In April, 2001, Timothy Thomas had several outstanding warrants for non-violent traffic violations. Late one night, an officer approached him, and Thomas ran, ultimately turning down a dark alley. Another officer entered the alley and fired a single round, which struck the unarmed Thomas in the chest, killing him. The officer later reported thinking that Thomas had a gun (Larson, 2004, April 10). Thomas' death – tragic in its own right – was complicated by the fact that the victim was Black. Like other police shootings of unarmed Black men in recent years (e.g., Amadou Diallo, Sean Bell, Officer Omar Edwards), Thomas' death sparked community protests and fueled speculation for non-violent traffic violations. Late one night, an officer approached him, and Thomas ran, ultimately turning down a dark alley. Another officer entered the alley and fired a single round, which struck the unarmed Thomas in the chest, killing him. The officer later reported thinking that Thomas had a gun (Larson, 2004, April 10). Thomas' death – tragic in its own right – was complicated by the fact that the victim was Black. Like other police shootings of unarmed Black men in recent years (e.g., Amadou Diallo, Sean Bell, Officer Omar Edwards), Thomas' death sparked community protests and fueled speculation about racism, raising a simple question: would the officer have fired if Thomas had been White?

The difficulty of attributing Thomas’ death to racism is that other situational factors may have affected the officer’s decision. For example, the dark alley in which the shooting occurred may have created a sense of confusion or danger that facilitated the decision to fire. It is not surprising that police attend to cues about their surroundings, using more extreme force in neighborhoods with higher crime and poverty, and greater proportions of minority residents (Geller, 1982). Werthman and Pilavin’s (1967) ecological contamination hypothesis proposed that the environment taints officers’ perceptions: people in a dangerous neighborhood actually seem more dangerous, and police treat them accordingly. In an effort to test this idea, Terrill and Reisig (2003; but see Smith, 1986) examined officers in 24 beats in Indiana and Florida. They found that, although officers used more force with Black (rather than White) suspects, the effect of race disappeared when statistical models controlled for neighborhood disadvantage. They argued that police treat Black suspects more harshly not simply because the suspects are Black but because they typically encounter Black suspects in more dangerous neighborhoods. Inferring support for the ecological contamination hypothesis, the authors suggested that officers may feel threatened in those environments.

For several years, we have been using a first-person-shooter task (FPST) to investigate decisions to “shoot” (Correll, Park, Judd & Wittenbrink, 2002, 2007; Correll, Urland & Ito, 2006). This task presents images of young men, some armed, some unarmed, set against backgrounds like city streets or parks. The participant’s goal is to shoot armed targets by pressing a button labeled shoot, but not to shoot unarmed targets (a decision indicated by pressing a second button labeled don’t shoot). Half of the targets (armed and unarmed) are Black, and half are White.

Our work has largely focused on the influence of a target’s race, and it has provided robust evidence of bias, both in the decisions participants make and in the speed with which they make them. First, participants typically shoot Black targets, armed and unarmed, more frequently than White targets. Second, even when participants respond correctly, they typically shoot an armed target more quickly when he is Black, but in response to an unarmed target, they indicate don’t shoot more quickly when he is White. Other researchers have obtained similar results using a variety of paradigms (e.g., Greenwald, Oakes & Hoffman, 2003; Payne, 2001; Plant, Peruche & Butz, 2005).

Considering the processes that might give rise to bias in the FPST, we propose a simple model of associations (see Fig. 1). We argue that participants quickly categorize targets according to race (Brewer, 1989; Ito & Urland, 2003) and activate related stereotypes, including the concept of danger (Devine & Elliot, 1995). In a task like ours, which involves detection of hostile targets, rapid racial categorization of Black targets may increase participants’ tendency to perceive them as threats, resulting in a predisposition to shoot.
From this model, we derived two key predictions. First, as the association between race and danger becomes more pronounced, bias should increase (see Correll et al., 2006, 2007, for support). A second prediction – the focus of the current research – suggests that any cue (i.e., not just target race) that sufficiently activates the concept of danger should create a predisposition to shoot. That is, if Black targets evoke a tendency to shoot because they seem threatening, then other (non-racial) cues that enhance perceptions of threat should similarly increase the tendency to shoot. For example, a dark alley in a dangerous part of town may create a context in which any unfamiliar person seems hostile.

Cacioppo and Berntson (1994; see also Kahneman & Tversky, 1984) contend that human beings (indeed, all organisms) must distinguish between opportunities and threats in their environment. To do so, they often integrate complex information, both positive and negative. But responses to multifaceted stimuli are often constrained to a unidimensional response. In the FPST, participants judge complex images — diverse people holding different objects situated in visually complicated environments. But participants have only two response options: shoot and don't shoot. Cacioppo's model involves two critical elements. First, it weights negative information more heavily than positive information. This negativity bias suggests that, given equal intensity, negative cues prompt withdrawal more than positive cues prompt approach. Second, the relationship between the intensity of stimulus information and behavior is nonlinear. Initial negative information has a powerful impact on behavior, motivating a defensive posture. But the incremental effect of each additional piece of negative information becomes less potent. In terms of our task, this model suggests that any highly salient threat cue may prompt a defensive orientation (i.e., a tendency to shoot), but additional threat cues may have little effect. In the absence of other cues, Black targets may signal greater danger than Whites, prompting the perceiver to shoot. But if contextual threats activate the concept of danger more broadly, all targets (Black and White) may be perceived in the light of this preexisting threat. Participants may therefore respond in a hostile fashion. Once participants adopt a defensive orientation due to an environmental threat cue, additional cues based on the target's race may have minimal incremental effects. Accordingly – if contextual threat cues cause White targets to receive the hostile treatment that Black targets always receive – racial bias should be attenuated in a hostile environment. This hypothesis (our primary prediction, H1), derived from a psychological and neuroscientific perspective, perfectly matches the prediction of sociology's ecological contamination hypothesis: a dangerous context will increase the tendency to shoot White targets.

H1 can be contrasted with an alternative hypothesis based on priming research. In a typical evaluative priming task, participants might view a prime stimulus (positive or negative) and then a target stimulus (positive or negative). In general, evaluatively consistent prime-target pairs facilitate responses: participants respond more quickly when the prime and the target are both positive (or both negative) and more slowly when one stimulus is positive and the other negative. In an interesting extension of this work, researchers included a third stimulus — a positive or negative stimulus that appeared before the prime. The results showed that the magnitude of the priming effect was enhanced when the pre-prime stimulus was evaluatively inconsistent with the prime. Essentially, participants showed a contrast effect as a function of the relationship between the pre-prime and the prime (Deutsch & Gawronski, 2009; Gawronski, Deutsch & Seidel, 2005). For example, a pleasant photograph of a kitten may generally facilitate classification of a positive target word like gift, and delay classification of negative words like war; but this pattern is exacerbated when an unpleasant image of a cockroach precedes the kitten. The idea is that the pre-prime image creates a psychological context against which the prime is contrasted. Translating this finding to the FPST, H2 predicts that, in a threatening environment.
context, non-threatening White targets will produce a contrast effect. In a dangerous environment, Whites may seem even less dangerous than they normally do. If so, participants should demonstrate a more pronounced reluctance to shoot White targets when they appear in a dangerous environment.

We tested these hypotheses by systematically manipulating the backgrounds in which FPST targets appeared. In our standard paradigm, targets are embedded in relatively innocuous backgrounds (e.g., parks, apartment buildings, train stations). For the present research, we assembled additional backgrounds featuring dumpsters and subway terminals covered with graffiti, dilapidated buildings, and inner-city streets (images evocative of poverty and crime). Targets from the original task were embedded in these threatening scenes. We then asked participants to perform the FPST, once with the original backgrounds and once with the dangerous backgrounds. In the neutral backgrounds, we predicted the standard pattern of bias (a tendency to shoot Black targets more frequently than Whites). However, the dangerous contexts raise two competing hypotheses. H1 suggests that a dangerous environment will prime the concept of threat in general, evoking a tendency to shoot both White and Black targets. H2 suggests that the contrast between a dangerous context and relatively non-threatening White targets may prompt participants to see Whites as even less dangerous, reducing (rather than increasing) the tendency to shoot them.

Pilot studies

We developed two versions of the FPST. The first, identical to the task used in previous research (Correll et al., 2002), presented targets in neutral backgrounds. The second differed only in that it employed threatening backgrounds. We conducted a preliminary study to equate the background images for visual complexity. We did not want performance to reflect systematic differences in participants’ ability to discriminate objects in the neutral vs. dangerous contexts. We selected a set of 40 (20 neutral and 20 dangerous) backgrounds (640 pixels × 480 pixels). Using Adobe Photoshop, we created a set of 160 images by superimposing 4 non-threatening objects (two cell phones, a coke can, and a wallet), one at a time, in each background. Objects were randomly assigned to 1 of 9 possible positions defined by a 3×3 grid covering the central portion of the image (384 pixels × 288 pixels). The grid was used only to guide the creation of these stimuli, it was not visible to participants.

Thirty-four students participated. Each of the 40 backgrounds was presented 4 times with an object (once with each of the 4 objects) and 4 times with no object (320 trials). For each background, participants indicated whether or not an object was present as quickly as possible. We examined average reaction times (across participants and objects) for trials on which participants correctly detected the object. We ultimately selected 18 neutral backgrounds and 18 dangerous backgrounds, which did not differ in terms of latency (M’s = 818.42 ms, 851.44 ms, respectively), t(34) = 0.95, p = 0.35. Latency to detect an object was thus roughly equivalent across contexts.

We also tested the 36 images to ensure that the ostensibly dangerous backgrounds were, in fact, perceived as more threatening than the ostensibly neutral scenes. 62 undergraduates rated each image on a scale from 1 (extremely safe) to 5 (neither safe nor dangerous) to 9 (extremely dangerous). A paired-samples test demonstrated that, as intended, the dangerous backgrounds (M = 6.25) were perceived as more threatening than the neutral backgrounds (M = 3.30), t(61) = 29.44, p < 0.001.

Method

Participants and design

Fifty-five non-Black undergraduates (mean age = 18.87; 33 female, 21 male, 1 missing; 46 White, 3 Latina/o, 2 Asian, 4 missing/

Table 1

<table>
<thead>
<tr>
<th>n = 55</th>
<th>Neat neutral context</th>
<th>Dangerous context</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>White targets</td>
<td>Black targets</td>
</tr>
<tr>
<td></td>
<td>Mean Std Dev</td>
<td>Mean Std Dev</td>
</tr>
<tr>
<td>Unarmed error rate</td>
<td>0.134 0.118</td>
<td>0.160 0.149</td>
</tr>
<tr>
<td>Armed error rate</td>
<td>0.140 0.100</td>
<td>0.096 0.074</td>
</tr>
<tr>
<td>Difference</td>
<td>−0.005 0.127</td>
<td>0.063 0.137</td>
</tr>
<tr>
<td>Unarmed log latency</td>
<td>6.253 0.049</td>
<td>6.269 0.044</td>
</tr>
<tr>
<td>Armed log latency</td>
<td>6.134 0.065</td>
<td>6.131 0.073</td>
</tr>
<tr>
<td>Difference</td>
<td>0.118 0.060</td>
<td>0.138 0.067</td>
</tr>
<tr>
<td>Criterion (c)</td>
<td>0.037 0.278</td>
<td>−0.109 0.289</td>
</tr>
<tr>
<td>Sensitivity (d’)</td>
<td>2.419 0.789</td>
<td>2.529 0.831</td>
</tr>
</tbody>
</table>

other) participated in partial fulfillment of a course requirement.1 Participants performed the task twice. The study involved a 2 (Task Order: dangerous context first vs. neutral context first) × 2 (Context: dangerous vs. neutral) × 2 (Target Race: Black vs. White) × 2 (Object Type: gun vs. no gun) mixed-model design, in which Order varied between participants and all other factors varied within participants.

Materials

Neutral-context task

The neutral task was essentially identical to the task used by Correll et al. (2002). Ten Black and ten White men were photographed holding guns and non-gun objects (e.g., a wallet or a cell phone). For each individual, we selected four images, two with guns and two with innocuous objects, resulting in 80 distinct images (20 of each type: armed White, armed Black, unarmed White, and unarmed Black). Using Photoshop, each target was embedded in a neutral background scene (in both the neutral and dangerous stimuli, two of the 18 backgrounds identified in the pilot test were randomly selected and used twice, yielding a set of 20). Targets were randomly assigned to backgrounds, with the restriction that each target type should be represented with equal frequency in each background.

The task was developed in PsyScope (Cohen, MacWhinney, Flatt & Provost, 1993), following a 2 × 2 within-subjects design, with Target Race (Black vs. White) and Object Type (gun vs. non-gun) as repeated factors. On any given trial, a series of scenes appeared, followed by a target image. Players were instructed to respond as quickly as possible whenever a target appeared, pressing a button labeled shoot if the target was armed, and pressing a button labeled don't shoot if he was unarmed. The game awarded points based on performance, and participants were required to respond to a target within 630 ms.2 Point totals and feedback, both visual and auditory, were presented at the conclusion of every trial. The game consisted of a 16-trial practice block and an 80-trial test block (see Correll et al., 2002, for details).

Dangerous-context videogame task

Targets from the neutral-context game were embedded in the 18 backgrounds chosen in the pilot study (two of which were used twice). These images included dilapidated buildings, dumpsters, subway terminals with graffiti, etc. With the exception of these backgrounds, the task was identical to the neutral-context version.

1 Two additional participants were excluded due to experimenter error, and two were excluded as outliers (Cook’s Ds for the three-way interaction reported below = .233 and .108; next highest value = .075; see Judd & McClelland, 1989).

2 In the present research, our goal was to examine the effect of context on errors. Accordingly, we used a 630-ms window, which reduces variability in reaction times, but increases errors.
**Procedure**

Participants, in groups of 1 to 6, were seated in cubicles equipped with iMacs. The experimenter introduced the study as a test of vigilance. Participants were told that they would perform the task twice. Between the two games, they were given a short break. Upon completion of the second game, participants were thanked and debriefed.

**Results**

On average, participants responded incorrectly on 11.52% of trials and timed out on 10.46% of trials. Error rates for each target type, in each game, were submitted to a 2 (Task Order: danger first vs. neutral first) × 2 (Context: dangerous vs. neutral) × 2 (Target Race: Black vs. White) × 2 (Object Type: gun vs. no gun) mixed-model ANOVA. There was a main effect of object, F(1,53) = 4.70, p < 0.035, such that participants were more likely to incorrectly shoot an unarmed target (false alarm) than to incorrectly choose not to shoot in response to an armed target (don’t-shoot). Sensitivity was gauged with the statistic, d'. Second, SDT estimates the degree to which participants favored a shoot response over a don’t-shoot response — did they set a very low bar for the decision to shoot (shooting often) or a very high bar (shooting rarely)? This criterion was assessed with the statistic, c.

We calculated c four times for each participant: White targets in neutral contexts, Blacks in neutral contexts, Whites in dangerous contexts, and Blacks in dangerous contexts (see Fig. 2). We then analyzed the criteria as a function of Order, Context and Target Race, submitting them to a 3-way mixed-model ANOVA. We obtained no effects involving Order, Fs < 0.14, ps > 0.7. We did, however, obtain an effect of Target Race, F(1,53) = 8.51, p < 0.006, and an interaction between Context and Race, F(1,53) = 4.14, p = 0.047. The criterion to shoot was lower for Black targets than for White targets in the neutral contexts, F(1,53) = 11.51, p < 0.002. In the dangerous context, however, the criteria did not differ for Black vs. White targets, F(1,53) = 0.63, p > 0.44. H1 suggests, specifically, that the presence of contextual danger cues should induce participants to set a lower criterion for White targets when they appear in threatening environments. Indeed, estimates of c were lower when Whites appeared in dangerous contexts rather than neutral contexts, F(1,53) = 4.98, p < 0.03. But context had no effect on the criteria for Black targets, F(1,53) = 0.11, p > 0.75. In essence, whenever danger was salient — either due to race or due to context — participants adopted a more lenient, more trigger-happy criterion for the decision to shoot.

The criterion measure is valuable, not just because it allows us to test the effects of condition, but because the statistic, c, has meaning in an absolute sense. Values close to zero indicate that participants were predisposed to shoot. Mean values of c fell significantly below zero for Blacks in both contexts (neutral t(54) = –2.80, p < 0.007; dangerous t(54) = –2.50, p < 0.016). They also tended in a negative direction for Whites in the neutral context, t(54) = –1.53, p = 0.14, but not in the dangerous context, t(54) = 1.07, p = 0.30. As a result, participants in the neutral context favored a shoot response over a don’t-shoot more often than did participants in the dangerous context.

**Signal detection analysis**

Signal Detection Theory (SDT; Green & Swets, 1966/1974; MacMillan & Creelman, 1991) offers a way to quantify and conceptualize the effects of race and context in this task by disentangling two distinct factors that influence error rates. First, it provides a measure of participants’ ability to differentiate armed targets from unarmed targets. Sensitivity was gauged with the statistic, d’. Second, SDT estimates the degree to which participants favored a shoot response over a don’t-shoot response — did they set a very low bar for the decision to shoot (shooting often) or a very high bar (shooting rarely)? This criterion was assessed with the statistic, c.

In the neutral context (i.e., low bar for the decision to shoot), participants favored a shoot response over a don’t-shoot more frequently than an armed Black, rather than White (i.e., c is lower for Blacks), but that sensitivity (d’) does not differ as a function of race.

Including the outliers slightly weakens the effect (p < 0.02).

Including the outliers does not alter the effect (p < 0.02).

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**Fig. 2.** Signal detection analysis. Participants set a lenient criterion (c, left panel) for Black targets in both neutral and dangerous contexts. For White targets, the criterion was low only in a dangerous context. Participants’ sensitivity (d’, right panel) did not differ as a function of race or context.
dangerous context \((t(54) = -1.53, p = 0.133)\), suggesting that participants favored the shoot response for these targets. Only when no danger cues were present (i.e., for White targets in a neutral context, \(t(54) = 0.98, p = 0.34\) did the criterion rise, indicating no predisposition to shoot.

Estimates of sensitivity (participants’ ability to distinguish between armed and unarmed targets, calculated as \(d’\)) were submitted to an identical mixed-model ANOVA. There were no significant effects of either race, context or their interaction. \(F_{S} = 0.25, 1.42, \text{ and } 0.22\), respectively, \(p’s < 0.62, 0.24, \text{ and } 0.65\), respectively), suggesting that the independent variables did not affect participants’ ability to distinguish between armed and unarmed targets. This result suggests that trials involving the dangerous contexts were not inherently more or less difficult than those involving the neutral contexts. Thus, participants set different criteria for the decision to shoot as a function of context even though they were equally able, in all conditions, to discriminate between armed and unarmed targets.

**Discussion**

The present research tested a single, very simple proposition: perception of threat fosters a predisposition to shoot. We have suggested that racial bias in decisions to shoot reflects the fact that most Americans associate Blacks (or, at least, young Black men) with danger (Correll et al., 2002; Devine, 1989; Devine & Elliot, 1995). If threat perception really mediates shooter bias, then it is suggested that racial bias in decisions to shoot reflects the perception of threat fosters a predisposition to shoot. We have manipulated racial and non-racial danger cues to determine whether armed and unarmed targets. This result suggests that trials involving the dangerous contexts were not inherently more or less difficult than those involving the neutral contexts. Thus, participants set different criteria for the decision to shoot as a function of context even though they were equally able, in all conditions, to discriminate between armed and unarmed targets.

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It may be important that the current study employed clear and visually salient danger cues (race and environment). If less salient cues are insufficient (individually) to prompt a defensive posture, a sufficiency model would predict more additive effects.

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\footnote{6} BDW is a measure of generalized fear, but it has also been associated with racial prejudice (Duckitt, Wagner, du Plessis & Birum, 2002) so this interaction may, in part, reflect different attitudes toward Black and White people.

\footnote{We wish to thank the editor for this citation.}
for the judgment at hand, namely to detect threat. This reasoning of course is entirely consistent with our proposal that threat detection relies on a sufficiency model; once a sufficient threat level has been reached, participants adopt a defensive posture (and additional cues have little incremental impact). As a result, the addition of threatening cues to the situation leads to an overall reduction in bias.

It is also important to recognize that the current study focuses explicitly on the effects of additional threat cues whereas the evaluative work examines both negative and positive contexts. This constraint raises a question about the effect of contextual cues that might signal safety. Positive situational cues may mitigate bias by impacting responses to Black targets in a positive fashion, rather than making responses to Whites more negative.

As discussed in the Introduction, sociologists and criminologists have a longstanding interest in race and its effects on police behavior. Based on a range of data sources (including the Federal Bureau of Investigation, citizen complaints, local police agency records and social observation), research suggests that police use of force, including the use of firearms, is applied more frequently and more severely to suspects who are young, male, and either Black or Latino (Geller, 1982; DOJ, 2001). Researchers like Terrill and Reisig (2003) have begun to explore how police shootings relate to the neighborhood in which an encounter occurs, and their initial results perfectly match the data reported here: a potentially dangerous and disadvantaged neighborhood may prompt more extreme use of force regardless of the suspect’s race.

Clearly, racial cues can and do signal threat. Young Black male targets prompt a defensive orientation. But racial threat perception may be one manifestation of a more comprehensive threat-detection process—a process that monitors the environment for a variety of threats. In this more comprehensive framework, race represents one of many possible signals, each of which can prompt defensive action. Several scholars suggest that humans have evolved mechanisms for detecting threat, which—like the speeding bus, charging bear or snake in the grass—must be processed quickly and efficiently (Öhman, Lundqvist & Esteves, 2001; Öhman, Flykt & Esteves, 2001). It may be reasonable to suggest that this mechanism responds to context as well as race. The current research only begins to touch on this question. All the same, the decelerating impact of multiple danger cues, documented here, highlights the complexity of the threat-detection process and hints at a fast-acting system capable of processing a complicated, multifaceted environment and triggering defensive behavior whenever the situation is deemed “dangerous enough.” That the presence of a Black man is, in some circumstances, sufficient to stimulate such a response remains a source of great concern, but the dynamic nature of this system holds promise for the study, understanding, and (perhaps eventually) control of these biases.

Acknowledgments

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