2006

Vigilance In African Americans: Cardiovascular reactivity and phasic heart period reactions to cued threat and nonthreat stimuli

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Vigilance in African Americans: Cardiovascular Reactivity and Phasic Heart Period Reactions to Cued Threat and Nonthreat Stimuli

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
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Date of Approval:
May 31, 2006

Keywords: race, stereotype, health, vagal, parasympathetic

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ABSTRACT

African Americans are at a greater risk of developing cardiovascular disease and associated risk factors than are Whites, and recent research has suggested that the effects of racial discrimination are a significant contributor to this disparity. Thus, a preattentive bias and vigilance for threat might serve as a mechanism through which experienced racial discrimination would negatively impact cardiovascular health. A study was conducted to investigate the physiological and attentional underpinnings of vigilance for discriminatory threat via examination of phasic heart period (HP) responses to cued threat and nonthreat stimuli. Thirty African American and forty-two European American undergraduate students from a large urban university participated in the study. Phasic HP reactions of participants were recorded during an S1-S2 procedure where cued stereotype-related threatening, nonstereotype-related threatening, and nonthreatening stimuli were presented. It was hypothesized that Blacks, more than Whites, would show: smaller magnitude and impaired habituation of cardiac orienting to neutral words; acceleration of heart rate in response to threat words; and a conditioned anticipatory heart rate deceleration to threat words over repeated trials. However, results did not support hypotheses; neither Whites nor

Blacks exhibited significant changes in phasic heart period in response to cued stimuli.

Introduction

"Injustice anywhere is a threat to justice everywhere."
Dr. Martin Luther King, Jr.

Epidemiological studies have consistently shown that African Americans are at a greater risk of developing cardiovascular disease (CVD) (see Wyatt, Williams, Calvin, Henderson, Walker & Winters, 2003, for a review) and associated risk factors, such as hypertension (American Heart Association, 1999; Gillum, 1991; National Center for Health Statistics, 1993). While ethnic differences in diet, physical activity, and obesity have been found to contribute to those differences, a growing body of research has suggested that the effects of racial discrimination are a significant contributor to disparities in rates of hypertension and CVD between Blacks and Whites (Anderson, McNeilly & Myers, 1992; Brondolo, Rieppi, Kelly, & Gerin, 2003; Clark, Anderson, Clark & Williams, 1999; Contrada et al., 2000; Krieger, 1990; Williams, 1992; Wyatt et al., 2003). Though this research has yielded a legitimate connection between perceived discrimination by African Americans and diminished cardiovascular health, the mechanism through which this connection exists is not entirely understood.

One of the ways in which racism is manifested within a target is as an acute or chronic stressor (Allison, 1998; Feagin, 1991; Swim, Cohen, & Hyers, 1998). An acute stress experience (e.g., being the target of a racial slur and

verbally or physically responding to it) can be characterized by a short-lived perception of threat and stressor followed by an acute response, whereas chronic stress (i.e., repeatedly perceiving experiences to be prejudicial and developing vigilance towards potential discriminatory events) can be characterized by chronic perceptions of threat and stress followed by chronic responding (Baum, O'Keefe, & Davidson, 1990; Dougall & Baum, 2001). Further, experienced acute and chronic stressors can lead to poor cardiovascular reactivity and health (Dougall & Baum, 2001). However, much of the research providing evidence for the causal link between perceived discrimination as stressor and poor cardiovascular health has been limited to comparisons of self-reports of experienced discrimination to cardiovascular responses to non-discrimination stressors or to the presence of associated risk factors for CVD (see Wyatt, Williams, Calvin, Henderson, Walker, & Winters, 2003 for a review).

The research falls short in providing insight on the mechanism through which experienced discrimination affects cardiovascular health. How exactly does stress resulting from discrimination and prejudice manifest itself psychologically and physiologically within the target of that discrimination? The present research effort endeavors to answer that question, at least in part, by positing that African Americans, as the targets of frequent and myriad forms of racism, form a preattentive bias towards potential threat in their environment. In other words, the hypothesis here is that African Americans exhibit an autonomic response to potential race-related threats that European Americans do not. Moreover, it is the decrease in parasympathetically-mediated heart rate variability

(HRV) and an inability to habituate to novel stimuli resulting from this autonomic response that may provide a partial explanation for the elevated risk for hypertension and CVD in African Americans.

However, before addressing the mechanism through which discrimination impacts cardiovascular health, it is important to provide a review of the relevant literature that provides the backdrop for the current research. This review is loosely divided into three sections: Racism, Vigilance for Threat, and Phasic Cardiac Reactions. Though a comprehensive review on the etiology of racism is beyond the scope of this review, the first section provides a general introduction that addresses the prevalence of racism, types or forms of racism (e.g., modern, overt), and how racism is perceived by the target (e.g., via signal detection theory). The second section provides a brief (due to the paucity of research in the area) overview on the concept of vigilance for threat, and how vigilance is seen to mediate the relationship between stress and cardiovascular reactivity and health. Again, the current research suggests that repeated exposure to discrimination creates a preattentive vigilance effect in African Americans, and that this vigilance effect is a potential mediator between the chronic stressors resulting from discrimination and cardiovascular health. The third and final section discusses phasic cardiac reactivity, and the use of the S1-S2 paradigm as a means of assessing and measuring vigilance for threat in African Americans.

Racism: Prevalence and Perception

Much of the existing body of research on racial prejudice centers on those who form, hold, and impart prejudicial beliefs (Oyserman & Swim, 2001; Swim & Stangor, 1998). While this research has obvious merit in helping to shed light on the mechanisms underlying the manifestation of racial prejudice, it has not provided any insight on the impact that prejudicial treatment has on its target. Recently, however, researchers have begun to explore the impact of prejudice on the social, psychological, and physical well being of those who must bear it; and, in doing so, they have begun to examine discrimination from the target's perspective. This shift in research focus has produced a body of work that, while not exhaustive, has produced substantive insight on the prevalence and perceptions of racial discrimination experienced by African Americans.

Prevalence of racial prejudice. Given our past and present cultural climate, one might intuitively assume that African Americans experience some form of racial prejudice on a frequent, if not daily, basis. However, it is difficult to assess the frequency with which African Americans encounter discrimination and prejudice, as prevalence studies tend to examine the perpetrators of discrimination via the endorsement of their prejudiced beliefs and/or situational factors leading to them to act out those beliefs (Swim, Cohen & Hyers, 1998). To date, few studies have been conducted to measure frequency of encounters with discrimination from African Americans' perspective, though those that have seem to confirm that these encounters do occur quite frequently (Essed, 1991; Feagin & Sikes, 1994).

Sociologists have explored (via retrospective self-report measures) the frequency with which African Americans must deal with racism in their daily lives by using: Likert-type scales ranging from *always* to *never* (Williams, 1997); dichotomous (e.g., yes/no) indicators of how often African Americans have received bad treatment in the past month because of their race; or, percentage estimates of time that respondents spent experiencing racism (Swim, Hyers, Cohen, Fitzgerald, & Bylsma, 2003). These studies report that African Americans experience racism "sometimes", responding at a 2.5 on a 1 (never) to 5 (always) scale (Shulz, Williams, Israel, Becker, Parker, James, 2000); approximately 20% of the time when applying for employment (Fix & Struyk, 1993); and about 60% of the time when making applications for housing (Massey, Gross, & Shibuya, 1994).

The changing nature of racism due to changing social forces (see Dovidio, Brigham, Johnson, & Gaertner, 1996 for a review) is a significant obstacle to accurately assessing its prevalence. Prevailing social norms within our culture have shifted the manifestation of prejudice from the overt to the covert (i.e., modern racism, which takes on more ambiguous forms such as receiving poor service or being trailed in stores by security guards); or, in other words, the expression or acting out of overt racial prejudice in today's culture is incongruent (and in some cases illegal) with the strongly advocated value of equality in our society (Tougas et al., 2004). The following two sections provide a general treatment on these two different, yet related, forms of racism.

Overt racism. Social psychological research has consistently found that racism, usually operationalized as negative stereotypes of Blacks held by Whites (instead of reported behavior towards Blacks by Whites), has been on the decline over the past 7 decades (Nail, Harton & Decker, 2003). For example, in 1933, Katz & Braly conducted a survey of college students and found that 84% of respondents reported African Americans as being superstitious. Gilbert's study in 1951 saw this percentage drop to 51%, and by 1993 the percentage of respondents reporting Blacks as superstitious had fallen to 1% (Dovidio, Brigham, Johnson & Gaertner, 1996). However, as Nail et al. (2003) point out, studies showing declines in racial prejudice do not account for perceived discrimination of more subtle forms of racism from the target's perspective (Duncan, 1976; Gaertner & Dovidio, 1977; Johnson, Whitestone, Jackson, & Gatto, 1995; Rogers & Prentice-Dunn, 1981; Schulman et al., 1999; Vanman, Paul, Ito, & Miller, 1997). Indeed, racism has not simply shifted forms, it has assumed multiple forms, and Blacks must now learn how to deal with more ambiguous forms of racism while still coping as targets of verbal and physical acts of overt racism.

In 1996, Landrine & Klonoff conducted a study in which African Americans were asked to provide percentages of time where they had experienced racism in everyday forms (their survey focused on the source of the racism, rather than the type). Specifically, African Americans were asked about their experiences with such overt forms of racism as being the target of name-calling, being falsely suspected or accused, and being made fun of or harmed. Nearly all respondents

(98%) reported experiencing some type of racism at least 1% of the time during the previous year, while 100% of respondents reported experiencing some type of racism during their lifetime, usually from strangers. Further, 70% of respondents who had experienced racism reported feeling “extremely angry”, and more than 30% reported taking some sort of responsive action.

Similarly, D’Augelli and Hershberger (1993) conducted a survey of how frequently African Americans reported experiencing overt forms of racism while in college. The majority of respondents (89%) reported that they had occasionally to frequently overheard general disparaging remarks about African Americans while on campus, and 59% reported that they themselves had been the targets of those remarks. Additionally, 36% of respondents reported being the target of physical threat or violence. Other studies have reported frequencies of African Americans’ experiences with racism (Essed, 1991; Feagin, 1991), along with perceptions of how problematic prejudice is for themselves or African Americans in general (Adams & Dressler, 1988; Sigelman & Welch, 1993); Though, as Sigelman & Welch point out, these studies deal with broad quality of life dimensions, and not with specific, everyday occurrences of overt and more subtle forms of racism.

Beyond examining the frequency with which Blacks encounter discrimination in their daily lives, a few researchers have examined the types of experiences that African Americans perceive as discriminatory. Swim and her colleagues found that African Americans typically reported encountering three types of discriminatory behaviors: (1) being stared at, glared at, or watched (e.g.,

while shopping in stores); (2) verbal expressions of prejudice (e.g., racial slurs, insensitive comments, and stereotyping); and (3) bad service (Swim, Cohen, Hyers, Fitzgerald, & Bylsma, 1997).

Feagin and colleagues conducted interviews of African American men and women concerning the types of racist experiences they encountered, and respondents reported receiving threats, poor service, verbal attacks, and harassment (Feagin, 1991 ;Feagin & Sikes, 1994). Respondents in those studies also reported multiple incidents of employment rejections, physical attacks, and police threats. More recently, Contrada and colleagues (Contrada et al., 2001) identified five forms of discrimination: (a) verbal rejection including insults and ethnic slurs; (b) avoidance such as shunning; (c) devaluation, or actions that express negative evaluations; (d) inequality-exclusion involving denial of equal treatment or access; and (e) threat-aggression involving actual or threatened harm. Coincidentally, a study of 74 African Americans using these dimensions was conducted using the same population to be used in the current study (Holt, 2004), and results revealed that African Americans experienced verbal rejections most frequently, followed by avoidance, exclusion, denial of equal treatment, devaluating action, threat of violence, and aggression, in decreasing order of frequency.

These studies bring to light a disturbing truism: that African Americans are still the targets of frequent acts of overt racism. What is equally disturbing is what these studies on overt forms of racism have not been able to measure - the prevalence and impact of more subtle and ambiguous acts of racism on the

social, psychological, and physiological well being of African Americans. Indeed, it is the inherent ambiguity of these more subtle forms of prejudicial treatment that create an additional stressor for the victim of that prejudice, in that a decision must be made as to whether or not discrimination has actually taken place in addition to deciding if and how to respond to it.

Modern racism. Recent research recognizing discrimination as a psychological stressor and risk factor for physical illness has spawned a shift in research focus away from major institutional forms of discrimination towards more subtle and ambiguous forms of racism found in everyday life such as being followed by a security officer in a store (Contrada et al., 2000). This covert racism has been conceptualized in many ways and has been variously named ambivalent (Katz & Hass, 1988), aversive (Dovidio, 2001; Gaertner & Dovidio, 1986), symbolic (Henry & Sears, 2002; Sears, 1988); subtle (Pettigrew & Meertens, 1995); new (Barker, 1984; Hopkins, Reicher, & Levine, 1997) or modern racism (McConahey, 1982, 1986). McConahey's (1982, 1986) conceptualization of modern racism is the most robust, as it "incorporates conflicting views such as residual antiminority group feelings, and egalitarian values in the perception that minorities demand and benefit from illegitimate changes in the racial hierarchy." (Tougas et al., 2004, p. 178)

Unfortunately, the subtle and ambiguous nature of modern racism makes the phenomenon very difficult to measure via reflective self-reports, for two reasons: (1) modern racism can take the form of an "everyday hassle" that, while perceived as prejudicial treatment by the target, is often forgotten by the end of

the day; and, (2) the ambiguity of modern racism makes it a highly subjective event (Swim et al., 2003). Indeed, an incident of modern racism exists only if the target of that racism perceives it to be so.

Perception of racial prejudice. As mentioned previously, there has been a research shift away from determinants of discriminatory behavior towards experiences and perceptions of discrimination by minorities (Contrada et al., 2000). As Essed (1988) points out, credit should be given to the knowledge and understanding of racism based on the accounts of those who must deal with it. Indeed, understanding the target's perspective is requisite to understanding how discriminatory experiences are perceived, particularly when there may be some disagreement as to what constitutes discrimination. In other words, if an African American perceives an act or experience to be discriminatory, then the psychological and physiological response is the same, regardless of how someone else might interpret that same act or experience. Thus, this new focus on understanding prejudice from the target's perspective requires taking into account the phenomenological experience of being African American, and by researching the target's internal frame of reference (Rosenberg, 1986).

In their review on encountering prejudice and discrimination, Swim et al. (1998) articulate four reasons as to the importance of examining targets' accounts of perceived discrimination: (1) targets' accounts provide a valuable source of information that reflects their personal experiences and interpretations of perceived discriminatory experiences; (2) targets' accounts provide insight into the underlying psychological processing that lead to perceiving events as

prejudicial (e.g., decision-making process leading to attributions of discrimination), which takes on particular importance when dealing with ambiguous forms of modern racism (Crocker, Major, & Steele, 1998); (3) targets of racism have insights into prejudice that non-targets do not and can be considered to have a unique expertise given their life experiences (Essed, 1992); (4) and finally, through family socialization and interactions with other members of their social group, targets (more than nontargets) are exposed to more information about prejudice; thus, targets are better able to place a potentially prejudicial event into a broader social context by observing recurring themes or comparing incidents with other similar incidents that are prejudicial (Essed, 1991; Jackson, McCullough, Gurin, & Broman, 1991).

Perhaps the greatest difficulty in studying if and how targets perceive an incident to be discriminatory is identifying whether or not the criterion used in making that determination is leading the target to an accurate assessment of the situation (Swim & Stangor, 1998). One method to study this issue could include comparing a target's interpretation of what constitutes discrimination with a third-party assessment of the impact of discrimination on that target, or to some preestablished definitional criteria. Or, rather than focusing on who is accurate in their perception of prejudice, one could make comparisons between potential perpetrators and targets of prejudice as to how they define and label various events across myriad circumstances. However, both research types might permit inferences to be made concerning potential biases in target's judgments about the potentially prejudicial behavior of others (Swim & Stangor, 1998).

The goal of the present research, however, is not to understand how targets of prejudice determine an incident to be discriminatory, or even if those determinations are accurate. If an African American perceives that he or she has been discriminated against, then the psychophysiological impact on that target is the same, regardless of the legitimacy of that perception. In other words, discrimination perceived by the target is discrimination realized in the form of a stressor. Thus, the goal of this study is to lend insight into a potential mechanism through which the stress resulting from being the perceived target of discrimination leads to poorer cardiovascular health. Moreover, what is germane here is how frequently targets report encountering prejudice (chronic stressors), and how sensitive targets are to potential threats of discrimination in their environment. The high prevalence of various forms of racism reported by African Americans suggests they perceive significant amounts of threat in their environment, and that they are making appraisals that prejudice is frequently taking place.

Appraisals of Threat and Signal Detection Theory

Encountering discrimination and prejudice in any of its forms can be a stressful event, and can leave the target of that mistreatment feeling angry, mistreated, or disrespected (Allison, 1998; Feagin & Sikes, 1994). How often one encounters events perceived to be prejudicial or discriminatory has significant implications as to how an individual internalizes those experiences (Feldman-Barrett & Swim, 1998). As Feldman-Barrett & Swim ask, does the target of perceived discrimination accept or discount feedback about the self

resulting from the encounter, and how will he or she strategize to protect themselves from future encounters with discrimination and prejudice? To answer these questions, Feldman-Barrett & Swim extend upon Feldman-Barrett & Fong's (1996) modification of Lazarus and Folkman's (1984) cognitive appraisal perspective to examine targets' perceptions of discrimination and prejudice.

Lazarus and Folkman (1984) put forth a stress and coping theory based on the tenet that in order to understand how individuals appraise their environment, one must consider both environmental demands on the individual and how the individual attempts to cope with those demands. Lazarus and Folkman (1984) suggest that the appraisal process takes place in two stages: (1) primary appraisal, in which there is an assessment of potential threat in the environment, and (2) secondary appraisal, in which the individual assesses their ability to cope with that threat should it materialize. Though the secondary appraisal process received the bulk of attention by Lazarus and Folkman, it was the primary appraisal process that Feldman-Barrett & Fong (1996) modified to explain individual variations in the primary appraisal process.

Though SDT was originally used as a means to understand errors in perception (e.g., false alarms, misses) in judging psychophysical signals, the theory has been applied to other domains. Here, Feldman-Barrett & Fong (1996) applied SDT to the primary appraisal process, and suggested that there are different costs associated with false alarms and misses when appraising for threat. Further, they suggest that individuals weigh those different costs in

making their threat appraisals, which provides valuable insight into underlying judgment strategies.

Feldman-Barrett & Swim (1998) suggest that a target's decision as to whether or not prejudice has taken place is a type of threat appraisal. When African Americans encounter overt acts of racial prejudice, such as having a racial slur directed at them or being physically attacked, their *hit rate* for detecting threat is 100%. However, most threat cues are ambiguous (such as encounters with modern racism), which limits an individual's sensitivity to detect threat in their environment (Fiske & Taylor, 1991).

To compensate for the limited sensitivity in detecting ambiguous threat cues, Feldman-Barrett & Fong (1996) suggest that individuals will weigh the consequences of their judgments to avoid making costly errors, thus protecting themselves. Specifically, targets of discrimination must balance the costs associated with either not perceiving a threat (i.e., miss) in the environment and thus bearing the brunt of it unexpectedly, or detecting a threat that does not manifest (i.e., error) and thus bear needless anxiety and disruption. Feldman-Barrett & Fong point out that when encountering unpredictable and ambiguous stimuli, individuals appraising for threat will make more errors and have fewer hits; thus, a high prior base rate for threat should lead to a goal of reducing misses more than errors. Frequency and magnitude of harm of misses leads to aversive learning, which, to reduce the number of misses, leads individuals to reduce their decision criterion and allow most cues to exceed the threshold and

be perceived as threat. Feldman-Barrett & Fong term this the “zero-miss” strategy.

Feldman-Barrett & Swim (1998) suggest that African Americans tend to employ judgment strategies that minimize the frequency with which they fail to correctly identify situations as prejudicial. This phenomenon, they suggest, is the result of repeated and pervasive experiences with racism in their environment, which leads to a learned decision rule and subsequent preattentive processing to see threat in current and future situations. In other words, if African Americans reduce their decision criterion in a high-threat environment to perceive all ambiguous cues as prejudicial in nature and thus threatening (resulting in zero misses), then this strategy will be considered adaptive by the target and will be consistently employed in all future interactions with their environment. It should be noted that African Americans who perceive themselves to be the targets of frequent prejudice should not be “blamed” for being oversensitive; rather, their increased sensitivity to perceiving cues as threatening is merely the result of persistent encounters with prejudice (Feldman-Barrett & Swim, 1998). Moreover, research has shown that collective and personal experiences of racism contribute to this miss-reducing strategy, in that Blacks are taught at home from an early age on how to detect and handle prejudice, and to be suspicious and distrustful of Whites (Biafora et al., 1993; Essed, 1991; Hines & Boyd-Frankline, 1982).

There is research to support the idea of a zero-miss strategy in perceiving prejudice. For example, in one study, participants performed a task and were

informed that none of their evaluators had discriminated against members of their particular ethnic group, suggesting a zero base rate for discrimination (Ruggiero & Taylor, 1995). In this condition, Ruggiero and colleagues characterized any perception of discrimination as an overestimation, and though participants did tend to attribute a negative evaluation to their own effort or ability, the mean attribution to discrimination was significantly greater than zero. Again, the most important consideration here is that these overestimations of prejudice should be viewed as a reasonable and adaptive response where high base rates of prejudice exists, and not as a deficit within the perceiver leading them to faulty judgments (Funder, 1987).

As stated previously, discrimination and prejudice within our culture has not simply shifted forms, it has assumed multiple forms. Despite a common belief by Whites that racism no longer exists, or is no longer a significant social issue, an examination on the current state of racism from the target's perspective provides evidence to the contrary. As discussed in this section, African Americans are still the targets of frequent acts of overt racism, which takes the form of acute stressors requiring acute responses. Moreover, modern racism has been borne out of prevailing social norms stressing equality. The inherent ambiguity of modern racism presents a unique challenge for those who must bear it, in that the onus has been put on the victim to determine whether or not prejudice has actually taken place. In this way, the responsibility of judging an interaction to be discriminatory falls on the target, thereby allowing the discriminator to relieve his or her responsibility by believing that the victim is

simply oversensitive to threat. Indeed, there is evidence to suggest that African Americans are hypersensitive to threat, though this hypersensitivity is not due to a deficiency in perception, but is an adaptive response that Blacks develop over time to protect the self. However, this constant appraising of the environment for prejudicial threat is not without its consequences. It is suggested here that this constant state of arousal within African Americans leads to a state of vigilance for threat, which, in turn, serves as a potential mechanism through which perceived discrimination contributes to CVD.

Vigilance for Threat

Within the stress and coping literature, chronic stress is usually operationalized as an experienced or realized threat (Gump & Matthews, 1998), though it has been shown that anticipated stress can have as significant an impact, if not greater than, an actual experienced threat (Spacepan & Cohen, 1983; Nomikos, Opton, Averill, & Lazarus, 1968). It then becomes important to examine how potential threats are perceived and anticipated in understanding stress, as vigilance for these potential threats has obvious psychological and physiological consequences (Gump & Matthews, 1998). Gump & Matthews define vigilance for threat as a chronic search in the environment for potential threats from other people or things, which might lead to repeated arousal. The effect of this chronic arousal is a depletion of one's coping reserves and subsequent wear and tear on the organism (Gump & Matthews, 1998). Additionally, vigilance for threat might "prime" the individual, increasing blood pressure and heart rate to increase blood perfusion of muscle to meet the

demands of a fight-flight response (Gump & Matthews, 1998). Thus, vigilance for threat may effectively compress this protective "spring," with a subsequent stressor potentially releasing this spring, thereby increasing successive cardiovascular reactivity more than would be expected. As Manuck, Marsland, Kaplan, & Williams (1995) note, it is the frequent and repeated cardiovascular reactivity to stress that serves as a risk factor for coronary heart disease.

It has been argued here that a chronic threat of discrimination exists in the environment of African Americans, and when there exists a chronic threat, vigilance for the occurrence of that threat ensues. This notion of vigilance for potential threats within a social environment seems intuitive, though surprisingly little research has been conducted to test this assumption. Indeed, when there is reference to this vigilance effect in the literature, it is either made as a matter of fact statement without empirical support, or it is assessed via behavioral indices.

The current research posits that vigilance is a psychological phenomenon that can be measured by, and mapped onto, underlying physiological processes. It is those physiological processes that serve as the mechanism through which the persistent threat of discrimination ultimately leads to diminished cardiovascular reactivity and long-term cardiovascular health.

Discrimination, cardiovascular reactivity and disease. Because the purpose of the present examination is to understand a potential *mechanism* through which discrimination impacts cardiovascular health, a thorough treatment on racial differences in cardiovascular reactivity and disease is beyond the scope of this review. Fortunately, Wyatt et al. (2003) provide a chronological summary

of research linking racism with CVD risk factors and outcomes and provides some additional context in support of the necessity and subsequent importance of the current study. As evidenced in Wyatt et. al.'s review, there are obvious disparities between Blacks and Whites in cardiovascular reactivity and prevalence of CVD, with many researchers attributing at least part of this disparity to the effects of discrimination. However, most of the research in this area has compared self-reports of discrimination to measures of cardiovascular reactivity and/or presence of CVD to assess the reasons for the disparity. While links have been found between being the target of discrimination and cardiovascular reactivity, hypertension, and CVD, these studies have fallen short in attempting to explain the mechanism through which discrimination impacts cardiovascular health. The present research endeavors to help fill that research void.

The current study posits that African Americans, as a result of being targets of frequent acts of discrimination in its myriad forms, become vigilant against threatening, or even potentially threatening, information in the environment. This vigilance effect, characterized as a preattentive bias towards threatening information, is hypothesized here to be an autonomically-mediated defensive response in African Americans, and thus provides a possible explanation as to the mechanism through which discrimination impacts cardiovascular health. To assess the presence of vigilance in African Americans, one must be able to measure autonomic reactivity to potentially threatening stimuli in the environment, and compare differences in reactivity

between Whites and Blacks. Fortunately, there exists a methodology to assess preattentive biases towards threatening information – the collection, observation, and measurement of phasic heart period reactions to threatening stimuli.

Phasic Cardiac Reactions

Before addressing the use and appropriateness of phasic heart period reactions as indicators of processing and attention, it is first necessary to provide a brief overview of the means by which the autonomic nervous system (ANS) regulates cardiac processes. The autonomic nervous system is comprised of the parasympathetic (PNS) and sympathetic (SNS) branches, both of which serve to innervate organs and systems. The effect of the SNS and PNS on an internal organ is an antagonistic one: for example, the acceleratory SNS activation and deceleratory PNS activation interact dynamically to effect cardiac activity (Bernston, Cacioppo, & Quigley, 1993). The vagus (10^{th} cranial) nerve provides the deceleratory parasympathetic component, in that its efferent (outgoing) fibers originate in the brain stem and terminate on the sinoatrial (SA) node, which act as a cardiac pacemaker (Beauchaine, 2001). Additionally, the brain receives continuous feedback (originating in the heart) from the vagus nerve's afferent fibers, which also serves to facilitate cardiac functioning (Porges, Doussard-Roosevelt, Portales, & Greenspan, 1996).

In 1995, Porges specified two sources of vagal efference: one originating in the nucleus ambiguous and the other originating in the dorsal motor nucleus, with both terminating on the SA node. The dorsal motor nucleus directs what Porges referred to as the "vegetative vagus," which mediates reflexive cardiac

activity such as the deceleration of heart rate associated with an orienting response. The “smart vagus,” originating in the nucleus ambiguous, mediates cardiac activity during periods when extra coping is required due to environmental demands. In this situation, mammals either attend to/engage the threat or resort to a fight-flight response following the orienting response; engaging requires sustained attention or vigilance (marked by heart rate inhibition mediated by the vagus), while the fight (rage) or flight (panic) response is characterized by vagal withdrawal and SNS mediated heart rate acceleration (Weber, van der Molen, & Molendaar, 1994).

The present examination posits that vigilance in African Americans is a preattentional bias toward threat-related information and an inability to properly habituate to novel stimuli. The majority of studies investigating preattentive biases (particularly, studies involving persons with addictions) have applied a modified Stroop task (e.g., presenting threatening words in various colors, whereby participants take longer to name the color of threatening words) to assess this vigilance effect (Ingjaldsson, Thayer, & Laberg, 2003; Johnson, Laberg, Cox, Vaksdal, & Hugdal, 1994; Setter, Chaluppa, Ackermann, Straube, & Mann, 1994). However, as Ingjaldsson et al. point out, there is need for a broader investigative approach to be able to make valid statements about the existence of such preattentive processes. Thus, the use of psychophysiological measures has been one such way to investigate these involuntary attentional processes.

Ingjaldsson et al. (2003) note that changes in phasic heart period responses are established indicators of processing and attending to stimuli. In other words, phasic heart rate (HR) changes provide a unique insight into the somatic processes underlying attention (Thayer, Friedman, Borkovec, Johnson, & Molina, 2000; see Graham & Hackley, 1991 and Jennings, 1986, for reviews). Phasic heart rate reactions are usually assessed with the well-known S1-S2 paradigm, which allows directional HR changes to be mapped onto cognitive process (Thayer et al., 2000).

Changes in phasic heart rate and information processing. Thayer et al. (2000) provide a thorough and cogent description of the S1-S2 paradigm as it relates to information processing, and they note how useful the study of phasic changes in HR have been to revealing characteristics of attention. For example, Thayer et al. note that HR deceleration and acceleration have traditionally been regarded as key components of the orienting and defensive responses (OR and DR, respectively; Graham & Clifton, 1966; Sokolov, 1963). An orienting response can be characterized as a reflexive redirection of attention that orients the individual toward the novel stimulus, whereas a defensive response can be characterized as a collection of responses that assist in blocking out an aversive stimulus. The orienting and defensive responses play a critical role in the S1-S2 paradigm, which involves the presentation of a series of paired stimuli.

Specifically, a cue stimulus (S1) is presented and is followed by a fixed interstimulus interval (ISI), followed by a second and usually distinctive stimulus (S2) (Thayer et al., 2000). During the ISI, a triphasic HR (see figure 1) response

is typically seen, with the three HR phases consisting of: (1) an initial HR deceleration within a few seconds after S1 (D1), typically interpreted as an OR to a novel stimuli; (2) an HR acceleration (A1) immediately following D1, which reflects various aspects of information processing, such as the signal function of S1 and the response requirements of S2 (Coles & Duncan-Johnson, 1975); followed by (3) a second deceleration (D2) that is greatest just prior to S2 (Gachtel & Lang, 1973; Somsen, van der Molen, & Orlebeke, 1983). Note that heart period (HP) is the inverse of heart rate (HR), so accelerations and decelerations of the triphasic response illustrated in Figure 1 are marked by decreases and increases in HP, respectively. This was done to maintain consistency throughout the paper, as figures in the Results section will be graphed in HP units.

Of the three phases associated with the triphasic HR pattern, the second deceleration (D2) is the most reliable, and is considered to be an indicator of anticipation for S2 (Berg & Donohue, 1992). Somsen et al. (1983) discovered an enhanced D2 just prior to an aversive S2 (e.g., in this case, unavoidable shock). When S2 is a neutral or appetitive stimulus, then there is an orienting response marked by an HR deceleration; alternatively, when S2 is averse, a defensive response is observed, which is marked by HR acceleration (Thayer et al., 2000). The impact of aversive stimuli is thought to be buffered by DR's (Hare & Blevings, 1975); or, DR's are thought to reflect cognitive avoidance of threatening information and motivated inattention (Jennings, 1986).

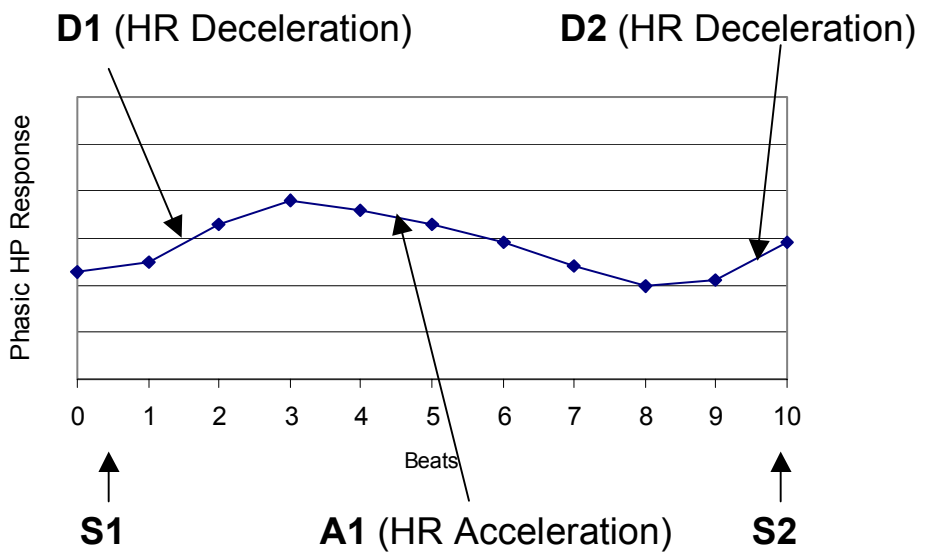


Figure 1. The beat-by-beat phasic heart period response associated with innocuous stimuli. Beat 0 is the last prestimulus beat. Note the rapid deceleration and slower recovery.

Vagal tone, phasic changes in HR, and attention. Respiratory Sinus Arrhythmia (RSA), or the degree to which heart rate ebbs and flows during the respiratory cycle, is typically used to estimate vagal tone (Berntson et. al., 1997; Hayano et. al., 1991). RSA results from increases in vagal efference during exhalation which decelerates heart rate, and from decreases in vagal efference during inhalation which accelerates heart rate (Porges, 1995). However, heart rate alone cannot be used to assess vagal tone, as the SNS also acts on the SA node and regulates cardiac activity (described previously). Thus, measures of RSA that are devoid of sympathetic influences are sought, and consensus has been reached that spectral analysis to assess vagal tone is the preferred method (Bernston et. al, 1997). Spectral analysis decomposes heart rate time series into component frequencies (low, mid, high) via Fourier transformations, and pharmacological blockade studies have shown that parasympathetic influences

(e.g., RSA) are observed primarily in the high-frequency range (Saul, Berger, Chen, & Cohen, 1989; Saul, Berger, Albrecht, Stein, Chen, & Cohen, 1991). The derived measure of RSA serves as an index of heart rate variability (HRV), or the beat to beat differences in the length of the cardiac cycle (Beauchaine, 2001).

As Thayer et al. (2000) note, the S1-S2 data are comparable with the literature in providing information on the autonomic substrates of attention. Specifically, changes in HR represented in the S1-S2 procedures are considered to be mediated by the parasympathetic branch of the autonomic nervous system. As described previously, the parasympathetic nervous system acts upon the sinoatrial node (i.e., pacemaker cells) of the heart via the vagus nerve, and increased neural input from the vagus on the SA node results in a slower yet more variable heart rate. The vagus nerve's role in linking both attention and HR with phasic changes in HRV has been emphasized in the literature (Coles, 1984; Coles & Strayer, 1985; Jennings, 1986; Porges, 1992; Somsen et al., 1983). Thayer et al. (2000) go on to note that the ability of the vagus to rapidly effect phasic, directional changes in HR reflects an organism's ability to support attention and other cognitive processes, and is indicative of a flexible and responsive attentional system.

In 1992, Porges proposed a model linking parasympathetic regulation with attention (reflected in the vagally mediated phasic changes in HR variability and HR), and concluded that the magnitude of the cardiac orienting response is an index of vagal regulation. Thayer et al. (2000) expand on this conclusion by noting that the reactive and sustained components of attention can be mapped to

distinct cardiac activity measures. Specifically, reactive attention (i.e., passive attention by the brain to a stimulus) is thought to include passive-reflexive attention (i.e., undeliberate and reflexive attention to cues in the environment), HR slowing, and the OR. Alternatively, sustained attention (i.e., deliberate attention placed and rested on a stimulus) is depicted as encompassing active-voluntary attention (i.e., purposeful attention devoted to a stimulus by an individual), vigilance, and the suppression of vagally-mediated HRV. Indeed, periods of sustained attention are accompanied by vagal withdrawal, which is represented by phasic suppression of HRV; and, though this vagal withdrawal is an appropriate physiological response, it is the persistent suppression of HR variability that contributes to poor cardiovascular health (Gump & Matthews, 1998; Gump & Matthews, 1998, Gianaros, Salomon, Zhou, Edmundowicz, Kuller & Matthews, 2005; Salomon, 2005).

Porges (1992) and Richards and Casey (1992) used tonic measures of HR variability to index cardiac vagal tone in conjunction with attentional processes. And, as Thayer et al. (2000) point out, “it is not HR variability per se that is pivotal; but rather, its value is as an indicator of the integrity of feedback mechanisms between the central (i.e., brain and spine) and peripheral (i.e., everything other than the brain and spine) nervous systems.” (p. 362). Thus, HRV may serve to index one’s ability to organize physiological resources and to adaptively respond.

Examining phasic heart period reactions to cued novel and aversive stimuli via the S1-S2 paradigm provides an effective means of assessing the

presence of individuals' preattentive biases towards threat-related cues in the environment and an inability to habituate to novel stimuli. It is this preattentive bias, marked by atypical directional changes in HR to cued threatening (stereotype) stimuli, that is suggested here to be indicative of vigilance for threat in African Americans. The study of phasic heart period reactions using the S1-S2 paradigm has been used in other areas to assess preattentive biases in the processing of information. Aikens, Borelli, and Baker (2004) utilized this methodology to assess preattentive biases to cued affective stimuli persons with combat-related posttraumatic stress disorder (PTSD). Ingjaldsson et al. (2003) used the S1-S2 paradigm to assess the preattentive processing of alcohol stimuli in alcohol-dependent individuals. In 2000, Thayer et al. examined phasic heart period reactions to cued threat and nonthreat stimuli in persons with generalized anxiety disorder (GAD).

The present study, while unique in its application, is a rough methodological replication of Thayer et al.'s (2000) study of persons with generalized anxiety disorder (GAD). In their study, persons with and without GAD were presented with innocuous S1 stimuli (a green or yellow dot) followed by a word (S2) that was a threatening (e.g., injury, foolish) or nonthreatening (e.g., melody, plastic). Results showed that persons with GAD displayed: smaller OR's and an impaired ability to habituate to neutral stimuli; HR acceleration in response to threat words; and conditioned anticipatory deceleration of HR in response to threat words over repeated trials. What is more relevant to the current research, however, is not the specific findings regarding persons with

GAD, but the effective and novel application of the S1-S2 paradigm to assess for preattentive biases in information processing. Indeed, applying Thayer et al.'s methodology to the current research question should provide for a meaningful assessment of whether or not African Americans are vigilant for threat.

Hypotheses

The aim of this study was to investigate the hypothesis that African Americans, more than European Americans, possess a preattentional bias toward ethnicity-related threat information in their environment. Specifically, it is proposed that African Americans, as a result of dealing with frequent and chronic encounters of overt and modern racism, become vigilant in assessing their environment for threat. Unlike other studies measuring this vigilance effect using more indirect methods (e.g., behavioral indices), this study will test the hypothesis that vigilance resulting from discrimination can be assessed at the autonomic level, and that Blacks will show irregular phasic HR changes toward stereotype-specific related information and an inability to habituate to novel stimuli in general.

Accordingly, the following hypotheses have been identified and will be tested. Hypothesis 1: Whites will show faster habituation to nonthreat words than will Blacks. Hypothesis 2: Whites will show early HR deceleration (OR) to stereotype-related threat words with eventual habituation to repeated presentations of words, whereas Blacks will show HR acceleration (DR) to stereotype-related threat words in both early and late presentations. Hypothesis 3: Whites are expected to show a greater magnitude of orienting (more

variability in responding) than Blacks. Hypothesis 4: Magnitude of OR is expected to be positively correlated to resting vagal tone. Hypothesis 5: Blacks, and not Whites, will develop a conditioned anticipatory HR deceleration to threat words. Anticipatory HR deceleration is a conditioned defensive response towards an unavoidable aversive stimulus, which is consistent with the hypothesized bias in Blacks towards stereotype-related threat in the environment. Hypothesis 6: Levels of perceived discrimination will moderate the effect of the conditioned anticipatory HR deceleration to threat words. That is, Blacks reporting higher levels of perceived discrimination will experience a greater anticipatory HR deceleration to stereotype-related threat words (denoting greater preattentive bias towards potential threat).

Method

Participants

72 undergraduate students (30 Black and 42 White[1]) from the University of South Florida's psychology department were recruited to participate in this study. Participants were recruited from the department's subject pool via web-based software, Experimentrak. Demographic data were obtained at experiment registration using the Experimentrak demographic questionnaire. Demographic variables (e.g., Gender, Born in the US, and Educated for Grades K-12 in the US) were analyzed using the Chi-Square statistic, and no significant differences were found between groups. However, White participants (M = 21.67 years, SD = 3.80) and Black participants (M = 19.43 years, SD = 1.65) differed significantly in their age, $t(70) = 3.02$, $p < .05$ (see Table 1).

Table 1. *Participant demographic data, by race.*

Group	Gender	Age	Born in the US?	Educated in the US?
European American	Female = 33 Male = 9	21.67* years	Yes = 40 No = 2	Yes = 42 No = 0
African American	Female = 21 Male = 9	19.43* years	Yes = 25 No = 5	Yes = 30 No = 0

* Significant at p<.05

[1] A sample size of 42 per group (N = 84) was determined via a conducted power analysis using an effect size (d=.31) gleaned from Thayer et. al. (2000). Due to recruiting difficulties, only 30 African Americans participated in the study.

Participants were disqualified from participation if they reported having a congenital heart disorder or history of other CV or renal disease, or if they reported taking prescription medications that affect the CV system. Students were not remunerated for their participation, though they did receive extra credit for time spent in approved psychology courses. This research was approved by the Institutional Review Board and informed consent was obtained from each participant prior to the start of the experiment.

Measures

Participants were asked to complete several measures upon registering for study participation.

Demographic data were obtained from participants when they registered for the experiment through the Department of Psychology via web-based software, Experimentrak. Eligibility requirements were assessed at that time. The Experimentrak system allows students to sign up for only the studies for which they are eligible, with eligibility requirements determined by the experimenter.

Perceived Discrimination was assessed using two measures: the Williams Everyday Discrimination Scale (Williams, Yu, Jackson, & Anderson, 1997) and the Measure of Ethnicity Related Threat (Contrada et al., 2001). The Williams Everyday Discrimination Scale (α = .839) (Appendix A) consists of ten items in which respondents report how often in day-to-day life they experience various forms of mistreatment, followed by the possible reasons for mistreatment (e.g., race, ethnicity, gender, age, weight, income and appearance). In other words, the

Williams Everyday Discrimination Scale does not explicitly ask about exposure to racial/ethnic discrimination until after mistreatment ratings are made. Alternatively, the Measure of Ethnicity Related Threat (α = .957) (Appendix B) does explicitly ask about exposure to racism, and includes subscales that measure exposure to discriminatory events such as verbal rejection, avoidance/exclusion, denial of equal treatment, and devaluing action.

S1-S2 Task

In accordance with the S1-S2 methodology described previously, a word task was initiated, whereby S1 was presented as a colored dot (green, blue or yellow and consistently paired with threat and nonthreat stimuli) in the middle of the monitor screen. Experimenter determined dot color and word type association just prior to each experimental session by randomly drawing (sampling without replacement) one card from a box containing fourteen cards for each of the six dot color/word type combinations. Association of dot color and word type was counterbalanced across participants, and this information was withheld from participants to assess higher order conditioning. S2 was then presented in the middle of the monitor screen, and was either a stereotype-related threat word, a non-stereotype-related threat word, or a nonthreat word. S1 and S2 were presented sequentially for 8s each (one trial), with a 12s interval between trials. Participants were instructed to silently read each word as it appeared on the monitor's screen. A total of 30 trials were presented: 10 using stereotype threat words, 10 using non-stereotype threat words, and 10 using non-threat words. One trial order was used for all participants, which was

determined a priori by randomly drawing words from a hat. The only constraint was that no more than two consecutive trials contained the same word type.

All task words were taken from three sources: Wittenbrink, Judd, & Park (2001); Kawakami & Dovidio (2001); and Judd, Park, Ryan, Brauer, & Kraus (1995) and were matched for word length. Based on studies performed by the respective authors of these three sources, words were found to be threatening or non-threatening, and threatening words were identified as related/not-related to the AA stereotype. Numbers in parentheses following each word represent presentation order. Stereotype-related threat words used: uneducated (4), complaining (8), isolated (9), reckless (11), lazy (14), dishonest (16), violent (17), dangerous (19), cliquish (26), hostile (29). Nonstereotype-related threat words used: threatened (2), terrified (3), cautious (6), desperate (10), cringing (13), weak (21), nervous (24), defenseless (25), quaking (27), helpless (28). Nonthreat words used: gratified (1), satisfying (5), gallant (7), playful (12), frivolous (15), calm (18), optimistic (20), friendly (22), reassure (23), carefree (30).

Procedure

Each participant received a brief tour of the Cardiovascular Research Laboratory, along with a brief description of the recording equipment, the recording methods, and the task. The experimenter then placed the electrodes necessary for phasic HR and HRV measurement. Two disposable electrodes were attached using a Lead II (upper right chest and lower left ribcage), which recorded the electrocardiogram (EKG). The electrode sites were prepared by

cleaning the areas with a disposable alcohol swab. EKG signals were amplified using the Biopac EKG100C bioamplifier (Biopac, Inc., Goleta, CA). The signal was sampled and digitized at 1000 Hz and acquired using AcqKnowldege software (Biopac, Inc., Goleta, CA) on a Dell computer. Participants were placed in a sound attenuated room, which was separate from the room housing the recording equipment. They were asked to remain seated in a comfortable chair throughout the experiment. The door to the room was closed and the participant was left alone for the duration of the experiment. The room contained a chair, a table, a television monitor, and a small, unobtrusive surveillance camera. Participants were asked to refrain from bringing cell phones, pagers, or watches into the experiment room.

The first phase of the experimental session involved periods of a paced-breathing task and a free-breathing baseline to ensure that participants were engaging in consistent breathing patterns (respiration is directly tied to HRV). Participants were then instructed to fix their attention on the computer screen, after which, they were presented with the S1-S2 task (described previous).

Upon experiment completion, participants were asked to recall as many words as possible, which served as a manipulation check to ensure that participants were attending to the task and to assess for potential memory bias for threat-related stimuli. Participants were then fully debriefed as to the nature and purpose of the experiment.

Quantification of Dependent Measures

S1 (Dot) and S2 (Word) were presented for 8 seconds each. The six successive cardiac interbeat intervals (IBIs; the time in milliseconds between sequential ECG R-spikes) following each of the paired stimuli (S1 and S2) were recorded continuously and used in the phasic heart period (HP) analyses. The R-spike of the EKG signal was detected using software that determines the temporal separation between adjacent IBIs (Mindware Technologies Ltd, Gahanna, OH).

Tonic cardiac vagal activity was calculated at the baseline using time and frequency domain measures (note: the following description of calculation of tonic cardiac vagal tone was extracted from Gianaros et. al., 2005). Specifically, for each minute during the five minute baseline, a 60-second time series of IBIs was created from an interpolation algorithm that uses a 250-millisecond sample time. This 60-second IBI time series was then (a) linearly-detrended, (b) mean-centered, and (c) tapered using a Hamming window. Spectral-power estimates were then determined (in ms2/Hz) with Fast Fourier transformations, and the values within the 0.15 to 0.40 Hz spectral bandwidth were integrated (ms2). These spectral-power estimates were natural-log transformed prior to statistical analyses because of distributional violations. The natural-logged spectral-power estimate in the 0.13 to 0.40 Hz bandwidth was taken as an indicator of HF-HRV. The mean of minute-by-minute estimates of HF-HRV for the 5-minute baseline period was used an overall measure of resting vagal tone.

Statistical Analyses

Statistical analyses were directed at individual hypotheses. Specifically, for: hypothesis 1, a 2 (race: Blacks vs. Whites) X 2 (trial: Trial 1 vs. Trial 10) X 6 (sample: IBI[2]) mixed analysis of variance was performed on the dot phase of the nonthreat condition; hypothesis 2, a 2 (race: Blacks vs. Whites) X 2 (trial: Trial 1 vs. Trial 10) X 6 (sample: IBI) mixed analysis of variance was performed on the word (S2) phase of the stereotype-related threat word condition, and; hypothesis 5, a 2 (race: Blacks vs. Whites) X 3 (condition: Stereotype-Related Threat vs. Non-Stereotype-Related Threat vs. Nonthreat) X 6 (sample: IBI) mixed analysis of variance was performed on the dot (S1) phase of Trial 10. Note that for the above analyses, the race factor was a between-subjects variable while all other variables were within-subjects. To test hypothesis 6, the PEDQ total score (mean of 16 scaled items) x condition x sample interaction was examined for Blacks only on the dot (S1) phase of Trial 10. Simple effects and trend analyses directed at specific hypotheses were also performed, where appropriate. Hypothesis 3 was tested using a directional Students *t* test to compare magnitudes of orienting responses between Blacks and Whites. Here, magnitude of orienting response (OR) was indexed by calculating the difference in magnitude between the last IBI preceding S2 (word) and the larger of the two IBIs following S2. Those differences were then averaged across all Trial 1 responses to generate an overall measure of orienting. Hypothesis 4 was tested

[2] The number of IBIs following dot and word presentation ranged from 6 to 14 across participants. To ensure inclusion of all participant data points, only the six IBIs directly preceding (S1) and following (S2) word presentation were included in final analyses.

using a Pearson product-moment correlation to test for the relationship between resting vagal tone and magnitude of orienting.

Results

Perceived Discrimination and Racism

It was expected that Blacks, more than Whites, would report higher levels of experienced perceived discrimination. Perceived discrimination was assessed using two measures: the Williams Everyday Discrimination Scale (Williams, Yu, Jackson, & Anderson, 1997) and the Measure of Ethnicity Related Threat (Contrada et al., 2001).

Williams Everyday Discrimination Scale

The Williams Everyday Discrimination Scale (α = .796 in the present study) is a scale consisting of 10-items in which respondents report how often in day-to day life they experience various forms of mistreatment (1=Never to 4=Often), along with the possible reasons for mistreatment (e.g., race, ethnicity, gender, age, weight, income and appearance). The ten individual item scores were summed to compute a total score. Whites (M = 19.74, SD = 5.19) and African Americans (M = 19.20, SD = 4.44) did not significantly differ in their reported frequency of encounters with various forms of mistreatment, $t(70) = .46$, $p = .65$. However, African Americans (73.3%, n = 22) were more likely than Whites (9.5%, n = 4) to attribute encounters of mistreatment to their race or ethnicity, χ^2 (1, N = 72) = 30.88, $p < .01$. Other attributions for mistreatment by Blacks and Whites were as follows: (a) gender-50.0%, 60.9%; (b) age-43.3%,

71.4%; (c) income-16.7%, 23.8%; (d) occupation-20.0%, 33.3%; (e) language-6.7%, 4.8%; (f) religion-16.7%, 14.3%; (g) overweight body-43.3%, 23.8%; (g) underweight body-30.0%, 7.1%; and (i) other physical appearance-33.3%, 23.8%, respectively.

Measure of Ethnicity Related Threat

The Measure of Ethnicity Related Threat (α = .927 in the present study), or PEDQ, measures how frequently one experiences discriminatory treatment based on race (1=Never to 7=Very Often), and includes subscales that measure exposure to discriminatory events such as verbal rejection, avoidance/exclusion, denial of equal treatment, and devaluing action. As expected, Blacks reported significantly more frequent encounters with discriminatory treatment than did Whites (see Table 2). It is interesting to note that Whites and Blacks did not significantly differ on their ratings concerning threats of violence, which suggests that racially-motivated discriminatory behavior has taken on more subtle forms.

Table 2. *PEDQ mean subscale and total scores, by race.*

Race	**European American (n=42)**	**African American (n=30)**	**t-value *df*=70**
Mean/SD - Subscale 1 *Verbal Rejection*	*M*=1.54, *SD*=0.90	*M*=2.81, *SD*=1.46	4.56*
Mean/SD - Subscale 2 *Avoidance*	*M*=1.54, *SD*=0.87	*M*=2.03, *SD*=1.02	2.23*
Mean/SD - Subscale 3 *Exclusion/Denial*	*M*=1.30, *SD*=0.48	*M*=2.33, *SD*=1.14	5.21*
Mean/SD - Subscale 4 *Disvaluation*	*M*=1.30, *SD*=0.61	*M*=2.42, *SD*=1.16	5.31*
Mean/SD - Subscale 5 *Threat/Violence*	*M*=1.41, *SD*=0.86	*M*=1.61, *SD*=0.66	1.09
Total Mean Score/SD *Mean of Scaled Items*	*M*=1.45, *SD*=0.68	*M*=2.22, *SD*=0.84	4.31*

* Significant at p<.05.

Manipulation Check

African Americans and European Americans (*M* = 3.13, *SD* = 2.11 and *M* = 2.88, *SD* = 1.71, respectively) did not differ in their ability to correctly recall more stereotype-related threat words, *t*(70) = .51, *p* = .58. Additionally, Blacks and Whites did not significantly differ in their ability to correctly recall any of the three word types, as shown in Table 3. Both groups were able to correctly recall, on average, 10 of the 30 words presented, suggesting that they were attending to the task. Additionally, at the conclusion of the study, participants were asked if they noticed a relationship between dot color and type of word presented in the dot-word task. Sixty-three participants (87.5%) correctly identified dot color with general tone of word presented (nine participants were not able to correlate dot color with word type. Only one participant used the word "stereotype" in describing the word type for stereotype-related threat words.

Table 3. *Mean number of words recalled and standard deviations, by race.*

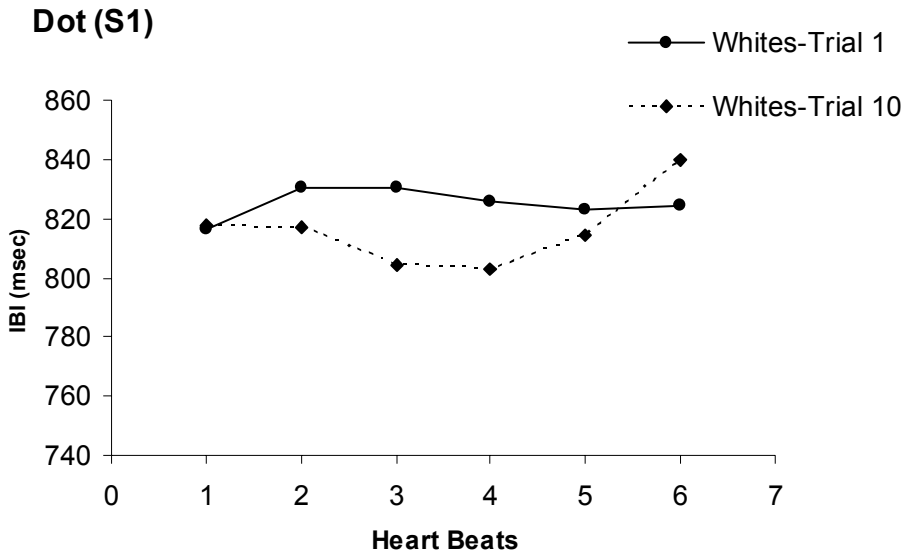
Race	Mean Number of Correct AA Stereotype Threat Words Recalled	Mean Number of Correct Non-Stereotype Threat Words Recalled	Mean Number of Correct Non-Threat Words Recalled	Mean Number of Correct Total Words Recalled
Whites (*n* = 42)	*M* = 2.88 *SD* = 1.71	*M* = 2.93 *SD* = 1.34	*M* = 3.83 *SD* = 2.17	*M* = 9.64 *SD* = 4.34
Blacks (*n* = 30)	*M* = 3.13 *SD* = 2.11	*M* = 2.87 *SD* = 1.72	*M* = 3.93 *SD* = 1.74	*M* = 9.93 *SD* = 4.19

Note: none of these mean differences were significant at p<.05.

Hypotheses 1: Habituation to Nonthreat Words

It was hypothesized that Whites would show greater habituation to nonthreat words than Blacks, as marked by an attenuated heart period (HP)

increase[3] on Trial 10 just prior to word (S2) presentation. In other words, it was expected that Whites (more than Blacks), as a result of learning dot color-word type associations through higher-order conditioning, would no longer exhibit an orienting response (OR) to nonthreatening stimuli by Trial 10. Figure 2 presents the phasic heart period responses of Whites and Blacks for the six interbeat intervals just prior to presentation of nonthreat words. An initial inspection of the trends shown in Figure 2 suggests some changes in mean IBI across Trials among Whites only (as expected), though no significant differences were found.



[3] An increase in heart period (HP) reflects a heart rate (HR) deceleration, which is indicative of an orienting response (OR).

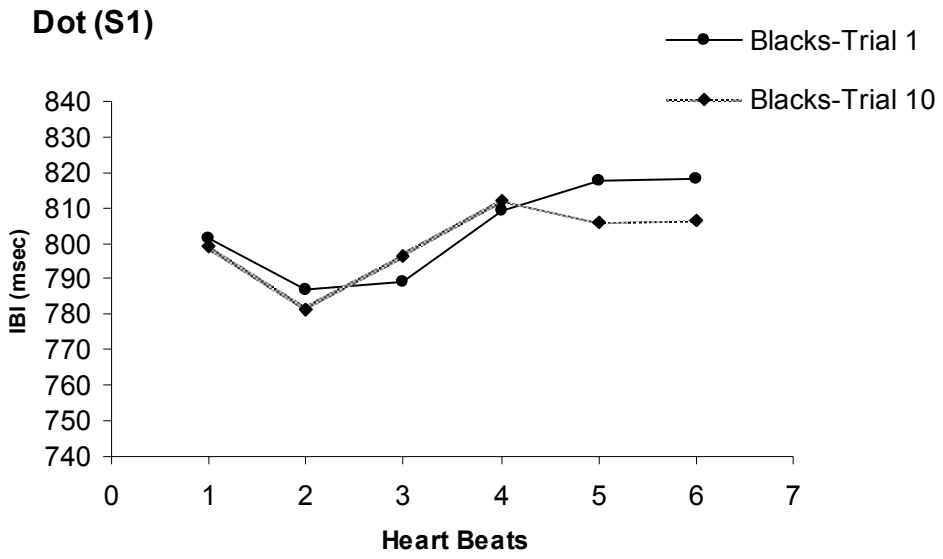


Figure 2. Phasic heart period responses of Whites and Blacks for the six interbeat intervals just prior to presentation of nonthreat words (S2).

A 2 (race: Blacks vs. Whites) X 2 (trial: Trial 1 vs. Trial 10) X 6 (sample: IBI) mixed analysis of variance was performed (race factor was between-subjects while the remaining factors were within-subjects) on the dot phase for the nonthreat word condition. Results did not support the hypothesis, as evidenced by the nonsignificant three-way (trial x sample x race) interaction, $F(3.1, 214.4) = 1.43$, $p = .24$, $\eta^2 = .02$ (note that the Greenhouse-Geisser corrected degrees of freedom were used, as the trial by sample within subjects effect was deemed to have a sphericity problem). No other main effects or interactions were significant, as shown in Table 4. Table 5 presents the estimated marginal means for race x trial x sample on the dot phase for the nonthreat word condition.

Table 4. *Hypothesis 1: results of three-way (trial x sample x race) mixed ANOVA on the dot phase for the nonthreat word condition (n = 72)*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Race	72803.58	1	72803.58	.47	.50	.01
Error (Race)	10940121.5	70	156287.45			
Trial	8065.168	1.000	8065.168	.29	.59	.004
Trial * Race	1521.465	1.000	1521.465	.06	.82	.001
Error (Trial)	1947952.525	70.000	27827.893			
Sample	32964.714	3.091	10665.321	1.98	.12	.028
Sample * Race	29335.880	3.091	9491.257	1.77	.15	.025
Error (Sample)	1163588.781	216.358	5378.066			
Trial * Sample	5419.180	3.063	1769.041	.36	.78	.005
Trial * Sample * Race	21348.551	3.063	6969.036	1.43	.24	.020
Error (Trial*Sample)	1045999.758	214.434	4877.956			

Computed using alpha = .05; Greenhouse-Geisser corrected degrees of freedom were used

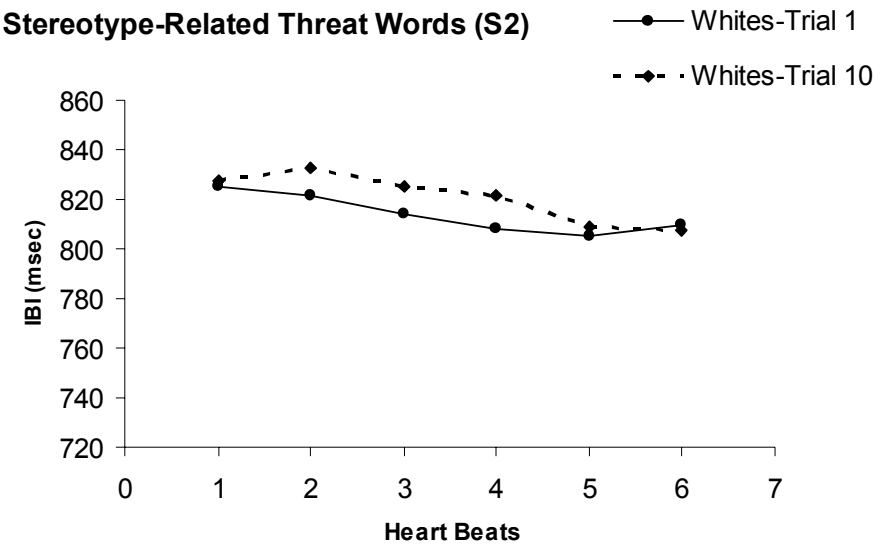
Table 5. *Hypothesis 1: estimated marginal means for race x trial x sample on the dot phase for the nonthreat word condition (Sidak corrected 95% confidence intervals)*

					95% Confidence Interval	
Race	**Trial**	**Sample**	**Mean**	**Std. Error**	**Lower Bound**	**Upper Bound**
Whites	1	1	816.310	20.510	775.404	857.215
		2	830.214	18.000	794.315	866.113
		3	830.595	17.347	795.998	865.193
		4	825.976	19.920	786.246	865.706
		5	823.048	20.770	781.624	864.471
		6	824.190	19.814	784.673	863.708
	10	1	817.738	23.240	771.388	864.088
		2	817.405	21.504	774.516	860.294
		3	804.405	20.924	762.673	846.136
		4	803.143	21.107	761.047	845.239
		5	814.310	21.380	771.669	856.950
		6	840.000	22.935	794.258	885.742
Blacks	1	1	801.400	24.267	753.000	849.800
		2	787.133	21.297	744.657	829.610
		3	789.100	20.525	748.164	830.036
		4	809.000	23.570	761.991	856.009
		5	817.700	24.575	768.687	866.713
		6	818.133	23.444	771.376	864.891
	10	1	799.267	27.497	744.425	854.109
		2	781.133	25.444	730.386	831.881
		3	796.367	24.758	746.989	845.744
		4	812.233	24.974	762.424	862.042
		5	805.800	25.297	755.347	856.253
		6	806.633	27.137	752.511	860.756

Again, it was expected that both Whites and Blacks would show a marked HP increase (OR) prior to nonthreatening words in Trial 1, but that by Trial 10, only Blacks would continue to show that same orienting response, and that Whites would no longer exhibit a HP increase prior to word presentation. However, neither Whites nor Blacks exhibited any significant HP changes in either trial prior to the presentation of nonthreat words.

Hypothesis 2: HR Acceleration to Threat Words in Blacks

Whites were expected to show early HR deceleration (or HP increase, indicative of an OR) following presentation of race-related threat words with eventual habituation to repeated presentations of words, whereas Blacks would show HR acceleration (or HP decrease, indicative of a DR) following race-related threat words in both early and late presentations. Initial examination of the trends found in Figure 3 suggest that Whites did not vary in their trial-to-trial Phasic HP responses to stereotype-related threat words (not expected), while Blacks appeared to show an initial HP increase (HR deceleration) following presentation of stereotype-related threat words (contrary to hypothesis), though no significant differences were found.



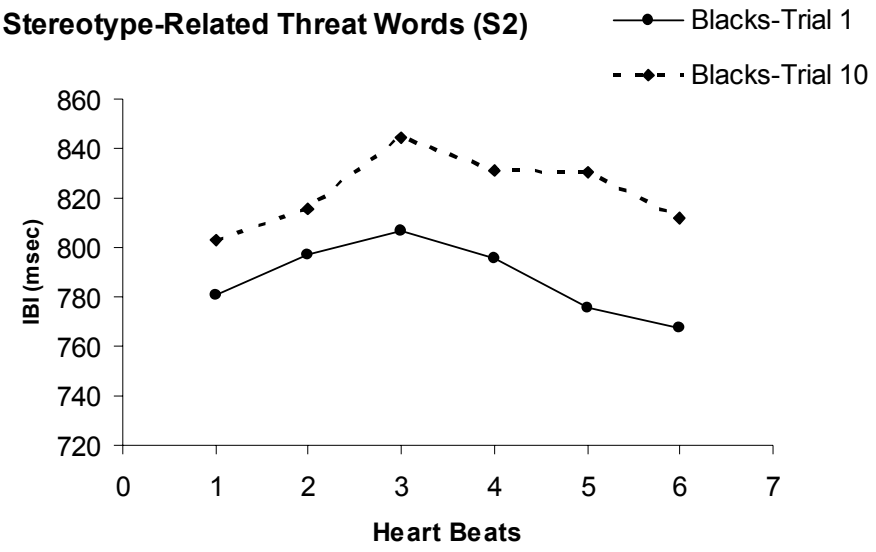


Figure 3. Phasic heart period responses during Trial 1 and 10 of Whites and Blacks for the six interbeat intervals following S2 (word) for stereotype-related threat words.

A 2 (race: Blacks vs. Whites) X 2 (trial: Trial 1 vs. Trial 10) X 6 (sample: IBI) mixed analysis of variance was performed on the word (S2) phase for stereotype-related threat words to test this hypothesis. Results (see Table 6) did not support the hypothesis as evidenced by the nonsignificant three-way (trial x sample x race) interaction, $F(2.9, 205.2) = .86$, $p = .46$, $\eta^2 = .01$ (note that the more conservative Greenhouse-Geisser corrected degrees of freedom were used, as the trial by sample within subjects effect was deemed to have a sphericity problem). Table 7 presents the estimated marginal means for race x trial x sample on the word (S2) phase for stereotype-related threat words.

Table 6. *Hypothesis 2: results of three-way (trial x sample x race) mixed ANOVA on the word (S2) phase for stereotype-related threat words (n = 72)*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Race	31494.753	1	31494.753	.218	.642	.003
Error (Race)	10117006.73	70	144528.668			
Trial	94817.500	1.000	94817.500	5.258	.025	.070
Trial * race	43855.750	1.000	43855.750	2.432	.123	.034
Error(Trial)	1262392.489	70.000	18034.178			
Sample	49207.380	2.970	16568.983	3.184	.025	.044
Sample * race	39235.963	2.970	13211.433	2.539	.058	.035
Error (Sample)	1081713.499	207.889	5203.312			
Trial * Sample	7029.977	2.931	2398.309	.484	.689	.007
Trial * Sample * race	12477.783	2.931	4256.853	.859	.461	.012
Error (Trial*Sample)	1016256.318	205.186	4952.864			

Computed using alpha = .05; Greenhouse-Geisser corrected degrees of freedom were used

Table 7. *Hypothesis 2: estimated marginal means for race x trial x sample on the word (S2) phase for stereotype-related threat words (Sidak corrected 95% confidence intervals)*

					95% Confidence Interval	
Race	**Trial**	**Sample**	**Mean**	**Std. Error**	**Lower Bound**	**Upper Bound**
White	1	1	824.929	19.307	786.422	863.435
		2	821.119	19.124	782.978	859.260
		3	813.952	19.138	775.783	852.122
		4	807.810	17.894	772.120	843.499
		5	805.167	17.085	771.092	839.242
		6	809.810	17.122	775.661	843.958
	10	1	827.500	17.456	792.685	862.315
		2	832.762	20.532	791.812	873.712
		3	825.310	21.318	782.792	867.827
		4	821.714	20.024	781.777	861.651
		5	808.929	21.122	766.802	851.055
		6	807.357	23.373	760.741	853.973
Black	1	1	780.400	22.844	734.838	825.962
		2	796.767	22.628	751.637	841.896
		3	806.667	22.645	761.504	851.830
		4	795.500	21.173	753.272	837.728
		5	775.500	20.215	735.182	815.818
		6	767.767	20.259	727.361	808.172
	10	1	802.900	20.654	761.706	844.094
		2	815.833	24.294	767.381	864.286
		3	844.233	25.224	793.926	894.540
		4	831.100	23.693	783.846	878.354
		5	830.667	24.992	780.822	880.511
		6	812.067	27.655	756.910	867.223

Again, it was expected that Whites would initially show a marked HP increase (OR) in response to threatening words in Trial 1, but that by Trial 10, Whites would no longer orient to stereotype-related threat words and would no longer exhibit a HP increase following word presentation. Blacks were expected to exhibit a defensive response, indicated by a HP decrease, following presentation of stereotype-related threat words in both trials 1 and 10. However, neither Whites nor blacks demonstrated any significant phasic HP changes in response to stereotype-related threat words in either trial.

The above mixed ANOVA yielded two significant results. The following main effects were significant: Sample, $F(3.0, 207.9) = 3.18$, $p = .025$, $\eta^2 = .04$ (note: the Greenhouse-Geisser correction was applied because the sphericity assumption was not met); and Trial, $F(1, 70) = 5.26$, $p = .025$, $\eta^2 = .07$. Follow-up analyses for the simple effects of sample were conducted (based on estimated marginal means: IBI 1: *M* = 808.93, *SD* = 13.16; IBI 2: *M* = 816.62, *SD* = 14.02; IBI 3: *M* = 822.54, *SD* = 14.33; IBI 4: *M* = 814.03, *SD* = 13.44; IBI 5: *M* = 805.07, *SD* = 13.53, and; IBI 6: *M* = 799.25, *SD* = 14.28), though no significant differences were found between any of the mean IBIs. Additionally, follow-up simple effects analyses showed that HP responses were significantly greater in magnitude during trial 10 (*M* = 821.70, *SD* = 14.57) than during trial 1 (*M* = 800.45, *SD* = 13.22); $F(1, 70) = 5.26$, $p = .025$, $\eta^2 = .07$. No other significant main effects or interactions were found.

Hypothesis 3: Orienting Responses Will Be Larger in Whites

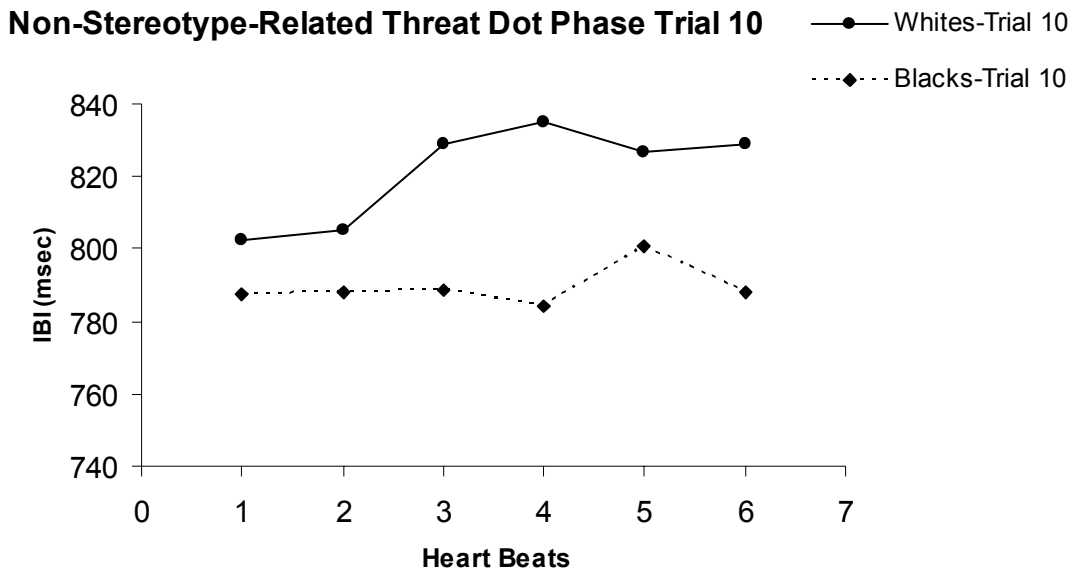
Orienting Response (OR) magnitude was indexed by calculating the difference in magnitude between the last IBI preceding S2 (word) and the larger of the two IBIs following S2. Those differences were then averaged across all Trial 1 responses to generate an overall measure of orienting. It was hypothesized that Blacks, as a result of maintaining a vigilant preattentive bias for threat due to experienced racism would exhibit lesser magnitude ORs to those stimuli as compared to Whites. However, magnitude of OR was not significantly different between Whites (*M* = 49.56 ms, *SD* = 38.41) and African Americans (*M* = 60.00 ms, *SD* = 44.78), $t(56.5) = 1.03$, $p = .31$.

Hypothesis 4: Resting Vagal Tone Will Be Related to the Magnitude of Orienting

Respiratory sinus arrhythmia (RSA), a measure of resting cardiac vagal tone, was indexed by calculating the grand mean across the five period RSA means that were generated by the MindWare software for each 60-second period of the five-minute baseline. It was expected that resting vagal tone and magnitude of orienting would be positively correlated, as both are indicators of flexible responsiveness to environmental demands. However, magnitude of OR was not significantly related to resting vagal tone, $r(72) = .17$, $p = .15$.

Hypothesis 5: Anticipatory HR Deceleration in African Americans

It was expected that Blacks, and not Whites, would develop a conditioned anticipatory HR deceleration to threat words by Trial 10. This anticipatory deceleration would be characterized by a marked HP increase in Trial 10 in the period just preceding presentation of the threatening word (S2). Initial examination of the phasic HP trends found in Figure 4 suggests that both Whites (not expected) and African Americans (expected) exhibited a general HP increase during Trial 10 in anticipation of stereotype-related threat words, while neither group exhibited an anticipatory HP increase in Trial 10 to non-stereotype-related threat words. However, these changes were not found to be significant.



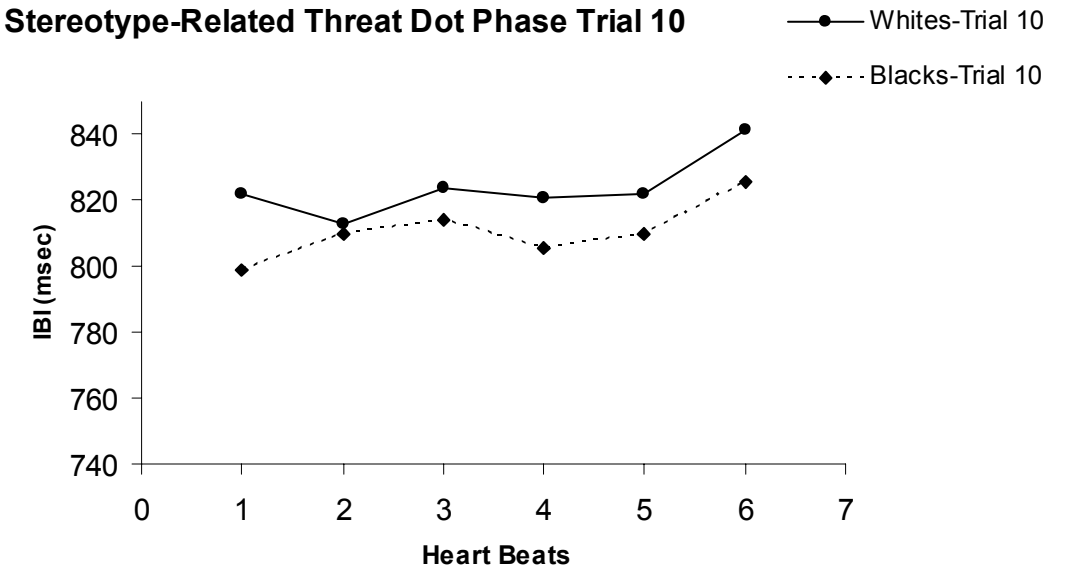


Figure 4. Trial 10 Phasic heart period responses of Whites and Blacks for the six interbeat intervals following S1 (dot) for non-stereotype-related and stereotype-related threatening words, respectively.

A 2 (race: Blacks vs. Whites) X 3 (condition: Stereotype-Related Threat vs. Non-Stereotype-Related Threat vs. Nonthreat) X 6 (sample: IBI) mixed

analysis of variance was performed (group factor was between-subjects while the remaining factors were within-subjects) on Trial 10 of the dot (S1) phase. Results (see Table 8) did not support the hypothesis as evidenced by the nonsignificant three-way (condition x sample x race) interaction, $F(5.4, 378.5) = 1.47$, $p = .196$, $\eta^2 = .02$ (note that the more conservative Greenhouse-Geisser corrected degrees of freedom were used, as the condition by sample within subjects effect was deemed to have a sphericity problem). Table 9 presents the estimated marginal means for race x condition x sample on the trial 10 dot (S1) phase for all word types.

Table 8. *Hypothesis 5: results of three-way (condition x sample x race) mixed ANOVA on the trial 10 dot (S1) phase for all word types (n = 72)*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Race	129294.593	1	129294.593	.528	.470	.007
Error (Race)	17133333.51	70	244761.907			
Condition	31927.823	1.872	17057.847	.665	.506	.009
Condition * Race	20743.897	1.872	11082.692	.432	.637	.006
Error (Condition)	3361596.953	131.022	25656.802			
Sample	49963.799	3.026	16513.929	3.005	.031	.041
Sample * Race	6463.021	3.026	2136.144	.389	.763	.006
Error (Sample)	1163726.177	211.789	5494.747			
Condition * Sample	23168.718	5.407	4285.289	.820	.544	.012
Condition * Sample * Race	41408.218	5.407	7658.869	1.465	.196	.021
Error (Condition*Sample)	1978410.765	378.460	5227.530			

Computed using alpha = .05; Greenhouse-Geisser corrected degrees of freedom were used

Table 9. *Hypothesis 5: estimated marginal means for race x condition x sample on the trial 10 dot (S1) phase for all word types (Sidak corrected 95% confidence intervals)*

					95% Confidence Interval	
Race	**Condition**	**Sample**	**Mean**	**Std. Error**	**Lower Bound**	**Upper Bound**
White	Nonthreat	1	817.738	23.240	771.388	864.088
		2	817.405	21.504	774.516	860.294
		3	804.405	20.924	762.673	846.136
		4	803.143	21.107	761.047	845.239
		5	814.310	21.380	771.669	856.950
		6	840.000	22.935	794.258	885.742
	Non-Stereotype-Related Threat	1	802.452	19.994	762.576	842.329
		2	805.286	20.947	763.508	847.063
		3	829.048	20.586	787.990	870.106
		4	835.190	19.846	795.609	874.772
		5	826.571	21.663	783.366	869.777
		6	828.929	22.392	784.269	873.588
	Stereotype-Related Threat	1	822.262	21.050	780.279	864.245
		2	812.833	19.350	774.241	851.426
		3	823.833	20.719	782.511	865.156
		4	820.548	20.292	780.077	861.018
		5	821.810	20.602	780.721	862.898
		6	841.714	21.472	798.890	884.539
Black	Nonthreat	1	799.267	27.497	744.425	854.109
		2	781.133	25.444	730.386	831.881
		3	796.367	24.758	746.989	845.744
		4	812.233	24.974	762.424	862.042
		5	805.800	25.297	755.347	856.253
		6	806.633	27.137	752.511	860.756
	Non-Stereotype-Related Threat	1	787.700	23.657	740.517	834.883
		2	787.833	24.785	738.401	837.265
		3	788.633	24.358	740.053	837.214
		4	784.433	23.482	737.600	831.266
		5	800.833	25.632	749.712	851.955
		6	788.267	26.495	735.425	841.109
	Stereotype-Related Threat	1	799.000	24.907	749.325	848.675
		2	809.633	22.895	763.970	855.296
		3	813.867	24.515	764.973	862.760
		4	805.600	24.010	757.714	853.486
		5	809.667	24.376	761.050	858.283
		6	825.900	25.406	775.229	876.571

Again, it was expected that Blacks, and not Whites, would show a marked HP increase (HR deceleration) just prior to presentation of threatening words in

Trial 10. However, neither Whites nor Blacks demonstrated any significant phasic HP changes in anticipation of stereotype-related threat words during Trial 10.

The above mixed ANOVA yielded one significant result. The main effect of Sample was significant, $F(3.0, 211.8) = 3.01$, $p = .031$, $\eta^2 = .04$ (note: the Greenhouse-Geisser correction was applied because the sphericity assumption was not met), illustrating only that there was significant variance (on the cubic component of the HP waveform) across mean IBIs during the dot phase. No other significant main effects or interactions were found.

Hypothesis 6: Level of Perceived Discrimination Moderates Conditioned Anticipatory HR Deceleration

It was hypothesized that levels of perceived discrimination would moderate the effect of the conditioned anticipatory HR deceleration to threat words. That is, Blacks reporting higher levels of perceived discrimination would experience a greater anticipatory HR deceleration to threat words. The total PEDQ score (mean of all scaled items) was used to index level of perceived discrimination by Blacks. Results (see Table 10), however, did not support the hypothesis. The PEDQ total score (mean of 16 scaled items) x condition x sample interaction was examined for Blacks only on the dot (S1) phase of Trial 10, and was not significant, $F(4.5, 127.2) = 0.52$, $p = .74$, $\eta^2 = .02$ (note that the more conservative Greenhouse-Geisser corrected degrees of freedom were used, as the condition by sample within subjects effect was deemed to have a sphericity problem). No other significant main effects or interactions were found.

Table 10. *Hypothesis 6: results of three-way (PEDQ Total x condition x sample) interaction on the dot (S1) phase of Trial 10 for Blacks only (n = 30)*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
PEDQ Total	522646.577	1	522646.577	2.00	.168	.067
Error (PEDQ Total)	7301799.58	28	260778.556			
Condition	21388.334	1.73	12390.091	.304	.707	.011
Condition * PEDQ Total	33348.916	1.73	19318.760	.474	.597	.017
Error (Condition)	1969154.317	48.34	40739.833			
Sample	18604.285	2.78	6684.627	.857	.460	.030
Sample * PEDQ Total	14202.534	2.78	5103.053	.654	.572	.023
Error (Sample)	607915.510	77.93	7800.985			
Condition * Sample	7495.468	4.54	1650.248	.256	.924	.009
Condition * Sample * PEDQ Total	15266.332	4.54	3361.130	.521	.743	.018
Error (Condition*Sample)	820159.501	127.18	6448.977			

Computed using alpha = .05; Greenhouse-Geisser corrected degrees of freedom were used

Discussion

The aim of this study was to investigate the hypothesis that African Americans, more than European Americans, possess a preattentive bias toward potential threats in their environment as a result of dealing with frequent encounters of overt and modern racism. The study of phasic heart period reactions using the S1-S2 paradigm was used to assess the presence of preattentive biases in the processing of information. This preattentive bias, suggested here to be indicative of vigilance for threat in African Americans, is characterized by atypical directional changes in HR to cued threatening (stereotype) stimuli. Specifically, Blacks, and not Whites, were expected to exhibit the following irregular HR responses: smaller OR's and an impaired ability to habituate to neutral stimuli; HR acceleration in response to threat words; and conditioned anticipatory deceleration of HR in response to threat words over repeated trials. However, results did not support hypotheses.

African Americans were expected to maintain vigilance in monitoring their environment for threat and to show an inability to disengage attention from nonthreatening events (Thayer et. al., 2000). As follows, it was hypothesized that Whites would show greater habituation to nonthreat words than Blacks, as marked by an attenuated orienting response to nonthreat words (S2) by Trial 10 (when S2 is a neutral or appetitive stimulus, then there is an orienting response

marked by an HR deceleration). HP data in the present study, however, did not support this hypothesis. Both Whites and Blacks were expected show marked increases in HP in Trial 1 in the dot phase prior to presentation of nonthreatening words (OR); and, by Trial 10, only Blacks were expected to continue exhibiting the HP increase in mean IBI prior to S2 presentation. However, neither Blacks nor Whites experienced any significant changes in their phasic HP responses to nonthreatening stimuli in either Trial 1 or Trial 10.

Whites were expected to show early HR deceleration (OR) to race-related threat words with eventual habituation to repeated presentations of words, whereas Blacks were expected to show HR acceleration (DR) to race-related threat words in both early and late presentations. HR accelerations to threatening stimuli may represent a defensive response against the impact of a potential threat, attentional processes required for processing stimuli, or a conditioned motivated inattention or cognitive avoidance to threat (i.e., vigilance) (Thayer et. al, 2000; Jennings, 1986; Somsen et. al., 1983). Results, however, revealed no significant differences between any mean IBIs following presentation of stereotype-related threat words within Blacks or Whites during Trial 1 or 10. In other words, Whites showed less variance in HP response during Trial 1 than anticipated (Whites were supposed to show early HR deceleration), and Blacks did not exhibit the expected initial HR acceleration in either Trial that is indicative of a defensive response to buffer the impact of aversive stimuli.

African Americans, as a result of maintaining a vigilant preattentive bias for threat due to experienced racism, were expected to show reduced vagal tone

in responding to novel stimuli, thus exhibiting lesser magnitude ORs to those stimuli as compared to Whites. However, magnitude of OR was not significantly different between Whites and African Americans across Trial 1 responses.

Vagal tone has been found to be positively related to magnitude of orienting response (Porges, 1992). It was expected that respiratory sinus arrhythmia (RSA), a measure of resting cardiac vagal tone, and magnitude of OR would be positively correlated, as both are indicators of flexible responsiveness to environmental demands. However, magnitude of OR was not significantly related to resting vagal tone.

It was expected that Blacks, and not Whites, would develop a conditioned anticipatory HR deceleration to threat words by Trial 10. This is consistent with: (1) the notion that Blacks possess a preattentional bias towards threat related information; and, (2) phasic HR changes found in nonanxious participants expecting electric shock (Somsen et. al, 1983). This anticipatory deceleration would be characterized by a marked HP increase in Trial 10 in the period just preceding presentation of the threatening word (S2). Results did not support the hypothesis - there were no significant differences in HP responses prior to word presentation (S2) in Trial 10 between or within Whites and Blacks.

Levels of perceived discrimination were expected to moderate the effect of the conditioned anticipatory HR deceleration to threat words. That is, Blacks reporting higher levels of perceived discrimination were expected to experience a greater anticipatory HR deceleration to threat words (denoting greater preattentive bias towards potential threat), as the vigilance effect should have

been more pronounced in those experiencing higher levels of perceived racism. However, level of perceived discrimination was not found to moderate the effect of the conditioned anticipatory HR deceleration to threat words.

These results should not undermine the fact that changes in phasic heart period responses are established indicators of processing and attending to stimuli (Ingjaldsson et al., 2003), and phasic heart rate (HR) changes provide a unique insight into the somatic processes underlying reactive (e.g., passive-reflexive attention, HR slowing, and the OR) and sustained (active-voluntary attention, vigilance, and the suppression of vagally-mediated HRV) components of attention (Thayer, Friedman, Borkovec, Johnson, & Molina, 2000; see Graham & Hackley, 1991 and Jennings, 1986, for reviews). Again, periods of sustained attention are accompanied by vagal withdrawal (represented by phasic suppression of HRV), and it is the persistent suppression of HR variability that contributes to poor cardiovascular health (Gianaros et al., 2005).

Limitations and Future Directions

African American participants were not representative of the larger Black community, and, as a result, may not have had similar life experiences that would generate a preattentive bias towards stereotype-related threat. Indeed, all Black participants were college educated, while only 30% of Blacks in the U.S. attend college (NCES, 2000). Additionally, while Black participants reported higher levels of perceived discrimination than did Whites, the mean rating of encounters with perceived discrimination was 2.22 out of 7. Moreover, Black participants had a mean age of 19.43 years, and it may be that preattentive biases towards

threat (as a result of frequent encounters with racism over time) may have not yet fully developed by that age, thus accounting for the similarity of some of the HP response patterns across White and Black participants. Indeed, there may have been a cohort effect that accounted for the similarities in responding across Blacks and Whites, as participants may have shared more similarities than differences in factors that would influence study outcomes. For examples, SES has been found to account for much of the observed racial disparity in health (Williams, 1999), and it may have been that Blacks and Whites in the present study shared similar SES, and thus accounted for similarities in responding to cued threat and nonthreat stimuli. In retrospect, SES data should have been collected and controlled for as a variable of interest.

While the stereotype-related words used in the present study were carefully chosen for their relatedness to the stereotype, it is possible that the words were not as intuitively related to the stereotype as needed to elicit pre-attentive cardiovascular responding. Indeed, only one participant in post-study debriefing identified one of the word types as stereotype-related, suggesting that the selected words may not have been effective at eliciting a preattentive bias to stereotype-related threat. Future studies should use words that are more intuitively related to the African American stereotype, and which have been ranked for how threatening those words are perceived to be.

Reduced power associated with a smaller than expected sample size is an important consideration when putting results into context. Examination of phasic HP trends in anticipation of, and in response to, threatening and nonthreatening

stimuli suggest that there may have been variance in responding, though there was not sufficient power to detect significant differences in mean IBIs. Additionally, this has been the first occasion, to the author's knowledge, where the use of the S1-S2 paradigm has been used on a non-clinical population. Power analyses in the present study used a medium effect size derived from Thayer et al.'s (2000) study using persons with GAD to determine sample size; however, in retrospect, a power analysis using a small effect size to determine sample size would have been more appropriate.

To ameliorate these issues, future iterations of this study should target a more heterogeneous participant population; specifically, both White and Black participants should be recruited who are more diverse in age, educational background, and geography.

Conclusion

The study of phasic cardiac reactions may yet aid attempts to illuminate the connections between experiences with racial discrimination and cardiovascular disease, a relationship that is now well documented in the literature (Anderson, McNeilly & Myers, 1992; Brondolo, Rieppi, Kelly, & Gerin, 2003; Clark, Anderson, Clark & Williams, 1999; Contrada et al., 2000; Krieger, 1990; Williams, 1992; Wyatt et al., 2003). It was hypothesized here that the frequent or prolonged exposure to stress resulting from these encounters with racial prejudice is associated with diminished vagal control of cardiac output and reduced parasympathetic (PNS) influence on cardiovascular system adjustments to environmental changes. As influence of the PNS (via the vagus) wanes,

vascular regulatory processes may assume control, and increased vascular regulation may contribute to vascular pathologies leading to the development of cardiovascular disease and associated risk factors, such as hypertension. The growing body of evidence suggests that environmental circumstances (e.g., experiences with racial prejudice) that elicit vigilance are associated with a variety of stress-related illnesses (Chen, Matthews, & Boyce, 2002; Ewart, 2004). Despite results, current research efforts have shown that vigilance is a psychological phenomenon that can be measured by, and mapped onto, underlying physiological processes. Future research should endeavor to further understand those physiological processes that serve as the mechanism through which the persistent threat of discrimination or other environmental phenomena ultimately leads to diminished cardiovascular reactivity and poorer long-term cardiovascular health.

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Appendices

Appendix A

Discrimination Scale

In your day-to-day life have you had the following experiences (CHOOSE ONE ANSWER FOR EACH)?

	Rarely	Sometimes	Often	Never
1. You are treated with less courtesy than other people.	1	2	3	4
2. You are treated with less respect than other people.	1	2	3	4
3. You receive poorer service than other people at restaurants or stores.	1	2	3	4
4. People act as if they think you are not smart.	1	2	3	4
5. People act as if they are afraid of you.	1	2	3	4
6. People act as if they think you are dishonest.	1	2	3	4
7. People act as if they're better than you are.	1	2	3	4
8. You or your family members are called names or insulted.	1	2	3	4
9. You are threatened or harassed.	1	2	3	4
10. People ignore you or act as if you are not there.	1	2	3	4

Were any of the following reasons why you had these experiences? (CHOOSE ONE ANSWER FOR EACH)

a. Race	NO	YES
b. Ethnicity	NO	YES
c. Gender	NO	YES
d. Age	NO	YES
e. Income level	NO	YES
f. Language	NO	YES
g. Religion	NO	YES
h. Body weight	NO	YES
i. Other physical appearance	NO	YES

Appendix B

Measure of Ethnicity-Related Threat and Ethnic Identity

Perceived Ethnic Discrimination Questionnaire (PEDQ)

Please think back ***over the past three months*** and then, unless instructed otherwise, for each item below indicate how often the event occurred using the following scale:

1	2	3	4	5	6	7
never			sometimes			very often

Write the rating (from 1 to 7) on the line provided in front of each item.

We would like to know about acts of discrimination that have been directed against or toward you personally during the past two months. Please respond to the following questions using the 7-point scale above.

Verbal rejection

1. ___ How often have you been subjected to offensive ethnic comments aimed directly at you, spoken either in your presence or behind your back?
2. ___ How often have you been exposed to offensive comments about your ethnic group (e.g. stereotypic statements, offensive jokes), spoken either in your presence or behind your back?
3. ___ How often have you been subjected to ethnic name calling (e.g. “wop”, “nigger”)?

Avoidance

4. ___ How often have others avoided physical contact with you because of you ethnicity?
5. ___ How often have others avoided social contact with you because of your ethnicity?
6. ___ How often have others outside of your ethnic group made you feel as though you don’t fit in because of your dress, speech, or other characteristics related to your ethnicity?

Exclusion

7. ___ How often have you been denied access to a public facility or organization because of your ethnicity?
8. ___ How often have you felt that certain places were off limits or that barriers were erected to keep you out of certain places because of your ethnicity?

Denial of equal treatment

9. ___ How often have you received unfair treatment from school officials because of your ethnicity?
10. ___ How often have you received unfair treatment from service people (e.g., waiters, bank tellers, security guards) because of your ethnicity?
11. ___ How often have you received unfair treatment from your superiors at a job (e.g. boss, supervisor) because of your ethnicity?

Devaluating action

12. ___ How often have others had low expectations of you because of your ethnicity?
13. ___ How often has it been implied or suggested that because of your ethnicity you must be unintelligent?
14. ___ How often has it been implied or suggested that because of your ethnicity you must be dishonest?
15. ___ How often has it been implied or suggested that because of your ethnicity you must be violent or dangerous?
16. ___ How often has it been implied or suggested that because of your ethnicity you must be dirty?
17. ___ How often has it been implied or suggested that because of your ethnicity you must be lazy?

Threat of violence

18. ___ How often have others threatened to hurt you because of your ethnicity?
19. ___ How often have others threatened to damage your property because of your ethnicity?

Aggression

20. ___ How often have others physically hurt you or intended to physically hurt you because of your ethnicity?
21. ___ How often have others damaged your property because of your ethnicity?
22. ___ How often have you been subjected to nonverbal harassment because of your ethnicity (e.g. being framed/set up, being given “the finger”)?

Appendix C

Health Information Questionnaire

Eating, drinking caffeine, smoking and taking certain medications can affect the cardiovascular system. Some medications are taken for the specific purpose of affecting the cardiovascular system, such as medication to lower blood pressure. However, some medications are taken for other reasons, but also happen to affect the cardiovascular system. Therefore, we need to know all medications that you take as well as when you last ate, drank caffeine, and smoked nicotine.

1. Please list all prescription and non-prescription medications that you are currently taking. Be sure to include any medications you have taken in the last 48 hours, even if it is something you do not regularly take (cold medicine, for example).

_____

_____

_____

_____

2. When did you last eat? _____ am / pm (circle one)
3. Do you drink caffeine? Yes No (circle one)
    a. If yes, when did you last drink caffeine? Time: _____ am / pm (circle one)
4. Do you smoke nicotine cigarettes? Yes No (circle one)
    a. If yes, when did you last smoke? Time: _____ am / pm (circle one)

Appendix D

Paced Breathing Task Instructions

To be played to Participant from tape:

In the next task, you will hear some tones. You'll notice that the tones have a rising and a falling pitch. As you listen to the tones, we would like you to breathe in time to the rising and falling pitch. Simply breathe in when the pitch is rising, and breathe out while the tone is falling. You can pause between breaths when there is no tone. Do you have any questions?

Appendix E

Computer Task Instructions

To be read to Participant by Experimenter:

In this task, you will see some dots and words appear on the screen in front of you. Simply sit and silently read the words as they appear on the screen. It is very important that you pay attention to the dots and the words the entire time. Afterwards, we will ask you some questions about the task. I will let you know when the task is completed. Do you have any questions?

Appendix F

CTS Protocol

CTS Participant Code _____
Date _____

Participant Person: _____
Computer Person: _____

Computer Task Version selected: _____ (#1-6, pulled from card box)

PARTICIPANT SET UP:

Participant Person:
1) Greet participant, explain procedures, go over informed consent, get informed consent signature

2) Give ***Health Questionnaire***

3) Get weight, height, waist & hip measurements.

Sex: M F
Ht._____in. Wt._____lbs.
Waist: _____cm Hip _____cm

4) Return scale to zero and put height bar down.

5) Ask participant to remove necklaces, watches, and dangling earrings. Turn off and put away cell phone.

6) Ask participant if they need to use the restroom before being hooked up.

7) Hook up and record Thoracic impedance information: DO NOT ROUND

L front _____cm L back _____cm

BP Cuff Size: S(C) M(A) L(LA)
(1) (2) (3)

6) Test BPs and signals

Initial BP readings Number of initial attempts _____

BP (S/D)_____ Pulse Rate: _____

BP (S/D)_____ Pulse Rate: _____

BASELINE:

Participant Person:

***5:00** Inflate BP cuff and record

Systolic: _____ Diastolic: _____
Pulse: _____

3:00 Inflate BP cuff and record

Systolic: _____ Diastolic: _____
Pulse: _____

1:00 Inflate BP cuff and record

Systolic: _____ Diastolic: _____
Pulse: _____

Computer Person:

Prep: Set clock for 10 minutes, prepare Hawaii Video

10:00 Start clock and start Hawaii Video

Open CTSSTUDY.GTL file
Setup and record a junk file (CTS####junk.acq) to ensure signal is good (until ready to begin recording baseline file)

Prep: Close junk file and open CTSSTUDY.GTL file
Set up file CTS###base.acq

***5:00** Start recording CTS###base.acq

0:00 Stop recording of CTS###base.acq

Stop Hawaii video

Comments:

_____

_____

_____

PACED BREATHING TASK:

Participant Person:	**Computer Person:**
1) Press play on tape to provide task instructions	Prep: Close previous file and open CTSSTUDY.GTL file
2) At conclusion of instructions (hit pause) and ask if any questions	Set up file CTS###pace.acq Set clock for 5:00
***5:00** Start tape to play paced tones, s**tart** clock as tones start	***Start** recording CTS###pace.acq when you hear the tones start (**5:00**)
3:00 Inflate BP cuff and record **Systolic: _____ Diastolic: _____** **Pulse: _____**	**Stop** recording CTS###pace.acq when you hear the tones stop
1:00 Inflate BP cuff and record **Systolic: _____ Diastolic: _____** **Pulse: _____**	
0:00 Stop tape	

Comments:

_____

_____

_____

COMPUTER TASK:

Participant Person:

1) Turn channel on TV to SVHS

2) Provide Instructions on Computer Task

3) Start Computer Task

4) After task ends, administer Word Recall Questionnaire

Computer Person:

Prep: Close previous file and open CTSSTUDY.GTL file

Set up file CTS###threat.acq

Set Clock for 15:35

15:35 Start clock and then cue other experimenter

15:30 Start recording CTS###threat.acq

0:00 Stop recording CTS###threat.acq

Make sure that you see no more triggers before you stop recording.

Comments:

_____

_____

_____

CONCLUDING THE SESSION:

1) Un-hook the participant.
2) Debrief the subject. Make sure that they are comfortable, and answer any questions they have about the study or the tasks they participated in. Tell them to contact us if they have questions later.
3) **Thank the subject!!!**
4) Complete clean-up.

Appendix G

Word Recall Questionnaire

Please write down all of the words that you can remember from the task you just completed:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____
24. _____
25. _____
26. _____
27. _____
28. _____
29. _____
30. _____

Appendix H

End of Study Questionnaire

By the end of the dot-word task, had you noticed anything about the relationship between the dots and the words? If so, what did you notice?

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Appendix I

Study Debriefing

(Use my words or yours. Just be sure to cover the main points)

1. First, ask what they think the study is about.

2. Explain that the study is about how people appraising the environment for threat.
    a. We're interested in how people are vigilant for threat**.** Everyone assesses for threat in their environment, which can be good when there is an actual threat.
    b. We think African Americans are more vigilant for threat due to experiences with racism and prejudice, and that has long-term consequences on cardiovascular health.
    c. Words were either neutral, threatening (not related to the AA stereotype), or threatening (related to the AA stereotype).
    d. We think European Americans will respond to non-stereotype threatening words, while African Americans will respond to both stereotype and non-stereotype threatening words.
    e. We're studying how the heart responds to these different types of words.

3. Explain why we measured blood pressure.
    a. We also had you hooked up to this Blood Pressure monitor. Why?
    b. We're also interested in health, particularly risk for cardiovascular disease.
    c. So we think that when people perceive threat (which is stressful), their blood pressure goes up. More perceived threat = more stress.
    d. The more your blood pressure goes up during stress, the more risk you have for getting heart disease.

4. Ask if they have any questions.
    a. "Do you have any questions about any of this? How do you feel about this study and being a participant in it?"

5. Ask them to not tell anyone about the hypotheses of the study.
    a. They can tell people it's about heart rate and blood pressure during rest and tasks. Anything that's in the informed consent, but not the main hypotheses.

b. It's important that participants don't know ahead of time what is going to happen in the study.
c. Participants won't respond naturally if they knew.
d. You can imagine how you would have thought differently during the study if you knew all about it and what was going to happen.
e. So we'd like to ask that you don't tell anyone about the study. Even if it's someone you think won't ever be in the study -- they could talk to someone else who would be in the study.
f. We don't really want word to "get out."
g. Would you mind helping us out and not telling anyone about the study?

Appendix J

Informed Consent

Social and Behavioral Sciences
University of South Florida

Information for People Who Take Part in Research Studies

The following information is being presented to help you decide whether or not you want to take part in a minimal risk research study. Please read this carefully. If you do not understand anything, ask the person in charge of the study.

Title of Study: Cardiovascular Responses to Computer Stimuli

Principal Investigators: Thomas King, M.A.; Kristen Salomon, Ph.D.

Authorized Research Investigators: Cathy Bykowski, Kristi White, Nicole Jagusztyn, Rene Sanchez, Susan Acebo-Dubreil, Brianne Slade, Sydnie Zillig, Sarah Bolden, Rhiannon Matzko, Samantha Gold

Study Location(s): University of South Florida, PCD 3124

You are being asked to participate because you are a healthy student at the University of South Florida and you have completed the Psychology Department's online questionnaires.

General Information about the Research Study

The purpose of this research study is to examine cardiovascular responses (such as heart rate) during rest and during demanding laboratory tasks. We are also interested in how people interpret these tasks and how these interpretations affect cardiovascular and behavioral responses. If you have cardiac problems, such as an arrhythmia (i.e., heart murmur) or congenital heart defect, you may not participate in this study.

Plan of Study

This study requires approximately 90 minutes of your time. First, a research assistant will weigh you and measure your height. The research assistant will also measure around your waist and hips. The research assistant will also collect health information from you by asking you to complete a brief health questionnaire. Next, the research assistant will put some sensors on your chest and neck, and a cuff on one arm. The placement of these sensors will require you to lift up your shirt and expose your stomach. These sensors allow us to measure your heart rate, blood pressure, blood flow, and blood vessel activity.

After all of the sensors are in place, you will sit comfortably in a cushioned chair and rest for several minutes. You will be shown a video to pass the time. Following this you will complete a task that involves viewing words on a computer screen and reading them silently. After you finish the task, you will sit and rest again. You will then be asked to complete a short speaking task. You will be given the opportunity to ask questions at any time during the study. After the final rest period, the research assistant will detach all of the sensors and answer any final questions that you may have.

Payment for Participation

You will not be paid for your participation in this study. You will receive one (1) research participation credit for every 30 minutes of your participation in this study.

Benefits of Being a Part of this Research Study

Participating in this study has no direct benefit to you. This study may help us to better understand cardiovascular responses to stress that may lead to health problems later in life.

Risks of Being a Part of this Research Study

You may feel uncomfortable when the sensors on your chest and arm are removed, much like the removal of an adhesive bandage. You may show some redness on your neck and arm where the sensors were placed. This redness should not last more than a few hours or a few days, depending on the sensitivity of your skin. You may also feel some anxiety during some of the task, but this will be no worse than many things that happen in normal everyday life.

Confidentiality of Your Records

Your privacy and research records will be kept confidential to the extent of the law. Authorized research personnel, employees of the Department of Health and Human Services, and the USF Institutional Review Board and its staff, and other individuals, acting on behalf of USF may inspect the records from this research project.
The results of this study may be published. However, the data obtained from you will be combined with data from others in the publication. The published results will not include your name or any other information that would personally identify you in any way.
Your name will not be attached to any of the information that we collect from today. You will be assigned a code number, and only this number will be attached to your information. We will link this information to some of the information you provided in the online questionnaires. We will link the code number we have assigned to you with your online data using your name. However, once the data is matched, your name will be removed and we will only use your code number. The data will be kept in a locked

cabinet and only the principal investigator and research assistants assigned to this project will have access to it.

Volunteering to Be Part of this Research Study

Your decision to participate in this research study is completely voluntary. You are free to participate in this research study or to withdraw at any time. There will be no penalty or loss of benefits you are entitled to receive, if you stop taking part in the study. Your decision about participation will in no way affect your student status.
Questions and Contacts

- If you have any questions about this research study, contact the principal investigator(s), Thomas King, M.A. or Kristen Salomon, Ph.D. at (813) 974-4922.
- If you have questions about your rights as a person who is taking part in a research study, you may contact the Division of Research Compliance of the University of South Florida at (813) 974-5638.

Consent to Take Part in This Research Study
By signing this form I agree that:

- I have fully read or have had read and explained to me this informed consent form describing this research project.
- I have had the opportunity to question one of the persons in charge of this research and have received satisfactory answers.
- I understand that I am being asked to participate in research. I understand the risks and benefits, and I freely give my consent to participate in the research project outlined in this form, under the conditions indicated in it.
- I have been given a signed copy of this informed consent form, which is mine to keep.

_____	_____	_____
Signature of Participant	Printed Name of Participant	Date

Investigator Statement
I have carefully explained to the subject the nature of the above research study. I hereby certify that to the best of my knowledge the subject signing this consent form understands the nature, demands, risks, and benefits involved in participating in this study.

_____	_____	_____
Signature of Investigator Or authorized research investigator designated by the Principal Investigator	Printed Name of Investigator	Date

About the Author

Thomas King received is B.A. in Psychology, and his M.A. in Industrial/Organizational (I/O) Psychology, from the University of South Florida. When not at school and work, Thomas spends his time with his wife and son.