008; Funes et al., 2010b). An intriguing possibility stemming from our results is that the personal and social significance of the task may modulate the scope of control readiness and adjustment. When facing an implicit bias task, the goal not to be (or appear) biased may be just as important as the assigned task goal (to correctly identify the target), arguably even more important (see Amodio et al., 2004, 2008, for an argument regarding egalitarian goals in a participants' sample similar to the one used in the current studies). Hence, an implicit bias task may significantly change the context in which conflict monitoring and control adjustment processes operate. This may lead to either quantitative changes in the threshold of control readiness and adjustment across situations, or even to qualitative changes that render control readiness across domains possible.

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