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Author
Breines, Juliana

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Adjusting the Thermometer of Race Relations: Physical Warmth Reduces Bias

By

Juliana Genevieve Breines

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Committee in charge:
Professor Serena Chen, Chair
Professor Ozlem Ayduk
Professor Rodolfo Mendoza-Denton
Professor Robb Willer

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Abstract

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Extending recent research suggesting that interpersonal warmth is metaphorically and experientially rooted in physical warmth, I conducted three experiments to examine the hypothesis that physical warmth can temporarily improve implicit attitudes toward negatively stereotyped outgroup members. In Experiment 1, a group of primarily European-American participants were randomly assigned to wear either a warm or cool compress on their forearm (ostensibly part of a product evaluation), then completed an Implicit Association Test (IAT) designed to assess implicit attitudes toward African-Americans relative to European-Americans. Experiment 2 replicated Experiment 1 using an additional neutral temperature control condition as well as two single-target IATs, permitting the assessment of absolute rather than relative implicit attitudes toward African- and European-Americans. In Experiment 3, a punishment decision measure was used to assess attitudes toward African- and European-Americans. The results of Experiment 1 supported the hypothesis that warmth leads to reduced bias, whereas the results of Experiment 2 did not support hypotheses. Experiment 3 yielded mixed results. Theoretical implications and future directions are discussed.

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Introduction

This research will examine how the embodied metaphor of warmth impacts attitudes toward a negatively stereotyped group. In three experiments, I tested the hypothesis that incidental sensations of physical warmth can decrease implicit bias toward African-Americans.

Embodiment

Theories of embodiment and conceptual metaphor (Barsalou, 2008; Lakoff & Johnson, 1980, 1999) challenge existing models of cognition by arguing that much of human thought and emotion is shaped by sensory perception, physical movement, and other concrete interactions with the physical environment. Conceptual metaphors (e.g., "importance is weight") link concrete, embodied experiences (source domains; e.g., weight) with more abstract, cognitive representations (target domains; e.g., importance).

Mappings between source and target domains are established through interaction with the physical and social environment, often during pre-linguistic stages of development, and they are reinforced throughout life by cultural and linguistic practices (Lakoff & Johnson, 1980; Williams, Huang, & Bargh, 2009). For example, physical proximity is a source domain that metaphorically maps onto the target domain of emotional closeness. This mapping presumably forms in early childhood when physical proximity is sought and experienced with attachment figures. The concrete experience of physical proximity provides a scaffold for representations of the abstract concept of emotional closeness. Similarly, moving forward in space is a source domain that maps onto the target domain of reaching for a personal goal. In early childhood, the physical experience of reaching for or moving toward a desired object provides a scaffold for representations of the abstract concept of approaching a desired personal goal, such as seeking a promotion at work.

Proximity does not literally mean emotional attachment and physically moving forward is unlikely to bring one closer to getting a promotion, but theory and research suggest that the connection between a metaphor's source and target domains may in fact operate at a literal level. In other words, activating a source domain, such as the sensation of physical warmth, can activate one or more associated target domains, such as interpersonal trust. Although this relationship is unidirectional in many cases (e.g., priming spatial distances affects perceptions of time, but priming temporal information does not affect spatial perceptions; Matlock Ramscar, & Boroditsky, 2005; see also Lakoff & Johnson, 1980), research suggests that cognitive representations of abstract concepts can also activate embodied perceptions. For example, in one study, priming social acceptance led participants to perceive warmer room temperatures (Zhong & Leonardelli, 2008). This view is consistent with other theories of embodied cognition (Barsalou, 2008; Varela, Thompson & Rosch, 1991).

A recent surge of interest in the topic of embodiment has sparked investigation of the source concepts that activate and are activated by multiple target domains, including mood, divinity, and power (represented by positions in vertical space; Meier, Hauser, et al, 2007; Meier & Robinson, 2006; Moeller, Robinson, & Zabelina, 2008; Schubert, 2005), morality (also represented by positions in vertical space, as well as brightness and cleansing behavior; Meier, Sellbom, & Wygant, 2007; Schnall, Benton, & Harvey, 2008; Sherman & Clore, 2009; Zhong & Lijenquist, 2006), friendliness and trust (represented by physical warmth; Williams & Bargh, 2008a), closeness to others (represented by physical warmth and spatial closeness; IJzerman & Semin, 2009, 2010; Williams & Bargh, 2008b), social acceptance and exclusion (represented by physical warmth and coldness; Zhong & Leonardelli, 2008), authenticity (represented by entity expansion; Landau et al., 2010), time (represented by forward vs. backward motion, spatial

distance, and ego vs. object movement; Boroditsky, 2000; Boroditsky & Ramscar, 2002; Casasanto & Boroditsky, 2008; Miles, Nind, & Macrae, 2010), importance (represented by physical weight and size; Ackerman, Nocera, & Bargh, 2010; Bruner & Goodman, 1947; Jostmann, Lakens & Schubert, 2009), nations (represented by bodies subject to disease; Landau, Sullivan, & Greenberg, 2009), and personal improvement (spatial distance; Ross & Wilson, 2001; Wilson & Ross, 2002). For an exhaustive review, see Landau, Keefer, & Meier (2010).

One target domain that has yet to be explored is prejudice and discrimination. Because of their subtle but powerful influence on cognitive processes and attitudes, embodiment primes have the potential to serve as a novel approach to addressing this pervasive problem.

Prejudice and prejudice reduction

Intergroup bias and conflict have been called the problem of the century (Fiske, 2002). These problems have pervaded human social life throughout history and are present across cultures. Although progress has been made – for example, Barack Obama's candidacy reportedly led to a reduction in bias against African-Americans (Plant et al., 2009) – prejudice and discrimination remain in both subtle and overt forms, and they occur wherever there are differences in ethnicity, gender, religion, socioeconomic status, sexual orientation, national origin, age, physical disability and disease, mental illness, and other distinctions.

Blatant forms of prejudice, such as aggressive behaviors and hate crimes, have decreased over time in the Unites States, though extremists (e.g., Ku Klux Klan members) do still exist. These individuals harbor and readily express explicit biases and feel personally threatened by other groups' existence. They tend to support racist movements, segregation, and in some cases the annihilation of outgroups (Pettigrew, 1998). Although these extremists may be in the minority, their influence can be powerful in certain contexts.

More common are subtle forms of prejudice, such as implicit negative stereotypes about outgroups (Dovidio & Gaertner, 2004). These biases tend to be automatic and difficult to control (Fiske, 1998, 2000; Macrae & Bodenhausen, 2000). Although subtle bias is less harmful than overt bias in most respects, it can be difficult to assess and to address, since most people are either unaware of or unwilling to admit to such bias (Greenwald & Banaji, 1995). The development of the Implicit Association Test (IAT) has helped researchers assess implicit bias by measuring reaction times to different word pairings (e.g., Black and Bad, White and Good versus the reverse; Greenwald, McGhee, & Schwartz, 1998). The IAT has been used extensively over the past decade, and research has revealed that even subtle, implicit bias can have serious consequences. Most people reveal some degree of implicit bias (Greenwald, Poehlman, Uhlmann, & Banaji, 2009) and scores on the IAT are related to multiple forms of ethnic discrimination, such as bias in employment decisions (Ziegert & Hanges, 2004), medical treatment decisions (Green et al., 2007), and voting behavior (i.e., preference for John McCain; Greenwald, Smith, Sriram, Bar-Anan, & Nosek, 2009), and to negative intergroup interactions (McConnell & Leibold, 2001).

Research using other measures of bias have demonstrated similar effects, showing that subtle bias can lead to multiple forms of social distancing and exclusion. For example, a multi-national study conducted by Pettigrew and Meertens (1995) showed that individuals who held subtle racial biases, unlike those with more extreme bias, did not actively seek to send immigrants back to their home country, but they also did not feel motivated to improve interethnic relations or to advocate for immigrant groups' civil rights. Thus, even subtle bias can maintain segregation and inequality.

Another way that more modern forms of prejudice persist is through the content of outgroup stereotypes (Cuddy, Fiske, & Glick, 2007; Fiske, Cuddy, Glick, & Xu, 2002). Both warmth and competence based stereotypes (i.e., the perception of low warmth and/or low competence) elicit negative behaviors toward outgroup members, referred to as active or passive harm. Social groups that are perceived as low in warmth (e.g., homeless people, poor African-Americans) are most likely to be regarded with contempt and disgust and to be treated with active harm (e.g., harassment, aggression), whereas those who are viewed as low in competence (e.g., the elderly, disabled people) are more likely to be treated with passive harm (e.g., exclusion).

Researchers have posited a number of possible causes of stereotyping and prejudice ranging from structural inequalities and poor economic conditions to psychological mechanisms of social categorization and ingroup favoritism. On a structural level, persistent residential and employment segregation reinforce stereotypes about the superiority or inferiority of different groups and limit opportunities for positive intergroup contact (Allport, 1954). Media portrayals also reinforce stereotypes, often through illusory correlations (e.g., Deaux & LaFrance, 1998). Prejudice can also result when poor economic conditions are paired with the belief that outgroup members pose a threat to employment opportunities (Jackson, 1993; Sherif, 1966). On a psychological level, prejudice is theorized to stem from the cognitive tendency to categorize people and objects into groups (Brewer & Brown, 1998, Rosch & Lloyd, 1978; Taylor, 1981) and the need to derive self-esteem from ingroup affiliations and comparisons with outgroups (Hewstone, Rubin, & Willis, 2002; Tajfel, 1981, Tajfel & Turner, 1979). Personality characteristics may also dispose people to prejudiced attitudes: for example, people high in social dominance orientation believe that superior groups should dominate inferior groups in a social hierarchy (Sidanius & Pratto, 1999). Prejudiced attitudes are perpetuated by social-cognitive processes such as the self-fulfilling prophecy and behavioral confirmation, whereby pre-existing beliefs lead to behaviors which elicit stereotype-confirming behavior from targets (Word, Zanna, & Cooper, 1974).

How can prejudice be reduced or eradicated? Researchers, educators, and policy-makers have been tackling this problem for decades. In addition to policy changes such as desegregation and affirmative action, one of the most popular and effective approaches is the *contact hypothesis*, which posits that constructive intergroup contact can be beneficial when it involves group members of equal status working toward a common goal and when it has institutional support (Allport, 1954; Pettigrew, 1988). This approach to prejudice reduction arose from observations that school desegregation was not having the desired effect – minority groups still showed lower levels of self-esteem (Stephen, 1978) and socialized primarily with ingroup members (Aronson & Gonzalez, 1988).

A large body of research has found evidence for the effectiveness of positive intergroup contact (Cook, 1985; Pettigrew & Tropp, 2006, 2011). The jigsaw classroom approach, which is based on the contact hypothesis, has also been shown to decrease prejudice and increase liking across group boundaries (Aronson, Blaney, Stephin, Sikes, & Snapp, 1978; Walker & Crogan, 1998). One mechanism for the effectiveness of this approach is the cognitive shift to a more inclusive ingroup identity and sense of "oneness" and self-other overlap (Gaertner & Dovidio, 2000; Gaertner, Mann, Dovidio, & Murrell, 1990; Page-Gould, Mendoza-Denton, & Tropp, 2008). Recategorization (also referred to as the common ingroup identity model) draws on principles of ingroup favoritism by increasing the salience of an overarching group identity such as "American" or "Human" (Dovidio, Gaertner, & Kafati, 2000; Gaertner et al.,1989; Leary,

Tipsord, & Tate, 2008; Wohl & Branscombe, 2005). More recent conceptualizations of recategorization have incorporated the need for distinctiveness and emphasize the value of a dual identity that simultaneously includes subgroup and superordinate identities (Dovidio, Gaertner, & Saguy, 2007).

Other approaches to prejudice reduction have focused on changing explicit and implicit stereotypes. Logical arguments do not seem to be very effective, as disconfirming evidence tends to only strengthens stereotypes (Kunda & Oleson, 1997). Aronson, Wilson, and Akert (2010) describe prejudice as being "like a fortress – a closed circuit of cognitions" that is not open to new perspectives. So how can the fortress of closed-mindedness be broken? One way is diversity education, such as participating in a prejudice and conflict seminar (Rudman, Ashmore, & Gary, 2001). Other methods target implicit attitudes with implicit primes. For example, Olson and Fazio (2006) developed a brief evaluative conditioning paradigm using repeated pairings of Black-Good and White-Bad that led to a reduction of automatic prejudice immediately after the intervention as well as two days later. The activation of counterstereotypes (e.g., exposure to pictures of admired individuals of a different race) has also been shown to be effective in reducing IAT-measured bias (Dasgupta & Greenwald, 2001), as have various forms of social tuning, such as the presence of an African-American experimenter (Lowery, Hardin, & Sinclair, 2001), and counterstereotypic mental visualizations, such as imagining a strong women (Blair, Ma, & Lenton, 2001).

The present research

Embodiment primes, which have been shown to have powerful effects on both cognitive and affective aspects of social perception, also have the potential to reduce implicit prejudice. Despite a reduction in more overt forms of prejudice, most people still reveal subtle forms of bias (Fiske, 2002). Although automatic biases can be difficult to control or modify (e.g., Bargh, 1999), researchers have identified a variety of methods for addressing implicit bias, such as through subtle contextual cues (see Blair, 2002 for a review). In addition to the types of interventions described above, basic physical sensations may also serve as such cues. In particular, I hypothesize that physical warmth may alter people's feelings of trust and positivity towards outgroup members, to whom they might otherwise hold more negative implicit attitudes. Warmth may be especially relevant for improving attitudes toward stigmatized groups precisely because these groups are typically viewed less warmly than non-stigmatized groups (Fiske et al., 2002) and because perceptions of low warmth are associated with active forms of discrimination (Cuddy et al., 2007). Warmth is considered the primary dimension of person perception (Asch, 1946) because it communicates something about others' intentions (warm intentions to help or cold intentions to hurt), whereas the competence dimension provides information about others' ability to carry out those intentions. Priming the warmth metaphor may "warm" participants to members of stigmatized groups, leading to more positive intergroup attitudes and judgments. Furthermore, to the extent that the warmth metaphor is rooted in early attachment experiences (Williams & Bargh, 2008), manipulations of physical warmth may function similarly to attachment security primes, which have been shown to improve intergroup attitudes (Mikulincer & Shaver, 2001).

The association between physical and interpersonal warmth is presumably formed in early childhood, when the sensation of physical warmth inherent in the experience of being held by a caregiver comes to be linked with feelings of safety, comfort, and love (Williams, Huang, & Bargh, 2009; see also Bowlby, 1969; Harlow, 1958). This linkage also appears to have a neurological basis: the insular cortex is involved in processing information related to both

psychological warmth (e.g., trust) and warm temperatures (Kang, Williams, Clark, Gray, & Bargh, 2010).

Recent research suggests that priming physical warmth can activate interpersonal warmth, especially warmth toward close or neutral others. Williams and Bargh (2008a) found that participants who held a warm (versus cool) beverage or compress judged a neutral target person as having a more generous and caring personality and were more likely to choose a gift for a friend rather than for themselves. In other words, warm temperatures led people to both perceive others as being warm and to behave more warmly themselves. Other studies have found similar results. Warmer room temperatures and beverages induced a more relational focus and greater self-other overlap with a known other (Ijzerman & Semin, 2009), and social proximity increased perceived room temperatures (IJzerman & Semin, 2010) whereas social exclusion decreased perceived room temperatures (Zhong & Leonardelli, 2008). New research suggests that people unconsciously regulate their body temperatures in accordance with feelings of social isolation versus affiliation (Bargh & Shalev, 2012). For example, lonelier participants reported taking more warm baths and showers, and physical warmth eliminated the need for social affiliation following a rejection recall.

Building on such research, I examined whether the positive social perceptions produced by physical warmth extend to attitudes toward stigmatized groups. In three experiments, I examined the hypothesis that participants primed with warmth by wearing a warm compress would show more positive (i.e., less negative) attitudes toward African-Americans both on the a standard Race IAT (Experiment 1), a single-target Race IAT (Experiment 2), and a punishment decisions measure (Experiment 3), compared to participants primed with cool (Experiments 1-3) or neutral (Experiments 2 & 3) compress temperatures. Because most people do not readily report explicit bias (Greenwald & Banaji, 1995), for Experiment 1 I selected a commonly used implicit measure of intergroup bias, the Implicit Association Test (IAT), as a dependent measure (Greenwald, McGhee, & Schwartz, 1998). Scores on the Race IAT have been shown to predict discriminatory behavior in medical, employment, and other settings (e.g., Green et al, 2007; Ziergert & Hanges, 2004). Experiment 2 sought to replicate Experiment 1 using a single-target IAT that de-confounded ingroup positivity from outgroup negativity, with the addition of a neutral temperature control condition. Experiment 3 also included three temperature conditions (warm, cool, and neutral), and used a different dependent measure of prejudice. Asian-American participants read student misconduct cases and made judgments and punishment severity ratings for identical transgressions conducted by either an African- or Asian-American target. Misconduct cases such as these are evaluated regularly in academic settings, and these evaluations bear on disciplinary decisions that affect students' academic and life outcomes. In all three experiments I focused on attitudes toward African-Americans, a group that has historically been and continues to be a target of prejudice and discrimination in American society (e.g., Bertrand & Mullainathan, 2003; Gilens, 1996).

Experiment 1: Warmth and implicit racial attitudes

Experiment 1 examined the hypothesis that wearing a warm compress, compared to a cool compress, would lead to lower implicit negative attitudes toward African-Americans relative to European-Americans.

Method.

Participants. Forty-six undergraduates participated in the experiment for course credit. The sample was primarily European-American (74%). Thirteen percent were Asian-American,

9% Hispanic, and 4% Indian. Participants ranged in age from 18 to 28 (M = 20.0, SD = 2.0). Seventy percent of the sample was female.

Procedure. Participants were randomly assigned to evaluate either a warm or cool compress as part of a product evaluation ostensibly unrelated to the experiment (this procedure was adapted from Williams & Bargh, 2008a). Experimenters (two Asian-American females) minimized their interactions with participants, who sat in private cubicles for the duration of the study. Instructions given by the computer and by the experimenters did not include any words related to temperature, so as to avoid the potential for semantic priming. The lightweight clay-based compresses were either heated for one minute in a microwave or stored in a freezer prior to their use in the experimental session. A comfortable cloth layer covered each compress and experimenters ensured that compress temperatures were comfortable for direct skin contact. Participants were instructed to wrap the compress around their non-dominant forearm and secure it with a Velcro strip. A cover story for the use of the compress was used: participants were led to believe that a research group in the business school wanted to assess whether a specific product could be used comfortably while typing. Participants were not aware that compress temperature differed across conditions.

Before applying the compress, all participants first wrote about a recent self-relevant negative event. The purpose of this task was to temporarily activate a sense of threat, since implicit bias tends to be more apparent in the context of ego threat (e.g., Spencer, Fein, Wolfe, Fong, & Dunn, 1998), and because physical warmth, like attachment security primes (e.g., Mikulincer & Shaver, 2008), may be most relevant and helpful under conditions of threat.

After applying the compress, participants filled out a variety of questionnaire items, including a brief measure of momentary positive affect (i.e., happy, content), negative affect (i.e., sad, angry, upset, disappointed) and self-esteem (i.e., proud, confident). Responses were made on a 5-point scale (1 = *Not at all*; 5 = *Extremely*).

Participants next completed an Implicit Association Task to assess attitudes toward African-Americans relative to European-Americans. The Implicit Association Task assesses the strengths of associations between two concepts by observing response latencies in computer-based categorization tasks (see Greenwald, et al., 2009 for a review). Although the purpose of the Race IAT is evident to some participants, they are generally not able to control their responses to affect their score without specific training (Kim, 2003).

I used a version of the Race IAT that is based on an improved scoring algorithm (Greenwald, Nosek, & Banaji, 2003; Greenwald, McGhee, and Schwartz, 1998) and programmed for Inquisit 3 Millisecond software. In this version, participants are asked to classify a series of words and photos along two category axes: "Black American" vs. "White American," and "Good" vs. "Bad." For the Black vs. White American distinction, participants classified a series of photos of African-American or European-American male and female faces. For the "Good" vs. "Bad distinction, participants categorized the following words: marvelous, superb, pleasure, beautiful, joyful, glorious, lovely, wonderful; tragic, horrible, agony, painful, terrible, awful, humiliate, nasty. Both the face photos and words were pilot tested in previous research (Greenwald, Nosek, & Banaji, 2003).

In the first blocks of trials, only one category axis was presented at a time (e.g., "Black American" vs. "White American," and "Good" vs. "Bad," each on one side of the screen), and exemplars (words or faces) for each category were presented on the screen one at a time. Participants were instructed to classify these exemplars as quickly as possible by pressing a key corresponding to the category ("e" for the category on the left, "i" for the category on the right).

These trials were not used to compute the final IAT score, since they did not include paired associations. In the next block of trials, these category labels were paired, and participants classified exemplars for all four categories at once, using the same key as in the first two individual trial blocks (e.g., "e" for "Black American" OR "Good" and "i" for "White American" OR "Bad"). The pairings were then switched (e.g., "e" for "White American" OR "Good" and "i" for "Black American" OR "Bad"). The order of these pairings was counterbalanced to control for order effects. The program requires participants to correct errors before proceeding, so this brief delay is factored into the latencies (which are measured when the correct response is selected). The final IAT score (D) represents the difference in average latency between the two combined tasks. Faster responses for the "White + Good/ Black + Bad" trials compared to the "Black + Good/ White + Bad" trials indicate a stronger relative association between "Black" and "Bad." In the present study, higher D scores indicated greater negative attitudes toward African-Americans relative to European-Americans.

Because research using the IAT shows that the majority of people who are not African-American show positive scores on the Race IAT (indicating implicit negative attitudes toward African-Americans; Greenwald et al., (2009), I expected that IAT score means in both conditions would be positive, indicating some level of bias. However, I expected that these scores would be lower in the warm compared to the cool condition, indicating relatively less negative attitudes toward African-Americans. Because most participants were European-American (74%), this group served as the comparison group in the IAT. I chose to include Asian-American, Hispanic, and Indian participants in analyses to increase generalizability. Positive scores on this IAT indicate more negative attitudes toward African-Americans, relative to European-Americans.

Finally, participants evaluated compress comfort, rated perceived compress temperature, filled out a suspicion probe, and were debriefed. Compress comfort ratings were made on a 7-point (1 = *Very uncomfortable*; 7 = *Very comfortable*). Temperature ratings were also made on a 7-point scale (1 = *Very cool;* 7 = *Very warm*).

Results.

Neither gender nor ethnicity significantly predicted IAT scores, nor did they interact with compress condition. Three participants expressed suspicion about the link between temperature and bias; excluding these participants did not change the results reported below, so they are included in all subsequent analyses. Means, standard deviations, and alphas are presented in Table 1.

A test of the perceived temperature manipulation check revealed that participants in the warm condition perceived the compress as significantly warmer ($M = 5.21$, $SD = .98$, $n = 24$) than those in the cool condition ($M = 2.63$, $SD = .73$; $n = 22$), $F(1, 44) = 101.09$, $p < .001$. One participant in the warm condition rated the temperature as a 4 (neutral), and two as a 7 (very warm), but excluding these participants did not change the results reported below, so they are included in all subsequent analyses.

As predicted, IAT scores were significantly lower in the warm condition ($M = .28$; $SD = .32$), compared to the cool condition ($M = .53$; $SD = .29$), indicating lower levels of implicit negative attitudes toward African-Americans among participants wearing a warm compress, $F(1, 44) = 7.82$, $p < .01$. There were no condition differences in positive affect, negative affect, self-esteem, or compress comfort, nor were these measures correlated with IAT score. Controlling for these variables did not change the results. When the sample was limited to European-American participants, the results were the same: Participants in the warm condition showed lower levels of bias ($M = .31$; $SD = .27$, $n = 17$) than participants in the cool condition ($M = .56$; $SD = .30$, $n =$

15), $F(1, 30) = 5.76$, $p < .05$. This effect remained significant when covariates (i.e., affect, self-esteem, compress comfort) were included.

Finally, because there was some variation in the degree of warmth versus coolness that participants experienced in each condition, I examined the correlation between self-rated temperature and IAT score across conditions. As expected, self-rated temperature was negatively correlated with IAT score, $r(46) = -.43$, $p < .01$, indicating lower levels of implicit negative attitudes for participants who felt warmer.

Discussion.

This experiment examined the hypothesis that physical warmth would reduce implicit negative attitudes toward African-Americans. As predicted, participants who wore a warm compress showed less implicit negative attitudes toward African-Americans, relative to European-Americans, than participants who wore a cool compress. Two possible alternative explanations were ruled out. First, warm compress temperatures could be more pleasant or comfortable than cool temperatures. However, participants actually rated the cool compress as slightly more comfortable than the warm compress (though this trend was nonsignificant), and compress comfort did not account for the effect of condition on implicit attitudes. Second, warm temperatures could have a calming effect, increasing positive affect and reducing negative affect, which could in turn improve attitudes (Johnson & Fredrickson, 2005). However, this alternative explanation was not supported by the data. Affect and self-esteem were relatively equal between conditions, and these variables did not account for the effect of condition on implicit attitudes.

Although this experiment ruled out several possible alternative explanations, there are other potential explanations for these findings that cannot be fully ruled out. For example, it may be that the effects are driven by cool temperatures increasing bias rather than warm temperatures reducing bias. To address this limitation, Experiments 2 and 3 used neutral comparison conditions in addition to the cool comparison condition.

Experiment 2: Warmth and implicit racial attitudes – Part 2

Experiment 2 replicated Experiment 1 using two single-target IATs designed to assess implicit attitudes toward African-Americans, with a separate IAT for attitudes toward European-Americans, instead of a dual-target IAT, in order to de-confound ingroup positivity and outgroup negativity. In addition, a third neutral compress condition was added. Like Experiment 1, Experiment 2 examined the hypothesis that wearing a warm compress would lead to lower implicit negative attitudes toward African-Americans. A primarily European-American sample was recruited, and analyses were again conducted with the sample limited to European-Americans as well as with the full sample. Unlike Experiment 1, no preliminary self-esteem threat was used in order to examine whether the effects of warmth would generalize in a non-threatening context.

Method.

Participants. Ninety-nine undergraduates participated in the experiment for course credit. Three participants were excluded because they identified as African-American, and four were excluded because they never applied the compress (presumably because they did not read the computer instructions). One participant was excluded because she stated that the compress "smelled terrible," which the experimenter found to be due to rotting food stored in the freezer where the compress was stored. The freezer was subsequently cleaned out and this problem did not recur. Finally, one participant was excluded because her score on the African-American IAT fell greater than 6 standard deviations above the mean. Analyses were conducted on the remaining ninety participants.

As in Experiment 1, the sample was primarily European-American (74%). Ten percent were Asian-American, 6% Middle-Eastern, 4% Hispanic, 1% Native American, and the remainder "Other." Participants ranged in age from 18 to 34 (M = 21.3, SD = 3.2). Seventy-two percent of the sample was female.

Procedure. Participants were randomly assigned to evaluate either a warm, cool, or neutral compress as part of a product evaluation ostensibly unrelated to the experiment. Experimenters were fully blind to compress condition. Compresses were pre-prepared by one minute of microwaving, storage in a freezer, or storage in a neutral-temperature drawer, and then placed in three unmarked boxes that were thick enough to block out temperatures. Experimenters carried the boxes to the lab room and placed one at each computer. Participants followed computer-based instructions and applied the compress themselves. They did not interact with the experimenter except for consent and debriefing procedures. Up to three participants were run in each session, and participants again sat in private cubicles for the duration of the study.

As in Experiment 1, experimenters and computer instructions did not include any words related to temperature, so as to avoid the potential for semantic priming. A cover story for the use of the compress was again used: participants were led to believe that a research group in the business school wanted to assess whether a specific product could be used comfortably while typing. Participants were not aware that compress temperature differed across conditions. After applying the compress, participants filled out brief measures of momentary positive affect (i.e., happy, content), negative affect (i.e., sad, angry, upset, disappointed) and self-esteem ("I have high self-esteem," SISE; Robins, Hendin, & Trzesniewski, 2001). Responses for affect were made on a 5-point scale (1 = *Not at all*; 5 = *Extremely*), and responses for self-esteem were made on a 7-point scale (1 = *Strongly disagree*; 5 = *Strongly agree*).

Participants next completed two single-target Implicit Association Tests assessing attitudes toward African-Americans and European-Americans, independently. The reliability and validity of the single-target IAT has been established in prior research (e.g., Bluemke & Friese, 2007). The same stimuli (photos and words) were used as in Experiment 1. The order of the two IATs was counterbalanced across conditions. Specifically, the African-American single-target IAT is comprised of two types of critical trials, one that combines Black and Good, with Bad on the opposing side, and one that combines Black and Bad, with Good on the opposing side. The stimuli to be classified included positive words, negative words, and African-American male and female faces. The European-American single-target IAT is the same, but with the substitution of European-American faces. The final IAT score (D) is computed by subtracting the "Black (or White) + Good" block from the "Black (or White) + Bad" block. A positive score is interpreted as revealing a stronger positive than negative association with Black (or White) and Good (Bluemke & Friese, 2007).

As in Experiment 1, I expected that African-American IAT score means in both conditions would indicate more negative attitudes than European-American IAT score means (Greenwald et al., 2009). However, I expected that African-American IAT scores would be higher (i.e., indicating more positive implicit attitudes) in the warm condition, compared to both the cool and neutral conditions. This pattern was expected to hold when controlling for European-American IAT scores. That is, negative implicit evaluations of African-American faces should differ across conditions in both an absolute and relative sense. Because most participants were European-American (74%), this group served as the comparison group in the IAT. However, as in Experiment 1, other ethnic groups (Asian-American, Hispanic, Native American, and Middle Eastern participants) were also included in analyses, though analyses were repeated when the

sample was limited to only European-American participants.

Finally, participants evaluated compress comfort, rated perceived initial and current compress temperature, filled out a suspicion probe, and were debriefed. Compress comfort ratings were made on a 7-point (1 = *Very uncomfortable*; 7 = *Very comfortable*). Temperature ratings were made on a 10-point scale (1 = *Very cool;* 10 = *Very warm*) for both initial and current compress temperature.

Results.

Neither gender nor ethnicity significantly predicted IAT scores, nor did they interact with compress condition. Four participants expressed suspicion about the link between temperature and bias; excluding these participants did not change the results, so they are included in all subsequent analyses. Means, standard deviations, and alphas are presented in Table 2.

A test of the perceived temperature manipulation check revealed that participants in the warm condition perceived the initial compress as significantly warmer (M = 7.84, SD = .85, n = 32) than those in the cool (M = 2.08, SD =1.16; n = 26) or neutral conditions (M = 5.00, SD = .72; n = 32), $F(2, 87) = 288.79$, $p < .001$. Both contrasts, warm versus cold and warm versus neutral, were significant ($p < .001$). Because temperature ratings were made on a 10-point scale, these average scores fall on moderately warm, moderately cool, and neutral, respectively. Current compress temperature ratings, which reflected the temperature of the compress at the conclusion of the study, differed less. Participants in the warm condition rated the compress as only slightly above neutral (M = 5.61, SD =1.17), which was not significantly different from the neutral condition ratings, which became slightly warmer, perhaps due to the influence of body heat (M = 5.16, SD =1.11), p = .14. Cool condition ratings also became warmer but remained significantly different from the warm and neutral conditions (M = 3.54, SD =1.42), $p < .001$.

Scores on the African-American IAT did not differ significant across conditions, $F(2, 87) = .27$, p = .77. The pattern of means was in the expected direction for the comparison between the warm (M = 33.20, SD = 165.73) and cool conditions (M = 7.53, SD = 99.15), with participants in the warm condition demonstrating slightly but non-significantly more positive implicit attitudes toward African-Americans than participants in the cool condition. The IAT score means were roughly equivalent between the warm and neutral condition (M = 32.23, SD = 163.70).

Controlling for scores on the European-American IAT, which also did not differ significantly across condition (p = .92), the results remained non-significant, but the pattern of means changed, with scores in the warm condition now slightly greater than both control conditions (Ms = 14.96, 3.37, and -10.41), but the differences were not significant (p = .74).

There were no condition differences in positive affect, negative affect, or self-esteem (ps > .3). Compress comfort was significantly higher in the warm condition (M = 5.59, SD = 2.5), compared to the cool (M = 5.12, SD = 1.73), and neutral (M = 4.28, SD = 1.69) conditions. It is surprising that the neutral temperature was perceived as the least comfortable. Controlling for these variables did not change the non-significant pattern of results described above. When the sample was limited to European-American participants, the results also remained the same: Participants in the warm (M = 42.07, SD = 169.19, n = 26) and neutral (M = 31.00, SD = 129.18, n = 26) conditions showed slightly higher positive implicit associations with African-Americans, compared to participants in the cool condition (M = .40, SD = 82.62, n = 15), $F(2, 64) = .44$, p = .65. This non-significant effect also remained unchanged when controlling for European-American IAT score, affect, self-esteem, and compress comfort.

As in Experiment 1, I examined the correlation between self-rated temperature and IAT scores across conditions. Neither initial nor current compress temperature were significantly correlated with scores on the African-American IAT, $r(90) = .12$, $p = .27$, and $r(90) = .14$, $p = .19$, respectively, though the association was positive, indicating slightly more favorable attitudes toward African-Americans for participants whose compresses felt warmer. Initial and current compress temperature was uncorrelated with scores on the European-American IAT ($ps > .85$).

Discussion.

This experiment provided another test of the hypothesis that physical warmth would promote more positive evaluations of a negatively stereotyped group, African-Americans, among a sample of primarily European-American participants. Results did not support predictions. Although the expected pattern of means was found for comparisons between warmth- and coolness-primed participants, there was not even a trending difference between the warm and neutral conditions, unless scores on the European-American IAT were entered as a covariate.

The non-significant results were surprising given that the effects were quite strong in Experiment 1. A number of differences exist between the two experiments that might explain the discrepant findings. First, Experiment 2 did not include the ego threat induction preceding the manipulation in Experiment 1. It is possible that the results of Experiment 1 were reliant on the presence of threat and do not generalize outside an ego-threatening context. To examine this possibility, in post-hoc analyses I assessed the interaction between negative self-relevant feelings following the negative event recall and condition in predicting IAT score in Experiment 1. Although participants who felt most bad about themselves seemed to derive the greatest benefit from the warmth manipulation, the interaction was non-significant. In a post-hoc analysis in Experiment 2, a similar pattern emerged for state self-esteem as the moderating variable, where participants who were lower in state self-esteem did benefit somewhat more from the warmth manipulation, though again the interaction was non-significant. Because implicit bias tends to be more apparent in the context of ego threat (e.g., Spencer et al., 1998), warmth may indeed be more effective in this context. This interpretation is consistent with the role of warmth as a buffer against threat in the context of early attachment experiences (e.g., Williams et al., 2009).

Second, Experiment 1 used a standard dual-target IAT whereas Experiment 2 used two single-target IATs. Although the reliability and validity of the single-target IAT has been established (Bluemke & Friese, 2007), it is possible that the effect of warmth has a stronger effect on relative judgments (i.e., intergroup comparisons) rather than absolute judgments. This difference is also related to the role of threat: relative judgments may involve a greater sense of competition or threat, a context in which warmth may be more relevant, whereas absolute judgments may be experienced as less threatening. Future research would be needed to examine this possibility.

Third, participants rated the warm compress as relatively less warm at the conclusion of the study in Experiment 2 compared to Experiment 1. Experiment 2 ratings were close to the "neutral" mark ($M = 5.61$ on a 10-point scale), while in Experiment 1 ratings made at the conclusion of the study averaged 5.21 on a 7-point scale with the same endpoints. There are two potential reasons for this discrepancy. First, participants in Experiment 2 completed two IATs, whereas those in Experiment 1 completed only one IAT, making the study shorter and leaving less time for the compress temperatures to neutralize. Second, because of the logistics of the double-blind procedure of Experiment 2, the compresses were not taken directly from the microwave or freezer to the lab room but rather were prepared in advance and then retrieved by experimenters, which could have also contributed to a faster rate of temperature neutralization.

Thus, lower compress temperatures in Experiment 2 may have played a role in the weaker results. It may be that level of warmth must pass a certain threshold for its effects to be apparent.

Experiment 3: Warmth and punishment severity bias

Given the lack of replication with the IAT in Experiments 1 and 2, Experiment 3 was designed to examine the warmth-bias hypothesis using a different dependent measure, attributions and ratings of punishment severity for an ingroup or outgroup student offender. Although this measure is less implicit than the IAT and is subject to participant control, it has the advantage of higher ecological validity, as it reflects a behavior that has real-world implications. Experiment 3 also included a sample of Asian-American participants, as well as an Asian-American control target, in order to examine whether the hypothesis would generalize beyond primarily European-American participants. I hypothesized that participants in the cool and neutral compress conditions would favor ingroup members in attributions, moral judgments, and punishment decisions. That is, they were expected to report lower situational attributions and harsher moral judgments, and to recommend giving more severe punishments to outgroup targets, relative to ingroup targets. In the warm compress condition, I expected this difference to be attenuated or eliminated. Finally, I expected that attributions and moral judgments might mediate the effect of condition (compress temperature and target ethnicity) on punishment measures.

Method.

Participants. One-hundred and thirty-one undergraduates participated in the experiment for course credit. Eighteen were excluded because a memory test at the conclusion of the study revealed that they had not read the student misconduct cases, leaving a final sample of 113. Participants ranged in age from 18 to 31 (M = 20.2, SD = 2.1). Fifty-eight percent of the sample was female.

Procedure. This experiment utilized a between-subjects 2 (target ethnicity condition) X 3 (compress temperature condition) design. First, participants were randomly assigned to evaluate either a warm, cool, or neutral compress as part of a product evaluation ostensibly unrelated to the experiment. As in Experiment 2, experimenters were fully blind to compress condition and carried previously shuffled boxes with all three types of compress to the lab room and randomly placed one at each desk before each session began. Participants followed computer-based instructions and applied the compress themselves; they did not interact with the experimenter except for consent and debriefing procedures. After applying the compress, participants filled out brief measures of momentary positive affect (i.e., happy, content), negative affect (i.e., sad, angry, upset, disappointed) and self-esteem ("I have high self-esteem," SISE; Robins et al., 2001). Responses for affect were made on a 5-point scale (1 = *Not at all*; 5 = *Extremely*), and responses for self-esteem were made on a 7-point scale (1 = *Strongly disagree*; 5 = *Strongly agree*).

Participants were next randomly assigned by a computer program to one of two ethnicity conditions, ingroup (Asian-American) or outgroup (African-American). They read a description of a student misconduct case where one student punched another student at a campus bar in response to mild provocation (adapted from Jordan, Spencer, & Zanna, 2005). All aspects of the case description were identical across the two ethnicity conditions with the exception of the stated ethnicity of the target and their name, which was included as one of the details regarding the incident, along with date, time, and location where the incident took place (all of which were held constant). The African-American offender was named Jason Bryant, and the Asian-American offender was named Tyler Li.

Participants were asked to imagine that they were part of the campus student conduct committee and needed to evaluate a misconduct case and determine an appropriate punishment. Included in this evaluation was a series of questions asking participants to make attributions about the offender's actions. The following items were included in the situational attributions measure: "Many people in his situation would have done the same thing," "This was probably the first time he punched another student," "The situation he was in is more to blame for his actions than anything about his personal character" and reverse-scored: "He probably loses his temper often" and "He is a violent person (relative to the average person)." These ratings were made on a 7-point scale ranging from "strongly disagree" to "strongly agree."

Next participants completed a two-item measure, designed for the purpose of this study, assessing harsh moral judgment of the offender, using the same 7-point scale. The items were, "His actions were morally wrong" and "I am disgusted by his actions." Disgust was included because it is an emotion associated with negative moral judgments (e.g., Schnall, Haidt, Clore, & Jordan, 2008).

Participants then rated how much they felt that the offender should be required to take an anger management class and how severe his punishment should be. These ratings were also made on a 1-7 scale ranging from "strongly disagree" to "strongly agree." Although a required anger management may not be a punishment per se, recommending this course of action for an offender suggests that one believes that the offender has a anger problem, a belief that could be related to racial stereotypes (e.g., Shapiro et al., 2009). The anger management requirement was presented to participants as a punishment that would be independent of any other specific punishments. That is, endorsing anger management was not a way of giving a less severe punishment. In fact, it was positively correlated with punishment severity, $r(107) = .49$, $p < .01$.

Participants next also had the opportunity to recommend specific punishment types (warning, probation, suspension, or expulsion). The punishment severity measures were previously used in Jordan et al. (2005).

Finally, participants evaluated compress comfort, rated perceived compress temperature, filled out a suspicion probe, and were debriefed. Compress comfort ratings were made on a 7-point (1 = *Very uncomfortable*; 7 = *Very comfortable*). Temperature ratings were also made on a 7-point scale (1 = *Very cool;* 7 = *Very warm*).

At least 24 hours after participating in the lab session participants filled out measures of trait modern racism (McConahay, 1986), trait self-esteem (Rosenberg, 1965), and ingroup identification.

Results.

Neither gender nor any of the three trait variables (modern racism, ingroup identification, and self-esteem) interacted with compress condition, target ethnicity, or with the interaction between compress and target ethnicity, to predict any of the dependent measures. Therefore these measures will not be discussed further. Means, standard deviations, and alphas (where relevant) for all dependent variables are presented in Table 3.

A test of the perceived temperature manipulation check revealed that participants in the warm condition perceived the final compress as significantly warmer ($M = 7.14$, $SD = 1.14$, $n = 49$) than those in the cool ($M = 2.56$, $SD = .91$; $n = 32$) or neutral conditions ($M = 4.78$, $SD = .55$; $n = 32$), $F(2, 113) = 233.41$, $p < .001$. Both contrasts were significant ($p < .001$). Because temperature ratings were made on a 10-point scale, these average scores fall on moderately warm, moderately cool, and neutral, respectively. It should be noted that final temperature

ratings in the warm condition were significantly higher in Experiment 3 than in Experiment 2, perhaps due to the shorter duration of Experiment 3.

Situational Attributions.

The first set of analyses examined the hypothesis that warmth-primed participants would make greater situational, or forgiving, attributions for the target's offense, and would show less ingroup bias in their attributions, compared to participants in the cool and neutral conditions.

There was no main effect of target ethnicity or compress condition on situational attributions (ps < .6), but the interaction between compress condition and target ethnicity predicting situational attributions was significant, $F(2, 107) = 5.46$, $p < .01$ (see Figure 1).

Tests of simple effects revealed that within the neutral condition, participants made lower situational attributions for outgroup ($M = 2.89$, $SD = .91$, $n = 17$) compared to ingroup targets ($M = 3.40$, $SD = .53$, $n = 15$), showing the expected pattern of bias ($p < .05$). Within the warm condition, by contrast, the reverse pattern was found: participants made greater situational attributions for outgroup ($M = 3.26$, $SD = .48$, $n = 23$) compared to ingroup targets ($M = 2.82$, $SD = .77$, $n = 26$; $p < .05$). Patterns in the cool condition resembled those of the neutral condition but were non-significant: rating for ingroup ($M = 3.33$, $SD = .58$, $n = 14$) versus outgroup ($M = 2.93$, $SD = .58$, $n = 18$) showed a slight preference for ingroup targets ($p = .12$).

I next compared ratings for ingroup and outgroup targets across the three compress conditions. Participants made lower situational attributions for ingroup targets in the warm condition compared to the cool or neutral conditions (ps < .05). Ingroup ratings did not differ significantly between the cool and neutral conditions ($p = .80$). For outgroup targets, the pattern was the opposite, though the simple effects were non-significant: participants made slightly greater situational attributions in the warm condition compared to the cool and neutral conditions (ps = .18 and .11, respectively).

In sum, the hypotheses were partially supported. The finding that outgroup members were rated more positively in the warm condition compared to the cool and neutral conditions was in line with hypotheses, although the finding that ingroup members were rated more negatively than outgroup members in the warm condition was not expected. In other words, warmth-primed participants did show lower bias than participants in the cool or neutral conditions, with bias defined as more forgiving attitudes toward ingroup compared to outgroup members. However, these participants actually showed a reversal of bias, where they seemed to favor outgroup members compared to ingroup members. Tests of simple effects revealed that the overall pattern was driven primarily by ingroup derogation, and somewhat by outgroup enhancement, within the warm condition.

Harsh moral judgments.

The second set of analyses examined the hypothesis that warmth-primed participants would make less harsh moral judgments for the target's offence, expressing lower levels of disgust and moral recrimination, and would show less ingroup bias in their judgments, compared to participants in the cool and neutral conditions.

There was no main effect of target ethnicity or compress condition on harshness (ps > .3), but the interaction between compress condition and target ethnicity predicting harshness was marginally significant, $F(2, 107) = 2.68$, $p = .07$ (see Figure 2). Tests of simple effects revealed that within the neutral condition, participants were slightly, though not significantly, more harsh toward outgroup ($M = 4.79$, $SD = 1.48$) compared to ingroup targets ($M = 4.20$, $SD = .90$), showing a typical pattern of bias ($p = .15$). Within the warm condition, by contrast, the reverse pattern was again found, though it was non-significant. Participants in this condition were

slightly less harsh toward outgroup (M = 4.22, SD = 1.15) compared to ingroup targets (M = 4.71, SD = 1.34; p = .14). This time, patterns in the cool condition resembled those of the warm condition and were also non-significant: ratings for outgroup (M = 4.11, SD = 1.04) versus ingroup targets (M = 4.69, SD = .81) were slightly biased in favor of outgroup targets (p = .16).

We next compared ratings for ingroup and outgroup targets across the three compress conditions. Participants made the least harsh judgments of ingroup targets in the neutral condition, compared to warm (p = .18) and cool (p = .23), which did not differ (p = .96). For outgroup targets, the pattern was the opposite, though also non-significant: Participants in the neutral condition were slightly more harsh than participants in the warm and cool conditions.

In sum, the hypotheses were minimally supported. The finding that outgroup members were rated somewhat more positively in the warm condition compared to the neutral conditions was consistent with hypotheses, but the contrast between warm and cool was not consistent, nor was the finding that ingroup members were rated more negatively than outgroup members in the warm condition, a pattern that also emerged for the situational attributions variable. In other words, warmth-primed participants did show lower bias than participants in the neutral, but not cool, conditions, with bias defined as less harsh moral judgment of ingroup compared to outgroup members. However, a surprising reversal of bias again emerged.

Punishment Measures.

Punishment severity. The third set of analyses examined the hypothesis that warmth-primed participants would recommend more severe punishments for the target's offense and show less ingroup bias in their judgments, compared to participants in the cool and neutral conditions.

There was no main effect of target ethnicity or compress condition on punishment severity (ps > .1), though participants in the cool condition showed a slightly lower overall tendency to recommend harsh punishments, compared to the other two conditions (p = .15). The interaction between compress condition and target ethnicity predicting punishment severity was non-significant, $F(2, 107) = .61$, p = .55 (see Figure 3). Tests of simple effects revealed that within the neutral condition, participants recommended slightly, though non-significantly, more severe punishment for outgroup targets (M = 4.94, SD = 1.44) compared to ingroup targets (M = 4.60, SD = 1.18, p = .39). Within the warm condition, the means for ingroup (M = 4.77, SD = 1.11) and outgroup (M = 4.61, SD = .89) severity ratings were closer, with a slight non-significant reversal (p = .62). The pattern of means in the cool condition resembled those of the cool condition and were also non-significant: ratings for outgroup (M = 4.43, SD = 1.09) versus ingroup (M = 4.17, SD = 1.30) slightly favored ingroup targets (p = .51).

I next compared ratings for ingroup and outgroup targets across the three compress conditions. Surprisingly, participants in the cool condition recommended the least severe punishments for ingroup targets, compared to participants in the warm (p = .08) and neutral conditions (p = .27), which did not differ (p = .64). For outgroup targets, the pattern was the same, though also non-significant. In other words, participants in the cool condition seemed to recommend less severe punishments regardless of whether the offender was an ingroup or outgroup member. These results were largely unexpected and inconsistent with hypotheses.

Anger management. The next set of analyses examined the hypothesis that warmth-primed participants would report less support for an anger management course requirement for offenders and would show less ingroup bias in their ratings, compared to participants in the cool and neutral conditions.

There was a marginally significant main effect of compress condition on support for the anger management requirement, with participants in the neutral condition showing greater support, $F(2, 107) = 2.40$, $p = .096$. There was no main effect of target ethnicity ($p > .6$). The interaction between compress condition and target ethnicity predicting anger management was significant, $F(2, 107) = 3.91$, $p < .05$ (see Figure 4).

Tests of simple effects revealed that within the neutral condition, participants reported significantly greater support for the anger management requirement for outgroup targets ($M = 5.81$, $SD = 1.33$) compared to ingroup targets ($M = 4.93$, $SD = 1.07$), showing the expected pattern of bias ($p < .05$). Within the warm condition, by contrast, the reverse pattern was found: participants reported marginally significantly lower support for the anger management requirement for outgroup ($M = 4.64$, $SD = 1.22$) compared to ingroup targets ($M = 4.87$, $SD = 1.25$). The contrast for ingroup and outgroup targets within the cool condition was non-significant ($p = .61$).

We next compared ratings for ingroup and outgroup targets across the three compress conditions. Participants reported slightly greater support for the anger management requirement for ingroup targets in the warm condition compared to the cool or neutral conditions, but these differences were not significant (ps $> .3$). Ingroup ratings also did not differ between the cool and neutral conditions ($p = .89$). For outgroup targets, the expected pattern was found for the contrast between the warm and neutral conditions: participants in the warm condition were significantly less supportive of the anger management requirement for outgroup targets compared to participants in the neutral condition ($p < .01$). The contrast between warm and cool was non-significant ($p = .81$). Unexpectedly, participants in the cool condition also reported significantly less support for the anger management requirement compared to participants in the neutral condition ($p < .01$).

As in Experiments 1 and 2, I examined the correlation between self-rated compress temperature and the primary dependent measures across conditions, separately for each target ethnicity. For outgroup targets, compress temperature was uncorrelated with situational attributions, moral judgment, punishment severity, and anger management (ps $> .25$). For ingroup targets, all correlations were also non-significant (ps $> .2$), with the exception of situational attributions, which was significantly negatively correlated with compress temperature, $r(63) = -.25$, $p < .05$. That is, warmer compress temperatures were associated with lower situational attributions for ingroup members across conditions. This unexpected finding mirrors the patterns described above where warmth seems to decrease leniency given to ingroup members.

In sum, the hypotheses were partially supported. The finding that outgroup members were less likely to be required to take anger management courses in the warm condition compared to the neutral condition was in line with hypotheses, although the finding that participants in the cool condition were also less biased than participants in the neutral condition was not expected.

Punishment decisions. The punishment decisions measure was divided into two categories: more severe (suspension or expulsion), and less severe (warnings or probation). A Chi-Square test was conducted to examine the hypothesis that a greater number of participants in the neutral and cool conditions would recommend suspension or expulsion (as opposed to warnings or probation) for outgroup targets compared to ingroup targets, whereas in the warm condition participants will recommend more equivalent punishments. This hypothesis was not

supported. In general, participants tended to recommend less severe punishments, regardless of target ethnicity or compress condition. The frequency table is presented in Table 4.

Additional analyses.

Next, differences in post-manipulation affect, self-esteem, and compress comfort were assessed and these variables were entered as covariates in the primary analyses to determine whether these variables might account for the significant effects reported above.

There were no significant differences in these variables across the target ethnicity conditions, which is not surprising given that these variables were assessed before participants were assigned to ethnicity condition. There were also no significant differences across the compress conditions, although there was an unexpected trend showing slightly more negative affect in the warm condition compared to cool and neutral, $F(2, 110) = 1.87$, $p = .16$, and slightly greater positive affect in the neutral condition compared to warm and cool, $F(2, 110) = 2.35$, $p < .10$. State self-esteem was marginally significantly higher in the cool condition, followed by warm and neutral, $F(2, 110) = 2.54$, $p = .08$. Compress comfort ratings did not differ significantly ($p = .70$), though participants in the neutral condition found it to be slightly more comfortable. Controlling for these variables in the analyses described above did not change the basic pattern of results, suggesting that affect and self-esteem did not account for the results.

Finally, because there was some variation in the degree of warmth versus coolness that participants experienced in each condition, I examined the correlation between self-rated compress temperature and all of the primary dependent measures. All correlations were non-significant, consistent with the generally non-significant main effect of compress condition on the dependent measures.

The hypothesized test of situational attributions and moral judgments as mediators of the effect of condition on the punishment measures was not conducted because the pattern of results was inconsistent across these measures.

Discussion.

This experiment examined the hypothesis that physical warmth would reduce implicit negative attitudes toward African-Americans, operationalized as bias in punishment decisions. Results indicated that, consistent with hypotheses, participants in the warm compress condition made significantly greater situational attributions for African-American offenders, compared to participants in the cool and neutral condition, and they also reported significantly lower support for a required anger management course for African-American offenders, compared to participants in the neutral condition. This pattern did not emerge for punishment severity ratings or specific punishment decisions. In addition, the pattern of ingroup ratings was not expected: participants in the warm condition, compared to participants in the cool and neutral conditions, were more harsh toward the offender if he was Asian-American, making less situational attributions and more strongly supporting the anger management requirement. Furthermore, although I expected the typical pattern of ingroup preference to be reduced in the warm condition, I did not expect a reversal of bias, where warm participants appeared to favor outgroup over ingroup targets.

Why would Asian-American participants judge ingroup targets more harshly when primed with warmth? It may be that warmth reduces defensiveness and makes people feel safe enough to criticize the bad behavior of ingroup members. This interpretation is in line with previous research showing that priming attachment security can reduce defensiveness (Mikulincer & Shaver, 2007). To the extent that warmth is a proxy for trust, closeness, and attachment security (Williams et al., 2009), it may also lessen the need for both outgroup

derogation *and* ingroup enhancement. This process does not explain ingroup derogation per se, but might contribute to a pattern that resembles derogation, a possibility that future research could explore. It is also possible that a within-subjects design, where participants made relative ratings for offenders of various ethnicities, would have yielded more equivalent ratings for ingroup and outgroup targets within the warm condition. Such a pattern would be consistent with the results of Experiment 1, where participants made relative judgments of both ingroup and outgroup targets.

As In Experiment 2, Experiment 3 differed from Experiment 1 in that the bias measure was not preceded by an ego threat. If the positive effects of warmth are indeed stronger in the presence of threat, it is possible that the inconsistency of the results in Experiment 3 is also at least partially due to the absence of a self-threatening context. Perhaps the effects would have been more consistent with hypotheses had the victim of the student assault been an ingroup member (i.e., Asian-American), rather than presumably European-American (a European-American name was used).

Finally, it should be noted that the present study did not find a main effect of warmth on general ratings across ethnic groups, thus failing to replicate prior research suggesting that warmth can increase general interpersonal warmth (e.g., Williams & Bargh, 2008a).

General discussion

Building on prior research linking physical and interpersonal warmth (e.g., Williams & Bargh, 2008a), I examined the hypothesis that physical warmth leads to lower bias in implicit attitudes toward African-Americans (Experiments 1 & 2) and punishment severity in a student misconduct case (Experiment 3).

The results of Experiment 1 supported this hypothesis. In this experiment, a group of primarily European-American participants who wore a warm compress showed less implicit negative attitudes toward African-Americans, relative to European-Americans, than participants who wore a cool compress. Alternative explanations involving compress comfort, positive and negative affect, and self-esteem, were not supported by the data. This experiment had a number of limitations, however, including the use of a dual-target IAT (Greenwald et al., 1988), a relative measure of implicit intergroup attitudes that could not disentangle ingroup positivity from outgroup negativity, and the absence of a neutral control condition.

Experiment 2 was designed to address these limitations by including a neutral temperature control condition and by using single-target IATs to focus specifically on implicit attitudes toward African-American, rather than African-Americans relative to European-Americans. Experiment 2 also improved on Experiment 1 by making experimenters fully blind to participant condition and by further minimizing experimenter-participant interaction. The results of Experiment 2 did not support hypotheses, however. Although warmth-primed participants showed slightly more positive attitudes toward African-Americans, as measured by the IAT, than cool-primed participants, this difference was non-significant, and there was no trending difference between IAT scores in the warm and neutral conditions, except when controlling for scores on the European-American IAT.

It is unclear what accounts for the differences in results between Experiment 1 and 2, though there are a number of possibilities. Most notable is the absence of the ego threat in Experiment 2. All participants in Experiment 1 were instructed to recall a negative self-relevant event before being assigned to compress condition. This procedure was included because prior research suggests that implicit bias is more apparent in the context of ego threat (e.g., Spencer et al., 1998), and because physical warmth was expected to be most effective in such contexts, just

as attachment security primes are most helpful under conditions of threat (e.g., Mikulincer & Shaver, 2008) and the warmth metaphor is hypothesized to operate through its association with early childhood attachment experiences (e.g., Williams et al., 2009). Experiment 2 did not include the threat induction in order to examine whether the effects of warmth generalized beyond that context, but it may be that the absence of threat represents a boundary condition for the benefits of physical warmth for intergroup attitudes. Future research would be needed to examine this possibility, ideally by including a threat and no threat condition across the compress temperature conditions. Because Experiment 2 differed from Experiment 1 in a number of ways (e.g., more neutral average compress temperatures, absolute as opposed to relative measures of intergroup attitudes), it is also possible that another factor could have accounted for the different patterns of results.

Because the IATs used in Experiments 1 and 2 yielded inconsistent results, Experiment 3 measured bias in a different way, operationalizing implicit negative attitudes toward African-Americans as bias in punishment decisions for hypothetical student misconduct cases. This study also recruited Asian-American rather than European-American participants to assess generalizability. Some patterns of results were consistent with hypotheses, whereas others were not. As expected, participants primed with warmth made significantly greater situational attributions for African-American offenders, compared to participants in the cool and neutral conditions. In other words, warmth-primed participants were less likely to assume that the offender was just a violent person by nature or that he often punched other students. These participants also reported significantly lower support for a required anger management course for African-American offenders, compared to participants in the neutral condition. This pattern did not emerge for punishment severity ratings or specific punishment decisions, although support for the anger management course was highly positively correlated with punishment severity ratings.

The pattern of results for ingroup ratings was not consistent with the hypothesis that bias would be reduced in the warm condition. Instead of being reduced, bias appeared to be reversed: participants in the warm condition, compared to participants in the cool and neutral conditions, were more harsh toward Asian-American offenders, making less situational attributions and more strongly supporting the anger management requirement. Furthermore, while cool and neutral-primed participants tended to show the predicted pattern of ingroup favoritism, warmth-primed participants appeared to favor outgroup over ingroup targets. The reason for this bias reversal is unclear. It is possible that warmth, like attachment security (Mikulincer & Shaver, 2007), could reduce defensiveness and allow participants to more freely criticize ingroup members. Warmth may lessen the need for both outgroup derogation *and* ingroup enhancement, though the between-subjects design of Experiment 3 makes it difficult to draw conclusions about relative ratings. A within-subjects design may have yielded the hypothesized closer ratings for ingroup and outgroup targets within the warm condition, which would be consistent with the relative judgment results of Experiment 1. Other variations worth exploring in future research include introducing a context of threat, for example by making the assault victim an ingroup member, and comparing the results for Asian-American participants with those of other ethnic groups. It is possible that cultural differences, such as norms about the acceptability of ingroup criticism, could account for the bias reversals seen in Experiment 3.

To the best of my knowledge, the results of these experiments constitute the first evidence that the embodied metaphorical association between physical and interpersonal warmth extends to the intergroup domain. Given the inconsistency of the results, however, further

research is needed to delineate the conditions under which warmth is beneficial for reducing intergroup bias. For example, the results of the present studies suggest that warmth may be most helpful in the context of threat, and it may impact relative group judgments more strongly than absolute group judgments. Furthermore, there may be an optimal degree of warmth that exerts positive effects. Future experiments could be designed to assess the effects of different degrees of warmth, and to consider individual differences that might moderate the point of optimal warmth. Recent research suggests, for example, that lonelier people tend to take more hot baths and showers, presumably because physical warmth can serve as a proxy for social warmth (Bargh & Shalev, 2011). The optimal degree of warmth for prejudice reduction may depend in part on individual differences such as loneliness and attachment style.

Related to the potential boundary conditions of warmth's benefits, it is also possible that neutral temperatures and cool temperatures could at times also be beneficial. A neutral compress can resemble a soothing human touch, especially when it warms through body heat. Similarly, cool temperatures might share some common elements with warmth, such as an association with soothing and calming. The cooling metaphor may help to explain why anger management bias was lower in both the warm and cool compress conditions in Experiment 3.

It is also possible that under some conditions warmth has a negative connotation, especially if it reaches uncomfortable levels of heat. Prior research suggests that warm ambient temperatures can increase aggression, and violent crime rates tend to be higher on hotter summer days (Anderson, Bushman, & Groom, 1997; Anderson, Deuser, & DeNeve, 1995). In contrast to these studies, the current research examined the effects of relatively comfortable levels of warmth on an isolated part of the body. The application of a compress likely makes the sensation of warmth, and presumably its associated psychological metaphors, more salient than the presence of ambient temperatures.

In addition to extending research on the interpersonal benefits of psychological warmth, these findings have relevance for the growing prejudice reduction literature. Although implicit attitudes are by definition uncontrollable, recent research has explored various methods for reducing implicit prejudice (see Blair, 2002 for a review). The potential for a prime as subtle as a warm temperature to temporarily affect implicit bias has implications for the malleability of implicit stereotypes using subtle environmental primes that do not require effort or conscious awareness. For example, providing warm beverages to people before they engage in an intergroup interaction could help make the interaction go more smoothly. Warmth primes could also potentially be integrated into evaluative conditioning models (e.g., Olson & Fazio, 2006): a warm stimulus could be repeatedly paired with outgroup labels or faces as a means of improving outgroup attitudes. Furthermore, these findings shed light on a potential mechanism by which prejudice interventions may alter implicit bias. Just as warmth may increase feelings of trust rooted in early attachment experiences, prejudice reduction interventions that increase "warm" feelings toward outgroup members may be especially effective.

These experiments represent an initial examination of the effect of temperature on implicit race bias. Future research is needed to ensure that this effect is replicable and generalizable to different types of warmth primes (e.g., room temperature, drinks) as well as to different measures of intergroup attitudes, such as actual discriminatory behavior. These experiments ruled out several alternative explanations (i.e., positive affect, self-esteem, and comfort) for significant effects, but there may be other potential explanations for the findings that cannot be fully ruled out, such as physiological mechanisms. In addition, it would be useful to examine how warmth primes influence judgments of groups that vary on dimensions of

warmth and competence (Fiske et al., 2002). In sum, these findings extend both the embodiment and prejudice literatures and have the potential to inform novel prejudice reduction interventions.

Metaphor has the power both to reinforce and to counteract destructive intergroup stereotypes (Henze, 2005; Santa Ana, 2002). Embodied metaphors are especially powerful because they are rooted in visceral, well-learned associations, and because they engage multiple senses. Adjusting the embodied metaphors that people experience in various contexts may thus be especially likely to affect prejudice levels.

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Table 1. *Means and Standard Deviations – Experiment 1*

Variables	M	SD	α
Positive affect	2.49	1.17	.77
Negative affect	3.03	1.20	.85
State self-esteem	2.36	1.20	.83
IAT Score	0.40	0.33	_
Compress comfort	4.37	1.44	_

Note: Responses for affect and self-esteem were made on a 5-point scale. Responses for compress comfort were made on a 7-point scale.

Table 2. *Means and Standard Deviations – Experiment 2*

Variables	M	SD	α
Positive affect	3.62	0.98	.79
Negative affect	1.68	0.93	.83
State self-esteem	4.97	1.43	-
IAT Score – African-American	25.44	147.63	-
IAT Score – European-American	46.23	127.63	-
Compress comfort	4.99	2.01	-

Note: Responses for affect were made on a 5-point scale.

Responses for compress comfort and self-esteem were made on a 7-point scale.

Table 3. *Means, Standard Deviations, and Alphas – Experiment 3*

Variables	M	SD	α
Positive affect	3.39	0.96	.73
Negative affect	1.80	0.86	.79
State self-esteem	4.57	1.41	_
Situational attributions	3.09	0.74	.68
Harsh moral judgment	4.48	1.17	.70
Punishment severity	4.60	1.11	-
Compress comfort	4.48	1.84	-

Note: Responses for affect were made on a 5-point scale. All other responses were made on a 7-point scale.

Table 4. Punishment decision frequencies – Experiment 3.

Compress Condition			Target Ethnicity		Total
			Outgroup	Ingroup	
Warm	Severity	High	8	7	15
		Low	15	19	34
	Total		23	26	49
Cool	Severity	High	1	6	7
		Low	13	12	25
	Total		14	18	32
Neutral	Severity	High	4	3	7
		Low	13	12	25
	Total		17	15	32

Figure 1. Compress condition by target ethnicity predicting situational attributions

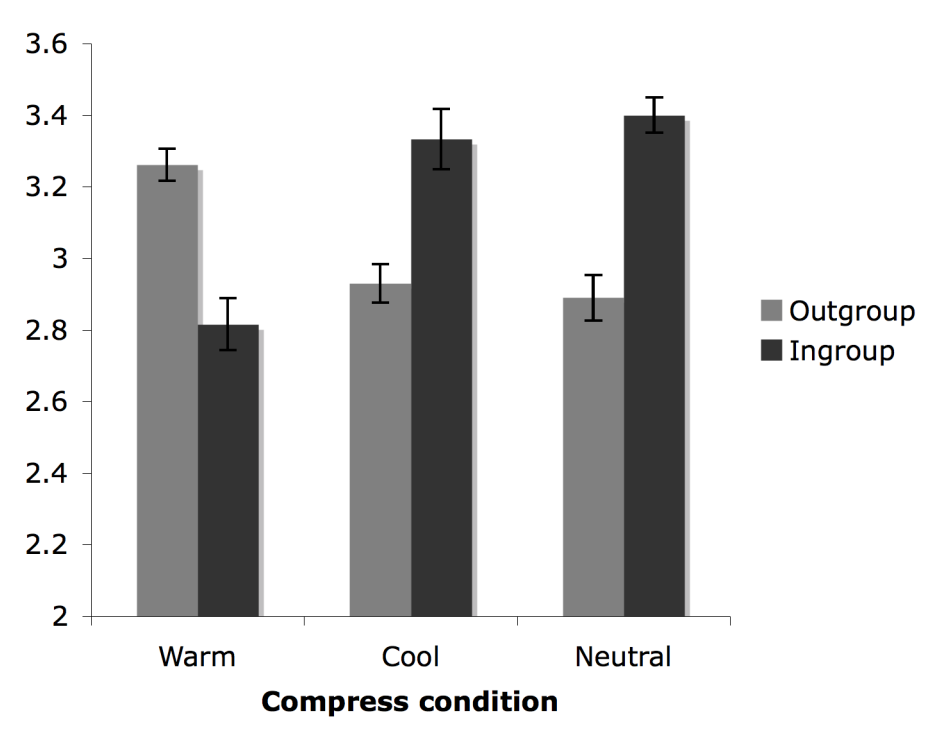

Figure 2. Compress condition by target ethnicity predicting harsh moral judgment

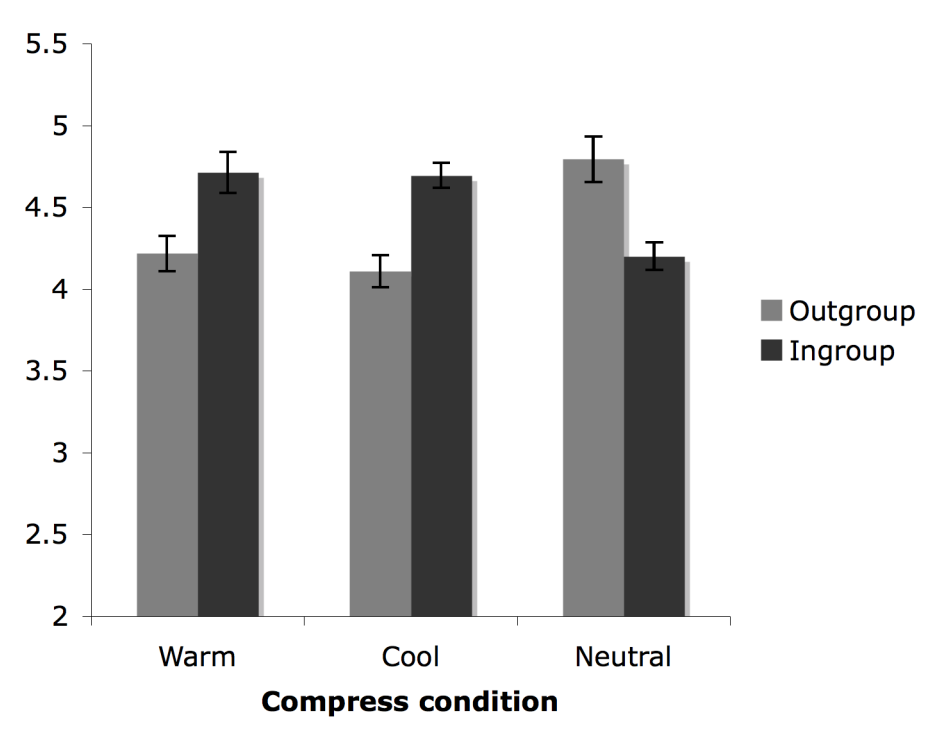

Figure 3. Compress condition by target ethnicity predicting punishment severity

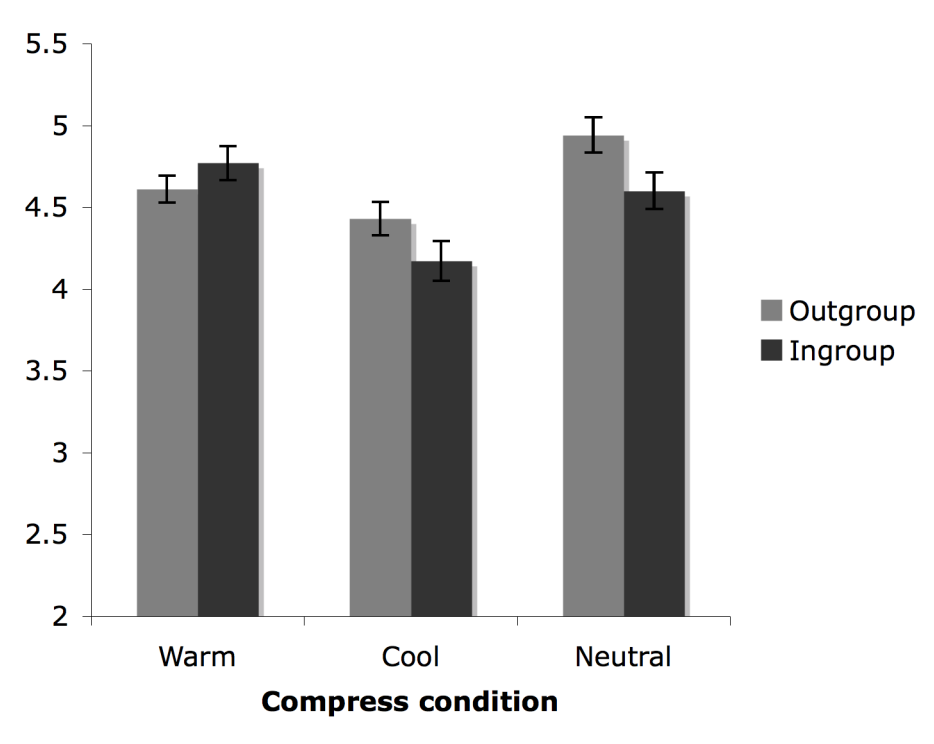

Figure 4. Compress condition by target ethnicity predicting anger management support