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Event-related potentials and the decision to shoot: The role of threat perception and cognitive control ☆

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Abstract

Participants played a videogame in which they were required to make speeded shoot/don't-shoot decisions in response to armed and unarmed targets, half of whom were Black, half of whom were White. Event-related brain potentials (ERPs), recorded during the game, assessed attentional processes related to target race and object type. Early ERP components (i.e., the P200 and N200) differentiated between Black and White targets, as well as between armed and unarmed targets. Explicitly measured cultural stereotypes predicted both this racial ERP differentiation and racial bias in the game. Most importantly, the degree of racial differentiation in the early ERP components predicted behavioral bias in the videogame and mediated the relationship between cultural stereotypes and bias.

Keywords: Social cognition; Race; Attention; Event-related potentials; Social categorization; Weapon; Stereotype; Black; White

The recent deaths of unarmed Black men, shot by police, have raised speculation that officers use race when making the decision to shoot. Indeed, several recent studies have shown that participants identify handguns as weapons more quickly and more accurately after seeing a Black face, but classify objects like tools as non-weapons more quickly and accurately after seeing a White face (Amodio et al., 2004; Judd, Blair, & Chapleau, 2004; Payne, 2001; Payne, Lambert, & Jacoby, 2002). Additional work showed a similar bias in the decision to "shoot" (Correll, Park, Judd, & Wittenbrink, 2002; see also Greenwald, Oakes, & Hoffman, 2003). In a videogame simulation, participants were instructed to "shoot" anyone holding a gun (by pressing one button), but not to shoot targets carrying anything else (a decision indicated by pressing a second button). It is important to note that race was technically irrelevant to this task. The correct response depended solely on the object being held. Nonetheless, participants shot armed targets more quickly and more frequently when those targets were Black, rather than White, but decided not to shoot unarmed targets more quickly and more frequently when they were White, rather than Black. Correll et al. termed this pattern *shooter bias*.

Correll et al. (2002) suggested that bias reflects the operation of racial stereotypes, which link Blacks to danger. They proposed that, in the shoot/don't-shoot game, a Black target (whether armed or unarmed) should activate the idea of danger and create a predisposition to shoot (see Fig. 1). When the target is, in fact, armed, this stereotypic predisposition is congruent with the correct response (i.e., to shoot) and should facilitate

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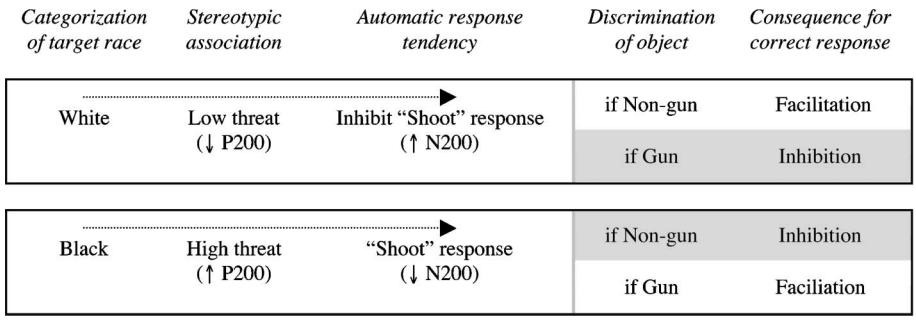

Fig. 1. Racial stereotypes influence threat perception and response tendencies, facilitating responses to stereotype-congruent targets (unarmed Whites and armed Blacks) but inhibiting responses to stereotype-incongruent targets (armed Whites and unarmed Blacks).

it. When the target is unarmed, however, the predisposition is incongruent with the correct response (i.e., to not shoot) and should interfere with it. In support of this idea, the researchers found that participants with greater knowledge of cultural stereotypes showed more pronounced shooter bias.

This prediction is consistent with recent models of automatic processing, such as the *Quadruple Process Model* (Conrey, Sherman, Gawronski, Hugenberg, & Groom, in press). This model suggests that, initially, a stimulus (e.g., a Black male) may activate a given association (threat). The likelihood of this activation is thought to reflect the strength of the association, in this case, the stereotype. Once activated, this association prompts consistent behavior (a shoot response). But, an individual can moderate this biased response if he or she has access to discriminable diagnostic cues (the presence/absence of a weapon), as well as the necessary cognitive capacity and motivation. That is, when diagnostic cues are available, the individual may override the bias and implement a more deliberate response. Given enough time, an individual who accurately perceives a Black target to be unarmed may successfully inhibit the stereotype-driven shoot response. (Of course, if the target is armed, such inhibition is unnecessary: the biased response tendency and the deliberative response will both prompt a decision to shoot.)

The goal of the current study was to examine the manner in which these stereotypes influence behavior online by examining event-related brain potentials (ERPs). ERPs are fluctuations in the electrical activity of the brain that occur in response to specific stimuli. Methodologically, they are valuable because they provide high temporal resolution, allowing researchers to distinguish between processing operations that occur quickly and in rapid succession after stimulus onset. Our particular interest was to examine ERPs related to two processes specified by the preceding analysis as critical to the shoot/don't-shoot decision, namely, threat detection and cognitive control.

Processing that occurs relatively early (e.g., within 300 ms of stimulus onset) has been associated with covert orienting to stimuli with evolutionary significance (Halgren & Marinkovic, 1995; LeDoux, 1998; Ohman, Lundqvist, & Esteves, 2001). For example, threatening images, like fierce dogs or angry human faces, enhance responses to an ERP component called the P200[1] (Carretie, Martin-Loeches, Hinojosa, & Mercado, 2001; Carretie, Mercado, Tapia, & Hinojosa, 2001; Eimer, Holmes, & McGlone, 2003). Interestingly, the P200 is also sensitive to race. Ito and Urland (2003) showed that Black faces evoke larger P200s than Whites, consistent with the idea that Blacks were perceived as threatening by their White participants. This P200 race difference occurs even when tasks direct attention away from race (e.g., requiring attention to non-social features; Ito & Urland, 2005). Detection of threat, including race-cued threat, is particularly relevant to the present study, which involves the identification of potentially hostile Black and White targets. If the P200 indexes threat perception, we predict that larger deflections should facilitate decisions to shoot but inhibit decisions not to shoot.

A slightly later component, the N200, has been linked to cognitive control processes (Kopp, Rist, & Mattler, 1996; Ritter, Simson, Vaughan, & Friedman, 1979). The N200 may reflect activity in the anterior cingulate cortex (ACC), which plays a critical role in the detection of conflict (Nieuwenhuis, Yeung, Van Den Wildenberg, & Ridderinkhof, 2003; Van Veen & Carter, 2002), including the inhibition of a prepotent response (Swainson et al., 2003). Response inhibition is also critical to performance in the current study. The design, instructions and reward structure of the videogame make shooting the dominant response, and participants are typically faster and more accurate in decisions to shoot than in decisions not to shoot. Initiation of executive control may therefore be required to inhibit this general tendency. As a precursor to response inhibition, larger N200s should therefore facilitate decisions *not* to shoot.

[1] Components are commonly referred to by the direction of their voltage deflection (positive/negative) and their time course. For example, the P200 is a positive-going component that typically reaches a peak 200 ms after stimulus onset.