

DEATH, PREJUDICE, AND ERPS:
UNDERSTANDING THE NEURAL CORRELATES OF BIAS

A Thesis presented to the Faculty of the Graduate School
University of Missouri- Columbia

In Partial Fulfillment
Of the Requirements for the Degree
Master of Arts

by

ERIKA A. HENRY

Dr. Bruce Bartholow, Thesis Supervisor

DECEMBER 2006

The undersigned, appointed by the dean of the Graduate School, have examined the thesis entitled

DEATH, PREJUDICE, AND ERPS:
UNDERSTANDING THE NEURAL CORRELATES OF BIAS

presented by Erika Henry,

a candidate for the degree of master of arts,

and hereby certify that, in their opinion, it is worthy of acceptance.

Professor Bruce Bartholow

Professor Jamie Arndt

Professor Steven Hackley

Professor Paul Bolls

ACKNOWLEDGEMENTS

Many thanks are owed to my committee advisor, Dr. Bruce Bartholow, for his exceptional help and guidance throughout this project. His contributions and insight have provided me with invaluable knowledge that this project would be incomplete without.

In addition, I would also like to thank the remaining members of my committee, Drs. Jamie Arndt, Paul Bolls, and Steven Hackley, for their insight and advice throughout the completion of my thesis. Their individual expertise greatly assisted me with a better understanding of a number of topics specific to the field of psychological research and beyond that were vital to the success of this project.

LIST OF TABLES

Table	Page
1. Study 1 Mean Error Rates and Response Times.....	59
2. Study 1 Mean ERP Amplitudes.....	60
3. Study 2 Facial Picture Viewing Task Mean Error Rates and Response Times.....	61
4. Study 2 Facial Picture Viewing Task mean ERP Amplitudes.....	62
5. Study 2 Geometrical Pictures Task Mean Error Rates and Response Times..	63
6. Study 2 Geometrical Figure Task Mean ERP Amplitudes.....	64

LIST OF FIGURES

Figure	Page
1. Study 1 ERP Waveform	65
2. Study 1 P2 Race x Electrode x Condition Interaction.....	66
3. Study 1 N2 Expression x Race x Condition Interaction.....	67
4. Study 1 N2 Race x Electrode x Condition Interaction.....	68
5. Study 2 Facial Picture Viewing Task Reaction Times for Race x Condition interaction.....	69
6. Study 2 ERP Waveform	70
7. Study 2 Facial Picture Viewing Task P2 Race x Electrode Interaction.....	71
8. Study 2 Facial Picture Viewing Task N2 Condition x Order Interaction.....	72
9. Study 2 Geometrical Picture Task ERP waveforms.....	73
10. Study 2: Facial Expressions Task Auxiliary P3 Analysis Race x Order x Condition Interaction.....	74

TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	ii
LIST OF TABLES.....	iii
LIST OF FIGURES.....	iv
Chapter	
1. INTRODUCTION.....	1
Terror Management Theory	
Terror Management Theory and Prejudice	
Social Identity Theory	
Person Perception and ERPs	
ERPs and Stages of Processing	
2. STUDY 1 METHOD.....	17
Participants	
Design	
Stimuli and Experimental Paradigm	
Facial Expressions Task	
Electrophysiological Recording	
Procedure	
3. STUDY 1 RESULTS.....	21
Analytic Approach	
Behavioral Data	
Reaction Times	
Accuracy	

	ERP Data	
	P2	
	N2	
	P3	
4.	STUDY 1 DISCUSSION.....	27
5.	STUDY 2 METHOD.....	32
	Participants	
	Design	
	Stimuli and Experimental Paradigm	
	Facial Expressions Task	
	Electrophysiological Recording	
	Procedure	
6.	STUDY 2 RESULTS.....	37
	Analytic Approach	
	Behavioral Data	
	Reaction Times	
	Accuracy	
	ERP Data	
	P2	
	N2	
	P3	
7.	STUDY 2 DISCUSSION.....	45
8.	GENERAL DISCUSSION.....	47

REFERENCES.....50

APPENDICES

1. FIGURE CAPTIONS75

CHAPTER 1

INTRODUCTION

Death is inevitable for every living creature, regardless of how heroic their struggles for survival prove. Although death is universal, awareness of one's *own* death is not. Only beings gifted, or perhaps burdened, with the cognitive capacity to conceptualize the abstract possess the ability to realize their lives will ultimately come to an end. It is this awareness famous philosopher and psychologist Ernest Becker (1973) proposed distinguishes humans from animals, as only humans are known to possess the capability to concede their eventual death. Despite the simplicity of this knowledge, coupled with the drive for self-preservation, this unique genus of consciousness has the potential to paralyze one with terror. This paradox of yearning to live, yet knowing one will not do so forever, has been proposed as being the underlying motivator of human behavior (Becker, 1973).

This notion that death awareness may influence behavior has proven more than a mere hypothesis. Research has shown that when people are reminded of their mortality, that is, when their mortality is made salient, distinctive behavior and attitudes are manifested (Arndt, Cook, & Routledge, 2004). The study of how the knowledge of one's own death affects human psychology is known as *Terror Management*.

Terror Management Theory

In accord with Becker's hypothesis, the main principle underlying Terror Management Theory is the existential issue of mortality. More specifically, terror management theory seeks to explain just how humanity copes with the distress death

awareness provokes and how this awareness influences human social behavior (Arndt et al., 2004). Thus, terror management research focuses on testing ways death awareness directly affects feelings, attitudes, and behavior (Arndt et al., 2004).

Building from Becker's theory, terror management posits humanity inhabits a unique category of being. Not only do people have the biological predisposition of being driven for survival, they also possess the cognitive capacity to foresee their eventual death. Thus, the intermingling of this desire and rare aptitude has the potential to create panic. In spite of this propensity for terror, however, most individuals are able to carry out their daily activities without apparent apprehension. To keep this fear at bay, terror management proposes that people have generated defenses to protect themselves against the knowledge of their impending mortality; thereby assuaging the terror that may otherwise take over.

Defense mechanisms believed to circumvent the worldwide panic that might otherwise result in knowing one's mortality can be broken down into two kinds of support systems: self-esteem and cultural worldview (Arndt et al., 2004). Self-esteem provides individuals with a sense of importance. By living up to socially prescribed standards, individuals believe their lives are significant and that they play a fundamental role in a meaningful universe. Society, or cultural worldview provides the universe with order, meaning, and permanence. Through this either literal immortality (e.g., Heaven) or symbolic immortality (e.g., one lives on through their accomplishments and achievements) is secured. Together, these two defenses prevent individuals fear from becoming unbearable. This tranquility, however, is not attained without a price.

Although these mortality safeguards prevent universal terror, investing one's immortality in a single worldview fosters the mindset that there can only be one right way of life. As a result, individuals strive to protect and promote their specific worldview, as one's immortality is intimately entrenched in this mode of existence and can only be survived through its prosperity. If one's worldview becomes extinct so does one's immortality, as their contribution to their particular way of life would in turn become meaningless. Which would bring us back to square one, with no defense mechanisms to contain the anxiety death awareness engenders. Thus, worldviews must be protected, and those investing in other worldviews must be converted. Ultimately, this mentality has the potential to create intolerance of any perspective that deviates from one's own.

As all human beings do not subscribe to a single worldview, and not everyone is waiting to be converted, validation systems (be it nationality, religion, political ideology, etc.) are continually threatened by neighbors with differing ideas and values. Feuds, vendetta's, crusades, wars and today's terrorism prove how hard it is for different worldviews to coexist. One recent example of the unrest mortality salience may induce is the sudden increase in the number of hate crimes following the 9/11 attacks.

Subsequent to 9/11, hate crimes increased by approximately twenty-one percent (Federal Bureau of Investigation, 2001). Although a number of these crimes were directed against people of Middle-Eastern descent, the attacks were not directed at this group exclusively. Hate crimes increased against African Americans, Asian Americans, Homosexuals, and many other minority groups (FBI, 2001). Although the increase in hate crimes could be merely coincidental with the 9/11 attacks, this pattern poses an

interesting and important question: Could such instances indicate a potential role for death awareness in the expression of outgroup bias? By examining how individuals perceive outgroup members following mortality salience, the current study seeks to determine the mechanisms involved in these prejudiced behaviors.

Terror Management and Prejudice

Although Becker only hypothesized on the link between mortality and prejudice-related behavior, evidence has been uncovered to support his speculations. Much of terror management focuses on understanding the relationship between death awareness and prejudice-related attitudes and behaviors. Through examining this link, research has shown that this apparent aversion to outgroups is at least partly embedded in one's fear of death.

One of the most consistent effects Terror Management research has established is that after administering a mortality salience induction, participants exhibit an increase in bias toward one's ingroup and against one's outgroup (Solomon, Greenberg, & Pyszczynski, 2000). For example, Greenberg et al. (1990) showed that after giving a group of Christian students a mortality salience manipulation their evaluations of other Christian students became more positive, while their evaluations of Jewish students became more negative in comparison to responses from students in the control group. Hundreds of similar studies have replicated comparable effects (for a review of this research see Greenberg et al., 1997). The paradigm commonly used to induce this intergroup bias involves assigning participants to experimental and control groups and asking them to evaluate essays that express either pro-U.S. or anti-U.S. sentiments. Results have all followed a similar trend: mortality salience manipulations significantly

increased participants' preferences for individuals who expressed pro-U.S. attitudes in their essay over individuals who expressed anti U.S. perspectives (e.g., Arndt, Greenberg, Pyszczynski, & Solomon, 1997; Arndt et al, 1997; Greenberg et al., 1990; Greenberg et al., 1992; Greenberg et al., 1994; Greenberg, et al., 1995; Simon et al., 1996; Simon et al., 1997; Harmon-Jones et al., 1997). Although the aforementioned scenario specifically investigates prejudicial attitudes elicited by mortality salience, worldview defense is not limited to merely influencing judgments.

In addition to evaluative processes, mortality salience has also been shown to creep into individuals behavior. Various research has shown that after being made aware of their own death and then asked to sit in a room where an outgroup member awaits, participants choose to sit significantly farther away from outgroup individuals than participants in the control condition (Ochsmann & Reichelt, 1994; Ochsmann & Mathay, 1996). More notably after administering MS, participants show a significant increase in aggression toward outgroup members than participants that had not been made to think about their mortality (McGregor et al., 1998; Lieberman et al., 1999). Together this research reflects that death awareness has a profound ability to elicit prejudicial evaluations and behaviors against outgroups. Although these scenarios illuminate the fact that prejudice is, in part, elicited by death awareness, terror management has continued to investigate this effect. In more current studies, terror management theorists have also looked at which outgroup members are considered more threatening than others and what happens when one is asked to make an evaluation of those outgroups in respect to each other.

The ingroups and outgroups in the previously mentioned studies are juxtaposed in such a way that group membership is fairly obvious. However, terror management has also conducted research examining what happens when worldview supporters and offenders are not as clearly depicted. In the instances of hate crimes both the perpetrator and victim may be perceived as a threat to one's worldview; thus terror management has been able to utilize this unique type of crime to further investigate how worldview defense operates. Results have shown that when hate crimes are described in abstract terms, that is when the victim remains anonymous, MS rallies more support for harsher penalties against hate crime offenders (Arndt, Personius & Cook, 2001). However, in instances when a victim is specifically referenced, punishments delegated to hate crime offenders are significantly less severe when administered by participants that had been reminded of their mortality when compared with punishments given by control participants (Arndt et al., 2001). This finding shows that participants are clearly threatened by both the perpetrator and victim of hate crimes. Interestingly enough however, despite their desire to punish those that do not uphold the laws of one's society, MS appears to elicit some sort of sympathy for these perpetrators when the victim's 'crime' against one's worldview is uncovered.

Despite these negative reactions to mortality salience, these effects on behavior and judgment have not been shown to be accompanied by self-reported negative affect (Greenberg et al., 1995). Furthermore, death awareness has not been shown to elicit physiological indications of anxiety such as skin conductance or facial electromyography (Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989; Arndt, Allen, & Greenberg, 2001). Thus, death awareness appears to elicit a specific variety of anxiety

that is not manifested through normal indications of fear or stress. Terror Management theorists interpret these unusual reactions to mortality salience as a indication of the distinctive cognitive state that death awareness generates. Rather than reminding individuals of the futility of their drive for self-preservation, mortality salience seems to remind one to bolster their worldviews, and through this invest in immortality. Intergroup bias manifests specifically, because group membership is one of the easiest sources by which people feel good about themselves and their role in the world (Tajfel & Turner, 1986). Supplementing one's self-esteem via group affiliation has long been linked to eliciting prejudice. In fact, terror management shares some similarities with past research speculating on the role that social identities play in prejudice related behavior.

Social Identity Theory

Social Identity Theory (SIT) is one of the most prominent theories developed to understand the psychological basis of intergroup discrimination, or prejudiced behavior (Tajfel & Turner, 1986). It is based on the notion that all individuals have the desire to think well of themselves, and one of the ways this is achieved is to be a part of a group (Tajfel & Turner, 1986). Groups can be thought of as an assortment of persons who consider themselves to be members of the same social category, that invest emotionally in this category, and typically agree about how their group is evaluated (Tajfel & Turner, 1986). People can define themselves as belonging to any number of groups (i.e., sex, nationality, profession, etc.; Tajfel & Turner, 1986). It is important to note, however, that group identification is solely cognitive; as long as the group and its members agree on membership criteria, a group can be formed on any sort of distinction -- even ones that are completely arbitrary. Thus group membership can be based on just about anything

including appearance, beliefs, wealth, etc. One study showed that a characteristic as trivial as eye color has been able to prompt group membership (Stewart, LaDuke, Bracht, Sweet, & Gamarel, 2003).

By grouping people into categories social identities are created. These identities serve two primary functions. First, they work as a means by which people define themselves as a part of a group. Secondly, they function to distinguish ingroups (i.e., groups we belong to) from outgroups (i.e., groups to which we do not belong). The act of grouping individuals into ingroups and outgroups has been shown to have both positive and negative effects. Beneficial effects of group affiliation are that it fosters positive social identity, thereby increasing self-esteem. The downside, however, is that it also encourages prejudiced-related behaviors (Tajfel & Turner, 1986).

Prejudice-related behaviors are believed to influence bias and relations through the process of social comparison. Social comparison is the evaluation of ourselves in relation to others. Upward social comparison is when we compare ourselves to those we perceive as 'better' than us. Downward social comparison is when we compare ourselves to those considered 'worse' than us. Social identity Theory merely extends social comparison to the group level. Thus, via comparing ingroups to outgroups we base a portion of self-esteem on group membership.

Because a portion of individuals self-esteem is derived from group membership, when self-esteem is threatened an easy method that can be utilized to feel better about one's group and thereby themselves, is to derogate outgroups. Research on stereotype application has shown that when people are primed with a need to restore their self-image, they activate negative stereotypes about outgroup members (Spencer, Fein,

Strahan, & Zanna, 2005). Similar to what has been learned from research on social identities, terror management theorists interpret the increase seen in the positive evaluation of ingroup members following death awareness as a way of increasing one's self-esteem through the validation of one's worldview; thereby strengthening one's anxiety buffer. Conversely, the increase in the negative bias toward outgroups is believed to transpire because the mere existence of outgroups challenges one's worldview, thus depleting one's self-esteem. Through this, one's anxiety buffer is impaired causing individuals to seek out ways to restore this damage.

Although hundreds of studies have shown bias for the ingroup and against the outgroup, this pattern does not manifest in all instances. On occasions where one's ingroup is framed negatively such that the ingroup may threaten to undermine one's self-esteem, participants have been shown to disidentify with their initial ingroup (Arndt, 2002). This in turn reveals that MS does not always foster ingroup camaraderie. Rather, MS elicits the need to feel better about oneself and one's social identity. By providing people with a sense of self, meaning and value, group identification plays an essential role in how one transcends their mortality. As we are all individuals in a society, one of the most handy ways to feel self-worth is to consider one's contribution to the world as significant. Thus, through impacting the world around us, we feel a sense of immortality. The fact that there are other cultures propagating the earth threatens the significance of one's own culture; thus outgroups are perceived as threatening and prejudice can be the result.

Despite this knowledge on how prejudice works in the instance of mortality salience, present research is unable to identify the exact mechanism involved in this

process and how it may play a role in eliciting these prejudicial attitudes and behaviors. To resolve this it must be determined at what level these prejudicial effects emerge. Is it that there are basic differences in person perception, such that MS causes a change in how we attend and evaluate others? More specifically, does MS increase our attention to outgroup negative attributes, while increasing awareness to ingroup positive attributes? Along with these questions, the extent to which these effects are automatic, or outside our awareness is also important to know. To determine how to answer to these questions, it is necessary to better understand the processes involved in how people are perceived.

Person Perception and ERPs

Person perception is the study of how people perceive others. Recently, much research on person perception has focused on understanding the cognitive processes involved in how race and gender are categorized in the brain (Ito & Urland, 2003) and how this plays a role in instances of racial bias and prejudice related behaviors (e.g., Payne, 2001; Correll, 2002; Amodio et al., 2004). Over the past several decades, a large number of studies in person perception have concentrated on understanding the variables that influence the categorization of people into social groups (e.g., race, social status, gender, etc.). When questioned about evaluations of others, participants are not always willing or able to disclose accurate assessments of their perceptions (Bartholow & Dickter, 2005). To the extent that individuals are unaware of their own psychological processes, it is senseless to expect that self-report measures may have any utility. However, physiological measures, such as event-related brain potentials (ERPs) have proven to be a successful methodology for detecting variables (e.g., thoughts, primes, situations, etc.) that may influence behavior and perception that lie outside of conscious

awareness or control (Rugg & Coles, 1995; Fabiani et al., 2000; Luck, Woodman, & Vogel, 2000). Through this ability to detect various influences on thoughts, ERPs bypass the need of self-report. By detecting discrepancies in the evaluative and categorization processes, ERPs are able to reveal how inconsistencies in stimuli covertly impact information processing and later behavior (Bartholow & Dickter, 2005).

ERPs are considered manifestations of brain activity that transpire in preparation for or in reaction to an event or stimulus in one's environment (Fabiani et al., 2000). Physiologically, ERPs are thought to correspond to post-synaptic potential firing in the cortex. Psychologically, ERPs reflect assorted sensory, cognitive, and motor processes (see Bartholow & Dickter, 2005), the level of engagement of which relate to the size of particular components – positive and negative deflections from baseline – in the ERP waveform. In an age where there are a variety of methodologies employed to measure and observe brain processes, the ERP is particularly useful because of its brilliant temporal resolution (i.e., its ability to detect electrical impulses over split seconds of time; Rugg & Coles, 1995). By tracking the time-course in which events occur in the brain, scientists are better able to understand the sequence of cognitive events (see Fabiani et al., 2000). This capability is particularly useful in studying person perception because it enables one to observe the stages of processing that unfold immediately following perception (see Bartholow & Dickter, 2005). By observing discrepancies in these stages of processing, one can differentiate how such incongruities impact information processing and subsequent behavior (see Rugg & Coles, 1995).

Despite the plethora of research on person perception, little attention has focused on the role that particular psychological states play in the cognitive processing of

outgroup members at the neuronal level. As evidence on TMT has shown, mortality may have a unique impact on the process of person perception. In the context of the current study, examining how quickly participants attend to and process ingroup and outgroup members will disclose if and how a mortality salience induction alters the perceptual processing of social cues. Thus, the present research utilized ERPs in attempt to uncover the mechanisms involved in the perception of outgroup members following mortality salience.

ERPs and Stages of Processing

ERP components are typically referred to as belonging to one of three categories; exogenous, mesogenous, and endogenous (Fabiani et al., 2000), according to how affected they are by attention manipulations (Fabiani et al., 2000). Exogenous components are believed to be relatively unaffected by attention and are considered an automatic response occurring early in the cognitive process (see Hackley, 1993; Fabiani et al., 2000). Mesogenous components are considered “semi-automatic” in the sense that they are able to occur even though attention is directed elsewhere (see Hackley, 1993; Fabiani et al., 2000). Lastly, endogenous components require attention and typically occur later in cognitive processing (see Hackley, 1993; Fabiani et al., 2000). Only when a subject is actively attending to and processing a particular stimulus will endogenous components transpire (see Hackley, 1993; Fabiani et al., 2000). In light of the current study’s goals, only components belonging to the later of these three categories (i.e., the mesogenous, and endogenous) will be examined as these are believed to reflect more socially relevant aspects of attention and evaluation.

The first group of components the current research is focused on observing are the P200 and the N200, appropriately termed according to their polarity (i.e., Negative or Positive) and latency (which can range from 0 to 1000 ms; see Coles & Rugg, 1995). These components are of specific interest to the research at hand because they reflect early attention-related processes known to be affected by ingroup-outgroup distinctions (e.g., Bartholow & Dickter, 2005; Ito & Urland, 2003).

The amplitude of the P200 and N200 waveforms indicate the degree to which attention is focused on some aspect of the existing stimulus (Coles & Rugg, 1995). More specifically, the P200 has been shown to exhibit larger amplitudes in response to outgroup pictures (see Ito & Urland, 2003), while the N200 has shown the reverse effect, eliciting larger amplitudes in the context of ingroup pictures (Dickter & Bartholow, in prep). Although these two components reflect distinctive cognitive functions (see Hackley, 1993), the current of study is primarily concerned with observing the differences in processing that reveal heightened or reduced attentional focus as a consequence of the mortality salience treatment. This in turn allows us to determine if the mortality salience induction directs early attentional processes such that outgroup members receive more attention, particularly when they appear threatening (i.e., angry facial expressions). In other words, examining these components will permit monitoring of the degree to which stimulus features (i.e., varying facial expressions and group representations) affect the early allocation of attentional resources. Given evidence that attention modulates early sensory perception as seen in the amplitudes of these early components (see Luck, Woodman, & Vogel, 2000), it stands to reason that differences in

perception that might arise from mortality salience would influence the extent to which the stimuli are attended.

Another ERP component of particular interest to the current research is the P300. This component occurs later in processing (ranging anywhere from 300 to 900 ms after stimulus onset) and is believed to require attention to be elicited (Coles & Rugg, 1995; Fabiani et al, 2000). Research has revealed that the P300 is primarily associated with two indices of cognitive processing: working memory updating and evaluative categorization (e.g., Donchin & Coles, 1988; Cacioppo et al., 1993, 1994; Fabiani et al. 1995; Ito et al., 1998). Given these properties, the P300 has proven exceptionally useful for research in person perception (see Bartholow & Dickter, 2005). In the context of the current study, the most useful cognitive marker the P300 conveys is its ability to reflect evaluative categorization.

The P300 was first used to investigate evaluative categorization in person perception by Cacioppo and colleagues (Cacioppo, Crites, Gardner, & Bernston, 1994). In this study, Cacioppo et al. (1994) administered a dichotomous evaluative categorization task in which a series of traits were exposed to participants. Participants' task was to categorize traits as being either positive or negative. Evaluative inconsistency was varied by embedding positive and negative traits in sequences containing primarily positive traits. Results show trials in which evaluatively inconsistent traits were presented in context of the consistent majority (e.g., negative traits embedded in a sequence of positive trait sequences) evoked significantly larger P300 amplitudes than instances in which traits were evaluatively consistent throughout the trial (e.g., positive traits

embedded in a sequence of positive trait sequences) suggesting that the P300 can be used as a marker for the evaluation of stimuli.

Subsequent work by this same group suggested that changes in P300 amplitude associated with person perception may be assessing implicit interpersonal attitudes (Crites, Cacioppo, Gardner, & Bernston, 1995). In this work participants viewed positive, neutral, and negative targets embedded in series of either positive or negative stimuli. Participants' task was to either report their specific attitudes about the stimuli or to misreport neutral or negative attitudes. Results show that inconsistent stimuli evoked a larger P300 regardless of participants' self-reported attitudes in comparison to trials in which evaluatively consistent stimuli were presented. Consequently, this evidence suggests that the P300 evoked during evaluative judgments reflects attitude categorization rather than attitude report processes. This finding is particularly important because it revealed how ERPs, or more specifically the P300, can potentially assess attitudes that people are unwilling to report.

Consistent with this line of research, it has also been found that the P300 reflects differences in the evaluative processing of negative and positive targets (Ito & Cacioppo, 2000). In this study, participants were exposed to stimuli that varied along evaluative (i.e., positive vs. negative) and non-evaluative (i.e., people vs. no people) dimensions. Participants were specifically instructed to categorize the stimuli according to one of these two qualities (i.e., evaluative or non-evaluative). Results show that the P300 proved sensitive to participants' explicit categorization task *and* implicit categorization along the non-task relevant categorization.

Given these findings the P300 will assist the current study in investigating the evaluative influences of mortality salience on person perception. More specifically, it will assist the proposed study in teasing out the effects that Mortality Salience has on the evaluative categorization of people as a function of group membership and facial expression.

The objective of the proposed experiments is to examine the broad range of processes that occur when person perception occurs while thoughts of one's own mortality are salient. Two different aspects of person perception will be evaluated, namely, the categorization of ingroup and outgroup individuals, and the role that facial expressions play in the categorization of these individuals. ERP components that are believed to indicate attention and evaluative processes will be examined to gain a better understanding of how mortality salience effects the cognitive processing of cues associated with ingroup and outgroup membership (Rugg & Coles, 1995). Utilizing the advantages that ERPs provide, in terms of temporal resolution of specific cognitive processes, will advance the investigation of how mortality salience influences perception of ingroup and outgroup members. Such findings will allow for connection between the terror management perspective and past research on person perception.

CHAPTER 2

STUDY 1 METHOD

Participants

Thirty healthy university students (13 female, 17 male) signed informed consent and participated in exchange for credit toward a course requirement. Twenty-eight participants identified their ethnicity as White; the remaining 2 identified their ethnicity as either Asian or Other. Participants were randomly assigned to either a control or experimental condition; thus each condition consisted of 15 participants.

Design

This study utilized a 2 (Condition; mortality salience versus control dental pain salience) x 2 (Target Group membership; White, Black) x 4 (Facial Expression; happy, angry, neutral, morphed) mixed factorial design with one between-subjects factor (Condition) and two within-subjects factors (Target Group and Facial Expression).

Stimuli and Experimental Paradigm

Control participants were asked to answer two open ended questions regarding dental pain: “Please briefly describe the emotions that the thought of your own dental pain arouse in you,” and “Jot down, as specifically as you can, what you think will happen to you as you physically experience dental pain and once you have physically experienced dental pain.” Experimental participants were asked to answer two open ended questions regarding death: “Please briefly describe the emotions that the thought of your own death arouse in you,” and “Jot down, as specifically as you can, what you think will happen to you as you physically die and once you are physically dead.” After

receiving the treatment, both control and experimental conditions engaged in a brief delay task that involved reading a passage and subsequently answering two brief questions about the passage. The purpose of the delay passage was to push death awareness outside of experimental group participants' focal attention. Research on mortality salience has shown that when death is explicitly in one's consciousness, proximal modes of defense are elicited (i.e., participants are more focused on their immediate survival as opposed to their immortal endurance; see Pyszczynski, Greenberg, & Solomon, 1999). In the context of the current study, the aim was to elicit distal defenses of one's self-esteem (i.e., their need to make a significant contribution to the world); hence the administration of the delay passage. Following the delay exercise, both groups participated in a picture viewing task in which they viewed photographs of individuals varying in race (i.e., White, Black). Each target exhibited either a happy, neutral, angry or morphed (i.e., angry and happy combined) facial expression. While viewing these images, participants were asked to identify angry and happy expressions by hitting corresponding keys on a keyboard. Behavioral and ERP data were recorded.

Facial Expressions Task

Forty pictures were used in this experiment. Ten separate individuals were portrayed in this set of pictures, each in a total of 4 pictures (i.e., one for each expression: neutral, angry, happy, and morphed). Half of the photos portrayed Black males and half portrayed White males. An oddball paradigm was used in which there were 5 pictures per block, one of which was the target. The target appeared in position 3, 4, or 5 within a given sequence to keep participants from anticipating when it would appear. The remaining non-target images randomly varied by race; however non-target items always

maintained a neutral expression. There were 18 repetitions of each trial type and 8 types of trials (i.e., Black Angry, Black Happy, Black Morph, Black Neutral, White Angry, White Happy, White Morph, and White Neutral); thus there were 144 trials total.

Each picture was presented for 50 ms with an interstimulus interval of 1000 ms. Participants were instructed to respond only to facial expressions exhibiting happy or angry expressions and to do nothing on trials in which neutral or ambiguous expressions were displayed. Picture sequences were arranged into 4 separate blocks and were completely randomized according to race and facial expression.

Electrophysiological Recording

The electroencephalogram (EEG) was recorded from 28 tin electrodes fixed in a stretch-lycra cap and placed according to standard scalp locations (10-20 system). All electrodes were referenced online to the right mastoid; an average mastoid reference was calculated offline. Vertical and horizontal electrooculographic (EOG) activity was recorded with electrodes placed above and below the left eye and approximately 2 cm outside the outer canthus of each eye. A ground electrode was placed close to the front of the cap, along the midline (FPz). All signals were amplified with a Synamps Amplifier and filtered on-line at .05 to 30 Hz at a sampling rate of 1000 Hz. Impedance was kept below 5K Ω . Ocular artifacts (i.e., blinks) were corrected from the EEG signal off-line. Trials containing voltage deflections of +/- 75 microvolts (μ V) were discarded before the averaging of waveforms. After artifact elimination, EEG data was averaged off-line according to participant, electrode, and stimulus conditions, and low-pass filtered at 12 Hz.

Procedure

Participants were randomly assigned to control and experimental groups. Upon arrival participants were briefed on the study via consent form and set-up procedures via the experimenter. Following these briefings, participants were prepped and had electrodes attached to their scalp and face locations. Participants were then asked to complete a packet of materials administered to maintain the notion that they were participating in a study about personality and identifying facial expressions. After the completion of this packet, individuals received the salience treatment (i.e., mortality or dental pain) in accordance with the group to which they had been assigned (i.e., experimental or control). After completing the treatment, participants completed the delay task, as described previously. All participants then engaged in the facial expressions task. ERPs were recorded continuously during the presentation of each stimulus. Finally, participants were debriefed about the true nature of the study, thanked, and dismissed.

CHAPTER 3
STUDY 1 RESULTS

Analytic Approach

ERP data were analyzed using mean waveform values. These values were determined by visually inspecting each individual participant's average waveforms in each condition and selecting a 300 ms time epoch surrounding the component peak values, and then computing the average amplitude within this epoch. Analysis of peak values reflected the same general results for all analyses reported unless otherwise noted. In instances where multiple comparisons were made in follow-up tests, the Bonferroni adjusted p-value was used such that the traditional alpha level of .05 was divided by the total number of comparisons made. Accuracy scores were analyzed using the square root of the Arcsine of error rates.

Behavioral Data

Table 1 presents the mean accuracy rates and response times for Angry and Happy expressions as a function of the conditions of the experiment. These data were analyzed using separate 2 (Condition) x 2 (Target Group) x 2 (Facial Expression) mixed factorial ANOVAs.

Reaction Times. Analyses revealed an overall Condition effect $F(1, 28)=5.87$, $p<.05$ such that participants in the mortality salience (MS) condition responded significantly faster overall ($M = 644$ ms) than participants in the control (No MS) condition ($M = 728$ ms). An overall Expression effect was also observed, $F(1,28)= 11.15$, $p < .01$, such that participants were significantly quicker to respond to happy faces ($M =$

661 ms) than angry faces ($M = 710$ ms). The effect of Target Group, however, did not prove significant $F(1, 28) = .37, p = .55$. No interactions proved significant (Race x Condition $F(1,28) = .02, p = .90$; Express x Condition $F(1,28) = 1.32, p = .26$; Race x Express $F(1, 28) = 1.32, p = .26$; Race x Express x Condition (1, 28) = .37, $p = .55$).

Accuracy. Analyses of the transformed accuracy data revealed the Condition main effect to be nonsignificant $F(1, 28) = 2.78, p = .10$. Although this effect was not significant, inspection of the means showed that participants in the MS condition tended to be more accurate (Error Rate $M = .35$) than participants in the control condition (Error Rate $M = .45$). The analysis did reveal an overall Expression effect, $F(1, 28) = 22.5, p < .001$, such that participants more accurately categorized happy expressions (Error Rate $M = .31$) than angry expressions (Error Rate $M = .49$). In addition, the Race main effect proved to be marginally nonsignificant, $F(1, 28) = 3.15, p = .08$, such that participants made more errors for White faces (Error Rate $M = .41$) than for Black faces (Error Rate $M = .38$). The Race x Expression interaction also proved to be marginally nonsignificant, $F(1, 28) = 3.69, p = .06$. Follow-up tests of this interaction indicated that error rates were higher for White Happy photos ($M = .34$) than for Black Happy photos ($M = .28$) $F(1, 28) = 6.988, p = .01$; however, there was no difference in the number of errors made for Black Angry ($M = .49$) and White Angry ($M = .49$) photos $F(1, 28) = .013, p = .91$. All other interactions proved nonsignificant (Race x Condition interaction $F(1, 28) = .11, p = .74$; Expression x Condition $F(1, 28) = .46, p = .50$; Race x express x Condition $F(1, 28) = .24, p = .62$).

ERP Data

Figures 1a and 1b present the waveforms elicited for Angry and Happy expressions as a function of the conditions of the experiment. These data were analyzed using separate 2 (Condition) x 2 (Ethnicity) x 2 (Facial Expression) x 3 (Scalp Region; frontal, central, parietal) x 3 (Electrode; left, midline, right) mixed factorial ANOVAs with repeated measures on all but the first factor. Mean ERP amplitudes are given in Table 2.

P2. Analysis revealed the overall Condition effect to be nonsignificant $F(1, 28) = 1.09, p = .30$. The Expression effect, however, did attain significance, $F(1, 28) = 6.24, p < .05$. Inspection of the means showed that *P2* amplitude elicited by angry pictures ($M = 3.63$) was significantly larger than that elicited by happy pictures ($M = 2.61$). The Expression x Condition effect did not reach statistical significance $F(1, 28) = .55, p = .46$.

The overall Race effect proved significant, $F(1, 28) = 4.65, p < .05$; the amplitude for Black faces ($M = 3.63$) was significantly larger than that for White faces ($M = 2.61$). Neither the Race x Condition $F(1, 28) = .38, p = .54$, nor the Expression x Race interaction, $F(1, 28) = .001, p = .97$, reached significance. The Expression x Race x Condition interaction also proved to be nonsignificant $F(1, 28) = 2.67, p = .11$.

There was an overall Electrode effect, $F(2, 56) = 11.82, p < .0001$ such that the *P2* amplitude was greatest at electrode Pz. The Race x Scalp Region x Condition effect also proved significant, $F(2, 56) = 3.47, p < .05$. The pattern of means associated with this interaction is shown in Figure 2. Inspection of Figure 2 suggests that the overall Race effect might interact with Condition, but only at Fz. This possibility was tested by conducting follow-up Race x Condition ANOVAs separately for the data at these 3 electrode locations. Unfortunately however these analyses did not prove significant at Fz

$F(1, 28) = 2.49, p = .12$, Cz $F(1, 28) = .23, p = .64$ or Pz $F(1, 28) = .002, p = .97$. Follow up tests did reveal that White faces in the MS condition elicited smaller amplitudes than did White faces in the No MS condition, $F(1, 28) = 3.38, p < .07$, however Black faces elicited comparable amplitude in both conditions, $F(1, 28) = .43, p = .51$.

N2. The Condition, $F(1, 28) = .54, p = .47$, and Expression, $F(1, 28) = .12, p = .73$ main effects were nonsignificant. However, the overall Race effect was significant, $F(1, 28) = 13.86, p < .001$, such that White faces elicited a significantly larger N2 amplitude ($M = -.96$) than Black faces ($M = .90$).

The electrode effect also proved significant $F(1, 28) = 13.55, p < .001$ such that the amplitude was larger at FCz ($M = -.84$) than at Cz ($M = -.56$) or Pz ($M = 1.62$). The amplitude at FCz proved to be significantly larger than at electrode Pz $F(1, 28) = 19.7, p < .001$, however it was not significantly different from the amplitude at electrode Cz $F(1, 28) = 1.41, p = .24$.

The Expression x Race x Condition interaction proved marginally nonsignificant $F(1, 28) = 3.20, p = .08$, such that White angry faces elicited significantly larger amplitudes in the MS condition ($M = -2.74$) in comparison to the control condition ($M = .50$) $F(1, 28) = 5.85, p < .05$ (see Figure 3). Further follow-up tests of this effect reveal that when comparing the amplitude of the N2 for White Angry faces and Black Angry faces there is no significant difference between these two means in the No MS condition $F(1, 28) = .07$, however this comparison is significant in the MS condition $F(1, 28) = 10.80, p = .002$

The Race x Electrode x Condition effect also proved significant $F(2, 56) = 3.75, p < .05$. This pattern of means can be seen in Figure 4. Follow up tests of this 3-way

interaction showed that at Fz, White faces elicited marginally nonsignificantly larger amplitudes in the MS condition than for the control condition $F(1, 28) = 3.16, p = .08$. In addition, in the MS Condition only White faces elicited a significantly larger amplitude than Black faces at Fz (White $M = -2.95$; Black $M = -.27$; $F(1, 28) = 11.16, p < .01$), Cz (White $M = -2.22$; Black $M = .24$; $F(1, 28) = 8.75, p < .01$), and Pz (White $M = .17$; Black $M = 2.43$; $F(1, 28) = 13.17, p < .001$). The control condition elicited this same pattern; however, only at Pz did it attain significance $F(1, 28) = 12.55, p < .001$. This finding is important because it further supports the notion that MS increases attention to ingroup cues early in processing. All other follow-up tests and effects in the original ANOVA were not significant.

P3. The Condition main effect was not significant, $F(1, 28) = .32, p < .57$, nor was the Expression, $F(1, 28) = .34, p = .57$, or Race main effects, $F(1, 28) = .49, p = .49$. There was a significant Electrode main effect $F(2, 56) = 110.1, p < .0001$ such that the P3 Mean amplitude was largest along the midline electrodes. Among the midline electrodes, the P3 proved largest at Pz ($M = 9.95$) in comparison to Fz ($M = 2.52$), where the amplitude was smallest, and Cz ($M = 7.31$). Follow up tests of this effect reveal that the amplitude at Pz was significantly larger than Cz $F(1, 28) = 35.09, p < .0001$, and that Cz was significantly larger than Fz $F(1, 28) = 142.97, p < .0001$ (i.e., the amplitude of the P3 decreased in size toward the front of the head).

The analysis showed a significant Electrode x Condition interaction, $F(2, 56) = 5.30, p < .01$. Follow up tests of this effect indicated that the control condition elicited a larger P3 amplitude than the MS condition but only at Fz, $F(1, 28) = 4.83, p < .05$. The pattern of means was reversed (i.e., larger P3 for MS than for control) at electrode Pz,

though this effect was not significant $F(1, 28) = 1.16, p = .29$. Given that the P3 amplitude was largest at Pz, it is hard to interpret this finding at the frontal electrode sites, as it is unlikely that it was fully developed here. Because the pattern reverses at Pz, it is unlikely that the pattern of means at Fz represents the P3 effect of interest in this research.

In addition to the Electrode x Condition interaction, a significant Expression x Electrode interaction was found $F(2, 56) = 10.91, p < .05$. Follow up tests of this effect reveal that angry expressions ($M = 3.00$) elicited significantly larger amplitudes than happy expressions ($M = 2.05$), but only at electrode Fz $F(1, 28) = 4.83, p < .05$. As with the previous interaction, this pattern is difficult to interpret at the frontal electrodes.

CHAPTER 4

STUDY 1 DISCUSSION

The results of Study 1 provided only mixed support for the primary hypothesis of this research, which was that inducing mortality salience would increase neural indices of racial bias. Specifically, it was expected that, relative to participants in the control condition, those in the MS condition would show larger P3 amplitudes to Black faces, particularly Black faces exhibiting angry expressions. The pattern of means depicted in Figures 1 (a) and (b) are partially consistent with this idea, at least with respect to larger P3 in the MS condition compared with control. Unfortunately though, the analyses of these differences did not prove reliable. Results did however show an overall Race effect in the P2, such that the amplitude was significantly larger for outgroup members than ingroup members. This finding is consistent with past research showing the P200 as an early marker for race perception (Ito & Urland, 2003; Correll, Urland, & Ito, in press; Dickter & Bartholow, 2006). This component, however, was not modified by condition indicating that MS is not necessarily increasing attention to outgroup members at this stage of processing.

Conversely, the N200 *was* modified by the MS manipulation. Consistent with the current finding, past research has also shown an overall Race effect in the N200 such that ingroup members elicit significantly larger amplitudes than outgroup members (Dickter & Bartholow, 2006; Ito & Urland, 2003, 2005; Ito et al., 2004). Of particular interest though was how the N200 was modified by Mortality Salience. The analyses of the N2 means showed that the N2 was larger in the MS condition than in the control condition,

specifically for White faces. Ultimately this effect is believed to suggest that MS is increasing the amount of attention that is already being allocated to the evaluation of ingroup members. This in turn may be causing a deeper level of processing of ingroup information (Dickter & Bartholow, 2006; Ito & Urland, 2003, 2005; Ito et al., 2004).

One potential interpretation of this pattern of means seen in the P2 and N2 data is that MS elicits enhanced ingroup bias but does not affect outgroup bias. In other words, intergroup bias can result from 1 of 3 patterns: increased outgroup acrimony, increased ingroup favoritism, or some combination. Given the pattern of results found in the P2 and N2 components, the role that MS plays appears not to necessarily increase outgroup acrimony so much as it enhances ingroup preference. Much research on prejudice uses discrimination *for* the ingroup and *against* outgroups interchangeably, however this is not necessarily taken as fact within existing literature on prejudice. Brewer (1999) has argued that ingroup love and outgroup hate are separate phenomena. Brewer makes the case that although ingroup preference may foster outgroup discrimination, this partiality does not necessarily always precipitate prejudice against the outgroup (Brewer, 1999). Rather, ingroup preference may be the result of positive emotions being reserved for the ingroup (Brewer, 1999). Thus, the increase in attention to the ingroup following MS, may be interpreted as a mechanism by which emotions such as admiration, sympathy and trust are reserved for the ingroup. A byproduct of this mechanism could be that these same emotions are thereby withheld from the outgroup resulting in bias and discrimination toward this group (see Brewer, 1999). Thus, if the N2 represents a deeper level of processing, and ingroup members are being evaluated more thoroughly, it is probable that death awareness is not necessarily a mechanism for outgroup hostility and discrimination

so much as a mechanism for ingroup favoritism. This preference in turn may cause one to allocate attentional resources in a biased manner such that they seek out and promote the familiar.

More generally, it is clear that inducing mortality salience had an effect on both neurocognitive *and* behavioral measures of person perception. Behavioral results indicate that mortality salience decreased reaction times and increased overall accuracy in identifying facial expressions. Although the increase in accuracy did not attain statistical significance, the overall pattern in the behavioral data is still important to underscore for two reasons. First, this pattern indicates an effect of mortality salience on rapid decision-making concerning ingroup and outgroup faces. Second, the behavioral pattern does not simply reflect a speed/accuracy tradeoff. Often, participants develop response strategies in speeded choice tasks based on a simple heuristic: when participants begin to respond more quickly, they become less accurate; when participants want to respond with more accuracy, they slow down (see Jacoby, 1991 for review). However, this was not the case here. Instead, it appears that mortality salience refines participants' decision making skills, improving their ability to accurately make quick decisions.

Considering the overall pattern of behavioral responding in conjunction with the generally larger P3s seen in the MS condition suggests an intriguing possibility. The increase in amplitude of the P300 suggests that MS may elicit a sort of heightened perceptual state in which people specifically seek out and evaluate social stimuli with heightened relevance and utility. Again, although the overall MS effect did not prove significant in the P3 data, the trend was in the predicted direction and thus is still important to note. Existing literature on TMT suggests that following mortality salience

participants evaluate their environment with more meaning and seek out others as a foundation for reaffirming their self-esteem (see Greenberg et al., 2003 for review). Thus, following MS, participants may be scrutinizing socially relevant stimuli with additional care and meaning, hence the increase in the P3 amplitude in addition to the increase in accuracy and reaction times.

The lack of statistical significance found to support the hypotheses in this study could be due to design imperfections. The current experimental design had various limitations that diminish the extent to which conclusions about social perception can be drawn. Specifically, although it appears that mortality salience increases attention to social stimuli or perhaps increases their relevance, the current paradigm did not include any socially irrelevant stimuli. Thus, we are unable to draw conclusions as to whether this heightened perceptual state is elicited solely by social stimuli (i.e., people) or if mortality salience simply increases attention or perceptual acuity more generally.

In addition, although the effects of interest were couched in terms of ingroup and outgroup differences, the current paradigm confounded group status with Race (i.e., the outgroup was solely defined as Black; ingroup was defined solely as White). Although the Black/White distinction is commonly referred to as ingroup/outgroup in social psychological research when samples are made up of exclusively White participants, it is unclear whether additional (non-White) outgroup targets would elicit responses similar to those seen for Black targets. For example, given that Blacks are often associated with violence in society, it could be that Black faces elicit responses associated with threat, or with negative stereotypes more generally, and that non-Black outgroup targets (e.g., Asians) would not elicit this same pattern. Moreover, in this paradigm the angry

expressions may be too closely related to the threat associated with the Black stereotype to tease apart whether MS is eliciting ingroup/outgroup bias or if it is merely enhanced stereotype activation.

One final limitation to the current study is that group membership may not have been activated in the best possible way. This is because within each trial the race of the targets varied. Thus, it may be more advantageous to hold race constant within each trial, thereby producing more prominent race effects.

CHAPTER 5

STUDY 2 METHOD

Based on the results and limitations of Study 1, a second study was designed with various paradigm changes aimed at overcoming the previously mentioned restrictions. First, group status and race were at least partially unconfounded by including targets representing three ethnic/racial groups (i.e., Black, White, and Asian). In addition, within trials the race/ethnicity of the photographs was held constant to better elicit group membership effects. Finally, Study 2 included an additional oddball task involving the presentation of geometrical figures. The purpose of this task was to determine whether mortality salience causes a heightened perceptual state for processing of all stimuli or merely those that are socially relevant.

Participants

Forty-six healthy university students (12 female, 34 male) signed informed consent and participated in exchange for credit toward an introductory psychology course requirement. Forty-one participants identified their ethnicity as being White, while the remaining 5 identified their ethnicity as either Asian (2) or African American (3). All participants were randomly assigned to control (No MS) or experimental (MS) conditions; resulting in 23 participants in each condition. Participants were recruited under the guise that the study was designed to test differences in facial recognition as a function of personality.

Design

The current experiment utilized a 2 (Condition; mortality salience versus control dental pain salience) x 3 (Target Group Membership; White, Black, Asian) x 3 (Facial Expression; neutral, happy, angry) mixed factorial design with 1 between-subjects factor (Condition) and 2 within-subjects factors (Race and Expression of target).

Stimuli and Experimental Paradigm

Facial expressions task. Forty-two pictures were displayed in this experiment. Fourteen pictures displayed faces of Black men, 4 each of which displayed Happy and Angry expressions, and 10 displayed neutral expressions. Similarly, 14 pictures displayed White men with the same configuration of expressions. An oddball paradigm was used to display the pictures. Each trial of this paradigm included 5 pictures per trial, 4 of which always exhibited neutral expressions and 1 of which was the target picture, which displayed 1 of 3 target expressions (i.e., neutral, angry, or happy) and appeared either 3rd, 4th or 5th in the trial sequence. This varying of target presentation was designed to prevent participants from anticipating when the target would be presented. The race of the pictures presented in each trial was held constant, however the individual in each picture varied.

Each picture was presented for 70 ms with an interstimulus interval that randomly varied between 1000 and 1300 ms. Participants were instructed to respond only to facial expressions exhibiting happy or angry expressions and to do nothing in response to photographs in which a neutral expression was displayed. Participants received a break to rest their eyes after every 60 trials. Trial sequences were completely randomized according to race and target facial expression. There were 30 repetitions of each trial type and 9 types of trials (i.e., Black Angry, Black Happy, Black Neutral, Asian Angry, Asian

Happy, Asian Neutral, White Angry, White Happy, White Neutral); thus there were 270 trials total.

Geometric figures task. Three images were used in this experiment, all of which were two-dimensional figures of geometrical objects. Target pictures were rectangles which were either oriented vertically or horizontally. Neutral pictures were triangles. Each image was light blue and displayed on a black background. An oddball paradigm was used such that there were 5 figures per trial, 4 of which were always neutral images (i.e., triangles) and 1 of which was one of the 2 target types (i.e., horizontal or vertically oriented rectangle). Participants' task was to determine if the target image was oriented horizontally or vertically. To do so, participants were to indicate their decision by pressing one of two keys on a keyboard. The target always appeared in the 3rd, 4th, or 5th position in the trial sequence, varied randomly; thus the presentation of the target varied so that participants were not able to predict it.

Each type of the 3 trial types (i.e., rectangle on its side, standing straight up, or trials in which there was no rectangle presented) was repeated 30 times for a total of 90 trials. Trials were completely randomized. Each figure was presented for 70 ms with an interstimulus interval that varied randomly between 1000 and 1300 ms. Participants were instructed to respond only to rectangles and to do nothing on trials in which a triangle appeared.

Electrophysiological recording

The electroencephalogram (EEG) was recorded from 10 tin electrodes fixed in a stretch-lycra cap and placed according to standard scalp locations (10-20 system). All electrodes were referenced online to the right mastoid; an average mastoid reference was

calculated offline. Vertical and horizontal electrooculographic (EOG) activity was recorded with electrodes placed above and below the left eye and approximately 2 cm outside the outer canthus of each eye. A ground electrode was placed close to the front of the cap, along the midline (FPz). All signals were amplified with a Synamps Amplifier and filtered on-line at .05 to 30 Hz at a sampling rate of 1000 Hz. Impedance was kept below 5K Ω . Ocular artifacts (i.e., blinks) were corrected from the EEG signal off-line. Trials containing voltage deflections of +/- 75 microvolts (μ V) were discarded before the averaging of waveforms. After artifact elimination, EEG data was averaged off-line according to participant, electrode, and stimulus conditions, and low-pass filtered at 12 Hz.

Procedure

Upon arrival, participants were briefed on the study via consent form and the experimenter explained the set-up procedures. Following these briefings, participants were prepped with electrodes and then were asked to complete a packet of materials that were aimed at sustaining the notion that they were participating in a study examining personality and the identification of facial expressions. Following the completion of the individual difference measures, participants received a treatment (i.e., mortality salience or dental pain) identical to those used in Study 1 depending on the group to which they were randomly assigned. After receiving the treatment, participants engaged in a brief delay task like that used in Study 1. All participants then engaged in the facial expression picture viewing task and the geometric figure picture viewing task. The order in which participants completed these tasks varied randomly such that half of the participants in each condition engaged in the facial expression task first, and half engaged in the

geometric figure task first. ERPs and behavior were recorded during both tasks. After completion of these tasks participants were debriefed about the true nature of the study, thanked, and dismissed.

CHAPTER 6
STUDY 2 RESULTS

Analytic Approach

The analytic approach was the same as in Study 1 except where noted.

Face Task Behavioral Analyses

Table 3 presents the mean accuracy rates and response times for Angry and Happy expressions in the as a function of the conditions of the experiment. The behavioral data (reaction times and accuracy) were analyzed using separate 2 (Condition) x 2 (Ethnicity) x 2 (Facial Expression) mixed factorial ANOVAs. Original analysis revealed that the 5 participants that indicated their race as non-White did not effect the overall results; thus all participants' data were included in the reported analyses. Also the Order variable was initially included in the analysis of the behavioral data. However, because it did not have any effect on the outcome, it was removed from the final analysis.

Reaction Times. The overall condition effect was not significant $F(1, 44) = .66, p = .42$. There was, however, a significant Race effect $F(2, 88) = 17.75, p < .001$ such that Asian Pictures elicited the fastest reaction times ($M = 676$ ms) while Black Pictures elicited the longest reaction times ($M = 719$ ms) and White pictures fell in between ($M = 696$ ms). Follow-up tests of this effect revealed that Black faces elicited significantly longer reaction times than White faces $F(1, 41) = 6.69, p < .01$ and Asian faces $F(1, 41) = 24.81, p < .0001$. Furthermore, White faces elicited significantly longer reaction times than Asian faces, $F(1, 41) = 16.39, p < .0001$.

There was also a significant Race x Condition interaction $F(2, 88) = 3.13, p < .05$ (see Figure 5). Follow-up tests of this interaction showed that within the MS Condition, participants were significantly slower to respond to Black faces in comparison to White faces, $F(1, 44) = 12.04, p < .001$, and Asian faces, $F(1, 44) = 25.15, p < .001$. Furthermore, participants in the MS condition were slower to respond to White faces than Asian faces $F(1, 44) = 5.91, p < .05$. In the No MS condition participants were significantly slower to respond to White, $F(1, 44) = 10.27, p = .002$, and Black faces, $F(1, 44) = 6.37, p < .05$, than to Asian faces; however there was no significant difference in this condition for responding to Whites versus Black faces, $F(1, 44) = .38, p = .55$. The difference in response time for each target group between the control and experimental conditions was not statistically significant (Black: $F(1, 44) = 1.78, p = .18$; White: $F(1, 44) = .137, p = .71$; Asian: $F(1, 44) = .32, p = .57$).

Although the Expression effect did not prove significant $F(1, 44) = .45, p = .50$, there was a significant Race x Expression interaction $F(2, 88) = 28.221, p < .001$. Follow up tests of this interaction showed that participants took longer to respond to Black Happy pictures than Black Angry pictures $F(1, 44) = 6.94, p < .05$, and also took longer to respond to White Happy versus White Angry pictures $F(1, 44) = 4.06, p = .05$. The reverse, however, was true for Asian pictures; participants were quicker to respond to Asian Happy pictures than Asian Angry pictures, $F(1, 44) = 35.99, p < .001$. All other effects were not significant (i.e., Expression x Condition $F(1, 44) = .64, p = .42$; Race x Expression x Condition $F(2, 88) = .10, p = .90$).

Accuracy. The analysis of the transformed accuracy data revealed all main effects to be nonsignificant (Condition $F(1, 44) = .52, p = .47$; Expression $F(1, 44) = 1.05, p$

=.31; Race $F(2, 88) = 1.37, p = .26$). There was however a significant Race x Expression interaction $F(2, 88) = 23.67, p < .001$. Follow-up tests revealed that Happy faces were identified incorrectly more often than were Angry faces for both Black, $F(1, 44) = 70.5, p < .00001$, and White faces $F(1, 44) = 84.56, p < .00001$. However, Asian pictures elicited the reverse pattern, such that participants made significantly more errors for Asian Angry pictures than Asian Happy pictures $F(1, 44) = 175.02, p < .00001$. In addition, a significant increase in errors were made for Asian Angry faces than Black Angry faces $F(1, 44) = 6.9, p = .0118$, and White Angry pictures $F(1, 44) = 14.57, p < .0005$. Error rates for White Angry and Black Angry faces were not significantly different $F(1, 44) = .484, p = .49$. Black Happy faces elicited a significantly higher error rate than Asian Happy faces $F(1, 44) = 29.28, p < .00001$, however, there was not a significant difference in error rates for White and Black Happy faces $F(1, 44) = .756, p = .38$. Participants were also significantly more likely to make errors for White Happy pictures than Asian Happy pictures $F(1, 44) = 24.24, p < .0001$. All other effects proved nonsignificant (Race x Condition $F(2, 88) = .45, p = .64$, Expression x Condition $F(1, 44) = .88, p = .35$, and Race x Expression x Condition $F(2, 88) = .33, p = .72$).

Face Task ERP Analysis

Figures 6a and 6b present the mean waveforms elicited by Angry and Happy faces as a function of the conditions of the experiment. These data were analyzed using separate 2 (Condition) x 2 (Order) x 2 (Ethnicity) x 2 (Facial Expression) x 3 (scalp region; frontal, central, parietal) x 3 (electrode; left, midline, right) mixed factorial ANOVAs with repeated measures on all but the first and second factors. Note the 'Order'

variable refers to whether the face task or geometrical task was administered first. See Table 4 for mean ERP amplitude values.

P2. The overall Condition and Order main effects were nonsignificant $F(1, 36) = .02, p = .87$, $F(1, 36) = .08, p = .77$ respectively. There was, however, an overall Race effect $F(2, 72) = 7.74, p < .001$ such that Black faces elicited the largest *P2*. In addition there was an overall Electrode effect $F(2, 72) = 15.82, p < .001$ such that *P2* amplitudes were largest along the midline. In addition there was a significant Race x Electrode Interaction $F(4, 144) = 3.43, p = .01$ (see Figure 7). Examination of these means suggested that Black faces elicited the largest *P2* amplitude ($M = 3.66$), while Asian faces elicited the smallest *P2* along the midline electrodes ($M = 2.35$).

Lastly there was a Region x Electrode interaction $F(4, 144) = 15.17, p < .00001$ such that the *P2* amplitude was largest among electrodes along the midline at central locations. All other effects proved nonsignificant at the .05 level.

N2. Analyses revealed the overall Condition effect to be nonsignificant $F(1, 36) = 2.5, p = .12$. The order effect was also nonsignificant $F(1, 36) = 1.05, p = .31$. The Condition x Order interaction was significant $F(1, 36) = 5.2, p < .05$ such that when the geometric figure task was given prior to the face task, the face task elicited a smaller *N2* amplitude for the MS condition only (see Figure 8). The overall Expression effect was nonsignificant $F(1, 36) = .29, p = .59$. The Race main effect however did prove significant $F(2, 72) = 9.02, p < .001$ such that the amplitude for Black faces ($M = 2.55$) was more positive than that for White ($M = 1.45$) and Asian ($M = 1.46$) faces (i.e., the *N2* was larger for White and Asian faces than for Black faces). Unfortunately however, the

Race x Condition interaction was found to be nonsignificant in this study $F(2, 72) = .68$, $p = .51$.

The overall Region effect $F(2, 72) = 6.67$, $p < .01$ such that amplitudes were largest in the frontal regions of the scalp. There was also a Region x Condition x Order interaction $F(2, 72) = 5.93$, $p < .01$ such that when the geometrical figure task was administered first, the N2 amplitude was significantly smaller for MS conditions than control conditions at all regions (Frontal: $F(1, 36) = 5.13$, $p < .05$, Central: $F(1, 36) = 7.14$, $p = .01$, Parietal: $F(1, 36) = 4.88$, $p < .05$). In addition there was also a significant Electrode effect such that the largest N2 amplitude was found at the Cz electrode $F(2, 72) = 8.64$, $p < .001$. There was also a Race x Electrode interaction $F(4, 144) = 3.08$, $p < .05$ such that White faces elicited the largest amplitudes at the Fz electrode. In addition there was a Region x Electrode interaction $F(4, 144) = 4.47$, $p < .01$ such that the midline electrodes produced the largest N2 amplitudes, all being most prominent at Frontal electrode sites.

P3. The Condition and Order main effects were not significant $F(1, 36) = .65$, $p = .42$ and $F(1, 36) = .05$, $p = .82$ respectively. The Expression main effect was significant, $F(1, 36) = 4.12$, $p < .05$, such that angry expressions elicited larger P3 amplitudes ($M = 5.31$) than happy expressions ($M = 4.77$). There was also a Region main effect $F(2, 72) = 68.9$, $p < .0001$ such that amplitudes were largest in the parietal region of the scalp. There was also an Electrode effect $F(2, 72) = 9.13$, $p < .001$ such that P3 amplitudes were largest among midline electrodes. Finally, there was a Region x Electrode interaction $F(4, 124) = 16.7$, $p < .0001$ such that P3 amplitudes were largest in the Parietal region and midline electrodes (Pz). No other analyses attained significance (Race x Condition

interaction proved nonsignificant $F(2, 72) = .06, p = .94$. In addition the Expression x Condition effect also proved nonsignificant $F(1, 36) = .69, p = .41$).

Geometrical Figure Task Behavioral Analyses

Table 5 presents the mean accuracy rates and response times as a function of the conditions of the experiment. The behavioral data (reaction times and accuracy) were analyzed using separate 2 (Condition) x 2 (Rectangle-Type) mixed factorial ANOVAs. Note, the variable 'rectangle-type' refers to whether the presented rectangle presented was sitting upright, or on its side.

Reaction Times. Analyses revealed that there were no significant effects observed in the reaction time data (Condition: $F(1,44) = .167, p = .68$; Rectangle Type: $F(1,44)=2.822, p = .10$; Rectangle type x Condition: $F(1, 44) = .006, p = .939$).

Accuracy. Analysis of the transformed accuracy data revealed the Condition main effect to be significant $F(1, 44) = 4.698, p <.05$ such that participants made significantly fewer errors in the MS condition ($M = .30$) than the control condition ($M = .39$). No other effects were significant.

Geometrical Figures Task ERP Analyses

Figure 9 presents the mean waveforms elicited by experimental (MS) and control (No MS) conditions. These data were analyzed using separate 2 (Condition) x 2 (Target Type: Tall Rectangle, Wide Rectangle) x 3 (Scalp Region; frontal, central, parietal) x 3 (Electrode; left, midline, right) mixed factorial ANOVAs with repeated measures on all but the first factor. See Table 6 for mean ERP amplitude values.

P2. The Condition main effect was not significant $F(1, 39) = .38, p = .54$. There was a significant Region effect $F(2, 78) = 3.77, p = <.05$ such that midline electrodes

produced the largest amplitudes. There was a significant Electrode effect $F(2, 78) = 8.26$, $p < .001$ such that the largest amplitudes were on the midline electrodes; and an overall Region x Electrode interaction $F(4, 156) = 4.06$, $p < .01$ such that P2 amplitudes were largest among midline central electrodes. All other analyses proved to be nonsignificant.

N2. The overall Condition effect was nonsignificant $F(1, 39) = .08$, $p = .77$. There was a significant Electrode effect $F(2, 78) = 5.01$, $p < .01$ such that the largest amplitudes were on the midline electrodes. There was also a significant Region x Electrode interaction $F(4, 156) = 8.14$, $p < .001$ such that amplitudes were largest at central left electrodes. All other analyses proved nonsignificant.

P3. The overall Condition effect was nonsignificant $F(1, 39) = .24$, $p = .622$. There was a significant Region effect $F(2,78) = 80.27$, $p < .0001$ such that the largest P3s were in the parietal region. There was a significant Electrode effect $F(2,78) = 28.3$, $p < .0001$ such that the largest P3s were on the right electrodes. There was also a Region x Electrode interaction $F(4, 156) = 9.69$, $p < .0001$ such that amplitudes were largest at the parietal midline electrode site.

Auxiliary Analyses of Facial Expression ERP Data

Winsorized P3. Inspection of individual subject waveforms and average P3 amplitudes revealed large inter-individual variability. Thus, in an effort to fully explore and better understand the data, the P3 means were examined by condition for the presence of outliers. As suggested by others (Tabachnick & Fidell, 1989; Wilcox, 1995), values considered to be extreme outliers were modified to the next-most extreme, non-outlying value in the distribution. This approach is preferable to deletion or mean

substitution in that it maintains the ordinal position of extreme scores while reducing their undue influence on the mean of the distribution.

After winsorizing outlying values in the Facial Expressions task P3 data, the Race x Order x Condition interaction attained statistical significance $F(2, 72) = 3.30, p < .05$ (see Figure 10). Although none of the follow-ups were significant, the trend was such that P3s were larger for MS conditions than control conditions. Furthermore, the Order in which the facial expression task was administered did not appear to effect the P3 amplitude for White photos, however when administered after the Geometrical Figures task, larger P3 amplitudes were elicited by Black and Asian photos than White photos.

CHAPTER 7

STUDY 2 DISCUSSION

Study 2 was aimed at overcoming the limitations of Study 1 and further investigating the mechanisms involved in the process of person perception following mortality salience. As can be seen in figures 6 (a) and (b), the results are consistent with Study 1 such that MS conditions elicited larger P3 amplitudes. Furthermore, upon winsorizing the P3 means, the MS effect proved significant in Study 2, revealing that mortality reminders may indeed enhance the evaluative categorization of social stimuli. Inclusion in Study 2 of a task involving the perception of non-social stimuli permitted clarification of whether the MS effect on ERP amplitudes was specific to socially-relevant stimuli. Comparison of the results from these 2 tasks indicates that mortality salience manipulations most prominently effect the perception of social compared to non-social stimuli. As depicted in Figure 9, the MS induction elicited somewhat larger P3 amplitudes in the Geometrical Figures task, however these differences did not prove as large as they were for socially relevant stimuli in addition to not proving reliable. Thus, MS may indeed produce heightened perception, but this effect appears most prominent for the perception of socially relevant stimuli.

Unfortunately, the effect of MS on the N2 ingroup bias effect seen in Study 1 was not replicated in Study 2. Given that the Order variable substantially altered this component in the MS condition specifically, it is possible that the N2 effect found in study 1 was muted. In regard to the Order variable though, it is interesting to note that the winsorized P3 analysis revealed that when the Geometrical figures task was administered

first, the P3 amplitude was larger for outgroup members in the Facial Expression Task. This could be because in these instances the Geometrical task is acting as an additional delay task. Research on mortality salience has discovered two kinds of defense mechanisms that are elicited in reaction to MS reminders: proximal and distal. Proximal defenses are elicited immediately following MS and are believed to encourage people to focus on immediate aspects of survival, such as putting on sunscreen, eating healthy, or putting on ones seat belt (Routledge, Arndt, & Goldenberg, 2004). Distal defenses however encourage one to invest in their immortality (Routledge et al., 2004). Distal defenses are what these two studies sought to elicit as these defenses are what have been shown to elicit prejudiced behaviors. To ensure that these distal defenses were elicited, as opposed to proximal, the current studies used a delay task meant to take death awareness out of one's conscious thoughts. If this delay task had not been given, death awareness is believed to have stayed in participants immediate consciousness causing proximal defenses to be engaged. In the current study, the P3 data suggest the geometric task, when administered first served as an additional delay task, thereby causing an increase in the amplitude of the P3 component in comparison to the control group.

Furthermore, the Order in which the facial expression task was administered did not appear to effect the P3 amplitude for White photos, however when administered after the Geometrical Figures task, larger P3 amplitudes were elicited by Black and Asian photos than White photos. suggesting that when administering the Facial Expressions Task second the Geometrical figure task could be acting as an additional delay task thereby increasing the strength of the MS effect at this particular component.

CHAPTER 8

GENERAL DISCUSSION

The purpose of this project was to determine whether reminders of death would produce evidence of increased race bias on relatively nonreactive, neurocognitive measures. Previous studies using behavioral and self-report measures have shown that mortality salience leads to increased expression of discrimination and bias against outgroups, however this research has yet to pinpoint the mechanism(s) responsible for these effects. It was hypothesized that, overall, MS would cause an increase in the amplitude of three ERP components; the P2, the N2, and the P3. In accord with Tajfel and Turner's Social Identity Theory (1986), it was believed that outgroups portraying negative attributes and ingroup members displaying positive attributes would be processed more deeply than outgroups exhibiting positive and ingroups exhibiting negative qualities. Furthermore, it was hypothesized that making one's mortality salient would amplify this effect as participants that were reminded of their impending death would seek out a way to restore the damage that death awareness had on their self-esteem.

Taken together the results of these two studies reflect that Mortality Salience does indeed have an effect on neurocognitive and behavioral processes. Results showed that MS generally causes a heightened sense of perception, specifically in regard to social as opposed to non-socially relevant stimuli. Although these results did not pan out to be significant in both studies, they have provided an interesting query to further investigate: how much does MS heighten ones perceptual functioning, and why. TMT research

suggests that following MS people's self-esteem is depleted, thus the heightened state of perception could be due to the fact that individuals need to seek out meaning in their environment; specifically meaning that is valuable to them and their self-esteem. One way in which to do this is to identify with one's ingroup. Which brings us to the N2 data found in Study 1.

Of most interest to the combined studies was the evidence found in Study 1 regarding the N2 component. Recent studies have found that the N2 elicited for ingroup members is significantly larger than that elicited by outgroup members (Ito et al., 2004; Dickter and Bartholow, in prep). A larger N2 is believed to reflect greater attention and depth of processing; thus, this increase is believed to reflect a sort of ingroup encoding bias such that ingroup members are allocated additional energy and focus in the perceptual process. This phenomenon fits nicely with Brewers argument regarding ingroup love (1999). If people are dedicating preferential treatment to the processing of ingroup members, it is possible that the prejudiced behavior against the outgroup is merely a result of exhausted resources. What is interesting about the current study is that it appears that MS may be amplifying this bias, revealing that the N2 may very well be the mechanism responsible for precipitating discrimination and bias against outgroups in instances where one's mortality is made salient. The mechanism itself, however, is not the direct cause of this discrimination and bias. Rather the mechanism found in the N2 appears to cause attentional resources and positive emotions to be reserved for the ingroup; which in turn deprives these emotions from the outgroup. Thus, this initial bias for the ingroup, meant to help and promote the familiar, eventually morphs into the prejudice and discrimination against the outgroup seen in previous research.

The lack of statistical significance in the P3 data and the inability to replicate the N2 data in study 2 could in fact be due to certain design limitations that future research should aim to overcome. Although prominent trends were seen in current data, there was a great deal of variance between subjects that may have muffled their statistical significance. Future studies may attempt to overcome this problem by increasing the sample size and the number of trials in the picture viewing tasks to reduce variance at the within-subject level. In addition, moderators of the MS effect at the personality level may assist in accounting for within-subject variance.

Taken together the results of these two studies reflect that Mortality Salience does indeed have an effect on neurocognitive and behavioral processes, however the specifics are still unclear. Thus, although the results of these studies provide only mixed support for my initial hypotheses, they begin to illuminate the mechanisms involved in racial bias and discrimination, and how MS may intensify this already present tendency.

REFERENCES

- Amodio, D., Harmon-Jones, E., Devine, P., Curtin, J., Hartley, S., & Covert, A. (2004). Neural signals for the detection of unintentional race bias. Psychological Science, 15, 88-93.
- Arndt, J., Allen, J. J. B., & Greenberg, J. (2001). Traces of terror: Subliminal death primes and facial electromyographic indices of affect. Motivation and Emotion, 25, 253-277.
- Arndt, J., Cook, A., & Routledge, C. (2004). The blueprint of terror management: Understanding the cognitive architecture of psychological defense against the awareness of death. Handbook of Experimental Existential Psychology. New York: The Guilford Press, 35-53.
- Arndt, J., Greenberg, J., Pyszczynski, T., & Solomon, S. (1997). Subliminal exposure to death-related stimuli increases defense of the cultural worldview. Psychological Science, 8, 379-385.
- Arndt, J., Greenberg, J., Schimel, J., Pyszczynski, T., & Solomon, S. (2002). To belong or not to belong, that is the question: Terror management and identification with gender and ethnicity. Journal of Personality and Social Psychology, 83, 26-43.
- Arndt, J., Greenberg, J., Solomon, S., Pyszczynski, T., & Simon, L. (1997). Suppression, accessibility of death-related thoughts, and cultural worldview defense: Exploring the psychodynamics of terror management. Journal of Personality and Social Psychology, 73, 5-18.

Arndt, J., Solomon, S., Kasser, T., & Sheldon, K. (2004). The urge to splurge: A terror management account of materialism and consumer behavior. Journal of Consumer Psychology, *14*, 198-212.

Attias, J., Bleich, A., Furman, V., & Zinger, Y. (1996). Event-related brain potentials in post-traumatic stress disorder of combat origin. Biological Psychiatry, *40*, 373-381.

Bartholow, B., & Dickter, C. (2005). Social cognitive neuroscience of person perception: A selective review focused on the event-related brain potential. In E. Harmon-Jones & P. Winkielman (Eds.), Fundamentals of social neuroscience. New York: Guilford Press.

Bartholow, B., Fabiani, M., Gratton, G., & Bettencourt, A. (2001). A psychophysiological examination of cognitive processing of and affective responses to social expectancy violations. Psychological Science, *12*, 197-204.

Bartholow, B., Pearson, M., Gratton, G., & Fabiani, M. (2003). Effects of alcohol on person perception: A social cognitive neuroscience approach. Journal of Personality and Social Psychology, *85*, 627-638.

Bechara, A., Damasio, H., Tranel, D., & Damasio, A. R. (1997). Deciding advantageously before knowing the advantageous strategy. Science, *275*, 1293-1294.

Bettencourt, A., Dill, K., Greathouse, S., Charleton, K., & Mulholland, A. (1997). Predicting evaluations of ingroup and outgroup members: The role of category-based expectancy violation. Journal of Experimental Social Psychology, *33*, 244-275.

Brewer, M. (1999). The psychology of prejudice: Ingroup love or outgroup hate? Journal of Social Issues, *55*, 429-444.

Cacioppo, J., Crites, S., Berntson, G., & Coles, M. (1993). If attitudes affect how stimuli are processed, should they not affect the event-related brain potential?

Psychological Science, *4*, 108-112.

Cacioppo, J., Crites, S., Gardner, W., & Bernston, G. (1994). Bioelectrical echoes from evaluative categorizations: I. A late positive brain potential that varies as a function of trait negativity and extremity. Journal of Personality and Social Psychology, *67*, 115-125

Crites, S., Cacioppo, J., Gardner, W., & Berntson, G. (1995). Bioelectrical echoes from evaluative categorization: II. A late positive brain potential that varies as a function of attitude registration rather than attitude report. Journal of Personality and Social Psychology, *68*, 997-1013.

Coles, M., & Rugg, M. (1995). Event-related brain potentials: An introduction. Electrophysiology of Mind: Event-Related Brain Potentials and Cognition. Oxford: Oxford University Press.

Coles, M., Smid, H. Scheffers, M., & Otten, L. (1995). Mental chronometry and the study of human information processing. Electrophysiology of Mind: Event-Related Brain Potentials and Cognition. Oxford: Oxford University Press.

Correll, J., Park, B., Judd, C., & Wittenbrink, B. (2002). The police officer's dilemma: Using ethnicity to disambiguate potentially threatening individuals. Journal of Personality and Social Psychology, *83*, 1314-1329.

Dickter, C., & Bartholow, B. (in prep). *Control of attention in the categorization of race and gender: A psychophysiological study*. Manuscript in preparation.

Donchin, E., & Coles, M. (1988). Is the P300 component manifestation of context updating? Behavioral and Brain Sciences, *11*, 357-427.

Fabiani, M., & Friedman, D. (1995). Changes in brain activity patterns in aging: The novelty oddball. Psychophysiology, *32*, 579-594.

Fabiani, M., Gratton, G., & Coles, M. (2000). Event-related brain potentials: Methods, theory, and applications. Handbook of Psychophysiology (2nd Ed.). Cambridge: Cambridge University Press, 53–84.

Federal Bureau of Investigation (2000).
http://www.fbi.gov/ucr/cius_00/hate00.pdf (p 11)

Federal Bureau of Investigation (2001). <http://www.fbi.gov/ucr/01hate.pdf> (p 13)

Greenberg, J., Pyszczynski, T., & Solomon, S. (1995). Toward a dual-motive depth psychology of self and social behavior. Efficacy, Agency, and Self-Esteem. New York: Plenum Press.

Greenberg, J., Pyszczynski, T., Solomon, S., Rosenblatt, A. V., Veeder, M., Kirkland, S., & Lyon, D. (1990). Evidence for terror management: II: The effects of mortality salience on reactions to those who threaten or bolster the cultural worldview. Journal of Personality and Social Psychology, *58*, 308-318.

Greenberg, J., Simon, L., Harmon-Jones, E., Solomon, S., Pyszczynski, T., Lyon, D. (1995). Testing alternative explanations for mortality salience effects: Terror management, value accessibility, or worrisome thoughts? European Journal of Social Psychology, *25*, 417-433.

Greenberg, J., Simon, L., Jones, E. A., Solomon, S., Pyszczynski, T., & Lyon, D. (1995). Testing alternative explanations for mortality salience effects: Terror

management, value accessibility, or worrisome thoughts? *European Journal of Social Psychology*, 25, 417-433.

Greenberg, J., Simon, L., Pyszczynski, T., Solomon, S., & Chatel, D. (1992). Terror management and tolerance: Does mortality salience always intensify negative reactions to others who threatens one's worldview? *Journal of Personality and Social Psychology*, 63, 212-220.

Greenberg, J., Solomon, S., & Pyszczynski, T. (1997). Terror management theory of self-esteem and cultural worldviews: Empirical assessments and conceptual refinements. In M.P. Zanna (Ed.), *Advances in experimental social psychology*, (pp. 61 - 139). San Diego: Academic Press.

Solomon, S., Greenberg, J., & Pyszczynski, T. (2000). Pride and prejudice: Fear of death and social behavior. *Current Directions in Psychological Science*, 9, 200-204.

Greenberg, J., Pyszczynski, T., Solomon, S., Simon, L., & Breus, M. (1994). Role of consciousness and accessibility of death-related thoughts in mortality salience effects. *Journal of Personality and Social Psychology*, 67, 627-637.

Hackley, S. (1993). An evaluation of the automaticity of sensory processing using event-related potentials and brain-stem reflexes. *Psychophysiology*, 30, 415-428.

Harmon-Jones, E., Greenberg, J., Solomon, S., & Simon, L. (1996). The effects of mortality salience on intergroup bias between minimal groups. *European Journal of Social Psychology*, 26, 677-681.

Harmon-Jones, E., Simon, L., Greenberg, J., Pyszczynski, T., Solomon, S., & McGregor, H. (1997). Terror management theory and self-esteem: Evidence that

increased self-esteem reduces mortality salience effects. Journal of Personality and Social Psychology, *72*, 24-36.

Ito, T., & Cacioppo, J. (2000). Electrophysiological evidence of implicit and explicit categorization processes. Journal of Experimental Social Psychology, *36*, 660-676.

Ito, T., Larsen, J., Smith, K., & Cacioppo, J. (1998). Negative information weighs more heavily on the brain: The negativity bias in evaluative categorizations. Journal of Personality and Social Psychology, *76*, 887-900.

Ito, T., Thompson, E., & Cacioppo, J. (2004). Tracking the timecourse of social perception: The effects of racial cues on event-related brain potentials. Personality and Social Psychology Bulletin, *30*, 1267-1279.

Ito, T., & Urland, G., (2003). Race and gender on the brain: Electrocranial measures of attention to the race and gender of multiply categorizable individuals. Journal of Personality and Social Psychology, *85*, 616-626.

Lieberman, J. D., Arndt, J., Personius, J., & Cook, A. (2001). Vicarious annihilation: The effect of mortality salience on perceptions of hate crimes. Law and Human Behavior, *25*, 547-566.

Lieberman, J. D., Solomon, S., Greenberg, J., & McGregor, H. A. (1999). A hot new way to measure aggression: Hot sauce allocation. Aggressive Behavior, *25*, 331-348.

Luck, S. J., Woodman, G. F., & Vogel, E. K. (2000). Event-related potential studies of attention, Trends in Cognitive Sciences, *4*, 432-440.

McGregor, H. A., Lieberman, J. D., Greenberg, J., Soloman, S., Arndt, J., Simon, & Pyszczynski, T. (1998). Terror Management and aggression: Evidence that mortality

salience motivates aggression against worldview threatening others. Journal of Personality and Social Psychology, *46*, 590-605.

Nelson, L., Moore, D., Olibetti, J., & Scott, T. (1997). General and personal mortality salience and nationalistic bias. Personality and Social Psychology Bulletin, *23*, 884-892.

Ochsmann, R., & Mathay, M. (1996). Depreciating of and distancing from foreigners: Effects of mortality salience. Unpublished manuscript, Universitat Mainz, Mainz, Germany.

Ochsmann, R., & Reichelt, K. (1994). Evaluation of moral and immoral behavior: Evidence of terror management theory. Unpublished manuscript, Universitat Mainz, Mainz, Germany.

Payne, B. K. (2001). Prejudice and perception: The role of automatic and controlled processes in misperceiving a weapon. Journal of Personality and Social Psychology, *81*, 181-192.

Pollak, S., Klorman, R., Thatcher, J., & Cichetti, D. (2001). P3b reflects maltreated children's reactions to facial displays of emotion. Psychophysiology, *38*, 267-274.

Pyszczynski, T., Soloman, S., & Greenberg, J. (2003). In the wake of 9/11: The psychology of terror. Washington, DC: American Psychological Association.

Rosenblatt, A., Greenberg, J., Solomon, S., Pyszczynski, T., & Lyon, D. (1989). Evidence for terror management theory I: The effects of mortality salience on reactions to those who violate or uphold cultural values. Journal of Personality and Social Psychology, *57*, 681-690.

Routledge, Clay, Arndt, Jamie and Goldenberg, Jamie L. (2004) A time to tan: proximal and distal effects of mortality salience on sun exposure Intentions. Personality and Social Psychology Bulletin, 30, 1347-1358.

Simon, L., Greenberg, J., Harmon-Jones, E., Solomon, S., & Pyszczynski, T. (1996). Mild depression, mortality salience, and defense of the worldview: Evidence of intensified terror management in the mildly depressed. Personality and Social Psychology Bulletin, 22, 81-90.

Simon, L., Greenberg, J., Harmon-Jones, E., Solomon, S., Pyszczynski, T., Arndt, J., & Abend, T. (1997). Terror management and cognitive-experiential self-theory: Evidence that terror management occurs in the experiential system. Journal of Personality and Social Psychology, 72, 1132-1146.

Spencer, S., Fein, S., Strahan, E., & Zanna M. (2005). The role of motivation in the unconscious: How our motives control the activation of our thoughts and shape our actions. Social Motivation: Conscious and Unconscious processes. (pp. 113-129). New York, NY, US: Cambridge University Press.

Stewart, T., LaDuke, J., Bracht, C., Sweet, B., & Gamarel, K. (2003). Do the "Eyes" Have It? A Program Evaluation of Jane Elliott's "Blue-Eyes/Brown-Eyes" Diversity Training Exercise. Journal of Applied Social Psychology, 33, 1898-1921.

Tabachnick, B. G., & Fidell, L. S. (1989). Using multivariate statistics. New York: Harper & Row.

Tajfel, H., & Turner, J. C. (1986). The social identity of intergroup behavior. In S. Worchel & W. Austin (Eds.), Psychology of intergroup relations (pp. 7-24). Chicago: Nelson-Hall.

Wilcox, R. R. (1995). Statistics for the social sciences. San Diego, CA: Academic Press.

Williams, L., Liddell, B., Rathjen, J., Brown, K., Gray, J., Phillips, M., Young, A., & Gordan, E. (2004). Mapping the time course of nonconscious and conscious perception of fear: An integration of central and peripheral measures. Human Brain Mapping, 21, 64-74.

Table 1

Study 1: Mean Error Rates and Response Times.

		MS		No MS	
		<i>Black</i>	<i>White</i>	<i>Black</i>	<i>White</i>
Angry	<i>Error Rate</i>	.20 (.11)	.21 (.13)	.30 (.23)	.29 (.23)
	<i>Reaction Time (ms)</i>	660 (90)	659 (93)	767 (155)	755 (166)
Happy	<i>Error Rate</i>	.08 (.07)	.11 (.08)	.12 (.11)	.15 (.10)
	<i>Reaction Time (ms)</i>	622 (80)	633 (76)	681 (83)	709 (111)

Note. Standard deviations are given in parentheses.

Table 2

Study 1: Mean ERP Amplitudes.

		No MS		MS	
		<i>Angry</i>	<i>Happy</i>	<i>Angry</i>	<i>Happy</i>
P2	<i>Black</i>	4.41	3.91	3.88	2.30
	<i>White</i>	4.51	2.37	1.72	1.86
N2	<i>Black</i>	1.51	1.35	1.55	0.33
	<i>White</i>	0.59	-0.37	-2.35	-0.69
P3	<i>Black</i>	6.67	6.59	6.67	5.79
	<i>White</i>	7.17	6.99	6.46	6.44

Table 3

Study 2: Facial Picture Viewing Task Mean Error Rates and Response Times.

		MS			No MS		
		<i>Black</i>	<i>White</i>	<i>Asian</i>	<i>Black</i>	<i>White</i>	<i>Asian</i>
Angry	<i>Error Rate</i>	.10 (.14)	.07 (.05)	.11 (.09)	.09 (.09)	.07 (.07)	.04 (.06)
	<i>Reaction Time (ms)</i>	722 (105)	694 (99)	716 (105)	659 (78)	658 (81)	680 (76)
Happy	<i>Error Rate</i>	.11 (.09)	.09 (.07)	.06 (.09)	.13 (.10)	.10 (.09)	.14 (.11)
	<i>Reaction Time (ms)</i>	757 (140)	711 (93)	654 (102)	691 (134)	677 (102)	614 (86)

Note. Standard deviations are given in parentheses.

Table 4

Study 2: Facial Picture Viewing Task mean ERP Amplitudes.

		No MS		MS	
		<i>Angry</i>	<i>Happy</i>	<i>Angry</i>	<i>Happy</i>
P2	<i>Black</i>	3.23	3.39	3.08	2.86
	<i>White</i>	1.73	1.48	2.69	1.98
	<i>Asian</i>	2.18	2.06	1.96	2.40
N2	<i>Black</i>	1.77	1.96	3.37	3.12
	<i>White</i>	0.70	0.51	2.73	1.84
	<i>Asian</i>	1.08	0.85	1.74	2.15
P3	<i>Black</i>	5.33	4.78	5.95	5.46
	<i>White</i>	4.82	4.10	5.35	4.99
	<i>Asian</i>	5.01	3.99	5.43	5.31

Table 5

Study 2: Geometrical Pictures Task Mean Error Rates and Response Times.

		MS	No MS
Tall	<i>Error Rate</i>	11 (.09)	.16 (.11)
	<i>Reaction Time (ms)</i>	741 (135)	725 (139)
Wide	<i>Error Rate</i>	.09 (.08)	.16 (.16)
	<i>Reaction Time (ms)</i>	720 (121)	705 (150)

Note. Standard deviations are given in parentheses.

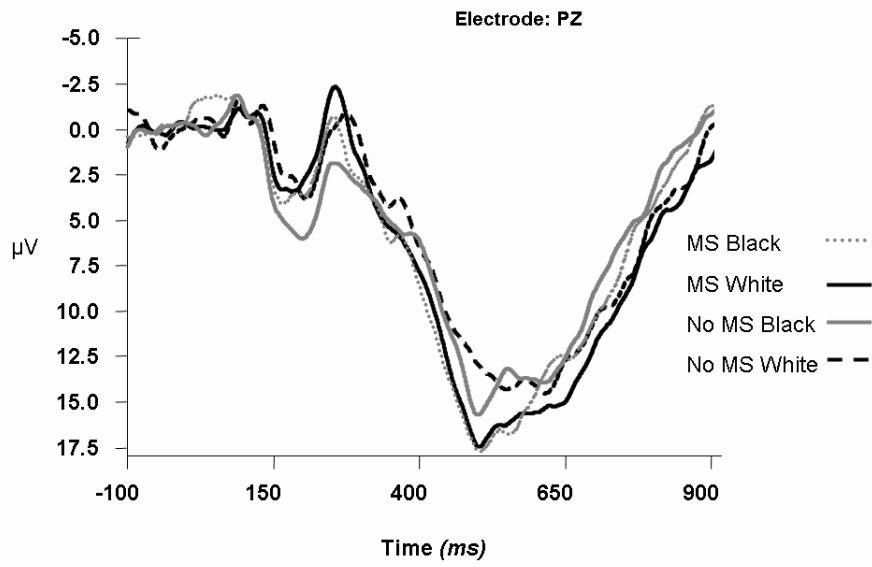
Table 6

Study 2: Geometrical Figure Task Mean ERP Amplitudes.

		No MS	MS
P2	<i>Wide Rectangle</i>	1.00	0.50
	<i>Tall Rectangle</i>	1.68	0.92
N2	<i>Wide Rectangle</i>	-1.44	-2.41
	<i>Tall Rectangle</i>	-1.29	-1.94
P3	<i>Wide Rectangle</i>	3.27	3.00
	<i>Tall Rectangle</i>	2.65	3.91

Figure 1

A.



B.

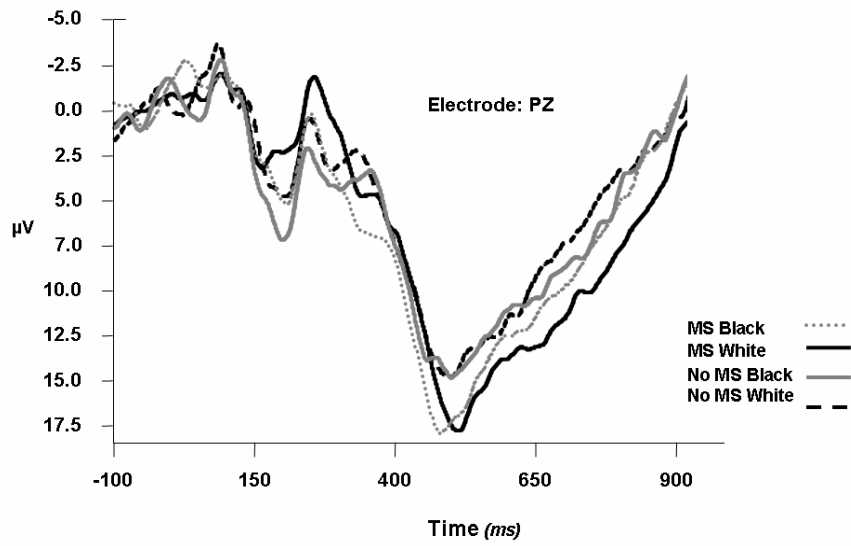
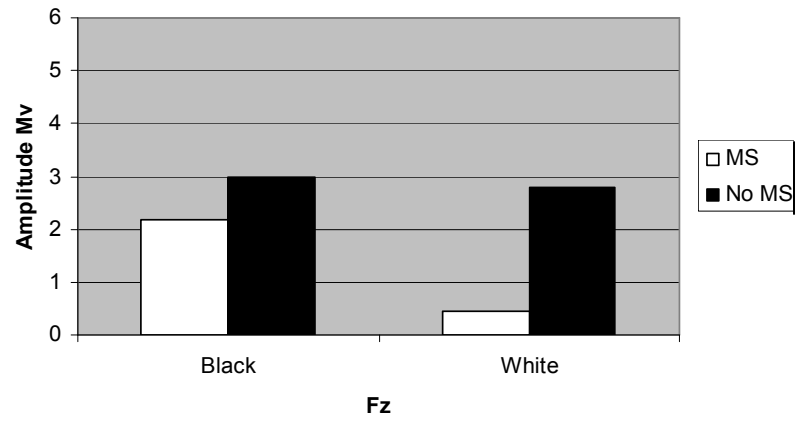
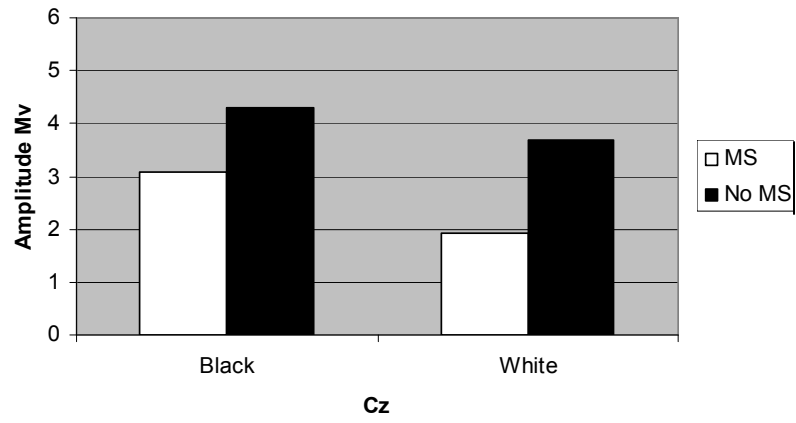


Figure 2

A.



B.



C.

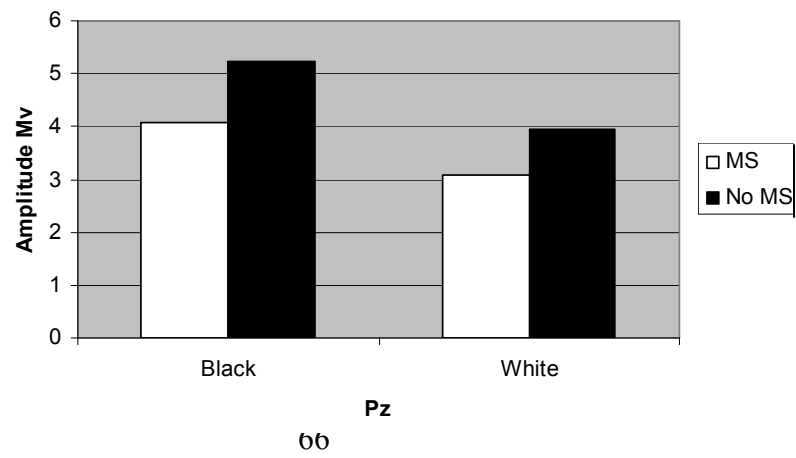
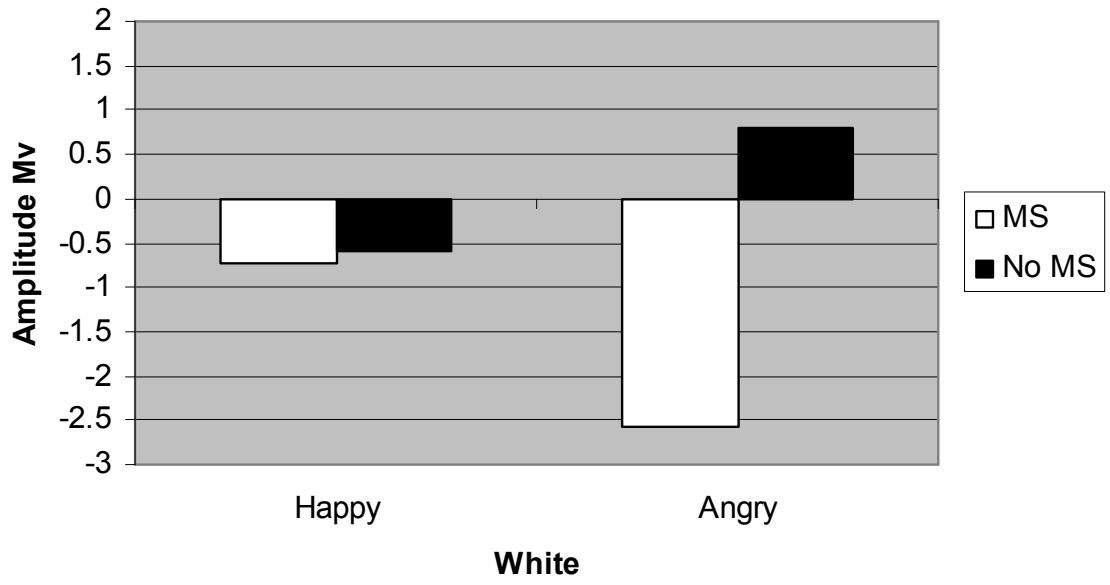


Figure 3

A.



B.

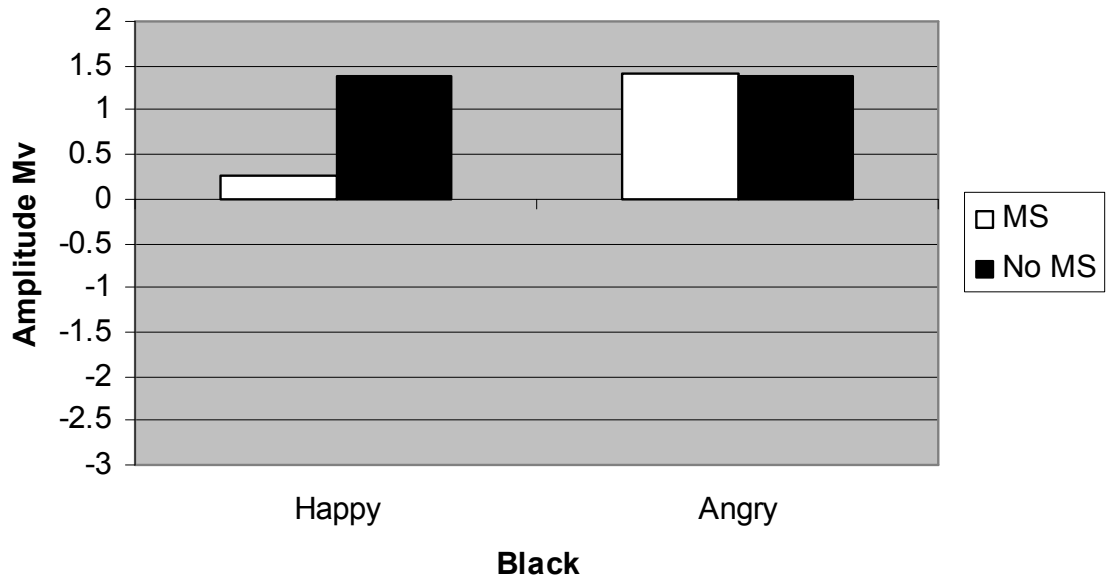
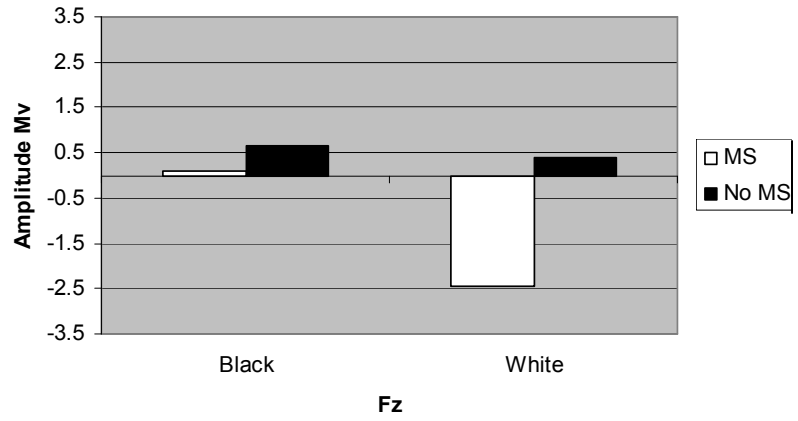
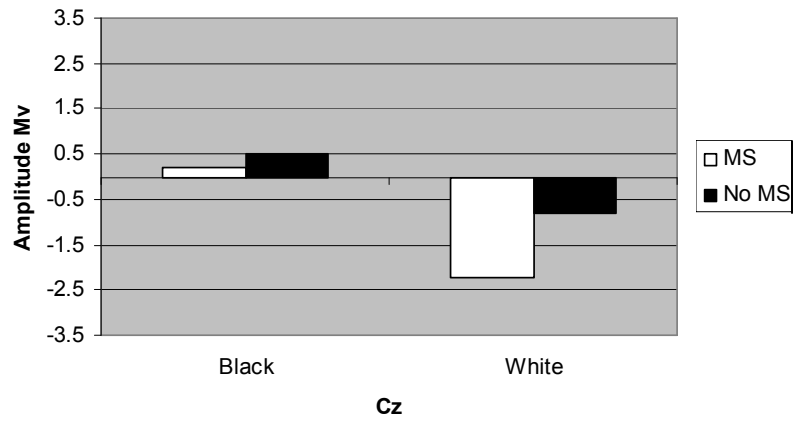


Figure 4

A.



B.



C.

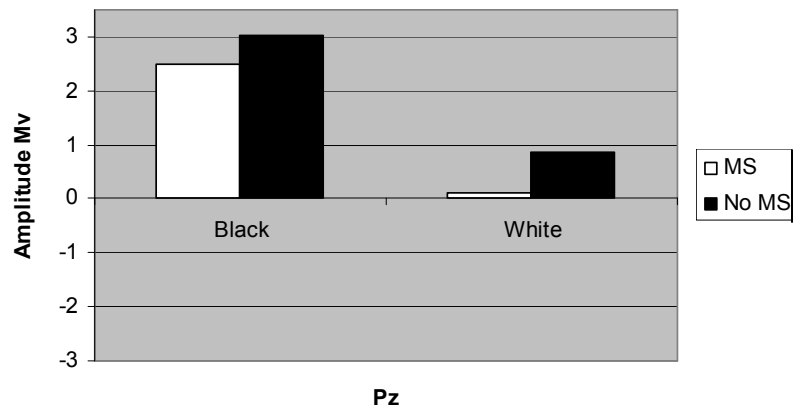


Figure 5

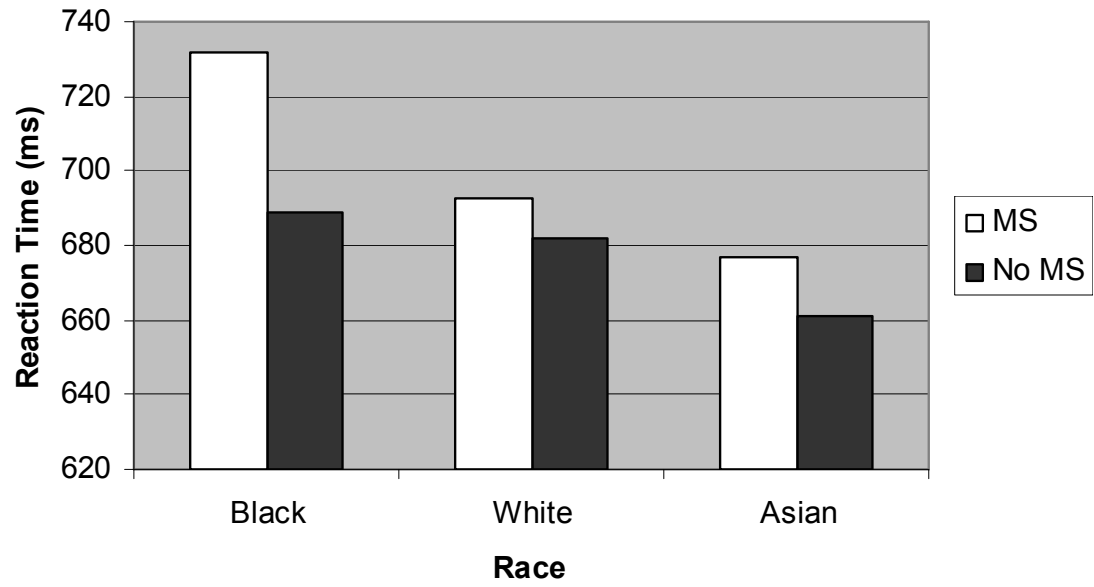
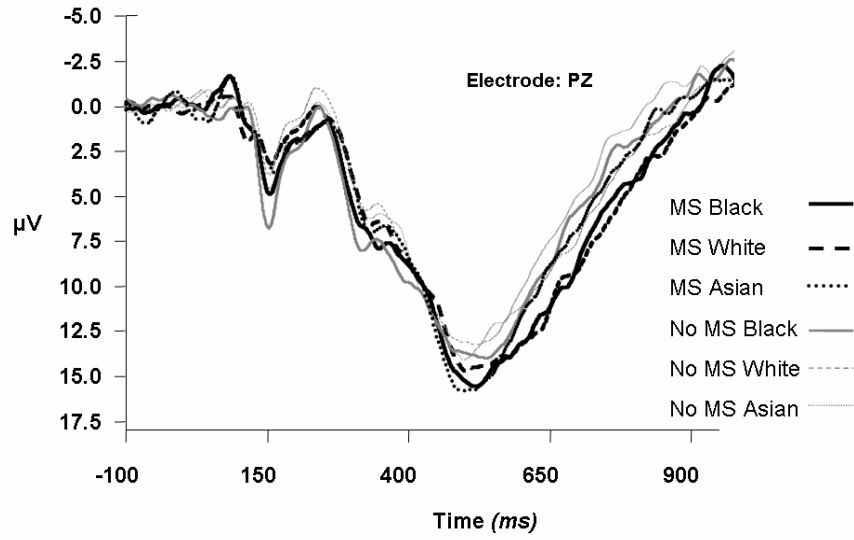


Figure 6

A.



B.

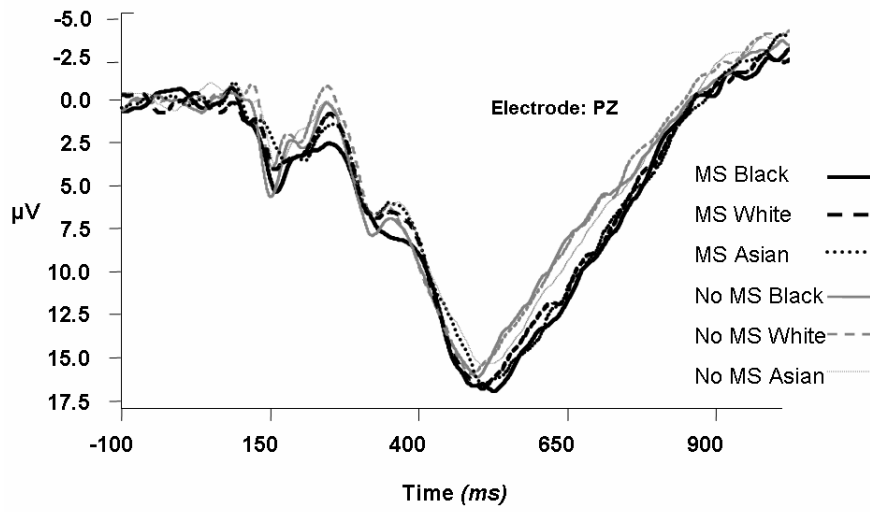


Figure 7

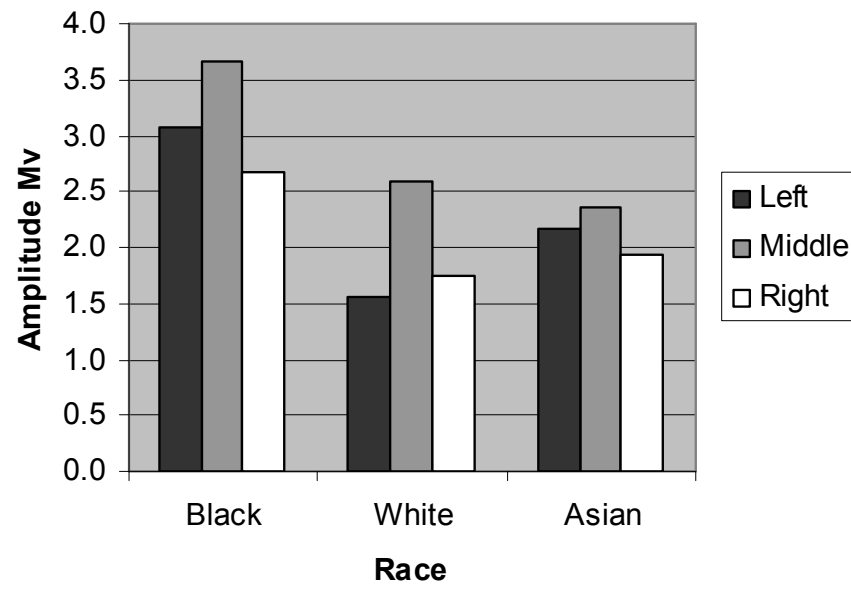


Figure 8

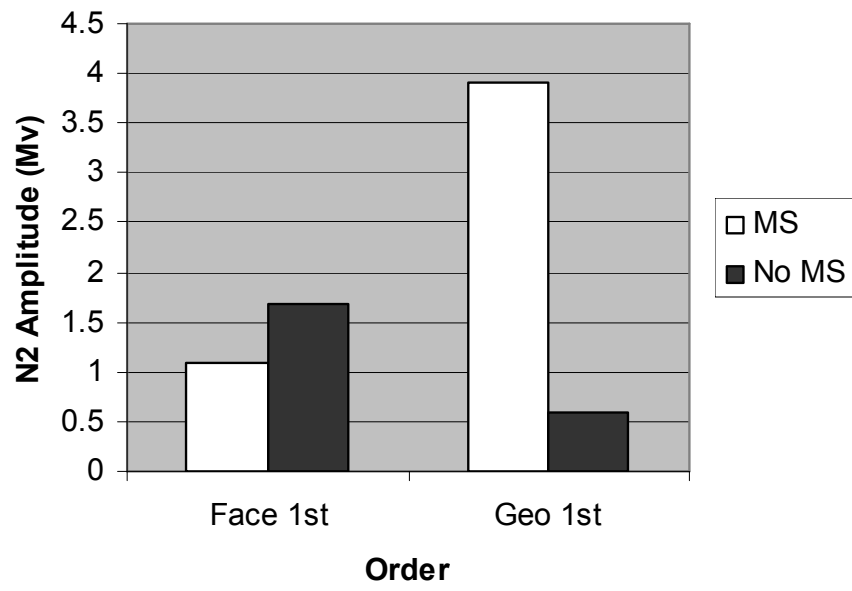


Figure 9

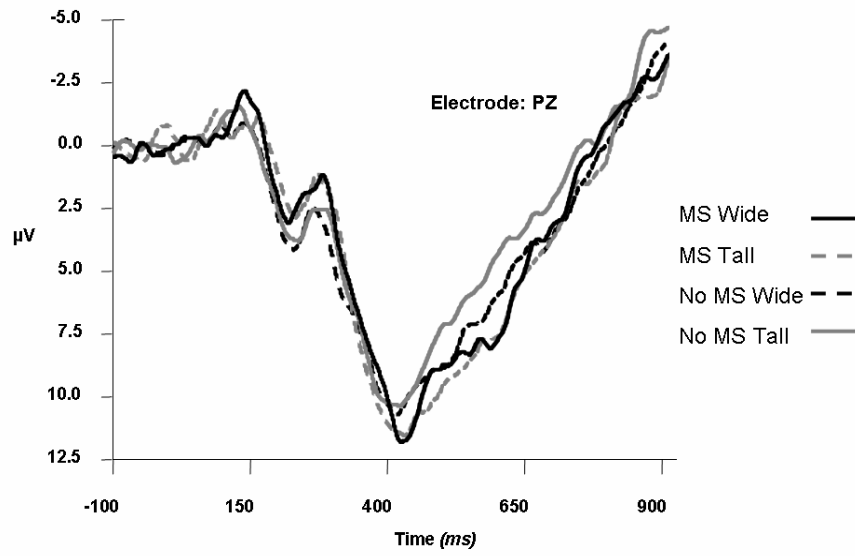
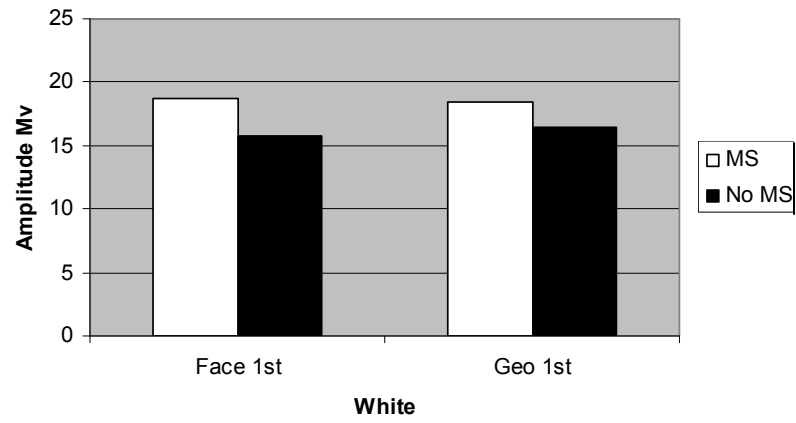
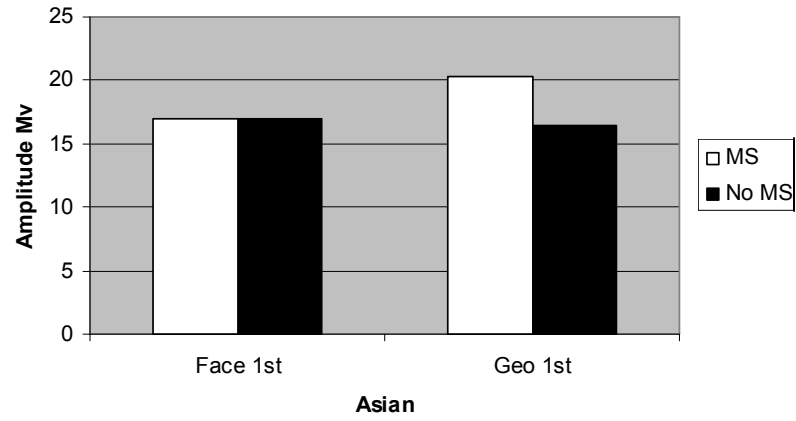
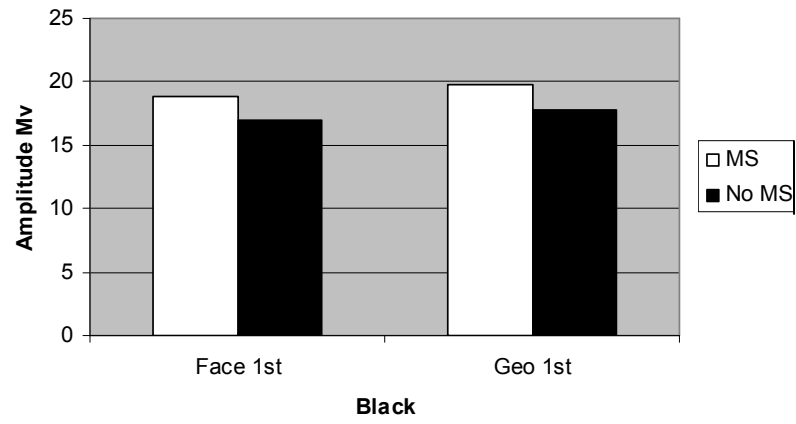


Figure 10

A.



B.



APPENDIX

Appendix A

Figure Captions

Figure 1. Study 1 ERP waveform. MS = Mortality Salience Condition; No MS = Control Condition. Panel A: Happy Expressions. Panel B: Angry Expressions.

Figure 2. Study 1 P2 Race x Electrode x Condition Interaction. MS = Mortality Salience Condition; No MS = Control Condition. Panel A: Fz. Panel B: Cz. Panel C: Pz.

Figure 3. Study 1 N2 Expression x Race x Condition Interaction. MS = Mortality Salience Condition; No MS = Control Condition. Panel A: White Targets. Panel B: Black Targets.

Figure 4. Study 1 N2 Race x Electrode x Condition Interaction. MS = Mortality Salience Condition; No MS = Control Condition. Panel A: Fz. Panel B: Cz. Panel C: Pz.

Figure 5. Study 2 Facial Picture Viewing Task Reaction Times for Race x Condition interaction. MS = Mortality Salience Condition; No MS = Control Condition.

Figure 6. Study 2 ERP waveform. MS = Mortality Salience Condition; No MS = Control Condition. Panel A: Happy Expressions. Panel B: Angry Expressions.

Figure 7. Study 2 Facial Picture Viewing Task P2 Race x Electrode Interaction.

Figure 8. Study 2 Facial Picture Viewing Task N2 Condition x Order Interaction. MS = Mortality Salience Condition; No MS = Control Condition. Face 1st = Person Perception Oddball Task was administered prior to Geometrical Oddball Task; Geo 1st = Geometrical Oddball Task was administered prior to Person Perception Oddball task.

Figure 9. Study 2 Geometrical Picture Task ERP waveforms. MS = Mortality Salience Condition; No MS = Control Condition. Tall = stimulus viewed was a tall rectangle; Wide = stimulus viewed was a wide rectangle.

Figure 10. Study 2 Facial Expressions Task Auxiliary P3 Analysis Race x Order x Condition Interaction. MS = Mortality Salience Condition; No MS = Control Condition. Tall = stimulus viewed was a tall rectangle; Wide = stimulus viewed was a wide rectangle. Panel A: White Targets. Panel B: Black Targets. Panel C: Asian Targets.