Attentional Bias and Threat in Response to Skin Tone Variation

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Abstract

Previous research has demonstrated attentional bias towards Black faces using the dot-probe paradigm among White participants. Research has also found that skin tone is a sufficient cue to activate within-race categorization. This current study used the dot-probe paradigm to investigate attentional bias towards Black faces with dark (high Afrocentric feature) and light (low Afrocentric feature) skin tone. In a randomized within-subjects design, 46 undergraduates completed this dot-probe task. Attentional bias was indexed using response time. In addition, physiological measures including corrugator activity, electrodermal activity, and heart rate were recorded to index threat-related responding. Participants also completed the external motivation to respond without prejudice (EM) scale to test whether EM moderates attentional bias to dark versus light skin tone. Contrary to predictions, this study suggested that the long presentation of various Black faces did not elicit any attentional bias or threat responses among individuals regardless of their EM. There was, however, a trend of high-EM individuals associated with avoiding dark-skinned Black faces. The null findings of attentional bias and threat response to the conditions may suggest that skin tone variation may not be a strong cue to elicit attentional bias.

Attentional Bias and Threat in Response to Skin Tone Variation

Racial categorization plays a big role in shaping social perception. It is a process by which people use certain distinct phenotypic features to place others into distinct and socially meaningful groups. For instance, individuals labeled 'Black' generally have Afrocentric facial features such as dark skin color, full lips, broad noses, and dark eye color, whereas 'White' individuals generally have Eurocentric features such as light skin color, thin lips, narrow noses, and light eye color. Within each racial category also exist subcategories where varying degree of corresponding features to a specific label may contain different social meanings. Dark-skinned Blacks are associated with more negative traits and cultural stereotypes of Black Americans compared to light-skinned Blacks (Maddox & Gray 2002). As Black males are stereotypically perceived as threatening and dangerous (Devine 1989), dark-skinned Blacks should be perceived as more threatening and dangerous than light-skinned Blacks.

Based on recent socio-functional perspectives on social perception, stereotypes affect where people allocate their cognitive resources— there is a prioritization of cognitive processing for stimuli that have clear functional implications (Ackerman et al., 2006). In particular, humans have prioritized threat detection of biological stimuli such as snakes and social cues such as angry faces for evolutionary reason to minimize threats to their well-being (Öhman & Mineka, 2001; Neuberg, Kenrick, Maner, & Shaller, 2004). Thus, combining the idea that humans have an attentional bias towards threatening stimuli and the idea that dark-skinned Blacks are perceived to be more threatening than light-skinned Blacks, the current experiment investigated whether faces with high Afrocentric features, compared to those with low Afrocentric features, would capture more attention and be perceived as more threatening among a sample of Whites.

Attentional Bias towards Threat

The purpose of this study was to determine whether Black faces with high Afrocentric features – for example, dark skin tone – would be viewed as threatening and, hence, capture attention. As mentioned earlier, humans have evolutionarily been primed to attend to biologically threatening stimuli such as snakes and spiders (Öhman & Mineka, 2001). Furthermore, social threats can also be attention grabbing:

for instance, angry faces are often processed faster and more efficiently than happy or neutral faces (Hansen & Hansen, 1998). Because social threats can be attention grabbing just like biological threats, Black faces should also capture the same level of attention.

Ito and Urland (2005) found that Black targets evoked a larger positive-going event-related brain potential (ERP), especially when participants were engaged in an explicit racial task while viewing pictures of Black or White men. These ERPs were negatively correlated with responses to threatening images such as fierce dogs, demonstrating that Black targets were perceived as threatening. Another study used the dot-probe detection paradigm to investigate whether the stereotype of young Black males was strong enough to unconsciously cause people to pay more attention, similar to evolved threats such as spiders (Trawalter, Todd, Baird, & Richeson, 2008). The dot-probe paradigm has allowed researchers to examine how people selectively attend to threatening stimuli (MacLeod, Matthews, & Tata, 1986). It requires the participant to detect the location of a dot that is hidden behind one of the two pictures presented on the computer screen. A short reaction time to indicate the location of the dot signifies that the participant was already attending to the location, and presumably, the previous stimulus at the same location. On the other hand, a longer response suggests that the participant was previously attending to the stimulus that did not have the dot behind it. Trawalter and colleagues (2008) discovered that White participants initially attend to Black rather than White male targets without explicit processing of race and danger. However, such pro-Black attentional bias became weaker in a second block as participants due to habituation, implying that the present study should focus its analysis on early time points. Based on previously stated research, attentional bias should occur towards Black faces because Blacks are perceived as threatening.

Black as Threat

Black men are often perceived as a threat both implicitly and explicitly (Cottrell & Neuberg, 2005). Because they are stereotypically viewed as dangerous, aggressive, and violent (Devine 1989), people might assume that Black men are armed and therefore shoot them. Recently, this has been demonstrated by Miller, Zielaskowski, and Plant (2012), who found that people were more likely to mistakenly shoot unarmed Black suspects than Asian or White suspects in computerized shoot/don't shoot tasks. The study also suggested that shooting bias, a process that reflects self-protecting behavior against potential threat, was not fully driven by cultural stereotypes and was instead partly triggered by the individual's differences in the perception of interpersonal threat (Miller, Zielaskowski, & Plant, 2012).

Implicit racial attitude, an unconscious negative attitude towards other racial groups, also affects the way people perceive threat. One study found that White individuals with relatively high levels of implicit racial attitude bias show heightened activity in the amygdala, a brain region that responds to unpleasant emotions and threat, when seeing Black male faces compared to White male faces that were shown for 30 ms (Cuningham et. al., 2004). The authors suggest that this difference in amygdala activity indicated heightened automatic threat responses to Black male targets. However, the differential activity in the amygdala switched to the prefrontal cortex when the stimulus was shown for 525 ms, suggesting attempts to control unwanted prejudice response. The attempt to control unwanted prejudice response is also related to one's external motivation to respond without prejudice.

External motivation to respond without prejudice. Given that previous studies have looked at external motivation to respond without prejudice (EM) in relation to attentional bias (Richeson & Trawalters, 2008; Bean et. al., 2012), this study replicated and extended the findings in investigating within-race bias. In response to changes in the social environment, White people have learned to hide overt expressions of prejudice to avoid negative social evaluation (Plant & Devine, 1998). Using startle eye-blink response as an indicator of affect process in the amygdala, Amodio and colleagues found that high-EM individuals evaluate Black targets more negatively than White targets (Amodio, Harmon-Jones, & Devine, 2003). Moreover, Richeson & Trawalter (2008) found that high EM resulted in an anxious response to Black individuals, supported by the fact that high-EM people revealed an attentional bias towards neutral Black faces presented for 30 ms and an attentional bias away from the neutral Black faces presented for 450 ms. Another study by Bean and colleagues (2012) further confirmed using eye tracking that high-EM individuals initially looked at and then attended away from Black individuals and hence a vigilance avoidance pattern. On the other hand, low-EM individuals appeared to be indifferent in their gaze.

The aforementioned research suggested that Black faces are perceived to be threatening based on the premise that people selectively attend to threatening stimuli. High-EM individuals are anxious and avoidant when Black faces are shown for a longer duration. However, it remains to be seen whether different reactions would occur towards individuals of various skin tones within the spectrum of 'Black'.

Within-Race Skin Tone Variation

Variations within race are still able to elicit racial bias tendencies. In fact, skin tone may represent a phenotypic feature that is used for racial category membership.

In most societies, light skin is valued over dark skin, and skin tone has socio-functional implications such as social status and intelligence (Neal & Wilson, 1989). Black individuals in the United States with a darker skin tone (high Afrocentric) are associated with lower levels of actual socioeconomic status and educational attainment compared to those with lighter skin tone (low Afrocentric) (Hughes & Hertel, 1990; Keith & Herring, 1991). Furthermore, Black teenager subjects associated light-brown skin tone with positive characteristics (color of the smartest girl) whereas they associated black skin with negative characteristics (color of the dumbest girl) (Anderson & Cromwell, 1977). Maddox and Gray (2002) found that descriptions of dark-skinned Blacks more closely resembled the traditionally negative stereotype of Blacks compared to light-skinned Blacks. Furthermore, the results of this work pointed towards the existence of different stereotypes within subcategories of Blacks based on skin tone. One study has shown that dark-skinned Blacks were more likely to experience negative treatment and outcomes (Blair, Judd, Sadler, & Jenkins, 2002). Hence, dark-skinned Blacks may be perceived as more negative and threatening than light-skinned Blacks. In order to confirm whether the attentional bias was due to the threatening perception of dark skin tone, physiological measures were used to indicate the extent to which the peripheral nervous system was prepped for action in light of perceive threat.

Physiological Measures

In humans, the autonomic nervous system is subdivided into sympathetic and parasympathetic branches. Sympathetic nervous system activity is associated with actions in response to aversive stimuli (Arnold, 1960) and generally the fight or flight response. On the other hand, the parasympathetic is responsible for the rest-and-digest activities. When viewing pictures that are rated as unpleasant, heart rate is observed to initially decelerate more than when neutral or pleasant pictures are viewed (Bradley & Lang 2007). Heart rate accelerates when pleasant pictures are viewed compared to neutral pictures. In contrast to heart rate, which is innervated by both sympathetic and parasympathetic branches, electrodermal activity is solely controlled by the sympathetic branch. Viewing emotional pictures (both unpleasant and pleasant) is shown to increase skin conductance activity compared to viewing neutral pictures (Lang et al., 1993).

Besides the autonomic nervous system, the somatic nervous system is also affected by emotions. Facial expressions such as smiling and frowning are often the most obvious signs of emotional engagement. Activity of the *corrugator supercilii* muscle, which controls eyebrow activities, is an indicator of distress (Ekman, Levenson, & Freissen, 1983). Its activity increases when pictures that are rated unpleasant are viewed compared to neutral pictures and decreases below baseline activity when pleasant pictures are seen (Lang et. al., 1993).

In sum, corrugator activity and heart rate are associated with hedonic valence (a dimension ranging from unpleasant to pleasant) whereas electrodermal activity is associated with emotional arousal (a dimension ranging from calm to excited). Thus, in the current research, physiological measures were incorporated in addition to the dot-probe paradigm to ensure that the stimuli were attended because of their threatening nature.

Present Research

Studies have investigated attentional bias towards pictures of Black men by using the dot-probe detection paradigm involving pictures of White and Black faces (Trawalter, Todd, Baird, & Richeson, 2008; Richeson & Trawalter, 2008). This study attempted to expand on the literature by incorporating physiological measures which could lend support to the idea that Black faces capture attention because they are perceived as threatening. Within-race bias towards darker skin tone has also been well documented. Using the dot-probe paradigm adds onto studies such as Maddox and Gray's (2002) in looking at whether skin tone is sufficient to activate an automatic threatened response. Hence, the aforementioned factors led me to examine attentional bias to dark versus light Black skin tone using the dot-probe paradigm. The current experiment not only aimed to explore the extent to which higher Afrocentric faces capture attention but also whether higher Afrocentric faces produce a threat response as indicated in physiological data. In addition, another aim was to determine whether external motivation to response without prejudice moderates attentional and threat effects. This would add to the current literature on within-race bias and also the biological basis of attentional bias.

As skin tone was justified to be a sufficient cue to activate racial categorization (Maddox & Chase, 2004), the present work used a dot-probe paradigm involving pairs of faces that vary only in skin color. In this experiment, pictures of young Black men's faces were used. The only difference between the pictures with high and low Afrocentric features was skin tone, which was either dark or light. On the critical trials, one high and one low Afrocentric face were presented simultaneously, which was then followed by the appearance of a dot in one of the two locations. First, I predicted that, in presence of one high and low Afrocentric face, there would be a shorter response time to locate the dot obscured by high Afrocentric face than the low Afrocentric face, which would reflect an attentional bias towards high Afrocentric feature. Secondly, if the high Afrocentric features were to evoke the feeling of threat, I predicted that trials where both high Afrocentric faces appear would elicit physiological signals that indicate the most unpleasantness (higher corrugator activity and larger deceleration of heart rate) or highest arousal (higher skin conductance), followed by trials consisting one high and one low Afrocentric face and then by trials consisting of a pair of low Afrocentric faces. Finally, I predicted that high-EM participants would avoid high Afrocentric faces and hence be faster in detecting the dot masked by the low Afrocentric face and showing greater threat response in physiological measures than middle and low-EM participants.

Method

Participants

Sixty-three students from Tufts University (41 females; M_{age} = 19.10 years, SD_{age} = 1.65 years) participated for course credit. Participants were 73% White, 24% Asian, 8% Black or African American, 2% Native Hawaiian or Other Pacific Islander, and 3% declined to provide this information; 9.5% were of Hispanic origin. There were 46 White participants, including 32 females. The Institutional Review Board at Tufts University approved all study procedures, and all participants provided informed consent prior to participating in the study.

Materials

Face stimuli. There were 24 pairs of facial stimuli. Each pair only differed in skin tone, resulting in 24 pictures of dark-skinned Black faces and 24 pictures of light-skinned Black faces before a neutral gray background. All pictures included frontal views of the neck and face, excluding parts of the forehead and were approximately matched for age (late teens to mid-twenties). The faces, made using FaceGen software (version 3.2.6, Singular Inversions Inc.), were selected out of 48 faces based on realism rating on a scale of 1 (not realistic) to 3 (realistic), provided by 4 research assistants. Based on these ratings, the top 24 faces in ratings for dark-skinned (M_{rating} = 1.94, SD_{rating} = 0.49) and light-skinned faces (M_{rating} = 1.84, SD_{rating}

= 0.61) were selected, and there was no significant mean difference of realism t (47) = 1.329, p = .190

Dot-probe task. The dot probe task was programmed using E-Prime software (version 1.1.4.1, Psychology Software Tools, Inc., Pittsburgh, PA, USA). In each trial, participants first saw a fixation cross for 1s, then two faces displayed at 6° of the visual arc to the left and right of fixation for 500 ms. One of the faces was subsequently replaced by a small black dot that lasted for 1500 ms or until the participant indicated its location by pressing either the left or right mouse button. Afterwards, a gray blank slide lasting 500 ms followed. There were 56 critical trials in which one high and one low Afrocentric face were presented in the same slide, and 28 trials each with the presence of either two high Afrocentric faces or two low Afrocentric faces in the same slide. Picture position and the dot location (left or right of fixation cross) were both randomized across trials. See Figure 1 for a diagram of the trial structure.

The reaction time to indicate the location of the dot served as a dependent variable. Throughout this manuscript, I use the following abbreviations to denote each of the four conditions of the task: HH_H, HL_H, HL_L, LL_L where H = High Afrocentric feature (dark skin tone), and L = Low Afrocentric feature (light skin tone). The letter after the underscore indicates the type of face behind which the dot probe subsequently appeared. Attentional bias towards high Afrocentric features was present if response time was slower for HL_L than HL_H. A facilitated engagement (calculated by LL_L – HL_H) and delayed disengagement (calculated by HL_L – LL_L) of attention would also be computed if the traditional bias score just described revealed a significant difference.

External motivation to respond without prejudice. Participants completed Internal and External Motivation to Respond without Prejudice scale (Plant & Devine, 1998) during the online pre-screening via Sona. The Internal Motivation to Respond without Prejudice scale (IMS) consists of 5 items (e.g., "I attempt to act in nonprejudiced ways toward Black people because it is personally important to me.") The External Motivation to Respond without Prejudice scale (EMS) consists of 5 items (e.g., "Because of today's PC (politically correct) standards I try to appear nonprejudiced toward Black people."). Participants used 7-point Likert-type scales to rate the degree to which they agree with each statement (1 = strongly disagree, 7 = strongly agree) (See Appendix A for the entire scale). The Cronbach's alpha for EMS was .882 whereas the Cronbach's alpha for IMS was .820.

Peripheral Physiology

Physiological data were collected using a MP150 system and AcqKnowledge 3.8.2 software (Biopac, Goleta, CA) throughout the dot probe task.

Corrugator electromyography (EMG). Corrugator EMG was used as an objective measurement of facial expressive behavior. It has been established that greater corrugator activity signifies unpleasant emotion, whereas lower corrugator activity signifies pleasant emotions (Larsen, Norris, & Cacioppo, 2003). Following site preparation with an electrode preparation pad, two 4-mm Ag/AgCl electrodes were placed over the *corrugator supercilii* muscle region. Data were sampled at 1,000 Hz and filtered from 5 Hz to 3 kHz (60-Hz notch filter on) online. Offline, data were resampled to 400 Hz, rectified and smoothed with a 16-Hz low-pass filter, decimated to 4 Hz, and smoothed with a 1-s prior moving average filter. These steps were completed in part with Matlab software (Mathworks, Natick, MA) using ANSLAB routines (Wilhelm & Peyk, 2005).

Electrocardiography. Electrocardiography was used to measure heart rate (HR), which is innervated by the sympathetic and parasympathetic system of the autonomic nervous system. When viewing unpleasant pictures, HR is known to slow down due the parasympathetic system. After wiping the left and right collarbones on the chest with electrode preparation pad, two disposable Ag/AgCl electrodes pre-gelled with 7% chloride (1 cm circular contact area) were placed on the same location. ECG was collected continuously at 1,000 Hz.

Offline, the ECG signal was downsampled to 400 Hz and bandpass-filtered from 0.5 to 40 Hz. Interbeat interval series were created by identifying the R-spikes using automated ANSLAB algorithms. R-spikes that were incorrectly identified or were missed were manually changed or selected, respectively. After such artifact correction, the interbeat interval series was converted to HR in beats per minute. HR data was decimated to 10 Hz and then smoothed with a 1-s prior moving average filter.

Electrodermal activity. Electrodermal activity (EDA) was used to measure sympathetic activation through skin conductance level. Two disposable Ag/AgCl electrodes pre-gelled with 0.5% chloride isotonic gel (1 cm circular contact area) were attached to the distal phalanges of the index and middle fingers of the subject's non-dominant hand. One additional ground electrode for all physiological channels was placed on the back of the neck. EDA level was recorded with DC coupling and constant voltage electrode excitation at 31.25 (sensitivity = 0.7 nS). Offline, EDA was smoothed with a 1 Hz low-pass filter, decimated to 10 Hz, and linearly detrended on a trial-by-trial basis.

Procedure

Participants were greeted and led to a laboratory room by an experimenter. After providing informed consent, two experimenters attached the EMG, ECG, and

EDA sensors to participants and calibrated for eye tracking recording (the data from which are not reported). First, subjects completed an emotion regulation task investigating the effect of cognitive reappraisal on cognitive load. Afterwards, subjects either completed this task and another dot probe task investigating attentional bias using Black and Whites faces, and the order of these two tasks was counterbalanced. One experimenter then read the instructions displayed on the participant's computer screen. Instructions prompted subjects to look naturally at the faces and indicate the location of the dot as quickly and accurately as possible. After the experiment was over, participants were asked to complete a demographic questionnaire and were then debriefed, thanked, and credited for their participation.

Data Analysis

One prediction of this study was that high Afrocentric faces would be viewed as more threatening than low Afrocentric faces, which would be reflected in physiological measures that are sensitive to valence and arousal dimensions of emotions. An increase in EMG and EDA activity and a deceleration in HR activity were expected. In order to measure such change in activity, each 500-ms time bin during the 2-s window of interest, during which the two faces were presented, were baseline corrected for the 500-ms time bin preceding the picture onset. After the baseline correction, physiological activity during each time bin was averaged across trials within conditions for each participant. The baseline-corrected means were then tested with a multivariate general linear model (GLM) to assess the effects of condition (HH_H, HL_H, HL_L, LL_L) and time (4 bins: 0.5, 1.0, 1.5, and 2.0 s post face onset) on physiological data.

In order to connect the above analyses with motivations to respond without prejudice, I conducted additional analysis to examine the interaction between

IMS/EMS and response time or IMS/EMS and each physiological measure. The cut-off point for high-EM group (top one third ranking) was 25 whereas the cut-off point for high-IM group was 32. In addition, to further analyze whether high-EM individuals would show avoidance (lack of attentional bias), a correlation of attentional bias scores in response time (HL_L-HL_H) with EM was conducted and followed up by a linear regression.

Data Retention

Incorrect responses and responses with latencies less than 150 ms were deleted from the data set. In addition, trials with latencies larger than 4 standard deviations than the within-subjects mean were removed. Across all conditions and participants, 99% of trials were retained for EMG and EDA, 98% for HR, and 98% for response time. In addition, multivariate outliers were excluded based on Mahalanobis Distance using average values across each measure ($p < .001$). Two subjects were excluded on this basis for EMG and one for EDA. Finally, due to previous research showing race-based attentional biases in only White participants, non-White participants were also excluded from analyses. Accounting for correct trials and the quality of the data, the subsample sizes for EMG, EDA, and HR were 39, 41, and 42 participants, respectively. When incorporated IMS and EMS for further analyses, the incompletion of scales reduced the subsample size for each measure by ten.

Results

Results were considered statistically significant at an alpha of 0.05 (two-tailed). Multivariate *F* statistics are reported for the repeated measures GLMs. Table 1 presents descriptives for response time, EMG, EDA, and HR for each condition.

Attentional Bias Effects on Response Time

A GLM analysis was conducted on average response time across all trials for each condition to explore the first hypothesis, which is whether there was an attentional bias shown in response time. However, contrary to predictions, the average response time to indicate the location of the probe did not differ significantly as a function of Condition, F (3, 40) = 0.078, p = .971. There was a significant effect of time on response time, F (1, 42) = 6.259, p = .016, indicating participants became familiar and quicker with the task.

Threat Response to High Afrocentric Faces

The second hypothesis, which stated that the condition HH_H would be viewed as the most threatening and arousing followed by HL_H or HL_L and then LL_L, was investigated by running each physiological measure with a GLM since the pictures' onset (see Figure 2 for summary). Support for the hypothesis would require either a significant main effect of Condition or a significant Condition X Time interaction. There was no significant main effect of Condition for corrugator, F (3, 37) = 0.324, p = .808, EDA, F (3, 37) = 0.126, p = .944, and HR F (3, 37) =1.144, p = .343. There also was no significant Condition x Time interaction for any of the physiological measures, corrugator F (9, 30) = 1.160, p = .355, EDA F (9, 32) = 1.029, p = .439, and HR F (9, 33) = 1.571, p = .165.

For all three physiological measures, there was a significant main effect of time for corrugator activity, F (3, 36) = 7.069, p = .001, EDA, F (3, 38) = 4.071, p = .013 and HR, F (3, 39) = 12.259, p < .001. This means that there is some physiological response across conditions, which may indicate threat in response to all conditions.

Follow-up two-tailed t-tests were conducted to investigate if the faces were perceived as threatening at all. Each physiological measure at each time point was compared to a test value of 0. For all four conditions, there was a significant effect for time point 1 for corrugator activity (HH_H: t (38) = 2.932, p = .006, HL_H: t (38) = 3.563, p = .001, HL_L: t (38) = 2.850, p = .007, LL_L: t (38) = 2.881, p = .006), and HR activity (HH_H: t (41) = 3.344, p = .002, HL_H: t (41) = 3.257, p = .002, HL_L: t (41) = 4.576, p < .001, LL_L: t (41) = 1.863, p = .070).

Individual Differences

After the aforementioned analyses, a correlation was conducted to see whether the behavioral measure of attentional bias – albeit not significant across the entire sample – correlated with the physiological measures. In this case, the traditional attentional bias score was calculated by the following formula: HL_L – HL_H (Richeson & Trawalter, 2008). There was no significant correlation between reaction time and corrugator activity, r (39) = 0.087, p = .598, EDA, r (41) = -0.060, p = .709, or HR, r (42) = 0.133, p = .401.

A further correlation was conducted on the attentional bias score of response time and the threat score for the physiological measures, which is calculated by the following formula: HH_H – LL_L. There was no significant correlation of attentional bias score of reaction time with corrugator activity r (39) = 0.052, p = .749, EDA, r (41) = -0.10, p = .952, or HR, r (42) = -0.091, p = .567.

As the previous analysis suggested that there are significant differences of corrugator activity and HR in time point 1, another correlation was conducted with attentional bias score of reaction time with the threat score of physiological data for that time point. There was no significant correlation of attentional bias score of response time with corrugator activity r (39) = 0.101, p = .542, EDA, r (41) = -0.249, p = .116, or HR, r (42) = -0.086, p = .586.

IMS/EMS

The third hypothesis was that high-EM individuals would show avoidance towards Afrocentric face instead of attentional bias. A GLM showed that there was no interaction between condition and EM in response time, F (3, 26) = 1.541, p = .228. As justified by the previous analysis, the analysis for each physiological measure was focused on time point 1. There was no significant interaction between condition and EM in corrugator activity, F (3, 23) = 0.671, p = .578, EDA, F (3, 25) = 0.838, p = .486, or HR, F (3, 25) = 0.209, p = .889. As for internal motivation to respond without prejudice (IM), there was no interaction between condition and IM in response time, F (3. 27) = 0.378 p = .769, corrugator activity, F (3, 24) = 2.171, p = .118, EDA, F (3, 26) = 0.292, p = .831, or HR, F (3, 26) = 0.769, p = .522.

Although there was no interaction between condition and EM, upon inspection of EM group differences in each condition using GLM, there was a significant difference for the HL_L in response time between high-EM (M = 417.704 ms, SE = 18.347) and middle/low-EM participants (M = 471.875, SE = 12.973), p = .023.

In order to further investigate the relationship between IM/EM and attentional bias, a correlation was conducted using the previous calculation of attentional bias score in response time. There was no significant between IM and attentional bias score in response time, r (31) = 0.229, p = .216, but a nearly significant trend between EM and attentional bias score in response time, r (30) = -0.354, p = .055 (see Figure 3). Higher levels of EM were associated lower attentional bias score, which reflect higher avoidance to the dark-skinned faces relative to the light-skinned faces. To determine whether the aforementioned correlation was driven by shorter reaction time to attend low Afrocentric face or by longer reaction time to attend to the high Afrocentric face, a linear regression was conducted to determine if EM (dependent variable) could be predicted from reaction times of HL_L and HL_H (independent variables). The overall model was marginally significant F (2, 29) = 2.625, p = .091, $r^2 = 0.163$. Moreover, the reaction times of HL_L, β = -1.160, t (27) = -2.283, p = .031, and HL_H, β = 1.053, t (27) = 2.073, p = .048, significantly predicted EM. These two separate predictors reflected that high-EM participants avoided rather than attended dark-skinned Black faces due to a longer response time of HL_H and a shorter response time of HL_L when compared to middle/low-EM participants.

Discussion

Summary of Results

This study was set to extend the traditional racial attentional bias among White people shown towards Blacks in the dot probe paradigm (Richeson & Trawalter 2008) by replacing black and white faces with Afrocentric faces that only differ in skin tone (dark vs. light skin). Physiological indices of emotional responding were also examined in order to support the attentional bias effect due to threat perception. Moreover, this study was set to understand whether attentional bias to dark skin tone reflects initial attentional engagement or a difficulty with attentional disengagement. The first hypothesis was that the response time of the HL_H condition was expected to be shorter than the HL_L condition, assuming that there was an attentional bias towards the high Afrocentric face. The results did not provide any significant support for this hypothesis. The physiological data also failed to support the second hypothesis which stated that the high Afrocentric faces would be perceived as the most threatening as seen in bodily signals. The reaction time and physiological data also failed to support the third hypothesis regarding high-EM individuals engaging in avoidance behavior and exhibiting a stronger threat response based on the physiological data.

Explanation for the Lack of Support for the Hypotheses

It was expected that there would be a traditional attentional bias towards the high Afrocentric faces. There may be several reasons that may explain the non-significant findings in the reaction time data. First of all, the timing of the stimulus presentation may have had an impact on the findings. The faces were shown for 500 ms, which according to Cuningham et al. (2004), was enough time to activate the prefrontal cortex. In fact, Richeson and Walters (2008) demonstrated that, at least for individuals with high external motivation to respond without prejudice, they had an attentional bias *away* from the neutral Black faces presented for 450 ms. It was only when the faces were shown for 30 ms that the participants showed an attentional bias towards the neutral Black faces (Richeson & Walters 2008) and a heightened activity in just the amygdala (Cuningham et. al., 2004). Hence, since the faces were shown for 500 ms in this study, the opposite of the hypothesis should have been expected, especially for participants with higher external motivation to respond without prejudice. Though the third hypothesis was not supported, there was a trend in which attentional bias score in response time was negatively correlated with EM. The negative correlation implied that high-EM individuals were avoiding rather than attending high Afrocentric faces, corresponding to existing literature (Richeson & Trawalter, 2008).

Theoretical and Practical Implications

In this study, there was a significant main effect of time on response time, indicating that participants in this study became familiar with the task and got faster. However, the absence of interaction between time and condition for response time indicated that the threat reaction might have dissipated as participants habituated to the faces (Trawalter, Todd, Baird, & Richeson, 2008). The null effect of response time on condition suggested that the differences between dark-skinned and light-skinned Black faces might not be strong enough to cause an attentional bias.

The physiological measures used in this study also indicated that skin tone might not be a strong enough cue to elicit within-race categorization and hence attentional bias. Corrugator activity and HR were used as means to measure expressive behavior whereas EDA were used to measure arousal level. All three aforementioned measures did not differ significantly and did not have a significant interaction between time and condition. It was worth noting that there was a significant difference between a test value of 0 for corrugator activity and HR at time point 1 (first 500 ms) for all conditions. This suggested that both high and low Afrocentric faces were seen as threatening and that future analyses should focus on early time points when looking at correlations.

Though there was no significant interaction between EM and condition for each of the dependent measures, the nearly significant trend of attentional bias score in response time negatively correlating with EM may imply that attentional bias was not present for most high-EM individuals due to the pattern of avoidance (Bean et. al., 2012). Further analysis of the linear regression demonstrated that this trend was in fact driven by participant's avoidance of the dark-skinned Black faces and their shift of attention to the light-skinned Black faces. Such encouraging trend signifies that EM may be an important factor regulating within-race categorization and attentional bias.

Limitations

There are several limitations that may explain the null findings of this study. One limitation was that habituation occurred throughout the task and nullified any possible effect of attentional bias and threat responses. Participants were focused on the completion on the task and hence developed strategies for short cuts such as always staring at one side of the screen. This phenomenon was evident during some of the experimental sessions where it was obvious from a real-time eye-tracking display that some participants looked at either the left or right side of the screen throughout large portions of the study. If the dot did not appear on the side on which they were focusing, they would simply indicate the opposite response. Such a strategy to complete the task would not only defeat the whole purpose of measuring attentional bias as only the face on a specific side would be attended all the time, but it would also affect the physiological data as the participants may just tune out everything else and just focus on the dot.

Though the null effect of physiological measure for all conditions may indicate the possibility that dark-skinned Blacks didn't induce greater perceived threat than light-skinned Blacks, existing published literature has shown that dark-skinned Blacks are perceived as more negatively and threatening than their counterparts (Maddox & Gray, 2002). Hence, there are also a number of methodological limitations that explain the null effect. One possible explanation could be that this task had always followed a task investigating cognitive reappraisal. The cognitive reappraisal task could be emotionally draining and may use up one's cognitive resource. Having faced very arousing and provocative images prior to this task, neutral Black faces may comparatively seem to be almost non-arousing and boring. This reason may explain why the mean change in EDA for each condition turned out to be negative, which was opposite of the expectation. Theoretically, participants should become anxious when seeing black faces that were presented for 525 ms (Cuningham et. al., 2004). Exposed to grotesque images may have already caused the participants to be in a high arousal state, which could explain the miniscule changes in

EDA. Although corrugator activity and HR did show a brief expected response within the first second for all four conditions, the overall non-significance of physiological data may indicate that the differences of skin tone between faces were not sufficiently different in terms of threat to cause large differences in bodily signals.

Directions for Future Research

There are several ways to improve this study in accordance to its limitations. First, the task should be conducted on its own without any preceding emotional task so that the faces would no longer be deemed as boring due to comparisons with images in other tasks. This change would allow the attentional bias effect and the bodily responses to threat become more salient. Furthermore, this study should have the pictures to be displayed only for 30 ms in order to capture the attentional bias effect (Richeson & Walters 2008; Trawalter, Todd, Baird, & Richeson, 2008). The fact that attentional bias would only exist when Black faces were shown for a short interval indicates that the stimuli may be avoided due to its threatening and dangerous nature. The blank slide following the dot slide should also vary from a range of 250 ms to 750 ms (averaging out to 500 ms) in order to prevent participants from habituating as habituation may have negated the attentional bias effect (Trawalter, Todd, Baird, & Richeson, 2008). Most importantly, to fix the problem of some participants focusing their gaze on a specific side of the screen, the dot-probe task could incorporate trials with picture pairs positioned above and below the fixation cross in addition to left and right. Participants then could not focus either left or right of the fixation but would have to return to the fixation cross for more efficiency. Another solution would be to use an eye tracking software to ensure that the trials would only start after the participants fixate on the cross. A future study should not only recruit more White participants to increase the statistical power for EM analysis, but it should also ensure that no tasks precede it.

In addition, future studies should try to improve the internal validity through manipulating other Afrocentric features along with skin tone to build a stronger effect of within-race bias. Perhaps adding facial expressions to the faces would enhance the attentional bias effect. Richeson and Trawalter (2008) demonstrated there was an attentional bias for neutral faces but not happy faces in a context of mixed neutral and happy faces. It may be that this context was important for showing the attentional bias effect in that study because neutral faces would be deem as more threatening when happy faces were also presented. To further establish the external validity of this task, more participants of different races should be recruited for additional analysis of such within-race bias for Afrocentric features.

Concluding Comment

In conclusion, the aim of the present study was to assess attentional bias towards dark-skinned Blacks and EM's effect on such bias while also assessing the threatening responses to skin tone variation through physiological measures. Although both dark-skinned and light-skinned faces were viewed as threatening, there was no effect of condition, indicating that skin tone might not be strong enough to elicit within-race attentional bias. Such null findings, however, should not be overemphasized due to methodological flaws. On the other hand, there was an encouraging trend in which high-EM individuals showed avoidance in attention towards dark skin tone. Such trend could possibly become a significant effect if the appropriate limitations were addressed. All in all, the novel idea of measuring physiological data with attentional bias should be further tested and may one day help establish a biological basis of racial stereotypes.

Table 1

Means (and Standard Errors) for the Dependent Measures of each condition

Dependent Measure	HH_H	HL_H	HL_L	LL_L
Response Time (ms)	463.46 (12.25)	461.00 (12.38)	462.87 (11.55)	462.35 (11.75)
Corrugator activity (change in μV)	0.080 (0.033)	0.047 (0.031)	0.057 (0.033)	0.061 (0.022)
Heart rate (change in BPM)	0.069 (0.126)	-0.004 (0.115)	0.088 (0.130)	-0.200 (0.110)
Electrodermal activity (change in μS)	-0.002 (0.002)	-0.001 (0.002)	-0.002 (0.002)	-0.001 (0.002)

Note. H = High Afrocentric face, L = Low Afrocentric face. The letter after the underscore indicates the dot's subsequent location.

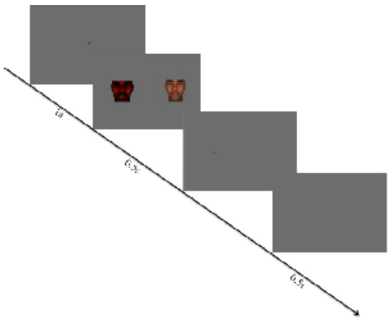
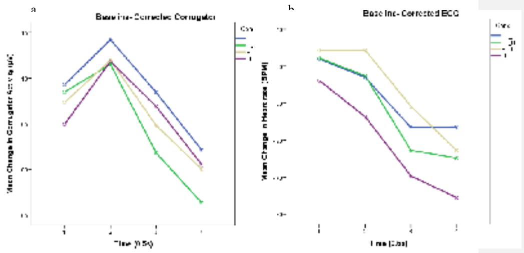
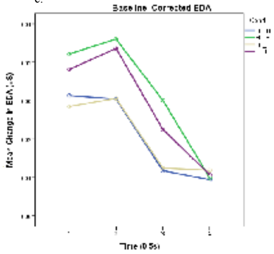


Figure 1. Trial structure. Trial began with a black fixation cross in the center of a gray screen for 1 s, followed by the presentation of two faces displayed at 6° to the left and right of fixation for 0.5 s. One of the faces was subsequently replaced by a small black dot that lasted for 1500 ms or until the participant indicated its location with the corresponding mouse button. A gray blank slide was then presented for 0.5 s.

a b



c.



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b

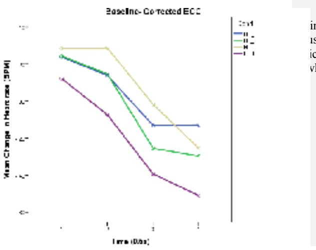

Figure 2. Post-face onset physiologic … in μV), b (heart rate change in beats pe… …strate change in activity over the two secor… …ic feature, and L = Low Afrocentric fea… …which the dot probe appears.

c

Appendix A

External Motivation to Respond without Prejudice Scale (EMS) and Internal Motivation to Respond without Prejudice Scale (IMS) (Plant & Devine 1998)

Instructions: The following questions concern various reasons or motivations people might have for trying to respond in nonprejudiced ways toward Black people. Some of the reasons reflect internal-personal motivations whereas others reflect more external-social motivations. Of course, people may be motivated for both internal and external reasons; we want to emphasize that neither type of motivation is by definition better than the other. In addition, we want to be clear that we are not evaluating you or your individual responses. All your responses will be completely confidential. We are simply trying to get an idea of the types of motivations that students in general have for responding in nonprejudiced ways. If we are to learn anything useful, it is important that you respond to each of the questions openly and honestly. Please give your response according to the scale below.

External Motivation to Respond without Prejudice Scale (EMS)

1. Because of today's PC (politically correct) standards I try to appear nonprejudiced toward Black people.
2. I attempt to appear nonprejudiced toward Black people in order to avoid disapproval from others.
3. I try to act nonprejudiced toward Black people because of pressure from others.
4. I try to hide any negative thoughts about Black people in order to avoid negative reactions from others.
5. If I acted prejudiced toward Black people, I would be concerned that others would be angry with me.

Internal Motivation to Respond without Prejudice Scale (IMS)

1. I attempt to act in nonprejudiced ways toward Black people because it is personally important to me.
2. I am personally motivated by my beliefs to be nonprejudiced toward Black people.
3. According to my personal values, using stereotypes about Blacks is OK. (R)
4. Because of my personal values, I believe that using stereotypes about Black people is wrong.
5. Being nonprejudiced toward Blacks is important to my self-concept.

Note: (R) indicates reverse coded item. Participants rated 10 items on a scale ranging from 1 (strongly disagree) to 7 (strongly agree).

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