Neural signals for the detection of race bias: Implications for regulatory ability

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Introduction

Many low-prejudice people often fail to regulate expressions of automatic race bias, despite their egalitarian beliefs (Devine et al., 1991; Monteith, 1993). However, extant theory does not account for why some low-prejudice people have difficulty controlling race bias compared with other low-prejudice people. We tested the hypothesis that the neural system that detects conflict between an automatic race-biased response tendency and nonprejudiced intentions may be less sensitive for low-prejudice people who are more prone to race bias.

Individual differences in race-bias regulatory ability

- Race-bias regulatory ability has been associated with people's internal and external motivations for responding without prejudice (Amodio et al., 2003; Devine et al., 2002)
  - Internal Motivation Scale (IMS) – personal reasons
    E.g., "I am personally motivated by my beliefs to be nonprejudiced towards Black people."
  - External Motivation Scale (EMS) – normative reasons
    E.g., "I attempt to appear nonprejudiced toward Black people in order to avoid disapproval from others."

Group	Explicit race bias	Implicit race bias	Regulatory ability
High IMS, Low EMS	Low	Low	Good
High IMS, High EMS	Low	High	Poor
Low IMS (High and Low EMS)	High	High	N/A

Dual system model of control

(Botvinick, Braver, Carter, Barch, & Cohen, 2001)

- Conflict monitoring system
  - Continuously monitors ongoing neural activity for conflict between behavioral tendencies
    - Associated with activity in anterior cingulate cortex (ACC)
  - When conflict is detected, regulatory system is signaled
- Regulatory system
  - Organizes behavior to resolve conflict
    - Associated with activity in prefrontal cortex

Thus, control may fail because:

a) the first system fails to detect conflict or

b) the second system is unable to implement the intended response

Present Study

- We used the IMS/EMS to identify good, poor, and non-regulators of race bias
  - Participants completed a sequential priming task assessing race bias while EEG was collected
  - We compared ERPs on trials eliciting high vs. low levels of race-bias–related conflict

Hypothesis: Poor regulators' control failures are related to a deficit in conflict-detection in the context of race bias

Method

Participants

- 45 White American students, selected based on IMS/EMS scores to comprise:
  - Good regulators (high IMS/low EMS)
  - Poor regulators (high IMS/high EMS)
  - Non-regulators (low IMS)

Procedure

- Completed 288 trials of gun-tool task
- EEG: 27 scalp sites, average earlobe reference (offline)

Derivation of N2 and ERN components

- 1-15 Hz signal at frontocentral midline (Fcz)
- Averaged within each trial type for correct and error responses
  - ERN: Peak negative amplitude -50 to 100 ms, centered on response
  - N2: Peak negative amplitude 200 to 400 ms post stimulus

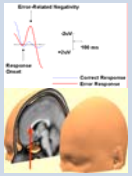
The N2 and Error-related negativity (ERN) waves

High levels of response conflict associated with larger N2 and ERN amplitudes

- N2 occurs with correct response
- ERN occurs with error response

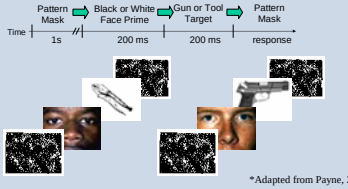
Both associated with:

- Negative polarity wave
- Fronto-central scalp distribution
- ACC neural generator



From W. Gehring: www.personal.umich.edu/~wgehring/lab/Learn.html

Gun-tool task*



*Adapted from Payne, 2001

- Participants categorized each target as "gun" or "tool" via button-press
- Responses were to be made within 500 ms of target

Participants were told:

- "This task is designed to measure racial prejudice"
- "Errors on certain trials indicate race bias"
  - E.g., responding "gun" instead of "tool" after a Black face suggested the influence of stereotypes on behavior

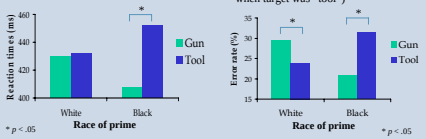
Behavioral measure of control

- The process dissociation procedure (PDP) framework assumes that automatic and controlled processes comprise any given response
  - Independent estimates of automatic and controlled contributions to performance on the gun-tool task were computed using the PDP (e.g., Payne, 2001; Jacoby, 1991)
- The PDP estimate of control comprised our measure of control

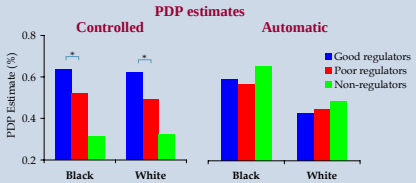
Results

A) Gun-tool task created race-biased response conflict

- Black face primes facilitated "gun" responses and inhibited "tool" responses
- Black faces led to more stereotype-consistent errors (e.g., "gun" response when target was "tool")

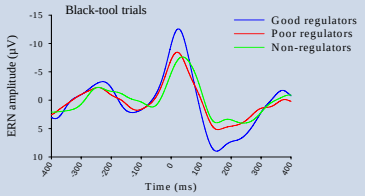


B) Greater control for good vs. poor regulators



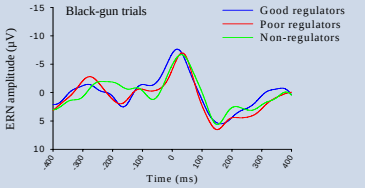
C) Greater race-bias conflict among good regulators

- ERNs for errors attributable to race bias (Black-tool errors) were enhanced for good regulators relative to poor and non-regulators



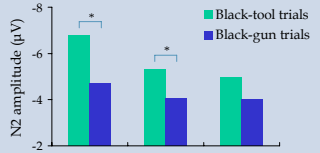
Good regulators vs. others: $t(43) = 3.63$, $p < .001$

- Groups did not differ in ERNs to errors that were not attributable to race-bias (Black-gun errors).



Good regulators vs. other: $t(43) = .62$, $p = .54$

D) Good and poor regulators exhibited enhanced N2s associated with correct race-bias trials

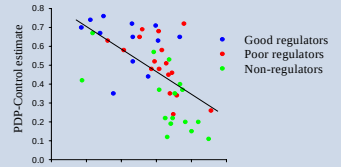


* p < .05

Trial effect: $F(1, 42) = 16.90$, $p < .001$

E) Race-bias ERNs predicted greater control

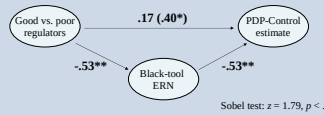
- Larger ERNs on race-bias trials predicted greater PDP-Control
  - Relationship not moderated by regulatory group



$r(43) = -.62$, $p = .001$

F) Regulatory differences mediated by ERN amplitude

- The difference in control between good and poor regulators was mediated by ERN amplitude associated with race-biased responses



Sobel test: $z = 1.79$, $p < .05$

Discussion

- Race-bias conflict-detection system more sensitive for good regulators compared with poor regulators, despite similarly positive attitudes toward African Americans
  - Proneness to respond with race-bias among low-prejudice people was mediated by level of race-bias conflict detection
- Results suggest that, for poor regulators, egalitarian intentions may not be well-internalized
  - Race-bias conflict requires the activation of egalitarian response tendencies to counter automatic race-biased tendencies
  - Suggests that prejudice reduction efforts should be directed toward automatizing nonprejudiced responses in race-related situations