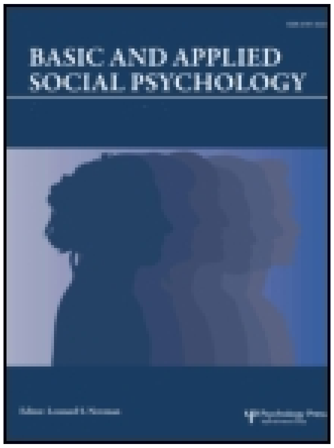

Basic and Applied Social Psychology
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/hbas20

When Fatigue Turns Deadly: The Association Between Fatigue and Racial Bias in the Decision to Shoot

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Published online: 22 Nov 2013.

BASIC AND APPLIED SOCIAL PSYCHOLOGY, 35:515–524, 2013

ISSN: 0197-3533 print/1532-4834 online
DOI: 10.1080/01973533.2013.840630

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Racial bias in the decision to shoot can be minimized if individuals have ample cognitive resources to regulate automatic reactions. However, when individuals are fatigued, cognitive control may be compromised, which can lead to greater racial bias in shoot/don't-shoot decisions. The current studies provide evidence for this hypothesis experimentally using undergraduate participants (Study 1) and in a correlational design testing police recruits (Study 2). These results shed light on the processes underlying the decision to shoot and, given the high prevalence of fatigue among police officers, may have important practical implications.

The shooting deaths of Amadou Diallo in 1999 and Timothy Thomas in 2001—two unarmed Black men—by police officers provoked intense public discussion and prompted social psychological research investigating potential causes. The role of suspect race in police officers' decision to shoot was central to these discussions and scientific inquiries (Correll, Park, Judd, & Wittenbrink, 2002; Greenwald, Oakes, & Hoffman, 2003; Payne, 2001; Plant, Peruche, & Butz, 2005). In addition, researchers have identified a number of other factors that influence the decision to shoot. For example, individual differences in implicit associations linking Blacks to weapons (Nosek et al., 2007; Payne, 2001) have been shown to predict the decision to shoot (Correll, Park, Judd, & Wittenbrink, 2007). Situational factors can also be critical to understanding the decision to shoot. Although the Diallo and Thomas cases were unrelated, the circumstances surrounding them were similar in that both shootings took place in threatening neighborhoods and occurred late at night. External factors like neighborhood and time of day are distinct from race but may still have consequences for whether race figures into shoot/don't-shoot decisions. Research by Correll, Wittenbrink, Park, Judd, and Goyle (2011), for example, suggests that dangerous neighborhoods signal threat, which can lower the threshold to shoot. The goal of the present article is to investigate the role of another moderating factor—fatigue—in the decision to shoot.

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EXPERIMENTAL RESEARCH ON THE ROLE OF SUSPECT RACE ON THE DECISION TO SHOOT

Over the past decade, researchers have developed controlled paradigms to isolate causal influences on the decision to shoot. For example, Correll and colleagues developed a first-person shooter task (FPST; Correll et al., 2002), in which participants are seated at a computer and presented with a simplified video game where they assume the role of a police officer surveilling public spaces. Images such as train stations, apartment buildings, and parks are displayed on the computer screen, and periodically a male target appears. Targets are armed or unarmed Black or White men. Participants are told to press one button to indicate "shoot" when the target is armed and a different button to indicate "don't shoot" when the target is unarmed. Race is peripheral to the task; however, the FPST reveals racial bias in both error rates (e.g., participants mistakenly "shoot" unarmed targets more if they are Black than White) and reaction times (e.g., participants are faster to "shoot" armed targets if they are Black than White). These effects are believed to emerge because of cultural associations and stereotypes linking Blacks with danger (Correll, Park, Judd, & Wittenbrink, 2007).

Research using the FPST and similar paradigms has identified some of the cognitive processes that underlie the decision to shoot. One of the critical findings to emerge from this research involves the role of cognitive control. Correll, Urland, and Ito (2006) measured event-related brain potentials (ERPs) while participants completed the FPST. ERPs reflect electrical activity in the brain (measured noninvasively by electrodes on the scalp) in response to various stimuli. ERPs are useful because they can reveal a lot about cognitive processing with high temporal resolution. Correll and colleagues found that individual differences in early ERP components that are associated with cognitive control and response inhibition, the N200, mediated the relationship between cultural stereotypes linking Blacks to danger and racial bias in the decision to shoot (Correll et al., 2006). Participants who reported stronger cultural associations between Black and danger showed smaller N200s in response to Black targets compared to White targets, and this reduced response inhibition resulted in greater bias on the FPST.

Complementary evidence comes from Payne's (2001) Weapons Identification Task (WIT). The WIT is similar to the FPST but involves the rapid presentation of faces (Black or White) followed by objects (guns or tools). Participants' task is to identify the objects as either guns or tools with a key press. Like the FPST, the WIT typically reveals a robust pattern of racial bias, which is especially evident when participants are forced to respond quickly (Payne, 2001). However, when the response window is expanded, participants show significantly less bias, presumably because they can recruit cognitive control processes necessary to override automatic associations. Research measuring ERPs while participants completed the WIT emphasizes the importance of such control in early processing (Amodio et al., 2004). Amodio and colleagues examined an ERP component called the event-related negativity (ERN), which originates from the anterior cingulate cortex, a brain area that has been linked to conflict detection. They found that the ERN was larger on trials of the WIT where race and object were stereotypically incongruent (e.g., a Black face followed by a tool), suggesting that participants perceived a conflict between race and object. Of interest, individuals with more pronounced ERNs demonstrated greater accuracy and slower reaction times, perhaps because they were exerting more effort to control their responses.

These studies converge on a central implication—people may possess stereotypes associating Black men with weapons or danger that could lead to racial bias in the decision to shoot, but the availability of cognitive control may help participants avoid responding in a stereotypical fashion. For this reason, factors that diminish cognitive control, such as fatigue, should increase racial bias in the decision to shoot. Fatigue is characterized by both physical and cognitive aspects and is an easy state to induce. Blagrove, Alexander, and Horne (1995), for example, showed that just 1 week of sleep reduction (i.e., sleeping 5 to even 7 h. per night, as opposed to 8 hr) was sufficient to produce fatigue (see also Banks & Dinges, 2007). Despite this, people commonly underestimate the negative impact that mild sleep loss can have on cognitive function (Banks & Dinges, 2007). Physically fatigued individuals may experience a lack of energy, feelings of weakness, and sleepiness (e.g., Shahid, Shen, & Shapiro, 2010). Mental symptoms of fatigue include dullness and difficulty maintaining usual levels of cognitive function (Chalder et al., 1993).

Those symptoms closely relate to cognitive depletion and circadian rhythm (e.g., Lorist, Boksem, & Ridderinkhof, 2005). Cognitive depletion is a temporary state wherein one has diminished capacity to exert control or volition over one's affect, behavior, and cognition (Muraven & Baumeister, 2000). Individuals who are fatigued can experience cognitive depletion (Shahid et al., 2010). Circadian rhythm is an individual difference and characterizes regular fluctuations in circadian arousal throughout the day. Periods of circadian arousal are associated with greater processing capacity and working memory efficiency, whereas lulls in circadian arousal are associated with poorer cognitive ability (Folkard, Wever, & Wildgruber, 1983) and feelings of fatigue (Shahid et al., 2010). Because stereotypes serve as cognitive shortcuts that allow individuals to quickly judge others (Macrae, Milne, & Bodenhausen, 1994), individuals should rely on them to a greater extent when they lack cognitive control. Consistent with this logic, Govorun and Payne (2006) demonstrated that depletion exacerbated racial bias in distinguishing weapons from tools using the WIT. Participants performed either a long or relatively brief cognitively taxing task prior to completing the WIT. Cognitively depleted participants displayed significantly more racial bias than control participants. Similarly, Bodenhausen (1990) showed that stereotyping varied at different points of the circadian rhythm. Participants judged the guilt of a White or non-White (Hispanic or Black) defendant accused of a transgression either at a resource-optimal or suboptimal point of their circadian rhythm. Participants judged non-White defendants more harshly than White defendants, but only when participants were rendering judgments during suboptimal periods.

The role of cognitive control and fatigue are especially germane to police work and the typical circumstances of officer-involved shootings. In 2000, the U.S. Department of Justice assessed the prevalence of fatigue among police officers (Vila, Kenney, Morrison, & Reuland, 2000). Using a sample of 303 active officers from four different police departments across the country, researchers found that 41% of police officers were at clinical levels of sleep deprivation. Using the FIT ("fitness-for-duty") Workplace Safety Screener (PMI, Inc.; Corfitsen, 1993), a physiological assessment of involuntary saccadic velocity (i.e., the speed with which the eye can track a moving point), Vila and colleagues (2000) found that 19% of the officers showed impairment. Alarmingly, 6.2% showed deficits equivalent to the performance of a person with a .10% blood alcohol concentration. The consequences of these levels of fatigue among officers are important to consider when it comes to cognitively demanding (and life-threatening) tasks like determining whether a suspect is armed.

Taken together, the data suggest that officer fatigue could harm decision making and increase racially biased decisions. Indeed, sociological data support the hypothesis that police officers' fatigue is associated with shooting behavior. In a national review of lethal force cases occurring between 1976 and 1998, Geller (1982) asserted that Blacks are disproportionately shot by officers and that these shootings tend to occur during the evening hours when officers are reportedly most tired (Vila & Kenney, 2002). Although this finding is consistent with the notion that fatigue might lead officers to show racial bias in their shooting, any number of factors could account for this observation. For example, it may be more difficult to make sense of threatening situations during the night when Black suspects are involved. It is also possible that Black criminals engage in more serious crimes at night that warrant greater use of lethal force.

One way to address these alternatives is to conduct laboratory-based experiments in which we can isolate and manipulate fatigue and test for its influence on the decision to shoot. Laboratory research investigating the effects of fatigue on general decision making shows that fatigue hampers the formation of good judgments, causes people to persist with ineffectual task strategies, and prompts impatient responses due to fatigue-related irritability (Staal, 2004; Vila et al., 2000). All of these processes may contribute to the emergence of racial bias in the decision to shoot with fatigue.

PRESENT RESEARCH

The current studies examined the effect of fatigue on the decision to shoot. Study 1 used a sample of undergraduate participants and tested whether cognitive depletion influences racial bias on the FPST. Study 2 examined police recruits and tested the relationship between performance on the FPST and the amount of sleep each recruit had the night before testing. Together, these studies contribute to an important literature on the decision to shoot and may further illuminate the cognitive processes implicated in this decision. Moreover, although obviously simulated situations, these studies take steps toward emulating the physiological conditions officers face in the field to provide converging experimental evidence on a real-world phenomenon for which direct experimental testing is difficult.

STUDY 1

Method

Participants and design. Seventy-seven undergraduate students (40 male, 36 female, one did not indicate gender) at the University of Chicago participated in this study in exchange for $10. Forty-four of the students identified as White, 14 as Asian, 10 as Latino, five as Black, three as other, and one did not indicate race.[1] The average age of the sample was 20.55 ($SD = 2.66$). The study design was a 2 (depletion: depleted or control) × 2 (target race: Black or White) × 2 (object type: gun or object) mixed model design with the last two factors varying within participant.

Procedure. Participants were randomly assigned to either the depleted or control conditions and run individually. Following Govorun and Payne (2006), we used the Stroop task (Stroop, 1935) to manipulate cognitive depletion. The Stroop task is a response inhibition task in which participants indicate the font color of words presented on the screen one at a time. Although this task is easy when the text color and word are congruent (e.g., when the word RED is printed in red), the task becomes

[1]Analysis revealed no effects of participant gender or race on racial bias in reaction time.

more difficult when the cues are incongruent (e.g., when the word BLUE is printed in red; Friedman & Miyake, 2004). Because the task requires participants to control responses to the irrelevant word cue and focus only on the relevant color cue, the task is cognitively depleting. Participants in the depleted condition completed 300 Stroop trials, whereas control participants completed 30 Stroop trials.

After participants finished the Stroop task, the experimenter administered the FPST. Each trial of the FPST began with the presentation of a random number of backgrounds (0–3), which appeared for a random duration (500–800 ms). Next, a final background was randomly selected and shown for a random duration (500–800 ms) before a target appeared on the background. Participants were instructed to respond to the target with a key press on a keyboard. They were told that targets would be armed (i.e., carrying a gun) or unarmed (i.e., carrying an innocuous object like a wallet or cell phone). Guns were always handguns and all objects (both guns and nonguns) were either black or silver in color. If the target was armed, participants were asked to press a button labeled "shoot." If the target was unarmed, participants were told to press a button labeled "don't shoot." Consistent with previous research (e.g., Correll, Park, Judd, & Wittenbrink, 2007), we delivered feedback about accuracy on each trial along with a running score. Participants earned 10 points for correctly shooting armed targets and 5 points for indicating they would not shoot unarmed targets. Participants were penalized 20 points for shooting an unarmed target and 40 points for failing to shoot an armed target. The score was given to motivate participants to respond accurately and was not dependent on target race. From the onset of the target, participants were given 850 ms to respond. This time window is long enough that participants tend to show very high accuracy rates; therefore, the key dependent variable was reaction time (Correll et al., 2002). The FPST comprised 16 practice and 100 test trials. Test trials featured 25 Black and 25 White unique male targets. Each target appeared once armed and once unarmed. Participants were thus presented with 25 Black armed, 25 Black unarmed, 25 White armed, and 25 White unarmed trials. Afterward, participants were debriefed and thanked.

Results and Discussion

To analyze the reaction time data,[2] we excluded trials on which participants responded incorrectly (5.4%) or failed to respond within the 850 ms response window (2.6%).[3] The remaining data were log-transformed and submitted to a 2 (depletion: depleted or control) × 2 (target race: Black or White) × 2 (object type: armed or unarmed) mixed-model analysis of variance with repeated measures on the last two factors. Although all analyses were conducted using log-transformed data, means are presented in ms to facilitate interpretation. Consistent with previous research, we observed a significant main effect for Object Type, $F(1, 75) = 330.43$, $p < .001$, $\eta_p^2 = .82$. Participants were faster to respond to armed relative to unarmed trials. Neither the depletion, $F(1, 75) = 3.09$, $p = .08$, $\eta_p^2 = .04$, nor the target race main effects, $F(1, 75) = 0.29$, $p = .59$, $\eta_p^2 = .00$, reached statistical significance. Although the depletion main effect did not meet conventional levels of statistical significance, depleted participants were marginally faster than controls. The direction of the observed trend was opposite of what we might expect, given research showing that cognitive load slows reaction time (Lamble, Kauranen, Laakso, & Summala, 1999). However, we refrain from interpreting this effect given that it might be an isolated effect and that the model contains a significant higher order interaction (Crawford, Jussim, & Pilanski, in press).

We also observed a significant Target Race × Object Type interaction, $F(1, 75) = 48.18$, $p < .001$, $\eta_p^2 = .39$. This interaction reflects racial bias in the decision to shoot and can be thought of in terms of faster responses to stereotype-congruent trials (Black armed and White unarmed) than stereotype-incongruent trials (Black unarmed and White armed). On unarmed trials, participants were faster to respond if the target was White than Black, $t(75) = 6.31$, $p < .001$, $\eta_p^2 = .34$. Conversely, on armed trials, participants were faster to respond to Blacks than Whites, $t(75) = -4.14$, $p < .001$, $\eta_p^2 = .19$. The Depletion × Target Race interaction was also significant, $F(1, 75) = 5.85$, $p = .02$, $\eta_p^2 = .07$. On Black target trials, depleted participants responded significantly faster than control participants, $t(75) = -2.29$, $p = .02$, $\eta_p^2 = .07$. On White target trials, there was no evidence that depleted and control participants differed, $t(75) = -1.09$, $p = .28$, $\eta_p^2 = .02$. There was no evidence of a Depletion × Object Type interaction, $F(1, 75) = 0.00$, $p = .98$, $\eta_p^2 = .00$.

The critical test of our hypothesis (that cognitive depletion exacerbates racial bias in the decision to shoot) was tested by the Depletion × Target Race × Object Type interaction. This interaction was statistically significant, $F(1, 75) = 4.09$, $p = .05$, $\eta_p^2 = .05$ (see Figure 1). To better understand the nature of this interaction, we examined the Target Race × Object Type interaction separately for depleted and for control participants. As previously described, the Target

[2]Data were also analyzed in terms of error rates; however, this analysis yielded null results. Neither the control nor cognitively depleted participants showed evidence for racial bias in terms of error rates, sensitivity, or criterion. This is consistent with previous research that has used the 850-ms version of the FPST and is likely attributable to the longer response window, which minimizes variability in accuracy.

[3]Participants in the depleted and control groups did not differ in terms of the number of trials that were excluded due to incorrect responses or time-outs.

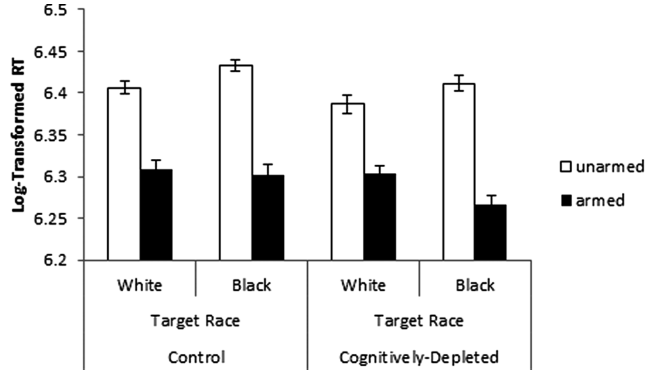

FIGURE 1 Means and standard errors for response reaction times as a function of target race, object, and experimental condition (Study 1).

Race × Object Type interaction reflects racial bias and can be reduced to a single index, *racial bias*, using the following equation: $(RT_{\text{Black unarmed}} + RT_{\text{White armed}}) - (RT_{\text{Black armed}} + RT_{\text{White unarmed}})$ where higher values represent greater racial bias. A similar analytic approach has been used in other research using the FPST (Correll et al., 2002, Study 3). Racial bias was significantly greater than zero among control participants ($M_{\text{racial bias}} = 19.38$ ms, $SD = 26.81$), $t(36) = 4.24$, $p < .001$, $\eta_p^2 = .33$ and depleted participants ($M_{\text{racial bias}} = 33.78$ ms, $SD = 38.41$), $t(39) = 5.61$, $p < .001$, $\eta_p^2 = .45$. Although there was evidence of racial bias in both conditions, the three-way interaction indicates that racial bias was significantly more pronounced in the depleted condition.

Next, we conducted simple effects tests to probe the nature of the Target Race × Object Type interactions by group. The simple effect of target race on unarmed trials was significant for both control ($M_{\text{difference}} = 15.87$ ms, $SD = 17.42$) and depleted ($M_{\text{difference}} = 14.38$ ms, $SD = 23.77$) participants, $t(36) = 5.52$, $p < .001$, $\eta_p^2 = .46$, and $t(39) = 3.82$, $p < .001$, $\eta_p^2 = .27$, respectively. Participants in both conditions were faster to accurately respond "don't shoot" when unarmed targets were White rather than Black. This effect did not differ by depletion condition, $t(75) = -0.20$, $p = .84$, $\eta_p^2 = .00$. We then tested the simple effect of target race on armed trials for each group separately. Although this effect was not statistically significant among control participants ($M_{\text{difference}} = 3.51$ ms, $SD = 24.51$), $t(36) = 0.98$, $p = .33$, $\eta_p^2 = .03$, the effect was significant among depleted participants ($M_{\text{difference}} = 19.40$ ms, $SD = 24.39$), $t(39) = 5.02$, $p < .001$, $\eta_p^2 = .39$. Depleted participants were faster to indicate "shoot" in response to armed targets if the target was Black rather than White, $t(75) = 2.80$, $p = .007$, $\eta_p^2 = .10$.

STUDY 2

Study 1 addressed the impact of one particular aspect of fatigue, cognitive depletion. Although police work is cognitively depleting, officer fatigue also stems from systemic causes (Vila & Kenney, 2002) such as double shifts (Bayley, 1994), overtime (Vila, 1996), disrupted sleep patterns (Hockey, 1986; Mitler, Carskadon, Czeisler, & Dement, 1988; Monk, 1990), required off-duty court appearances (Kroes, 1985), shift irregularities (O'Neill & Cushing, 1991; Pierce & Dunham, 1992), impaired recuperation (Gardell, 1987), and spillover of job-related stress into personal life (Gardell, 1987). Fatigue due to these factors may have psychological, emotional, and physical consequences. In Study 2, we examined the consequences of one aspect of fatigue—lack of sleep (Neylan et al., 2010)—on shoot/don't-shoot decisions. We hypothesized that sleep would negatively relate to racial bias in decisions to shoot.

Method

Participants and design. Participants were 224 new recruits (174 male, 47 female, three unreported) to a large metropolitan police department. The police department volunteered to be part of a study examining the effects of police academy training on the decision to shoot. Recruits participated in the study on a voluntary basis. Eighty-nine recruits were White, 73 were Latino/a, 27 were Black, 20 were Asian, five were biracial, one was multiracial, and nine indicated other.[4] Of the 213 recruits who reported age, the average was 23.98 ($SD = 2.96$). The study involved a 2 (target race: Black or White) × 2 (object type: gun or object) × fatigue (continuously measured) mixed-model design with the first two variables varying within participant. Two measures of fatigue—amount of sleep on the night prior to testing (sleep before testing) and amount of sleep on an average night (average sleep)—were assessed and were separately correlated with bias in decisions to shoot.

Procedure. In the morning, during the first day of training, recruits completed the FPST at a private website using the Project Implicit infrastructure (http://implicit.harvard.edu/). Compared to Study 1, we used a shorter (700 ms) response window, which reduces variation in reaction times and amplifies differences in error rates. We used this version of the FPST, because at the time of testing, we intended to track recruits as they progressed through basic recruit training. Previous research suggested that training (such as the type of training police officers receive) tends to influence errors, rather than reaction times (Correll, Park, Judd, Wittenbrink, Sadler, et al., 2007). Thus we used the 700-ms version of the FPST to collect a baseline measure of performance in

[4]Analyses by recruit gender and race revealed no differences in terms of racial bias in reaction time, errors, *d'*, or *c*. The effects of sleep were also not moderated by gender or race.

terms of errors. In addition, the change in the dependent variable allowed us to test another measure of racial bias in the decision to shoot, affording us an opportunity to examine the generalizability of this relationship. The task was otherwise identical to the paradigm in Study 1.

Two of the targets in the FPST (one unarmed White, one unarmed Black) yielded extremely high error rates (more than 70%) as compared to an average error rate of 31% for other targets. We therefore excluded both the armed and unarmed trials featuring these targets from the analyses. This left 96 test trials per participant. After the FPST, recruits completed a questionnaire on which they answered two questions about sleeping behavior: "How many hours did you sleep last night?" (sleep before testing) and "On average, how many hours do you sleep each night?" (average sleep) Single-item measures of hours slept on a typical night and number of hours slept in the previous 24-hr period are commonly used to assess fatigue (e.g., Veasey, Rosen, Barzansky, Rosen, & Owens, 2002). Rather than assess sleep from the previous 24 hr, we opted to measure sleep the night before testing, as testing occurred early in the morning. No other measures of sleep or fatigue were assessed. On average, recruits reported getting 6.65 h. ($SD = 1.40$) of sleep before testing and 7.55 h. ($SD = 0.99$) average sleep.

Results and Discussion

Reaction time. Our first analysis focused on participants' reaction times. We present these results for the sake of completeness and caution that the 700-ms version of FPST that was used is designed to maximize variability in terms of the errors individuals make, rather than variability in reaction time. For the reaction time analysis, we treated data the same as in Study 1. We excluded trials on which participants responded incorrectly (15.9%) or failed to respond within the 700-ms response window (22.6%). Note that we excluded approximately 10 times the number of trials here as compared to Study 1. The remaining data were log-transformed. Although the full design of the study involved a 2 (target race: Black or White) × 2 (object type: gun or object) × fatigue (continuously measured and mean centered in primary analyses) mixed-model with the first two variables varying within participant, we simplified the design substantially by reducing the Target Race × Object Type interaction to a single measure of racial bias. Recall from Study 1 that racial bias on the FPST represents a pattern of stereotype-congruent responding (e.g., faster shoot response to armed Blacks and slower reaction time to armed Whites). It is important to note that statistics resulting from the full design are mathematically equivalent to the results of this simpler model.

For the first analysis we regressed racial bias in reaction time on sleep before testing. The intercept of this model, which tests whether there was significant evidence of racial bias, was statistically significant, $F(1, 222) = 5.34$, $p = .02$, $\eta_p^2 = .02$. However, there was no evidence of an effect of sleep before testing on racial bias in reaction times, $F(1, 222) = 0.13$, $p = .72$, $\eta_p^2 = .00$. Overall, racial bias in reaction times was observed in the sample of recruits, but this was not moderated by sleep before testing. In a second analysis, we regressed racial bias in reaction times on average sleep. The test of the intercept was identical, and there was no effect of average sleep on racial bias in reaction time, $F(1, 222) = 0.27$, $p = .60$, $\eta_p^2 = .00$. Although these results do not replicate Study 1, we again point out that this version of the FPST is designed to capture variance in *errors* and might not be well suited to fairly test the hypothesis of bias in *reaction time*.

Errors. Our next set of analyses focused on the errors that recruits made on the FPST. Again, the full design of the study involved a 2 (target race: Black or White) × 2 (object type: gun or object) × fatigue (continuously measured) mixed-model with the first two factors varying within participant. We again simplified the analysis by computing racial bias, but this time in terms of errors using the following equation: $(\text{Error}_{\text{Black unarmed}} + \text{Error}_{\text{White armed}}) - (\text{Error}_{\text{Black armed}} + \text{Error}_{\text{White unarmed}})$. Racial bias in errors can be conceptualized as making relatively few mistakes on stereotype-congruent trials (armed Blacks and unarmed Whites) and more mistakes on stereotype-incongruent trials (unarmed Blacks and armed Whites).

First, we regressed racial bias in errors on sleep before testing. The intercept of the model was statistically significant, $F(1, 222) = 11.70$, $p = .001$, $\eta_p^2 = .05$, meaning that there was evidence of a racial bias in errors in the sample (see Figure 2). We also observed a significant effect of sleep before testing on racial bias, $F(1, 222) = 3.77$, $p = .05$, $\eta_p^2 = .02$ (see Figure 3). To better understand this effect, we examined racial bias at low (−1 SD), average, and high (+1 SD) levels of sleep before testing. For recruits who reported low levels of sleep before testing, we observed significant evidence of racial bias ($M_{\text{racial bias}} = .06$, $SD = .22$), $F(1, 222) = 14.14$, $p < .001$, $\eta_p^2 = .06$. At mean levels of sleep before testing, racial bias was also evident ($M_{\text{racial bias}} = .03$, $SD = .15$), $F(1, 222) = 11.70$, $p = .001$, $\eta_p^2 = .05$. However, at high levels of sleep before testing, there was no evidence for racial bias ($M_{\text{racial bias}} = .01$, $SD = .21$), $F(1, 222) = 0.90$, $p = .34$, $\eta_p^2 = .00$. In a second analysis, we examined the potential influence of average sleep on racial bias in errors by regressing racial bias on self-reported average sleep. We observed significant racial bias in errors, as revealed by a significant intercept (virtually identical to the previous analysis). There was no evidence for an effect of average sleep on racial bias, $F(1, 222) = 0.81$, $p = .37$, $\eta_p^2 = .00$. Racial bias was statistically equivalent across all levels of average sleep.

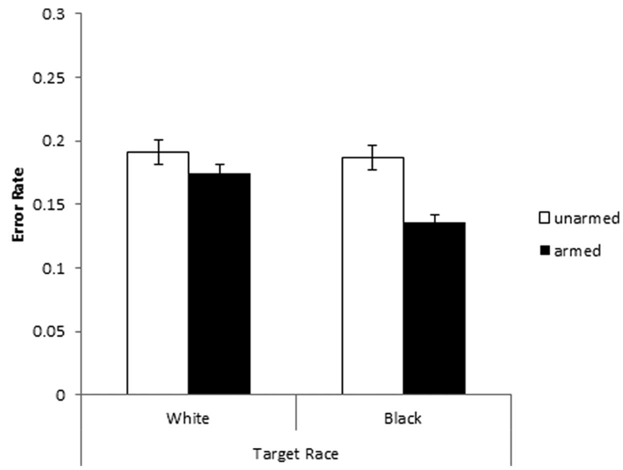

FIGURE 2 Overall means and standard errors for error rate as a function of target race and object (Study 2).

Signal detection analysis. Next, we employed Signal Detection Theory (SDT; Green & Swets, 1966) to model recruits' performance on the FPST. SDT is a statistical technique that estimates two indices based on error rates.[5] The first index derived from SDT is *c*, or the criterion, which reflects the decision criterion. Above that criterion, an individual will indicate a shoot response, but below that criterion an individual will indicate a don't shoot response. Lower values of *c* therefore signify a more "trigger happy" response. We examined whether fatigue increases racial bias in the tendency to shoot, as reflected by *c* by conducting a 2 Target Race (Black or White) × Sleep Before Testing (continuously measured) regression with *c* as the dependent variable. We observed a main effect of target race, $F(1, 222) = 13.44$, $p < .001$, $\eta_p^2 = .06$. On average, participants set a lower *c* for Black targets ($M_c = -.09$, $SD = .28$) than White targets ($M_c = -.01$, $SD = .28$). This main effect reflects racial bias. The main effect of sleep before testing was not significant, $F(1, 222) = 0.07$, $p = .79$, $\eta_p^2 = .00$. However, there was a Target Race × Sleep Before Testing interaction, $F(1, 222) = 4.01$, $p = .05$, $\eta_p^2 = .02$ (see Figure 4).

To probe the nature of this interaction we tested the difference between *c* for Black and White targets at low (–1 *SD*), average, and high (+1 *SD*) levels of sleep before testing. At low sleep before testing, there was a significant effect of target race, $t(222) = 3.97$, $p < .001$, $\eta_p^2 = .07$. Participants set a lower *c* for Black targets ($M_c = -.12$, $SD = .40$) than for White targets ($M_c = .00$, $SD = .21$). At mean levels of sleep before testing, there was also a significant target race effect, $t(222) = 3.67$, $p < .001$, $\eta_p^2 = .06$. Again, participants set a lower *c* for Black targets ($M_c = -.09$, $SD = .28$) than for White targets ($M_c = -.01$, $SD = .28$). Finally, at high levels of sleep before testing, there was no evidence for an effect of target race, $t(222) = 1.07$, $p = .29$, $\eta_p^2 = .01$. Recruits set statistically equivalent *c* for Black targets ($M_c = -.07$, $SD = .40$) and White targets ($M_c = -.03$, $SD = .40$).

Our next analysis involved a 2 target race (Black or White) × average sleep (continuously measured) regression with *c* as the dependent variable. We found a main effect of target race, virtually identical to the prior analysis. Again, participants set a lower threshold to shoot Black ($M = -.09$, $SD = .28$) than White targets ($M = -.01$,

[5]SDT *d'* and *c* estimates are calculated using the following equations: $d' = zH - zFA$; $c = -0.5 \times (zFA + zH)$. H represents the proportion of hits relative to misses and FA represents the proportion of false alarms relative to correct rejections. The z operator transforms these terms to z-scores. H and FA are corrected to prevent infinite *z* scores. When H or FA equal 0, a value of $1/2n$ is substituted, where *n* is the total number of gun and object trials, respectively. When H or FA equal 1, a value of $1 - (1/(2 \times n))$ is substituted.

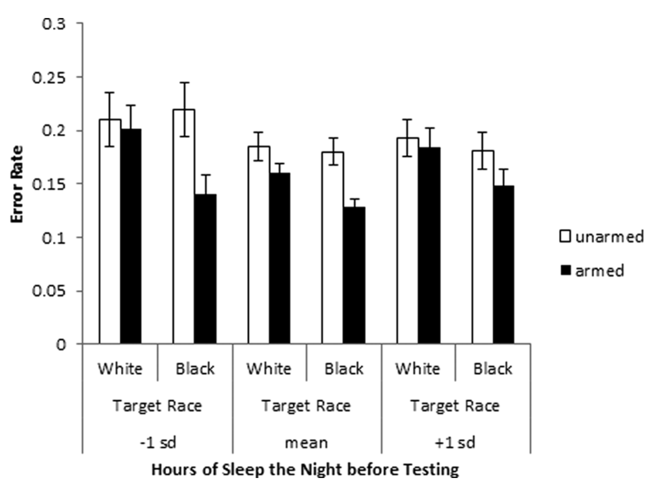

FIGURE 3 Means and standard errors for error rates as a function of target race, object, and self-reported number of hours slept the night before testing (Study 2).

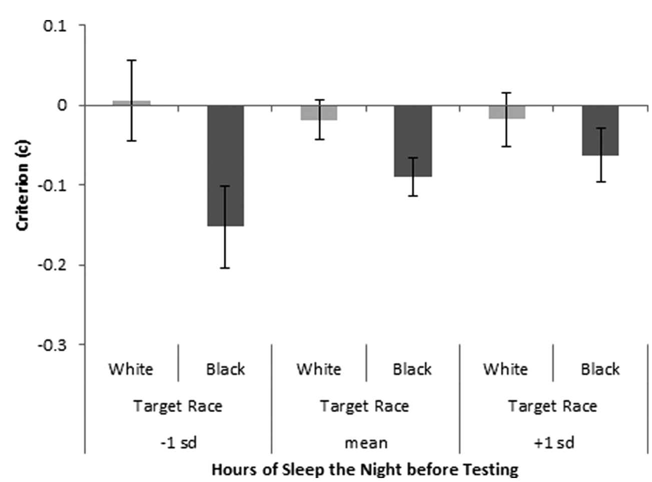

FIGURE 4 Means and standard errors for criteria (*c*) as a function of target race, object, and self-reported number of hours slept the night before testing (Study 2).

SD = .28). There was no evidence for an effect of average sleep, $F(1, 222) = 0.05$, $p = .83$, $\eta_p^2 = .00$ or a Target Race × Average Sleep interaction, $F(1, 222) = 0.47$, $p = .49$, $\eta_p^2 = .00$. These analyses indicate that the amount of sleep recruits had prior to testing (but not on an average night) had a significant influence on how much racial bias they exhibited on the FPST. Those who reported sleeping less the night prior to testing showed significant racial bias in *c*, whereas racial bias was absent among those who reported getting more sleep before testing.

The second index captured by SDT is *d'*, or sensitivity in distinguishing between guns and nongun objects. Higher *d'* values indicate better performance. To examine the relationship of fatigue on *d'* we again conducted two separate analyses looking first at sleep before testing and then average sleep. A 2 (target race: Black or White) × Sleep Before Testing (continuously measured) regression with *d'* as the dependent variable revealed a main effect of target race, $F(1, 222) = 19.81$, $p < .001$, $\eta_p^2 = .08$, such that *d'* was higher for Black ($M = 2.21$, $SD = .84$) targets than White targets ($M = 2.02$, $SD = .83$). This indicates better overall performance to Black compared to White trials; however, this effect is likely an anomaly. Race effects on *d'* in the FPST are typically null (Correll et al. 2002; Correll, Park, Judd, Wittenbrink, Sadler, et al., 2007; Correll et al., 2006), though they have also been observed in the opposite direction than observed here (greater *d'* for White targets than Black targets; Correll, Park, Judd, & Wittenbrink, 2007). There was no evidence for a main effect of Sleep Before Testing, $F(1, 222) = 0.10$, $p = .75$, $\eta_p^2 = .00$. The Target Race × Sleep Before Testing interaction was also not significant, $F(1, 222) = 0.31$, $p = .58$, $\eta_p^2 = .00$.

Next, we conducted a 2 (target race: Black or White) × Average Sleep (continuously measured) regression with *d'* as the criterion. The main effect of target race was essentially identical, such that participants showed greater sensitivity to Blacks ($M = 2.21$, $SD = .84$) than Whites ($M = 2.02$, $SD = .83$). There was no evidence for an effect of average sleep, $F(1, 222) = 0.01$, $p = .94$, $\eta_p^2 = .00$. The Target Race × Average Sleep interaction was marginal, $F(1, 222) = 3.50$, $p = .06$, $\eta_p^2 = .02$. For the purposes of exploration, we decomposed this interaction and examined the effect of target race at low (–1 *SD*), average, and high (+1 *SD*) levels of average sleep. At low levels of average sleep, there was a marginal target race effect, $t(222) = 1.81$, $p = .07$, $\eta_p^2 = .02$, such that participants showed greater *d'* for Black ($M_{d'} = 2.17$, $SD = 1.20$) than White targets ($M_{d'} = 2.06$, $SD = 1.20$). At mean levels of average sleep, we found a significant effect of target race, $t(222) = 4.48$, $p < .001$, $\eta_p^2 = .08$. Sensitivity toward Black targets ($M_{d'} = 2.21$, $SD = 0.84$) was greater than to White targets ($M_{d'} = 2.02$, $SD = 0.84$). Finally, at high levels of average sleep, *d'* was again significantly higher in response to Black targets ($M_{d'} = 2.26$, $SD = 1.20$) compared to White targets ($M_{d'} = 1.98$, $SD = 1.20$), $t(222) = 4.48$, $p < .001$, $\eta_p^2 = .08$. The results revealed a trending pattern, such that higher average sleep corresponded with better discrimination of guns and nonguns for Black compared to White targets. It may be that participants who get more sleep on a typical night direct more attention to the Black targets, allowing them to identify objects more accurately on Black trials. Of course, this is speculative and the current studies are not designed to address this possibility. Furthermore, the interaction was not statistically reliable so we caution against overinterpreting this effect.

GENERAL DISCUSSION

Despite social psychologists' collective knowledge of the processes underlying the decision to shoot, additional research examining moderating factors involved in this high-stakes decision is needed. The current studies explore the role that fatigue may have on the decision to shoot. In Study 1 we experimentally manipulated cognitive depletion and compared performance between control and cognitively depleted participants. Both groups showed significant racial bias in response latencies, but bias was even more pronounced among cognitively depleted participants. Study 2 investigated the association between sleep and decisions in the FPST among police recruits. We found that recruits showed significant racial bias in terms of reaction time, errors, criterion, and sensitivity. Moreover, racial bias on errors and the criterion was negatively associated with the amount of sleep officers reported getting the night before testing and racial bias. The effects reported in Study 2 are particularly impressive in that we observed differences in shooting behavior within a relatively narrow range of sleep. Recall that participants reported getting an average of 6.65 hours ($SD = 1.40$) of sleep before testing and 7.55 h. ($SD = 0.99$) average sleep. That we observed significant moderation in racial bias in errors and *c* by shifting about 1 h. in each direction of the mean is noteworthy.

The primary goal of the current research was to examine the relationship between fatigue and the decision to shoot. Given the prevalence of fatigue among police officers (Vila et al., 2000), this is an important question with real world implications. Although the current research is suggestive of the fact that fatigue exacerbates racial bias in the decision to shoot, we point out limitations of the current research. First and foremost, the correlational design of Study 2 leaves the results vulnerable to alternative interpretations. For instance, officers who received less sleep the night before testing might have slept less because they were more anxious and/or aroused. After all, testing for Study 2 took place on the 1st day of basic recruit training, which could very likely have induced arousal among some participants. Arousal has been shown to increase stereotyping and prejudice (Kim & Baron, 1988; Lambert et al. 2003; Wilder, 1993). Participants who slept less the night before testing may also differ in terms of important personality traits that bear on stereotyping. People who score higher on neuroticism, for example, also tend to sleep less (Kumar & Vaidya, 1982) and may also have a greater tolerance for stereotyping (Carter, Hall, Carney, & Rosip, 2006). Ultimately, although we have attempted to measure fatigue in Study 2, we cannot fully rule out alternative interpretations with respect to this study. However, these concerns are partially allayed by the fact that we found a causal relationship between fatigue and bias in the decision to shoot in Study 1, albeit with a distinct form of fatigue—cognitive depletion rather than amount of sleep. The basic assumption motivating the current research is the notion that the decision to shoot is sensitive to factors that vary across time and situation. As such, it is important to consider that the effects of fatigue may also be moderated by other factors. For example, the extensive training and police officers receive may weaken the effect of fatigue. A recent meta-analysis by Hagger, Wood, Stiff, and Chatzisarantis (2010) found that individuals who received self-control training were less affected by cognitive depletion than those who did not receive self-control training. One reason for why this might be is that training allows individuals to automate responding to relevant information (i.e., the object targets are holding) while tuning out irrelevant information (i.e., race). Consistent with this idea, Plant et al. (2005) proposed that training can eliminate bias. However, the attenuation of racial bias in the decision to shoot may depend largely on the type of outcomes being measured. For example, research conducted on police officers finds that although officers show a robust pattern of racial bias on reaction times they do not show any evidence of racial bias in the mistakes they make (Correll, Park, Judd, Wittenbrink, Sadler, et al., 2007). In other words, although police officers are slower to respond to stereotype incongruent trials (i.e., armed Whites and unarmed Blacks) than stereotype congruent trials (i.e., unarmed Whites and armed Blacks), they end up making decisions that are not influenced by target race. This strongly suggests that police officers are still activating cultural stereotypes associating Blacks with danger but somehow manage to override these stereotypes and respond to the object targets are holding.

Given that officers rely heavily on cognitive control to override racially biased responding, training may produce an ironic effect whereby trained individuals are actually more racially biased when fatigued or when their executive control is disrupted in other ways. We recently observed evidence of this in a study we conducted examining the effect of cognitive load on training in the FPST (Correll, Wittenbrink, Axt, Goyle, & Miyake, 2013). Like fatigue, cognitive load can disrupt cognitive control (Lavie, Hirst, de Fockert, & Viding, 2004). Participants received training on the FPST (experts) or not (novices) and then all participants completed the FPST under three cognitive load conditions: no load, low load, and high load. Load was manipulated using a concurrent task that varied in difficulty. Replicating previous research (Correll, Park, Judd, Wittenbrink, Sadler, et al., 2007), when there was no load, experts showed significantly less racial bias than novices in terms of c. Under low cognitive load, experts and novices showed the same degree of racial bias in c. Of interest, cognitive load led to increased bias for experts but had essentially no effect on novices. This is consistent with the idea that training may make individuals more susceptible to racial bias when their cognitive resources are compromised.

In the field, fatigue, training, and many other variables (e.g., arousal, neighborhood, the type of call to which officers are responding, etc.) presumably interact to influence a police officer as he or she decides whether to use lethal force. Identifying these contributing factors and empirically investigating how they interact to inform this decision is obviously important. Although isolating and manipulating variables in a controlled, laboratory setting is necessary for establishing causality, determining whether these relationships hold up in the field requires studying these relationships in the real world (e.g., analysis of sociological data). Although this is true of most social psychological research, it may be essential for studying the decision to shoot where realistically recreating the decision to shoot context would be virtually impossible not to mention unethical. Thus, bridging the gap between the lab and the field is a necessary step in understanding the complexities involved in police officers' decisions to shoot.

ACKNOWLEDGMENTS

Primary support for this work was provided by National Science Foundation Continuing Grant 0642580 to the second and third authors. Additional support was provided by the Booth School of Business. We thank Miho Goto, Elton Lor, and Ashley Meyer for their invaluable help with this research.

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