INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI

A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor MI 48106-1346 USA
313/761-4700 800/521-0600

ANGER FOLLOWING PROVOCATION IN INDIVIDUALS WITH PSYCHOPATHIC CHARACTERISTICS

Brian Lee Steuerwald

A Dissertation Submitted to
the Faculty of the Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Greensboro
1996

Approved by

David Rosen
Dissertation Co-Advisor

Jacquelyn W. White
Dissertation Co-Advisor

STEUERWALD, BRIAN LEE, Ph.D. Anger Following Provocation in Individuals with Psychopathic Characteristics. (1996) Directed by Drs. David S. Kosson and Jacquelyn G. White 218pp.

Theoretical views of psychopaths' anger generally fall into one of two categories: the deficient/attenuated-anger hypothesis or the adequate/heightened-anger hypothesis. This study tested divergent predictions of these two hypotheses in a group of individuals with psychopathic characteristics. Participants were 62 male undergraduates who were assigned to one of three groups (i.e., control, low-socialization, psychopathy-analogue) on the basis of Gough's (1957) Socialization scale scores and Hares's (1991) Psychopathy Checklist-Revised Factor 1 ratings. To induce anger, participants worked on a computer task and then received unjust criticism about their performance. Primary issues examined were the capacity/magnitude of anger experiences, the temporal course of arousal associated with anger, and the effects of anger on cognitive processing. Findings were generally not inconsistent with the adequate/heightened-anger hypothesis of psychopathy. Following provocation, individuals with psychopathic characteristics were not significantly different from controls on systolic/diastolic blood pressure, pulse, perioral EMG, finger temperature, reported subjective anger, or on the amount of retaliation directed towards the provocateur. However, as compared to controls, individuals with psychopathic characteristics did

evidence lower reductions in self-reported happiness and show less increases in corrugator and zygomatic EMG following provocation. There was also evidence that, as compared to controls, some physiological measures remained elevated longer for individuals with psychopathic characteristics after provocation. Deficits observed on a lexical decision task before provocation were absent after provocation for individuals with psychopathic characteristics.

APPROVAL PAGE

This dissertation has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Dissertation Co-Advisor David Kasson

Dissertation Co-Advisor Jacquelyn W. White

Committee Members Kurt L. Eason

July 2 1996
Date of Acceptance by Committee

July 2, 1996
Date of Final Oral Examination

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

REVIEW OF THE LITERATURE

Psychopathy is a chronic clinical condition frequently associated with individuals who evidence extreme egocentricity, interpersonal callousness, unusual emotional experiences, impulsivity, and an antisocial lifestyle. Most investigators and clinicians suggest that the condition is manifested at a relatively early age and is generally resistant to successful treatment. Because of the chronicity of the disorder, the resistance to successful treatment, and the impact of psychopaths' behavior on themselves, others, and society, the condition is considered very serious.

The unusual emotional experiences associated with psychopathy occupy a prominent role in many descriptions of the disorder. The primary purpose of this study was an examination of anger in males with psychopathic characteristics. Although many theoretical accounts of anger in psychopaths have been offered, little empirical research has been conducted. To provide a context for the study, a discussion of emotions and anger will be presented first. This will be followed by a discussion of the psychopathy construct and then a review of theoretical perspectives and empirical evidence related to emotional experiences in psychopaths. Because attentional processes were also

examined, a brief review of this area as it pertains to this study will be presented. The terms emotion and affect (and their various derivatives) are used interchangeably throughout this study.

Emotions and Their Assessment

Historically, the study of emotions has been controversial and not well accepted in mainstream psychology. Early critics considered the study of emotions too subjective, imprecise, and unscientific for psychology (e.g., Watson, 1919). Others argued that the concept of emotions should be abandoned or at least placed under more appropriate topics of study (e.g., Hebb, 1946; Koffka 1935; Masserman, 1946). For example, some suggested that the concept of emotion should be replaced with physiological arousal, activation, or energy mobilization (e.g., Duffy, 1962). Still others minimized the role of emotions in influencing behavior altogether (e.g., Brown & Farber, 1951). With the advance of refined theories, definitions, and assessment techniques, however, the study of emotions in psychology has gained more acceptance and flourished in the last thirty years. From this increased study, two major theoretical perspectives have emerged: the fundamentalist and the cognitive perspectives.

The fundamentalist perspective is heavily influenced by biology and the writings of Darwin (1872/1965) who proposed that emotions evolved to enhance functioning and the chance

of survival. The fundamentalist perspective asserts that emotions are discrete patterns of behavior, subjective experience, and physiological activity (Izard, 1977; Plutchik, 1962; Tomkins, 1962). The name of this perspective derives from the proposal that only a few discrete emotional patterns are innate. Although there is disagreement as to what these discrete patterns are, most theorists include the emotions of anger, sadness, happiness, and fear. Other non-fundamental emotions are considered combinations of fundamental ones.

The cognitive perspective argues that emotional experiences are the result of cognitive processes and physiological (primarily autonomic nervous system) activity, and both are considered necessary components of emotional experiences (Lazarus, 1991; Mandler, 1984; Schachter, 1966). Physiological activity is considered a non-specific state of heightened arousal which motivates or energizes the organism to scan the environment for an explanation of the arousal. Different emotional experiences develop depending on how the organism appraises the situation. Although this appraisal process may reflect conscious effort on the part of the organism, it may also be unconscious, automatic, and rapid (Lazarus, 1991). The cognitive theories of emotion also argue that emotional experiences have adaptive utility and lead to changes in physiological, behavioral, and subjective/experiential systems of the organism.

Although the cognitive theories of emotion are most noted for the position that cognitive appraisal is a necessary component in the development of specific emotional reactions, more recent attention has been directed at how emotional reactions may affect more basic cognitive processes including memory and attention. Indeed there is growing evidence that emotional experiences can affect basic cognitive processes. Several studies have demonstrated that positive emotional experiences facilitate the retrieval of positive memories (e.g., see Isen, 1990 for a review). Similarly, studies that have induced anger have reported mood congruent facilitation effects (Laird et al., 1982; Laird, Cuniff, Sheehan, Shulman, & Strum, 1991; Nasby & Yando, 1982). In contrast, the evidence for the effects of sadness on negative material in memory is more mixed with sadness either failing to facilitate the recall of negative material or being less effective as a retrieval cue than positive feelings (e.g., see Isen, 1990 for a review). Moreover, attentional biases have also been reported in individuals with anxiety disorders (Macloed & Mathews, 1988; Macloed, Mathews, & Tata, 1986) and depression (Laurent & Stark, 1993; Williams, Watts, Macloed, & Mathews, 1988).

Although the mechanism for these facilitation effects is not well understood, a frequent explanation is that emotional events prime schemas or nodes associated with specific emotions (e.g., Bower, 1981; Isen, Shalker, Clark,

& Karp, 1978). Regardless of the causal mechanism, these facilitation effects can be useful in functioning. Emotional experiences that stimulate recall of past similar emotional events help guide the organism toward effective coping in a particular situation (Lazarus, 1991; Mandler, 1984). In addition, focused attention to potentially harmful stimuli under conditions of fear and anger may help the organism prepare for appropriate, rapid responding.

Differences between the cognitivists and fundamentalists regarding the necessity of cognitive appraisal for the development of emotional reactions and the specificity of physiological activity have sparked debate and generated a great deal of research (Ekman, 1992; Ekman, Levenson, & Friesen, 1983; Izard, 1993; Lazarus, 1991; Stemmler, 1989; Zajonc, 1985). Despite these differences, both perspectives agree that emotional experiences represent a change in the state of the organism that has adaptive utility. In addition, both perspectives agree that emotional experiences are associated with behavioral, physiological, and subjective/experiential changes in the organism. In fact, changes in these systems are the defining characteristics of an emotional experience in the theories of Izard (1977), Plutchik (1962), Tomkins (1962), Mandler (1984), and Lazarus (1991).

The triple response theory of an emotional experience suggests that the subjective/experiential, physiological,

and behavioral systems of an emotional experience are generally correlated (Lang, 1968). For example, when angered an individual will show increases in physiological activity (e.g., blood pressure), behavior (e.g., retaliation against the instigator), and subjective feelings of anger. However, there are several reasons correlations between systems could be low or negligible. Mild emotional experiences may only be detectable by self reports of subjective feelings (Lang, 1968). In addition, subjective reports and emotionally related behaviors can be feigned or withheld because of extraneous factors such as psychological defenses or social pressures (Bernstein & Nietzel, 1973; Lazarus, 1991; Rachman & Hodgson, 1974). Further, individuals vary on the extent to which their emotional states are outwardly exhibited, and a discontinuity between emotional states and emotional expressiveness has been reported in normal individuals (Buck, 1984; Zuckerman & Przewuzman, 1979), individuals with medical conditions (e.g., Hollaender & Florin, 1993; Watson, Pettingale, & Greer, 1984) and individuals with psychiatric conditions (Kring, Kerr, Smith, & Neale, 1993). Moreover, changes in physiological activity can be related to both emotional and nonemotional experiences such as attention and effort (Graham & Clifton, 1966; Lacey & Lacey, 1974).

Thus, it is not surprising that empirical findings related to the concordance of the systems of emotion have been mixed. For example, Hokanson and Burgess (1962)

reported that participants who were unjustly provoked by a confederate of the experiment showed increases in blood pressure and retaliation against the confederate. In contrast, Bernstein and Nietzel (1973) reported that phobic participants could be persuaded through social pressure to approach a phobic stimulus even though they reported feelings of fear. The implication for empirical research on emotions is that reliance on one emotion system may be incomplete, unreliable, and misleading. Because the relations between systems of emotions are variable and not well understood, emotion investigators emphasize that empirical studies of emotion should assess responses in all three systems of emotions (e.g., Izard, 1993, Izard, Kagan, & Zajonc, 1985; Lang, 1978; Lazarus, 1991). In addition, the assessment of all three systems in empirical investigations allows the examination of conditions in which activity in different systems may be concordant and discordant.

Physiological Activity and Emotions

The relation between physiological activity and emotional experiences has been discussed at length in early accounts of emotions (Cannon, 1929; James, 1890; Titchener, 1910) as well as in more contemporary emotion theories (Izard, 1977; Plutchik, 1962; Mandler, 1984; Lazarus, 1991). Moreover, the assessment of physiological activity in empirical studies of emotion has been popular because these measures are under less direct control by participants and

thus may not be as easily influenced by extraneous factors (e.g., social pressure). Despite the general agreement that physiological activity is a useful component in the assessment of emotions, there is disagreement as to the interpretation/specificity of this activity. A review of empirical findings provides a context for understanding this controversy.

Autonomic Activity. Autonomic nervous system activity measures (heart rate, electrodermal activity, blood pressure) are some of the most frequently assessed physiological measures in emotion research. However, the meaning and specificity of autonomic activity associated with emotional experiences remains controversial. Some investigators argue that increases in physiological activity reflect a state of generalized arousal or activation that is common to many types of positive and negative emotional experiences (e.g., Duffy, 1962; Lindsley, 1951; Mandler, 1984; Schachter, 1966). In contrast, other investigators argue that different types of emotional experiences are associated with different patterns of autonomic activity (e.g., Izard, 1977; Plutchik, 1962).

The empirical evidence regarding the specificity of autonomic activity for different emotions is mixed. For example, increases in electrodermal activity have been reported for both positive and negative emotional experiences (Greenwald, Cook, & Lang, 1989). In addition,

although heart rate increases have been reported for negative but not positive emotional experiences, discrimination between negative emotions (e.g., anger, sadness, fear) is more difficult because of similar magnitude and/or direction changes in heart rate associated with the experience of these emotions (Ekman et al., 1983; Levenson, Carstensen, Friesen, & Ekman, 1991; Schwartz, Weinberger, & Singer, 1981; however, see Ax, 1953).

The above not withstanding, there is evidence that negative emotions can be differentiated on at least some physiological measures. An increase in finger temperature has been found under anger conditions, and a decrease or little change in finger temperature has been reported under fear conditions (Ekman et al., 1983; Levenson et al., 1991). In addition, significant increases in diastolic blood pressure from baseline levels have been reported under conditions of anger but not sadness or fear (Schwartz et al., 1981).

Facial EMG. Charles Darwin (1872/1965) was one of the first individuals to emphasize the importance of the facial region in the experience and communication of emotional experiences. According to Darwin, facial expressions are a product of evolutionary selection and have survival value. Duchenne (1862/1990) was the first investigator to systematically examine the role of specific facial muscles in the generation of facial expressions. Using electrical

stimulation of the facial region he identified specific facial muscles that were related to specific emotional experiences.

In more recent times, the study of facial expressions has played an important role in our understanding of emotions and emotional experiences. For example, findings that facial expressions of certain emotions are reliably classified similarly across different cultures has been used as evidence to support the existence of "basic" universal emotions (Ekman, 1992; Ekman, Friesen, & Ellsworth, 1972; Izard, 1971). Other investigators suggest that facial expressions serve a central role in the initiation of an emotional experience (Izard, 1971; Tomkins, 1962; Zajonc, 1985).

In recent years there has been an increase in the number of empirical studies examining the relation between facial expressions and emotional experiences. For example, Ekman, Friesen, & Ancoli (1980) covertly videotaped participants while viewing a pleasant (designed to elicit happiness), negative (designed to elicit disgust) and neutral film. After each film presentation, participants rated their subjective feelings. Facial expressions were coded using the Facial Action Coding System (FACS), a procedure in which trained observers rate changes in discrete facial muscles from videotapes (Ekman & Friesen, 1978).

The results supported the relation between self reports of subjective feelings and facial expressions. More specifically, the positive film clip was related to greater self-reports of happiness and increased zygomatic activity (i.e., pulling up of the cheek muscle). On the other hand, the negative film clip was associated with increased levator labii superioris activity (i.e., sideways pulling of the mouth) and self-reports of disgust but not other negative emotions.

Other studies have used facial EMG in the study of emotional experiences (e.g., Dimberg, 1990; Fridlund, Schwartz, & Fowler, 1984). From these studies, facial EMG activity associated with positive versus negative emotional experiences are the most easy to differentiate. Negative emotional experiences are often associated with increased corrugator (brow muscle) activity with little change in zygomatic (cheek muscle) activity; positive emotional experiences, with increased zygomatic but little corrugator activity (Cacioppo & Petty, 1981; Dimberg, 1987; Voglmaier & Hakerem; 1989). However, increased zygomatic activity has also been reported under conditions of anger (Smith, McHugo, & Lanzetta, 1986)

As in the case of autonomic activity, however, it appears more difficult to discriminate between different negative emotional experiences (i.e., fear, sadness, anger) using facial EMG. For example, Fridlund et al. (1984)

reported that increased corrugator EMG activity was associated with the experience of anger, sadness, and fear. However, these investigators also reported that perioral EMG activity was higher under conditions of anger as compared to sadness.

In summary, physiological, behavioral, and subjective changes associated with an emotional reaction are generally considered the defining characteristics of an emotion. In addition, many investigators of emotions have emphasized that all three systems should be assessed in empirical studies because reliance on one system may be misleading, unreliable, and/or incomplete. Also, the assessment of all three systems in emotion research provides an opportunity to examine how and under what conditions the systems are related, an area that is not well understood. Physiological activity has long been associated with emotional experience. Although there remains a controversy regarding the specificity of physiological activity, several types of activity have been reliably associated with anger including increases in blood pressure, pulse, finger temperature, corrugator EMG, and perioral EMG.

Definition and Operationalization of Anger

People experience a wide range of emotions during the course of everyday functioning. Anger is a commonly experienced emotion, occurring in most people one to two times a week or more (Averill, 1982, Studies 1 and 2). Anger

is particularly powerful emotion because of its potential negative impact on interpersonal relations and on the person experiencing the emotion (Lazarus, 1991). Attesting to the importance of this emotion, some of the earliest discussions of anger and its causes can be found in the writings of Plato (Hamilton & Cairns, 1961) and Aristotle (McKeon, 1941). In more contemporary times, anger has been discussed in the context of psychopathology (Freud, 1920), everyday social functioning (Averill, 1982; Mandler, 1984; Lazarus, 1991) and aggression (Berkowitz, 1962; Zillmann, 1979). In short, the importance of understanding anger cannot be understated.

Like other emotional experiences, anger is defined in terms of changes in physiological, behavioral, and subjective/experiential systems of the organism. Several different types of changes in the organism's physiological and behavioral systems have been reported under conditions of anger. The most commonly self-reported physiological changes include increases in breathing, heart rate, pulse, and temperature (Davitz, 1969; Gates, 1926). Consistent with these self-reports, several laboratory studies using anger inductions report increases in these physiological measures (e.g., Ax, 1953; Stemmler, 1989; see Zillmann, 1979 for a review). In addition, there is evidence indicating that changes in skin temperature (Ekman et al., 1983; Levenson et al., 1991) and diastolic blood pressure (Schwartz et al.,

1981) can reliably discriminate between anger reactions and other emotion reactions (e.g., happiness, sadness, fear).

Facial reactions such as sneers and clenching of teeth have also been frequently reported as reactions to anger (Davitz, 1969; Gates, 1926; Scherer, Wallbott, Matsumato, & Kudoh, 1988). Reports from empirical studies of facial EMG changes after anger induction are generally consistent with these self-reported changes (e.g., Fridlund et al., 1984; Smith et al., 1986). There is also tentative evidence that changes in facial EMG can differentiate between different emotional experiences. For example, increases in perioral EMG activity have been reported under conditions of anger but not sadness (Fridlund et al., 1984). In summary, the results of physiological findings indicate that anger reactions can be reliably assessed and, to some extent, differentiated from other emotional experiences.

Because of the potential harmful consequences, behavioral reactions against the instigator of anger have received a great deal of attention. Although most people report a desire to verbally and/or physically retaliate against a provocateur when angered, overt physical reactions (e.g., hitting, kicking) are less frequent than verbal retaliation (Averill, 1982, Study 2; Davitz, 1969; Gates, 1926). In controlled laboratory settings, behavioral anger reactions have most often been operationalized in terms of retaliation (e.g., mild electric shocks, negative feedback)

towards an instigator after provocation. The results of several studies have demonstrated that 1) retaliation is directed towards the instigator after provocation and 2) physiological activity associated with anger decreases after an opportunity to retaliate against the provocateur is offered (e.g., see Zillmann, 1979 for a review). Thus, retaliatory behaviors appear related to the alleviation of anger.

Although there has been an increased interest in the effects of emotional experiences on basic cognitive processes, only a few studies have examined anger. These studies have been limited to the examination of the effects of anger on the retrieval of anger-congruent material. Nasby and Yando (1982) induced anger in children by having them recall past experiences of anger. Participants were then presented with a list of adjectives, some of which were anger-relevant. After removing the list, these investigators reported that participants recalled more anger-congruent words from the list of presented adjectives. Laird et al. (1982) induced anger by having adult participants posture anger facial expressions. Subsequently, it was found that participants reported more anger-related memories of past experiences. This finding was replicated by Laird et al. (1991). In contrast, Gerrig and Bower (1982) induced anger in participants by hypnosis and found no advantage or disadvantage in recognizing anger-congruent words. Taken

together, the results of these studies provide some support that anger can influence the retrieval of anger-congruent memories. The effects of anger on other cognitive processes (e.g., attention) has not received any empirical attention and represents a gap in our understanding of the effects of anger on cognitive processes.

Causes of Anger

Several causes of anger have been offered. Frustration has long been considered a major cause of anger and aggression. St. Thomas Aquinas (1225-1274) suggested that the blocking of a desire could lead to anger (cf. Averill, 1982). Freud (1920) and McDougall (1923) argued that anger and aggression are instinctive responses to frustrated impulses. These views were formalized by Dollard, Doob, Miller, Mower, and Sears (1939) with the introduction of the frustration-aggression hypothesis. In its original form the hypothesis stated that aggression is always preceded by frustration, and frustration always leads to some form of aggression. Berkowitz (1962) reformalized the aggression-frustration hypothesis by including the concept of anger. According to Berkowitz, frustration leads to anger which in turn increases the probability of an aggressive response. Anger was considered a heightened drive state and operationally defined as an increase in physiological arousal.

The extreme position such as that proposed by Berkowitz (1962) that frustration always leads to anger and aggression has generally been abandoned as numerous empirical studies have demonstrated that frustration is neither a sufficient nor a necessary condition for aggression (Buss, 1966; Geen, 1968; Taylor & Pisano, 1971; Worchel, 1974). In addition, in some instances frustration may actually inhibit aggression (Gentry, 1970, Rule & Hewlitt, 1971). Nevertheless, the view of frustration as an important cause of anger remains popular (e.g., Berkowitz, 1989).

Other investigators argue that frustration is too broad a concept to be useful in understanding the origins of anger. Averill (1982) argues that several different types of events may be frustrating, and some types of frustration may more frequently lead to anger than others. In addition, Lazarus (1991) suggests that frustration resulting from the blocking of a goal may lead to several types of negative emotions including sadness, anxiety, and/or anger. Instead these investigators suggest that anger often arises in interpersonal contexts where one's self-esteem or image is threatened by another.

Several studies have examined conditions that lead to anger by asking participants to describe real-life anger experiences. Gates (1926) and Meltzer (1933) asked college students to identify the nature of instigation that led to anger episodes over a one week time period. Both of these

studies reported that anger most often developed as a result of frustration associated with the disruption of self-assertive activities (e.g., threats to self-esteem, being dominated by another) rather than frustration associated with the disruption of routine activities (e.g., sleep). Anastansi, Cohen, and Spatz (1948) reported that over 70% of anger experiences resulted from disrupted plans and threats to self-image in a group of college students who monitored anger experiences daily. In a study of similar design, McKellar (1949) reported that 44% of anger experiences were attributed to the disruption of the pursuit of a goal, and 54% of anger experiences were attributed to encroachment upon one's values, status, or possessions.

Averill (1982, Study 1) also examined conditions that led to anger in college students and community residents who recalled events that occurred over the previous week. In this study, each of six types of instigating conditions were evaluated as possible causes of the anger episode. The six "causes" were 1) an interruption of a planned or ongoing activity, 2) an action which resulted in a loss of personal pride, self-esteem, or sense of personal worth, 3) a violation of wishes and expectations that may not be important to others, 4) a violation of socially accepted ways of behaving, 5) definite or possible property damage, and 6) possible or actual physical injury and/or pain. Each anger episode was evaluated on the extent to which each of

the causes was involved. Thus, each anger episode could be evaluated as having one or more causes. The majority (82%) of the anger episodes were classified as evoked by the interruption of a planned or ongoing activity. About 65% of the anger episodes were also classified as being evoked by an action which resulted in a loss of or threat to self-esteem/image, violations of wishes and expectations that may not be important to others, and violations of socially accepted ways of behaving. The other categories received substantially less endorsement as causes of anger. In addition, Averill reported that in 82% of anger episodes, the instigation was perceived as unjustified or avoidable by the person experiencing the anger. Moreover, 88% of all anger experiences were reported to have involved another person and 58% of the people who were the targets of anger were of equal peer status. Fewer targets were of greater (24%) or lower (16%) social status than the person experiencing the anger.

Related to gender and anger, men and women do not generally differ on the number or intensity of anger episodes; however, women are less likely to express their anger in the form of aggression and report greater guilt after engaging in aggressive behavior (Averill, 1982). Campbell (1993) argues that this increased guilt resulting from aggression in women is associated with the different way in which men and women are socialized about aggressive

behavior. More specifically, men are taught that, to a limited extent, aggression towards others is tolerated, whereas for women, virtually all forms of aggression are viewed as socially unacceptable. For men, aggression resulting from anger provides a means for gaining control over others and maintaining adequate self-esteem. On the other hand, for women, aggression resulting from anger serves as a mechanism for the expression of anger and a cathartic release of internal tension (Campbell, Muncer, & Coyle, 1992). Further, men often view aggressive behavior as a positive experience, whereas women generally view aggression as a negative experience (Campbell & Muncer, 1987).

To summarize, anger is an emotion that most often develops in the context of interpersonal interactions with a peer of similar social status. Frustration associated with the blocking of a goal and threats to self-esteem and image are among the most prominent factors associated with anger. However, the probability of an anger reaction is greatly enhanced when the blocking of the goal and/or the threats to self-esteem are perceived as unjustified. The implications of these findings for empirical investigations attempting to induce anger in laboratory settings strongly suggest that the nature of the induction should include a frustration or blocking of a goal, threats to self-esteem and image, and that the provocation should be perceived as unjustified by

the subject. In addition, this provocation would be most effective in an interpersonal context in which a peer of similar social status is the provocateur. Although beyond the scope of this study, views of aggression generally differ between men and women. Men often view their aggression as a positive experience and as a way to gain control/maintain self-esteem. Conversely, women generally consider their aggression as a negative experience that results from their failure to control internal tension/anger.

The Performer/Evaluator Paradigm

Several different types of induction techniques have been used in empirical studies of anger and aggression. These range from encouraging participants to recollect and re-experience actual anger episodes (e.g., Nasby & Yando, 1982) to actually provoking participants in an interpersonal situation (e.g., Hokanson & Burgess, 1962). A popular experimental design used to induce anger has been termed the performer/evaluator paradigm. In this paradigm a participant is provoked (e.g., insulted for poor task performance or effort) by the experimenter or a confederate and later given the opportunity to retaliate (e.g., provide competence rating) against the provocateur. In this paradigm systolic and diastolic blood pressure are the most frequently assessed physiological measures and the amount of retaliation serves as an index of behavioral anger

reactions. The amount of increase in blood pressure observed in studies using this paradigm appears to be related to the intensity of the provocation. For example, Zillmann and Sapolsky (1977) directed intense, persistent derogatory remarks at participants about their task performance and reported an average increase in systolic blood pressure of 18 mmHg. However, more typical average increases in blood pressure following provocation are approximately 10 mmHg for systolic blood pressure and about 5.5 mmHg for diastolic blood pressure. Ironically, self-reported subjective experiences of anger are not often assessed in these studies as the focus has most often been on aggression rather than anger per se (however, see Hokanson & Burgess, 1962). Nevertheless, there is nothing inherent in this paradigm to restrict the collection of subjective feelings states.

The performer/evaluator paradigm has several merits in the study of anger. Several studies have demonstrated its utility and reliability in the study of anger and aggression. It also represents a relatively straightforward method in which anger induction techniques can be controlled and kept constant across participants. In addition, the interpersonal nature of the induction technique is consistent with arguments that anger most often develops in the context of social interactions (Averill, 1982) and this strategy further increases the probability that the induction technique will be successful and valid. Further,

emotional reactions can be assessed across physiological, behavioral, and subjective/experiential systems. Finally, participants can be kept unaware as to the intent of the study and thus demand characteristics can be minimized. Because of these considerable advantages, the performer/evaluator paradigm was used in this study. Unlike most studies, however, subjective ratings of anger were assessed in addition to physiological measures and behavioral measures of retaliation.

Although previous anger empirical studies have primarily focused on normal populations, anger has also been considered important in abnormal behavior (e.g., Freud, 1920). Because of their persistent aggressive and antisocial lifestyle, the study of anger reactions in psychopaths may provide additional important information about this disorder. This study examined anger reactions of individuals with psychopathic characteristics. To provide a context for this study a discussion of the psychopathy construct and emotional reactions in psychopaths will be outlined next.

The Psychopathy Construct and Its Assessment

Clinical descriptions of psychopathy date back to the early 1800's when Philippe Pinel described certain individuals who engaged in impulsive, self-damaging acts while seemingly having all of their reasoning abilities intact (cf. Millon, 1981). According to Pinel, these individuals suffered from deficits in passion and affect,

not deficits in reasoning. Other early descriptions of the disorder focused on the psychopath's antisocial, morally reprehensible behavior (e.g., Rush, 1812). Prichard (1835) described the psychopath as lacking a sense of rightness, goodness, and responsibility.

In more contemporary times, Cleckley's (1976) clinical descriptions of psychopathy have strongly influenced current conceptualizations of the disorder. Cleckley posits sixteen symptoms of the disorder some of which are guiltlessness, incapacity for deep affectionate bonds, impulsivity, poverty of emotional experiences, superficial social charm, and an inability to profit from experience. Although Cleckley's accounts of the condition are mainly descriptive, he did propose that the psychopath suffers from a dissociation between affect and cognition. Consequently, this dissociation leads to a lack of appreciation of many life experiences and an inability to appropriately modify behavior in a socially acceptable way.

Contemporary psychodynamic views of psychopathy consider the disorder an aggressive variant of narcissistic personality disorder (Bursten, 1989; Kernberg, 1975; Meloy, 1988; Millon, 1981). Like the narcissist, the psychopath possesses primitive defense mechanisms, excessive feelings of specialness, self-righteousness, and sense of entitlement. Unlike the "pure" narcissist, however, the psychopath is less able to use anxiety adaptively, has

poorer moral development, and less impulse control. Consequently, the psychopath has greater difficulty in controlling aggressive tendencies which are usually directed at others.

The diagnosis of psychopathy depends on the criteria and/or theoretical position one adopts. In many instances the criteria used to diagnose the condition have relied heavily on the antisocial aspects of the disorder. For example, several of the criteria for Antisocial Personality Disorder (American Psychiatric Association (APA), 1987, 1994) are related to engagement in antisocial activities (e.g., criminal activity, juvenile delinquency, substance abuse, child neglect) but few criteria related to more psychological and/or personality characteristics (e.g., egocentricity, grandiose sense of self, poverty of affect) frequently associated with psychopathy.

The Psychopathy Checklist (PCL; Hare, 1985) is a diagnostic tool designed to assess psychopathy largely based on the descriptions presented by Cleckley (1976). The PCL contains 20 criteria each rated on a 3-point scale which assess both psychological and behavioral dimensions of psychopathy. PCL ratings of these criteria are based on information obtained from an interview and a review of prison file information.

A factor analysis of the PCL criteria has revealed two interrelated, yet distinct, factors (Harpur, Hare, &

Haskistan, 1989). Factor 1 describes many of the psychological characteristics associated with the disorder (e.g., callousness, egocentricity, grandiosity, poverty of affect) and Factor 2 describes many of the behavioral characteristics (e.g., early behavior problems, impulsivity, criminal versatility) of psychopathy. Notably, many indices often used to diagnose psychopathy are strongly related to Factor 2 and less related to Factor 1. These include the Minnesota Multiphasic Personality Inventory subscales 4 and 9 (MMPI; Hathaway & McKinley, 1943), Gough's Socialization Scale (Gough, 1957), and the Diagnostic and Statistical Manual for Mental Disorders 3rd edition-revised (DSM-III-R; APA, 1987) criteria for Antisocial Personality Disorder.

Gough's Socialization scale (Gough, 1957) is the most widely used measure used to select psychopathy-analogue individuals. This 54-item scale with a true/false response format has demonstrated good internal consistency and test-retest reliability (Megargee, 1972). Attesting to the scales's validity, relations between antisocial group membership (e.g., delinquents, criminals) and low Socialization scores have been reported in several studies (see Megargee, 1972 for a comprehensive review). The scale also has demonstrated its utility as a selection measure of psychopathic-like individuals. Similar to psychopaths, individuals selected on the basis of low Socialization scores have displayed passive avoidance learning deficits

(Nathan, 1980), a failure to modulate dominant responses (Howland, Kosson, Patterson, & Newman, 1993), electrodermal hyporesponsiveness (Raine & Venables, 1984;, Waid & Orne, 1982), and self-report greater levels of antisocial activity and substance use (Kosson, Steuerwald, Newman, & Widom, 1994).

A major concern with the Socialization scale as a sole selection measure of individuals with psychopathic characteristics is that it primarily related to Factor 2 (e.g., antisocial characteristics) of the PCL (Harpur et al., 1989). Thus, low Socialization scorers may or may not possess those qualities often associated with the PCL Factor 1 (e.g., egocentricity, grandiosity, poverty of affect) which are considered an important dimension of the psychopathy construct. A reasonable strategy to address this concern, however, would be to assess PCL Factor 1 criteria in low Socialization scorers and then assign group membership on the basis of Socialization scores and interview-derived PCL Factor 1 ratings. Such a strategy might identify a more homogeneous group of individuals who are more similar to the full clinical condition of psychopathy. This strategy was employed in the present study.

Emotional Experiences of Psychopaths

The abnormal or deficient affective experiences associated with psychopathy occupies a prominent role in

many accounts of the disorder. Cleckley (1976) argues that psychopaths have a general poverty of major affective reactions. Although Cleckley suggests the psychopath may experience "vexation, spite, quick and labile flashes of quasi-affection, peevish resentment, shallow moods of self-pity, puerile attitudes of vanity, and absurd and showy poses of indignation (p. 380)", genuine fear, anger, sadness, and happiness are likely to be absent. Cleckley asserts that this absence of genuine, sustained emotional experience serves as the principal deficit in psychopaths. According to Cleckley, the lack of genuine affective experiences prohibits the psychopath from modifying and directing his behavior in an appropriate way. In essence, "he cannot be taught the awareness of significance which he fails to feel" (p. 410).

Although several clinical descriptions have included the psychopath's reduced ability to experience and/or sustain periods of sadness (Meloy, 1988; Yochelson & Samenow, 1976) and happiness (Craft, 1966; McCord & McCord, 1964; Meloy, 1988; Millon, 1981), it is the psychopath's deficient fear and anxiety that has received the most attention. Millon (1981) asserts that the psychopath is fearless, undaunted by danger and punishment. Furthermore, Cleckley (1976) argues that the psychopath is relatively free of anxiety and worry that might be judged normal in distressing situations and may even appear calm and serene

under such circumstances.

This deficient fear and anxiety has been suggested as the mechanism for the psychopath's failure to appropriately modify behavior in situations that most people would find punishing (e.g., Lykken, 1957). Other behaviorally-based (Gorenstein & Newman, 1980) or biologically-based (Fowles, 1980; Gray, 1975) theories of psychopathy also consider deficient fear and anxiety responses an important dimension of the disorder. In addition, inabilities to experience fear and anxiety may in part account for the general lack of remorse, shame, and guilt frequently associated with the disorder (e.g., McCord & McCord, 1964).

Deficient fear and anxiety responses have received the most empirical attention in psychopathy emotion research. In the typical research paradigm, an aversive stimulus (e.g., loud noise, brief shock, unpleasant picture) is presented during the collection of physiological measures (e.g., heart rate, electrodermal activity, eye-blink startle responses). Several studies employing this basic paradigm have reported reduced physiological activity associated with fear and anxiety in psychopathic individuals (Blankenstein, 1969; Hinton & O'Neil, 1976; Hare, 1972; Mathis, 1970; Patrick, Bradley, & Lang 1993; Patrick, Cuthbert, & Lang, 1990). An important aspect in this area of investigation appears to be whether the presentation of the aversive stimulus is forewarned or not. Reduced fear and anxiety responses in

psychopaths have been more consistently reported when the presentation of the aversive stimulus is forewarned, suggesting that psychopaths may employ a coping style that buffers the negative effects of an aversive stimulus if given the opportunity to prepare for the stimulus. (see Hare, 1978 for a review; Hare, 1982; Ogloff & Wong, 1990).

Psychopaths' ability to process affective linguistic stimuli has also been examined. Previous research has demonstrated that emotional words are processed more quickly than neutral words (Graves, Landis, & Goodglass, 1981; Strauss, 1983). Williamson, Harpur, and Hare (1991) examined psychopaths' and nonpsychopaths' processing of emotional words, neutral words, and nonwords in a lexical decision task. On this task participants made decisions as to whether a presented letter string was a word or not. Classification accuracy, response latency, and electrocortical activity were the dependent measures. Consistent with previous research, nonpsychopaths' reaction times were faster for emotional words than neutral words. In contrast, psychopaths did not show this facilitation of response latency facilitation for emotional words. In addition, nonpsychopaths showed larger event-related potentials during the presentation of emotional words than during neutral words. On the other hand, psychopaths showed no event-related potential differences for word type. There was no difference between groups on classification accuracy.

Although several theoretical accounts suggest psychopaths display deficient or abnormal experiences of fear/anxiety, sadness, and happiness, there is more disagreement as to the psychopath's experience of anger. Cleckley's (1976) view of anger in psychopaths is consistent with his suggestion of a general poverty of affect. Although he asserts that psychopaths may experience minor frustrations and annoyances, genuine anger is likely to be absent. Cleckley argues that overt actions commonly associated with anger episodes (e.g., facial expressions, gestures, verbalizations) are no more than dramatic displays that lack an affective basis in the psychopath.

Although there is general agreement that the psychopath may feign anger episodes to achieve a goal, several investigators assert that psychopaths do experience genuine anger. McCord and McCord (1964) argue that psychopaths frequently experience anger as a result of ineffective strategies for coping with everyday frustrations. Millon's (1981) description of psychopathy includes hostile affectivity which is marked by frequent pugnacious and irascible temper outbursts. Placing the psychopath's anger in the context of interpersonal relationships, Millon argues that psychopaths are easily angered when faced with embarrassment. Similarly, Meloy (1988) proposes that most instances of anger in the psychopath arise when real or imagined threats from others to feelings of specialness and

entitlement occur. Under these conditions the psychopath is more likely to react with violence because of an inability to appropriately regulate intense emotions.

Yochelson and Samenow (1976) present perhaps the most extreme position regarding anger in psychopaths. According to these investigators psychopaths experience intense, chronic anger which creates serious consequences for themselves and others. Anger in psychopaths tends to metastasize such that an isolated event spreads and intensifies until all perspective is lost. Under these conditions the psychopath's overwhelming anger may lead to decreases in his ability to function. When angered, the psychopath "attempts to reassert the worth of his entire being" (p. 273) often through aggressive and/or criminal behavior.

Similar to the positions of Meloy (1988) and Millon (1981), Yochelson and Samenow (1976) assert that the psychopath is overly sensitive to criticism. Even slight criticisms are interpreted as "putdowns" and the psychopath's response is one of anger. Moreover, the psychopath responds angrily to anything perceived as preventing him from getting what is wanted. Even when the psychopath is responsible for his own mistakes, his frustrations are usually directed towards others.

Overall, the different accounts of anger in psychopaths generally fall into one of two perspectives. One

perspective, termed the deficient/attenuated-anger hypothesis, argues that psychopaths cannot experience genuine anger. Cleckley (1976) is the leading advocate of this hypothesis. According to this position, psychopaths' overt actions commonly associated with anger episodes (e.g., facial expressions, gestures, verbalizations) are dramatic displays that lack an affective basis. The other perspective, termed the adequate/heightened-anger hypothesis, argues that psychopaths can experience anger, often at frequent and intense levels. The leading advocates of this position include McCord and McCord, (1964), Meloy (1988), Millon (1981) and Yochelson and Samenow (1976). According to this position, psychopaths lack coping strategies to deal with everyday frustrations and/or are over-sensitive to threats against self-esteem and image. Consequently, the psychopath's response is one of anger and vindictiveness towards others.

Despite these divergent hypotheses, very few empirical studies have examined anger in psychopaths. Sterling and Edelman (1988) examined reactions to anger and anxiety provoking scenarios in psychopaths and nonpsychopaths. Psychopaths were identified by offender status (i.e., incarcerated) and low scores on Gough's Socialization scale (Gough, 1957). Nonpsychopaths were identified by non-criminal status and high scores on the Socialization scale. In this study, two anxiety and two anger scenarios

were presented and participants rated the amount of anxiety, anger, fear, and feelings of threat they would feel in each situation. The results showed that, as compared to nonpsychopaths, psychopaths appraised both the anxiety and anger scenarios as significantly more anger provoking. Also, as compared to nonpsychopaths, psychopaths rated the anxiety scenarios as more threatening and the anger scenarios as less threatening.

These results suggest that psychopaths differ on the intensity of anger experiences and the types of situations that lead to anger. However, the total reliance on self-reports about emotional reactions to hypothetical situations tempers generalizations to real-life situations and emotional reactions. This concern is particularly relevant given that psychopaths are noted for frequent lying and/or displaying emotional reactions that lack an affective basis. Thus, psychopaths in the study may have reported what they thought they should have felt instead of what they would actually have felt had the scenarios been real.

In addition, the psychopathic group was selected on the basis of offender status and low Socialization scores. Although the Socialization scale has been shown to correlate with the antisocial lifestyle associated with psychopathy, it is not related to other characteristics (e.g., narcissism, callous interpersonal relations) frequently associated with the condition (Harpur et al., 1989). Thus,

it is unclear if, and to what extent, the "psychopaths" in the study possessed those personality attributes frequently associated with the disorder.

Studies by Patterson (1991) and Forth (1993) are the only known studies that have attempted to induce anger in incarcerated psychopaths. Both studies examined the experience of several different emotions, in incarcerated PCL-identified psychopaths and nonpsychopaths. Film clips were used to induce the different emotions. For the anger condition, both studies had participants view an 80-second scene from the movie "Witness" in which an Amish farmer is harassed by a group of non-Amish teenagers.

Dependent measures in Patterson's (1991) study included facial expressions and self-reported emotional experiences. The results indicated no significant group differences in the frequency or magnitude of negative emotional facial expressions in the anger condition. Similarly, no group differences were observed for self-reported anger in the anger condition.

In Forth's (1993) study heart rate, skin conductance, facial expressions and subjective ratings of emotional experiences were the dependent measures. The results of the subjective ratings to the anger film clip showed that anger had the highest ratings; however, there were no significant differences between psychopaths' and nonpsychopaths' ratings. Facial expression data were classified on the basis

of discrete emotional expressions (e.g., happiness, sadness, fear, anger). Using this procedure no angry facial expressions (or other discrete emotional expressions) were elicited by any psychopaths or nonpsychopaths during the anger film clip. Psychopaths and nonpsychopaths showed an elevation in heart rate and skin conductance which suggested that participants experienced arousal consistent with anger; however, no significant group differences were observed.

The studies of Patterson (1991) and Forth (1992) represent advances in the study of emotional experiences in psychopaths in that they examined several types of emotions. Nevertheless, the study of several emotions within the same study may have overwhelmed participants and "washed-out" group differences for specific emotions. In addition, as suggested by Forth, incarcerated individuals may learn to inhibit emotional reactions (particularly fear and anger) because of the potential negative consequences they could suffer (e.g., exploitation by others, conflict with staff). Also, the films used in these studies may have been a relatively weak anger induction technique. However, in a more recent study using improved film clips (e.g., longer duration to allow participants to invest themselves in the story) to induce anger, Sullivan (1994) reported that after the anger induction psychopathy-analogues (low-socialized college students) evidenced a lower amount of facial expressions associated with anger than controls, but these

groups reported experiencing similar levels of anger.

Nevertheless, the use of film clips to induce anger may weak induction technique in general. Anger is an emotion usually experienced in the context of interpersonal relationships (Averill, 1982). Although a person may experience anger when injustices are directed at others, it is most often experienced when perceived injustices are directed at one's self. In addition, it may be very difficult to successfully induce anger in anyone through the viewing of a very brief film clip. Moreover, psychopaths are frequently characterized as lacking the capacity for empathy. Therefore, if questions related to psychopaths' ability to experience emotions are of interest, using films to induce emotions may be confounded by psychopaths' inability to be empathetic. In short, further investigations of anger responses in psychopathic individuals are warranted.

As presented earlier, recent empirical efforts have examined the effects of emotional reactions on basic cognitive processes (e.g., memory, attention). Although anger experiences have been found to facilitate the retrieval of anger-congruent material, the effects of anger on attentional processes have not been examined. An examination of this topic would increase our understanding of anger reactions in general as well as the relations between anger and attention. Additionally, recent empirical

work in the area of psychopathy has focused on attentional processes with promising results that may provide a more complete picture of psychopathy. However, no work has examined the effects of anger on attentional processes in psychopaths. To provide a context for this examination, a review of the attention literature related to psychopathy will be presented next.

Attentional Processes and Psychopathy

Historically, theories of psychopathy have been developed within a learning theory paradigm (Hare, 1970; Lykken, 1957). More recently, however, interpretations of experimental results have been discussed in terms of cognitive constructs and theories (Hare, 1982; Jutai & Hare, 1983; Hare & McPherson, 1984; Howland et al., 1993; Newman & Kosson, 1986; Ogloff & Wong, 1990; Raines & Venables, 1984). Many of these studies have discussed results in terms of attentional over-focusing and/or shifts in attention.

Some theoretical accounts of psychopathy suggest that attentional processes may influence behavior. Yochelson and Samenow (1976) argue that the psychopath engages in a focused attentional process which allows him to "think about his action that he wants to take without interference by thoughts opposing it" (p. 414). Similarly, Kosson and Newman (1986) propose an over-focusing hypothesis which suggests that psychopaths may over-focus on primary task cues at the expense of not adequately attending to secondary task cues.

One implication for the over-focusing hypothesis is that psychopaths will allocate more attentional resources to available reward cues in a given situation at the expense of not attending to potential punishment cues. Studies designed to test the over-focusing hypothesis have provided at least partial support for this position (e.g., see Harpur & Hare, 1990 for a concise review of these studies).

Recently, the psychopath's ability to shift attention has been examined. Howland et al. (1993) examined psychopaths' and non-psychopaths' ability to classify the location of a target whose location was more often than not validly cued. More specifically, in the majority of trials the cue validly predicted the location of a subsequently appearing target (i.e., the cue and target appeared on the same side of the computer screen). However, in a minority of trials the cue invalidly predicted the location of the target (i.e., the target appeared on the side of the computer screen opposite from where the cue had appeared). Participants used their left hand to classify targets presented on the left side of the computer screen and their right hand to classify targets appearing on the right. These investigators reported that, as compared to nonpsychopaths, psychopaths made more classification errors when a cue was presented on the right side of the screen but the target was presented on the left side of the screen. These results were interpreted as indicating possible deficits in attentional

shifts in psychopaths.

To summarize, findings related to attentional processes in psychopaths have provided some promising results which may provide a more complete picture of psychopathy. However, the study of attentional processes in psychopathy is in its early stages and further research needs to be completed. One useful area would be an examination of the effects of anger on attentional processes because investigators have asserted that attention to threatening stimuli is especially heightened in psychopaths under conditions of anger (Meloy, 1988; Yochelson & Samenow, 1976).

Statement of Purpose

The unusual emotional experiences associated with psychopathy occupy a prominent role in many descriptions of the disorder. Most of these descriptions and empirical investigations have focused on the experience of fear and anxiety, with other emotions receiving less attention. An understanding of anger in psychopaths would be particularly useful because of the potential negative impact this emotion can have on the psychopath, on others, and on society. Further, of the different descriptions of specific emotions in psychopaths, descriptions of the experience of anger in psychopaths are the most diverse and controversial.

A review of the literature indicates that two principal hypotheses have been offered to account for anger (or the lack thereof) in psychopathic individuals. The

deficient/attenuated-anger hypothesis, asserts that psychopaths lack the ability to experience anger (Cleckley, 1976). In contrast, the adequate/heightened-anger hypothesis asserts that psychopaths can experience anger and that these episodes may be intense and metastasize over time (McCord & McCord, 1964; Meloy, 1988; Million, 1981; Yochelson & Samenow, 1976). Both hypotheses, however, have remained virtually untested. Using provocation to induce anger and assessing physiological, behavioral, and subjective indices associated with anger, the purpose of this study was to test the competing predictions of the deficient/attenuated-anger and the adequate/heightened-anger hypotheses.

Participants in the study were male undergraduates selected on the basis of Socialization scores and PCL Factor 1 ratings. Using combinations of these two measures, three groups were identified: control, psychopathy-analogue, and low-socialization. The control group consisted of participants who scored high on the Socialization scale (i.e., highly socialized) and low on the PCL Factor 1 items. The psychopathy-analogue group consisted of participants who scored low on the Socialization scale (i.e., under socialized) and high on PCL Factor 1 items. The low-socialization group consisted of participants who scored low on the socialization scale and low on the PCL Factor 1 items. The reasons for including two groups with under socialization characteristics are discussed below.

Previous research using incarcerated samples has identified two factors associated with psychopathy. Factor 2 contains criteria (e.g., early behavior problems, irresponsibility) which are related to a persistent antisocial lifestyle, and Factor 1 contains criteria (e.g., lack of empathy, poverty of affect) which are related to interpersonal/emotional features of the disorder (Harpur et al., 1989). Typically, psychopathy-analogue studies have used group identification measures (e.g., Socialization scale) that are more associated with the antisocial features and not the interpersonal/emotional features of psychopathy. In this study, the inclusion of a group with low-socialization and high PCL Factor 1 scores represented an attempt to identify a more homogenous group of individuals who were more similar to the full clinical syndrome of psychopathy. By also including the low-socialization and low Factor 1 group in this study, similarities and differences between the two low-socialization groups could be examined and the benefits of the additional selection procedure in analogue studies could be assessed.

Only two known studies have attempted to induce anger in incarcerated psychopaths, and both reported no significant differences between psychopaths and nonpsychopaths on the amount of anger experienced (Forth, 1992; Patterson, 1991). However, both studies used film clips to induce anger, and Forth suggests that the

effectiveness of this anger induction procedure with psychopathic samples is questionable (however, see Sullivan, 1994).

As an alternative anger induction procedure, in this study anger was manipulated via provocation using the performer/evaluator paradigm, which has received substantial empirical support for inducing anger/aggression. More specifically, in this study provocative statements were delivered to participants regarding their performance on a computerized cognitive processing task. Based on theoretical accounts and empirical findings related to the causes of anger, the provocation was designed to accomplish three goals: to block the attainment of a goal, to provide a threat to self-esteem/image, and to be deemed as unjustified by the participant (Anastansi et al., 1948, Averill, 1982; Berkowitz, 1962; Dollard et al., 1939; Freud, 1920; Lazarus, 1991). In addition, participants were led to believe that the provocation was delivered by a peer of similar status, which has been reported to increase the probability of an anger episode (Averill, 1982). These aspects of the manipulation should increase the power for inducing anger.

Several dependent measures were collected in the study. In accordance with the triple-response system theory of emotional experiences, physiological, behavioral, and subjective measures associated with emotional experiences and/or anger were used as dependent measures. Regarding

physiological measures, systolic/diastolic blood pressure and pulse rates were assessed. These measures were chosen because of their theoretical connection with anger episodes and because of their validated utility in anger/aggression research (Hokanson & Burgess, 1962; Schwartz et al., 1981; Ekman et al., 1983; Levenson et al., 1991). Other physiological measures assessed included finger temperature, corrugator, perioral, and zygomatic facial EMG. These measures have been less widely used in anger research, although they have been theoretically linked to emotional experiences. For example, changes in facial expressions have been suggested as serving a central role in the initiation of an emotional experience (Izard, 1971; Tomkins, 1962; Zajonc, 1985). Further, overt facial expressions provide a method for communicating an individual's emotional state to others (Izard, 1977). Regarding anger, associations between facial EMG and anger have been hypothesized, and some data consistent with these theoretical connections have been obtained (e.g., Fridlund et al., 1984; Smith et al., 1986).

The behavioral measure of anger assessed in this study was retaliation towards a confederate after provocation. Retaliation towards a confederate or experimenter after provocation has been demonstrated in several empirical studies of anger/aggression (e.g., see Zillmann, 1979 for a review). Subjective experiences of anger were also assessed in this study via self-report questionnaire. Other dependent

measures collected in the study were response latencies and word identification accuracy rates obtained from a combined lexical decision/cued reaction time task. Response latencies and accuracy rates each contribute useful information about how efficiently participants process stimuli.

The deficient/attenuated-anger hypothesis and the adequate/heightened-anger hypothesis of psychopathy make divergent predictions regarding the magnitude, temporal course, and effects of anger on basic cognitive processes in individuals with psychopathic features. Specific hypotheses for each of these areas are addressed separately below.

Adequacy of the Anger Induction Technique. Before testing the deficient/attenuated-anger hypothesis and the adequate/heightened-anger hypothesis of psychopathy, it was necessary to demonstrate that the anger induction technique was effective. An a priori decision was made that the anger induction technique would be judged effective if, as compared to pre-provocation levels, significantly greater levels of blood pressure (systolic and diastolic) were exhibited by the control group after provocation. As an additional anger manipulation check, it was also deemed necessary to demonstrate that the control group exhibited retaliation towards a confederate after provocation. This strategy was based on several empirical findings that increases in blood pressure and retaliation are found after participants are provoked in experiments that use the

performer/evaluator paradigm.

Capacity/Magnitude Hypotheses. A major purpose of the study was to test the competing hypotheses related to the magnitude of anger reactions in individuals with psychopathic characteristics. It was predicted that, as compared to pre-provocation levels, control group participants would evidence significantly greater systolic/diastolic blood pressure, pulse rates, corrugator EMG, perioral EMG, zygomatic EMG, finger temperature, and self-reports of subjective anger after provocation. In addition, it was predicted that control group participants would retaliate against a confederate who provoked them.

The deficient/attenuated-anger hypothesis predicts lower physiological, behavioral, and subjective/experiential responses associated with anger after provocation in individuals with psychopathic characteristics as compared to individuals without psychopathic characteristics. A pattern of results indicating that, as compared to the control group, the psychopathy-analogue group evidenced significantly lower levels of systolic blood pressure, diastolic blood pressure, pulse rates, corrugator EMG, perioral EMG, zygomatic EMG, finger temperature, self-reports of subjective anger and retaliation towards the confederate after provocation would be consistent with this hypothesis.

In contrast, the adequate/heightened-anger hypothesis predicts similar or higher physiological, behavioral, and subjective/experiential responses associated with anger after provocation in individuals with psychopathic characteristics as compared to individuals without psychopathic characteristics. A pattern of results indicating that, as compared to the control group, the psychopathy-analogue group evidenced similar or significantly higher levels of systolic blood pressure, diastolic blood pressure, pulse rates, corrugator EMG, perioral EMG, zygomatic EMG, finger temperature, self-reports of subjective anger, and retaliation towards the confederate after provocation would be consistent with this hypothesis.

Temporal Course Hypotheses. This study also examined the temporal course of arousal associated with anger. This issue was examined after participants were provoked but before an opportunity to retaliate against the confederate was offered. These analyses were limited to the physiological data collected in the study.

The deficient/attenuated-anger hypothesis of psychopathy predicts a more rapid decrease in physiological activity associated with anger in individuals with psychopathic characteristics. A pattern of results indicating that, as compared to the control group, the psychopathy-analogue group showed a more rapid decrease in

systolic blood pressure, diastolic blood pressure, pulse rates, finger temperature, corrugator EMG, perioral EMG, and zygomatic EMG over the course of time after provocation but prior to retaliation would be consistent with this hypothesis.

The adequate/heightened-anger hypothesis of psychopathy makes two different predictions about changes in physiological activity. One prediction is that changes in physiological activity over time would be similar for psychopaths and nonpsychopaths. A pattern of results indicating that, as compared to the control group, the psychopathy-analogue group evidenced similar changes in systolic blood pressure, diastolic blood pressure, pulse rates, finger temperature, corrugator EMG, perioral EMG, and zygomatic EMG over the course of time after provocation but prior to retaliation would be consistent with this prediction.

In contrast, Yochelson and Samenow (1976) argue that anger in psychopaths metastasizes over time. Thus, one variant of the adequate/heightened-anger hypothesis also predicts physiological activity associated with anger would increase over time. A pattern of results indicating that, as compared to the control group, the psychopathy-analogue group evidenced continued elevations in systolic blood pressure, diastolic blood pressure, pulse rates, finger temperature, corrugator EMG, perioral EMG, and zygomatic EMG

over the course of time after provocation but prior to retaliation would be consistent with this prediction.

Cognitive Processing Hypotheses. An examination of the effects of anger on cognitive processes was also conducted using a combination of word identification (i.e., lexical decision) and attentional shifting tasks in this study. Deficits in psychopaths have been observed on both tasks separately under "nonemotional" conditions. This study attempted to replicate those findings reported by Howland et al. (1993) related to attentional shifts and Williamson et al. (1991) related to response latency facilitation for emotional words. Based on the findings reported by these investigators, it was predicted that prior to provocation: 1) as compared to the control group, the psychopathy-analogue group would make more classification errors on invalidly cued left target trials (i.e., trials in which the cue was presented on the right side of the computer screen but the target appeared on the left side of the screen), 2) the control group would show a response facilitation effect for emotional words (i.e., response latencies for emotional words would be significantly shorter than response latencies for emotionally-neutral words), and 3) the psychopathy-analogue group would not show a response facilitation effect for emotional words.

Predictions of participants' performance on the cognitive processing task after the anger induction were

limited to the lexical decision task and based on evidence that the experience of anger facilitates the processing of anger-congruent material (e.g., Laird et al., 1982). In this study the emotional words were all anger/aggression relevant. More specifically, it was predicted that, for the control group, the response facilitation effect for emotional words observed prior to provocation would be larger after provocation.

The two anger hypotheses of psychopathy make divergent predictions regarding performance on the cognitive processing task after provocation for individuals with psychopathic characteristics. The attenuated/deficient-anger hypothesis predicts that pre- and post-provocation performances on the lexical decision task would be similar for individuals with psychopathic features because of little changes in anger levels after provocation (i.e., their performance would not change because they would not experience anger after provocation). A post-provocation pattern of results indicating the absence of the response facilitation effect for emotional words in the psychopathy-analogue group would be consistent with this hypothesis.

In contrast, the adequate/heightened-anger hypothesis predicts that the response facilitation effect for emotional words would be observed in individuals with psychopathic characteristics after provocation because anger experiences facilitate the processing of anger-relevant material.

(Again, the emotional words used in the study were anger/aggression relevant.) A post-provocation pattern of results indicating response facilitation for emotional words in the psychopathy-analogue group would be consistent with this hypothesis. However, Yochelson and Samenow (1976) also argue that psychopaths become so overwhelmed by anger that their ability to function is diminished. Thus, as compared to pre-provocation performance, a pattern of results indicating a poorer post-provocation performance on the lexical decision and/or the attentional shifting dimensions of the cognitive task by the psychopathy-analogue group would be consistent with this argument.

Although not bearing on the primary analyses of the study presented above, other analyses reported herein were designed to provide more information about anger experiences in individuals with and without psychopathic characteristics. One set of secondary analyses examined the relation between the physiological, behavioral, and subjective/experiential systems associated with anger that were assessed in the study. Another set of secondary analyses examined changes in physiological measures and subjective/experiential measures after the opportunity to retaliate against the confederate had been offered. The rationale for these analyses and predictions is discussed separately below.

Correlations between Physiological, Behavioral, and Subjective Measures Associated with Anger. The physiological, behavioral, and subjective systems of an emotional response are theoretically related (Lang, 1968). However, the evidence for concordance between the systems is quite mixed and appears to be related to several factors (e.g., the magnitude of the emotional response, social pressures) (Rachman & Hodgson, 1974). In regard to anger experiences, Hokanson and Burgess (1962) reported a significant relation between blood pressure and self-reports of anger after provocation but did not report a correlation coefficient. Despite several other known investigations of anger/aggression using the performer/evaluator paradigm, none have reported the concordance or discordance between activity in the different systems.

Data collected in this study provided an opportunity to examine several different measures associated with anger from the three systems of an emotional response. Remaining consistent with the basic premise of the triple-response theory, it was predicted that the different anger dependent measures associated with the three emotional response systems would be significantly correlated for the control group. Anger measures for of the three systems were also predicted to be significantly correlated in the psychopathy-analogue group if results consistent with the adequate/heightened-anger hypothesis of psychopathy were

observed. However, the anger measures were not predicted to be significantly correlated in the psychopathy-analogue group if results consistent with the deficient/attenuated-anger hypothesis of psychopathy were observed.

Changes in Physiological and Subjective Measures after Retaliation. Decreases in systolic and diastolic blood pressure have been reported after the opportunity to retaliate against a provoker is offered (see Zillmann, 1979 for a review). This decrease in blood pressure suggests that the opportunity to retaliate against the provocateur mediates and reduces anger. Changes in other physiological factors (e.g., facial EMG) or subjective reports of anger have not been examined, but there is little reason to believe that a similar pattern would not emerge. It was predicted that reductions in physiological measures and self-reported anger to pre-provocation levels would be observed in the control group after the opportunity to retaliate against the confederate was offered.

The deficient/attenuated-anger hypothesis of psychopathy makes no prediction regarding the return of physiological measures and self-reports of anger to pre-provocation levels because according to this hypothesis, there would be no (or minimal) increases in physiological measures and self-reported anger after provocation in the first place. On the other hand, if results consistent with the adequate/heightened-anger hypothesis of psychopathy were

observed, it was predicted that reductions in physiological measures and self-reported anger to pre-provocation levels would be found in the psychopathy-analogue group after the opportunity to retaliate against the confederate was offered. However, Yochelson and Samenow's (1976) suggestion that psychopaths' anger metastasizes until they lose all perspective predicts that, for individuals with psychopathic characteristics, significant anger reductions would not occur after the opportunity to retaliate against a provocateur is offered. Results indicating no reduction in physiological measures and self-reports of anger in the psychopathy-analogue group after retaliation would be consistent with this argument. This examination of the temporal course and reduction in anger following retaliation also provided a way of examining differences between adequate anger and heightened anger in individuals with psychopathic characteristics.

Planned Comparisons. Planned comparisons for all dependent measures and hypotheses presented above were computed to examine differences between the control group and the psychopathy-analogue group and to examine differences between the control group and the low-socialization group. Depending on the specific hypotheses being tested, planned comparisons consisted of either interaction contrasts or simple main effect contrasts. The specific type of planned comparison computed is described in

the Results section for each specific analysis.

Summary

Although several studies have examined fear and anxiety in psychopaths, very few studies have examined anger (or other emotions) in psychopaths or individuals with psychopathic features. Thus, the examination of anger in individuals with psychopathic features was designed not only to contribute to our understanding of this emotion in these individuals but to also provide a more complete picture of psychopaths' emotional reactions in general. Moreover, an examination of attentional processes in general and under conditions of anger was designed to contribute to the burgeoning body of research related to cognition in psychopaths and to our understanding of the conditions under which attentional processes would be enhanced and/or impaired in psychopaths.

This study was also designed to contribute to our understanding of anger in general. More specifically, the assessment of anger across the physiological, behavioral, and subjective/experiential systems of an emotion reaction allowed an examination of the concordance and discordance between theoretically related systems. In addition, the study was designed to gain a better understanding regarding the effects of anger on cognitive processes, an area which has not received much systematic study.

CHAPTER II

METHOD

Participants

Participants were 62 undergraduate males recruited through the UNCG psychology subject pool. Participants were initially selected on the basis of scores on the Socialization (So) scale which was administered during mass testing sessions. Individuals who scored in the extreme thirds of the So scale distribution were invited to participate in the study.

As a further group assignment procedure, PCL Factor 1 ratings were obtained from those who participated in the study. To derive these ratings, participants were interviewed about family, romantic relationships, work, school, and antisocial activity histories. The semi-structured interview was a modified version of that used with an incarcerated sample. Factor 1 scores could range from 0 to 16. All interviews were conducted by clinical psychology graduate students who had received extensive training. To examine interrater reliability for the PCL Factor 1 items, 26 of the interviews were audiotaped and rated by a clinical psychology graduate student who had extensive PCL training. The zero-order correlation between PCL Factor 1 ratings of the interviewer and the observer was

.72. The magnitude of this correlation indicated substantial agreement between the raters on Factor 1 items. (The zero-order correlations between ratings for Factor 2 items and PCL total scores were .83 and .86, respectively.)

Group assignment was based on a combination of So scores and PCL Factor 1 ratings. The psychopathy-analogue group contained 20 participants who scored in the lower third of the So scale distribution (i.e., 30 and lower) and scored 5 or above on the PCL Factor 1 items. The low-socialization group contained 21 participants who scored in the lower third of the So scale distribution and scored 4 or lower the PCL Factor 1 items. The control group contained 21 participants who scored in the upper third of the So scale distribution (i.e., 35 and above) and scored 4 or lower on the PCL Factor 1 items.

So score means for the control, low-socialization, and psychopathy-analogue groups were 39.90 (*SD* = 3.21), 26.05 (*SD* = 2.96), and 25.70 (*SD* = 3.67), respectively. Group differences were significant $F(2,59)=126.60$, $p<.001$ and indicated that the control group had higher socialization scores than the other two groups. Factor 1 score means for the control, low-socialization, and psychopathy-analogue groups were 1.67 (*SD*=.97), 1.95 (*SD*=1.28), and 7.10 (*SD*=1.59), respectively. Group differences were significant $f(2,59)=112.77$, $p<.001$ and indicated that the psychopathy-analogue group had higher Factor 1 scores than the other two

groups.

The average ages of the control, low-socialization, and psychopathy-analogue groups were 20.29 (SD = 3.26), 19.52 (SD = 3.74), and 21.00 (SD = 4.34), respectively. The majority of participants were Caucasian (control 85.7%, low-socialization 85%, psychopathy-analogue 100%), and the remainder of participants were African-American. The majority of participants were right-handed (control 81%, low-socialization 100%, psychopathy-analogue 95%). Groups were not significantly different on any of these factors.

Procedural information was given and informed consent was obtained prior to beginning the study. Participants were paid for their participation and received experiment credit as partial fulfillment of a research requirement in introductory psychology courses.

Apparatus and Stimuli

Anger Induction. Provocation was used to induce anger. Participants were led to believe that their performance on a computerized cognitive task (discussed below) was being evaluated by another similar-aged male participant located in another room also working on the computer task. In fact, there was no other participant. This supposed participant is referred to herein as the confederate. The basic design of the provocation was to lead participants to believe that their performance on the computer task was unfairly evaluated by the confederate. To examine the extent to which

participants viewed the confederate's feedback as unfair, at the conclusion of the study but prior to debriefing, participants rated the "fairness" of the feedback provided by the confederate on a 10-point Likert scale (0=extremely unreasonable to 9=extremely reasonable). Means for this rating for the control, low-socialization, and psychopathy-analogue groups were 1.67 (SD = 1.35), 1.48 (SD = 1.25), and 2.10 (SD = 1.48). These group differences were not significant, $F(2,59)=1.12$, $p=.33$, and indicated that overall participants rated the confederate's feedback as unfair/unjustified. The specific conditions and steps involved in the provocation are discussed in detail in the Procedure section.

Cognitive Processing Task. Cognitive processes were examined using a cued reaction time task similar to that employed by Howland et al. (1993) but modified to include a lexical decision component. This task was performed on a Zenith Data Systems personal computer (model 2CV-2526-EY) with a Seiko Instruments color monitor (model CM-1430). The software was a program written by the author in turbo-pascal. This computerized task consisted of a number of trials in which the presentation of an initial cuing stimulus on each trial more often than not predicted the location of a target stimulus. More specifically, on 80% of trials the target stimulus was presented on the same side of the computer screen (i.e., right or left) as the cuing

stimulus. Herein, these trials are termed valid trials. Conversely, on 20% of trials the cuing stimulus did not predict the location of the target stimulus (i.e., the target stimulus appeared on the opposite side of the computer screen from the cuing stimulus). Herein, these trials are termed invalid trials.

The cuing stimulus was a white asterisk. The target stimuli consisted of 12 anger-relevant, 12 emotionally-neutral, and 24 pronounceable nonsense words. These were equally divided between the blocks (i.e., 6 anger-relevant, 6 nonemotional, 12 nonsense). Thus, different targets were used in each block (i.e., pre/post provocation) to control for practice/familiarity effects.

Anger-relevant and emotionally-neutral words were selected from 7-point pleasant/unpleasant scale ratings reported in Toglia and Battig (1978). Anger-relevant words were selected on the basis of their relevance to anger/aggression and ratings of more than 1.5 SD's below the mean pleasantness ratings. Emotionally-neutral words were selected on the basis of pleasantness ratings that fell within plus or minus .5 SD's of the mean.

Anger-relevant and emotionally-relevant words were matched on number of letters, number of syllables and on levels of concreteness, imagery, and familiarity from ratings provided by Toglia and Battig (1978). Pronounceable nonsense words were constructed by the author; although

pronounceable, they are not found in an English dictionary. (See Appendix A for a copy of the target lists.)

The cuing stimulus appeared for 750 milliseconds (ms) and was immediately followed by the target. On each trial the target stimulus was presented for 350 ms but participants had 1500 ms to respond. Participants were instructed that the cuing stimulus was the best guide as to where the target stimulus would appear and to respond to the target stimulus as quickly as possible.

Participants used their right hand second digit to push the letter "J" on the computer keyboard if the target appearing on the right side of the computer screen was a word and pressed the letter "K" using the third digit of their right hand if the target was a nonsense word. Moreover, participants used their left hand third digit to press the letter "D" if a target appearing on the left side of the computer screen was a word and pressed the letter "F" using the second digit of their left hand if the target was a nonsense word.

Participants received monetary payoffs for accurate responses. The amount of monetary payoff given for correct responses on each trial varied from one to three cents, such that quicker responses were rewarded with greater amounts of money. Each incorrect response was penalized by the loss of one cent. Feedback was given after each trial as to whether the response was correct or incorrect and how much money was

awarded or lost.

Each block consisted of 240 trials. Of these 240 trials, 96 were validly cued right target trials (i.e., cue and target appeared on the right side of the computer monitor). Of these 96 trials, 24 contained anger-relevant word targets, 24 contained emotionally-neutral word targets, and 48 contained nonsense word targets. In addition, 24 trials were invalidly cued right targets (i.e., the cue appeared on the left side of the monitor, but the target appeared on the right side). Of these 24 trials, 6 contained anger-relevant word targets, 6 contained emotionally-neutral word targets, and 12 contained nonsense word targets. Each block also had 96 validly cued left target trials (i.e., cue and target appeared on the left side of the computer monitor). Of these 96 trials, 24 contained anger-relevant word targets, 24 contained emotionally-neutral word targets, and 48 contained nonsense word targets. In addition, 24 trials were invalidly cued left targets (i.e., the cue appeared on the right side of the monitor, but the target appeared on the left side). Of these 24 left hand invalid trials, 6 contained anger-relevant word targets, 6 contained emotionally-neutral word targets, and 12 contained nonsense word targets. On any given trial there was a 50% chance that the target would be a word. Trials were presented in a pseudo-random order that remained constant for all participants.

Physiological. Facial electromyographic (EMG), finger temperature, blood pressure, and pulse were dependent measures. EMG and finger temperature were assessed using a Biolab physiological monitoring system. For facial EMG, two 4 mm Ag/AgCl leads filled with conductive gel were attached via adhesive collars to the perioral (lower lip), zygomatic (cheek) and corrugator (brow) sites on the left side of the face. A 4 mm Ag/AgCl ground lead filled with conductive gel was attached to the mid-line forehead area just below the hairline. EMG activity was recorded at a sampling rate of 10 Hz, a rate similar to that used in other facial EMG studies of emotions (e.g., Fridlund et al., 1984). EMG signals were band-limited to 100-250 Hz. Although it is recognized that much of a signal is lost with this high band-limit, it is within the range suggested by Fridlund and Cacioppo (1986) in order to maximize recording-site specificity and system signal-to-noise ratio. Finger temperature was assessed via an electrode attached to the tip of the third digit of the left hand. Similar to facial EMG, finger temperature was sampled at 10 Hz. Blood pressure and pulse were assessed using a Dinamap Vital Signs Monitor (Model 8110). Measurements were taken via an arm cuff attached to the left arm.

Subjective. Subjective ratings of emotional experiences were obtained for five emotional states, sadness, happiness, anger, anxiety, and fear. Levels of each of these emotional

states were assessed using a 10-point likert scale response format, with 0 representing "do not feel at all" and 9 representing "feel very strongly". (See Appendix B for a copy of this measure.)

Behavioral. The level of retaliation towards the confederate after provocation was the behavioral measure of anger. In particular, participants rated the confederate's overall levels of performance, effort, and intelligence on the cued reaction time task. Ratings were made on a 7-point scale (i.e., 1=extremely low to 7=extremely high). In addition, participants made a "yes/no" decision as to whether the confederate received a monetary performance bonus. These measures were assessed twice during the study, once before provocation and once after provocation. (See Appendix C for these rating scales.)

Intelligence. Levels of intelligence may moderate performance on cognitive tasks (Sternberg & Salter, 1982). Thus, intelligence was assessed and examined in a set of supplementary analyses. The Shipley Institute of Living Scale (SILS; Shipley, 1940) was used as a measure of intelligence. This brief, self-administered measure has demonstrated good reliability and validity. Split-half reliability has been reported at .92 (Shipley, 1940) and test-retest reliability has been reported at .78 (Zachary, 1986). Attesting to its validity, SILS scores have been reported to be related to several other intelligence indices

(see Zachary, 1986).

Anxiety. Levels of trait anxiety have been reported as a moderator of psychopaths' performance on a cooperation task (Widom, 1976) and on an empathy task (Patterson, 1991). In addition, anxiety has been reported to affect performance on cognitive tasks (e.g., MacLoed et al. 1986; MacLoed & Mathews, 1988). Therefore, trait anxiety was assessed and examined in a set of supplementary analyses. The Welsh Anxiety Inventory (WAI; Welsh, 1956) was used to assess levels of trait anxiety. This inventory contains 39 true/false items. The inventory has demonstrated adequate reliability. Split-half reliability has been reported at .88 and test-retest reliability has been reported at .70 (Welsh, 1956). Regarding validity, the WAI has been reported as correlated with other anxiety measures and greater WAI scores have been reported in individuals with psychological disorders (Welsh, 1956).

Procedure

Upon entering the experiment participants were provided with a false cover story that the study was designed to examine the effects of feedback about performance on a computerized reaction time task and subsequent performance on the same task. Participants were told that another similar-aged male participant was being tested simultaneously and that each would give performance feedback to the other twice during the experiment. Again, there was

no other male participant. After obtaining informed consent, the physiological equipment was attached and instructions about the cued reaction time task were presented.

Feedback procedures were explained to participants. More specifically, participants were told that they would complete two blocks of trials on the computer task. After each block, participants (i.e., the actual participant and the confederate) would evaluate the other's performance on three dimensions (i.e., overall performance, overall effort, estimate of intelligence) and decide whether a $5.00 performance bonus would be awarded for that block of trials. It was stressed that awarding the performance bonus was based entirely on the participants' judgment.

Following these instructions baseline physiological measures were recorded. These measures included 48 seconds of EMG, 48 seconds of finger temperature, systolic/diastolic blood pressure, and pulse. Next, the cued reaction time task trials began. Short rest periods occurred every five minutes during each block of trials. During these rest periods, facial EMG (48 seconds), finger temperature (48 seconds), blood pressure, and pulse were measured. These measures were also assessed at the end of the first block of trials. To make the manipulation more plausible, the experimenter left the room after every rest period to "check" the progress of the confederate.

After the first block of trials, the computer displayed summary performance information. Regardless of participant's actual performance, the summary information stated that the participant's accuracy was 87.2% and that this performance was better than 86 out of every 100 people tested on the task. In addition, the summary information stated that the participant's response speed was on average 754 ms which was better than 82 out of every 100 people tested. The experimenter wrote down this information and pretended to take it to the confederate in the other room.

Upon returning, the experimenter presented false summary information to the participant about the confederate's performance. The content of this information remained the same for all participants and indicated that the confederate's accuracy was 85.3% and that this performance was better than 84 out of every 100 people tested. Further, the summary information stated that the confederate's response speed was on average 782 ms and that this performance was better than 80 out of every 100 people tested. (Notably, this information indicated that the confederate's performance was similar to, but slightly poorer than, the participant's performance.) Based on this information, the participant rated the confederate's overall performance, effort, and intelligence and decided if the monetary performance bonus was to be awarded.

The experimenter then told the participant that he was going to obtain the other participant's feedback and make an audiotape regarding his feedback to the participant. The experimenter left the room, returned approximately three minutes later, and made an audiotape with the participant containing his verbal feedback to the confederate. Following this, EMG (48 seconds), finger temperature (48 seconds), pulse, and blood pressure were assessed. The measures obtained during this assessment served as the pre-provocation baseline measures.

The participant was then given the written feedback (supposedly from the confederate) and the confederate's audiotaped feedback was played. The confederate's written feedback was the same for all participants and indicated that the participant's performance was only average, his effort was low, and his intelligence was estimated as low average. In addition, the confederate withheld the $5.00 performance bonus. The audiotaped feedback reviewed these ratings and also contained some disparaging remarks about the participant. (See Appendix D for the exact content of the tape.) During the playing of the tape, EMG and finger temperature were assessed (over an interval of 144 seconds). Immediately following the playing of the audiotape, blood pressure and pulse measurements were assessed.

Next, another block of the cued reaction time task was presented. At five minute intervals facial EMG (48 seconds),

finger temperature (48 seconds), blood pressure, and pulse were assessed during rest periods. Following this, summary performance information was again displayed by the computer. This information was the same for all participants and indicated that the participant's accuracy was 89.3% and this was better than 88 out of every 100 tested. In addition, the information indicated that the participant's response time on average was 725 ms which was better than 85 out of every 100 people tested. (Notably, this summary information indicated that the participant's performance was slightly better than his performance during the first block of trials.) This information was recorded by the experimenter and participants were instructed that feedback would once again be given. Again, the experimenter pretended to take the information to the confederate and returned approximately three minutes later with the confederate's summary performance information. This information stated that the confederate's accuracy was 86.7% which was better than 85 out of every 100 people tested. In addition, the summary information stated that the confederate's average response time was 740 ms which was better than 83 out of every 100 people tested. (Notably, this summary information indicated that the confederate's performance was better than during the first block of trials and again similar to, but slightly poorer than, the participant's performance.) Participants again rated the confederate's performance and

decided whether the monetary performance bonus should be awarded. The experimenter left the room and returned three minutes later.

Upon returning, a final set of facial EMG (48 seconds), finger temperature (48 seconds), blood pressure, and pulse was assessed. These assessments were used to examine post-retaliation changes in physiological activity. Participants then rated their current levels of five different emotions (i.e., anger, anxiety, fear, happiness, and sadness). In addition, they retrospectively rated levels of these emotions for how they felt when they first came to the experiment, and how they felt after receiving the first set of feedback from the confederate. It was during this time that participants also rated the "fairness" of the original feedback provided by the confederate.

Following the experimental procedure, participants were debriefed and told that the feedback that they received was falsified in order to examine the effects of emotional experiences on reaction times and accuracy on the computer task. The experimenter gave a detailed explanation as to why the deception was used (i.e., an effort to generate valid emotional reactions) and provided opportunities for participants to discuss aspects of the deception and/or the study in general. All participants were directly asked if, and to what extent, they were experiencing any negative feelings resulting from either the provocation or from the

fact that they were deceived by the experimenter as part of the study. No participants expressed that they were experiencing negative feelings from the provocation or from the fact that they were deceived by the experimenter, and in no instance did the experimenter doubt the participant's truthfulness. Because deception was used in the study, participants were asked if the information collected about them could still be used in the study. All participants agreed and signed a waiver indicating that they understood that deception had been used and that the information collection about them could be used in the study. Participants were then interviewed and/or asked to complete the WAI and SILS. Participants were paid for their performance on the computer task as well as the two $5.00 performance bonuses. On average, participants received a total of $16.00.

CHAPTER III

RESULTS

Preliminary Analyses

Initial Data Inspection

Group data for each of the dependent measures were examined for normality and homogeneity of variances. In a few instances group data were skewed and/or group variances were heterogeneous. However, the degree of skewness and/or amount of heterogeneity for these few variables was considered small (Glass, Peckham & Sanders, 1971; Keppel, 1982; Winer, 1971). Taking this into account, as well as the relatively large sample size for each group and the robustness of the Analysis of Variance (ANOVA) procedures, the use of ANOVA procedures in the statistical analyses of these data appears appropriate.

Group Comparisons on Trait Anxiety and Intelligence

Group comparisons on trait anxiety and intelligence were conducted. As assessed by the WAI, mean trait anxiety scores for control, low-socialization, and psychopathy-analogue groups were 8.57 (*SD* = 7.37), 15.00 (*SD* = 8.87), and 10.90 (*SD* = 9.10), respectively. To examine group difference on reported trait anxiety, scores were submitted to a one-way ANOVA. The results of this analysis were significant, $F(2, 59) = 3.10$, $p = .05$. Follow-up comparisons

using a Tukey's HSD test indicated that the low-socialization group reported significantly higher levels of trait anxiety than the control group. Shipley overall intelligence t-scores for the control, low-socialization, and psychopathy-analogue group were 58.66 (*SD* = 3.57), 56.67 (*SD* = 5.89), and 56.95 (*SD* = 5.14), respectively. An analyses of these scores using a one-way ANOVA did not indicate significant group differences, $F(2, 59) = 1.00$, $p = .38$.

Group Comparisons on Pre-Provocation Physiological Measures

An argument could be made that any group differences observed for changes in physiological measures after provocation could have been affected by pre-provocation (i.e., baseline) levels. To address this issue, pre-provocation levels for each physiological measure were submitted to a one-way ANOVA to examine group differences. (Means and standard deviations for each physiological measure are presented in Table 2). The results of these analyses indicated that groups did not differ on pre-provocation levels of systolic blood pressure, $F(2, 59) < 1$, diastolic blood pressure, $F(2, 59) = 1.45$, $p = .24$, pulse, $F(2, 59) < 1$, corrugator EMG, $F(2, 59) < 1$, zygomatic EMG, $F(2, 59) < 1$, or perioral EMG, $F(2, 59) = 2.01$, $p = .14$. For finger temperature, the results of the one-way ANOVA indicated a nonsignificant trend, $F(2, 59) = 2.40$, $p = .10$. A visual inspection of the data suggested that greater

finger temperature in the psychopathy-analogue group as compared to the low-socialization group accounted for this trend. Overall, groups were similar on physiological measures prior to provocation.

Manipulation Check

As a manipulation check on the anger induction technique, changes in systolic and diastolic blood pressure were compared in the control group using paired t-tests. The mean increase in systolic blood pressure after provocation was 9.29 mmHg and this increase was significant, $t(20) = 5.45$, $p < .001$. The mean increase in diastolic blood pressure after provocation was 6.00 mmHg and this increase was also significant, $t(20) = 4.37$, $p < .001$.

The control group's retaliation towards the confederate after provocation was also used to examine the effectiveness of the anger induction technique. Two separate analyses were conducted: one was based on feedback ratings of performance, effort, and intelligence and the other was based on awarding the $5.00 performance bonus. Summed feedback ratings of performance, effort, and intelligence were computed separately for ratings made before provocation and after provocation. The scores of these summed ratings could range from 0 (extremely low) to 21 (extremely high). The decrease in feedback scores to the confederate from pre-provocation ratings to post-provocation ratings was on average 2.10 points and indicated that retaliation towards the

confederate had occurred. This pre/post decrease in feedback ratings was significant, $t(20) = 2.74$, $p = .01$.

The second analysis examined the awarding of the $5.00 performance bonus pre- and post-provocation. In the control group, 100% of participants awarded the performance bonus prior to provocation. After provocation, however, only 52% of control group participants awarded the performance bonus. This difference was significant, $T(20) = 30$, $p < .01$.

Taken together, control group participants evidenced increases in blood pressure and retaliation which are consistent with theoretical views of anger reactions and with previous empirical work using a similar anger induction technique (e.g., Hokanson & Burgess, 1962). Thus, it is concluded that the anger induction technique used in this study was effective.

Overview of Statistical Analyses

ANOVAs were the primary statistical analysis procedures used in this study. Although the ANOVA procedures varied depending on the research question being addressed, these procedures generally were in the form of a 3(group) X 2(block) design. The group level corresponded to the control, low-socialization, and psychopathy-analogue groups, and the block level corresponded to the repeated measure factor (e.g., pre-provocation levels verses post-provocation levels). The specific measures included in the block level are presented in each subsection.

For any analysis that followed this general design, data were initially submitted to this omnibus ANOVA. Regardless of the outcome of the group X block interaction from the omnibus ANOVA (not reported herein), two planned comparisons were computed to examine group differences. One planned comparison examined differences between the control group and the psychopathy-analogue group. The other planned comparison examined differences between the control group and the low-socialization group.

Depending on the question being addressed, planned comparisons which examined group differences were one of two types: simple main effects or interaction contrasts. For simple main effect analyses, a pooled error term was computed based on the procedures provided by Kirk (1995, p. 531) and used in the analyses. Interaction contrasts (primarily used to examine pre/post difference scores) were also computed based on procedures provided by Kirk (1995, p. 533). More specifically, levels assessed at time one (T1) (e.g., pre-provocation scores for systolic blood pressure) were subtracted from measures assessed at time two (T2) (e.g., post-provocation scores for systolic blood pressure) for participants in the groups that were being compared and a hybrid mean-squared between-group x block term was computed. The error term and denominator degrees of freedom used in the interaction contrasts were the repeated measures error term and corresponding degrees of freedom obtained in

the initial ANOVA (Kirk, 1995; p. 536). A significant result would indicate that the magnitude of change from T1 to T2 was different for the groups being compared.

Although the planned interaction contrasts and simple main effects were the primary analyses of interest, group main effects from the omnibus ANOVA are reported to evaluate any group differences on responses collapsed across the block levels. Also, block main effects from the omnibus ANOVA are reported to evaluate the effects of the provocation or retaliation for the sample as a whole. Any deviations from this general ANOVA procedure will be presented in the specific subsection.

Other statistical procedures used in this study included Pearson correlations, t-tests, and Chi-square techniques. Regardless of the statistical procedure being used, in all primary, secondary, or supplemental analyses, an alpha level of .05 was used to evaluate statistical significance, and an alpha level range of .06 to .10 was considered a nonsignificant trend.

Primary Analyses

Capacity/Magnitude

One of the primary purposes of the study was to examine group differences in subjective, physiological, and behavioral measures associated with anger after provocation. These analyses provided information about if, and to what extent, individuals with psychopathic characteristics

experienced anger. Zero-order correlations computed between the different dependent measures associated with anger indicated that the intercorrelations were generally low; hence, the use of multivariate procedures would have been inappropriate. (Table 6 contains the correlation matrix for these dependent measures, and a discussion of this issue is presented in a later section.) Therefore, each dependent measure was analyzed separately, and data were initially submitted to a 3(group) X 2(block) ANOVA. The block levels corresponded to pre-provocation and post-provocation scores of the specific dependent measure being examined. Planned interaction contrasts were use to evaluate group differences. Herein, these interaction contrasts are referred to as the pre/post difference scores.

Subjective. Table 1 contains pre-provocation means, post-provocation means, and pre/post difference scores for each group and each emotion. Subjective ratings were initially submitted to a 3(group) X 2(block) ANOVA separately for each of the five assessed emotions. Results of the statistical analyses for each emotion are presented below.

For anger, the block main effect was significant, $F(1, 59) = 91.50$, $p < .001$, indicating increases in self-reported anger following provocation for the sample as a whole. The group main effect was not significant, $F(2, 59) < 1$. The planned contrasts of the pre/post anger difference scores

were not significant for the control versus psychopathy-analogue group comparison, $F(1, 59) = 2.73$, or the control versus low-socialization group comparison, $F(1, 59) < 1$.

For happiness, the block main effect was significant, $F(1, 59) = 47.24$, $p < .001$, indicating decreases in self-reported happiness following provocation for the sample as a whole. The group main effect was not significant, $F(2, 59) < 1$. The planned contrast of the pre/post happiness difference scores was significant for the control versus psychopathy-analogue group comparison, $F(1, 59) = 4.82$, $p < .05$, indicating that the control group reported a greater reduction in happiness after provocation. The pre/post happiness difference scores comparison between the control group and low-socialization group was not significant, $F(1, 59) < 1$.

For sadness, the group main effect was not significant, $F(2,59) < 1$. Group changes in reported sadness after provocation were small, and the block main effect indicated that these changes were not significant for the sample as a whole, $F(1, 59) < 1$. The planned contrasts of the pre/post sadness difference scores were not significant for any of the group comparisons (both $Fs(1, 59) < 1$).

For fear, the block main effect was significant, $F(1, 59) = 10.34$, $p = .002$, indicating decreases in self-reported fear following provocation for the sample as a whole. The group main effect was not significant, $F(2, 59) < 1$. The

planned contrasts of the pre/post fear difference scores were not significant for the control versus psychopathy-analogue group comparison, $F(1, 59) < 1$, or the control versus low-socialization group comparison, $F(1, 59) = 2.19$.

For anxiety, a nonsignificant trend for the group main effect, $F(2, 59) = 2.35$, $p = .10$, indicated a tendency for the control group to report higher anxiety levels before and after provocation. However, overall changes in reported anxiety after provocation were small, and the block main effect indicated that these changes were not significant for the sample as a whole, $F(1, 59) < 1$. The planned contrasts of the pre/post anxiety difference scores were not significant for the control versus psychopathy-analogue group comparison, $F(1, 59) < 1$, or the control versus low-socialization group comparison, $F(1, 59) = 2.70$.

In summary, increases in self-reported anger after provocation were significant for the sample as a whole, and there were no significant group differences. The nonsignificant difference between the control group and the psychopathy-analogue group on reported anger replicated the findings reported by Patterson (1991), Forth (1992), and Sullivan (1994). Further, these results were not inconsistent with the adequate/heightened-anger hypothesis but were not consistent with the deficient/attenuated-anger hypothesis of psychopathy.

Decreases in fear and happiness after provocation were significant for the sample as a whole. Group comparisons indicated that the control group reported a significantly greater reduction in happiness after provocation than the psychopathy-analogue group. Although the two anger hypotheses of psychopathy make no predictions about other emotional experiences in psychopaths, this finding suggests that some conditions may differentially affect emotional experiences for psychopaths and nonpsychopaths.

Blood Pressure. Systolic blood pressure, diastolic blood pressure, and pulse were analyzed separately using 3(group) X 2(block) ANOVAs. The block levels corresponded to pre-provocation measurements (obtained immediately prior to provocation) and post-provocation measurements (obtained immediately after provocation). Table 2 contains pre-provocation means, post-provocation means, and pre/post difference scores for each group and each measure. Results of the analyses are presented below.

For systolic blood pressure, the block main effect indicated significant increases following provocation for the sample as a whole, $F(1, 59) = 53.44$, $p < .001$. The group main effect was not significant, $F(2,59) < 1$. Planned contrasts of the pre/post systolic blood pressure difference scores were not significant for the control versus psychopathy-analogue group comparison, $F(1, 59) = 1.00$, or the control versus low-socialization group comparison, $F(1,$

59) = 2.25.

The block main effect for diastolic blood pressure indicated significant increases for the sample as a whole, $F(1, 59) = 46.88$, $p < .001$. The group main effect was not significant, $F(2, 59) = 1.27$, $p = .29$. Planned contrasts of the pre/post diastolic blood pressure difference scores were not significant for the control versus psychopathy-analogue group comparison, $F(1, 59) < 1$, or the control group versus low-socialization group comparison, $F(1,59)=1.47$.

For pulse, the block main effect indicated a nonsignificant trend towards an increase following provocation for the sample as a whole, $F(1, 59) = 3.11$, $p = .08$. The group main effect was not significant, $F(2,59) < 1$. Planned contrasts of the pre/post pulse difference scores were again not significant for either the control versus psychopathy-analogue group comparison, $F(1, 59) < 1$, or the control versus low-socialization group comparison, $F(1, 59) = 1.03$.

In summary, significant increases in systolic and diastolic blood pressure following provocation were observed for the sample as a whole, whereas a nonsignificant trend for increases in pulse following provocation was observed for the sample as a whole. No significant differences were found for any of the group comparisons. Taken together, these results were not inconsistent with the adequate/heightened-anger hypothesis but were not consistent

with the deficient/attenuated-anger hypothesis of psychopathy.

Facial EMG. Corrugator, perioral, and zygomatic EMG activity were assessed during provocation. A visual inspection of the raw EMG data indicated that the greatest increases in activity across groups were in response to six provocative statements made by the confederate to participants on the audio-taped feedback. The six provocative statements were: 1) that the participant's performance was only average, 2) his effort was low, 3) his intelligence was at best low average, 4) he should not receive the $5.00 performance bonus, 5) he was not pushing the buttons quick enough, and 6) that given his effort and intelligence, he could not improve his performance on the next block of trials.

EMG activity associated with these six provocative statements were extracted in interval lengths of eight seconds. Thus, a total of 48 seconds of EMG activity was extracted for each EMG site (responses to 6 statements X 8 second interval length). These 48 seconds of EMG activity were summed and then averaged separately for each participant and for each muscle site. These means served as the measure of EMG activity during provocation and were compared to a 48-second baseline measure assessed just prior to provocation.

Table 2 contains pre-provocation means, post-provocation means, and pre/post difference scores for each group and each EMG site. EMG responses were analyzed separately for each muscle site. Data from each site were initially submitted to a 3(group) X 2(Block) ANOVA. Results of the analyses are presented below.

For corrugator EMG, the block main effect $F(1, 59) = 2.10$, $p = .15$, and the group main effect, $F(2, 59) < 1$, were not significant. The planned contrast of the pre/post corrugator difference scores was significant for the control versus psychopathy-analogue group comparison, $F(1, 59) = 6.58$, $p < .05$, indicating greater increase in corrugator activity in the control group during provocation. The contrast of the pre/post corrugator difference scores was not significant for the control versus low-socialization group comparison, $F(1, 59) < 1$.

For perioral EMG, a nonsignificant trend for the group main effect, $F(2, 59) = 2.64$, $p = .08$, indicated a tendency for the control group to evidence higher levels of perioral activity before and during provocation. The block main effect indicated significant increases during provocation for the sample as a whole, $F(1, 59) = 10.46$, $p = .002$. The planned contrasts of were not significant for any of the group comparisons (both Fs$(1, 59) < 1$).

For zygomatic EMG, the block main effect indicated significant increases during provocation for the sample as a

whole, $F(1, 59) = 9.58$, $p = .003$. The group main effect was not significant, $F(2, 59) = 1.50$, $p=.23$. The planned contrast of the pre/post zygomatic difference scores was significant for the control versus psychopathy-analogue group comparison, $F(1, 59) = 4.29$, $p < .05$, indicating greater zygomatic increases in the control group during provocation. The contrast of the pre/post zygomatic difference scores was not significant for the control versus low-socialization group, $F(1, 59) = 1.28$.

To summarize, as compared to the psychopathy-analogue group, the control group evidenced significantly greater increases in corrugator and zygomatic activity during provocation, and these findings are consistent with the deficient/attenuated-anger hypothesis of psychopathy. Further, these findings are generally consistent with the findings of Sullivan (1994) who reported less anger facial expressions following an induction technique in individuals with psychopathic characteristics as compared to controls. In contrast, perioral activity was not significantly different between the control group and psychopathy-analogue group, and this finding was not inconsistent with the adequate/heightened-anger hypothesis of psychopathy.

Finger Temperature. Finger temperature was assessed during provocation. As with the EMG data, finger temperature associated with the six provocative statements (presented above) was extracted in interval lengths of eight seconds.

Thus, a total of 48 seconds of finger temperature was extracted (responses to 6 statements X 8 second interval length). These 48 seconds of finger temperature were summed and then averaged for each participant. These means served as the measure of finger temperature during provocation and were compared to a 48-second baseline obtained just prior to provocation. Table 2 contains pre-provocation means, post-provocation means, and pre/post difference scores for each group.

Finger temperature data were initially submitted to a 3(group) X 2(block) ANOVA. This analysis indicated that the group main effect, $F(2, 59) = 2.11$, $p = .13$, and the block main effect, $F(1, 59) < 1$, were not significant. The planned contrasts of the pre/post finger temperature difference scores were not significant for the control versus psychopathy-analogue group comparison, $F(1, 59) < 1$, or the control and low-socialization group comparison, $F(1, 59) = 1.17$. Although these results were not inconsistent with the adequate/heightened-anger hypothesis of psychopathy, the predicted increase in finger temperature during provocation was not generally observed, raising questions about the interpretation of these results.

Behavioral. Measures of retaliation were assessed by comparing participants' feedback to the confederate before and after provocation. Feedback included participants' ratings of the confederate's overall performance and effort,

estimate of intelligence level, and whether a $5.00 performance bonus was awarded. Because the awarding of the $5.00 performance bonus was based on a dichotomous scale and the other ratings were based on a continuous scale, awarding of the performance bonus was examined separately.

Participants' ratings of the confederate's performance, effort, and intelligence were found to be significantly correlated for ratings obtained before provocation (range = .51 to .54) and after provocation (range = .73 to 78). Although the intercorrelations were somewhat lower before provocation, the degree of relatedness between these factors was determined to be sufficient to combine ratings into composite scores. Thus, for each participant two composite scores were computed. One composite score was the sum of the performance, effort, and intelligence ratings obtained before provocation, and the other composite score was the sum of the performance, effort, and intelligence ratings obtained after provocation (each rating was based on a 7-point scale). Using this approach, each composite score could range from 0 (extremely low) to 21 (extremely high).

Pre-provocation composite means for the control, low-socialization, and psychopathy-analogue groups were 16.33 (*SD* = 1.35), 16.33 (*SD* = 1.85), and 16.40 (*SD* = 1.67), respectively. Post-provocation composite means for the control, low-socialization, and psychopathy-analogue groups were 14.24 (*SD* = 3.82), 15.28 (*SD* = 2.81), and 15.15 (*SD* =

2.16), respectively.

Composite scores were initially submitted to a 3(group) X 2(block) ANOVA. The block main effect indicated significantly lower ratings of the confederate's performance following provocation for the sample as a whole, $F(1, 59) = 17.17$, $p < .001$. Thus, retaliation towards the confederate was observed. The group main effect was not significant, $F(2, 59) < 1$. Planned contrasts of the pre/post composite difference scores were not significant for the control versus psychopathy-analogue group comparison, $F(1, 59) < 1$, or for the control and low-socialization group comparison, $F(1, 59) = 1.49$.

Regarding the awarding of the $5.00 performance bonus, 100% of participants in all groups gave the bonus before provocation. After provocation, 52.4% of control group, 81% of low-socialization group, and 55% of psychopathy-analogue group gave the bonus. Statistical analysis of these differences indicated that after provocation the control group withheld the performance bonus more often than the low-socialization group, $\chi^2(1, N = 42) = 3.86$, $p < .05$. The difference in post-provocation awarding of the performance bonus was not significant between the control group and psychopathy-analogue group, $\chi^2(1, N = 41) = 0.03$.

To summarize, each group rated the confederate's performance as lower and withheld the monetary performance bonus more often after provocation, indicating that

retaliation towards the confederate had occurred. The control group withheld the monetary performance significantly more often than the low-socialization group. No other significant group differences were found. Because the control and psychopathy-analogue groups did not differ on the amount of retaliation, these results were not inconsistent with the adequate/heightened-anger hypothesis but were not consistent with the deficient/attenuated-anger hypothesis of psychopathy.

Temporal Course

The two anger hypotheses of psychopathy make divergent predictions regarding the temporal course of anger in individuals with psychopathic characteristics. This study tested these hypotheses, limiting analyses to physiological measures. More specifically, facial EMG, blood pressure, pulse, and finger temperature were assessed at 5-, 10-, and 15-minute intervals after provocation but before the opportunity to retaliate against the confederate was offered, in order to examine changes over an extended period of time after provocation.

Two types of analyses were conducted to examine changes in physiological activity over an extended time period. One type of analysis was designed to examine whether the magnitude in levels of physiological measures observed at each of the extended post-provocation time periods (i.e., 5-, 10-, and 15-minutes post provocation) had significantly

changed from magnitude levels observed immediately after or during provocation. For these analyses, within-group patterns were examined using paired t-tests for each physiological measure. For blood pressure and pulse, magnitude levels observed at each of the extended post-provocation periods were compared to magnitude levels observed immediately after provocation. For facial EMG and finger temperature, the 48-second interval of activity assessed during provocation (in response to the six provocative statements) were compared to a 48-second interval recorded at each extended post-provocation time period. Planned interaction contrasts were used to evaluate group differences. This was accomplished by initially submitting data for each physiological measure and for each extended post-provocation time period to a 3(group) X 2(block) ANOVA and then computing the interactions contrasts. The block levels corresponded to measurements assessed immediately after (or during) provocation and measurements assessed at each extended post-provocation time period.

The second type of analysis was designed to examine whether the levels of physiological measures observed at each extended post-provocation time period were significantly different from levels obtained immediately before provocation. This type of analysis provided information as to whether physiological measures had

returned to pre-provocation baseline levels. For these analyses, within-group comparisons were examined using paired t-tests for each physiological measure. For blood pressure and pulse, measurements assessed just prior to provocation were compared to measurements assessed at each extended post-provocation period. For facial EMG and finger temperature, the 48-second interval of activity assessed just prior to provocation was compared to a 48-second interval recorded at each extended post-provocation time period. For these analyses, no between-group effects were examined.

Mean difference scores (i.e., extended post-provocation scores minus pre-provocation scores) for each group, physiological measure, and post-provocation time period are presented in Table 3. The results of the analyses are presented for each extended post-provocation time period below.

Five minutes post-provocation. The following analyses report comparisons between physiological measures obtained at five minutes post-provocation and physiological measures obtained either during provocation (i.e., corrugator EMG, perioral EMG, zygomatic EMG, finger temperature) or immediately after provocation (systolic/diastolic blood pressure, pulse).

Systolic blood pressure at five minutes post-provocation was significantly lower than levels immediately

after provocation for the control group, $t(20) = 2.93$, $p = .008$, but not significantly different for the psychopathy-analogue group, $t(19) < 1$, or for the low-socialization group, $t(20) < 1$. The planned interaction contrast comparison between the control group and the low-socialization group was significant, $F(1,59) = 4.82$, $p < .05$, indicating a greater systolic blood pressure reduction in the control group. The planned interaction contrast comparison between the control group and the psychopathy-analogue group showed a nonsignificant trend, $F(1, 59) = 3.47$, $p < .10$, and indicated a tendency towards greater systolic blood pressure reduction in the control group.

Diastolic blood pressure at five minutes post-provocation was significantly lower than levels immediately after provocation for the control group, $t(20) = 3.59$, $p = .002$, but not significantly different for the psychopathy-analogue group, $t(19) = -1.26$, $p = .22$, or for the low-socialization group, $t(20) = 1.30$, $p = .21$. The planned interaction contrast comparison between the control group and the psychopathy-analogue group was significant, $F(1, 59) = 11.48$, $p < .01$, indicating a greater diastolic blood pressure reduction in the control group. The planned interaction contrast comparison between the control group and the low-socialization group was not significant, $F(1, 59) = 2.41$.

Pulse at five minutes post-provocation was not significantly different from levels immediately after provocation for the control group, the psychopathy-analogue group, or the low-socialization group, (all *t*s < 1). The planned interaction contrasts were not significant for the control group versus psychopathy-analogue group comparison or for the control group versus low-socialization group comparison (both *F*s(1, 59) < 1).

Similarly, corrugator EMG at five minutes post-provocation was not significantly different from levels during provocation for the control group, *t*(20) < 1, for the psychopathy-analogue group, *t*(19) = -1.06, *p* = .30, or for the low-socialization group, *t*(20) < 1. The planned interaction contrasts were again not significant for any of the group comparisons (both *F*s(1, 59) < 1).

Perioral EMG at five minutes post-provocation was significantly lower than levels during provocation for the low socialization group, *t*(20) = 2.05, *p* =.05, but not significantly different for the control group, *t*(20) = 1.13, *p* = .27, or for the psychopathy-analogue group, *t*(19) = 1.08, *p* = .29. Planned interaction contrasts were not significant for any of the group comparisons (both *F*s(1, 59) < 1).

As compared to levels during provocation, zygomatic EMG at five minutes post-provocation showed a nonsignificant trend towards lower activity for the control group, *t*(20) =

1.92, p = .07, and for the low-socialization group $t(20)$ = 1.78, p = .09; however, a significant difference was not found for the psychopathy-analogue group, $t(19)$ = 1.27, p = .22. The planned interaction contrast comparison between the control group and the psychopathy-analogue group showed a nonsignificant trend, $F(1, 59)$ = 3.47, $p < .10$, and indicated a tendency towards greater zygomatic EMG reduction in the control group. The planned interaction contrast comparison between the control group and the low-socialization group was not significant, $F(1, 59)$ = 1.41.

Finger temperature at five minutes post-provocation was significantly lower than levels during provocation for the control group, $t(20)$ = 3.64, p = .002, for the low-socialization group, $t(20)$ = 2.26, p = .04, and for the psychopathy-analogue group, $t(19)$ = 2.66, p = .02. The planned interaction contrasts were not significant for any group comparisons (both Fs$(1, 59) < 1$).

The following analyses report comparisons between physiological measures obtained at five minutes post-provocation and physiological measures obtained just prior to provocation.

Systolic blood pressure at five minutes post-provocation was significantly greater than pre-provocation levels for the psychopathy-analogue group, $t(19)$ = 3.48, p = .002, and for the low-socialization group, $t(20)$ = 2.51, p = .02. As compared to pre-provocation levels, systolic blood

pressure at five minutes post-provocation showed a nonsignificant trend towards being greater for the control group, $t(20) = 1.91$, $p = .07$.

Diastolic blood pressure at five minutes post-provocation was significantly greater than pre-provocation levels for the psychopathy-analogue group, $t(19) = 4.03$, $p = .001$, but not significantly different for the control group, $t(20) = 1.03$, $p = .32$, or for the low-socialization group, $t(20) = 1.54$, $p = .14$.

Pulse at five minutes post-provocation was not significantly different than pre-provocation levels for the control group, $t(20) < 1$, or for the low-socialization group, $t(20) = 1.14$, $p = .27$. However, a nonsignificant trend towards greater pulse was found for the psychopathy-analogue group, $t(19) = 2.00$, $p = .06$.

Results for EMG measures were generally similar, indicating returns to pre-provocation levels for most groups and measures. Corrugator EMG at five minutes post-provocation was not significantly different for the control group, $t(20) = 1.40$, $p = .18$, for the psychopathy-analogue group $t(19) < 1$, or for the low-socialization group, $t(20) < 1$. Similarly, zygomatic EMG at five minutes post-provocation was not significantly different than pre-provocation levels for the control group, for the psychopathy-analogue group, or for the low-socialization group, (all ts < 1). Perioral EMG at five minutes post-provocation was significantly

greater than pre-provocation levels for the psychopathy-analogue group $t(19) = 2.48$, $p = .02$, but not significantly different for the control group, $t(20) = 1.39$, $p = .18$, or for the low-socialization group, $t(20) < 1$.

Finger temperature at five minutes post-provocation was significantly lower than pre-provocation levels for the control group, $t(20) = -4.33$, $p < .001$, and for the psychopathy-analogue group, $t(19) = -3.64$, $p = .002$, but not significantly different for the low-socialization group, $t(20) = -1.14$, $p = .27$.

To summarize, group comparisons indicated that the control group showed a greater reduction in diastolic blood pressure as compared to the psychopathy-analogue group. Also, as compared to the psychopathy-analogue group, the control group showed trends for greater reductions of systolic blood pressure and zygomatic EMG. In addition, as compared to the low socialization group, the control group showed a trend for greater systolic blood pressure reduction. Also, pulse and EMG measures had generally returned to pre-provocation levels for each group, with the exceptions of greater perioral activity and a trend for greater pulse for the psychopathy-analogue. Regarding the comparisons between control and psychopathy-analogue group, these findings were not inconsistent with the adequate/heightened-anger hypothesis but were not consistent with the deficient/attenuated-anger hypothesis of

psychopathy. The control group was either lower than or similar to the psychopathy-analogue group on all measures.

Ten minutes post-provocation. The following analyses report comparisons between physiological measures obtained at ten minutes post-provocation and physiological measures obtained either during provocation (i.e., corrugator EMG, perioral EMG, zygomatic EMG, finger temperature) or immediately after provocation (systolic/diastolic blood pressure, pulse).

Systolic blood pressure at ten minutes post-provocation was significantly lower than levels immediately after provocation for the control group, $t(20) = 2.05$, $p = .03$, but not significantly different for the psychopathy-analogue group, $t(19) < 1$, or for the low-socialization group, $t(20) < 1$. The planned interaction contrast comparison between the control group and the psychopathy-analogue group showed a nonsignificant trend, $F(1, 59) = 3.96$, $p < .10$, indicating a tendency towards greater systolic blood pressure reduction in the control group. The planned interaction contrast comparison between the control group and the low-socialization group was not significant, $F(1, 59) < 1$.

Diastolic blood pressure at ten minutes post-provocation was not significantly different than levels immediately after provocation for the control group, $t(20) = 1.45$, $p = .16$, for the psychopathy-analogue group, $t(19) < 1$, or for the low-socialization group, $t(20) = 1.61$, $p =$

.12. The planned interaction contrasts were not significant for the control group versus psychopathy-analogue group comparison, $F(1, 59) = 1.34$, or for the control group versus low-socialization group comparison, $F(1, 59) < 1$.

Pulse at ten minutes post-provocation was not significantly different from levels immediately after provocation for the control group, the psychopathy-analogue group, or the low-socialization group, (all ts < 1). The planned interaction contrasts were not significant for any of the group comparisons, (both Fs(1, 59) < 1).

Corrugator EMG at ten minutes post-provocation was not significantly different than levels during provocation for the control group, $t(20) = 1.12$, $p = .28$, for the psychopathy-analogue group, $t(19) = -1.44$, $p = .17$, or for the low-socialization group, $t(20) < 1$. The planned interaction contrasts were not significant for any of the group comparisons, (both Fs(1, 59) < 1).

As compared to levels during provocation, perioral EMG at ten minutes post-provocation showed a nonsignificant trend towards being lower for the low-socialization group, $t(20) = 2.04$, $p = .06$. In contrast, perioral EMG was not significantly different for the control group, $t(20) = 1.31$, $p = .21$, or for the psychopathy-analogue group, $t(19) = 1.27$, $p = .22$. The planned interaction contrasts were not significant for any of the group comparisons, (both Fs(1, 59) < 1).

Zygomatic EMG at ten minutes post-provocation was significantly lower than levels during provocation for the control group, $t(20) = 2.19$, $p = .04$, and for the low-socialization group, $t(20) = 3.26$, $p = .004$; however, a significant difference was not found for the psychopathy-analogue group, $t(19) = 1.25$, $p = .23$. The planned interaction contrast comparison between the control group and the psychopathy-analogue group was significant, $F(1, 59) = 4.91$, $p < .05$, and indicated a greater zygomatic EMG reduction in the control group. The planned interaction contrast comparison between the control group and the low-socialization group was not significant, $F(1, 59) = 1.95$.

Finger temperature at ten minutes post-provocation was significantly lower than levels during provocation for the control group, $t(20) = 2.97$, $p = .008$, for the low-socialization group, $t(20) = 2.12$, $p = .05$, and for the psychopathy-analogue group, $t(19) = 3.05$, $p = .007$. The planned interaction contrasts were not significant for any of the group comparisons, (both $Fs(1, 59) < 1$).

The following analyses report comparisons between physiological measures obtained at ten minutes post-provocation and physiological measures obtained just prior to provocation.

Systolic blood pressure at ten minutes post-provocation was significantly greater than pre-provocation levels for the control group, $t(20) = 2.80$, $p = .01$, and for the

psychopathy-analogue group, $t(19) = 4.07$, $p = .001$. As compared to pre-provocation, systolic blood pressure at ten minutes post-provocation showed a nonsignificant trend towards greater levels for the low-socialization group, $t(20) = 2.03$, $p = .06$.

Diastolic blood pressure at ten minutes post-provocation was significantly greater than pre-provocation levels for the control group, $t(20) = 2.53$, $p = .02$, and for the psychopathy-analogue group, $t(19) = 3.65$, $p = .002$, but not significantly different for the low-socialization group, $t(20) < 1$.

Pulse at ten minutes post-provocation was significantly greater than pre-provocation levels for the psychopathy-analogue group, $t(19) = 2.24$, $p = .04$, but not significantly different for the control group, $t(20) = 1.69$, $p = .11$, or for the low-socialization group, $t(20) < 1$.

Corrugator EMG at ten minutes post-provocation was not significantly different than pre-provocation levels for the control group, $t(20) = 1.12$, $p = .28$, for the psychopathy-analogue group $t(19) = -1.44$, $p = .17$, or for the low-socialization group, $t(20) < 1$. Similarly, zygomatic EMG at ten minutes post-provocation was not significantly different for the control group, for the psychopathy-analogue group, or for the low-socialization group, (all ts < 1). Perioral EMG at ten minutes post-provocation showed a nonsignificant trend towards being greater than pre-provocation levels for

the psychopathy-analogue group, $t(19) = 1.88$, $p = .08$, but was not significantly different for the control group, $t(20) < 1$, or for the low-socialization group, $t(19) < 1$.

Finger temperature at ten minutes post-provocation was significantly lower than pre-provocation levels for the control group, $t(20) = -3.45$, $p = .003$, and for the psychopathy-analogue group, $t(19) = -3.83$, $p = .001$, but not significantly different for the low-socialization group, $t(20) < 1$.

In summary, group comparisons indicated that the control group showed a greater reduction in zygomatic activity than the psychopathy-analogue group. Also, the control group showed a trend for greater systolic blood pressure reduction than the psychopathy-analogue group. Similar to observations at five minutes post-provocation, the results of the pulse and EMG analyses indicated a return to pre-provocation levels for most groups and measures, the exceptions being greater pulse and a trend towards greater perioral EMG for the psychopathy analogue group. Overall, these findings were not inconsistent with the adequate/heightened-anger hypothesis but were not consistent with the deficient/attenuated-anger hypothesis of psychopathy.

Fifteen minutes post-provocation. The following analyses report are comparisons between physiological measures obtained at fifteen minutes post-provocation and

physiological measures obtained either during provocation (i.e., corrugator EMG, perioral EMG, zygomatic EMG, finger temperature) or immediately after provocation (systolic/diastolic blood pressure, pulse).

Systolic blood pressure at fifteen minutes post-provocation was significantly lower than levels immediately after provocation for the control group, $t(20) = 2.29$, $p = .03$. A nonsignificant trend for greater systolic blood pressure was found for the psychopathy-analogue group, $t(19)$ 1.73, $p = .10$. A nonsignificant result was found for the low-socialization group, $t(20) = 1.00$, $p = .33$. The planned interaction contrasts were not significant for any of the group comparisons, (both Fs(1, 59) < 1).

Diastolic blood pressure at fifteen minutes post-provocation was not significantly different than levels immediately after provocation for the control group, for the psychopathy-analogue group, or for the low-socialization group, (all ts < 1). The planned interaction contrasts were not significant for any of the group comparisons, (both Fs(1, 59) < 1).

Pulse at fifteen minutes post-provocation was not significantly different than levels immediately after provocation for the control group $t(20) < 1$, for the psychopathy-analogue group, $t(19) = 1.54$. $p = .14$, or for the low-socialization group, $t(20) < 1$. The planned interaction contrasts were not significant for any of the

group comparisons, (both *F*s(1, 59) < 1).

Corrugator EMG at fifteen minutes post-provocation was not significantly different than levels during provocation for the control group, *t*(20) 1.21, *p* = .24, for the psychopathy-analogue group, *t*(19) = 1.15, *p* = .27, or for the low-socialization group, *t*(20) = 1.48, *p* = .15. The planned interaction contrasts were not significant for any of the group comparisons, (both *F*s(1, 59) < 1).

Perioral EMG at fifteen minutes post-provocation was not significantly different than levels during provocation for the control group *t*(20) < 1, for the psychopathy-analogue group *t*(19) = 1.06, *p* =.30, or for the low-socialization group *t*(20) < 1. The planned interaction contrasts were not significant for any of the group comparisons, (both *F*s(1, 59) < 1).

Similarly, zygomatic EMG at fifteen minutes post-provocation was significantly lower than levels during provocation for the control group, *t*(20) = 2.13, *p* = .05, and for the low-socialization group, *t*(20) = 2.78, *p* = .01; however, a significant difference was not found for the psychopathy-analogue group, *t*(19) = 1.30, *p* = .21. The planned interaction contrast comparison between the control group and the psychopathy-analogue group was significant, *F*(1, 59) = 4.00, *p* = .05, and indicated a greater zygomatic EMG reduction in the control group. The planned interaction contrast comparison between the control group and the low-

socialization group was not significant, $F(1, 59) < 1$.

Finger temperature at fifteen minutes post-provocation was significantly lower than levels during provocation for the control group, $t(20) = 3.51$, $p = .002$, for the low-socialization group, $t(20) = 2.86$, $p = .01$, and for the psychopathy-analogue group, $t(19) = 3.21$, $p = .005$. The planned interaction contrasts were not significant for any of the group comparisons, (both $Fs(1, 59) < 1$).

The following analyses report comparisons between physiological measures obtained at fifteen minutes post-provocation and physiological measures obtained just prior to provocation.

Systolic blood pressure at fifteen minutes post-provocation was significantly greater than pre-provocation levels for the control group, $t(20) = 2.86$, $p = .01$, and for the psychopathy-analogue group, $t(19) = 2.07$, $p = .05$. A nonsignificant trend towards greater systolic blood pressure was found for the low-socialization group, $t(20) = 1.73$, $p = .10$.

Diastolic blood pressure at fifteen minutes post-provocation was significantly greater than pre-provocation levels for the control group, $t(20) = 4.75$, $p < .001$, and for the psychopathy-analogue group, $t(19) = 3.10$, $p = .006$. The low-socialization group showed a nonsignificant trend towards greater diastolic blood pressure, $t(20) = 1.91$, $p = .07$.

Pulse at fifteen minutes post-provocation was not significantly different from pre-provocation levels for the control group, $t(20) = 1.03$, $p = .32$, for the psychopathy-analogue group $t(19) < 1$, or for the low-socialization group, $t(20) < 1$.

Corrugator EMG at fifteen minutes post-provocation was significantly lower than pre-provocation levels for the psychopathy-analogue group, $t(19) = -2.26$, $p = .04$. In contrast, corrugator EMG was not significantly different for the control group, $t(20) = 1.19$, $p = .25$, or for the low-socialization group, $t(20) < 1$.

Perioral EMG at fifteen minutes post-provocation was not significantly different than pre-provocation levels for the control group, $t(20) < 1$, for the psychopathy-analogue group $t(19) = 1.06$, $p = .30$, or for the low-socialization group, $t(20) < 1$. Similarly, zygomatic EMG at fifteen minutes post-provocation was not significantly different than pre-provocation levels for the control group, $t(20) < 1$, for the psychopathy-analogue group, $t(19) < 1$, or for the low-socialization group, $t(20) = -1.10$, $p = .29$.

Finger temperature at fifteen minutes post-provocation was significantly lower than pre-provocation levels for the control group, $t(20) = -3.89$, $p = .001$, and for the psychopathy-analogue group, $t(19) = -4.04$, $p = .001$, but not significantly different for the low-socialization group, $t(20) = -1.27$, $p = .22$.

In summary, group comparisons indicated that the control group showed a greater reduction in zygomatic activity than the psychopathy-analogue group. In general, blood pressure remained significantly greater than pre-provocation levels for the groups. Analyses of pulse and facial EMG indicated levels similar to pre-provocation levels for all groups and measures, with the exception that corrugator activity was lower than pre-provocation levels for the psychopathy-analogue group. Overall, these findings were not inconsistent with the adequate/heightened-anger hypothesis but were not consistent with the deficient/attenuated-anger hypothesis of psychopathy.

Trend Analyses of Physiological Measures. Previous analyses of the physiological measures (i.e., temporal course, capacity/magnitude) limited comparisons to two points in time (e.g., pre-provocation levels compared to levels immediately after provocation). Although this approach is appropriate for examining group differences at specific points in time, is does not indicate overall changes or patterns of physiological activity across time. Therefore, trend analyses were conducted to examine within- and between-group differences on the general pattern of change in physiological activity across several time periods. Levels of physiological activity for five time periods were included in these analyses: pre-provocation, during or immediately following provocation, 5-minutes post-

provocation, 10-minutes post provocation, and 15-minutes post-provocation.

Trend analysis computations were based on the procedures suggested by Kirk (1995). More specifically, data were initially submitted to a 3(group) X 5(time period) ANOVA for each physiological measure to generate a group X time period error term. Raw data for each group and each time period were then differentially weighted to examine quadratic trends (i.e., low pre-provocation levels followed by higher levels immediately after (or during) provocation and then recovery across extended post-provocation time periods) and linear trends across time. Within-group linear and quadratic trends were initially examined. Group comparisons of interest were between the control and psychopathy-analogue groups and between the control and low-socialization groups. However, group comparisons were only examined if both groups being compared showed a significant within-group trend. The rationale for this approach was that if one group showed a significant trend and the other did not, a between-group comparison of the trend magnitude would be of limited value.

Figure 1 shows changes in systolic blood pressure across time for each group. Within-group analyses indicated significant quadratic trends for the control group, $F(4, 236) = 12.75$, $p < .01$, the low-socialization group, $F(4, 236) = 8.52$, $p < .01$, and the psychopathy-analogue group,

$F(4, 236) = 11.61$, $p < .01$. Differences between the quadratic trends were not significant for the control vs. psychopathy-analogue group comparison or for the control vs. low-socialization group comparison (both Fs$(1, 236) < 1$). Regarding linear trends, within-group analyses indicated that the control group approached significance, $F(4, 236) = 2.14$, $p < .10$. The linear trends were not significant for the low-socialization group, $F(4, 236) = 1.72$, or for the psychopathy-analogue group, $F(4, 236) = 1.22$. No linear trend group comparisons were examined.

Figure 2 shows changes in diastolic blood pressure across time for each group. A significant quadratic trend was found for the psychopathy-analogue group, $F(4, 236) = 10.46$, $p < .01$, but not for the low-socialization group, $F(4, 236) = 1.02$, or for the control group, $F(4, 236) = 1.15$. No quadratic trend group comparisons were examined. Significant linear trends were found for the control group, $F(4, 236) = 11.25$, $p < .01$, and for the psychopathy-analogue group, $F(4, 236) = 9.39$, $p < .01$, but not for the low-socialization group, $F(4, 236) = 1.54$. Differences in the linear trends were not significant for the control group vs. psychopathy-analogue group comparison, $F(2, 236) < 1$.

Figure 3 shows changes in pulse across time for each group. The quadratic trend was significant for the psychopathy-analogue group, $F(4, 236) = 5.59$, $p < .01$, but not for the low-socialization group, $F(4, 236) < 1$, or for

the control group, $F(4, 236) = 1.43$. Further, the linear trends were not significant for the control group, $F(4, 236) = 1.46$, for the psychopathy-analogue group, $F(4, 236) < 1$, or for the low-socialization group, $F(4, 236) < 1$. No quadratic or linear trend group comparisons were examined.

Figure 4 shows changes in corrugator EMG across time for each group. The quadratic trend for the low-socialization group approached significance, $F(2, 95) = 2.60$, $p < .10$. (Degrees of freedom for EMG measures and finger temperature were corrected using the Huynh-Feldt Episilon, because the multisample sphericity assumption was violated for each of these measures.) The quadratic trends were not significant for the control group, $F(2, 95) = 2.16$, or for the psychopathy-analogue group, $F(2, 95) < 1$. Further, the linear trends were not significant for the control group, $F(2, 95) < 1$, for the psychopathy-analogue group, $F(2, 95) = 1.08$, or for the low-socialization group, $F(2, 95) < 1$. No quadratic or linear trend group comparisons were examined.

Figure 5 shows changes in perioral EMG across time for each group. The quadratic trend was significant for the control group, $F(2, 128) = 3.49$, $p < .05$, and approached significance for the psychopathy-analogue group, $F(2, 128) = 2.77$, $p < .10$, but was not significant for the low-socialization group, $F(2, 128) < 1$. The linear trends were not significant for any group (all Fs$(2, 128) < 1$). No

quadratic or linear trend group comparisons were examined.

Figure 6 shows changes in zygomatic EMG across time for each group. Quadratic trends were significant for the control group, $F(2, 92) = 14.27$, $p < .01$, and for the low-socialization group, $F(2, 92) = 6.85$, $p < .01$, but not for the psychopathy-analogue group, $F(2, 92) < 1$. The comparison of quadratic trends between the control group and the low-socialization group was not significant, $F(1, 92) < 1$. The linear trend was significant for the control group, $F(2, 92) = 5.90$, $p < .01$, but not significant for the low-socialization group, $F(2, 92) = 2.37$, or for the psychopathy-analogue group, $F(2, 92) < 1$. No linear trend group comparisons were examined.

Figure 7 shows changes in finger temperature across time for each group. Quadratic trends were not significant for any group (all Fs$(2, 123) < 1$). In contrast, linear trends were significant for the control group, $F(2, 123) = 32.34$, $p < .01$, for the low-socialization group, $F(2, 123) = 8.75$, $p < .01$, and for the psychopathy-analogue group, $F(2, 123) = 25.13$, $p < .01$. The difference between the linear trends for the control group vs. low-socialization group comparison was significant, $F(1, 123) = 3.71$, $p < .05$, indicating a greater reduction in finger temperature in the control group over time. The difference between the linear trends for the control group vs. psychopathy-analogue group comparison was not significant, $F(1, 123) < 1$.

To summarize, although a few significant differences were found when in earlier temporal course analyses in which groups were compared at specific points in time (e.g., pre/post-provocation difference of corrugator EMG for the control vs. psychopathy-analogue group comparison), results of the trend analyses did not indicate significant group differences in the change in physiological activity across time for most measures. Within-group trend analyses did indicate some differential pattern of change in some physiological measures for the control group and the psychopathy-analogue group; however, between-group comparisons did not indicate significant differences. Overall, findings from both sets of temporal course analyses were not inconsistent with the adequate/heightened-anger hypothesis of psychopathy.

Cognitive Processing

Lexical decision task pre-provocation. An examination of the lexical decision task performance was undertaken to test the hypothesis that, prior to provocation, the psychopathy-analogue group would not demonstrate a response facilitation effect for emotional words. Herein, the response facilitation effect was defined as the difference between response latencies to emotionally-neutral words and response latencies to anger-relevant words (i.e., emotionally-neutral response latencies minus anger-relevant response latencies). Response latencies to nonwords were not

included in these analyses.

Preliminary analyses of the lexical decision task data indicated an unexpected pattern of performance. During the first half of the task (i.e., trials 1-5), the mean response latencies for anger-relevant and emotionally-neutral words for the sample as a whole were 680.27 (*SD* = 109.54) and 714.64 (*SD* = 108.16), respectively. Responses to anger-relevant words were on average 34.37 ms faster than responses to emotionally-neutral words. This difference in response latencies was significant, $F(1, 59) = 38.51$, $p < .001$, indicating that the facilitation effect for emotional words had occurred. In contrast, during the second half of the task (trials 6-10), the mean response latencies for anger-relevant and emotionally-neutral words for the sample as a whole were 600.36 (*SD* = 92.78) and 586.85 (*SD* = 100.99), respectively. During these trials, responses to emotionally-neutral words were on average 13.51 ms faster than responses to anger-relevant words, and this difference was significant, $F(1, 59) = 9.85$, $p = .003$. To my knowledge this serendipitous finding has not been reported in the empirical literature, perhaps because other studies have only presented each word one to six times. Nevertheless, because the response facilitation effect was only observed during the first half of trials (i.e, five presentations of each word), analyses were limited to these trials.

Because data analyses were limited to the first half of trials, data were collapsed across side of presentation (i.e., whether the word was presented on the left or right side of the computer screen) and trial type (i.e., whether the cue was valid or invalid) because the number of observations were too few to produce stable, reliable means for each of these cells. Response latencies and accuracy (correct vs. incorrect) were recorded for each trial and served as the dependent measures. Mean response latencies (for correct responses) and accuracy rates (percent correct) were computed separately for each participant and each word type.

To test for speed/accuracy tradeoffs, zero-order correlations were computed between response latencies and accuracy rates for each word type. In these analyses, larger positive correlations indicated greater speed/accuracy tradeoffs. Results of these analyses indicated that the correlations were low and nonsignificant: for anger-relevant words, -.05; for emotionally-neutral words, .00. Similar analyses conducted for each group revealed higher but still nonsignificant correlations (range = -.34 to .11). Overall, it appeared that speed/accuracy tradeoffs were not a consistent influence on lexical decision task performance.

Response latencies and accuracy rate means for each group and word type are presented in Table 4. Data were initially analyzed separately for response latencies and

accuracy using 3(group) X 2(word type) ANOVAs. Planned comparisons were computed to evaluate group differences using interaction contrasts for response latencies and simple main effect contrasts for accuracy rates. The results of the statistical analyses are presented below.

For response latencies, the group main effect was not significant, $F(2, 59) < 1$. The word type main effect was significant, $F(1, 59) = 38.51$, $p < .001$, indicating shorter response latencies for anger-relevant words compared to emotionally-neutral words for the sample as a whole.

To test the hypothesis that the psychopathy-analogue group would not demonstrate response facilitation for emotional words, within group patterns were examined. For the psychopathy-analogue group, the average response facilitation effect for emotional words was 18 ms and not significant, $t(19) = 1.61$, $p = .12$. In contrast, the average response facilitation effect for emotional words for the control group was 38 ms and significant, $t(20) = 4.83$, $p < .001$. The low-socialization group was more similar to the control group in that the average response facilitation effect for emotional words was 47 ms and significant, $t(20) = 4.90$, $p < .001$. Despite these within group differences, the planned contrast of the response facilitation effect for emotional words did not indicate a significant difference between the control group and psychopathy-analogue group, $F(1, 59) = 2.19$. The comparison between the control group

and low-socialization group was also not significant, $F(1, 59) < 1$.

For accuracy, the group main effect was significant, $F(2, 59) = 3.61$, $p = .03$, indicating overall greater accuracy rates for the low-socialization group. The word type main effect was also significant, $F(1, 59) = 5.48$, $p = .02$, indicating higher accuracy rates for anger-relevant words compared to emotionally-neutral words for the sample as a whole.

To further investigate the word type main effect, word type accuracy rate differences were compared separately within each group. For the psychopathy-analogue group, a comparison between accuracy rates for anger-relevant words and emotionally-neutral words indicated a significantly higher accuracy rate for anger-relevant words, $t(19) = 2.16$, $p = .04$. In contrast, the accuracy rates for the different word types were not significantly different for the control group, $t(20) < 1$ or for the low-socialization group, $t(20) = 1.28$, $p = .22$.

Simple main effects were computed to examine accuracy rate differences for each word type between the control and psychopathy-analogue groups and the control and the low-socialization groups. The comparison between the control and psychopathy-analogue groups did not indicate significant accuracy rate differences for emotionally-neutral words, $t(118) < 1$ or anger-relevant words, $t(118) = 1.32$. In

contrast, the comparison between the control and low-socialization groups did indicate significant accuracy rate differences for emotionally-neutral words, $t(118) = 2.38$ $p < .025$ and for anger-relevant words, $t(118) = 2.38$ $p < .025$. In both instances, the control group had lower accuracy rates.

To summarize, the psychopathy-analogue group did not demonstrate the response facilitation effect for emotional words but the control and low-socialization groups did. Despite these differences in performance, no significant differences were found for any of the group comparisons. These results partially replicated the findings of Williamson et al., (1991) who reported that nonpsychopaths, but not psychopaths, demonstrated response facilitation effect for emotional words. Unlike the Williamson et al. study, however, a significant group difference was not found in the current study.

For accuracy rates, within-group examinations indicated that the psychopathy-analogue group evidenced significantly greater accuracy rates for anger-relevant words as compared to emotionally-neutral words. Between-group comparisons indicated that, as compared to the control group, the low-socialization evidenced significantly higher accuracy rates for emotional words and neutral words. The control group did not significantly differ from the psychopathy-analogue group on accuracy rates for anger-relevant or emotionally-neutral

words, and these findings replicate those reported by Williamson et al. (1991).

Lexical decision task post-provocation. An examination of the lexical decision task after provocation was undertaken to examine the effects of provocation on task performance. As in the first block of trials (i.e., pre-provocation), an unexpected pattern of performance on the lexical decision task was observed after provocation. During the first half of the task (i.e., trials 1-5), the mean response latencies for anger-relevant and emotionally-neutral words for the sample as a whole were 571.65 (*SD* = 78.92) and 609.08 (*SD* = 76.44), respectively. Responses to anger-relevant words were on average 37.43 ms faster than responses to emotionally-neutral words. This difference in response latencies was significant, $F(1, 59) = 93.89$, $p < .001$, indicating that the facilitation effect for emotional words had occurred. In contrast, during the second half of the task (i.e., trials 6-10), the mean response latencies for anger-relevant and emotionally-neutral words for the sample as a whole were 553.30 (*SD* = 66.44) and 540.75 (*SD* = 62.82), respectively. During these trials, responses to emotionally-neutral words were on average 12.55 ms faster than responses to anger-relevant words, and this difference was significant, $F(1, 59) = 15.90$, $p < .001$. Thus, data analyses were limited to the first half of the presented trials (i.e., five presentations of each word). Data

reduction procedures were identical to those presented above in the examination of task performance prior to provocation.

To test for speed/accuracy tradeoffs, zero-order correlations were computed between response latencies and accuracy rates for each word type. (A positive correlation would indicate the magnitude of speed/accuracy tradeoffs.) These correlations were low and nonsignificant: for anger-relevant words, .01; for emotionally-neutral words, .06. Similar analyses conducted for each group revealed higher but again nonsignificant correlations (range = -.33 to .22). Overall, it appeared that speed/accuracy tradeoffs were not a consistent influence on lexical decision task performance.

Statistical analysis procedures were identical to those used to examine task performance prior to provocation. Response latencies (for correct responses) and accuracy rate means for each group and word type are presented in Table 4. Data were initially analyzed separately for response latencies and accuracy using 3(group) X 2(word type) ANOVAs. The results of these analyses are presented below.

For response latencies, the group main effect was not significant, $F(2, 59) < 1$. The word type main effect was significant, $F(1, 59) = 93.89$, $p < .001$, indicating shorter response latencies for anger-relevant words compared to emotionally-neutral words for the sample as a whole.

An examination of the response facilitation effect for emotional words within each group was conducted. For the

psychopathy-analogue group, the average response latency facilitation effect for emotional words was 35 ms and significant, $t(19) = 3.93$, $p = 001$. For the control group, the average response facilitation effect for emotional words was 34 ms and significant, $t(20) = 5.81$, $p < .001$. For the low-socialization group, the average response facilitation effect for emotional words was 43 ms and significant, $t(20) = 8.99$, $p < .001$. Planned contrasts of the response facilitation effect for emotional words did not indicate significant differences for the control group versus psychopathy group comparison, $F(1, 59) < 1$ or for the control group versus low-socialization group comparison, $F(1,59)=1.00$.

For accuracy, a nonsignificant trend for the group main effect, $F(2, 59) = 2.45$, $p = .10$, indicated a tendency for overall greater accuracy in the low-socialization group. The word type main effect was significant, $F(1, 59) = 4.19$, $p = .05$, indicating greater accuracy rates for anger-relevant words compared to emotionally-neutral words for the sample as a whole.

To further investigate the word type main effect, word type accuracy rate differences were compared separately for each group. A comparison between error rates for anger-relevant words and emotionally-neutral words within the psychopathy-analogue group showed a nonsignificant trend, $t(19) = 1.85$, $p = .08$, indicating a tendency for greater

accuracy rates for anger-relevant words. Accuracy rates for the different word types were not significantly different for the control group, $t(20) = 1.24$, $p = .23$, or for the low-socialization group, $t(20) < 1$.

Simple main effects were computed to examine group differences on accuracy rates for each word type. The comparison between the control and psychopathy-analogue groups did not indicate significant accuracy rate differences for emotionally-neutral words, $t(118) < 1$, or for anger-relevant words, $t(118) = 1.14$. The comparison between the control and low-socialization groups also did not indicate significant accuracy rate differences for emotionally-neutral words, $t(118) = 1.42$, or for anger-relevant words, $t(118) < 1$.

To summarize, unlike their performance prior to provocation, the psychopathy-analogue group showed the response facilitation effect after provocation. The other groups also show the facilitation effect. Group comparisons did not indicate any significant differences. These results were not inconsistent with the adequate/heightened-anger hypothesis but were not consistent with the deficient/attenuated-anger hypothesis of psychopathy. Also, these results are not consistent with the suggestion of Yochelson and Samenow (1976) that psychopaths' ability to function decreases as a result of being overwhelmed by their anger. For accuracy rates, none of the group comparisons

were significant, and these results were not inconsistent with the adequate/heightened-anger hypothesis and not consistent with the deficient/attenuated-anger hypothesis of psychopathy.

Cued reaction time task pre-provocation. An examination of the cued-reaction task was undertaken to test the hypothesis that, prior to provocation, the psychopathy-analogue group would make more errors on invalidly cued left target trials (i.e., trials in which the cuing stimulus appeared on the right side of the compute screen but the target stimulus appeared on the left side of the screen). Also of interest was an examination of group differences on response latencies, as previous research has reported a trend for individuals with psychopathic features to demonstrate longer response latencies for right-side invalidly cued trials (Howland et al., 1993).

Response latencies and accuracy (correct vs. incorrect) were recorded for each trial and served as the dependent measures. Initially, data were collapsed across the different word types (i.e., anger-relevant, emotionally-neutral) to provide the most reliable estimates of cell means. Mean response latencies (for correct responses) and accuracy rates (percent correct) were then computed separately for each group according to whether the cuing stimulus was valid or invalid (cue type) and according to the side on which the target stimulus appeared (target

type).

To test for speed/accuracy tradeoffs, zero-order correlations were computed between response latencies and accuracy rates for each type of trial (e.g., right target validly cued). In these analyses, higher positive correlations reflected greater speed/accuracy tradeoffs. The results of these analyses indicated that correlations were small (range = -.24 to .14) and nonsignificant. Similar correlations were computed separately for each group. No significant positive correlations were found in these analyses. For the low-socialization group, significant negative correlations were found for validly cued right targets (r = -.54, p < .05) and validly cued left targets (r = -.43, p < .05). Other correlations ranged from -.28 to .32 and were not significant. Overall, it appeared that speed/accuracy tradeoffs were not a consistent influence on cued reaction time task performance.

Response latencies and accuracy rate means for each group and trial type are presented in Table 5. Response latencies and accuracy were examined separately. Data were initially examined using 3(group) X 2(side) X 2(cue type) ANOVA's. Planned simple main effects contrasts were computed to evaluate group differences on response latencies and accuracy rates. The results of response latency analyses are presented first.

The group main effect for response latencies was not significant, $F(2, 59) < 1$. A significant cue type main effect, $F(1, 59) = 810.75$, $p < .001$, indicated that, for the sample as a whole, response latencies were shorter for validly cued targets than for invalidly cued targets. A significant side main effect, $F(1, 59) = 4.10$, $p = .05$, indicated that response latencies were shorter for right side targets than for left side targets for the sample as a whole. However, the significant cue type and side main effects were qualified by a significant side X cue type interaction, $F(1, 59) = 8.39$, $p = .005$. Paired t-tests were used to clarify the nature of this interaction. The results of these analyses indicated that response latencies were significantly shorter for validly cued right side targets than for validly cued left side targets, $t(61) = -4.48$, $p < .001$. In contrast, response latencies for invalidly cued right targets did not significantly differ from response latencies for invalidly cued left targets, $t(61) < 1$.

Group differences for each trial type were examined using simple main effects contrasts. No significant differences in response latencies were found between the control group and psychopathy-analogue group for validly cued left targets, invalidly cued left targets, validly cued right targets, or invalidly cued right targets, ($ts(118) < 1$). Similarly, no significant differences in response latencies were found between the control group and low-

socialization group for any trial type (all ts(118) < 1).

The group main effect for accuracy was significant, $F(2, 59) = 4.82$, $p = .02$, and indicated overall greater accuracy rates in the low-socialization group. A significant cue type main effect, $F(1, 59) = 47.48$, $p < .001$, indicated greater accuracy rates for validly cued targets for the sample as a whole. A significant side main effect, $F(1, 59) = 7.86$, $p = .007$, indicated that accuracy rates were greater for left side targets. However, the significant cue type and side main effects were qualified by a significant side X cue type interaction, $F(1, 59) = 6.10$, $p = .02$. Paired t-tests were used to clarify the nature of this interaction. The results of these analyses indicated that accuracy rates were significantly higher for invalidly cued left targets than invalidly cued right targets, $t(61) = 2.94$, $p = .005$. In contrast, accuracy rates for validly cued right targets and validly cued left targets were not significantly different, $t(61) < 1$.

Group differences for each trial type were examined using simple main effects contrasts. No significant group differences in accuracy rates were found between the control group and psychopathy-analogue group for validly cued left targets, $t(118) < 1$, invalidly cued left targets, $t(118) = 1.49$, validly cued right targets, $t(118) < 1$, or invalidly cued right targets, $t(118) = 1.40$. No significant group differences in accuracy rates were found between the control

group and low-socialization group for validly cued left targets or validly cued right targets (both $\underline{t}$s(118) < 1). However, as compared to the control group, the low-socialization group demonstrated significantly higher accuracy rates to invalidly cued left targets, $\underline{t}(118) = 2.66$, $\underline{p} < .05$, and invalidly cued right targets, $\underline{t}(118) = 2.66$, $\underline{p} < .05$.

To summarize, no significant group differences were found for response latencies. No significant differences on accuracy rates were found for the control group versus psychopathy group comparisons. The failure to find significantly higher accuracy rates for the control group on invalidly cued left target trials contradicts the findings of Howland et al., (1993). In fact, compared to the psychopathy-analogue group, the control group demonstrated nonsignificantly lower accuracy rates for these types of trials. As compared to the control group, the low-socialization group evidenced greater accuracy rates for invalidly cued right targets and invalidly cued left targets.

Cued reaction time task post-provocation. An examination of the cued reaction time task after provocation was undertaken to examine the effects of provocation on task performance. Data reduction procedures were identical to those presented above in the examination of task performance prior to provocation.

To test for speed/accuracy tradeoffs, zero-order correlations were computed between response latencies and accuracy rates for each type of trial (e.g., right target validly cued). In these analyses, higher positive correlations indicated greater speed/accuracy tradeoffs. A significant correlation was found for invalidly cued right targets (r = .26, p < .05). Other correlations ranged from -.06 to .18 and were not significant. Similar correlations were computed separately for each group. For the control group, a significant correlation was found for validly cued left targets (r = .51, p < .05). Other correlations ranged from -.41 to .44 and were not significant. Overall, it appeared that speed/accuracy tradeoffs were not a consistent influence on cued reaction time task performance.

Response latencies and accuracy rate means for each group and trial type are presented in Table 5. Statistical analysis procedures were identical to those used to examine cued reaction time task performance prior to provocation. Response latencies and accuracy were examined separately. Data were initially examined using 3(group) X 2(side) X 2(cue type) ANOVA's. Response latency results are presented first.

The group main effect on response latencies was not significant, $F(2, 59) < 1$. A significant cue type main effect, $F(1, 59) = 1413.74$, $p < .001$ indicated that, for the sample as a whole, response latencies were shorter for

validly cued targets. A significant side main effect, $F(1, 59) = 7.17$, $p = .01$, indicated that, for the sample as a whole, response latencies were shorter for right side targets than for left side targets. The side X cue type interaction, $F(1, 59) = 2.57$, $p = .11$, was not significant.

Group differences for each type of trial were examined using simple main effects contrasts. No significant differences in response latencies were found for any group comparison on any trial type (all ts$(118) < 1$).

For accuracy rates, the group main effect was significant, $F(2, 59) = 3.73$, $p = .03$ and indicated overall greater accuracy rates in the low-socialization group. A significant cue type main effect, $F(1, 59) = 23.73$, $p < .001$ indicated that, for the sample as a whole, accuracy rates were greater for validly cued targets. A significant side main effect, $F(1, 59) = 9.14$, $p = .004$, indicated that, for the sample as a whole, accuracy rates were greater for left side targets. However, the significant cue type and side main effects were qualified by a significant side X cue type interaction, $F(1, 59) = 6.10$, $p = .02$, which indicated that accuracy for validly cued left targets was significantly greater than accuracy for invalidly cued left targets, $t(61) = 5.19$, $p < .001$, and invalidly cued right targets, $t(61) = 2.57$, $p = .01$. In contrast, accuracy rates for validly cued right targets were significantly higher than invalidly cued right targets, $t(61) = 4.63$, $p < .001$, but not significantly

different from invalidly cued left targets, $t(61) = 1.35$, $p = .18$.

Simple main effects contrasts indicated no significant differences in accuracy between the control group and psychopathy-analogue group for validly cued left targets, $t(118) < 1$, invalidly cued left targets, $t(118) < 1$, validly cued right targets, $t(118) < 1$, or invalidly cued right targets, $t(118) = 1.65$. No significant differences in accuracy were found between the control group and low-socialization group for validly cued left targets, $t(118) < 1$, invalidly cued left targets, $t(118) = 1.35$, or validly cued right targets, $t(118) = 1.04$. A nonsignificant trend was found for invalidly cued right targets, $t(118) = 1.67$, $p < .10$, indicating a tendency for greater accuracy in the low-socialization group.

To summarize, no significant differences on response latencies or accuracy were found for any of the group comparisons. These results were not inconsistent with the adequate/heightened-anger hypothesis but were not consistent with the attenuated/deficient anger hypothesis of psychopathy. These results were also not consistent with the suggestion of Yochelson and Samenow (1976) that psychopaths functioning decreases because they are overwhelmed by their anger.

Secondary and Supplementary Analyses

This study addressed several secondary and supplementary questions that could provide useful information about the pattern of anger in individuals with and without psychopathic characteristics. One set of analyses examined the relationship between physiological, behavioral, and subjective measures associated with anger. Another set of analyses examined changes in physiological measures and subjective emotions after the opportunity to retaliate against the confederate was offered. A final set of analyses examined the relations between trait anxiety, intelligence, and lexical decision/cued reaction time task performances.

Correlations Between Anger Measures

The physiological, behavioral, and subjective systems of an emotional response are theoretically related (Lang, 1968). However, the evidence for concordance between the systems is quite mixed and appears to be related to several factors (e.g., the magnitude of the emotional response, social pressures) (Rachman & Hodgson, 1974). Little is known about the concordance of systems under conditions of anger because virtually no studies have reported the concordance or discordance between systems following anger inductions (however, see Hokanson & Burgess, 1962). Analyses undertaken in this study provided an opportunity to examine relations between several physiological, behavioral, and subjective

measures associated with anger.

In these analyses, pre/post-provocation difference scores were computed for each of the different measures assessed in the study. Pre-provocation levels were obtained immediately prior to provocation. Post-provocation levels were obtained immediately following provocation, or in the case of facial EMG and finger temperature, during provocation. Zero-order correlations were computed between these difference scores. The results are presented in Table 6. Most correlations were low, though in the expected direction. Only two correlations reached statistical significance. A positive correlation was found between changes in subjective anger and retaliation. A positive correlation was also found between zygomatic and perioral activity. Given that these muscle sites are physically close to each other, it is suspected that the high correlation is related to activity from one muscle site being recorded by the electrode at the other site.

As a further set of analyses, zero-order correlations were computed between the pre/post-provocation difference scores for each group separately. These results are presented in Tables 7-9. For the control group, only the correlation between zygomatic and perioral activity reached significance; however, correlations for the other measures were generally in the expected direction. For the low-socialization group, pulse was correlated with diastolic

blood pressure and zygomatic activity was correlated with perioral activity. For the psychopathy-analogue group, systolic blood pressure was significantly correlated with subjective anger, and subjective anger was also correlated with retaliation in the predicted direction. Thus, the prediction that the systems associated with the emotional experience of anger would be correlated was not generally supported.

Changes in Physiological Measures after Retaliation

Reductions in systolic and diastolic blood pressure have been reported after the opportunity to retaliate against a provocateur was offered (see Zillmann, 1979 for a review). It is less clear whether, and to what extent, reductions would occur in other physiological systems because other systems have not typically been assessed. To address this question, changes in physiological activity after the opportunity to retaliate against the confederate were examined.

In these analyses comparisons were made between physiological measures obtained after retaliation to those levels obtained before provocation using a series of 3(group) X 2(block) ANOVAs. The block levels corresponded to the pre-provocation measures and the post-retaliation measures. (Post retaliation measures for EMG and finger temperature consisted of an averaged 48-second interval for each measure.) Subsequent planned interaction contrasts were

computed to examine group differences. Table 10 contains the pre-provocation means, post-retaliation means, and pre/post difference scores for each group and each measure.

For systolic blood pressure, a significant block main effect indicated that post-retaliation systolic blood pressure was higher than pre-provocation systolic blood pressure for the sample as a whole, $F(1, 59) = 7.03$, $p = .01$. The group main effect was not significant, $F(2, 59) < 1$. Planned contrasts of the pre/post systolic blood pressure difference scores were not significant for the control versus psychopathy-analogue group comparison, $F(1, 59) = 1.20$, or the control versus low-socialization group comparison, $F(1, 59) < 1$.

A similar pattern of results was found for diastolic blood pressure. The significant block main effect indicated that post-retaliation diastolic blood pressure was significantly higher than pre-provocation diastolic blood pressure for the sample as a whole, $F(1, 59) = 12.90$, $p = .001$. The group main effect was not significant, $F(2, 59) < 1$. Planned contrasts of the pre/post diastolic difference scores were not significant for the control versus psychopathy-analogue group comparison, $F(1, 59) < 1$, or the control versus low-socialization group comparison, $F(1, 59) = 2.52$.

For pulse, the group main effect was not significant, $F(2,59) < 1$. In addition, the block main effect indicated

that pre-provocation and post-retaliation pulse rates were not significantly different from each other for the sample as a whole, $F(1, 59) < 1$. Planned contrasts of the pre/post pulse difference scores were not significant for any of the group comparisons (both Fs$(1, 59) < 1$).

Similar results were obtained for facial EMG indices. For corrugator activity, the group main effect was not significant, $F(2, 29) < 1$. The block main effect indicated that pre-provocation and post-retaliation corrugator activity were not significantly different from each other for the sample as a whole, $F(1, 59) = 2.71$, $p = .11$. Planned contrasts of the pre/post corrugator difference scores were not significant for the control versus psychopathy-analogue group comparison, $F(1, 59) = 1.26$, or the control versus low-socialization group comparison, $F(1, 59) = 1.28$.

For perioral activity, the group main effect was not significant, $F(2, 59) = 1.89$, $p = .16$. The block main effect indicated that pre-provocation and post-retaliation perioral activity were not significantly different from each other for the sample as a whole, $F(1,59) < 1$. Planned contrasts of the pre/post perioral difference scores were not significant for the control versus psychopathy-analogue group comparison, $F(1, 59) = 1.17$, or the control versus low-socialization group comparison, $F(1, 59) < 1$.

For zygomatic activity, the group main effect was not significant, $F(2,59) < 1$. The block main effect indicated

that pre-provocation and post-retaliation zygomatic activity were not significantly different from each other for the sample as a whole, $F(1, 59) < 1$. Planned contrasts of the pre/post zygomatic difference scores were not significant for the control versus psychopathy-analogue group comparison, $F(1, 59) < 1$, or the control versus low-socialization group comparison, $F(1, 59) = 1.08$.

For finger temperature, the group main effect was not significant, $F(2, 59) = 1.54$, $p = .22$. The block main effect indicated that post-retaliation finger temperature was significantly lower than pre-provocation finger temperature for the sample as a whole, $F(1, 59) = 44.16$, $p < .001$. The planned contrast of the pre/post finger temperature difference scores was not significant for the control group versus psychopathy-analogue group comparison, $F(1, 59) < 1$. The comparison between the control group and low-socialization group showed a nonsignificant trend, $F(1, 59) = 3.03$, $p < .10$ indicating a tendency for lower finger temperature in the control group.

In summary, the predicted reduction of systolic and diastolic blood pressure to pre-provocation levels after the opportunity to retaliate against the confederate was offered was not supported. No significant group differences were found for these measures. Other physiological measures were not significantly different (or significantly lower) than pre-provocation levels. However, these measures had

generally returned to baseline levels before the opportunity to retaliate was offered. Thus, it is unlikely that the retaliation was related to reductions in these measures.

Changes in Subjective Emotions after Retaliation

No known anger study using the performer/evaluator has examined changes in subjective reports of different emotion levels after the opportunity to retaliate against the confederate had been offered. This type of analysis could reveal useful information about the resolution of anger and/or changes in other emotions. Such an analysis was undertaken in this study.

For these analyses, subjective ratings were initially submitted to a 3(group) X 2(block) ANOVA separately for each of the five assessed emotions. The block levels corresponded to pre-provocation and post-retaliation ratings. Subsequent interaction contrasts were computed to examine group differences. Table 11 contains pre-provocation means, post-retaliation means, and pre/post difference scores for each group and each emotion. Results of the statistical analyses for each emotion are presented below.

For anger, the group main effect was not significant, $F(2, 59) < 1$. The block main effect indicated no significant differences between pre-provocation and post-retaliation reported anger for the sample as a whole, $F(1, 59) = 1.96$, $p = .17$. The planned contrast of the pre/post anger difference scores was not significant for the control versus

psychopathy-analogue group comparison, $F(1, 59) = 2.00$, but contrast between the control and low-socialization group showed a nonsignificant trend, $F(1,59) = 2.96$, $p < .10$, indicating a tendency for the control group to report greater anger after retaliation.

For happiness, the group main effect was not significant, $F(2,59) < 1$. The block main effect indicated no significant differences between pre-provocation and post-retaliation reported happiness for the sample as a whole, $F(1, 59) < 1$. The planned contrasts of the pre/post anger difference scores were not significant for any of the group comparisons (both Fs$(1, 59) < 1$).

For sadness, the group main effect was not significant, $F(2,59) < 1$. The block main effect indicated a nonsignificant trend for the sample as a whole, $F(1, 59) = 3.20$, $p = .08$, reflecting a tendency for participants to report less sadness at the end of the study as compared to the beginning of the study. The planned contrasts of the pre/post sadness difference scores were not significant for the control versus psychopathy-analogue group comparison, $F(1, 59) = 1.78$, or the control versus low-socialization group comparison, $F(1, 59) < 1$.

For fear, the group main effect was not significant, $F(2,59) < 1$. The block main effect indicated that reported fear was significantly lower after retaliation for the sample as a whole, $F(1, 59) = 27.30$, $p < .001$. The planned

contrasts of the pre/post fear difference scores were not significant for any of the group comparisons (both *F*s(1, 59) < 1).

For anxiety, the group main effect was not significant, *F*(2,59) = 2.27, *p* = .11. The block main effect indicated that reported anxiety was significantly lower after retaliation for the sample as a whole, *F*(1, 59) = 44.88, *p* < .001. The planned contrasts of the pre/post anxiety difference scores were not significant for any of the group comparisons (both *F*s(1, 59) < 1).

To summarize, pre-provocation and post-retaliation levels of reported happiness and anger did not significantly differ for the sample as a whole. In contrast, post-retaliation levels of fear and anxiety were significantly lower than pre-provocation levels for the sample as a whole. A nonsignificant trend for lower sadness after retaliation was also found for the sample as a whole. No significant group differences were obtained for any emotion. The return of anger to pre-provocation levels is consistent with the suggestion that retaliation towards the instigator leads to a reduction of anger.

Lexical Decision Task Supplementary Analyses

Levels of trait anxiety may affect performance on a task involving emotional stimuli (MacLoed et al., 1986; MacLoed & Mathews, 1988), and levels of intelligence may affect performance on cognitive tasks in general (Sternberg

& Salter, 1982). Therefore, the effects of trait anxiety and intelligence on the lexical decision task performance (response latencies and accuracy) was examined.

Zero-order correlations were computed between trait anxiety scores and measures of lexical decision task performance (i.e., response latencies and accuracy rates). Correlations were computed for each word type (anger-relevant and emotionally neutral) and for each block of trials (pre- and post-provocation) separately. The results of these analyses indicated that correlations ranged from -.06 to -.12 for response latencies and all were nonsignificant. For accuracy rates, correlations ranged from -.02 to .18, and all were nonsignificant. These analyses indicated that trait anxiety was not significantly related to performance on the lexical decision task; therefore, no further analyses were conducted.

As another set of supplementary analyses, zero-order correlations were computed between Shipley overall intelligence scores and measures of lexical decision task performance. Correlations were computed for each word type (anger-relevant and emotionally neutral) and for each block of trials (pre- and post-provocation) separately. The results of these analyses indicated small, yet significant, correlations between overall intelligence scores and response latencies to anger-relevant words (r = -.27, p < .05) and emotionally-neutral words (r = -.28, p < .05)

during the first block of trials. For the second block of trials, nonsignificant correlations were found between overall intelligence and response latencies to anger-relevant words (r = -.21) and emotionally-neutral words (r = -.23); although the direction and magnitude of the correlations were similar to those in the first block of trials.

Despite the relatively small magnitude of these correlations, follow-up analyses were conducted. In these analyses, the three groups (i.e., control, psychopathy-analogue, low-socialization) were further subdivided into low and high intelligence scorers. High intelligence was defined as scores above the Shipley overall intelligence median, and low intelligence was defined as scores below the Shipley overall intelligence median. (The median score was 58 for the whole sample.) Thus, a total of six subgroups were identified. The mean magnitude of the response facilitation effect for emotional words was computed for each of the six subgroups and for each block of trials (i.e., pre- and post-provocation). Within-group differences were examined using paired t-tests. Between-group differences were examined using a one-way analysis of variance. Table 12 contains the response facilitation effect for emotional words means for each group for each block of trials and the results of the within group analyses.

As can be seen in Table 12, the results of the within-group comparisons indicated that neither of the psychopathy-analogue subgroups demonstrated the response facilitation effect for emotional words prior to provocation. In contrast, both of the control subgroups and both of the low-socialization subgroups did significantly demonstrate the facilitation effect prior to provocation. The results of the one-way ANOVA did not indicate significant subgroup differences on the magnitude of the facilitation effect, $F(5, 56) < 1$. Thus, results of these analyses were very similar to pre-provocation results when intelligence levels were not taken into account.

Following provocation, both psychopathy-analogue subgroups significantly demonstrated the response facilitation effect for emotional words. Further, both low-socialization subgroups significantly demonstrated the effect. The high intelligence control subgroup also significantly demonstrated the response facilitation effect. However, the low intelligence control subgroup only showed a nonsignificant trend for the response facilitation effect. The results of the one-way ANOVA did not indicate significant subgroup differences on the magnitude of the facilitation effect, $F(5, 56) < 1$. Overall, these results were similar to post-provocation results when intelligence levels were not taken into account.

Small, significant correlations were also found between overall intelligence scores and accuracy for anger-relevant words for the first block of trials (r = .27, p < .05) and the second block of trials (r = .25, p < .05). The correlations between overall intelligence and accuracy for emotionally-neutral words were nonsignificant for the first block of trials (r = .08) and the second block of trials (r = .15).

Because of the significant correlations, follow-up analyses were conducted for the anger-relevant words accuracy rate. In these analyses, six subgroups were identified by subdividing the three original groups into low and high intelligence scorers. The mean accuracy for each word type was computed for each of the six subgroups for the first block of trials. Table 13 contains these means for each group and for each block of trials. Data were analyzed using a one-way ANOVA.

For accuracy under the pre-provocation condition, the results of the ANOVA were significant, $F(5, 56) = 4.33$, p = .002. Follow-up procedures using Tukey's HSD test indicated that the anger-relevant word accuracy rate for the low intelligence control subgroup was significantly lower than each of the other subgroups. For accuracy under the post-provocation condition, the results of the ANOVA were significant, $F(5, 56) = 2.40$, p = .05. A visual examination suggested that this significant result was due to lower

accuracy rates for the low intelligence control subgroup and for the low intelligence psychopathy-analogue subgroup; however, follow-up analyses using Tukey's HSD did not reveal any significant subgroup differences. This results suggest that intelligence levels affect accuracy rates to a greater extent than response latencies on the lexical decision task; however, this overall effect appeared relatively small.

Cued Reaction Time Task Supplementary Analyses

As with the lexical decision task, trait anxiety and/or intelligence may have affected performance on the cued reaction time task, and thus, analyses were undertaken to examine these effects.

As a set of supplementary analyses, zero-order correlations were computed between trait anxiety scores and measures of the cued reaction time task performance (i.e., response latencies and accuracy rates). Correlations were computed for each trial type (e.g., validly cued right targets) and for each block of trials (pre- and post-provocation) separately. The results of theses analyses indicated that correlations ranged from -.20 to .13 for response latencies, and all were nonsignificant. For accuracy rates, correlations ranged from -.08 to .13, and all were nonsignificant. These analyses indicated that trait anxiety was not significantly related to performance on the cued reaction time task; therefore, no further analyses were conducted.

As another set of supplementary analyses, zero-order correlations were computed between Shipley overall intelligence scores and measures of the cued reaction time task. Correlations were computed for each trial type and for each block of trials separately. For the first block of trials, small, yet significant, correlations were found between intelligence and response latencies for validly cued right targets (r = -.28, p < .05) and invalidly cued right targets (r = -.27, p < .05). For the second block of trials, a small, significant correlation was found between intelligence scores and response latencies for validly cued right targets (r = -.25, p < .05). Other correlations ranged from -.21 to -.15 and were nonsignificant.

Because of the fairly consistent significant correlations between intelligence and right targets, follow-up analyses for these types of targets were conducted. In these analyses, six subgroups were identified by dividing the three original groups into low and high intelligence scorers using a median split. The mean response latencies for validly cued right targets and invalidly cued right targets were computed separately for each of the six subgroups and for each of the blocks of trials. Table 14 contains these means for each group and for each block of trials. Data were analyzed separately using one-way ANOVAs for type of trial.

Under pre-provocation conditions, results of the analyses did not indicate significant subgroup differences on response latencies for validly cued right targets, $F(5, 56) = 1.57$, $p = .18$, or for invalidly cued right targets, $F(5, 56) < 1$. A similar pattern of results were obtained under post-provocation conditions. No significant subgroup differences were found for validly cued right targets, $F(5, 56) = 1.05$, $p = .40$, or for invalidly cued right targets, $F(5, 56) < 1$. In summary, intelligence levels appeared not to strongly effect response latencies on the cued reaction time performance.

Small, significant correlations were found between intelligence scores and accuracy for validly cued right targets ($r = .29$, $p < .05$) and validly cued left targets ($r = .27$, $p < .05$) during the second block of trials. Other correlations ranged from -14 to .22 and were nonsignificant.

Follow-up analyses examined validly cued trials for the second block of trials. In these analyses, six subgroups were identified by dividing the three original groups into low and high intelligence scorers. The mean accuracy rates for validly cued right targets and validly cued left targets during the second block of trials were computed separately for each of the six subgroups. Table 15 contains these means for each subgroup and for each block of trials. Data were analyzed separately using a one-way ANOVAs for each trial type.

Results of the ANOVA on validly cued right targets indicated a nonsignificant trend, $F(5, 56) = 2.21$, $p = .07$. A visual inspection of these means suggested that this trend was accounted for by a tendency for the low intelligence control subgroup to evidence lower accuracy than the other subgroups. For validly cued left targets, the results of the ANOVA was significant, $F(5, 56) = 2.71$, $p = .03$. A visual inspection of the means suggested that the low intelligence control subgroup and the low intelligence psychopathy-analogue subgroup contributed to this significant result; however, follow-up procedures using Tukey's HSD test did not indicate any significant group differences. In summary, intelligence levels appeared to affect accuracy rates to a greater extent than response latencies, although this overall effect appeared relatively small.

CHAPTER IV

DISCUSSION

This study was designed to test divergent predictions made by the adequate/heightened-anger hypothesis and the deficient/attenuated-anger hypothesis of psychopathy. The primary research questions examined were related to the capacity/magnitude of anger experiences, the temporal course of physiological arousal associated with provocation, and the effect of anger on cognitive processes in individuals with psychopathic characteristics. Given evidence that the provocation was effective in inducing anger, the overall findings of this study were not inconsistent with the adequate/heightened-anger hypothesis but were not consistent with the deficient/attenuated-anger hypothesis of psychopathy. Because several issues associated with anger in individuals with (and without) psychopathic characteristics were examined, a discussion of each issue will be presented below.

Capacity/Magnitude Hypotheses

A primary purpose of this study was to examine whether, and to what extent, individuals with psychopathic characteristics experienced anger. Related to this issue, the findings were overall not inconsistent with the adequate/heightened-anger hypothesis but were not consistent

with the deficient/attenuated-anger hypothesis of psychopathy. Following provocation, the psychopathy-analogue group was not significantly different from the control group on systolic/diastolic blood pressure, pulse, perioral EMG, reported subjective anger, or on the amount of retaliation directed towards the confederate.

Although Cleckley's (1976) views of psychopathy have strongly influenced contemporary conceptualizations of the disorder, at least in North America, evidence from this study generally contradicts his position that psychopaths do not experience anger. In contrast, evidence from this study was more consistent with the position of other theorists that psychopaths do experience anger (e.g., McCord & McCord, 1964; Meloy, 1988; Millon, 1980; Yochelson & Samenow, 1976).

The findings were not consistent with the assertion by some investigators (e.g., Meloy, 1988; Yochelson & Samenow, 1976) that psychopaths experience more intense anger than nonpsychopaths. It is possible that heightened anger for the psychopathy-analogue group was not observed because of the nature of the experimental setting. Although the study was designed to make the experience personally relevant (i.e., unjust criticism about participants' performance, blocking the obtainment of a monetary goal), the experience, in general, was probably lower in personal relevance than many real-life experiences that lead to anger. Ethically, however, it may be difficult to generate laboratory

conditions that are sufficiently personally relevant for psychopathic individuals to display heightened anger, and alternative empirical paradigms (e.g., monitoring real-life experiences) that could provide convergent evidence across different paradigms would be useful.

Finger temperature was the only measure that was not consistent with the predicted pattern of change after provocation; reductions were generally observed instead of increases. Further, finger temperature showed a continuous decline at all other post-provocation time periods, suggesting that it was subject to adaptation effects of the experiment and less sensitive to the anger induction procedure. Because of this unusual pattern of results and skepticism about its validity, finger temperature will be excluded from further discussion.

The control group did evidence significantly greater increases in zygomatic EMG and corrugator EMG activity than the psychopathy-analogue group during provocation. Although the reduced zygomatic and corrugator EMG activity in the psychopathy-analogue group are consistent with the deficient/attenuated-anger hypothesis of psychopathy, in light of other findings, arguments that the psychopathy-analogue group experienced a significantly lower level of anger than the control group appear unreasonable. As opposed to experiencing less anger, it is suggested that the lesser amount of change in zygomatic and corrugator EMG activity

observed in the psychopathy-analogue group during provocation may have reflected less emotional expressiveness. As in the case of some individuals with other psychological disorders, psychopaths may show a greater discontinuity between their emotional states of anger and their outward emotional expressions of anger.

One other observation appears relevant here. Although not systematically assessed, it was observed that some participants smiled during the provocation. Smiling associated with nervous tension and embarrassment is a common reaction to provocation in performer/evaluator paradigm studies (Zillmann, 1979). Although zygomatic EMG increases when the jaw is clenched (as in an anger reaction), it also increases as a result of pulling the corners of the mouth upward to produce a smile. Thus, the lower zygomatic activity may have been related to the psychopathy-analogues withholding expressions of embarrassment during provocation. On the other hand, given that embarrassment is considered a form of anxiety (Izard, 1977; Lazarus & Lazarus, 1994), it is possible that the psychopathy-analogue group actually experienced less embarrassment than the control group. However, an indirect examination of this suggestion did not indicate that this was the case. That is, the control group and psychopathy-analogue group reported similarly low levels of anxiety after the provocation. A more direct test of this suggestion

remains to be addressed in future investigations.

It is also possible that because of the large number of dependent measures included in the study, the significant group differences observed for zygomatic and corrugator EMG may have been due to alpha inflation. However, the facial EMG and self-report anger results in this study generally replicated the study of Sullivan (1995) who reported that as compared to controls, psychopathy-analogue participants reported experiencing similar levels of anger but showed less angry facial expressions after an anger induction technique. The consistency between the results of these two studies suggests that the findings reported herein reflect valid group differences.

Cleckley (1976) suggests that the psychopath appears calm and serene in situations that others normally find distressing. In some instances this appearance of calmness may not be an accurate reflection of their actual emotional state. It remains to be seen as to why and under what emotional conditions a discontinuity between emotional states and emotional expressiveness would be found in psychopaths. Few studies have examined emotional experiences aside from fear and anxiety in psychopaths (however, see Patterson, 1991; Forth, 1992). Results from this study indicate that investigations of other emotional experiences would provide a more complete picture of psychopaths' emotional experiences.

Temporal Course Hypotheses

Analyses of physiological arousal changes over an extended post-provocation time period were conducted to examine differences between the control group and the psychopathy-analogue group. Comparisons between levels assessed immediately after (or during) provocation and levels assessed at five minutes post-provocation indicated that the control group showed a significantly greater reduction in diastolic blood pressure and zygomatic activity than the psychopathy-analogue group. A similar pattern was found for zygomatic EMG at ten and fifteen minutes post-provocation. Trends towards greater reductions in systolic blood pressure in the control group than in the psychopathy-analogue group were observed at five and ten minutes post-provocation. In no instance did the psychopathy-analogue group show a greater reduction on any physiological measure than the control group. These findings were not inconsistent with the adequate/heightened-anger hypothesis and were not consistent with the deficient/attenuated-anger hypothesis of psychopathy. Further, the findings were not consistent with the assertion of Yochelson and Samenow (1976) that psychopaths' anger metastasizes. More specifically, little evidence was found indicating that physiological activity increased over the extended post-provocation time period in the psychopathy analogue group.

However, there was evidence that levels of some measures remained similar to elevated levels observed immediately (after or during) provocation in the psychopathy-analogue group. Systolic and diastolic blood pressure assessed at each of the extended post-provocation time periods remained similar to levels observed immediately after provocation and significantly greater than pre-provocation levels. A similar pattern was observed for pulse and perioral EMG at five and ten minutes post-provocation. In general, those measures that were elevated after provocation tended to remain elevated across the extended post-provocation time period for the psychopathy-analogue group.

In contrast, the control group a showed decrease in systolic blood pressure across each extended time period that, although greater than pre-provocation levels, was significantly lower than levels immediately after provocation. Diastolic blood pressure initially returned to levels not significantly different than pre-provocation, but then rose to levels not significantly different from levels immediately after provocation. Pulse and perioral EMG returned to levels not significantly different than pre-provocation levels by five minutes post-provocation.

The combined results of the within-group patterns of the control group and the psychopathy-analogue group suggest that physiological arousal associated with anger may take

longer to recover in psychopaths. Zillmann (1979, 1988) argues that residual physiological arousal associated with one anger reaction can be transferred (and contribute to) a second anger reaction. Termed excitation transfer, the cumulative effects of the physiological arousal may contribute to more intense second anger reaction.

The amount of "transferred" arousal is dependent on the extent to which recovery of arousal to baseline levels occurs after the initial anger episode. If recovery is relatively fast, then little arousal is transferred. However, if recovery is slow, more arousal can be transferred. Findings from this study suggest that recovery from arousal associated with anger in psychopathic individuals may be slower than in nonpsychopaths. If this is the case, then as compared to nonpsychopaths, psychopaths may look similar on the initial anger episode but may be more susceptible to more frequent and/or more intense subsequent anger episodes. This would be consistent with some investigators' suggestion that psychopaths experience more frequent and intense anger episodes (e.g., Meloy, 1988; Yochelson & Samenow, 1976).

However, the interpretation of changes in physiological arousal over time remains tentative. First, because of the large number of analyses conducted, some of the significant findings may have been due to alpha inflation. Second, even if not allowed to retaliate, arousal associated with

provocation cannot be maintained indefinitely, and there is some evidence that a gradual recovery to baseline levels occurs after about eight minutes for systolic blood pressure (Hokanson & Edelman, 1966). Clearly, this did not occur for either the control group or the psychopathy analogue group, and it is suspected that some of the naturally occurring recovery in physiological arousal was impeded by participants' effort in working on the computer task. Clearer results regarding psychopaths' physiological recovery after provocation would be obtained if they did nothing after provocation. However, even if working on the computer task did affect recovery rates, there is still evidence that changes in physiological activity after provocation were different for the control group and the psychopathy-analogue group.

Cognitive Processing Hypotheses: Lexical Decision Task

An examination of performance on a lexical decision task in controls and individuals with psychopathic characteristics was conducted for two primary reasons. The first reason was to replicate findings reported by other investigators related to deficits in processing emotional stimuli in psychopaths. These analyses were based on performances prior to provocation. The second reason was to examine the effects of anger on the processing of anger-relevant stimuli in both controls and individuals with psychopathic characteristics. These analyses were based on

performances after provocation. A discussion of performance prior to provocation will be presented first.

As predicted, prior to provocation, the control group, but not the psychopathy-analogue group, demonstrated response facilitation for lexical processing of emotional words. However, group comparisons on the magnitude of the facilitation effect were not significant. These results partially replicated those by Williamson et al. (1991) who reported nonpsychopaths, but not psychopaths, demonstrated the response facilitation effect and that group differences were significant.

A closer examination of the two studies indicated that in the Williamson et al. (1991) study the average response latency was 48 ms faster for emotional words as compared to nonemotional words for the nonpsychopath group. In the current study the average response latency for emotional words was 38 ms faster than the average response latency to nonemotional words in the control group. This response facilitation effect magnitude was similar to, although slightly lower, than that reported by Williamson et al.

For the psychopath group, in the Williamson et al. (1991) study, emotional words were responded to more slowly than non-emotional words. Expressing this in terms of the facilitation effect magnitude, this value was -28 ms. In contrast, in the current study, the psychopathy-analogue group responded on average 18 ms faster to emotional words

as compared to nonemotional words. Clearly, the psychopathy-analogue group performed differently on the task than the psychopath group in the Williamson et al. study. A reason for this performance difference may be related to the analogue nature of the current study. That is, college students with psychopathic features and incarcerated psychopaths differ in many respects (e.g., psychopathy symptom severity, educational level, antisocial histories), and these differences may affect performance. Nevertheless, the absence of the response facilitation effect for emotional words by psychopathy-analogue group does provide some support of the downward extension of this phenomenon in diagnosed psychopaths to a sample that evidences psychopathic characteristics.

Group comparisons indicated that controls and psychopathy-analogues did not significantly differ on accuracy rates for emotional or nonemotional words under pre-provocation conditions. Again, these findings replicated those reported by Williamson et al. (1991). However, within group analyses indicated that the psychopathy-analogue group was significantly more accurate for anger-relevant words than for emotionally-neutral words. In considering the lack of the response facilitation effect for the psychopathy-analogue group, the greater accuracy rates for emotional words suggests the possibility that more time was taken to adequately process emotion-relevant stimuli which, in turn,

resulted in greater accuracy rates for emotional words. If this was the case, a significant speed/accuracy tradeoff correlation would be expected. However, the correlation between response latencies and accuracy rates in the psychopathy analogue group for emotional words was -.34 and nonsignificant, indicating that longer response latencies were associated with poorer accuracy rates. Thus, the reasons for the greater accuracy rates for emotional words as compared to nonemotional words for the psychopathy-analogue group are unclear at the present time. However, this increased accuracy rate suggests that the psychopathy-analogue group was not completely unaffected by the emotional aspects of the stimuli.

In contrast to the pre-provocation condition, as predicted, the psychopathy-analogue group demonstrated the response facilitation effect for emotional words after provocation. This finding was not inconsistent with the adequate/heightened-anger hypothesis and was not consistent with the attenuated/deficient-anger hypothesis of psychopathy. This finding was also not consistent with the assertion of Yochelson and Samenow (1976) that psychopaths become overwhelmed by their anger and subsequently show an impairment in their ability to function. The control group also showed the response facilitation effect after provocation. However, the magnitude of this effect was similar to that observed before provocation. Thus, the

prediction that the control group would show a greater response facilitation effect after provocation as compared to before provocation was not supported. As with performance prior to provocation, there were no significant group differences in the magnitude of the response facilitation effect, emotional word accuracy rates, or nonemotional word accuracy rates.

Regarding the performance of the psychopathy analogue-group, it appears that some aspect of the provocation enhanced performance such that they responded faster to anger-relevant words. Two different explanations can account for this finding. Yochelson and Samenow (1976) argue that when angered psychopaths become more attentive to anger-relevant stimuli. Because participants were angered and then asked to respond to anger-relevant words, results obtained in this study are consistent with these investigators' argument.

An alternative explanation for the presence of the psychopathy-analogue groups' response facilitation effect after provocation is related to optimal arousal theory which states that performance is maximized under optimal conditions of arousal (e.g., Leuba, 1955). According to this position, it was the general arousal, not the anger per se, that was responsible for the presence of the response facilitation effect in the psychopathy-analogue group. There is some evidence that increased general stimulation enhances

performance in psychopathic individuals. Psychopaths often perform more poorly on passive avoidance tasks in that they respond more often to trials that are punished (Lykken, 1957). Chesno and Kilmann (1975) reported that psychopaths exposed to high levels of auditory stimulation during performance on a passive avoidance task withheld punishable responses more often than psychopaths exposed to lower levels of auditory stimulation. Findings reported by Chesno and Kilmann and the findings reported in the current study are consistent with optimal arousal theories. Similarly, several theories propose deficient arousal in psychopaths (e.g., Quay, 1965; Fowles, 1980) and their need for heightened, frequent levels of stimulation. Perhaps this heightened level of arousal is necessary to maximize psychopaths' performance.

Future studies could test these alternative explanations. If only general arousal is needed to show the response facilitation effect in psychopathic individuals then other methods of inducing arousal (e.g., intense auditory stimulation, vigorous physical activity) should be sufficient to produce the response facilitation effect. In contrast, if the observed facilitation effect was due to increased sensitivity to emotion stimuli consistent with the current emotional state, then it would be expected that the facilitation effect would only be observed when the emotional state and emotional stimuli are congruent.

Regardless of the causal mechanism, the finding that the psychopathy-analogue group showed the response facilitation after, but not before, angered indicates a link between emotion and cognition not previously identified in psychopaths.

The failure to find enhanced response facilitation effects for anger-relevant words in the control group after provocation suggests the possibility that anger may not affect lexical decisions to the extent that it affects other cognitive processes. All previous studies reporting an association between anger and cognitive processes have focused on processes associated with memory. However, this suggestion remains very tentative for several reasons. The processes underlying lexical decisions are complex and controversial. Indeed, in this study the response facilitation effect for emotional words was apparently temporally limited. In fact, an analysis of trials presented during the second half of each block indicated that responses to emotionally-neutral words were significantly faster than responses to anger-relevant words. This interesting finding has not been addressed in the empirical literature and warrants further empirical investigation. Also, it has generally been more difficult to demonstrate that negative emotional states facilitate the processing of negative emotional stimuli in empirical studies, suggesting that several factors not yet clearly understood are related

to this facilitation effect (Isen, 1990). Further, this study is the first to examine the effects of anger on lexical decisions, and further studies are needed before conclusions can be made.

It remains possible that anger following the provocation did enhance participants' overall performance on the cognitive task and was not limited to just anger-relevant stimuli. Response latencies and accuracy rates for both emotional and nonemotional words improved for all groups after provocation as compared to before provocation. However, it is suspected that much of this enhanced performance was due to practice effects rather than to the effects of anger. Because all participants received the provocation, it is impossible to separate the effects of anger from the effects of practice in this study. Further studies examining the effects of anger on cognitive processes might find it useful to include groups who receive the anger induction and groups who do not receive the anger induction.

Cognitive Processing Hypotheses: Cued Reaction Time Task

As compared to the control group, the psychopathy-analogue group did not evidence lower accuracy rates for invalidly cued left target trials. This finding contradicts that reported by Howland et al. (1993). This study and the one conducted by Howland et al. differed in two significant ways which may have affected the results. First, targets in

the Howland et al. study were squares and participants responded as fast as they could when the target appeared on the screen. In the current study, targets were words and nonwords. Although participants were also instructed to respond as fast as they could when the target appeared, they first had to make a decision as to whether the target was a word or not. Thus, in the current study an additional level of complexity was involved that was not present in the Howland et al. study. It is possible that this additional level of complexity washed out the inhibited dominant response effect found by Howland et al.

Participants in the current study also appeared to approach the task differently than the participants in the Howland et al. (1993) study. In the Howland et al. study, significant, moderately-high speed/accuracy tradeoffs were observed for the control group and the psychopathy-analogue group. Speed/accuracy tradeoffs were not present to a significant extent in the current study. It is possible this difference in the approach to the cognitive task affected the outcome of the results. Nevertheless, a further examination of psychopathic individuals' performance on the cued reaction time task is needed to clarify the discrepant findings of these two studies.

Correlations between Physiological, Behavioral, and Subjective Measures Associated with Anger

This study was also designed to address basic questions about the relation between different measures associated with anger. In accordance with the triple-response theory of emotional responses, it was predicted that the different measures associated with anger would be significantly correlated for the control group. This prediction was not supported; only one significant correlation was found. Although some of the correlations were in the predicted direction, most were very small, and some correlations were not in the predicted direction. The overall picture of relatedness did not change when data were collapsed across groups; only two significant correlations were found. Correlations in the predicted direction were quite small, and several correlations were not in the predicted direction.

Lang (1968) suggests that the greatest concordance between the three systems is most likely to be observed under intense emotional experiences. Discordance is more likely to be observed under less intense emotional experiences where other factors (e.g., individual differences, response bias) can affect the degree of concordance between systems. The estimated moderate level of anger experienced by participants in this study may partially explain the observed discordance between the

different systems.

Further, a discontinuity between emotional states and emotional expression may affect concordance and discordance rates. This may be particularly true for anger which may be viewed negatively by others when outwardly expressed. Nevertheless, it is interesting that seemingly similar measures (e.g., systolic and diastolic blood pressure) assessed in this study were not significantly correlated. It is entirely possible that some measures, both within and between systems, are more related to each other than other measures associated with anger. Unfortunately, other studies using provocation have not reported correlations between the different measures associated with anger, so it is difficult to compare the results of this study compare to results of those studies using a similar design. Because the relations between the different systems associated with anger have not received much empirical attention, further examinations are needed to gain a better understanding about what conditions concordance and discordance exits between the systems.

Changes in Physiological and Subjective Measures after Retaliation

Several studies report that arousal associated with provocation returns to baseline levels after the opportunity to retaliate against the instigator is offered, suggesting that retaliation assists in the alleviation of anger (see Zillmann, 1979 for a review). It was predicted that

decreases to pre-provocation levels for physiological measures and subjective reports of emotional experiences would be found after the opportunity to retaliate was offered. Mixed support was found for this prediction. For subjective anger and happiness, the two subjective measures most affected by the provocation, a return to pre-provocation levels was observed for the control group and psychopathy-analogue group and there was not a significant difference between these groups.

Pulse and facial EMG measurements obtained after retaliation were not significantly different from pre-provocation levels and there were no significant differences between the control group and the psychopathy-analogue group on any of these measures. However, measurements obtained fifteen minutes after provocation but before the opportunity to retaliate was offered indicated that each of these measures had already returned to pre-provocation levels for each of the groups. Thus, it is unlikely that levels of these measures observed after retaliation were related to the effects of retaliating against the confederate.

In contrast, systolic and diastolic blood pressure at fifteen minutes post-provocation were significantly more elevated than pre-provocation levels for the control and psychopathy-analogue groups. After the opportunity to retaliate was offered, systolic and diastolic blood pressure remained significantly greater than pre-provocation levels.

Further, there were no significant differences between the control group and the psychopathy-analogue group. Thus, the prediction that these measures would return to pre-provocation levels after the opportunity to retaliate had been offered was not supported.

This finding was surprising, because several studies have reported decreases in one or both of these measures after the opportunity to retaliate has been offered (see Zillmann, 1979 for a review). One parsimonious explanation of this finding is that significant reductions in blood pressure were not observed because participants were awaiting feedback about their performance from the confederate. Because the first feedback was unfavorable and judged as unfair, participants may have been expecting more unfavorable feedback. This expectation alone may have been sufficient to keep blood pressure elevated. If this is the case, however, it is somewhat surprising that reported levels of anxiety and/or fear for this time period were not elevated above pre-provocation levels. In fact, after retaliation both anxiety and fear were reported as lower than pre-provocation levels for the control group and the psychopathy-analogue group.

Zillmann (1979) asserts that autonomic arousal (e.g., blood pressure) resulting from provocation will show a prompt recovery after the threat is averted or the annoyer is duly punished. Thus, Zillmann suggests that retaliation

towards an instigator accomplishes two goals that result in the reduction of arousal associated with provocation: 1) to punish the instigator and 2) to avert further attacks from the instigator.

The current study, however, presented a situation in which retaliation towards the instigator provided the opportunity to punish the instigator, but the retaliation had no impact on averting further attacks by the instigator. More specifically, participants rated the confederate's performance for the second block of trials (i.e., post-provocation) while the experimenter left the room pretending to obtain the confederate's feedback to the participant. Upon returning, the experimenter supposedly had the confederate's feedback to the participant in hand. Regardless of how much the participant had punished the confederate (i.e. rated the confederate's performance, effort, and intelligence as low, withheld the $5.00 performance bonus), it had no impact on how the confederate rated the participant's performance. Hence, it may be that because the threat was not averted, a reduction in blood pressure was not observed.

Zillmann's (1979) account of reduction in arousal after provocation suggests that either punishing the instigator or averting further attacks from the instigator is sufficient to reduce arousal associated with provocation. In many instances retaliation accomplishes both goals. Less is known

about situations in which only one of the goals is met. Findings from the current study suggest that in situations in which the two goals are decoupled, punishing the instigator may not be sufficient to the reduce the arousal associated with provocation. Further studies are needed to address this issue more systematically.

The Utility of Factor 1 Scores in Psychopathy-Analogue Studies

In an attempt to define a homogeneous group of individuals more similar to the full clinical condition of psychopathy, individuals who scored low on the socialization scale were also assigned to groups on the basis of PCL Factor 1 ratings. The low-socialization group consisted of participants rated low on Factor 1 and the psychopathy-analogue group consisted of participants rated high on Factor 1. Several sources of evidence from this study provide preliminary evidence for the validity of this psychopathy-analogue group selection procedure.

The most compelling evidence that the combined high Factor 1/low-socialization selection procedure identified individuals more similar to actual psychopaths was found on lexical decision task performance. Under pre-provocation conditions, the low-socialization group (i.e., low Factor 1 ratings and low Socialization scores) demonstrated a response facilitation effect for emotional words, but the psychopathy-analogue group (i.e., high Factor 1 ratings and

low Socialization scores) did not. In fact, the facilitation effect for the low socialization group was greater, though not significantly so, than the facilitation effect observed for the control group. Thus, compared to the findings reported by Williamson et al. (1991), the psychopathy-analogue group performed more like incarcerated psychopaths than did the low-socialization group. In addition, the low-socialization group showed significantly greater accuracy on invalidly cued left target trials than the control group. This finding is the opposite of that reported by Howland et al. (1993) who found significantly greater accuracy rates on invalidly cued left trials for the control group as compared to a low-socialization group (not differentiated on Factor 1 ratings) and an incarcerated psychopath group. Both findings suggest that a low-socialization group with low Factor 1 is more dissimilar from the diagnosable psychopath. It should be noted, however, that the psychopathy-analogue group did not perform as predicted on the cued-reaction time task, but their performance was overall less inconsistent than the low-socialization group with results reported by Howland et al.

Additional sources of evidence from this study suggest that the Factor 1 distinction was useful. Where significant differences after provocation were found between the control group and psychopathy-analogue group (i.e., subjective happiness, corrugator EMG, zygomatic EMG), the low-

socialization group was not significantly different than the control group. Further, the control group and low-socialization group did not significantly differ on any of the subjective emotion measures, physiological measures, and one of the two retaliation measures after provocation, indicating that these two groups were more similar than not. The results of the temporal course analyses also indicated that the control group and low-socialization group were more similar than not.

Psychopathic individuals are often characterized as less anxious than nonpsychopaths (e.g., Cleckley, 1976; Meloy, 1988). In this study the low-socialization group reported a significantly higher level of trait anxiety than the control group; however, the difference between the control group and the psychopathy-analogue group on trait anxiety was not significant. Also, the low-socialization group awarded the $5.00 performance bonus significantly more often than the control group after provocation, despite indications that the two groups had experienced similar levels of anger. Higher trait anxiety and reduced retaliation when experiencing anger would not be expected from psychopathic individuals.

Standage, Smith, and Norman (1988) reported that individuals from a psychiatric population who scored low on the Socialization scale presented a wide range of diagnoses. While this range of diagnoses included individuals with

antisocial/psychopathic personalities, it also included individuals with other personality disorders (e.g., borderline, histrionic, dependent) and other psychological disorders (e.g., substance abuse, mood disorders). It is clear that low Socialization scores are not limited to psychopathic individuals. Although not assessed in this study or any known study, it seems reasonable to suggest that individuals from college populations who score low on the Socialization scale also present with a wide range of features associated with different psychological disorders, including, but not limited to, psychopathic characteristics. As compared to controls, the higher trait anxiety reported in the low-socialization group is more consistent with psychological conditions (e,g, mood disorders, dependent personality) distinct from psychopathy. Thus, the use of high Factor 1 ratings in conjunction with a combination of low Socialization scores may, in part, identify an analogue group more similar to the full clinical condition of psychopathy by virtue of eliminating individuals who evidence characteristics associated with psychological conditions other than psychopathy. Future research could test the validity of this suggestion by assessing a wide range of psychological symptoms in low-socialized individuals. Because this is the first known study to use the Factor 1/low-socialization combination, further studies are needed to evaluate the utility of this selection

procedure in identifying a psychopathy-analogue group more similar to the clinical psychopath.

Facial EMG and Anger

Regarding other findings not directly related to psychopathy, the increases in corrugator, perioral, and zygomatic EMG activity observed in the control group during provocation replicates findings by other investigators using imagery techniques to manipulate anger levels (e.g., Fridlund et al., 1984; Smith et al., 1986) and provides additional support for the association between these EMG indices and anger experiences. At a broader level, these results also provide additional support for the association between facial expressions and emotional experiences which figure prominently in some emotion theories (e.g., Ekman et al., 1972; Izard, 1977).

It also appears that Facial EMG activity associated with anger may be relatively short in duration, especially as compared to other physiological arousal associated with anger. For the control group, no facial EMG measure at any extended post-provocation time period was significantly elevated from pre-provocation levels, whereas systolic blood pressure was. This suggests rates of recovery that may differ widely for various physiological measures.

Limitations and Future Directions

As currently stated, the adequate/heightened-anger hypothesis of psychopathy contains elements that accounts

for similar and greater anger levels in psychopathic individuals as compared to nonpsychopaths. Results from this study provided little evidence that the anger experienced by the psychopathy-analogue group was greater than the level of anger experienced by the control group. However, if as suggested by evidence in this study, psychopaths experience anger episodes longer than those of nonpsychopaths, then some modifications to the adequate/heightened-anger hypothesis would be appropriate. However, at present it would be premature to make this distinction for several reasons. In particular, this is the first study using this type of anger induction technique with individuals with psychopathic characteristics, and the results reported herein need replication. Also, psychopaths may experience greater anger than nonpsychopaths under different conditions not examined in this study. In addition, anger experienced by college students with psychopathic characteristics may be less intense than episodes experienced by clinically diagnosable psychopaths.

Along a similar line of thought, generalizations from analogue populations to clinical populations should be made with caution. Although it would be expected that a similar pattern of results would be observed in clinically diagnosed psychopaths, potential differences between these two groups (e.g., socioeconomic status, educational background, intelligence level, extensiveness of criminal history) may

significantly impact the initiation, magnitude, and/or resolution of anger in diagnosed psychopaths. With this in mind, results reported herein should be considered as a preliminary account of anger in individuals with psychopathic characteristics that could provide predictions for future studies using diagnosed psychopaths.

BIBLIOGRAPHY

Anastansi, A., Cohen, N., & Spatz, D. (1948). A study of fear and anger in college students through the controlled dairy method. Journal of Genetic Psychology, 73, 243-249.

American Psychiatric Association (1994). Diagnostic and statistical manual of mental disorders (4th ed.,). Washington, D.C.: Author.

American Psychiatric Association (1987). Diagnostic and statistical manual of mental disorders (3rd ed., revised). Washington, D.C.: Author.

Averill, J. R. (1982). Anger and aggression: An essay on emotion. New York: Springer-Verlag.

Ax, A. F. (1953). The physiological differentiation between fear and anger in humans. Psychosomatic Medicine, 15, 433-442.

Berkowitz, L. (1962). Aggression: A social psychological analysis. New York: McGraw-Hill.

Berkowitz, L. (1989). Frustration-aggression hypothesis: Examination and reformulation. Psychological Bulletin, 106, 59-73.

Bernstein, D. A., & Nietzel, M. T. (1973). Procedural variation in behavior avoidance tests. Journal of Consulting and Clinical Psychology, 41, 165-174.

Blankenstein, K. R. (1969). Patterns of autonomic functioning in primary and secondary psychopaths. Unpublished Master's Thesis, University of Waterloo, Canada.

Buck, R. (1984). The communication of emotion. New York: Guilford Press.

Bower, G. H. (1981). Mood and memory. American Psychologist, 36, 129-148.

Brown, J. S., & Farber, I. E. (1951). Emotions conceptualized as intervening variables - with suggestions towards a theory of frustration. Psychological Bulletin, 48, 465-495.

Bursten, B. (1989). The relationship between narcissistic and antisocial personalities. Psychiatric Clinics of North America, 12, 571-584.

Buss, A. H. (1966). Instrumentality of aggression, feedback, and frustration as determinants of physical aggression. Journal of Personality and Social Psychology, 3, 153-162.

Cacioppo, J. T., & Petty, R. E. (1981). Electromyograms as measures of extent and affectivity of information processing. American Psychologist, 36, 441-456.

Campbell, A. (1993). Men, women, and aggression. New York: Basic Books.

Campbell, A., & Muncer, S. (1987). Models of anger and aggression in the social talk of men and women. Journal

for the Theory of Social Behavior, 17, 489-512.

Campbell, A., Muncer, S, & Coyle, E. (1992). Social representation of aggression as an explanation of gender differences: A preliminary study. Aggressive Behavior, 18, 95-108.

Cannon, W. B. (1929). Organization for physiological homeostatics. Physiological Review, 9, 280-289.

Chesno, F. A., & Kilmann, P. R. (1975). Effects of stimulation intensity on sociopathic avoidance learning. Journal of Abnormal Psychology, 84, 144-150.

Cleckley, H. C. (1976). The mask of sanity (5th ed.). St. Louis: Mosby.

Craft, M. (1966). Conclusions. In M. Craft (Ed.), Psychopathic disorders and their assessment (pp.206-225). Oxford: Pergamon Press.

Darwin, C. (1965). The expression of emotions in man and animals. Chicago: University of Chicago Press. (Original work published 1872)

Davitz, J. R. (1969). The language of emotion. New York: Academic Press.

Dimberg, U. (1990). Facial reactions to fear-relevant stimuli for subjects high and low in specific fear. Scandinavian Journal of Psychology, 31, 65-69.

Dimberg, U. (1987). Facial reactions, autonomic activity and experienced emotion: A three component model or emotional conditioning. Biological Psychology, 24,

105-122.

Dollard, J., Doob, L., Miller, N., Mower, O., & Sears, R. (1939). Frustration and aggression. New Haven: Yale University Press.

Duchenne, B. (1990) The mechanism of human facial expression or an electro-physiological analysis of the expression of the emotions (A. Cuthbertson, Trans.). New York: Cambridge University Press. (Original work published 1862)

Duffy, E. (1962). Activation and behavior. New York: Wiley.

Ekman, P. (1992). Are there basic emotions? Psychological Review, 99, 550-553.

Ekman, P., & Friesen, W. V. (1978). Facial Action Coding System (FACS): A technique for the measurement of facial action. Palo Alto, CA: Consulting Psychologists Press.

Ekman, P., Friesen, W. V., & Ancoli, S. (1980). Facial signs of emotional experience. Journal of Personality and Social Psychology, 39, 1125-1134.

Ekman, P., Friesen, W. V., & Ellsworth, P. C. (1972). Emotion in the human face. New York: Pergamon Press.

Ekman, P. Levenson, R. W., & Friesen, W. V. (1983). Autonomic nervous system activity distinguishes among emotions. Science, 221, 1208-1210.

Forth, A. (1992). Emotion and psychopathy: A three-component analysis. Unpublished doctoral dissertation, University

of British Columbia, Vancouver, Canada.

Fowles, D. C. (1980). The three arousal model: Implications of Gray's two-factor learning theory for heart rate, electrodermal activity, and psychopathy. Psychophysiology, 17, 87-104.

Freud, S. (1920). A general introduction to psychoanalysis (G. S. Hall, trans.) New York: Boni and Liveright.

Fridlund, A. J., & Cacioppo, J. T. (1986). Guidelines for human electromyographic research. Psychophysiology, 23, 567-589.

Fridlund, A. J., Schwartz, G. E., & Fowler, S. G. (1984). Pattern recognition of self-reported emotional state from multiple-site facial EMG activity during affective imagery. Psychophysiology, 21, 622-637.

Gates, G. S. (1926). An observational study of anger. Journal of Experimental Psychology, 9, 325-331.

Geen, R. G. (1968). Effects of frustration, attack, and prior training in aggressiveness upon aggressive behavior. Journal of Personality and Social Psychology, 9, 316-321.

Gentry, W. D., (1970). Effects of frustration, attack, and prior aggressive training on overt aggression and vascular processes. Journal of Personality and Social Psychology, 16, 718-725.

Gerrig, R. J., & Bower, G. H. (1982). Emotional influences on word recognition. Bulletin of the Psychonomics

Society, 19, 197-200.

Glass, G. V., Peckham, P. D., & Sanders, J. D. (1971). Consequences of failure to meet assumptions underlying the fixed effects analyses of variance and covariance. Review of Educational Research, 42, 237-288.

Gorenstein, E. E., & Newman, J. P. (1980). Disinhibitory psychopathology: A new perspective and a model for research. Psychological Review, 87, 301-35.

Gough, H. (1957). Manual for the California Psychological Inventory. Palo Alto, CA: Consulting Psychologists Press.

Graham, F. M., & Clifton, R. K. (1966). Heart rate change as a component of the orienting response. Psychological Bulletin, 65, 305-320.

Graves, R., Landis, T., & Goodglass, H. (1981). Laterality and sex differences for visual recognition of emotional and non-emotional words. Neuropsychologia, 19, 95-102.

Gray, J. A. (1975). Elements of a two-process theory of learning. New York: Academic Press.

Greenwald, M. K., Cook, E. W., & Lang, P. J. (1989). Affective judgment and psychophysiological response: Dimensional covariation in the evaluation of pictorial Stimuli. Journal of Psychophysiology, 3, 51-64.

Hamilton, E., & Cairns, H. (Eds.) (1961). The collected dialogues of Plato. New York: Pantheon Books.

Hare, R. D. (1970). Psychopathy: Theory and research. New

York, Wiley.

Hare, R. D. (1972). Cardiovascular components of orienting and defensive responses. Psychophysiology, 9, 606-614.

Hare, R. D. (1978). Electrodermal and cardiovascular correlates of psychopathy. In R. D. Hare and D. Schalling (Eds.), Psychopathic behavior: Approaches to research. New York: Wiley.

Hare, R. D. (1982). Psychopathy and physiological activity during anticipation of an aversive stimulus in a distraction paradigm. Psychophysiology, 19, 266-271.

Hare, R. D. (1985). The Psychopathy Checklist. Unpublished manuscript, University of British Columbia, Vancouver, Canada.

Hare, R. D. (1991). Manual for the Revised Psychopathy Checklist. Toronto, Ontario: Multi-Health Systems.

Hare, R. D., & McPherson, L. M. (1984). Psychopathy and perceptual asymmetry during verbal dichotic listening. Journal of Abnormal Psychology, 93, 141-149.

Harpur, T. J., & Hare, R. D. (1990). Psychopathy and attention. In J. T. Enns (Ed), The development of attention: Research and theory (pp 429-444). Amsterdam, Netherlands: North-Holland.

Harpur, T. J., Hare, R. D., & Hakstian, A. R. (1989). Two-factor conceptualization of psychopathy: Construct validity and assessment implications. Psychological Assessment: A Journal of Consulting and Clinical

Psychology, 1, 6-17.

Hathaway, S. R., & McKinley, J. C. (1943). Manual for the Minnesota Multiphasic Personality Inventory. New York: Psychological Corporation.

Hebb, D. O. (1946). Emotion in man and animals: An analysis of the intuitive process of recognition. Psychological Review, 53, 88-106.

Hinton, J., & O'Neil, M. (1976) Psychophysiological response profiles: An outline of pilot research leading to possible computer predictions of recidivism. Paper presented at NATO Advanced Institute on Computer Prediction in Parole, Cambridge.

Hokanson, J. E., & Burgess, M. (1962). The effects of three types of aggression on vascular processes. Journal of Abnormal and Social Psychology, 64, 446-449.

Hokanson, J. E., & Edelman, (1966). Effects of social responses on vascular processes. Journal of Personality and Social Psychology, 3, 442-447.

Hollaender, J., & Florin, I. (1983). Expressed emotion and airway conduction in children with bronchial asthma. Journal of Psychosomatic Research, 27, 307-311.

Howland, E. W., Kosson, D. S., Patterson, C. M., & Newman, J. P. (1993). Altering a dominant response: Performance of psychopaths and low socialization college students on a cued reaction time task. Journal of Abnormal Psychology, 102, 379-387.

Isen, A. M. (1990). The influence of positive and negative affect on cognitive organization: Some implications for development. In N. L. Stein, B. Leventhal, and T. Trabasso (Eds.), Psychological and biological approaches to emotion (pp. 75-94), Hillsdale, NJ: Lawrence Earlbaum Associates.

Isen, A. M., Shalker, T. E., Clark, M. and Karp, L. (1984). Affect accessibility of material in memory and behavior: A cognitive loop? Journal of Personality and Social Psychology, 36, 1-12.

Izard, C. E. (1971). The face of emotion. New York: Appleton-Century-Crofts.

Izard, C. E. (1977). Human emotions. New York: Plenum Press.

Izard, C. E. (1993). Four systems for emotion activation: Cognitive and noncognitive processes. Psychological Review, 100, 68-90.

Izard, C. E., Kagan, J., & Zajonc R. B. (1984). Emotions, cognition and behavior. Cambridge: Cambridge University.

James, W. (1890). The principles of psychology. New York: Holt.

Jutai, J. W., & Hare, R. D. (1983). Psychopathy and selective attention during a complex perceptual-motor task. Psychophysiology, 20, 146-151.

Keppel, G. (1982). Design and analysis: A researcher's handbook (2nd ed.). Englewood Cliffs, NJ:

Prentice-Hall.

Kernberg, O. F. (1975). Borderline conditions and pathological narcissism. New York: Science House.

Kirk, R. E. (1995). Experimental design: Procedures for the behavioral sciences (3rd ed.). Pacific Groves, CA: Brooks/Cole.

Koffka, K. (1935). Principles of Gestalt Psychology. New York: Harcourt/Brace.

Kring, A. M., Kerr, S. L., Smith, D. A., & Neale, J. M. (1993). Flat affect in schizophrenia does not reflrct diminished subjective experience of emotion. Journal of Abnormal Psychology, 102, 507-517.

Kosson, D. S., & Newman, J. P. (1986). Psychopathy and the allocation of attentional capacity in a divided attention situation. Journal of Abnormal Psychology, 95, 257-263.

Kosson, D. S., Steuerwald, B. L., Neuman, J. P. & Widom, C. (1994). The relation between socialization and antisocial behaviro, drug use, and family conflict in college students. Journal of Personality Assessment, 63, 473-488.

Lacey, J., & Lacey, R. (1974). Studies of heart rate and other bodily processes in sensorimotor behavior. In R. Orbist, A. Black, & L. Dicara (Eds.), Cardiovascular psychophysiology (pp.538-564). Chicago: Aldine.

Laird, J. D., Cuniff, M., Sheehan, K., Shulman, D., & Strum,

G. (1991). Emotions specific effects of facial expressions on memory for life events. In D. Kuiken (Ed.), Mood and memory: Theory, research and applications (pp. 87-98). London: Sage Publications.

Laird, J. D., Wagener, J. J., Halal, M., & Szegda, M. (1982). Remembering what you feel: The effects of emotion on memory. Journal of Personality and Social Psychology, 42, 646-657.

Lang, P. J. (1968). Fear reduction and fear behavior: Problems in treating a construct. In J. M. Shlien (Ed.), Research in psychotherapy (Vol. 3). Washington, D. C.: American Psychological Association.

Lang, P. J. (1978). Anxiety: Toward a psychophysiological definition. In H. S. Akiskal & W. L. Webb (Eds.), Psychiatric diagnosis: Explanation of biological predictors (pp. 365-389). New York: Spectrum.

Laurent, J., & Stark, K. D. (1993). Testing the cognitive content-specificity hypothesis with anxious and depressed youngsters. Journal of Abnormal Psychology, 102, 226-237.

Lazarus, R. S. (1991). Emotion and adaptation. New York: Oxford.

Lazarus, R. S., & Lazarus, B. N. (1994). Passions and reason: Making sense of our emotions. New York: Oxford University Press.

Levenson, R. W., Carstensen, L. L., Friesen, W. V., & Ekman,

P. (1991). Emotion, physiology, and expression in old age. Psychology and Aging, 6, 28-35.

Leuba, C. (1955). Toward some integration of learning theories: The concept of optimal stimulation. Psychological Reports, 1, 27-33.

Lindsley, D. B. (1951). Emotion. In S. S. Stevens (Ed.), Handbook of experimental psychology. New York: Wiley.

Lykken, D. T. (1957). A study of anxiety in the sociopathic personality. Journal of Abnormal and Social Psychology, 55, 6-10.

MacLoed, C., & Mathews, A. (1988). Anxiety and the allocation of attention to threat. Quarterly Journal of Experimental Psychology: Human Experimental Psychology, 38, 659-670.

MacLoed, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. Journal of Abnormal Psychology, 95, 15-20.

Mandler, G. (1984). Mind and body: Psychology of emotion and stress. New York: Norton.

Masserman, J. H. (1946). Principles of dynamic psychiatry. Philedelphia: W. B. Saunders.

Mathis, H. (1970). Emotional responsivity in the antisocial personality (Doctoral Dissertation, The George Washington University), Ann Arbor, MI: University Microfilms, No. 71-12, 299.

McCord, W., & McCord, J. (1964). The psychopath: An essay on

the criminal mind. New York: Van Nostrand.

McDougall, W. (1923). Outline of psychology. New York: Scriber's.

McKellar, P. (1949). The emotion of anger in the expression of human aggressiveness. British Journal of Psychology, 39, 148-155.

McKeon, R. (Ed.) (1941). The basic works of Aristotle. New York: Random House.

Megargee, E. (1972). The California Psychological Inventory handbook. Palo Alto, CA: Consulting Psychologists Press.

Meloy, J. R. (1988). The psychopathic mind: Origins, dynamics, and treatment. Northvale, NJ: Jason Aronson.

Meltzer, H. (1933). Student's adjustments in anger. Journal of Social Psychology, 4, 285-309.

Millon, T. (1981). Disorders of personality: DSM-III: Axis II (pp. 181-215). New York: Wiley.

Nasby, W., & Yando, R. (1982). Selective encoding and retrieval of affectively valent information. Journal of Personality and Social Psychology, 43, 1244-1255.

Nathan, S. (1980). Passive avoidance learning in high- and low-socialized college students. Unpublished raw data, Indiana University, Bloomington.

Newman, J. P., & Kosson, D. S. (1986). Passive avoidance learning in psychopathic and nonpsychopathic offenders. Journal of Abnormal Psychology, 95, 252-256.

Ogloff, J., & Wong, S. (1990). Electrodermal and cardiovascular evidence of a coping response in psychopaths. Criminal Justice and Behavior, 17, 231-45.

Patrick, C. J., Bradley, M. M., & Lang, P. J. (1993). Emotion in the criminal psychopath: Startle reflex modulation. Journal of Abnormal Psychology, 102, 82-92.

Patrick, C. J., Cuthbert, B. N., & Lang, P. J. (1990). Emotion in the criminal psychopath: Fear imagery. Psychophysiology, 27, 55.

Patterson, C. M. (1991). Emotion and interpersonal sensitivity in psychopaths. Unpublished dissertation, University of Wisconsin-Madison.

Plutchik, R. (1962). Emotion: A psychoevoluntionary synthesis. New York: Harper and Row.

Pritchard, J. C. (1835). A treatise on insanity and other disorders affecting the mind. London: Sherwood, Gilbert-Piper.

Quay, H. C. (1965). Psychopathic personality as pathological stimulation-seeking. American Journal of Psychiatry, 122, 180-183.

Rachman, S., & Hodgson, R. I. (1974). Synchrony and desynchrony in fear and avoidance. Behaviour Research and Therapy, 12, 311-318.

Raine, A., & Venables, P. H. (1984). Electrodermal nonresponding, antisocial behavior, and schizoid tendencies in adolescents. Psychophysiology, 21,

424-433.

Rule, B. G., & Hewitt, L. S. (1971). Effects of thwarting on cardiac responses and physical aggression. Journal of Personality and Social Psychology, 19, 181-187.

Rush, B. (1812). Medical inquiries and observations upon diseases of the mind. Philadelphia.

Schachter, S. (1966). The interaction of cognitive and physiological determinants of emotional state. In C. D. Spielberger (Ed.), Anxiety and behavior (pp. 193-224). New York: Academic Press.

Scherer, K. R., Wallbott, H. G., Matsumato, D., & Kudoh, T., (1988). Emotional experience in the cultural context: A comparison between Europe, Japan, and the United States. In K. R. Scherer (Ed.), Facets of emotion: Recent research (pp. 5-30). Hillsdale NJ: Erlbaum Associates.

Schwartz, G. E., Weinberger, D. A., & Singer, J. A. (1981). Cardiovascular differentiation of happiness, sadness, anger, and fear following imagery and exercise.

Shipley, W. C. (1940). A self-administering scale for measuring intellectual impairment and deterioration. Journal of Psychology, 9, 371-377.

Smith, C. A., McHugo, G. J., & Lanzetta, J. T. (1986). The facial muscle patterning of posed and imagery-induced expression of emotions by expressive and nonexpressive posers. Motivation and Emotion, 10, 133-157.

Standage, K., Smith, D. & Norman, R. (1988). A clasification of respondents to the CPI Socialization scale: Associations with psychiatric diagnoses and implications for research. Personality and Individual Differences, 9, 231-236.

Stemmler, G. (1989). The autonomic differentiation of emotions revisited: Convergent and discriminant validation. Psychophysiology, 26, 617-632.

Sterling, S., & Edelman, R. J. (1988). Reactions to anger and anxiety-provoking events: Psychopathic and nonpsychopathic groups compared. Journal of Clinical Psychology, 44, 96-100.

Sternberg, R. J., & Salter, W. (1982). Conceptions of intelligence. In R. J. Sternberg (Ed.), Handbook of human intelligence. New York: Cambridge University Press.

Strauss, E. (1983). Perception of emotional words. Neuropsychologia, 21, 99-103.

Sullivan (1994). Emotional and empathetic ability in psychopaths: Verbal and nonverbal indices of an analouge group. Unpublished thesis, University of North Carolina at Greensboro.

Taylor, S. P., & Pisano, R. (1971). Physical aggression as a function of frustration and physical attack. Journal of Social Psychology, 84, 261-267.

Titchener, E. B. (1910). A textbook of psychology. Delmar,

NY: Scholar's Facsimilies and Reprints.

Toglia, M. P., & Battig, W. F. (1978). Handbook of semantic word norms. Hillsdale, NJ: Lawrence Erlbaum Associates.

Tomkins, S. S. (1962). Affect, imagery, consciousness: The positive affects (Vol. 1). New York: Springer.

Voglmaier, M. M., & Hakerem, G. (1989). Facial electromyography (EMG) in response to facial expressions: Relation to subjective emotional experience and trait affect. Psychophysiology, 26, 64.

Waid, W. M., & Orne, M. T. (1982). Reduced electrodermal response to conflict, failure to inhibit dominant behaviors, and delinquency proneness. Journal of Personality and Social Psychology, 43, 769-774.

Watson, J. B. (1919). Psychology as a behaviorist views its. Psychological Bulletin, 20, 158-177.

Watson, M., Pettingale, K. W., & Greer, S. (1984). Emotional control and autonomic arousal in breast cancer patients. Journal of Psychosomatic Research, 28, 467-474.

Welsh, G. S. (1956). Factor Dimensions A and R. In G. S. Welsh & W. G. Dahlstrom (Eds.), Basic readings on the MMPI in psychology and medicine (pp. 264-281). Minneapolis: University of Minnesota Press.

Widom, C. S. (1976). Interpersonal conflict and cooperation in psychopaths. Journal of Abnormal Psychology, 85, 330-334.

Williams, J. M. G., Watts, F. N., MacLoed, C., & Mathews, A. (1988). Cognitive psychology and emotional disorders. New York: Wiley.

Williamson, S. Harpur, T. J., & Hare, R. D. (1991). Abnormal processing of affective words by psychopaths. Psychophysiology, 28, 260-273.

Winer, B. J. (1971). Statistical principles in experimental design (2nd ed.). New York: McGraw-Hill.

Worchel, S. (1974). The effect of three types of arbitrary thwarting on the instigation to aggression. Journal of Personality, 42, 301-318.

Yochelson, S., & Samenow, S. E. (1976). The criminal personality: Volume 1: A profile for change.

Zachary, R. A. (1986). Shipley Institute of Living Scale: Revised Manual. Los Angeles: Western Psychological Association.

Zajonc, R. B. (1985). Emotion and facial efference: A theory reclaimed. Science, 228, 15-21.

Zillmann, D. (1971). Excitation transfer in communication-mediated aggressive behavior. Journal of Experimental Social Psychology, 7, 419-434.

Zillmann, D. (1979). Hostility and aggression. Hillsdale, NJ: Lawrence Erlbaum Associates.

Zillmann, D. (1988). Cognitive-excitation interdependencies in agressive behavior. Special issue: Current theoretical perspectives on aggression and antisocial

behavior. Aggressive Behavior, 14, 51-64.

Zillmann, D. & Sapolsky, R. (1977). What mediates the effect of mild erotica on annoyance and hostile behavior in males? Journal of Personality and Social Psychology, 35, 587-596.

Zuckerman, M., & Przewuzman, S. (1979). Decoding and encoding facial expression in pre-school age children. Environmental Psychology and Nonverbal Behavior, 3, 147-163.

TABLE 1.

Pre-Provocation Means, Post-Provocation Means, and Pre/Post Difference Scores for Subjective Emotional Experiences.

Emotion/Group	Pre-Provocation	Post-Provocation	Pre/post Diff.*
Anger			
Control	0.67 (1.20)**	4.43 (2.77)	3.76
Low-Socialization	1.10 (1.41)	4.19 (2.71)	3.10
Psychopathy-Analogue	1.45 (2.06)	3.90 (2.65)	2.45
Happy			
Control	6.05 (1.32)	4.10 (2.59)	-1.95
Low-Socialization	6.14 (1.46)	4.24 (1.79)	-1.91
Psychopathy-Analogue	5.95 (1.28)	5.20 (1.70)	-0.75
Sad			
Control	1.14 (1.80)	1.24 (1.92)	0.10
Low-Socialization	1.19 (1.72)	1.74 (2.15)	0.52
Psychopathy-Analogue	1.40 (1.64)	1.35 (2.16)	-0.05
Fear			
Control	1.91 (2.26)	0.95 (1.75)	-0.95
Low-Socialization	1.19 (1.94)	1.00 (1.64)	-0.19
Psychopathy-Analogue	1.35 (1.98)	0.45 (0.83)	-0.90
Anxiety			
Control	3.33 (2.03)	3.69 (2.60)	0.28
Low-Socialization	3.00 (2.35)	2.24 (2.36)	-0.76
Psychopathy-Analogue	1.40 (1.64)	2.20 (2.19)	-0.20

* Computed as post-provocation minus pre-provocation scores
** Numbers in parentheses are standard deviations

TABLE 2.

Pre-Provocation Means, Post-Provocation Means, and Pre/Post Difference Scores for Physiological Measures.

Pre/post Measure/Group	Pre-Provocation	Post-Provocation	Diff.*
Systolic			
Control	123.62 (10.20)**	132.91 (7.68)	9.29
Low-Socialization	124.81 (12.20)	130.48 (11.94)	5.67
Psychopathy-Analogue	121.25 (10.50)	128.10 (9.82)	6.85
Diastolic			
Control	62.00 (11.69)	68.00 (11.30)	6.00
Low-Socialization	64.62 (11.97)	68.48 (12.50)	3.86
Psychopathy-Analogue	59.00 (7.22)	64.10 (7.70)	5.10
Pulse			
Control	75.14 (10.89)	77.14 (11.85)	2.00
Low-Socialization	74.71 (11.26)	74.62 (12.58)	-0.09
Psychopathy-Analogue	71.65 (10.84)	74.25 (12.35)	2.60
Corrugator EMG			
Control	8.04 (7.29)	9.65 (9.53)	1.61
Low-Socialization	7.16 (7.71)	7.94 (7.43)	0.78
Psychopathy-Analogue	8.67 (7.85)	7.91 (7.80)	-0.76
Perioral EMG			
Control	10.32 (9.27)	14.72 (12.36)	4.40
Low-Socialization	8.38 (6.16)	11.17 (7.55)	2.79
Psychopathy-Analogue	6.09 (3.40)	9.06 (6.34)	2.97
Zygomatic EMG			
Control	6.65 (9.08)	14.25 (18.47)	7.60
Low Socialization	8.51 (7.12)	12.44 (9.35)	3.93
Psychopathy Analogue	6.07 (3.18)	6.91 (3.69)	0.84
Finger Temperature			
Control	86.53 (6.71)	85.88 (6.43)	-0.65
Low Socialization	84.65 (8.61)	85.15 (7.49)	0.50
Psychopathy Analogue	89.51 (5.77)	88.67 (5.35)	-0.84

* Computed as post-provocation minus pre-provocation scores
** Numbers in parentheses are standard deviations

TABLE 3.

Extended Post-Provocation Difference Scores.

	Minutes after Provocation			
	0*	5	10	15
Systolic				
Control	9.29**	3.76	5.24	5.04
Low-Socialization	5.67	6.14	3.95	3.57
Psychopathy-Analogue	6.85	6.45	8.25	3.65
Diastolic				
Control	6.00	1.48	3.81	4.86
Low-Socialization	3.86	2.19	0.95	3.48
Psychopathy-Analogue	5.10	6.85	5.55	4.90
Pulse				
Control	2.00	1.29	2.19	1.67
Low-Socialization	-0.09	0.95	0.52	-0.48
Psychopathy-Analogue	2.60	2.40	2.45	0.85
Corrugator EMG				
Control	1.61	2.32	1.22	0.92
Low-Socialization	0.78	2.66	0.01	-0.57
Psychopathy-Analogue	-0.76	-0.31	-0.92	-1.42
Perioral EMG				
Control	4.40	1.59	0.90	1.95
Low-Socialization	2.79	-0.26	-0.01	0.75
Psychopathy-Analogue	2.97	1.47	1.21	0.93
Zygomatic EMG				
Control	7.60	0.65	-0.46	-0.34
Low-Socialization	3.93	0.93	0.36	-0.98
Psychopathy-Analogue	0.84	0.05	-0.04	-0.15
Finger Temperature				
Control	-0.65	-3.16	-3.67	-4.73
Low-Socialization	0.50	-2.03	-1.61	-2.19
Psychopathy-Analogue	-0.84	-2.81	-3.72	-4.20

* indicates difference score immediately after provocation
** Difference scores were computed by subtracting the pre-provocation score from the post-provocation extended score.

FIGURE 1.

Changes in Systolic Blood Pressure across Time.

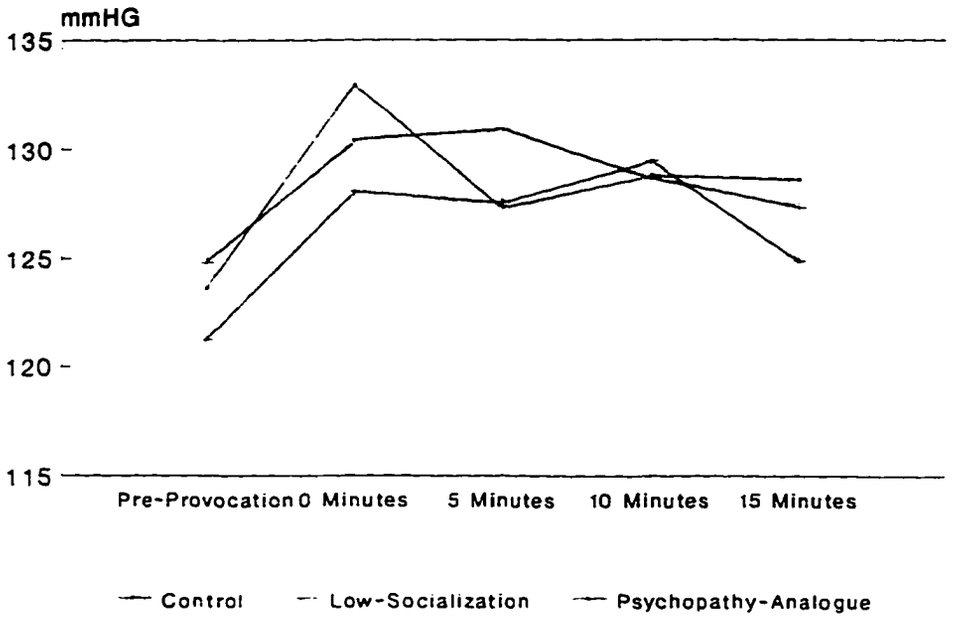


FIGURE 2.

Changes in Diastolic Blood Pressure across Time.

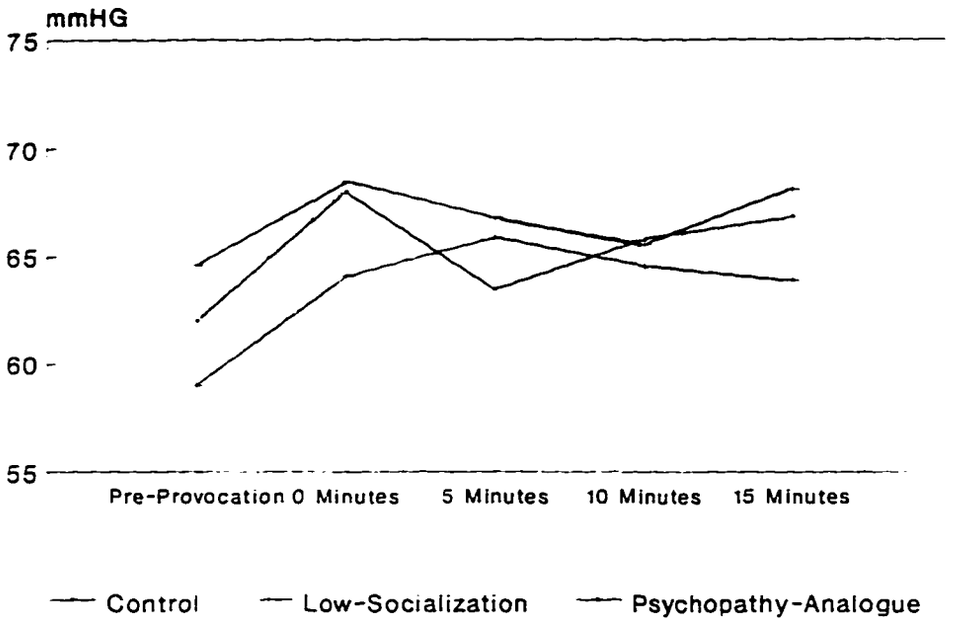


FIGURE 3.

Changes in Pulse across Time.

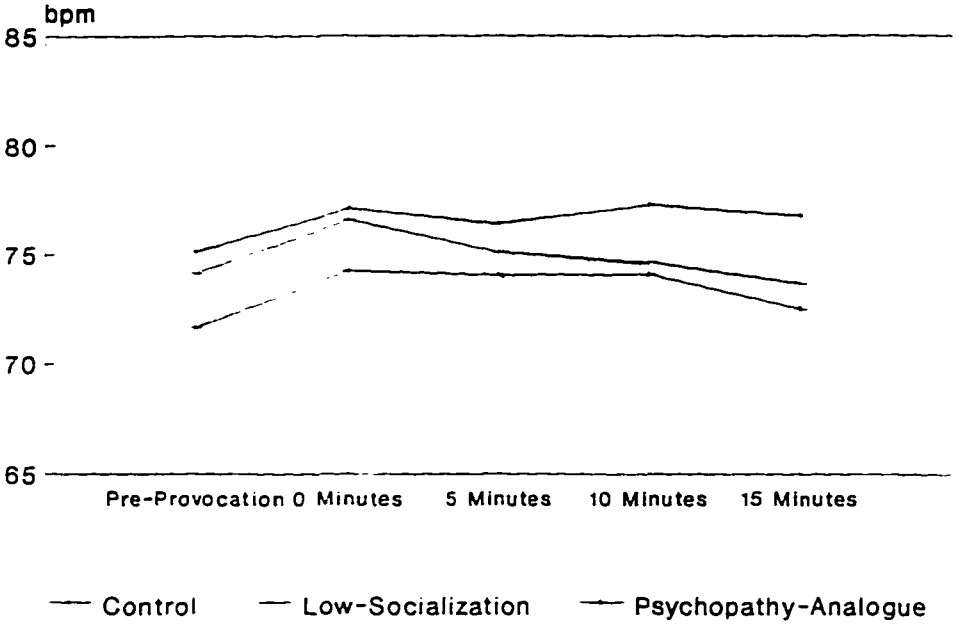


FIGURE 4.

Changes in Corrugator EMG across Time.

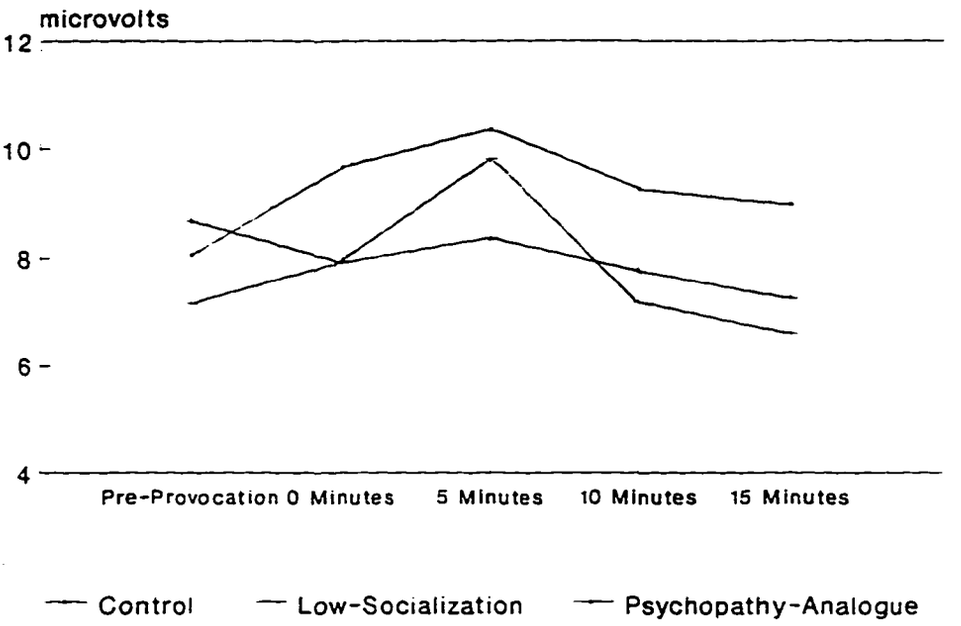


FIGURE 5.

Changes in Perioral EMG across Time.

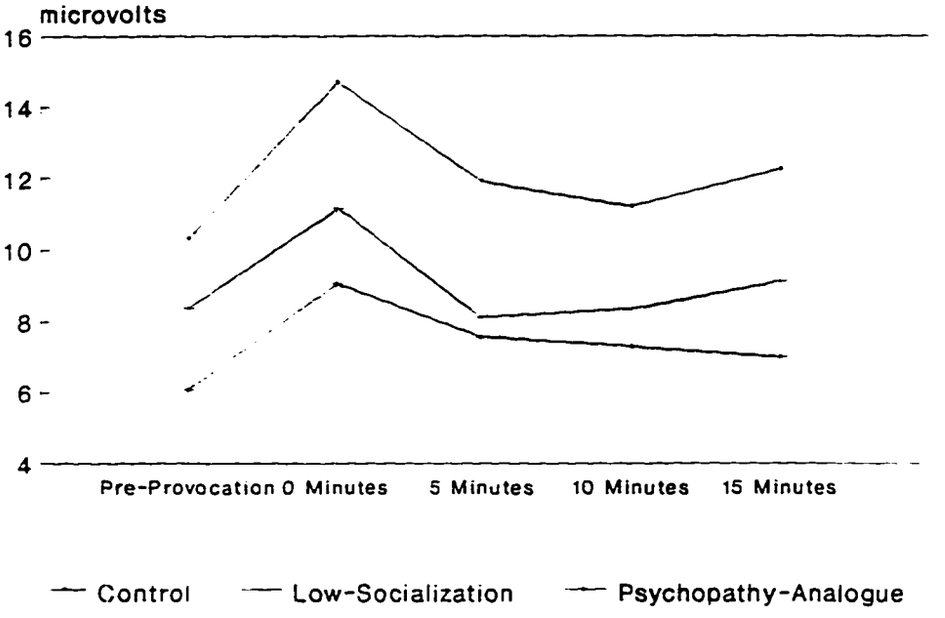


FIGURE 6.

Changes in Zygomatic EMG across Time.

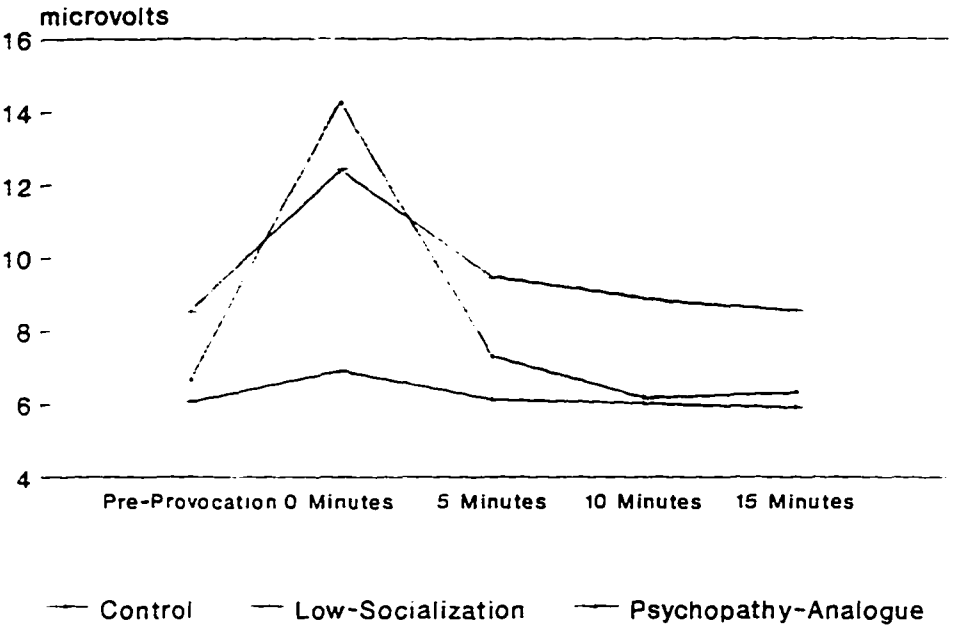


FIGURE 7.

Changes in Finger Temperature across Time.

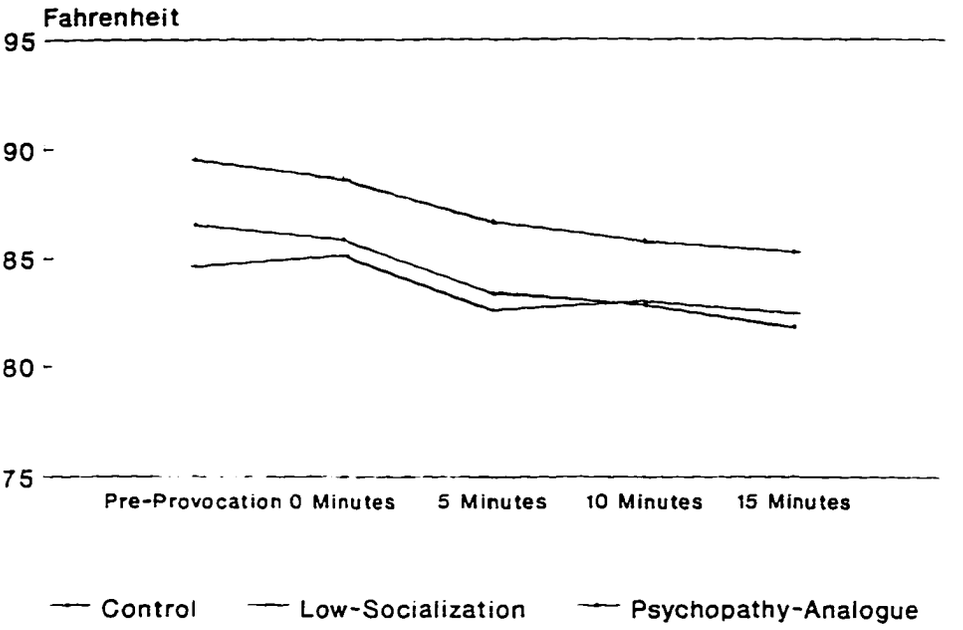


TABLE 4.

Mean Response Latencies and Accuracy Rates for the Lexical Decision Task.

	Control	Low-So.*	Psych.-Analogue
Block 1 (Pre-Provocation)			
Mean Response Latency (ms)			
Anger-relevant words	667	675	699
Emotionally-neutral words	705	722	717
Accuracy (% correct)			
Anger-relevant words	.89	.95	.92
Emotionally-neutral words	.88	.93	.89
Block 2 (Post-Provocation)			
Mean Response Latency (ms)			
Anger-relevant words	566	565	584
Emotionally-neutral words	600	608	620
Accuracy (% correct)			
Anger-relevant words	.94	.96	.93
Emotionally-neutral words	.93	.95	.90

* Low-So. = Low-Socialization Group, Psych.-Analogue = Psychopathy-Analogue group

TABLE 5.

Mean Response Latencies and Accuracy Rates for the Cued Reaction Time Task.

	Control	Low-So.*	Psych.-Analogue
Block 1 (Pre-Provocation)			
Mean Response Latency (ms)			
Valid cue left targets	613	618	639
Invalid cue left targets	807	790	795
Valid cue right targets	589	594	604
Invalid cue right targets	805	792	800
Accuracy (% correct)			
Valid cue left targets	.93	.95	.94
Invalid cue left targets	.86	.94	.90
Valid cue right targets	.92	.95	.94
Invalid cue right targets	.80	.91	.84
Block 2 (Post-Provocation)			
Mean Response Latency (ms)			
Valid cue left targets	530	532	559
Invalid cue left targets	729	725	734
Valid cue right targets	510	520	535
Invalid cue right targets	726	720	722
Accuracy (% correct)			
Valid cue left targets	.95	.97	.95
Invalid cue left targets	.92	.96	.90
Valid cue right targets	.94	.96	.94
Invalid cue right targets	.88	.93	.83

* Low-So. = Low-Socialization Group, Psych.-Analogue = Psychopathy-Analogue group

TABLE 6.

Zero-Order Correlations Between the Anger Measures for the Whole Sample.

	SYS	DIA	PUL	SUB	BEH	PER	ZYG	COR
DIA	.08							
PUL	.17	.07						
SUB	.14	.03	-.08					
BEH	.11	-.24	.20	.35**				
PER	-.07	.08	-.16	-.05	-.11			
ZYG	.01	.01	-.25	.19	-.06	.74**		
COR	-.01	.01	.18	.07	.07	-.03	.16	
TEM	.01	-.03	-.06	-.25	-.06	.16	.01	-.02

SYS=systolic blood pressure, BEH=summed ratings of performance, effort, and intelligence, SUB=anger subjective, DIA=diastolic, PUL=pulse, BON=performance bonus, ZYG=zygomatic, COR=corrugator, PER=perioral, TEM=finger temperature

** p<.01

TABLE 7.

Zero-Order Correlations Between the Anger Measures for the Control Group.

	SYS	DIA	PUL	SUB	BEH	PER	ZYG	COR
DIA	.13							
PUL	-.05	-.24						
SUB	.11	-.18	-.29					
BEH	-.04	-.37	.37	.33				
PER	-.02	.12	-.22	.15	-.02			
ZYG	-.04	.04	-.31	.26	-.09	.87**		
COR	-.01	-.08	.33	.08	.05	-.03	.09	
TEM	-.33	-.26	-.24	-.40	-.11	-.21	-.26	-.18

SYS=systolic blood pressure, BEH=summed ratings of performance, effort, and intelligence, SUB=anger subjective, DIA=diastolic, PUL=pulse, ZYG=zygomatic, COR=corrugator, PER=perioral, TEM=finger temperature

** p<.01

TABLE 8.

Zero-Order Correlations Between the Anger Measures for the Low- Socialization Group.

	SYS	DIA	PUL	SUB	BEH	PER	ZYG	COR
DIA	-.12							
PUL	.40	.46*						
SUB	-.25	.08	.20					
BEH	.10	-.34	.07	.26				
PER	-.01	.06	-.06	-.36	-.36			
ZYG	.09	-.07	-.06	-.04	-.15	.70**		
COR	.20	.36	.31	.06	-.08	-.22	.06	
TEM	.14	.05	-.02	-.35	-.08	.42	.16	-.04

SYS=systolic blood pressure, BEH=summed ratings of performance, effort, and intelligence, SUB=anger subjective, DIA=diastolic, PUL=pulse, ZYG=zygomatic, COR=corrugator, PER=perioral, TEM=finger temperature

* $p<.05$
** $p<.01$

TABLE 9.

Zero-order Correlations Between the Anger Measures for the Psychopathy- Analogue Group.

	SYS	DIA	PUL	SUB	BEH	PER	ZYG	COR
DIA	.10							
PUL	.32	.28						
SUB	.64**	.26	.08					
BEH	.26	-.03	-.19	.49*				
PER	-.32	-.02	-.16	-.12	-.12			
ZYG	-.24	-.22	-.29	.08	-.11	.28		
COR	-.51	-.28	-.32	-.30	.19	.15	.21	
TEM	-.13	-.04	.17	-.04	.05	-.10	-.23	.19

SYS=systolic blood pressure, BEH=summed ratings of performance, effort, and intelligence, SUB=anger subjective, DIA=diastolic, PUL=pulse, ZYG=zygomatic, COR=corrugator, PER=perioral, TEM=finger temperature

* $p<.05$
** $p<.01$

TABLE 10.

Pre-Provocation Means, Post-Retaliation Means, and Pre/Post Difference Scores for Physiological Measures.

Pre/post Measure/Group	Pre-Provocation	Post-Retaliation	Diff.*
Systolic			
Control	123.62 (10.20)**	126.14 (10.06)	2.52
Low-Socialization	124.81 (12.20)	125.52 (12.93)	0.71
Psychopathy-Analogue	121.25 (10.50)	126.70 (12.69)	5.45
Diastolic			
Control	62.00 (11.69)	66.86 (11.65)	4.86
Low-Socialization	64.62 (11.97)	65.19 (15.14)	0.57
Psychopathy-Analogue	59.00 (7.22)	65.55 (9.51)	6.55
Pulse			
Control	75.14 (10.89)	75.24 (10.09)	0.10
Low-Socialization	74.71 (11.26)	72.62 (11.14)	-2.10
Psychopathy-Analogue	71.65 (10.84)	71.85 (12.55)	0.20
Corrugator EMG			
Control	8.04 (7.29)	8.04 (7.20)	0.00
Low-Socialization	7.16 (7.71)	6.09 (4.48)	-1.07
Psychopathy-Analogue	8.67 (7.85)	7.34 (8.48)	-1.33
Perioral EMG			
Control	10.32 (9.27)	9.98 (6.04)	-0.34
Low-Socialization	8.38 (6.16)	7.90 (6.10)	-0.48
Psychopathy-Analogue	6.09 (3.40)	7.38 (4.10)	-1.29
Zygomatic EMG			
Control	6.65 (9.08)	6.43 (9.08)	-0.22
Low-Socialization	8.51 (7.12)	7.41 (5.85)	-1.10
Psychopathy-Analogue	6.07 (3.18)	6.37 (4.83)	0.03
Finger Temperature			
Control	86.53 (6.71)	80.47 (7.01)	-6.06
Low-Socialization	84.65 (8.61)	81.81 (7.22)	-2.64
Psychopathy-Analogue	89.51 (5.77)	83.22 (6.13)	-6.28

* Computed as post-provocation minus pre-provocation scores
** Numbers in parentheses are standard deviations

TABLE 11.

Pre-Provocation Means, Post-Retaliation Means, and Pre/Post Difference Scores for Subjective Emotional Experiences.

Emotion/Group	Pre-Provocation	Post-Retaliation	Pre/post Diff.*
Anger			
Control	0.67 (1.20)**	1.48 (1.94)	0.81
Low-Socialization	1.10 (1.41)	1.05 (1.12)	-0.05
Psychopathy-Analogue	1.45 (2.06)	1.55 (2.06)	0.10
Happy			
Control	6.05 (1.32)	5.86 (1.68)	-0.19
Low-Socialization	6.14 (1.46)	6.10 (1.92)	-0.04
Psychopathy-Analogue	5.95 (1.28)	6.15 (1.09)	0.20
Sad			
Control	1.14 (1.80)	1.10 (1.90)	-0.04
Low-Socialization	1.19 (1.72)	1.00 (1.48)	-0.19
Psychopathy-Analogue	1.40 (1.64)	0.90 (1.48)	-0.50
Fear			
Control	1.91 (2.26)	0.48 (1.17)	-1.43
Low-Socialization	1.19 (1.94)	0.14 (0.48)	-1.05
Psychopathy-Analogue	1.35 (1.98)	0.30 (0.57)	-1.05
Anxiety			
Control	3.33 (2.03)	1.76 (1.92)	-1.57
Low-Socialization	3.00 (2.35)	1.52 (1.91)	-1.48
Psychopathy-Analogue	1.40 (1.64)	0.65 (1.14)	-0.75

* Computed as post-retaliation minus pre-provocation scores
** Numbers in parentheses are standard deviations

TABLE 12.

Response Facilitation Effect for Emotional Words by High and Low Intelligence Groups.

Group/Intelligence	Response Facilitation Effect (ms)	Paired t-test Result	p
Block 1 (Pre-Provocation)			
Control			
Low Intelligence (n = 8)	42	3.32	.01
High Intelligence (n = 13)	35	3.42	.005
Low Socialization			
Low Intelligence (n = 12)	51	3.65	.004
High Intelligence (n = 9)	41	3.18	.01
Psychopathy-Analogue			
Low Intelligence (n = 10)	21	1.08	.31
High Intelligence (n = 10)	15	1.24	.25
Block 2 (Post-Provocation)			
Control			
Low Intelligence (n = 8)	24	2.04	.08
High Intelligence (n = 13)	40	6.81	< .001
Low Socialization			
Low Intelligence (n = 12)	45	6.73	< .001
High Intelligence (n = 9)	41	5.67	< .001
Psychopathy-Analogue			
Low Intelligence (n = 10)	45	3.10	.01
High Intelligence (n = 10)	26	2.44	.04

TABLE 13.

Accuracy for Anger-Relevant Words by High and Low Intelligence Groups.

Group/Intelligence	Pre-Provocation Accuracy	Post-Provocation Accuracy
Control		
Low Intelligence (n = 8)	.81	.90
High Intelligence (n = 13)	.94	.96
Low-Socialization		
Low Intelligence (n = 12)	.94	.95
High Intelligence (n = 9)	.96	.96
Psychopathy-Analogue		
Low Intelligence (n = 10)	.92	.90
High Intelligence (n = 10)	.92	.95

TABLE 14.

Response Latencies for Right Targets by High and Low Intelligence Groups.

Group/Intelligence	Validly Cued Right Targets (ms)	Invalidly Cued Right Targets (ms)
Block 1 (Pre-Provocation)		
Control		
Low Intelligence (n = 8)	627	825
High Intelligence (n = 13)	565	792
Low Socialization		
Low Intelligence (n = 12)	634	818
High Intelligence (n = 9)	541	757
Psychopathy-Analogue		
Low Intelligence (n = 10)	615	828
High Intelligence (n = 10)	592	773
Block 2 (Post-Provocation)		
Control		
Low Intelligence (n = 8)	538	732
High Intelligence (n = 13)	494	722
Low-Socialization		
Low Intelligence (n = 12)	532	735
High Intelligence (n = 9)	505	700
Psychopathy-Analogue		
Low Intelligence (n = 10)	554	744
High Intelligence (n = 10)	517	700

TABLE 15.

Accuracy for Validly Cued Targets Post-Provocation by High and Low Intelligence Groups.

Group/Intelligence	Validly Cued Right Targets	Validly Cued Left Targets
Control		
Low Intelligence (n = 8)	.89	.94
High Intelligence (n = 13)	.97	.97
Low-Socialization		
Low Intelligence (n = 12)	.95	.97
High Intelligence (n = 9)	.97	.98
Psychopathy-Analogue		
Low Intelligence (n = 10)	.93	.93
High Intelligence (n = 10)	.96	.97

APPENDIX A.

Target "Word" Lists for Lexical Decision Task.

List A

Anger-Relevant: demolish, hurt, kill, attack, brutal, anger

Emotionally-Neutral: vertical, pull, rear, permit, seller, older

Nonsense: roterdon, libborak, dait, bont, frug, talp, mausor, abtess, dotace, karrel, balop, jalen

List B

Anger-Relevant: suffocate, rape, shot, murder, destroy, cruel

Emotionally-Neutral: adjective, down, melt, napkin, lease, lighter

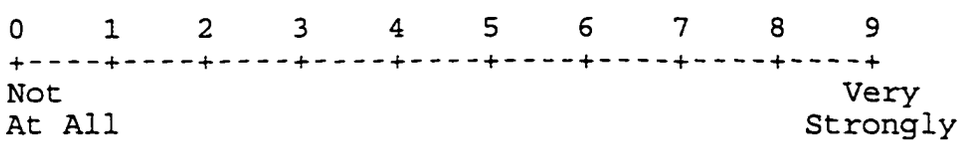
Nonsense: helicarns, trelipham, leel, biek, saze, caut, pommen, succon, coblomb, bladels, wheet, ceint

APPENDIX B.

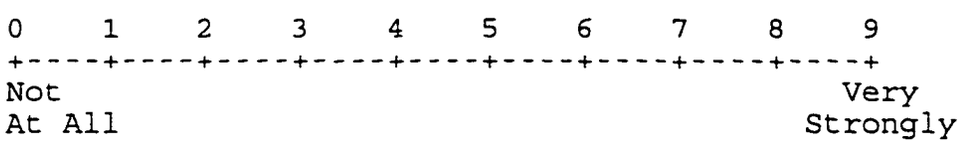
Subjective Emotion Rating Scale.

Please circle the number that best represents how you feel.

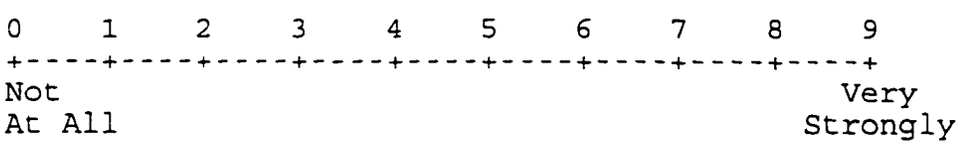
1) Happy:



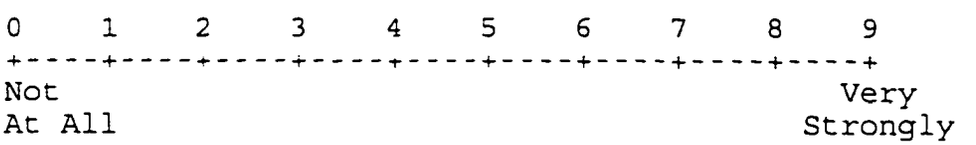
2) Sad:



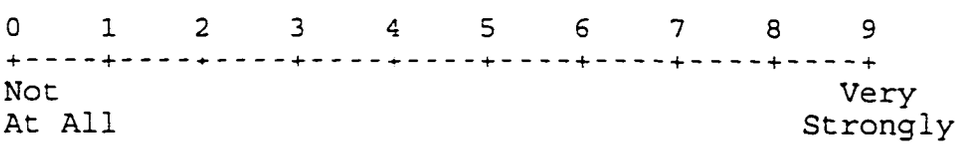
3) Anger:



4) Fear:



5) Anxiety:



APPENDIX C.

Feedback Form.

Performance Feedback

1) Overall this participant's performance was:

1-------2-------3-------4-------5-------6-------7
extremely low low average high high extremely
low average average high

2) Overall this participant's effort was:

1-------2-------3-------4-------5-------6-------7
extremely low low average high high extremely
low average average high

3) The participant's level of intelligence is judged to be:

1-------2-------3-------4-------5-------6-------7
extremely low low average high high extremely
low average average high

4) Should the performance bonus of $5.00 dollars be awarded? (Circle one.)

Yes No

APPENDIX D.

Confederate's Verbal Feedback to the Participant.

Experimenter (E) - Now we're going to go over your feedback. 87.2% of his responses were correct and this is better than 86 out of every 100 people tested on the task. His speed was on average 754 milliseconds which is better than 82 out of every 100 people tested on this task. Based on his score and your knowledge of how easy or difficult the task is, how did you rate his overall performance?

Confederate (C) - Oh, I'd say that his performance is only about average.

E - So what number value did you give him?

C - I gave him a 4.

E - OK. Now how did you rate his overall effort?

C - I thought his effort was low so I gave him a 2.

E - Alright. Could you discuss how you came to those ratings of his performance and effort.

C - Well what I did was I based his performance on the number he got right and his effort on how fast he pushed the buttons. I just didn't think that he pushed the buttons quick enough.

E - (Pause) You do realize that his speed and accuracy was a little bit better than yours.

C - Yeah, but I was thinking of something else when I started. Really once I got into the swing of it, it was pretty simple. I guess I think my scores are a little lower because of how I was doing at the beginning not at the end.

E - Okay, what is your estimate of his intelligence?

C - I would say at best it's probably low average, so I gave him a 3.

E - Should the $5.00 performance bonus be awarded?

C - No, I don't think so.

E - What type of suggestions do you have for him regarding how he can improve his performance.

C - I can't really think of anything. I guess, you know, given his skill level and his intelligence, I think he's doing pretty much about as good as he can.

E - Alright, anything else you want to add.

C - No, not really.

E - Alright, thanks.