Understanding Racial Bias in the Weapons Identification Task in Terms of Implicit Contrast Effects

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Abstract

Measures of implicit bias have become an important and popular tool in the research of prejudice and stereotyping. However, previous research indicates that implicit contrast processes may cause the association between one prime and one target (e.g. Black faces and guns) to create an apparent response facilitation between the other prime and other target (e.g. White faces and tools). Two experiments demonstrate that the apparent associations between a prime and target are contextually dependent in a way that can be parsimoniously explained by response mapping contrast models. Application of Process Dissociation Procedure further demonstrated that contextual shifts in response biases were unlikely to be caused by changes in controlled responses. Results support the generality of response mapping contrast effects in semantic, not just evaluative, priming tasks, and indicate that caution is necessary when designing and interpreting measures of implicit bias.

Intergroup prejudices, such as racial bias, continue to pose a serious societal problem and an interesting phenomenon for psychological study. For the effective study of this problem, accurate and valid laboratory measures of bias and prejudice are necessary. Researchers have long been concerned about the potential for demand characteristics and self-presentational concerns to obscure bias assessment in self-report measures. Implicit measures offer the promise of circumventing these problems by measuring racial bias in ways that reduce the capacity for controlled responding, thereby ostensibly providing a way to detect respondents’ ‘true’ attitudes and behavioral tendencies (De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009; Fazio, Jackson, Dunton, & Williams, 1995; Greenwald, McGhee, & Schwartz, 1998; Payne, 2001).

Implicit measures are not without their shortcomings, however. Recent research has demonstrated that, despite some earlier claims to the contrary, implicit measures such as the Implicit Association Test (IAT; Greenwald et al., 1998) and Weapons Identification Task (WIT; Payne, 2001) do not provide a measurement of bias completely free from the influence of controlled, deliberate responding (e.g., Hilgard, Bartholow, Dickter, & Blanton, in press; Ito et al., 2014; Klauer, Schmitz, Teige-Mocigemba, & Voss, 2010; McFarland & Crouch, 2002;; Payne, 2005; Conrey et al., 2005). However, implicit bias measures also are sensitive to the particular task contexts in which pertinent stimuli are presented, such as those provided by the instructions of the task, thoughts and behaviors performed immediately before the task, or the choice of ostensibly irrelevant control stimuli used in the task. This source of variance can modulate or even reverse the apparent bias inferred from the response facilitation between a prime and a target. For example, Scherer & Lambert (2009) found that a single group of primes could elicit either a “pleasant” or an “unpleasant” response bias, depending on the nature of the other prime stimuli that appeared in the task. If similar context-specific effects are present in measures of implicit bias, then the observed association between a prime and a target may not capture participants’ latent, implicit bias as is often assumed. Rather, the measure of implicit bias could be contaminated to some degree by the influence of context. The purpose of the current research was to test this possibility within the WIT, often used to assess an implicit association between young Black men and danger (see Payne, 2001, 2005).

**Response Selection and Interference**

Measures of implicit bias are understood to model bias as the pattern of response facilitation and/or conflict between a prime and a target. For example, in the WIT, participants must classify targets as either guns or tools (via button press) after being primed with a White or Black face. Following a Black face (as compared to a White face) prime, participants are more likely to misidentify a tool as a gun (e.g., see Amodio et al., 2004; Payne, 2001, 2005), suggesting the presence of an implicit racial bias that associates Blacks with armed violence.

There are at least two differing accounts of the mechanism through which primes influence behavior. One of the original interpretations of these kinds of priming effects is that they are caused by automatically spreading activation along associations between primes and relevant attributes (e.g., Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Fazio et al., 1995). However, considerable research has lent support to an alternative perspective, which holds that priming effects occur to the extent that the response category activated by the prime stimulus interferes with or facilitates the response category required by the target (Bartholow, Riordan, Saults, & Lust, 2009; De Houwer, Hermans, Rothermund, & Wentura, 2002; Gawronski, Deutsch, & Seidel, 2005; Klauer & Tiege-Mocigemba, 2007; Klinger, Burton, & Pitts, 2000;). This “response interference” perspective assumes that the observed effects stem from the categorization goal that is required by the task.

**Response mapping and implicit contrast effects.** One important implication of response interference models is that the primes cause preparation of a response, which causes prime-target response facilitation or interference. These assumptions provided the basis for the Response Mapping (RM) model of priming (see Scherer & Lambert, 2009; Scherer & Lambert, 2012; Scherer & Schott, 2012). According to the RM model, even though the goal of the priming task is to classify only the target stimuli, participants also use the response options to categorize the primes that are supposed to be ignored. Consider a task in which participants see negative and neutral picture primes followed by negative and positive word targets. Negative primes are yoked to the negative response, and will facilitate responses to negative word targets. This is unremarkable. However, because the negative response category is occupied, the neutral primes will be categorized as best they can with the remaining response option. Thus, the neutral primes are *contrasted away* from the negative response and are categorized with the positive response. The presentation of neutral primes then facilitates positive-word responses, even though the neutral primes lack positive affective content. We will refer to this phenomenon as *response-mapping contrasts* (RM contrast), as an association between one set of primes and one response causes the other set of primes to be contrasted away to the other response.

To date, RM contrasts have been demonstrated primarily in evaluative priming tasks such as the Affect Misattribution Procedure (as developed by Payne, Lambert, & Jacoby, 2005) and evaluative sequential-priming tasks (Scherer & Lambert, 2009), showing that stimuli with no preexisting evaluative associations can nonetheless facilitate positive or negative responses in a priming task—resulting in the appearance of automatic positivity or negativity—depending on the valence of the other primes used in the task. The present research sought to better understand the generality of the RM contrast effect by studying it in a measure of implicit racial bias (the WIT), specifically by manipulating the category of primes that accompany Black faces (or White faces) in the task. Importantly, no research to date has demonstrated RM contrast effects in priming tasks that involve stereotypic associations. The phenomenon would be expected to generalize to this context, given that nothing in the Response Mapping Model requires a specific kind of categorization for the phenomenon to emerge.

**Other Contextual Changes in Implicit Bias**

The RM contrast model is relatively new, and, in some ways, is not the typical explanation of contextual changes in apparent bias. A more traditional account of context-specific effects of primes holds that the activated association itself changes depending on the context. We refer to this as the “shifting-associative-content model,” as it proposes that the associative content activated by presentation of the prime has changed as a function of the context. This is in opposition to the RM contrast account, which argues that the activated associative content remains the same and that only the process of response selection has been changed by context.

Some previous experimental manipulations have changed the apparent bias observed in stereotype priming tasks through changing the thoughts presumably activated by the prime. For example, imagining or being exposed to counter-stereotypical category members can attenuate the expression of implicit bias (Blair, Ma & Lenton, 2001; Dasgupta & Greenwald, 2001; Dasgupta & Asgari, 2004; Lai et al., 2014). Implementation intentions (e.g., thinking “safe” upon seeing a Black face) also reduce the expression of bias (Kawakami, Dovidio, Moll, Hermsen, & Russin, 2000; Mendoza, Gollwitzer, & Amodio, 2010; Stewart & Payne, 2008), as can contextual cues that prime different social roles (e.g. Black prisoner vs. Black lawyer; Barden, Maddux, Petty, & Brewer, 2004). These examples represent situations in which the experimental conditions likely create new associations with the prime stimuli, or alter the preexisting associations that come to mind when perceiving the prime stimulus. That is, the associative content activated by presentation of the prime has been shifted, whether by making salient particular social subcategories that could be activated by the prime (e.g., lawyer vs. prisoner) or by replacing the contents of the association (e.g., thinking “safe” opposes the automatic association of Blacks with danger).

When extending the WIT to include racial categories other than Blacks and Whites, it is possible that specific group comparisons may influence apparent associations (i.e., between racial categories and semantic categories) in the task. For example, Latinos may seem relatively threatening when compared to Whites, but less so when compared to Blacks. This process, then, could cause contextual shifts in the implicit bias measured by the WIT by changing the semantic content activated by the prime. However, the RM contrast model predicts that task behavior also could be altered as a function of response categorization, rather than changes in activated semantic content. This phenomenon would not require the activation of an underlying association, and so potentially could explain diverse and unusual phenomena observed in priming tasks.

One unusual phenomenon observed in priming tasks is that observed response biases do not always seem to represent a pre-existing implicit association. For example, a common observation in the WIT is that White primes facilitate “tool” responses; following a White face prime, respondents generally are more accurate in responding to tool targets compared to gun targets (Amodio et al., 2004, 2008; Payne, 2001; Payne et al., 2002; Stewart & Payne, 2008). Whereas an association between Blacks and guns is expected on the basis of prevailing racial stereotypes, it is less clear what causes the White-tool association. To the extent that responses in the WIT (and similar tasks) reveal biased implicit associations, the White-tool association requires an explanation in terms of some prevailing stereotype linking Whites with tool use or manual labor, or at least a stereotype that inhibits the association of Whites with guns. Although this is possible, no such stereotypic association has ever been reported in the research literature.

An especially perplexing and implausible pair of associations was found by Judd, Blair, and Chapleau (2003), who used modified forms of the WIT in an attempt to determine whether response bias in the WIT was the result of stereotypic associations (i.e., between Blacks and gun violence) or a more general negative evaluative association. In these modified tasks, the gun and tool targets were replaced, in one block, by guns and insects, and, in the other block, by fruits and sports objects. Black primes significantly facilitated responses to guns over insects and sports objects over fruits, indicating that the priming effects were stereotypical and semantic, rather than evaluative, in nature. Bafflingly, White primes facilitated responses to insects relative to guns, and fruits relative to sports objects. As in the above apparent White-tool association, it seems implausible that participants have latent stereotypic associations linking Whites with insects and fruits.

A more likely explanation for these patterns seems to be the presence of a RM contrast effect. The RM contrast model would predict that, in each task, Black primes would be classified to the stereotypical response, i.e., guns and sports objects. This would leave the White primes to be mapped onto the remaining response, causing the presentation of a White face to facilitate responses to insects and fruit. The RM contrast phenomenon could thereby cause the illusion of an implicit association between a given prime and response.

**RM contrast in implicit bias tasks.** Although these studies suggest that RM contrast effects might play a role in stereotype priming tasks such as the WIT, this notion has never been directly tested. The presence of RM contrast effects in the WIT would have important implications above and beyond explaining the apparent White-tool. Implicit categorization and contrasts could influence how easily the WIT and tasks like it could be generalized to other groups. Whether participants are observed to associate Latinos with guns, for example, could depend on whether Latinos are compared with Blacks or with Whites, with the RM model prediction being that Latinos will facilitate gun responses when compared to Whites but not Blacks. This prediction is generated by considering that Blacks are strongly stereotypically associated with guns, Latinos perhaps less so, and Whites likely the least of all. Thus, in a WIT task that presents Black and Latino faces, the Black primes will occupy the “gun” response and contrast the Latino primes towards the “tool” response, whereas when compared to Whites, the Latino primes will occupy the “gun” response.

**Process dissociation procedure.** In addition to determining whether contrast effects can emerge for stereotypic associations in the WIT, the current research aims to address whether such effects are the result of shifts in automatic bias or shifts in the degree to which participants control their responses. It is now widely recognized that responses in any given “implicit” task can be the result of both automatic bias and variability in control over responses (Ito et al., 2014; Payne, 2005; Payne, Jacoby, & Lambert, 2005). Previous reports have portrayed implicit contrasts as the result of an automatic process (Scherer & Lambert, 2009), but it is possible that implicit contrast effects occur because different combinations of primes elicit varying degrees of motivation control one’s responses, or that certain combinations of primes are more or less challenging to handle via controlled processing. To address this issue, we used the Process Dissociation Procedure (PDP; Jacoby, 1991) to create estimates of the extent to which participants’ responses were determined by controlled versus automatic processes (see Payne, 2001). Note, however, that PDP cannot distinguish between sources or types of automatic processes, and so cannot be used to compare a shifting-associative-content model against an RM contrast model of the results. Nevertheless, it can help to rule out changes in controlled processing as a cause of shifts in apparent bias.

**Summary**

The present study had the following main goals. First, we sought to establish whether implicit contrast effects previously studied in the context of evaluative priming paradigms (e.g., Scherer & Lambert, 2009) also emerge in a semantic priming paradigm, namely, the WIT. Doing so could not only provide a plausible explanation for the often-observed association between White faces and tools in the WIT (see Amodio et al., 2004, 2008; Payne et al., 2002), but more generally would suggest caution and consideration in the interpretation of bias observed in this and other stereotype-priming paradigms. Second, we hoped to compare whether changes in observed response priming are more likely to be due to response contrast effects or to changes in the actual activated semantic content of a prime. Finally, we wished to study the *magnitude* of response contrast effects in the WIT, as statistically significant yet tiny effects potentially could be considered irrelevant.

Two experiments were conducted using modified forms of the WIT. In Experiment 1, participants performed a standard Black/White WIT or a version that replaced one category of primes (either Black or White faces) with neutral objects (e.g., a hair dryer). To extend and clarify the results of Experiment 1, a second experiment investigated the influence of Hispanic primes when compared to Black, White, or neutral primes. In both studies, PDP analyses assessed whether the observed effects were the result of changes in the influence of automatic or controlled processes.

Considering previous evidence of spontaneous contrast in priming studies, we developed the following hypotheses for Experiment 1: Spontaneous contrast effects will occur in the WIT, such that a single stimulus could be capable of priming either “gun” or “tool” responses depending on the other primes in the task. Black primes will remain strongly associated with guns regardless of task context, causing neutral objects and White primes to facilitate tool responses (cf. Scherer & Lambert, 2012). However, if White primes are actually associated with tools, the neutral objects should reverse their association when they appear in a task along with White faces, instead facilitating gun responses. Otherwise, if White primes and neutral objects are associated with neither guns nor tools, neither should prime either response in the absence of Black primes.

**Experiment 1**

**Method**

We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study. Data and analytic code are publicly hosted at https://osf.io/XXXXXX.

**Participants and design.** Participants were 130 university undergraduates who participated in exchange for partial course credit. Sample size was set so that the size of each experimental group roughly approximated those of previous studies of the RM contrast effect (e.g. Scherer & Lambert, 2009). The study was a 3 (Condition: Black/White, Black/Neutral, White/Neutral) x 2 (Prime category) x 2 (Target: Gun or Tool) mixed model design, with Condition varying between subjects and Prime and Target varying within subjects. Prime content was determined by condition: In the Black/White condition, trials were evenly divided between Black and White faces that appeared as primes, as is typical of the WIT; in the Neutral/Black condition, primes included Black faces and neutral objects; in the Neutral/White condition, primes included White faces and neutral objects.

**Materials.** Materials included four images of each prime and target category: Black faces, White faces, neutral object primes, and guns and tool targets. Black and White primes and gun and tool targets were taken from the original WIT (Payne, 2001; available from <http://www.unc.edu/~bkpayne/materials.html>). Neutral household objects (e.g., hair dryer) were chosen from the International Affective Picture System (IAPS[[1]](#footnote-1); Lang, Bradley, & Cuthbert, 2008) and had a mean valence of 4.83 (*SD* = 0.14) and mean arousal of 2.86 (*SD* = 0.89), both assessed using scales ranging from 1 (*very negative* and *very calm*, respectively) to 9 (*very positive* and *very aroused*, respectively). These stimuli were converted to grayscale so as to match the other stimuli in the study. The stimuli used in both experiments are presented in Figure 1.

**Procedure.** Participants were randomly assigned to perform one of three versions of the WIT. All versions used the tool and gun targets that were used in the traditional WIT, but primes varied by condition. As is typical of the WIT, each trial started with a pre-stimulus pattern mask presented for 1000ms, followed by presentation of the prime for 200ms, followed immediately by a target presented for 200ms, followed by a pattern mask for 300ms. Participants were instructed to respond within 500ms of target onset. If participants failed to respond within this deadline, the post-target mask turned red to indicate a too-slow response. The post-target mask remained on screen for an additional 500ms if the response was within the deadline or an additional 1000ms if the response was too slow. Participants first performed a practice block of 24 trials of their version of the WIT. Participants responding outside the 500ms deadline on more than 10 trials were made to repeat the practice block. After that, each possible Prime x Target trial type was presented 64 times for a total of 256 trials. Participants were allowed a short break after every 32 trials.

**Results**

Data were preprocessed with R (R core team, 2013), then analyzed with SAS and an online Bayes factor calculator (Rouder, Speckman, Sun, Morey, & Iverson, 2009).

Participants whose overall accuracy was not significantly greater than chance (accuracy < 57%, α = 0.01) were excluded (*n* = 16). As is typical in research investigating implicit racial bias, nonwhite participants (*n* = 33) were excluded from analysis[[2]](#footnote-2). Thus, the final sample size for Experiment 1 was *n* = 81 (26 Black/White, 28 Black/Neutral, 27 White/Neutral).

**Accuracy.** First, to characterize patterns of measured implicit bias, trial accuracies for each condition (Black/White, Black/Neutral, White/Neutral) were submitted to a 2 (Prime: White, Black, or Neutral, depending on condition) x 2 (Target: Tool, Gun) analysis of variance (ANOVA). (Because primes were nested within conditions, it was not possible to run the fully-crossed 3 Condition x 3 Prime x 2 Target ANOVA.) Significant Prime x Target interactions would indicate that the primes elicited differential response facilitation (i.e., what is typically interpreted as an implicit bias). Mean accuracy rates for each cell are presented in Table 1.[[3]](#footnote-3)

Replicating past research, in the Black/White Condition there was a significant Prime x Target interaction, *F*(1, 75) = 22.33, *p* < .001, ωp2 = .17, 90% CI [.08, .29]. Following a Black prime, accuracy was significantly greater for gun targets than for tool targets, *t*(103) = 4.59, *p* < .001, *dz* = 0.90. Following a White prime, accuracy was significantly greater for tool targets than for gun targets, *t*(103) = 2.10, *p = .*039, *dz* = 0.41.

In the Black/Neutral condition, there were significant effects of Prime (*F*(1, 111) = 14.19, *p* < .001, ωp2 = .11, 90% CI [.04, .21]), Target (*F*(1, 111) = 16.22, *p* < *.*001, ωp2 = .12, 90% CI [.04, .23]), and a Prime x Target interaction (*F*(1, 111) = 126.00, *p* < .001, ωp2 = .53, 90% CI [.42, .62]). Following a Black prime, accuracy was significantly better for gun targets than for tool targets, *t*(111) = 5.09, *p* < .001, *dz* = 0.96. Following a neutral object prime, accuracy was significantly better for tool targets than for gun targets, *t*(111) = 5.27, *p* < .001, *dz* = 1.00.

Finally, in the White/Neutral condition, there was a significant effect of Prime (*F*(1, 107) = 8.02, *p* = .006, ωp2 = .06, 90% CI [.01, .16]), and a Prime x Target interaction (*F*(1, 107) = 38.21, *p* < .001, ωp2 = .26, 90% CI [.15, .37]). In contrast to the effects observed for White primes in the Black/White condition (i.e., the typical WIT), White primes increased accuracy for gun targets relative to tool targets, *t*(107) = 4.36, *p* < .001, *dz* = 0.84. In contrast, neutral object primes significantly increased accuracy for tool targets relative to gun targets, *t*(107) = 4.38, *p* < .001, *dz* = 0.84.

Next, we sought to determine whether the effects of primes significantly differed across conditions by testing separate 2 (Condition) x 2 (Target) interactions for each prime type. If accuracy rates for a particular prime were changed by the interaction of condition and target, this would indicate that task context altered the observed association between a prime and a target (e.g., through contrast effects). The effect of Black primes did not change between the Black/White and Black/Neutral conditions, *F*(1, 52) = 0.00, *p* = .993, ωp2 = .00, 90% CI [.00, .00], JZS Bayes 4.91 : 1 in favor of null. However, the effect of White primes differed significantly across conditions, demonstrating a significant White-Tool bias in the Black/White condition but a significant White-Gun bias in the Neutral/White condition, *F*(1, 53) = 17.78, *p* < .001, ωp2 = .14, 90% CI [.05, .25]. A significant interaction also was observed for neutral primes, *F*(1, 53) = 9.15, *p = .*004, ωp2 = .07, 90% CI [.02, .17], indicating a Neutral-Tool response facilitation that was significantly larger in the Neutral/Black condition than in the Neutral/White condition.

***PDP analysis.*** Next we examined whether the aforementioned effects could be explained by changes in automatic or controlled processes across the task conditions. PDP (Jacoby, 1991) transforms accuracy rates to generate two parameters:

*C* = P(correct | congruent) – P(incorrect | incongruent)

*A* = P(correct | congruent) / (1 –C).

*C* represents the strength of a control process that selectively chooses a correct response regardless of prime-response congruency. *A* represents the strength of an automatic choice of response that can be observed in the case that *C* fails to choose a correct response.

Here, parameters *A* and *C* were generated for each category of primes such that a “gun” response was considered the congruent response. Thus, for each prime, *C* = (gun trial accuracy) – (tool trial errors) and *A* = (tool trial errors) / (1 – *C*). The *A* parameter for each prime thereby ranged from 0 (perfect “tool” response tendency) to 1 (perfect “gun” response tendency). The *C* parameter ranges from 0 (purely automatic) to 1 (purely controlled). PDP estimates for each prime type as a function of condition are given in Table 2.

A series of one-way ANOVAs was conducted to determine whether task condition (Black/White, Neutral/Black, Neutral/White) affected the PDP components associated with each set of primes. Parameter *A* for White primes was significantly affected by task condition*, F*(1, 51) = 21.66, *p* < .001, ω2 = 0.30, 90% CI [.13, .44]. White primes exhibited a stronger automatic response tendency towards guns in the Neutral/White condition (*A* = 0.62) than in the Black/White condition (*A* = 0.42). Parameter *A* for neutral primes was also significantly affected by task condition, *F*(1, 53) = 10.11, *p* = .003, ω2 = 0.14, 90% CI [.04, .30]. Neutral primes demonstrated stronger “gun” response tendency in the Neutral/White condition (*A* = 0.40) than in the Neutral/Black condition (*A* = 0.28). Parameter *A* for Black primes did not vary as a function of condition, *F*(1, 52) = .05, *p = .*82, ω2 = .00, 90% CI [.00, .05], JZS Bayes 4.80 : 1 in favor of null. Parameter *C* did not vary as a function of condition for any of the primes (For Black primes, *F*(1, 52) = .33, *p* = .57, ω2 = .00 [.00, .08], JZS Bayes 7.90 : 1 in favor of null; for Neutral primes, *F*(1, 53) = 1.01, *p = .*32, ω2 = .00 [.00, .11], JZS Bayes 5.73 : 1 in favor of null; for White primes, *F*(1, 51) = 0.34, *p = .*56, ω2 = .00, [.00, .08], JZS Bayes 7.79 : 1 in favor of null). In summary, context changed the automatic tendency to respond “gun” following White and neutral primes, but not Black primes. Context did not change participants’ tendency to make controlled responses.

**Discussion**

In Experiment 1, Black primes consistently facilitated responses to guns and were not affected by the task content, in line with prior research using an evaluative priming paradigm (Scherer & Lambert, 2012). This is the first research, to our knowledge, that has demonstrated the stability of the Black-gun bias across more than one group comparison. The stability of this association across contexts suggests a strong implicit bias (Krosnick, 1988; Scherer & Lambert, 2012). Although other recent research (Sadler, Correll, Park, & Judd, 2012) has shown similar Black-gun biases when comparing the ability to discriminate guns from harmless objects held by members of multiple racial groups (Black, White, Latino, and Asian men), the current study is the first to simultaneously demonstrate both the stability of the Black-gun bias and the malleability of gun associations (and associations with other objects) with nonBlacks (Whites, in this case) differing as a function of the context provided by the presence of other primes.

Specifically, in contrast to the invariant Black-gun bias, the effects of both White primes and neutral object primes differed dramatically depending on the context provided by the other primes in the task. Neutral primes consistently facilitated tool responses, but this effect became stronger when the contrasting prime was strongly associated with guns (i.e., when the other primes were Black faces). White primes showed the most variability in response activation, dramatically shifting from tool bias (when contrasted against Black primes) to gun bias (when contrasted against neutral object primes). Furthermore, PDP analysis indicated that the observed effects were due to changes in the strength with which a prime automatically facilitated gun responses, not due to changes in the ability to make controlled, accurate responses. While PDP cannot distinguish between the shifting-associative-content and RM contrast models, it is nonetheless useful in ruling out the possibility of changes in controlled processing.

One might argue that these effects occurred not because of RM contrasts, but rather because the different prime comparisons activated different preexisting associations as a function of context. For example, in the context of Black faces, White faces might activate thoughts of tools, but in the context of neutral objects, White faces instead might remind participants of guns. In order for this kind of shifting-association model to adequately explain the present data, it would need multiple levels of preexisting associations that are highly context-sensitive, only being activated when a given prime is presented alongside other specific types of primes. For example, it might be argued that, when presented outside of a specific social comparison, Whites are stereotypically associated with law enforcement or 2nd amendment activism, and so activate thoughts related to guns. The shifting association model might further argue that when presented alongside Black faces, the White faces instead prime thoughts of handymen and tool use. This explanation is complicated in that it assumes many different pre-existing associations, and furthermore, that the activation of these associations is highly context-specific, yet still generalizable across many people. Thus, to explain the results of Experiment 1 with a pure shifting association model, one would have to assume that 1) Blacks are associated with guns, 2) Whites are also associated with guns, 3) neutral objects are associated with tools, 4) Whites are instead associated with tools when Blacks are present, and 5) the association between neutral objects and tools is somehow stronger when Blacks are present.

By contrast, an RM contrasts perspective can deal with the present effects relatively parsimoniously. Instead of requiring delicate, contextually-sensitive associations, RM contrast instead assumes that the pre-existing associations activated by these primes are stable, but that participants map the primes onto the task responses in the way that makes the most sense, given the array of stimuli and response options that are presented. To explain the results of Experiment 1 using a response mapping framework, then, requires only two assumptions: 1) that Blacks are associated with guns, and either 2a) that neutral objects are associated with tools (causing White faces to facilitate gun responses) or 2b) that Whites are associated with guns (causing objects to facilitate tool responses), but are less associated with guns than Blacks. The RM contrast perspective can thereby explain the observed data through the inference of fewer preexisting associations and, more importantly, fewer idiosyncratic and unlikely interactions between primes.

In sum, the present study demonstrated that a single set of unchanging stimuli can elicit different patterns of response priming as a function of the other primes with which they were paired in the task. Identical stimuli facilitated different responses as a function of the experimental context provided by other stimuli, and the pattern of these effects could not be easily explained by purely association-based models. Still, the current results are ambiguous with respect to which prime holds a given preexisting association and which prime is affected by contrast processes. Thus, it cannot be determined whether the present results were caused by a moderate White-gun association or by a neutral object-tool association. The second experiment was designed to address these ambiguities.

**Experiment 2**

A second experiment sought to examine how patterns of observed bias could vary for a single prime category across several contexts. To reduce the ambiguity as to which prime has a preexisting association and which prime is contrasted away, we use triangulation, comparing a single category of prime stimuli against several other categories. This way, changes in the apparent association of the single category are caused by contrast effects in general, rather than the particular associative content of a single category of contextual primes. This experiment also sought to characterize how implicit contrast effects could complicate the extension of implicit bias tasks such as the WIT to novel contexts and racial groups.

In Experiment 2, Hispanic face primes were chosen as the ambiguous category based on the rationale that they represent a minority group that features some stereotypical association with armed violence (e.g., Latino gangs), but perhaps not so strong a stereotype as that linking Blacks with guns and violence. In the first experiment, the neutral household object primes facilitated tool responses. We had hoped that the neutral primes would lack any preexisting association, but it seemed possible that they were associated with the tool targets, as the neutral primes and tool targets shared several perceptual and semantic attributes. To avoid the influence of this possible preexisting association, in the second experiment neutral abstract art primes were used instead of neutral household object primes given that they seemed less likely to have an association with either tools or guns. Hence, the categories of primes in this study included Hispanic faces that were presented along with either Black faces, White faces, or neutral abstract art (see Figure 1). It was predicted that associations with guns would be strongest for Black primes, reduced somewhat for White primes (because Experiment 1 demonstrated that White primes may possess a moderate association with guns), and absent for neutral abstract art primes. Thus, the magnitude of Hispanic-gun bias was expected to be greatest in the Neutral/Hispanic condition, reduced somewhat in the White/Hispanic condition, and most significantly reduced in the Black/Hispanic condition.

**Method**

**Participants and design.** One hundred undergraduate students completed the study for partial course credit. Sample size was again based roughly on previous sample sizes in contrast effect research. The study design was a 3 (Condition: Black/Hispanic, White/Hispanic, or Neutral/Hispanic) x 2 (Prime: Hispanic or Other) x 2 (Target: Gun or Tool) mixed model, with Condition varying between subjects and Prime and Target varying within subjects. The “Other” category of primes was determined by the level of Condition, as described below.

**Materials.** As in Experiment 1, Black and White face primes and gun and tool images were the same as in the typical WIT (Payne, 2001). A number of Hispanic faces were pilot tested by a separate sample (*n* = 21), none of whom participated in the main experiment, for whether observers could determine their ethnicity. Four Hispanic faces were chosen by the combined criteria of being the most likely to be identified as Hispanic and the least likely to be identified as Black or White.[[4]](#footnote-4) Neutrally-valenced abstract art stimuli were selected from the IAPS set[[5]](#footnote-5) (Lang et al., 2008; mean valence = 4.88 (SD = 0.19), mean arousal = 3.05 (SD = 0.68)).

**Procedure.** Participants were randomly assigned to one of three conditions defined by the prime categories they included: Black/Hispanic, White/Hispanic, or Neutral/Hispanic. In each condition, participants performed a WIT, identifying targets as either guns or tools via button press. In the Black/Hispanic condition, primes were Black Faces and Hispanic faces. In the White/Hispanic condition, primes were White faces and Hispanic faces. In the Neutral/Hispanic condition, primes were neutrally-valenced abstract art stimuli and Hispanic faces. Presentation durations and the response deadline were the same as in Experiment 1. Participants first performed a practice block of 24 trials of a WIT in which every trial was primed by a neutral object. Participants responding outside the 500ms deadline on more than 10 trials were made to repeat the practice block. After that, participants performed 24 trials of each prime-target pairing, for a total of 96 trials. Participants were given a brief break after the 32nd and 64th trials.

The primary hypothesis was that a significant Condition x Target interaction would emerge for Hispanic-prime trials, indicating that the effect of the Hispanic primes varied as a function of the other primes in the experiment.

**Results**

Nonwhite participants (*n* = 18) were excluded from analysis[[6]](#footnote-6), as were participants who did not have an overall accuracy significantly greater than chance (*n* = 15). Thus, the final sample included 67 individuals (By condition: Black/Hispanic, *n* = 18; White/Hispanic, *n* = 25; Neutral/Hispanic, *n* = 24.)

**Accuracy.** Again, to characterize the patterns of accuracy in each context, separate 2 (Prime: Hispanic, Other) x 2 (Target: Gun, Tool) ANOVAs were conducted within each task condition. As in Experiment 1, significant Prime x Target interactions would indicate response facilitation caused by the primes. Mean accuracy rates for each cell are presented in Table 3.[[7]](#footnote-7)

In the Black/Hispanic condition, a main effect of Target was significant (*F*(1, 51) = 8.90, *p* = .004, ωp2 = .10, 90% CI [.02, .23]) as well as a Prime x Target interaction (*F*(1, 51) = 7.46, *p* = .009, ωp2 = .08, 90% CI [.01, .21]). Following a Black prime, responses to guns were more accurate (*M* = 0.799) than responses to tools (*M* = 0.693), *t*(51) = 4.041, *p* < *.*001, *dz* = 0.95. Following a Hispanic prime, responses to guns (*M* = 0.743) were not significantly different from responses to tools (*M* = 0.738), *t*(51) = 0.178, *p = .*859, *dz* = 0.04, JZS Bayes Factor 9.06 :1 in favor of null.

In the White/Hispanic condition, the main effect of Target was significant, *F*(1, 72) = 15.8, *p* < .001, ωp2 = .13, 90% CI [.05, .24], but the Prime x Target interaction was not significant, *F*(1, 72) = 0.41, *p = .*526, ωp2 = .00, 90% CI [.00, .05]. Participants were more accurate on gun trials than tool trials, regardless of prime. Specifically, following a White prime, gun trials (*M* = 0.805) were more accurate than tool trials (*M* = 0.756), *t*(72) = 2.36, *p = .*021, *dz* = 0.47; following a Hispanic prime, gun trials (*M* = 0.816) were more accurate than tool trials (*M* = 0.749), *t*(72) = 3.26, *p = .*002, *dz* = 0.65.

Finally, in the Neutral/Hispanic condition, the Prime x Target interaction was significant, *F*(1, 69) = 47.83, *p* < .001, ωp2 = 0.33, 90% CI [.21, .45]. Following a neutral abstract prime, responses to tools were more accurate (*M* = 0.782) than responses to guns (*M* = 0.680), *t*(69) = 4.58, *p* < .001, *dz* = 0.94, but following a Hispanic prime, responses to guns were more accurate (*M* = 0.814) than responses to tools (*M* = 0.698), *t*(69) = 5.198, *p* < .001, *dz* = 1.06.

Next we conducted a 3 Condition x 2 Target ANOVA on the Hispanic-prime trials only. A significant interaction would support the hypothesis, indicating that the contextual stimuli altered the degree to which Hispanic primes facilitated responses to tools and guns. As predicted, the Condition x Target interaction was significant, *F*(2, 64) = 3.93, *p = .*025, ωp2 = .04, 90% CI [.00, .12], suggesting that the magnitude of Hispanic-gun response facilitation varied across conditions. Contrast weights were assigned to test this possibility (e.g. [(Neutral/Hispanic Gun – Neutral/Hispanic Tool) - (Black/Hispanic Gun – Black/Hispanic Tool)]). Hispanic-gun response bias in the Neutral/Hispanic condition was significantly greater than Hispanic-gun response bias in the Black/Hispanic condition (*t*(192) = 3.32, *p = .*001, *dz* = 0.41), but not greater than Hispanic-gun response bias in the White/Hispanic condition (*t*(192) = 1.58, *p = .*116, *dz* = 0.19). Hispanic-gun response bias in the White/Hispanic condition was slightly but not significantly greater than Hispanic-Gun response bias in the Black/Hispanic condition, (*t*(192) = 1.88, *p = .*061, *dz* = 0.23).

***PDP Analysis.*** Parameters *A* and *C* were again estimated through PDP for Hispanic primes. As before, estimates were calculated so that an *A* parameter of 1 would indicate a perfect automatic tendency to respond “gun,” while an *A* parameter of 0 would indicate a perfect automatic tendency to respond “tool.” A one-way ANOVA was conducted to determine whether task condition affected these parameters for Hispanic primes. PDP parameter estimates are provided in Table 2.

Parameter *A* was significantly affected by task condition, *F*(2, 64) = 6.31, *p* = .003, ωp2 = .14, 90% CI [.03, .28]. The automatic “gun” response tendency for Hispanic primes was weakest in the Black/Hispanic block (*A* = .48), stronger in the White/Hispanic block (*A* = .57), and strongest in the Neutral/Hispanic block (*A* = .63). The strength of parameter *C* was not affected by task condition, *F*(2, 64) = 0.96, *p = .*39, ωp2 = .00, 90% CI [.00, .10], JZS Bayes Factor 27.4 : 1 in favor of null (*C* = .48, .57, .51 for Black/Hispanic, White/Hispanic, and Neutral/Hispanic conditions, respectively).

**Discussion**

In this study, the significant Condition x Target interaction in Hispanic-primed trials demonstrates that task context can change the effect of a prime on task behavior. PDP analysis supports this claim by indicating that the different contexts changed the tendency of Hispanic primes to automatically facilitate “gun” responses, but not participants’ abilities to make controlled, accurate responses. Here, Black faces increased gun-trial accuracy, White faces increased gun-trial accuracy (but not more than did Hispanic faces), and neutrally-valenced abstract stimuli increased tool-trial accuracy. More importantly, and consistent with our predictions, the response facilitation of Hispanic primes on gun targets differed by condition. In the Neutral/Hispanic condition, Hispanic primes significantly increased gun-trial accuracy. What’s more, this latent bias seemed to have exerted contrast effects on the neutral primes, causing them to significantly facilitate tool responses despite there being nothing “tool-like” about the neutral abstract art primes. In the White/Hispanic condition, the Hispanic-Gun response facilitation was reduced somewhat, and in the Black/Hispanic condition, the Hispanic-Gun response facilitation was completely absent.

While these results likely indicate a mild Hispanic-gun association, an alternate possibility is that, as in Study 1, there was an association between the neutral abstract art primes and the tool targets that caused contrasting response facilitation between Hispanic face primes and gun targets. However, given that a Hispanic-gun stereotype seems more likely than an abstract art-tool semantic association, we favor the previous explanation: a constant mild Hispanic-gun stereotypic association becomes more or less apparent given the presence or absence of contrast effects from more or less strongly-associated primes. Either way, both accounts highlight the presence of context effects in priming, causing the same prime to have different effects in different contexts.

This study presents further evidence that the observed stereotypic association between a racial prime and a particular target is not absolute, but instead is contingent on the nature of the comparison primes used in a particular task. We have argued that these changes are most likely due to RM contrast processes of categorization and response selection, as it seems unlikely that Hispanics “seem” less violent when compared to Whites but more violent as compared to abstract art.

**General Discussion**

The present research highlights the reliability and generality of contrast effects in priming paradigms. Specifically, we observed systematic changes in automatic stereotypic response bias caused by various prime stimuli, and these changes were consistently in the direction that would be predicted by contrast effects. Racial primes with stronger stereotypic associations with guns were found to be less contextually malleable than racial primes with weaker gun associations, and primes with stronger associations tended to have the largest contrastive effect on the other prime categories in the task. This is a novel finding, as automatic contrast effects have most typically been found in evaluative, not semantic, priming tasks. These data lend support to the RM model and have important implications for tasks measuring implicit bias and stereotypes.

In concordance with the idea that weak associations are more contextually sensitive than strong associations (Scherer & Lambert, 2012), the present studies found that Black primes facilitated “gun” responses across conditions, regardless of the comparison primes with which they were paired. Moreover, as predicted, Hispanic and especially White primes did not facilitate “gun” responses when compared to Black primes, but these primes did facilitate “gun” responses when compared to other neutral prime stimuli. This finding suggests that biases measured in these tasks may not be as symmetrical (i.e., simultaneous and complementary biases, as in a White-good bias with a matching Black-bad bias) as is sometimes supposed (see Greenwald et al., 1998). Instead, response contrast effects may cause response patterns to take on the appearance of a symmetrical bias. For example, the present data indicate that patterns of response facilitation and interference in the WIT are chiefly due to a stable stereotypic association between Blacks and guns. However, response contrast effects then cause the White primes to become categorized with the opposite “tool” response. This process causes participants to demonstrate patterns of responses suggesting that they have an implicit stereotype that associates Whites and tools, when it seems unlikely that any such association exists (similar effects have been observed for evaluative bias towards the elderly: Scherer & Lambert, 2009, Experiment 6; Scherer & Schott, 2012, Experiment 3).

Previous research provides further evidence of this phenomenon. Judd et al. (2003) used modified forms of the WIT that replaced gun/tool decisions with gun/insect and sports object/fruit decisions. Participants demonstrated response associations between Black faces and guns and Black faces and sports objects, indicating semantic bias. However, in that study response facilitation also was observed between White faces and insects and White faces and fruit. Because it seems extremely unlikely that there is an implicit semantic association between Whites and insects or Whites and fruit, this previous study provides further evidence for the role of RM Contrast processes in performance of the WIT and similar tasks.

The present research also highlights the complexity involved when generalizing the WIT and similar tasks to stimuli of other races and content. Measurement of preexisting stereotypic associations is complicated by these contrast effects, such that observed patterns of bias are due not only to the construct of interest, implicit associations, but also due to the way in which participants use the response options to categorize the prime stimuli. The influence of task context on a given priming effect ranged from fairly small (ωp2= .04 for changes in Hispanic-gun bias in Experiment 2) to fairly large (ωp2= .14 for changes in White-gun bias in Experiment 1). At their largest, the apparent gun biases for these primes were larger than the standard Black/White WIT effect itself (here observed in Experiment 1 as ωp2= .17, while gun bias in modified WITs were as large as ωp2= .27 in the Neutral/White WIT, Experiment 1, and ωp2= .33 in the Neutral/Hispanic WIT, Experiment 2). Researchers may need to consider and account for these effects in order to most accurately depict implicit bias. In spite of these complexities, it seems likely that within a single version of an implicit bias task, contrast effects may be stable across participants, and thereby variance in observed task performance should still reflect the relative strength of implicit associations between a given group and guns.

Finally, the present results lend support to the response-selection, rather than spreading-activation, account of priming effects. The RM contrast model argues that participants automatically categorize the primes according to the available responses, even when there is no evaluative or semantic association between prime and response. Thus, categorization of primes is likely a vital and inevitable process in priming tasks, and can explain certain phenomena which cannot be explained by spreading semantic activations. While the present report focuses on the influence of categorization processes and response mapping contrasts in measurements of implicit racial bias, it seems likely that these processes are also active in sequential priming tasks in general.

**Limitations and Future Directions**

The current research is limited by some lingering complications of interpretation. Due to the nature of contrast effects and asymmetrical associations between primes and target categories, it is difficult to conclude which priming effects are due to preexisting associations and which are due to contrast effects. For example, in Study 1, White primes activated gun responses when in the context of neutral object primes. It cannot be determined from these data whether this effect is due to a preexisting association between Whites and gunsor due to contrast effects caused by an association between neutral objects and tools. Similarly, it is not clear in Study 2’s Neutral/Hispanic condition whether the association between Hispanics and guns caused the response facilitation between the neutral primes and tools, or if there was instead an association between neutral primes and tools which, through contrast effects, caused response facilitation between Hispanics and guns. Of course, the former seems much more plausible than the latter; either way, the findings still demonstrate the malleability of a prime’s effect as a function of the context in which it is presented.

Finally, although we believe that RM contrast effects provide the most parsimonious explanation for most—if not all—of the presently observed effects, we cannot unambiguously rule out the more conventional explanation for implicit attitude malleability effects; namely, that the task context changes the accessibility of the prime’s associative content. This shifting-associative-content account provides a good explanation for the findings of other studies of context effects (e.g., Barden, et al., 2004; Dasgupta & Greenwald, 2001; Dasgupta & Asgari, 2004; ) but does not explain the present results well. Unlike the RM contrast model, this shifting-associative-content explanation would suggest that participants’ stereotypic associations with the primes are changing based on the context: both White and Hispanic faces automatically activate stereotypes related to guns when compared to neutrally-valenced abstract art, but do not activate those stereotypes when they are compared to Black primes. This possibility seems less likely and less parsimonious than an RM contrast account of the study’s findings.

In summary, we suggest that patterns of responses in implicit bias tasks are influenced by all of following: 1) the semantic association between prime content and target, 2) the influence of controlled processes (Ito et al., 2014; McFarland & Crouch, 2002;Klauer et al., 2010), and 3) the unintentional categorization of primes using the available responses. The RM contrast model provides an easy way to consider these interactions between prime categories, which may contaminate and complicate the measurement of implicit bias. Researchers may wish to explore the possibility of testing a stimulus in a variety of prime contexts and assessing not only the *degree* of apparent bias, but also the *stability*, as primes with stronger associations are expected to be less contextually sensitive, as in this report and elsewhere (Scherer & Lambert, 2012).

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Table 1

*Mean Accuracy Rates in the Weapons Identification Task: Experiment 1*

|  |  |  |  |
| --- | --- | --- | --- |
|  | Target type | |  |
| Context and prime type | Gun | Tool | Difference |
| *Black/White task* |  |  |  |
| Black primes | .83 (.08) | .73 (.12) | .10\*\*\* |
| White primes | .76 (.11) | .80 (.13) | -.04\* |
| Difference | .08\*\* | -.08\*\* |  |
|  |  |  |  |
| *Black/Neutral task* |  |  |  |
| Black primes | .84 (.08) | .74 (.12) | .10\*\*\* |
| Neutral primes | .62 (.10) | .85 (.08) | -.22\*\*\* |
| Difference | .22\*\*\* | -.11\*\*\* |  |
|  |  |  |  |
| *White/Neutral task* |  |  |  |
| Neutral primes | .66 (.11) | .77 (.12) | -.11\*\*\* |
| White primes | .82 (.10) | .71 (.12) | .11\*\*\* |
| Difference | -.16\*\*\* | .06\* |  |

*Note:* values in parentheses are standard deviations. †*p* < .10; \**p* < .05; \*\**p* < .01; \*\*\**p* < .001.

Table 2. PDP estimates in the Weapon Identification Task, Experiments 1 and 2. Values in parentheses are standard errors. Parameter estimates in Experiment 2 are for Hispanic-prime trials.

|  |  |  |  |
| --- | --- | --- | --- |
| Experiment 1 | | | |
|  | Black/White | Neutral/Black | Neutral/White |
| Parameter *A* |  |  |  |
| Black primes | .61 (.03) | .62 (.04) |  |
| White primes | .42 (.03) |  | .62 (.04) |
| Neutral primes |  | .28 (.03) | .40 (.04) |
|  |  |  |  |
| Parameter *C* |  |  |  |
| Black primes | .56 (.03) | .58 (.05) |  |
| White primes | .56 (.04) |  | .53 (.05) |
| Neutral primes |  | .47 (.03) | .43 (.04) |
|  |  |  |  |
| Experiment 2 | | | |
|  | Black/Hispanic | Neutral/Hispanic | White/Hispanic |
| Parameter *A* | .48 (.03) | .63 (.04) | .57 (.04) |
| Parameter *C* | .48 (.05) | .51 (.06) | .57 (.06) |

Table 3. Mean accuracy rates in the Weapons Identification Task, Experiment 2.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Target type | |  |
| Context and prime type | Gun | Tool | Difference |
| *Black/Hispanic task* |  |  |  |
| Hispanic primes | 0.74 | 0.74 | 0.00 |
| Black primes | 0.80 | 0.69 | 0.11\*\*\* |
| Difference | -0.06† | 0.05† |  |
|  |  |  |  |
| *White/Hispanic task* |  |  |  |
| Hispanic primes | 0.82 | 0.75 | 0.07\*\* |
| White primes | 0.81 | 0.76 | 0.05\* |
| Difference | 0.01 | -0.01 |  |
|  |  |  |  |
| *Neutral/Hispanic task* |  |  |  |
| Hispanic primes | 0.81 | 0.70 | 0.11\*\*\* |
| Neutral primes | 0.68 | 0.78 | -0.10\*\*\* |
| Difference | 0.13\*\*\* | -0.08\*\*\* |  |

*Note:* †*p* < .10; \**p* < .05; \*\**p* < .01; \*\*\**p* < .001.

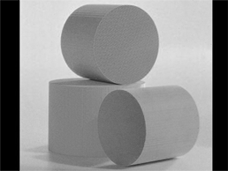
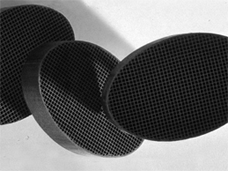
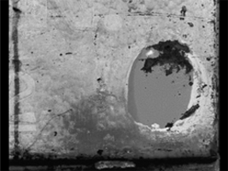
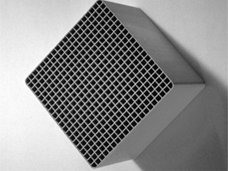
**Figure Captions**

***Figure 1.*** Stimuli used in experiments 1 and 2. Black, White, Tool, and Gun stimuli are as provided by Payne (2001). Hispanic face stimuli were retrieved by Google image search. Neutral object and abstract art stimuli were selected from the IAPS. Experiment 1 used the Black, White, and Neutral Object primes, while Experiment 2 used the Black, White, Neutral Abstract, and Hispanic Primes.

Tool: 

Gun: 

Neutral Object: 

Neutral abstract: 

Black: 

White: 

Hispanic: 

1. Image numbers 6570.2, 7002, 7025, and 7175, as used in Scherer & Lambert (2009). [↑](#footnote-ref-1)
2. This exclusion did not influence the patterns of means or significant effects. Curious readers are welcome to download the data and code. [↑](#footnote-ref-2)
3. Because the current form of the WIT used a response-time deadline, the primary performance metric is accuracy rates, not reaction times (RTs). However, RT data also were. These analyses are reported in the supplemental materials. [↑](#footnote-ref-3)
4. These faces were acquired through Google image search. By accident, one Hispanic face was of George Zimmerman, the defendant in the infamous court case *State of Florida v. George Zimmerman*. Data collection was completed months before the trial: the last subject was collected on May 8, 2013, while the trial ran from June 24th to July 18th, 2013. Neither any participant nor any researcher recognized Zimmerman during the pilot test and experiment. Cropping this face to make it more similar to the usual WIT primes may have made it harder to recognize. Excluding this prime from analysis did not change the pattern of results. Even if this picture were somehow causing the Hispanic faces as a category to be more strongly associated with guns, this would not complicate interpretation of the results, which support the hypotheses through changes in Hispanic-gun association across conditions. [↑](#footnote-ref-4)
5. Images used were IAPS numbers 7184, 7185, 7186, and 7187. [↑](#footnote-ref-5)
6. Again, exclusion of these participants did not change the pattern of means or significance of effects, and readers are welcome to download and re-analyze the data. [↑](#footnote-ref-6)
7. Reaction times were also analyzed for rigor’s sake. These analyses are available in the supplement. [↑](#footnote-ref-7)