AN INVESTIGATION OF SELF-REPORT AND PSYCHOPHYSIOLOGIC EMPATHIC RESPONSES IN NON-PSYCHOPATHIC AND PSYCHOPATHIC INDIVIDUALS

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DEDICATION

This dissertation is dedicated to my late grandfather, Max Kirsch.
I wish he were here to see me get my PhD — I think he would have liked that.

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ABSTRACT

A lack of empathy is considered to be one of the hallmark features of psychopathy. However, remarkably little research has specifically examined the relationship between psychopathy and empathy, and what does exist relies solely on self-report measures, which is problematic given psychopaths' propensity for dishonesty. This research signifies an attempt to develop an objective measure of empathy, using psychophysiological indices of emotional experience as indicators of an empathic response. Specifically, corrugator and zygomatic facial muscle activity, event-related heart rate, and acoustic startle reflex responses were measured while participants viewed brief film clips of individuals experiencing happy and sad emotional events.

Pilot investigations of the films suggest that they are appropriate for eliciting happy and sad empathic emotion, and the pattern of responses by undergraduates with high and low trait levels of empathy indicates the validity of the approach and the promise of utilizing psychophysiological indices of emotional responding to measure situational empathy in a more objective manner. In particular, participants demonstrated patterns of psychophysiological responses to the empathy-inducing films which both matched their self-reported emotional experiences as well as the emotional valence of the stimuli. Moreover, several of the psychophysiological indices were able to discriminate high and low empathy individuals, whereby low empathy participants exhibited less facial expressiveness and less modulation of the acoustic startle reflex to the empathy-inducing stimuli than their high empathy counterparts.

The paradigm was then extended to a sample of male undergraduates with high and low levels of psychopathic traits, as assessed by the Psychopathic Personality Inventory-Revised. Results suggest a significant negative relationship between self-reported psychopathy and self-reported dispositional empathy, with high levels of psychopathy associated with low levels of dispositional empathy, particularly with respect to affective empathy. However, despite differences in dispositional empathy, psychopathic and non-psychopathic undergraduates were not easily discriminated on subjective or objective measures of situational empathy, with the exception of an anomalous pattern of zygomatic EMG activity exhibited by the psychopathic participants. The implications of these findings are discussed with respect to the nature of the empathic capabilities of psychopaths, as well as considerations of the methodological limitations of the current study and directions for future research.

INTRODUCTION

Unfortunately, violence is relatively common in our society. In 2006, over 1.4 million violent crimes occurred across the United States, resulting in a violent crime rate of 474 per 100,000 persons (US Department of Justice, 2007). Although this rate has decreased more than 20 percent in the last 10 years (US Department of Justice, 2007), it is still unacceptably high. A greater understanding of the causes of violent crime would serve to reduce the amount of violence in our society by allowing us to create prevention and intervention programs which can better address the phenomenon.

Aggressive and violent acts are perpetrated by individuals for a wide variety of purposes. Reactive aggression is typically impulsive and unplanned, and is motivated by strong negative emotional states such as anger, dysphoria, and frustration (e.g., Berkowitz, 1993). Proactive or instrumental aggression, on the other hand, is believed to be more "cold-blooded", whereby a lack of emotion is typically associated with the premeditated, goal-directed perpetration of violence (e.g., Cornell, et al., 1996; Stanford, et al., 2003). It is widely believed that empathy inhibits aggressive behavior (e.g., Miller & Eisenberg, 1988), and as such, a lack of empathy may then facilitate violence and other criminal acts (Farrington, 1998; Jolliffe & Farrington, 2007). There is also a vast body of research linking psychopathic traits with violent behavior (Porter & Woodworth, 2006). In particular, compared to non-psychopathic criminals, psychopaths are more likely to commit violent acts both in the community and within institutions (e.g., Hare & McPherson, 1984; Porter, Birt, & Boer, 2001; Serin, 1991), violently recidivate upon

release from prison (e.g., Serin & Amos, 1995), use weapons and threats in the commission of their offenses (e.g., Serin, 1991), and commit violent crimes for instrumental and even sadistic purposes (e.g., Cornell, et al., 1996; Flight & Forth, 2007; Woodworth & Porter, 2002).

Not surprisingly, psychopaths are thought to experience empathy deficits (e.g., Cleckley, 1976; Hare, 1991), and this lack of empathy is believed to mediate their violent behaviors (e.g., Silver, Mulvey, & Monahan, 1999). However, there is limited empirical work investigating the presence of empathy deficits in psychopaths, and the literature that currently exists relies solely on self-report measures of empathy. Subjective measures of empathy present unique problems for use with psychopathic samples, given the psychopath's tendency for dishonesty and socially desirable responding (Hare, 1998). The following studies represent an attempt to better understand the nature and quality of empathy deficits among psychopathic individuals by developing and testing an objective measure of empathic emotional responding.

Chapter 1 outlines a set of studies that were designed to develop and validate a measure of empathy by using psychophysiological indices of emotional experience as objective indicators of situational empathic emotional responding. Psychophysiological measures are ideal for use with psychopathic populations because they can provide us with unbiased, objective information regarding how psychopaths process information and experience events, which will ultimately help us to ascertain how and why these individuals are able to commit acts of violence, particularly of an instrumental nature. Chapter 2 then describes a study investigating the relationship between psychopathy and

empathy using subjective measures, as well as studying the application of the objective measure described in Chapter 1 to a sample of male undergraduates with high levels of psychopathic personality traits.

Overall, this is an extremely important area of research, given the considerable amount of harm caused to society by psychopathic individuals, and the relatively sparse empirical data that currently exists to explain psychopaths' harmful behaviors. Although the widespread notion that low empathy allows psychopaths to perpetrate acts of violence is intuitive and face-valid, little work has been done to reliably document empathy deficits in psychopathic or other criminal populations. This project aims to contribute to the psychological literature by providing information regarding the nature and extent of empathy deficits in psychopathic individuals, which will be informative for risk assessments, treatment decisions, and case management plans.

CHAPTER 1: THE DEVELOPMENT AND TESTING OF AN OBJECTIVE MEASURE OF EMPATHY

Introduction

While conceptualizations of empathy vary across disciplines, a generally agreed-upon definition is the understanding and sharing of another's emotional state or condition (Eisenberg & Strayer, 1987). In the psychological literature, empathy comprises two separate but linked components: a cognitive or perspective-taking component and an affective component (Strayer, 1987). An empathic response requires the ability to both recognize affective cues in another and take their perspective (the cognitive component), plus the capacity to respond affectively (the affective component; Cohen & Strayer, 1996). Overall, it is believed that empathy acts as a motivator of prosocial behavior (Eisenberg, 2000; Moore, 1990), as well as an inhibitor of aggression (Feshbach & Feshbach, 1982; Miller & Eisenberg, 1988).

As such, criminologists have long theorized that deficits in empathy facilitate offending behavior, in that offenders' lack of awareness or insensitivity to other people's feelings may impair their ability to appreciate the effects their behavior has on others (Farrington, 1998). For this reason, considerable attention has been paid to the presence of empathy deficits in psychopaths, given their overwhelming representation within the criminal justice system (Harpur & Hare, 1994) and their propensity to commit frequent and varied criminal acts, particularly of a violent nature (e.g., Hemphill, Hare, & Wong, 1998; Salekin, Rogers, & Sewell, 1996). It is also not surprising that a lack of empathy is considered to be a hallmark feature of the disorder (e.g., Hare, 1998), as well as a

mediator of the psychopath's aggressive and antisocial behaviors (e.g., Hart & Hare, 1997; Porter & Woodworth, 2006).

Clear evidence of generalized empathy deficits in offenders (Jolliffe & Farrington, 2004) and psychopaths (Kirsch & Becker, 2007), however, does not yet exist. This may be due to limitations in currently available methods of assessing empathy (Marshall, Hudson, Jones, & Fernandez, 1995). In both normative and offender samples, empathy is typically assessed via self-report questionnaires designed to measure one's general tendency to be empathic, or one's dispositional empathy (e.g., Davis, 1983; Hogan, 1969; Mehrabian & Epstein, 1972). Unfortunately, the use of self-report measures with offenders and psychopathic individuals is highly problematic, given their propensity for dishonesty and socially desirable responding (e.g., Hare, 1998). Moreover, it has been suggested that empathy deficits in offenders may be situation-specific (Marshall, et al., 1995) or component-specific (Kirsch & Becker, 2007) as opposed to global in nature. Current instruments are incapable of addressing these questions because they fail to measure either situational empathic responding or the subcomponents of empathy, or both.

Accordingly, in order to accurately assess the presence and nature of empathy deficits in offender and psychopathic populations, more objective measures of both dispositional and situational empathy need to be developed. One area that has demonstrated some potential for the objective measurement of empathy is the use of psychophysiological correlates of emotional experience as indirect measures of empathic responding. Such indices are promising because they suffer less from self-presentational

biases and conscious manipulation of responses (Eisenberg, Fabes, Bustamante, & Mathy, 1987) and there is good reason to believe they can be used as markers of empathy-related emotions (Eisenberg & Fabes, 1990). Such measures include facial expressions (or facial muscle activity), heart rate (HR), and the acoustic startle reflex.

The most commonly used physiological measure of empathy to date is facial muscle activity. This is likely because facial expressions are easily measured and facial mimicry is widely believed to be an essential component in the process of emotional empathy (e.g., Basch, 1983; Hoffman, 2000). Specifically, the observation and subsequent imitation of facial expressions may lead an observer to experience similar emotions (Davis, 1996) in part because facial actions are thought to generate both subjective feelings and emotion-specific autonomic nervous system activity (Levenson, Ekman, & Friesen, 1990). Research has consistently demonstrated that the viewing of emotional faces results in both mimicry responses and similar emotional reactions using still picture (e.g., Lundqvist & Dimberg, 1995) and short film stimuli (e.g., Hess & Blairy, 2001; McHugo, Lanzetta, Sullivan, Masters, & Englis, 1985). There is also reason to believe that mimicry is biologically hard-wired and unconscious, since infants as young as 12 days old exhibit mimicry behavior (Meltzoff & Moore, 1977) and mimicry can occur even when the emotional faces are presented such that they do not reach conscious awareness (Dimberg, Thunberg, & Elmehed, 2000). Moreover, the extent of mimicry responses has been related to differences in dispositional empathy (Sonnby-Borgstrom, Jonsson, & Svensson, 2003), with high empathy individuals exhibiting a higher degree of mimicking behaviors and greater correspondence between facial

expressions and self-reported feelings (Sonnby-Borgstrom, 2002). Thus, it appears that facial mimicry of emotional expression is biologically-based, relatively automatic, and associated with one's trait level of empathy.

To a lesser degree, HR has been employed as an indicator of empathic emotional experience. In general, emotional valence has been shown to affect features of the HR response, with greater initial deceleration in response to unpleasant pictures and greater peak acceleration in response to pleasant pictures (e.g., Bradley, Codispoti, Cuthbert, & Lang, 2001) and directed facial actions consistent with happiness (Levenson, et al., 1990). Arousal and attention also influence HR; during periods of emotional arousal, anxiety, or distress, HR tends to accelerate (Bradley, 2000) while HR decelerates during sensory intake and when focusing one's attention outward (Lacey, Kagan, Lacey, & Moss, 1963). In relation to empathy, HR deceleration is observed in connection with empathic sadness (e.g., Eisenberg, et al., 1991), and is associated with an increased willingness to help needy others (Eisenberg, et al., 1989). In addition, greater empathic accuracy is associated with linkages in HR reactivity between observers and individuals involved in negative emotional interactions (Levenson & Ruef, 1992). Thus, it has been argued that HR deceleration in response to empathy-inducing sad stimuli may result from one's own sadness as well as the individual's shift in attention towards another person who may be in need (Zhou, Valiente, & Eisenberg, 2003).

The acoustic startle reflex is another widely used index of current emotional state. In humans, the startle response is modulated by an individual's affective state and resulting motivational disposition (Bradley, 2000). In particular, the startle eyeblink

response is potentiated when viewing unpleasant pictures and inhibited when viewing pleasant pictures, in relation to neutral pictures (e.g., Lang, Bradley, & Cuthbert, 1990). This modulation is believed to result from the process of motivational priming—the defensive startle reaction is augmented when the individual is already in a defensive motivational state (i.e., in response to unpleasant emotional stimuli) and diminished when the individual's motivational state is appetitive in nature (i.e., in response to pleasant stimuli; Lang, 1995). There is an extensive literature documenting startle reflex reactivity in response to still pictures (e.g., Bradley & Lang, 2000b), but affective modulation of the startle response has also been found in response to emotional films (Jansen & Frijda, 1994; Kaviani, Gray, Checkley, Kumari, & Wilson, 1999) as well as emotionally-valenced sounds (Bradley & Lang, 2000a). Unfortunately, no work has been conducted investigating the utility of the startle reflex as a measure of emotional empathy, although it is reasonable to expect that startle eyeblink would be modulated by an individual's emotional response to the experiences of others, thus serving as an indicator of empathic responding.

The aim of the current study was thus to develop and validate an objective measure of situational empathy by measuring psychophysiological activity believed to be indicative of an empathic response. In particular, corrugator (frown) and zygomatic (smile) facial muscle activity, HR, and acoustic startle reflex were assessed and compared to self-reported emotion in response to films of individuals having discretely happy and sad emotional experiences. These measures of emotional response were chosen based on their strong empirical foundation in the emotion and empathy literatures, as well as their

ease of application to later work with criminal and psychopathic populations (e.g., Patrick, Bradley, & Lang, 1993).

This study used films as opposed to the more validated approach of still picture presentation (e.g., Lang, 1995) because it has been argued that films offer advantages for eliciting broad, multi-system emotional responses in that they can be more emotionally potent than still pictures (Rottenberg, Ray, & Gross, 2007) and dynamic facial expressions are considered to be more ecologically valid and more easily recognized (Wicker, et al., 2003) than static expressions. In addition, the unfolding of emotional events and corresponding emotional expressions of film characters would appear more likely to elicit empathy in viewers than still pictures of facial expressions, given the larger amount of information that is conveyed. Because a large database of empathy-inducing films does not exist, a set of film images was first developed that would reliably elicit empathic responses in viewers. To do this, a number of brief films from a database of commercially-available film footage were pilot tested to assess their emotional evocativeness. Those films which yielded the greatest reports of happy and sad empathic emotion were selected for inclusion as empathy-inducing stimuli.

The major aim of the present study was to determine if there are reliable psychophysiological indicators of an empathic response in non-disordered individuals. Based on the psychophysiology of emotion literature, viewing empathy-inducing films was predicted to result in facial mimicry, changes in film-related HR, and modulation of the startle eyeblink response, in addition to subjective reports of concordant emotion. Specifically, it was predicted that films portraying individuals experiencing happy events

would elicit self-reported happiness, increased zygomatic EMG activity, and HR acceleration, while films depicting individuals having sad experiences would result in self-reported sadness, increased corrugator EMG activity, and HR deceleration.

Because the literature to date has failed to specifically address the question of startle and empathy, hypotheses with respect to patterns of startle responding were somewhat less straightforward. Although some preliminary work has been conducted to examine startle responses to facial expressions (e.g., Hess, Sabourin, & Kleck, 2007), such research has investigated only a limited number of emotions, and these studies have yielded equivocal results. While one study found evidence of inhibited startle in infants to happy adult faces (Balaban, 1995), others have failed to find evidence of startle modulation in adults to either happy adult (Alpers & Adolph, 2006; Hess, et al., 2007) or smiling infant faces (Spangler, Emlinger, Meinhardt, & Hamm, 2001). It is possible that the photos of happy facial expressions were not of sufficient intensity to elicit enough emotion or arousal in the adult participants to modulate the startle reflex (Hess, et al., 2007); work with more intense, dynamic facial expressions is needed to address this question.

In the only study to investigate sad expressions (Spangler, et al., 2001), startle responses by adult participants to pictures of crying babies did not differ from startles to pictures of happy or emotionally neutral babies, and were on a similar level with startles to pleasant International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1995) pictures. This lack of startle modulation occurred despite subjective reports and facial expressions consistent with negative emotional experience. Furthermore, other

investigations using negative but non-fearful unpleasant stimuli have also failed to find the expected pattern of startle modulation. In particular, some researchers found no evidence of startle potentiation (Balaban & Taussig, 1994), while others observed significant startle inhibition in response to disgusting scenes such as toe surgery (Kaviani, et al., 1999). It has been argued that unpleasant stimuli such as crying babies and medical procedures may elicit negative emotional reactions, but may also evoke approach tendencies such as comfort and help (Hess, et al., 2007; Lang, 1995; Spangler, et al., 2001). This activation of the appetitive motivation system, even in conjunction with negative emotional experience, would produce diminished startle responses such as those found in the above studies.

Based on these findings, significant startle inhibition was predicted in response to films portraying sad individuals, as empathic responding to such films was expected to elicit approach or helping tendencies in the viewers. Similarly, happy films were predicted to be sufficiently evocative to produce happiness, and accordingly, would also elicit significant startle inhibition compared to neutral films.

A secondary aim of this study was to demonstrate that the psychophysiological indices were specifically measuring empathic emotion, as opposed to just emotion in general. To accomplish this, the self-report and psychophysiological responses of high and low empathy participants were compared, with the expectation that these measures would reliably discriminate high and low empathy individuals, in that high empathy participants would report more intense emotional experiences and would display greater psychophysiological reactivity in response to the films.

Experiment 1: Validating and Selecting Film Stimuli

A database of empathy-inducing film stimuli for use in psychophysiological research does not currently exist. As such, it was necessary to select and test films to determine their suitability for inclusion in studies of empathic responding. Given that a majority of work to date has focused on static facial expressions, films were sought that primarily consisted of individuals having discrete emotional experiences and displaying facial expressions consistent with these experiences.

Method

Participants

Participants were 102 undergraduates (60 female and 42 male) recruited from the University of Arizona introductory psychology participant pool. Data from two males were lost due to computer problems at the time of data collection, resulting in the inclusion of 100 participants. Participants were between the ages of 18 and 33 years (M=18.7, SD=1.7) and 73%, 11%, and 8% reported being Caucasian, Hispanic, and Asian, respectively. All participants were fluent in English and had normal or corrected-to-normal vision. Participants received course credit for their participation.

Stimulus Materials

Film clips were chosen from a collection of thousands of professionally-created and commercially-available digital images from the gettyimages® web database. Film clips were brief (4-25 second) sound-free close-up shots of an individual or individuals experiencing and expressing a variety of emotions. Individuals depicted were diverse with respect to age, ethnicity, sex, and socioeconomic status. Films tested in this

validation study were selected by the author based on the perceived clarity and intensity of the emotional experience being portrayed by the individual(s) in the film segment, and categorized preliminarily as happy, sad, or emotionally neutral. Ninety-three film clips were pilot tested with the participants, 31 of each film type.

Self-Report Measures

Post-Film Questionnaire (PFQ). The PFQ (Rottenberg, et al., 2007) was developed to help validate emotional film clips for research purposes by determining each film's ability to elicit emotional states in viewers. On the PFQ, participants report the greatest emotion they experienced while watching a film by using a 9-point Likert scale (0- not at all/none to 8- extremely/a great deal) to rate a variety of discrete emotion terms (i.e., amusement, anxiety, disgust, happiness, shame). The PFQ also includes the term 'confusion' in order to assess how easy it is for participants to understand the film clip outside of its normal context (Rottenberg, et al., 2007). The PFQ was shortened to include only five emotion terms (happiness, sadness, anger, fear, and confusion) in this study, since participants were required to view and rate over 90 films, and films were pre-selected to be either happy, sad, or emotionally neutral. Anger and fear were included as emotion terms to help discriminate emotionally unpleasant films from sad films and confusion was included to determine if participants had difficulty understanding what was happening in the films.

Procedure

Participants were tested individually in an experimental session lasting approximately 1.5 hours. Participants were seated comfortably in a dimly lit room and

told that they would be shown a number of film clips on a computer monitor and asked to rate their emotional experience in response to each film. After obtaining informed consent, participants viewed the films in blocked, randomized order so that no more than two films of each type were presented consecutively. Digital film clips were displayed on 19" computer monitor approximately 2 feet from the participant, controlled by a computerized script. Immediately following each film clip, the PFQ was presented on the computer screen accompanied by digitized instructions prompting participants to provide their ratings. Upon completion of the PFQ, participants were presented with a blank screen for 10 seconds and instructed to attempt to clear their mind of all thoughts, feelings and memories. This procedure was repeated until all of the clips were presented.

Results

Films were measured on the intensity and discreteness of emotion they elicited in viewers. Intensity refers to whether a film received a high rating on the target emotion compared to other films, while discreteness refers to the degree to which viewers reported feeling the target emotion more intensely than the other non-target emotions (Rottenberg, et al., 2007). To determine each film's intensity, mean ratings for each of the five self-report emotional descriptors were calculated for the film. Discreteness was measured by calculating the mean intensity rating for the target emotion (happiness or sadness), and then subtracting the average of the intensity ratings for the four non-target emotions. Since there was no target emotion for the neutral films, intensity was measured for each of the five emotional descriptors, and overall intensity was calculated by averaging the intensity ratings for all of the emotion terms. Across all happy films tested, mean

intensity ratings ranged from 2.4 to 6.6 (M=4.4, SD=1.0) and discreteness ratings ranged from 0.3 to 6.3 (M=3.8, SD=1.3). Across all sad films tested, mean intensity ratings ranged from 2.8 to 6.9 (M=4.5, SD=0.9) and discreteness ranged from 1.3 to 4.6 (M=2.8, SD=0.8). Discreteness/intensity ratings for neutral films ranged from 0.8 to 1.8 (M=1.2, SD=0.3).

The 10 films which elicited the highest intensity and discreteness ratings for happiness, and the 10 films which elicited the highest intensity and discreteness ratings for sadness were selected as happy and sad stimuli, respectively, for use as the empathy-inducing stimuli in the subsequent psychophysiological studies. The 10 films which elicited the lowest intensity ratings for happiness and sadness and the lowest overall (neutral) intensity ratings were selected as neutral stimuli for the psychophysiological studies. Table 1.1 shows intensity and discreteness scores for the 30 films selected.

Results of independent samples t-tests indicate that happy and sad films did not differ with respect to target emotion intensity ratings ($t_{(18)}$=1.0, *ns*), though the film types did differ with respect to discreteness ratings. Specifically, happy films were significantly more emotionally discrete than sad films, $t_{(18)}$=6.4, p<.001 (two-tailed).

Discussion

Overall, the results from pilot testing the empathy-inducing film stimuli were quite promising, in that films were identified that elicited the specific emotions of happiness and sadness in viewers, as well as neutral comparison films which elicited low levels of emotion for use in the study of the psychophysiology of empathy. For the selected films, intensity and discreteness ratings for happiness and sadness were quite

high, indicating their ability to elicit those distinct emotions. It was unfortunate to find significantly lower discreteness ratings for the sad films compared to the happy films, but this is likely reflective of the choice of emotion descriptors in the PFQ, as opposed to the failure of the films to elicit pure sadness in viewers. Specifically, the PFQ included four negative emotion terms (anger, fear, sadness, and confusion), but only one positive emotion term (happiness). Given how discreteness is calculated, it is likely that the mere presence of a larger number of negative emotions would yield lower discreteness ratings for negatively-valenced compared to positively-valenced films. Future use of the PFQ will take this confound into consideration.

Experiment 2: Measuring the Timing of Experienced Emotion

A vast majority of research investigating acoustic startle reflex uses IAPS pictures as emotional stimuli, and therefore, times startle probe delivery in relation to film onset. However, contrary to the still nature of IAPS pictures, which are assumed to elicit emotion immediately upon presentation (e.g., Bradley & Lang, 2000b), films are dynamic and unfolding and may not elicit emotion as quickly as still pictures. As such, it was necessary to determine the timing of emotional responses to the emotional films selected in the previous study so that startle probes could be presented and psychophysiological measures obtained after it was clear that the target emotion was being experienced.

Method

Participants

Participants were 39 undergraduates (21 female and 18 male) recruited from the University of Arizona introductory psychology participant pool. Participants were between the ages of 18 and 26 years (M=18.8, SD=1.5), and 69%, 15% and 8% reported being Caucasian, Asian, and Hispanic, respectively. All participants were fluent in English, had normal or corrected-to-normal vision, and received course credit for their participation.

Materials and Measures

Emotional Films. Film clips consisted of the 20 happy and sad films selected from Experiment 1. Films were brief (7-20 seconds; M=13.4, SD=4.1), sound-free, and depicted an individual or individuals having discretely happy or sad emotional experiences. 'Peak' emotion times for neutral films were not assessed because those films had been previously rated as eliciting little to no emotion in viewers.

Emotional Ratings Dial. A computerized version of an affect rating meter (Ruef & Levenson, 2007) was employed to continuously measure participants' subjective emotional experience while viewing the film clips. The affect rating meter consisted of a dimensional scale ranging from 0 (very happy) to 8 (very sad), with 4 (neutral) as the midpoint, presented on the computer screen directly below the film as it was playing. Participants were instructed to use the computer mouse to slide the cursor across the rating scale as often as necessary to indicate their current emotional state, using any of the numbers or points in between. The position of the cursor along the scale was recorded every 10 ms.

Procedure

Participants were tested individually in an experimental session lasting approximately 30 minutes. After obtaining informed consent, participants were seated in a dimly lit room and told that they would be viewing and rating brief emotional film clips. Digital film clips were displayed on 19" computer monitor approximately 2 feet from the participant, controlled by a computerized script. Immediately prior to each film's onset, computerized instructions were displayed, indicating the emotional valence of the upcoming film clip (either happy or sad) and reminding participants to rate the amount of happiness or sadness they experienced as they watched the film. Films were presented in blocked, randomized order so that no more than two films of each type were presented consecutively. While the film clips were playing, participants made continuous ratings of their emotional experience using the affect rating meter described above. Participants then viewed 10 seconds of blank screen before the next film was presented. This procedure was repeated until all of the clips were presented and rated.

Results

'Peak' emotion for each participant was calculated as the time in the film when his or her emotion rating reached 50% of his or her maximum emotion rating. 'Peak' emotion for each film was then calculated by averaging the peak emotion ratings for all participants. For all films, film peak emotion times ranged from 2.5 to 5.7 seconds after film onset (M=3.86, SD=0.86). Proportionally, they occurred at a time that was 30.9% (SD=9.1) the length of the films. Happy and sad films had mean peak emotion times of 3.5 (SD=0.86) and 4.2 seconds (SD=0.70) respectively. Although peak emotion occurred significantly later in sad films compared to happy films ($t_{(18)}$=2.2, p<.05, two-tailed),

film types did not differ with respect to the proportional timing of peak emotion, that is, when peak emotion occurred as a function of overall film length, ($t_{(18)}$=0.04, *ns*, two-tailed; *Ms*=31.0% and 30.8% for happy and sad films, respectively).

To determine startle probe timing for the neutral films, 'peak' emotion was established by randomly assigning peak emotion times from half of the happy and sad films. Mean peak emotion for neutral films was 3.2 seconds (*SD*=1.7), which did not differ significantly from peak emotion in happy or sad films (t's$_{(18)}$<1.7, *ns*, two-tailed).

Discussion

A computerized version of an affect rating meter was utilized to continually measure the emotional experience of participants as they viewed films selected as empathy-inducing stimuli, in order to determine the correct timing of startle probes in the upcoming psychophysiological study. Results indicate that the affect rating meter was able to measure the timing of emotional experience and 'peak' emotion was determined based on average ratings of emotional intensity.

Experiment 3: Psychophysiological Measurement of Empathy

As described in the general introduction, this experiment was conducted to develop and validate an objective measure of empathy using psychophysiological indices of emotional experience.

Method

Participants

Participants were 43 female and 56 male undergraduate student volunteers recruited from a pool of students taking Introductory Psychology courses at the University of Arizona. All participants were fluent in English, healthy, had normal or corrected-to-normal hearing and vision, and were not currently taking any psychotropic medications. Participants were selected into high and low empathy groups based on their scores on a self-report measure of trait empathy. Participants received course credit or monetary compensation for their participation. Data from 4 (2 female, 2 male) participants were lost due to equipment failure during data collection, 4 participants (1 female, 3 male) were excluded because they were determined to be non-startlers (i.e., they demonstrated fewer than five valid startle trials within a film type) and 32 (14 female, 18 male) participants were excluded because they exhibited high amounts of psychopathic traits, as defined by scoring above the 75th percentile on the Psychopathic Personality Inventory- Revised (PPI-R; Lilienfeld & Widows, 2005). This resulted in a final sample of 59 participants (26 female, 33 male) who were between the ages of 18 and 36 (M=19.8, SD=3.3) and 69%, 12%, and 3% reported being Caucasian, Hispanic, and Asian, respectively.

Stimulus Materials

Empathy-inducing stimuli consisted of the 30 emotional films chosen in Experiment 1, plus 24 distractor films included to allow for randomization of startle probe timing and occurrence. Distractor films were identical to manipulation films with respect to length and highly similar in content. Films were brief (4-20 seconds; M=11.7,

SD=4.5), sound-free, and depicted an individual or individuals having a discretely happy, sad, or neutral emotional experience. Individuals in the films were diverse with respect to sex, age and ethnicity. The 54 films presented during the study included 18 films of each type (happy, neutral, sad), with 10 manipulation films and 8 distractor films per film type. Films were presented via a freely-available stimulus delivery and recording software program (DMDX; available at http://www.u.arizona.edu/~jforster/dmdx.htm) in blocked, randomized order such that there were equal numbers of films of each type within each block, with no more than two films of the same valence appearing consecutively.

Startle stimuli consisted of 50ms bursts of 95dB white noise with instantaneous rise time presented binaurally via Telephonics TDH-39P headphones. For the 30 manipulation films, startle probes were delivered pseudorandomly at 2, 2.5, 3.5 or 4.5 seconds after 'peak' emotion (as determined in Experiment 2) occurred (*M*=6.99, *SD*=1.71); startle probes occurred at these intervals equally across film types. Given that startle probes to manipulation films generally occurred later in the films to allow for 'peak' emotion to develop, startle probes were delivered early in 14 of the distractor films to increase the unpredictability of startle probes. For these films, startle probes occurred 1, 1.5, or 3.5 seconds after film onset. To further increase unpredictability, 10 distractor films were included in which no startle probe was presented. Startle probes were not presented during inter-trial intervals.

Self-Report Measures

Interpersonal Reactivity Index (IRI). Students in introductory psychology courses at the University of Arizona were administered, during a mass-survey session, the IRI

(Davis, 1983), a self-report multidimensional measure of dispositional empathy. The IRI requires respondents to rate each of the 28 items on a 5-point Likert scale (0- does not describe me well to 4- describes me very well). The IRI is divided into four 7-item subscales, each tapping a separate aspect of the global construct of empathy; these subscales have been found to be uniquely associated with a number of traits and emotional responses theoretically linked to empathy (Davis, 1983; Davis, Hull, Young, & Warren, 1987). The Perspective-Taking (PT) subscale measures the tendency to adopt the psychological point of view of others; the Empathic Concern (EC) subscale assesses other-oriented feelings of sympathy, compassion, or concern for unfortunate others; the Personal Distress (PD) subscale measures self-oriented feelings of personal unease in response to the distress of others; and the Fantasy (FS) scale assesses the tendency to transpose oneself imaginarily into the feelings and actions of fictitious characters in books, movies, and plays. Overall, the IRI subscales have adequate internal reliabilities (α=.71-.77) as well as test-retest reliabilities ranging from .62-.71 (Davis, 1983). For this study, the IRI total score and the PT and EC subscales were examined, given their correspondence with theoretical definitions of cognitive and affective empathy, respectively. Test-retest reliabilities for Total, PT and EC scores ranged from .81-.90 over the course of this study (from initial screening to test session administration).

The IRI was used to screen potential participants into High and Low empathy groups. A total of 682 participants (424 females, 258 males) completed the IRI and comprised the norming sample for determining high and low empathy cutoff scores. Because females scored significantly higher than males on this measure ($t_{(680)}$=9.1,

$p<.001$, two-tailed), participants were selected based on how they scored compared to individuals of their same sex. Specifically, individuals in the top or bottom 10 percentiles for their sex comprised the high and low empathy groups, respectively. For males, this included individuals with IRI total scores above 75 (High; *M*= 80.6) or below 46 (Low; *M* =35.6). For females, this included individuals with IRI total scores above 84 (High; *M*=89.7) or below 55 (Low; *M*=46.3). In addition to having total scores in the appropriate range, participants were only selected if their PT and EC subscale scores were in the top or bottom third for their sex on each of the subscales. This ensured that participants not only had high or low levels of empathy overall, but had consistently high or low levels of cognitive and affective empathy as well.

Self-Assessment Manikin (SAM). The SAM (Lang, 1980) is a non-verbal pictorial measure that allows participants to report their subjective emotional experience in response to affective stimuli, consisting of ordinal scales for ratings of emotional valence and arousal. For each dimension, SAM depicts five graphic figures and participants can select any of the figures or between the figures, resulting in a 9-point scale. For valence, the graphic ranges from a frowning, unhappy figure (a score of 1[1]) to a smiling, happy figure (a score of 9). For arousal, the graphic ranges from a relaxed sleepy figure (a score of 1) to an excited wide-eyed figure (a score of 9). Participants indicate feeling neither happy nor unhappy and neither calm nor aroused using the midpoint of each scale (a

[1] Participants actually rated SAM valence and arousal in the opposite direction (1= most pleasant, 9= most unpleasant), but this was later reversed for data analysis purposes to remain consistent with the literature.

score of 5). SAM ratings have been found to reliably correlate with physiological responses to images, with ratings of valence negatively correlating with corrugator EMG activity and positively correlating with zygomatic EMG activity (e.g., Lang, Greenwald, Bradley, & Hamm, 1993). Participants completed a computerized version of the SAM measuring valence and arousal immediately following each film clip. For each film, participants were instructed to rate their own experience of valence and then their level of emotional arousal, as well estimate the experienced valence and arousal of the individual(s) depicted in the film (referred to herein as Perceived Others) using the SAM.

Marlowe-Crowne-13 (MC-13). The *MC-13* (Reynolds, 1982) is a 13-item true-false measure designed to assess socially desirable response tendencies. The *MC-13* is a shortened version of the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960), both of which have been extensively researched and found to have high internal consistency and test-retest reliability (e.g., Crowne & Marlowe, 1960; Reynolds, 1982; Silverstein, 1983). Social desirability was measured to help determine whether differences in empathic responding were mediated by participants' propensity to succumb to demand characteristics in the experimental paradigm.

Psychopathic Personality Inventory-Revised (PPI-R). The PPI-R (Lilienfeld & Widows, 2005) is a 154-item self-report measure designed to assess the core personality features of psychopathy in non-criminal populations. Respondents rate themselves on each item using a 4-option (false, mostly false, mostly true, true) Likert-type format. The PPI provides a global index of psychopathy, consisting of eight subscales measuring various facets of the construct and three validity scales designed to measure the validity

and reliability of responses. The PPI has been shown to demonstrate good test-retest reliability as well as convergent validity with other self-report and observer measures of psychopathy and related traits in both undergraduate and criminal samples (e.g., Lilienfeld & Andrews, 1996; Sandoval, Hancock, Poythress, Edens, & Lilienfeld, 2000). The PPI-R was used in the current study to screen out participants who reported high levels of psychopathic traits, as these traits are believed to be associated with abnormal emotional processing and low levels of empathy (e.g., Hare, 1998; Patrick, et al., 1993). Participants scoring above the 75th percentile on the PPI-R (based on age, sex and sample norms obtained from the test manual) were excluded from analyses, which resulted in the exclusion of 14 females and 18 males.

Procedure

All participants were tested individually in a single experimental session lasting approximately 2 hours. Informed consent was obtained at the beginning of the session. Participants were seated in an upright lounge chair located approximately 3 feet in front of a 19" computer monitor, in a temperature-controlled, sound-insulated, dimly lit room. Participants were told that they were participating in an experiment investigating undergraduates' reactions to film clips that will later be used in advertising campaigns. They were told that their emotional reactions to the films could be measured via sweat activity on their face (e.g., Lundqvist & Dimberg, 1995) and HR, in addition to their self-reported emotions. By concealing the true purpose of the empathy investigation and facial muscle activity measurement, we hoped to reduce any bias in self-reported emotion as well as subjects' conscious control of their facial expressions. After electrodes were

attached and signals were checked, participants were fitted with headphones, watched computerized instructions, and completed four practice film trials to ensure they were comfortable with the rating procedure. Startle probes were presented during each of the practice films to allow for habituation of the startle response.

Following the practice trials, participants completed the film viewing task which was divided into two approximately equal segments, with a short break in between to allow participants to stretch their legs and remain alert. Each film trial consisted of presentation of a fixation cross 1.5 seconds prior to film onset, film clip presentation, 1 second of blank screen following film offset, and presentation of SAM valence and arousal scales for self and Perceived Others. SAM ratings were made in counter-balanced order, whereby during the first segment of the film-viewing task, half of the participants rated their own valence and arousal first while the other half rated Perceived Other valence and arousal first. The orders were reversed for the second segment of the film task. Upon completion of all SAM ratings for the film, there were 6 seconds of blank screen, followed by the next film trial.

After all film clips were presented, electrodes were removed and participants were seated at a desk in a neighboring room and asked to complete the PPI-R, MC-13, and IRI. These measures were administered at the end of the experiment to minimize the risk of their behavioral responses during film viewing being influenced by the measures. Following completion of the questionnaires, participants were fully debriefed and thanked for their participation.

Physiological Recording and Data Reduction

Facial EMG responses to film stimuli were measured by bipolar recording of the activity of the left corrugator supercilii and zygomatic major muscles in accordance with guidelines outlined by Fridlund & Cacioppo (1986). Two 4mm Ag-AgCl surface electrodes filled with conductive gel were placed on cleaned and lightly abraded skin approximately 1cm apart at each muscle site with a common ground electrode attached to the midline of the forehead. For the corrugator muscle, one electrode was placed directly above the brow in line with the inner eye fissure, and the other electrode was placed approximately 1cm lateral and slightly superior to the first. For the zygomatic muscle, one electrode was placed midway along the imaginary line between the corner of the mouth and the preauricular depression, with the other electrode approximately 1cm inferior and medial to the first (Fridlund & Cacioppo, 1986). Startle eyeblink responses to film stimuli were measured by bipolar recording of the activity of the left obicularis occuli muscle in accordance with guidelines outlined by Blumenthal and colleagues (2005). Specifically, a 4mm Ag-AgCl electrode was placed below the left eyelid in line with the pupil in forward gaze, and a second electrode was placed 1-2 cm lateral to the first. HR was measured using 4mm Ag-AgCl electrodes on the left and right forearm, midway between the elbow and the wrist. All raw physiological signals were sampled continuously at a rate of 5000 Hz, amplified with a SynAmps2 amplifier in AC mode, notch filtered at 60 Hz, and bandpass filtered prior to digitization (high-pass filter set at .5 Hz, low-pass filter set at 1000 Hz).

Corrugator and zygomatic EMG signals were high-pass filtered offline at 12 Hz, full-wave rectified, epoch-locked to include only the 1 sec before and 1.9 sec following

'peak' emotion for each film, and EMG signal was averaged over this epoch. The 1.9 second post-peak emotion epoch was chosen in order to avoid any potential overlap with startle probes, as films varied with respect to the length of time between peak emotion and startle probe delivery. These averages were then ln-transformed to ensure a normal distribution and standardized within-subject using a *z*-transformation to correct for individual differences in the overall magnitude of facial expressiveness. *Z*-scores were then averaged within each film type to yield an EMG score for each film type at each muscle site.

Obicularis EMG signal was high-pass filtered offline at 12 Hz, full-wave rectified, then smoothed with a 40 Hz low-pass filter. Startle responses were identified using a peak detection program that identified the maximum value in the 30-180 ms window following startle probe presentation. Outlier startle responses were identified as any response greater than 2 *SD* above the mean startle response for each participant. Startle peaks, minus any outlier trials, were then ln-transformed and standardized within-subject using a *z*-transformation to correct for individual differences in startle reactivity. Startle magnitudes were calculated by averaging these *z*-scores of all startle trials within films of each type to yield an overall startle magnitude for each film type. As stated earlier, participants who exhibited fewer than five valid startles in any film type were designated as non-startlers and excluded from all analyses.

The ECG signal was digitally low pass filtered (100 Hz 96 dB per octave) and decimated to a sampling rate of 500 Hz, then imported to QRSTool (Allen, Chambers, & Towers, 2007) to identify each beat using the algorithms in QRSTool, after which all

interbeat interval series were examined and corrected by hand to ensure accuracy. Film-related HR was then derived by averaging the IBIs during the time window from film onset to startle onset and then converting each average IBI to HR. The HR value for each film was then *z*-transformed within-subjects to correct for individual differences in resting HR; these *z*-scores were finally averaged within film type to yield an overall HR *z*-score for each film type. Data for 2 high empathy male participants were lost due to technical difficulties with the ECG signal during recording.

Data Analysis

Analyses consisted of separate 3 (Film Type: happy, neutral, sad) X 2 (Empathy: high, low) mixed model ANOVAs with film type as a within-subjects factor, and each behavioral rating or physiological measure as the dependent variable. To correct for violations of sphericity, the Greenhouse-Geisser correction for degrees of freedom was adopted for all ANOVAs; reported *p*-values reflect this correction. Because all physiological variables were within-subject *z*-scores with a mean of zero for all subjects, main effects for Empathy could not be computed and are not reported here. For all significant main effects, pairwise comparisons were conducted to examine the nature of differences across film types. When significant Film Type by Empathy interactions were encountered, pairwise comparisons were conducted across empathy groups to determine the nature of the interaction. In instances where variances differed significantly across groups (Levene's test for equality of variances were significant), pairwise comparisons were reported with degrees of freedom and significance values for 'equal variances not assumed' paired samples *t*-tests.

Because of established sex differences in self-reported affect and emotional expressiveness (e.g., Bradley & Lang, 2000b) as well as sex differences in IRI scores among participants in this study, all analyses were also conducted including sex as a second between-subjects factor. Results of analyses with sex as a factor were only reported when significant main effects and/or interactions were detected.

Results

Film Ratings

Table 1.2 shows all means and standard deviations for the film ratings variables. As expected, a main effect of film type on self-report affective valence ratings showed that happy films were rated as most pleasant, sad films were rated as least pleasant, and neutral film ratings fell in between, $F(_{2, 114})$=176.85, p<.001, ε=.61, η_p^2=.76. This main effect was qualified by a 2-way Film Type by Empathy interaction, $F(_{2,114})$=7.01, p<.01, η_p^2=.11. As illustrated in Figure 1.1, compared to low empathy participants, high empathy participants rated sad films as less pleasant (i.e., more sad), $t(_{54.4})$=3.65, p<.001, and happy films as more pleasant, $t(_{56.8})$=1.98, p=.053. High empathy individuals thus showed stronger self-reported affective responses to the happy and sad films, compared to low empathy individuals.

There was a significant main effect for self-reported arousal in response to the films, $F(_{2, 114})$=47.32, p<.001, ε=.97, η_p^2=.45. Happy films were rated as more arousing than both neutral ($t(_{58})$=10.92, p<.001) and sad ($t(_{58})$=3.99, p<.001) films, and sad films as more arousing than neutral films ($t(_{58})$=5.80, p<.001). Thus, while the emotional films were more arousing than the neutral films, the happy films were viewed as the most

arousing. There was not a Film Type by Empathy interaction, suggesting that despite the high empathy participants' greater reported emotional valence, the groups were equally emotionally aroused by the films.

On ratings of the perceived valence and arousal experienced by the individuals depicted in the films, a significant main effect of film type on Perceived Other Valence ratings occurred. Happy films were rated as most pleasant and sad films as least pleasant for the Perceived Others, $F_{(2,114)}$=1942.70, p<.001, ε=.74, η_p^2=.97. Arousal ratings for Perceived Others showed a similar main effect as with the self ratings, with happy films rated as the most arousing, and neutral films as the least arousing for the Perceived Others, $F_{(2,114)}$=59.71, p<.001, ε=.79, η_p^2=.51. As with the self-arousal ratings, Perceived Other arousal for happy films was higher than arousal for sad films, t(58)=6.46, p<.001. There were no Film Type by Empathy interactions for Perceived Other Valence or Perceived Other Arousal. These findings suggest that participants, regardless of their trait empathy levels, are equally able to identify the emotional states of others.

Paired samples comparisons of Self and Perceived Other Valence ratings demonstrate that overall, participants rated the emotional experience of the individuals in the films as stronger than their own. In particular, compared to self ratings, pleasantness ratings were significantly higher for others in happy films ($t_{(58)}$=16.36, p<.001, M's=6.46and,8.40 respectively) and lower for others in sad films ($t_{(58)}$=15.89, p<.001, M's=3.45 and,1.87 respectively) and neutral films ($t_{(58)}$=3.00, p<.01, M's=4.81 and 4.66, respectively). Using self-other valence difference scores as the dependent variable, a main effect for Film Type emerged, $F_{(2,114)}$=310.7, p<.001, ε=.68, η_p^2=.85. Overall, the

absolute values of difference scores demonstrate that self-other valence differences were largest for happy films (*M*=1.9, *SD*=.91) and smallest for neutral films (*M*=.15, *SD*=.38), with sad films falling in between (*M*=1.6, *SD*=.76).These scores all differed significantly from one another (*t*'s($_{58}$)=3.4–13.4, *p*'s<.001). This main effect was qualified by a Film Type by Empathy interaction, $F(_{2,114})$=5.2, *p*<.05, η_p^2=.08. As illustrated in Figure 1.2, low empathy participants exhibited larger self-other difference scores compared to their high empathy counterparts, particularly with respect to sad films, $t(_{57})$=3.52, *p*<.001, suggesting that higher levels of empathy are associated with more similar emotional experiences to observed sadness in others. However, although viewing emotional others leads to similar emotional states in viewers, it is appears to be less contagious with respect to happiness and more contagious with respect to sadness.

Facial EMG

Table 1.3 contains all group means and standard deviations for the psychophysiological variables.

Corrugator. There was a main effect of film type for corrugator EMG activity, $F(_{2,114})$=38.38, *p*<.001, ε=.92, η_p^2=.40. Responses of the corrugator muscle were significantly greater for sad films than happy ($t(_{58})$=8.64, *p*<.001) and neutral ($t(_{58})$=2.24, *p*<.05) films. In addition, corrugator EMG responses to happy films were significantly smaller than for neutral films ($t(_{58})$=5.83, *p*<.001). Contrary to expectations, no Film Type by Empathy interaction was found.

Zygomatic. There was a main effect of film type for zygomatic EMG activity, $F(_{2,114})$=5.83, *p*<.005, ε=.98, η_p^2=.09, and this was qualified by a marginal Film Type by

Empathy interaction, $F_{(2,114)}=2.81$, $p=.07$, $\eta_p^2=.05$. Pairwise comparisons demonstrated that for the high empathy group, happy films elicited significantly larger zygomatic responses than both neutral ($t_{(34)}=3.39$, $p<.005$) and sad ($t_{(34)}=4.66$, $p<.001$) films, while there were no significant differences in zygomatic activity across film types for the low empathy group (all t's<1). Moreover, the high empathy group exhibited significantly larger zygomatic responses to happy films than the low empathy group, $t_{(41.1)}=2.14$, $p<.05$. As illustrated in Figure 1.3, zygomatic responses did not differ across groups for neutral or sad films. However, these effects are qualified by a Film Type by Sex interaction ($F_{(2,110)}=3.65$, $p<.05$, $\eta_p^2=.06$) and a Film Type by Empathy by Sex interaction ($F_{(2,110)}=8.74$, $p<.001$, $\eta_p^2=.14$). Pairwise comparisons suggest that low empathy males show different patterns of zygomatic EMG activity than both low empathy females and high empathy males. Specifically, compared to low empathy females, low empathy males exhibit less zygomatic activity when viewing happy films ($t_{(22)}=4.48$, $p<.001$) and more zygomatic activity when viewing neutral ($t_{(22)}=2.23$, $p<.05$) and sad ($t_{(22)}=2.03$, $p=.06$) films, as shown in Figure 1.4. High empathy males and females do not differ in their zygomatic responses across all film types. As illustrated in Figure 1.5, low empathy males also differ from high empathy males by exhibiting less zygomatic activity to happy films ($t_{(31)}=5.07$, $p<.001$) and more zygomatic activity to neutral films ($t_{(31)}=2.88$, $p<.01$. High and low empathy females do not differ from each other. Thus, it appears that low empathy males are the group responsible for the interaction with respect to zygomatic activity, in that they show significantly diminished

smile responses to the happy films, compared to high empathy participants as well as low empathy females.

Film-Related Heart Rate

Overall, heart rate varied by film type, $F_{(2,110}$[2]$)=8.66$, $p<.001$, $\varepsilon=.995$, $\eta_p^2=.14$, with sad films eliciting significantly lower heart rates than happy ($t_{(56)}=3.66$, $p<.001$) or neutral ($t_{(56)}=3.91$, $p<.001$) films. Although analyses were conducted with *z*-transformed HR, mean raw HR's were as follows: 74.3 (*SD*=10.5), 74.4 (*SD*=10.9), and 73.5 (*SD*=10.8) for happy, neutral and sad films respectively. No Film Type by Empathy interaction was found.

Startle Magnitude

There was a significant main effect of film type on startle magnitude, $F_{(2,114)}=6.12$, $p<.005$, $\varepsilon=.88$, $\eta_p^2=.10$. This was qualified by a marginal Film Type by Empathy interaction, $F_{(2,114)}=3.02$, $p=.06$, $\eta_p^2=.05$. While the low empathy group did not exhibit any differences in their startle magnitude across film types (all *t*'s<1), the high empathy group demonstrated significantly potentiated startle responses to happy films compared to both neutral ($t_{(34)}=2.42$, $p<.05$) and sad ($t_{(34)}=4.57$, $p<.001$) films. High empathy individuals also showed significantly inhibited startle responses to sad compared to neutral films ($t_{(34)}=2.17$, $p<.05$). As illustrated in Figure 1.6, compared to the low empathy group, the high empathy group showed significantly larger startle responses to

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[2] Two high empathy participants did not have complete film-related heart rate data due to technical problems with the EKG leads during data collection, and were excluded from the HR analyses.

happy films ($t_{(57)}$=2.08, p<.05) and significantly smaller startle responses to the sad films ($t_{(57)}$=2.07, p<.05). High empathy participants demonstrated a pattern of greater startle modulation across film types, which is suggestive of greater emotional response to the films.

IRI Total and Subscale Scores

In addition to analyzing the data using IRI total score as a grouping variable, correlations were examined among IRI total and subscale scores with the behavioral ratings and physiological variables discussed above. Table 1.4 displays correlations between IRI scores and self-report and psychophysiological variables for happy (Panel A) and sad (Panel B) empathy-inducing films. For happy films, SAM valence ratings were significantly positively correlated with IRI Perspective-Taking (PT) and Empathic Concern (EC) subscale scores. This indicates that higher levels of self-reported cognitive and affective empathy are associated with increased feelings of pleasantness when viewing others having happy emotional experiences. For sad films, SAM valence ratings were significantly negatively correlated with IRI total score and both PT and EC subscale scores. This indicates that higher levels of overall self-reported empathy, cognitive empathy and affective empathy are associated with lower reported feelings of pleasantness (or greater unpleasantness) when viewing others having sad emotional experiences. With respect to psychophysiological variables, there was a significant positive correlation between zygomatic EMG activity in response to happy films and IRI total score, as well as PT and EC subscale scores. This suggests that higher levels of trait empathy, cognitive empathy, and affective empathy are associated with greater smiling

when viewing others having happy emotional experiences. There was also a significant positive correlation between startle magnitude when viewing happy films and IRI total, PT and EC scores. There were marginally significant negative correlations between startle magnitude when viewing sad films and PT (r=-.24, p=.06) and EC (r=-.23, p=.08) subscale scores. These suggest that higher levels of trait empathy, as well as the subcomponents of perspective-taking and empathic concern, are associated with greater modulation of the startle response.

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[3] Social desirability responding, as assessed by Marlowe-Crowne score, was entered as a covariate in all of the above analyses. However, it was found to be a significant covariate in only one dependent variable: startle magnitude, $F_{(1,56)}$=5.51, p<.05. It should be noted, however, that in this instance, Marlowe-Crowne score did not diminish the significance of the Film Type by Empathy interaction. Marlowe-Crowne score was not found to interact with film type in any of the analyses run, suggesting that desirability responding is not accounting for the observed effects.

[4] Because the low empathy group was significantly older than the high empathy group (Ms=21.13, 18.91), $t_{(57)}$=2.68, p<.05, age was entered as a covariate in all of the above analyses to assess whether accounting for age eliminated effects of interest. Age was found to be a significant covariate for only one dependent variable: self-reported arousal ($F_{(1,56)}$=4.79, p<.05). However, given that there was no Film Type by Empathy interaction for arousal, the impact of age as a covariate is negligible. Age was not found to interact with film type in any of the analyses, suggesting that the age of participants is not accounting for the observed effects.

Discussion

Emotion Ratings

This study sought to develop a set of stimuli that reliably elicits an empathic response. Valence and arousal ratings for the individuals depicted in the films demonstrate participants' ability to recognize their emotional states, and self-reported valence ratings demonstrate the films' ability to elicit these same emotions, insofar as the films depicting happy individuals elicited the highest pleasantness ratings, the films depicting sad individuals elicited the lowest pleasantness ratings, and the neutral films had pleasantness ratings that fell in between the two. As expected, Perceived Others were rated as having more intense emotional experiences than study participants, although this varied somewhat with respect to film type. Concordant emotional experience, measured by self-other ratings difference score, was more likely in sad films and less likely in happy films. This suggests that it is easier to elicit empathic sadness than empathic happiness in response to emotional films.

As anticipated, the emotional films elicited higher levels of self-reported arousal than the neutral films, with happy films rated as the most arousing. In this study, as in past research with still pictures (e.g., Bradley & Lang, 1994), depictions of happiness and joy are associated with larger amounts of self-reported arousal than pictures of sad individuals, suggesting that happiness is a more arousing emotion than sadness. This is supported by the Perceived Other arousal ratings, which reveal a more pronounced arousal effect for the individuals in the film, who are believed to be experiencing these emotions firsthand.

Overall, high empathy participants' tendency to report experiencing higher levels of the target emotions and demonstrate smaller differences in self versus other rated emotion, and the significant correlations between valence ratings for the films and IRI total and subscale scores all support the notion that the films are eliciting an empathic response in viewers, particularly in those individuals who have high trait levels of empathy.

Facial EMG

In addition to subjective reports, the more objective measures of corrugator and zygomatic EMG activity also establish the films' effectiveness at eliciting empathic emotion. Specifically, participants' facial expressions while watching the emotional films denote a significant degree of facial mimicry. Overall, participants displayed increased frowning when viewing sad films and increased smiling in response to happy films. Modulation of the smiling response was especially prominent in high as compared to low empathy participants, suggesting that for happiness, dispositional empathy is related to the degree of facial mimicry exhibited. Furthermore, and consistent with theories of the development of empathic emotion (e.g., Basch, 1983; Davis, 1996), participants' facial expressions corresponded with their reported emotional states. This is particularly true of high empathy individuals who both rated happy films as more pleasant and displayed more smiling to these films.

Of interest, low empathy males exhibited an anomalous pattern of facial expressions, with increased smiling activity to neutral and sad films, as opposed to happy films. Such activity suggests that these participants exhibited a distinct lack of facial

mimicry in that their facial expressions were discordant with those of the individuals in the film, despite subjective reports of similar (albeit less intense) emotion. This failure to exhibit smile responses to happy films may be a function of males' general tendency to be less emotionally expressive (e.g., Bradley, 2000), although this is not the case for the high empathy males. Perhaps it is the combination of low expressivity and low dispositional empathy that is particularly salient with respect to one's ability to engage in smiling mimicry.

With respect to frowning mimicry, unfortunately, despite high empathy participants' greater reported sadness, their frown responses when viewing sad films did not significantly differ from those of the low empathy group. It is clear that corrugator EMG was an appropriate measure for assessing empathic emotion because there was significant modulation of corrugator activity across film types for all participants, including a marked contraction of the brow to sad films and a significant relaxation of the brow to happy films. However, it is unclear why high and low empathy participants were not distinguished based on their corrugator activity. It is questionable whether these sad films were of sufficient intensity to evoke the degree of sadness necessary for significant variations in corrugator response over and above some minimal contraction of the muscle, which is consistent with the findings of lower reported arousal to sad as compared to happy films. Recent work suggests that compared to high empathy individuals, low empathy individuals show diminished corrugator EMG activity in response to films of animals and humans in distressing situations, particularly of a physically painful nature (Westbury & Neumann, 2008). This provides support for the

notion that the corrugator muscle may be an appropriate measure for assessing negative empathic emotions, although more work is needed to establish its validity with respect to sadness in particular.

Heart Rate

As expected, significantly lower HR was seen in response to the sad films. This is consistent with a sympathetic response (Eisenberg, et al., 1991) as well as an outward orientation in viewers (Lacey, et al., 1963), perhaps due to a shift in attention away from oneself and towards a distressed individual (e.g., Zhou, et al., 2003). Unfortunately, no significant differences between high and low empathy participants emerged with respect to HR changes, suggesting that HR may not be the most discriminating measure with respect to varying levels of empathic responding. This is supported by past research, which also failed to find a relationship between dispositional empathy and HR deceleration to sympathy-inducing stimuli despite clear evidence overall of the stimuli's effects on HR (e.g., Eisenberg, et al. 1991, 1994). Perhaps HR is sensitive enough to differentiate emotions within participants, but not levels of emotional responses between participants due to the many other factors that may vary across individuals, such as body weight, fitness level, and respiration (Bradley, 2000).

Startle Response

As predicted, there was evidence of significant startle modulation across film types, though this modulation occurred only in the high empathy group. In these individuals, startle responses were inhibited to sad films and potentiated to happy films, compared to neutral. This suggests that high empathy participants were more emotionally

affected by the films to the extent that their experienced emotion was strong enough to activate their motivational priming system. The significantly inhibited startles to sad films are suggestive of approach motivation, perhaps in the direction of helping the distressed individuals in the films (e.g., Hess, et al., 2007; Spangler, et al., 2001). This is further supported by the finding that startle inhibition to sad films was only evident among the high empathy group, as higher levels of dispositional empathy are expected to produce greater empathic sadness, as well as enhance one's willingness to help needy others (e.g., Eisenberg, et al., 1989).

Contrary to expectations, however, these same high empathy participants demonstrated potentiated startle eyeblinks to happy films. Inhibition of the startle response to pleasant emotional stimuli has been widely documented in the general emotion literature (e.g., Bradley & Lang, 2000b), although this effect does not appear to generalize to pictures of happy facial expressions (e.g., Alpers & Adolph, 2006; Hess, et al., 2007; Spangler, et al., 2001). Although it is possible that this failure to obtain startle inhibition to positive emotional faces is due to insufficient emotional intensity in static stimuli, it is plausible that other factors are at play. Two areas that warrant further investigation in this regard are arousal and mentation.

In general, increasing amounts of arousal to emotional stimuli further facilitate the affective modulation of the startle reflex, such that greater reductions in startle magnitude are generally associated with highly arousing pleasant stimuli (Bradley, 2000). However, some research has found evidence of enhanced startle to highly arousing emotional stimuli, regardless of valence (e.g., Witvliet & Vrana, 1995; see also Cook, Hawk, Davis,

& Stevenson, 1991). This has been explained as a function of one's engagement in emotional responses, in that active engagement is thought to render startle more sensitive to arousal than valence (Lang, Bradley, & Cuthbert, 1997). In support of this view, Dillon and LaBar (2005) found that when participants were instructed to enhance their emotional responses to positive IAPS pictures, they exhibited larger startle magnitudes than when they were given no instructions, or were asked to maintain or suppress their emotion. Upon debriefing, participants reported that their enhancement strategies typically included imagining themselves in the scenes, which presumably led to greater amounts of emotional engagement, more arousal, and hence, increased startle responses. Witvliet and Vrana (1995) also found evidence to suggest that highly arousing positively-valenced mental imagery can lead to startle potentiation. In particular, they found that participants displayed similar startle magnitudes when asked to imagine themselves in high arousal joyful situations as well as less arousing sad situations. These startles were larger than startle responses to pleasant, relaxing situations.

We propose that a similar process was occurring in the present study. Specifically, enhanced mental imagery during happy films is hypothesized to have led to increased arousal, which in turn, increased startle magnitudes. This occurred as the high empathy participants saw the happy individuals in the films, started to experience similar emotions, and perhaps even began to imagine themselves having a similar experience, which then increased not only the pleasantness of their emotional experience, but also the intensity of this emotion, resulting in larger startle responses to the happy films, compared to low empathy participants who did not engage in this mental imagery, as well

as startle responses to neutral films which do not elicit the same degree of emotional experience, arousal, or imagination.

Support for this contention comes from a number of findings in this study. First, happy films were associated with both the greatest amounts of reported arousal and the largest startle responses. Second, potentiated startle was evident only in high empathy participants, and significant positive correlations were found between startle magnitude and IRI total score as well as perspective-taking and empathic concern subscale scores. Lastly, according to Davis (1983) one of the basic components of dispositional empathy is the tendency to transpose oneself imaginarily into the feelings and actions of fictitious characters. This propensity can be measured with the Fantasy subscale (FS) of the IRI. As expected, scores on this scale were significantly higher for high empathy (M=22.9, SD=3.8) compared to low empathy (M=11.6, SD=6.0) participants ($t_{(57)}$=8.9, p<.001, two-tailed). Moreover, FS scores were significantly positively correlated with startle magnitude to happy films (r=.26, p<.05), while scores on the other IRI subscales were not. A test of the difference between dependent correlations (Williams, 1959) revealed that the correlation of FS and startle magnitude to happy films was significantly larger than the correlations of the EC ($t_{(56)}$=2.08, p<.05, two-tailed) and PD ($t_{(56)}$=2.04, p<.05, two-tailed) subscales and startle. Taken together, these findings provide preliminary support for the mentation/arousal hypothesis. Specifically, it appears that a greater propensity to imagine oneself in another's situation, a component of overall trait empathy, might enhance one's empathic emotional response to films of others having joyful emotional experiences, and result in larger startle magnitudes to these films. More

work examining startle responding to happy facial expressions is clearly warranted, as is further research addressing the relationship between facets of trait empathy, positive empathic emotional experiences, and startle modulation.

General Discussion

Overall, these results suggest the promise of this approach for eliciting and measuring empathic emotion. The films were effective at eliciting happy and sad empathic emotion, as represented by subjective reports of emotional experience congruent with film valence, increased corrugator EMG activity to sad films, increased zygomatic EMG activity to happy films, decreased HR to sad films, and affective modulation of the acoustic startle reflex. Moreover, this paradigm was able to differentiate high and low trait empathy individuals with respect to both behavioral ratings and psychophysiological indices of emotional response. In general, high empathy individuals were more emotionally responsive to the empathy-inducing films, as indicated by greater self-reported emotion, increased facial mimicry responses, and enhanced affective modulation of the startle reflex. Overall, significant correspondence was identified between dispositional and situational self-reports of empathy and psychophysiological indicators of situational empathic responses. This congruence between state and trait measures of empathy in varying formats (subjective and objective) provides further evidence of the validity of this paradigm for assessing empathy.

In aggregate, the results of this study suggest the potential for psychophysiological indices of emotional experience to function as objective measures of empathy. The indices used in this study, particularly zygomatic EMG and acoustic startle

reflex, were able to discriminate levels of empathic responding to both happy and sad emotional stimuli to a similar degree as self-report measures in a sample of undergraduates. The physiological measures have advantages however, over self-report in that they are less susceptible to desirability responding and/or conscious distortion. This is especially important in work with criminal offenders and psychopaths, given their propensity to manipulate information to their own benefit (e.g., Hare, 1998). There is an ever-increasing need for objective measures of empathy in offenders to accurately assess the presence and nature of empathy deficits among these individuals. Although many theories abound regarding the role of deficient empathy in criminal offending, few empirical investigations of empathy deficits exist. An objective measure of situational empathic responding, such as the one developed here, has the potential to unlock the mystery of the empathic capabilities of the criminal offender and psychopath. Such a measure would allow an examination of the presence of cognitive, affective, global, or situational empathy deficits in a variety of offender subgroups. This information is critical with respect to forensic clinical research and practice, and can only serve to improve current risk assessment, treatment planning, and violence prevention efforts.

However, while this study has yielded some promising results, there is still considerable work to be done. In particular, this paradigm should be replicated in community samples. Moreover, while the short emotional film clips were sufficient for eliciting empathic emotion in viewers, it is possible that longer films which provide more of a story, such as excerpts from popular films (e.g., Rottenberg, et al., 2007), may prove more evocative in this regard. Finally, the pattern of startle modulation among high

empathy participants warrants further investigation. Given the equivocal findings in the literature with respect to participants' startle responses to happy facial expressions, more research needs to focus on the underlying dispositions and mechanisms that give rise to potentiated startles during pleasant emotional states induced by empathy. We have hypothesized that increased mental imagery due to trait empathy may account for these findings, and recommend that future research paradigms be designed to specifically test this hypothesis.

Finally, and perhaps most importantly, the behavioral correlates of empathic responding were not assessed in this study. In order to definitively determine whether emotional responses to empathy-inducing stimuli are in fact empathic in nature, it is necessary to also measure behavioral outcomes motivated by empathy, such as helping others in need (e.g., Batson, O'Quin, Fultz, Vanderplas, & Isen, 1983; Eisenberg, et al., 1989). This paradigm can not be validated as an objective measure of empathy until it can be proven that the emotional responses measured by these psychophysiological indices actually translate into empathic behavior.

In addition, there are other psychophysiological indices of emotion which demonstrate significant potential for use in the objective measurement of empathy and empathic responding, including the post-auricular reflex and functional neuroimaging. The post-auricular reflex is a vestigial muscle response in humans which can be easily measured simultaneously with the startle reflex (Benning, Patrick, & Lang, 2004). Compared to the defensive nature of the startle reflex, the post-auricular reflex is believed to be an index of the appetitive motivational system and thus, shows a pattern of affective

modulation opposite to that of startle, with the largest responses to positive emotional stimuli and smaller responses to unpleasant stimuli (Benning, et al., 2004; Hess, et al., 2007). Such a measure would be particularly useful in empathy research to corroborate current theories which conceive of startle inhibition to sad facial expressions as indicative of approach or helping orientations. If this were the case, larger post-auricular responses would be expected to the sad stimuli among high empathy individuals. Moreover, this measure may also clarify the current findings with respect to startle potentiation to positive facial expressions by providing information on the motivational systems activated in individuals as they process and respond to the happy emotional experiences of others.

Research investigating the brain structures and neural networks associated with emotional experience is burgeoning, and recent attention has focused more specifically on the brain activity associated with shared or empathic emotion. Overall, findings indicate that the sharing of another's emotions is automatic and underpinned by shared affective neural networks (deVignemont & Singer, 2006), and that activation of these networks is related to overall levels of dispositional empathy. In particular, brain imaging work has demonstrated that similar regions are activated during observation of another's emotional experience and when subjects feel their own emotions (e.g., Botvinick, et al., 2005; Carr, et al., 2003; Singer, et al., 2004; Wicker, et al., 2003); such areas include the premotor cortex, anterior cingulate cortex, anterior insula, and amygdala. Moreover, individuals who score higher on dispositional measures of emotional empathy have been found to show stronger activations in several of these

regions compared to individuals with lower levels of dispositional empathy (Singer, et al., 2004). However, neuroimaging work to date has been limited to the emotions of pain and disgust. Future work should examine the neural structures involved with empathic responses to each of the basic emotions (e.g., Ekman & Friesen, 1972), with particular emphasis on happiness and sadness.

Overall, it appears that situational empathic responding can be elicited and measured in individuals using objective measures. Such an approach is a promising alternative to more subjective methods, and can provide greater specificity with respect to the assessment of the subcomponents and temporal course of empathy in normative, criminal, and psychopathic individuals. Such information is invaluable for refining our current theories of empathy and empathic responding, as well as for informing theory, research, and clinical practice with offenders.

CHAPTER 2: THE SUBJECTIVE AND OBJECTIVE MEASUREMENT OF EMPATHY IN PSYCHOPATHIC INDIVIDUALS

Introduction

Psychopathy is a personality disorder with a distinctive pattern of interpersonal, affective, lifestyle, and antisocial features (e.g., Hare & Neumann, 2006) that is often associated with the commission of frequent and varied criminal acts (e.g., Hanson & Bussiere, 1998; Kosson, Smith, & Newman, 1990), particularly of a violent (e.g., Hemphill, et al., 1998; Salekin, et al., 1996) and instrumentally aggressive nature (e.g., Woodworth & Porter, 2002). It has long been believed that a lack of empathy or concern for others is a defining feature of the disorder (e.g., Cleckley, 1976; Hare, 1991), so much so that "callous/lack of empathy" is one of the 20 items on the most widely used and empirically validated measure of psychopathy, the Psychopathy Checklist-Revised (PCL-R; Hare, 1991, 2003). In particular, it has been argued that psychopathic offenders are more likely than other offenders to show generalized empathy deficits (Fernandez & Marshall, 2003) and these deficits are believed to be associated with Factor 1 (affective/interpersonal) psychopathic traits such as callousness, shallow affect, and lack of remorse or guilt (Hare, 2003). It is not surprising that low levels of empathy are thought to exist in psychopaths, given that psychopaths demonstrate affective deficits in a number of other areas, including emotional language processing (e.g., Kroner, Forth, & Mills, 2005; Williamson, Harpur, & Hare, 1991), fear reactivity (e.g., Lykken, 1957;

Patrick, et al., 1993; Levenston, Patrick, Bradley, & Lang, 2000), and specific emotion recognition (e.g., Blair, et al., 2004; Kosson, Suchy, Mayer, & Libby, 2002).

It is also believed that the psychopath's empathy deficits may mediate his offending behaviors (Silver, et al., 1999), particularly with respect to instrumental aggression, because the capacity to inflict serious injury on another person for goal-directed purposes is thought to be made possible by a lack of concern or respect for others that would otherwise inhibit such behavior (Cornell, et al., 1996). This is supported by research demonstrating a general association between psychopathy and instrumental violence (Cornell, et al., 1996; Flight & Forth, 2007; Porter, et al., 2001; Woodworth & Porter, 2002), and a specific association between Factor 1 psychopathy scores and the perpetration of instrumental homicides (Woodworth & Porter, 2002).

However, despite the widespread belief that psychopaths demonstrate low empathy, a review of literature has revealed remarkably few studies which specifically investigate this relationship. In general, results of the existing research show the expected negative relationship between psychopathy and empathy, with correlations ranging from -.30 to -.55 (Flight & Forth, 2007; Mahmut, Homewood, & Stevenson, 2008; Mullins-Nelson, Salekin, & Leistico, 2006; Zagon & Jackson, 1994). These findings, however, are not as robust as one would expect given the centrality of empathy deficits in the conceptualization of psychopathy. In particular, although Zagon & Jackson (1994) found a significant negative association between psychopathy and dispositional empathy (as measured by the Interpersonal Reactivity Index or IRI; Davis, 1983), when analyses were limited to male participants only, the relationship was no longer significant. Moreover,

the authors failed to find significant negative relationships between psychopathy factor scores and the Empathic Concern (EC) and Perspective-Taking (PT) subscales of the IRI, those scales thought to tap affective and cognitive empathy respectively. Mahmut and colleagues (2008) also failed to find group differences in self-reported empathy scores between high and low psychopathy participants when analyses were limited to males only and Mullins-Nelson and colleagues (2006) found that among their male participants, although psychopathy and empathy total scores were significantly negatively correlated, there was no relationship between Factor 1 psychopathy and IRI total scores, and in fact, males exhibited a significant positive relationship between Factor 1 psychopathy and IRI EC subscale scores. Taken together, while these findings provide some preliminary support for the notion that psychopathy is associated with general empathy deficits, they also call into question the assertion that low empathy is linked to Factor 1 psychopathy and other affective deficits, given that measures tapping Factor 1 are generally uncorrelated (or positively correlated) with the affective component of empathy.

Perhaps extant research has failed to identify a robust relationship between low empathy and psychopathy because of methodological limitations with respect to the measurement of empathy in psychopathic samples. The literature to date has relied solely on self-report measures of dispositional empathy, as opposed to more objective measures of both dispositional and situational empathy and its constituent components (i.e., cognitive and affective empathy; Strayer, 1987). The use of self-report measures is particularly problematic with psychopathic individuals, given their propensity for deceitfulness and manipulation of information for their own benefit (e.g., Hare, 1998).

Moreover, currently available instruments measure only dispositional or trait levels of empathy and (with the exception of the IRI) fail to assess the subcomponents of empathy. This is unfortunate because it is possible that empathy deficits may not be global in nature, but rather situation-specific (Marshall, et al., 1995) or component-specific (Kirsch & Becker, 2007). Overall, the reliance on currently available empathy measures with psychopathic individuals makes it impossible to determine if psychopaths truly exhibit significantly lower levels of empathy than non-psychopaths, if such deficits are global or situation-specific in nature, or if psychopaths' empathy deficits (if they exist) are due to impairments in cognitive empathy, affective empathy, or both (Kirsch & Becker, 2007).

The current study represents the first research to examine the relationship between empathy and psychopathy using both subjective and objective measures of empathy. The objective measures of situational empathy used in this study, developed and validated on a sample of non-psychopathic undergraduate students (discussed in Chapter 1), rely on psychophysiological indicators of emotion thought to indicate an empathic response. Psychophysiological measures of emotion are believed to be superior to self-report because they are less subject to self-presentation biases or conscious manipulation of responses (Eisenberg, et al., 1987). Moreover, the use of psychophysiologic measures with psychopaths has a long and proven history (e.g., Hare, 1965; Lykken, 1957), with demonstrated reliability and validity for the assessment of affective processing and emotional experience in this population (e.g., Flor, Birbaumer, Hermann, Ziegler, & Patrick, 2002; Patrick, 1994; Patrick, et al., 1993).

The objective measures of empathy employed in this study include facial muscle electromyographic (EMG) activity, heart rate, and the acoustic startle reflex. These measures of emotional response were chosen based on their strong empirical foundation in the emotion and empathy literatures (e.g., Bradley & Lang, 2000b), as well as their ease of application to work with psychopathic populations (e.g., Patrick, et al., 1993). The acoustic startle reflex was specifically chosen as an index of empathic emotion, given its reliability as a relatively pure indicator of emotional valence that is not subject to deliberate control or other confounds such as attention or context (Patrick, 1994). Moreover, the startle reflex has been extensively studied in the criminal psychopath and results of such investigations have demonstrated anomalous patterns of startle modulation within this population. Compared to non-psychopathic offenders, psychopaths in general, and high Factor 1 psychopaths in particular, fail to show startle potentiation when viewing aversive or unpleasant images (e.g., Patrick, et al., 1993) and exhibit significant startle inhibition in response to pictures depicting assaults on others (Levenston, et al., 2000).

The current investigation of empathy in psychopathic individuals study utilized the same paradigm that was used in the validation study, and participants were recruited from the same undergraduate population. Psychopathic participants in this study consisted of male undergraduates who scored at or above the 87th percentile on the PPI-R (Lilienfeld & Widows, 2005), a self-report measure of psychopathic personality traits, while the non-psychopathic comparison group was comprised of male undergraduates with PPI-R scores at or below the 50th percentile. These percentiles were defined with

respect to the PPI-R community/college normative sample. The sample was limited to male participants because considerably less is known about the characteristics of female psychopaths and there is an extremely low base rate of the disorder in women (e.g., Hare, 2003; Kennealy, Hicks, & Patrick, 2007; Vitale, Smith, Brinkley, & Newman, 2002).

In the current study, participants viewed a number of brief empathy-inducing film clips while psychophysiological indices of emotion (facial EMG, heart rate, startle eyeblink) were monitored. In addition to the psychophysiological assessment of emotional experience, participants also provided self-report ratings of their emotional experience in response to each film clip as well as estimates of the emotional experience of the individuals portrayed in the films (Perceived Other ratings). Results from the validation study discussed in Chapter 1 indicate that the short films were successful at eliciting empathic emotion and the psychophysiological indices were successful at measuring this emotion. Moreover, the paradigm was able discriminate high and low empathy individuals with respect to both self-report and psychophysiological indices of situational empathic responding. Finally, there was a significant degree of correspondence between dispositional and situational self-reports of empathy and the psychophysiological indices of situational empathy, suggesting that the approach has significant potential as an objective measure of situational empathy.

Based on findings from previous research, as well as the results of the validation study, a number of hypotheses were formulated with respect to the pattern of responses expected by psychopathic individuals. Specifically, it was predicted that psychopathic participants would display reduced psychophysiological reactivity to the empathy-

inducing stimuli compared to the non-psychopathic participants, while at the same time demonstrating similar self-reports of emotional experience. Such a pattern of findings has been established in previous research with psychopaths, in that psychopaths have been found to exhibit a mismatch between subjective reports and psychophysiological indices of emotion (e.g., Patrick, et al., 1993; Patrick, Cuthbert, & Lang, 1994). This lends credence to the notion that the affective deficits of psychopaths are masked by their non-psychopathic expressive abilities, resulting in a pantomime of emotional experience (Cleckley, 1976; Patrick, 1994), or as Johns and Quay (1962) so succinctly put it, the psychopath "knows the words but not the music" (p. 217).

Despite clear evidence of deficient emotional experience in psychopaths, however, the literature is somewhat equivocal with respect to their emotional perspective-taking abilities (e.g., Blair, Colledge, Murray, & Mitchell, 2001; Glass & Newman, 2006; Habel, Kuhn, Salloum, Devos, & Schneider, 2002). In particular, a number of studies have failed to find evidence of generalized situational perspective-taking deficits in both offender and community samples of individuals with psychopathic traits (e.g., Glass & Newman, 2006; Kosson, et al., 2002; Mullins-Nelson, et al., 2006). As such, it was expected that psychopathic participants in this study would not show situational perspective-taking deficits assessed by self-report, and thus, would demonstrate Perceived Other ratings similar to those of the non-psychopathic participants.

It was further predicted that psychopathic participants would display significantly lower levels of dispositional empathy compared to their non-psychopathic counterparts, evidenced by lower IRI total scores, as well as lower scores on the subscales believed to

tap the affective component of empathy, specifically the Empathic Concern and Personal Distress subscales. With respect to dimensions of psychopathy and empathy, it was predicted that the Coldheartedness factor would be most associated with dispositional and situational empathy deficits, given that Coldheartedness is considered to be the PPI-R factor that is most closely related to empathy deficits (Lilienfeld & Widows, 2005; Sandoval, et al., 2000). This prediction represents a divergence from the literature in some respects, in that empathy deficits are represented on Factor 1 of the PCL-R (Hare, 1991; Harpur, Hare & Hakstian, 1989) and hence, are generally assumed to be represented on Factor I of the PPI-R as well, given their similar factor structures (Benning, Patrick, Hicks, Blonigen, & Krueger, 2003). However, Factor I of the PPI-R has not been found to map perfectly onto Factor 1 of the PCL-R (Benning, et al., 2003; Lilienfeld & Widows, 2005), and, with the exception of Flight & Forth's (2007) research with an adolescent offender sample, most studies have failed to find a significant relationship between PPI-R or PCL-R Factor 1 scores and empathy (Mullins-Nelson, et al., 2006; Rutherford, Alterman, Cacciola, & McKay, 1997; Sandoval, et al., 2000). As such, it is believed that it may be more appropriate to investigate the Coldheartedness factor of the PPI-R, either alone or in combination with Factor I of the PPI-R, with respect to its relationship with empathic deficits.

Methods

Participants

Participants were 33 male undergraduate volunteers recruited from a pool of students taking introductory psychology courses at the University of Arizona. All

participants were fluent in English, healthy, had normal or corrected-to-normal hearing and vision, and were not currently taking any psychotropic medications. Participants were selected into psychopathic (n=16) and non-psychopathic control (n=17) groups based on their total scores on the PPI-R, a self-report measure of psychopathy. Specifically, the psychopathic group (M=65.7, SD=5.51) was comprised of individuals with standard (T) scores at or above the 87th percentile, while the non-psychopathic comparison group (M=39.8, SD=6.6) consisted of those individuals with PPI-R T scores at or below the 50th percentile. Fourteen out of the 16 participants in the psychopathic group had been recruited to participate in the previous validation study of the psychophysiology of empathy (see Chapter 1), but scored in the psychopathic range on the PPI-R, making them ineligible for that study but eligible for the current one. The remaining two psychopathic participants and all of the comparison participants were selected from a second wave of recruitment specifically aimed at locating psychopathic and non-psychopathic male undergraduates. Participants received course credit or monetary compensation for their participation. Data from 2 participants (both non-psychopathic controls) were lost due to equipment failure during data collection, which resulted in a final sample of 31 participants (16 psychopaths) between the ages of 18 and 20 (M=18.7, SD=0.5). Participants were predominantly Caucasian (84%) or Hispanic (13%). The psychopathic and non-psychopathic groups did not differ with respect to age ($t_{(29)}$=.60, *ns*, two-tailed) or ethnicity (X^2(2, N=31)= .97, *ns*).

Stimulus Materials

Empathy-inducing stimuli consisted of the 54 emotional and distractor films used in the previous validation study of the psychophysiology of empathy. Films were brief (4-20 seconds; *M*=11.7, *SD*=4.5), sound-free, and depicted an individual or individuals having discretely happy, sad, or neutral emotional experiences. Individuals portrayed in the films were diverse with respect to age, gender, and ethnicity. Eighteen films of each type (happy, neutral, sad) were shown, with 10 manipulation films and 8 distractor films per film type. Films were presented via a freely-available stimulus delivery computer program (DMDX; available at http://www.u.arizona.edu/~jforster/dmdx.htm) in blocked, randomized order so that equal numbers of each film type were included in each block, and no more than two films of the same valence appeared consecutively.

Startle stimuli consisted of 50ms bursts of 95dB white noise with instantaneous rise time presented binaurally via Telephonics TDH-39P headphones. Delivery and timing of startle probes were identical to the procedure used in the previous study. Probes were delivered pseudorandomly during the manipulation films, at 2, 2.5, 3.5 or 4.5 seconds after 'peak' emotion (*M*=7.0, *SD*=1.7), and occurred equally across films types. Because startle probes to manipulation films generally happened later in the films, startle probes were delivered early in 14 of the distractor films at 1, 1.5, or 3.5 seconds after film onset in order to increase the unpredictability of startle probes. To further enhance probe unpredictability, 10 additional distractor films were included during which no startle probes were presented.

Self-Report Measures

Levenson Psychopathy Scales (LPS). All students in introductory psychology courses at the University of Arizona were administered the LPS (Levenson, Kiehl, & Fitzpatrick, 1995) during the recruitment period of this study. The LPS is a self-report measure designed to assess primary and secondary psychopathy in undergraduate students. Respondents are asked to endorse 26 self-statement items tapping Factor 1 and 2 psychopathic traits using a 4-point scale ranging from "disagree strongly" to "agree strongly." This measure has demonstrated good internal consistency (Falkenbach, Poythress, Falki, & Manchak, 2007) and convergent and discriminant validity (Levenson, et al., 1995) in undergraduate samples. This scale was chosen as a preliminary screening measure because it is relatively quick and easy to administer compared to the other more validated measures of psychopathy such as the PCL-R and the PPI-R. A total of 381 males completed this measure. The score distribution for this sample (M=55.1, SD=9.6) was similar to those obtained in other undergraduate male samples (e.g., Falkenbach, et al., 2007).

Psychopathic Personality Inventory-Revised (PPI-R). The PPI-R (Lilienfeld & Widows, 2005) is a 154-item self-report measure designed to assess the core personality features of psychopathy in both community and offender samples. Respondents are instructed to rate themselves on each item using a 4-option (false, mostly false, mostly true, true) Likert-type scale. The PPI-R provides a global index of psychopathy, as well as scores on eight content scales, and three factor scores reflecting different components of the overall construct. The PPI-R also contains three validity scales designed to measure profile validity and response sets. PPI-R scores are calculated by converting raw

scores to standard or *T* scores with a mean of 50 and a standard deviation of 10, based on norms for male and female community/college and male offender samples of various age groups. *T* scores and percentiles are given for each content scale, as well as factor and total scores.

The factor scores of the PPI-R are believed to represent the underlying dimensions of psychopathy (Benning, et al., 2003; Lilienfeld & Widows, 2005). Fearless Dominance, or PPI-I, measures fearlessness, social influence, and immunity from stress, and is generally considered to be most similar to Factor 1 of the PCL-R (e.g., Benning, et al., 2003; Falkenbach, et al., 2007; Lilienfeld & Widows, 2005). Self-Centered Impulsivity, or PPI-II, measures traits such as Machiavellian egocentricity, blame externalization, and rebellious noncomformity, and is generally considered to be most similar to Factor 2 of the PCL-R (e.g., Benning, et al., 2003; Lilienfeld & Widows, 2005). Although the Coldheartedness content scale does not load highly on either of these factors, it has been argued that it should be considered a factor in its own right, given its centrality to the core construct of psychopathy (Lilienfeld & Widows, 2005) and its demonstrated highly negative association with self-reported empathy (Sandoval, et al., 2000), a hallmark feature of the disorder (e.g., Hare, 1998).

Overall, the PPI-R has been shown to demonstrate good test-retest reliability as well as convergent validity with other self-report and observer measures of psychopathy and related traits in both undergraduate and criminal samples (e.g., Falkenbach, et al., 2007; Lilienfeld & Andrews, 1996; Sandoval, et al., 2000). The PPI-R is generally considered to be an efficient and valid tool for measuring psychopathic traits in

community samples, particularly with respect to affective and interpersonal psychopathic traits (Falkenbach, et al., 2007).

As such, the PPI-R was used in the current study to select individuals into psychopathic and non-psychopathic groups. In particular, participants were considered to be psychopathic if they had a total *T* score of 60 or higher, which corresponds to scores at or above the 87th percentile. Non-psychopathic comparisons were those individuals who had *T* scores of 50 or lower, which correspond to total scores at or below the 50th percentile.

Self-Assessment Manikin (SAM). The SAM (Lang, 1980) is a non-verbal measure that allows individuals to report their emotional experience in response to affective stimuli, consisting of ordinal scales for ratings of emotional valence and arousal. For each dimension, SAM depicts five graphic figures and participants can select any of the figures or between the figures, resulting in a 9-point scale. For valence, the graphic ranges from a frowning, unhappy figure (a score of 1[5]) to a smiling, happy figure (a score of 9). For arousal, the graphic ranges from a relaxed sleepy figure (a score of 1) to an excited wide-eyed figure (a score of 9). Participants can indicate feeling neither happy nor unhappy and neither calm nor aroused using the midpoint of each scale (a score of 5). SAM ratings have been found to reliably correlate with physiological responses to images, with ratings of valence positively correlating with zygomatic EMG activity and negatively correlating with corrugator EMG activity (e.g., Lang, et al., 1993). In this

[5] Participants actually rated SAM valence and arousal in the opposite direction (1= most pleasant, 9= most unpleasant), but this was later reversed for data analysis purposes to remain consistent with the literature.

study, participants completed a computerized version of the SAM measuring valence and arousal immediately following each film. Participants were instructed to use the SAM to rate their own valence and arousal, as well as estimate the valence and arousal of the individual(s) depicted in the film (referred to herein as Perceived Others).

Interpersonal Reactivity Index (IRI). The IRI (Davis, 1983) is a self-report multidimensional measure of dispositional empathy which requires respondents to rate 28 self-statements on a 5-point Likert scale (0- does not describe me well to 4- describes me very well). The IRI is divided into four 7-item subscales, each tapping a separate aspect of the global construct of empathy. The Perspective-Taking (PT) subscale measures the tendency to adopt the psychological point of view of others; the Empathic Concern (EC) subscale assesses other-oriented feelings of sympathy, compassion, or concern for unfortunate others; the Fantasy (FS) scale assesses tendencies to transpose oneself imaginarily into the feelings and actions of fictitious characters in books, movies, and plays; and the Personal Distress (PD) subscale measures self-oriented feelings of personal unease in response to the distress of others. The IRI subscales have demonstrated adequate internal reliabilities (α=.71-.77) as well as test-retest reliabilities ranging from .62-.71 (Davis, 1983) and have been found to be uniquely associated with a number of traits and emotional responses theoretically linked to empathy (Davis, 1983; Davis, et al., 1987).

Procedure

Participant selection. In order to indentify participants to include in the psychophysiology study, males with high (above the 85th percentile; scores of 65 or

higher) and low (below the 50th percentile; scores of 55 or lower) psychopathy scores on the LPS were contacted and asked to complete a follow-up packet of questionnaires containing, among other things, the PPI-R. A total of 42 males completed the questionnaire packet: 12 males with high LPS scores (*M*=70.1, *SD*=4.4) and 30 males with low LPS scores (*M*=44.5, *SD*=6.8). The questionnaire session was conducted with small groups of 3 to 6 males and lasted approximately 30 minutes. Participants were administered the PPI-R and several filler questionnaires and told that their scores on these measures might make them eligible to participate in a follow-up study examining psychophysiological responses to film clips. Those individuals who scored in the desired range on the PPI-R were then contacted and asked to participate in the psychophysiological study. A total of 19 individuals (2 psychopathic and 17 non-psychopathic) out of the 42 tested in the questionnaire session qualified and went on to complete the psychophysiological study, although data from 2 of the non-psychopathic participants were lost due to technical difficulties during data collection.

Psychophysiological test session. The procedure for this study was almost identical to the procedure used in the previous validation study (Chapter 1). All participants were tested individually in a single experimental session lasting approximately 1.5 hours. Informed consent was obtained at the beginning of the session. Participants were seated in an upright lounge chair located approximately 3 feet in front of a 19" computer monitor, in a temperature-controlled, sound-insulated, and dimly lit room. Participants were told that the experiment was investigating people's emotional reactions to film clips created for advertising purposes. They were told that their reactions

to the advertisements would be assessed using sensors that can measure the sweat activity on their face and their HR, in addition to self-reports. Bias in self-reported emotion as well as participants' conscious control of their facial expressions was hopefully reduced by concealing the true purpose of the empathy investigation and facial muscle activity measurement. After all electrodes were attached and signals were checked, participants were fitted with headphones, watched computerized instructions, and completed four practice film trials to ensure they were comfortable with the rating procedure. To allow for habituation of the startle response, startle probes were presented during each of the practice films.

Following the practice trials, participants completed the film viewing task. The task was divided into two approximately equal segments to allow for a short break in between so that participants could remain alert and stretch their legs if necessary. Each film trial consisted of presentation of a fixation cross for 1.5 seconds prior to film onset, film clip presentation, 1 second of blank screen following film offset, and presentation of SAM valence and arousal scales for self and Perceived Others. SAM ratings were made in counter-balanced order, whereby during the first segment of the film-viewing task, half of the participants rated their own valence and arousal first while the other half rated Perceived Other valence and arousal first. The orders were reversed for the second segment of the film task. Upon completion of all SAM ratings for the film, there were 6 seconds of blank screen, followed by the next film trial.

After all of the film clips were presented, the electrodes were removed and participants were seated at a desk in a neighboring room and asked to complete the IRI

and several other brief filler questionnaires. The IRI was administered at the end of the experiment to minimize the risk of their responses during film viewing being influenced by the empathy measure. Following completion of the questionnaires, participants were fully debriefed and thanked for their participation.

Physiological Recording and Data Reduction

Facial EMG responses were measured by bipolar recording of the activity of the left corrugator supercilii and zygomatic major muscles in accordance with guidelines outlined by Fridlund & Cacioppo (1986). Specifically, at each muscle site, skin was cleaned and gently abraded and two 4mm Ag-AgCl surface electrodes filled with conductive gel were placed approximately 1cm apart along the line of each muscle, with a common ground electrode attached to the midline of the forehead. Startle eyeblink responses were measured by bipolar recording of the activity of the left obicularis occuli muscle in accordance with guidelines outlined by Blumenthal and colleagues (2005). Two 4mm Ag-AgCl electrodes filled with conductive gel were placed along the obicularis muscle, one below the left eyelid in line with the pupil in forward gaze and another 1-2 cm lateral to the first. HR was measured using 4mm Ag-AgCl electrodes on the left and right forearm, midway between the elbow and the wrist. All electrode impedances were reduced below 10 kΩ. All raw physiological signals were continuously sampled at 5000 Hz, amplified with a SynAmps2 amplifier in AC mode, notch filtered at 60 Hz, and bandpass filtered prior to digitization (high-pass filter set at .5 Hz, low-pass filter set at 1000 Hz).

Corrugator and zygomatic EMG signals were high-pass filtered offline at 12 Hz, full-wave rectified, epoch-locked to include only the 1 sec before and 1.9 sec following 'peak' emotion for each film, and EMG signal was averaged over this epoch. These averages were then ln-transformed to ensure a normal distribution and standardized within-subject using a *z*-transformation (*M*=0, *SD*=1) to correct for individual differences in the magnitude of facial expressiveness. *Z*-scores were then averaged within each film type to yield an overall EMG score for each film type at each muscle site.

Obicularis EMG signal was high-pass filtered offline at 12 Hz, full-wave rectified, then smoothed with a 40 Hz low-pass filter. Startle responses were identified using a peak detection program that identified the maximum value in the 30-180 ms window following startle probe presentation. Outlier startle responses were identified as any response greater than 2 *SD* above the mean startle response for each participant. Startle peaks, minus any outlier trials, were then ln-transformed and standardized within-subject using a *z*-transformation to correct for individual differences in startle reactivity. Startle magnitudes were calculated by averaging the *z*-scores of all startle trials within films of each type to yield an overall startle magnitude for each film type.

The ECG signal was digitally low pass filtered at 100 Hz, decimated to a sampling rate of 500 Hz, and then imported to QRSTool (Allen, et al., 2007) to identify each beat. Film-related HR was then derived by averaging the inter-beat intervals (IBI's) during the time window from film onset to startle probe delivery and then converting each average IBI to HR. The HR value for each film was then *z*-transformed within

subjects to correct for individual differences and these *z*-scores were finally averaged within film types to yield an overall HR *z*-score for each film type.

Data Analysis

Analyses consisted of separate 3 (Film Type: happy, neutral, sad) X 2 (Psychopathy: psychopath, non-psychopathic control) mixed model ANOVAs with film type as a within-subjects factor, and each behavioral rating or physiological measure as the dependent variables. The Greenhouse-Geisser correction for degrees of freedom was adopted to correct for violations of sphericity; reported *p*-values reflect this correction. Because all physiological variables are within-subject *z*-scores with a mean of zero for all participants, main effects for Psychopathy could not be computed and are not reported here. For all significant main effects, pairwise comparisons were conducted to examine the nature of differences across film types. When significant Film Type by Psychopathy interactions were encountered, pairwise comparisons were conducted across groups to determine the nature of the interaction. In instances where variances differed significantly across groups (Levene's test for equality of variances were significant), pairwise comparisons were reported with degrees of freedom and significance values for 'equal variances not assumed' paired samples *t*-tests.

Results

Dispositional Empathy

In order to examine group differences in dispositional empathy, several one-way ANOVAs with IRI total and subscale scores as the dependent variables were conducted. Table 2.1 displays group means and standard deviations for IRI total and subscale scores,

as well as indicates significant differences between groups on these variables. Overall, these results suggest that the psychopathic group had significantly lower levels of overall trait empathy ($F_{(1, 29)}$= 17.20, p<.001), as well as significantly lower scores on the EC ($F_{(1, 29)}$= 19.82, p<.001), FS ($F_{(1, 29)}$= 4.43, p<.05), and PD ($F_{(1, 29)}$= 10.52, p<.005) subscales. Of note, psychopaths did not differ significantly from non-psychopathic controls on their PT subscale scores, which suggests that their perspective-taking abilities are not impaired to the same extent as other aspects of empathy.

In addition to overall levels of psychopathy, the relationship between the different factors of psychopathy and the subcomponents of dispositional empathy were also examined. As can be seen in Table 2.2, there were significant negative correlations between PPI-R total and factor scores and IRI total and subscale scores. Overall, it appears that psychopathy is negatively correlated with one's general level of dispositional empathy (r=-.66, p<.001), as well as one's level of Empathic Concern (r=-.73, p<.001), Personal Distress (r=-.55, p<.001), and to a lesser degree, Perspective-Taking (r=-.38, p<.05). While PPI-R Factors I and II are also negatively correlated with IRI total and some IRI subscale scores, as expected, Coldheartedness appears to be *most* negatively related to one's overall trait level of empathy (r=-.75, p<.001) as well as dispositional affective empathy (as measured by the EC and PD subscales; r=-.86, p<.001 and r=-.63, p<.001, respectively). It is interesting to note however, that Coldheartedness is only marginally negatively correlated with perspective-taking abilities (r=-.35, p=.06), which suggests that this facet of psychopathy is more closely related to affective as opposed to cognitive empathy deficits. A test of the difference between dependent correlations

(Williams, 1959) indicated that the relationship between Coldheartedness and EC was significantly larger than the correlation between Coldheartedness and PT ($t_{(28)}$=3.63, p<.01, two-tailed) further supporting the notion that Coldheartedness is more clearly associated with affective as compared to cognitive empathy deficits.

Film Ratings

Table 2.3 shows group means and standard deviations for the film rating variables. As expected, there was a significant main effect of film type on self-reported affective valence ($F_{(2, 58)}$=86.49, p<.001, ε=.60, η_p^2=.75), with happy films rated as more pleasant than neutral ($t_{(30)}$=11.25, p<.001, two-tailed) and sad ($t_{(30)}$=9.80, p<.001, two-tailed) films, and neutral films rated as more pleasant than sad films ($t_{(30)}$=6.16, p<.001, two-tailed). There was not a main effect for psychopathy, nor was there a Film Type by Psychopathy interaction, suggesting that non-psychopathic and psychopathic undergraduates did not differ with respect to their self-reported affective responses to the films.

There was a significant main effect of film type on self-reported emotional arousal ($F_{(2, 58)}$=42.67, p<.001, ε=.90, η_p^2=.60), with happy films rated as more arousing than both sad ($t_{(30)}$=5.47, p<.001, two-tailed) and neutral ($t_{(30)}$=10.29, p<.001, two-tailed) films. Sad films were rated as more arousing than neutral films ($t_{(30)}$=2.91, p<.01, two-tailed). There was not a main effect for psychopathy or a Film Type by Psychopathy interaction for self-reported arousal, suggesting that both groups reported experiencing the same intensity of emotion in response to the films.

Significant main effects of film type on Perceived Other valence ($F_{(2, 58)}$=870.95, p<.001, ε=.65, η_p^2=.97) and arousal ($F_{(2, 58)}$=89.32, p<.001, ε=.83, η_p^2=.76) occurred, and exhibited similar patterns of ratings across film types as self valence and arousal ratings did, with happy films rated as the most pleasant and the most arousing, sad films rated as least pleasant and somewhat arousing, and neutral films rated as neutral in pleasantness and low in arousal. There were no significant main effects for psychopathy or Film Type by Psychopathy interactions for Perceived Other valence or arousal, which suggests that psychopathic participants did not differ in their perspective-taking abilities compared to the non-psychopathic controls.

In order to assess the degree of correspondence between participants' reported emotion and their ratings of emotion felt by the individuals in the films, self-other difference scores were calculated by subtracting participant's own valence ratings from their Perceived Other valence ratings. There was a main effect of Film Type ($F_{(2, 58)}$= 50.33, p<.001, ε=.99, η_p^2=.63), with significantly smaller self-other difference scores for neutral films compared to both happy ($t_{(30)}$=8.93, p<.001, two-tailed) and sad ($t_{(30)}$=8.26, p<.001, two-tailed) films. Self-other difference scores for happy and sad films did not differ, suggesting that neither emotion was more contagious than the other. There was not a main effect for Psychopathy nor was there a Film Type by Psychopathy interaction for self-other difference score, suggesting that psychopaths and non-psychopathic controls did not differ with respect to the correspondence of their reported emotion and that of the individuals in the films.

Facial EMG

Table 2.4 displays the group means and standard deviations for all of the psychophysiological variables.

Corrugator. There was a main effect of Film Type on corrugator EMG ($F_{(2, 58)}$= 12.93, p<.001, ε=.91, η_p^2=.34), with happy films eliciting smaller corrugator activity than both sad ($t_{(30)}$=5.04, p<.001, two-tailed) and neutral ($t_{(30)}$=4.00, p<.001, two-tailed) films. However, contrary to expectations, neutral and sad films did not significantly differ with respect to corrugator muscle activity. Moreover, there was not a Film Type by Psychopathy interaction, suggesting that frown mimicry was similar for both psychopathic and non-psychopathic males.

Zygomatic. While there was no main effect of Film Type on zygomatic EMG activity, there was a significant Film Type by Psychopathy interaction ($F_{(2, 58)}$= 3.33, p<.05). As illustrated in Figure 2.1, non-psychopathic control participants exhibited the anticipated linear relationship of zygomatic activity, with significantly larger smiling responses to happy films than to sad films ($t_{(30)}$=3.52, p<.005, two-tailed), while psychopathic participants demonstrated an anomalous pattern of zygomatic activity. In particular, zygomatic responses did not differ across film types for the psychopathic participants, suggesting that they are deficient with respect to smiling mimicry in response to the films. For specific film valences, psychopaths showed less zygomatic activity to happy films and more zygomatic activity to sad films than did non-psychopathic control participants.

Film-Related Heart Rate

As expected, there was a significant main effect of film type on heart rate ($F_{2, 58}$= 4.45, p<.01, ε=.97, η_p^2=.16), with sad films eliciting significantly lower heart rates than both happy (t_{30}=2.84, p<.01, two-tailed) and neutral (t_{30}=3.20, p<.005, two-tailed) films. There was no Film Type by Psychopathy interaction for film-related heart rate, however, suggesting that the two groups did not differ in the modulation of heart rate across the empathy-inducing films.

Startle Magnitude

Overall, there was evidence of significant modulation of the startle reflex across film types ($F_{2, 58}$= 4.24, p<.05, ε=.85, η_p^2=.13), with sad films eliciting significantly smaller startle eyeblinks than happy films (t_{30}=2.78, p<.01, two-tailed). Contrary to expectations, there was not a Film Type by Psychopathy interaction, suggesting that overall emotional experience in response to the films was similar for psychopathic and non-psychopathic undergraduates.

PPI-R Scores and Situational Empathy

In addition to analyzing the data using PPI-R total scores as a grouping variable, the correlations among PPI-R total and factor scores with the behavioral ratings and physiological variables were also examined. Table 2.5 displays correlations between PPI-R scores and self-report and psychophysiological variables to happy (Panel A) and sad (Panel B) empathy-inducing films. There were few significant relationships among the PPI-R and indices of situational empathic responding. Total scores and Self-Centered Impulsivity (PPI-II) scores were significantly correlated with zygomatic responses to

both happy and sad films, such that higher levels of overall and PPI-II psychopathy were associated with decreased smiling to happy films and increased smiling to sad films. Coldheartedness was significantly positively correlated with self-reported pleasantness (r=0.42, p<.05), self-other difference scores (r=0.41, p<.05), and zygomatic responses (r=0.55, p<.005) to sad films. This suggests that the specific psychopathic trait of Coldheartedness is associated with less sadness in response to sadness in others, less congruence of emotion with sad others, and increased smiling in response to sad emotional expressions in others, all of which might be considered to representative of deficient empathic responses. Of note, PPI Factor I scores were uncorrelated with all dependent variables, suggesting that the Fearless Dominance factor of the PPI-R is not specifically associated with situational empathy.

Discussion

Dispositional Empathy

This study sought to investigate the nature of dispositional and situational empathy deficits in a sample of psychopathic individuals using both subjective and objective assessment techniques. Subjective measures of psychopathy and dispositional empathy revealed a significant negative association between the two, with psychopathic participants exhibiting significantly lower levels of trait empathy, as well as significantly lower scores on several dimensions of empathy, including empathic concern, personal distress, and empathic fantasy.

Correlations between PPI-R total and factor scores and trait empathy measures also suggest a strong negative relationship between psychopathy and empathy,

particularly with respect to affective empathy. These findings replicate and extend the literature on this topic, in that the correlations between psychopathy and empathy seen in the current study are similar, albeit more robust, than those found in previous research (e.g., Flight & Forth, 2007; Mahmut, et al., 2008; Mullins-Nelson, et al., 2006; Zagon & Jackson, 1994) and these relationships remained significant when both psychopathy and empathy were broken down into their constituent components. In particular, the Fearless Dominance (or PPI-I) factor was negatively related to general empathy, as well as cognitive and affective empathy, while the Coldheartedness factor was most strongly associated with both general and affective empathy deficits. Together, these findings provide support for the notion that trait empathy deficits are associated with Factor 1 psychopathy (Hare, 1991, 2003), given that PPI-R Coldheartedness and Fearless Dominance are both believed to be representative of Factor 1 PCL-R traits (Lilienfeld & Widows, 2005). These results also support the hypothesized relationship between Factor 1 psychopathy and instrumental aggression, in that the empathy deficits associated with the affective/interpersonal dimension of psychopathy may enable the psychopath to inflict serious injury with little or no concern for the victim (Cornell, et al., 1996).

Situational Empathy

As expected, psychopaths did not differ from non-psychopaths with respect to their self-reported emotional responses to the empathy-inducing film stimuli. This is consistent with Cleckley's (1976) idea of the mask of sanity, whereby the psychopath's affective deficits are masked by his ability to use emotional language appropriately. Also as predicted, psychopathic participants did not demonstrate any deficiencies in their

perspective-taking abilities to both happy and sad emotional displays by others, which is consistent with the vast majority of research examining the emotion recognition abilities of psychopaths. Such research has found adult psychopaths to perform as well or better than non-psychopathic controls on recognition tasks for happy and sad facial expressions (e.g., Blair, et al., 2004; Habel, et al., 2002; Glass & Newman, 2006; Kosson, et al., 2002).

The results pertaining to the more objective measures of empathic emotion were less discriminating, however. Although participants in this study generally demonstrated the expected pattern of psychophysiological reactivity to the empathy-inducing films, such as relaxation of the brow in response to happy films and decreased heart rate and startle eyeblink responses to sad films, contrary to expectations, psychopathic participants demonstrated few differences from non-psychopathic controls in their psychophysiological reactions to the empathy-inducing films. This is not entirely unsurprising with respect to corrugator EMG activity and film-related heart rate changes, given that these indices were not able to discriminate high and low empathic individuals in the previous validation study. It was expected, however, that there would be evidence of significant group differences in zygomatic EMG activity and startle modulation, because these indices have been found to be sensitive to differences in trait levels of empathy (Chapter 1). Such a pattern was revealed in the zygomatic EMG activity of psychopathic participants, whereby these individuals failed to show significant modulation of their smiling response to the happy and sad empathy-inducing films, resulting in the expression of significantly less smiling to happy films and more smiling

to sad films compared to the non-psychopathic controls. This pattern of non-normative emotional expression (e.g., Bradley & Lang, 2000b) combined with reports of appropriate levels of pleasant and unpleasant emotional experience in response to the films is suggestive of a dissociation of reported and experienced emotion in psychopaths (e.g., Patrick, et al., 1994).

The failure to replicate the literature with respect to deficient startle responses to aversive or unpleasant emotional stimuli seen in criminal (e.g., Herpertz, et al., 2001; Levenston, et al., 2000; Patrick, et al., 1993) and community (e.g., Benning, Patrick, & Iacono, 2005; Justus & Finn, 2007; Vanman, Mejia, Dawson, Schell, & Raine, 2003) psychopaths, however, was entirely unexpected. In the current study, psychopathic participants could not be distinguished from non-psychopaths based on their startle reactivity to the empathy-inducing stimuli, with both groups displaying the expected linear relationship of startle eyeblink responses to happy and sad films (Chapter 1).

There are several possible explanations for the failure to replicate previous findings of attenuated startle modulation among psychopathic participants. Perhaps the emotional stimuli used in this study simply do not compare to the stimuli used in other work investigating affective startle modulation in psychopaths. In particular, previous research has relied exclusively on International Affective Picture System (IAPS; Lang, et al., 1995) pictures to elicit emotion. Such work has traditionally focused on eliciting the negative emotions of fear and disgust using pictures depicting mutilated bodies, disease, aimed guns, and threatening animals, in addition to eliciting pleasant emotion using pictures portraying cute animals, adventure scenes and erotica (Benning, et al., 2005;

Patrick, et al., 1993). This is the first study to our knowledge to assess the psychopath's startle responsivity to emotional stimuli other than IAPS pictures. Moreover, the stimuli employed in this study were specifically chosen to elicit empathic happiness and sadness, and portrayed individuals experiencing happy or sad events and/or expressing happy or sad emotion. Despite similar valence ratings for these positive and negative stimuli, it is arguable that our films elicit distinctly different emotional experiences compared to the stimuli used in previous work with psychopaths. As a result, the patterns of startle reactivity should also be expected to differ. Results from the validation study suggest that the normative pattern of startle responding to discretely happy and sad emotional stimuli is different from the normative pattern of startle responses to the pleasant and unpleasant IAPS pictures used in other studies, with happy stimuli eliciting potentiated startles and sad stimuli eliciting diminished startles compared to neutral stimuli (Chapter 1). Unfortunately no research has been conducted to examine the psychopath's emotional experiences in reference to happy and sad emotional stimuli. Furthermore, although startle reactivity to dynamic stimuli such as short films has been assessed in normative samples (e.g., Jansen & Frijda, 1994; Kaviani, et al., 1999), such studies have not been extended to psychopathic individuals. As such, at the present time, it is unclear whether deficits in modulation of the startle reflex would exist in psychopaths in response to films, as compared to still pictures.

It is also possible that the participants in this study were simply not psychopathic enough to experience the level of affective deficits necessary to cause deficient modulation of the startle reflex. The vast majority of research in this area has been

conducted with criminal psychopath samples, and while high psychopathy participants in these studies were found to exhibit anomalous patterns of startle, mixed-level psychopaths (those individuals with intermediate scores on the PCL-R) demonstrated patterns of startle modulation that were similar to low psychopathy offenders and non-psychopathic undergraduates (Patrick, et al., 1993). Given that this was a sample of undergraduates, it is likely that few of the psychopathic participants in this study would meet PCL-R criteria for psychopathy, and thus, are more likely to be similar to the mixed-level criminal psychopaths with respect to their degree of psychopathy and, as a result, their responses to emotionally evocative stimuli.

Given the hypothesized relationship between the startle reflex and the defensive motivational system (e.g., Lang, 1995), psychopaths' deficits in fear responsivity (e.g., Hare, 1965; Patrick, et al., 1994) are thought to contribute to their deficient startle responses to aversive or fearful imagery (Patrick, 1994). It is less clear how deficits in empathic sadness may affect startle reactivity. In the previous validation study (Chapter 1), high levels of empathy were associated with inhibited startle responses to sad films and potentiated startle to happy films compared to neutral films, while low empathy was related to a lack of modulation of startle to the emotional films. The pattern of startle seen by psychopathic participants in the current study appears to represent a middle-ground between the startle patterns exhibited by high and low empathy participants in the previous study. While the current participants demonstrated modulation of the startle response for sad compared to happy films, the magnitude of these responses did not differ significantly from startle responses to neutral emotional films. It is possible that such a

pattern represents an intermediate or average amount of situational empathy, neither high enough to fully modulate startle, nor low enough to render modulation completely absent. Such a pattern might be expected in samples of individuals who are high on psychopathic traits, but do not fully meet criteria for psychopathy, particularly with respect to Factor 1 interpersonal/affective traits. It is certainly possible that a sample of undergraduate males with high PPI-R scores would fit this description, and future work should attempt to examine the relationship between extreme PPI-R scoring and PCL-R total and factor score profiles. It would be particularly informative to determine how scores on the PPI-R and its three factors relate to PCL-R cut-off scores. Although extant research has extensively examined the construct validity and factor structure of the PPI-R in both community and offender samples (e.g., Benning, et al., 2003; Benning, Patrick, Salekin, & Leistico, 2005; Lilienfeld & Andrews, 1996; Sandoval, et al., 2000), only one published study has specifically addressed the relationship between the PPI and PCL-R cut scores (Poythress, Edens, & Lilienfeld, 1998), and the study was limited to a small sample of male offenders. Poythress and colleagues (1998) found the two measures to be moderately to highly correlated (r =.54), and determined that PPI total scores were able to correctly predict categories of psychopathy 86% of the time. The sensitivity of the PPI was significantly more limited, however, with only 50% of psychopaths correctly identified by PPI total score (Poythress, et al., 1998). These findings suggest that while high PPI-R total scores are indicative of the presence of psychopathic traits, they do not imply the presence of psychopathy per se, and thus, even participants with scores above

the 87th percentile on this measure might not experience the level of affective deficits believed to be characteristic of the full-blown psychopath.

Therefore, at this time it is unclear whether affective startle modulation is an appropriate index of situational empathic responding, at least for assessing undergraduates who are high on psychopathic traits but may not exhibit significant, and therefore measurable, levels of deficient emotional experience. Future research investigating startle responses to empathy-inducing stimuli by criminal psychopaths or community members who meet criteria for psychopathy based on PCL-R score would help to shed light on the merit of this approach for assessing situational empathy.

Other physiological indices of empathic emotion were more successful in this study. In particular, psychopaths' anomalous pattern of smile responses to the empathy-inducing films, in conjunction with their reports of normative emotional experiences, suggests the ability of facial EMG measurement to detect discrepancies between experienced and reported emotion in this population. Future work, however, needs to investigate the sensitivity of the corrugator muscle and event-related heart rate changes for determining levels of empathic responding in both normative and psychopathic samples.

General Conclusions

Overall, the results of this study provide significant support for the notion that psychopathy is associated with generalized deficits in empathy. Our findings indicate that the psychopath is particularly deficient with respect to affective empathy, or the sharing of another's emotional experience (Eisenberg & Strayer, 1987), while his cognitive

empathy, or perspective-taking abilities, remain relatively intact. This suggests that the psychopath's empathic deficits are not a function of his inability to recognize emotional experience in others, but rather his failure to experience and express congruent emotion in response to such knowledge. Furthermore, these empathy deficits appear to be associated with Factor 1 psychopathy, in that the Fearless Dominance and Coldheartedness factors of the PPI-R were most highly correlated with self-reported dispositional empathy deficits. In addition, the Coldheartedness factor was also associated with specific situational empathy deficits when observing sad emotional displays by others. Together, these results highlight the importance of the Coldheartedness factor and its constituent traits with respect to both dispositional and situational empathy (Lilienfeld & Widows, 2005; Sandoval, et al., 2000). Future work should continue to investigate the relationship between such traits and different aspects of empathy and empathy-related responding, as well as determine if these relationships mediate instrumental offending by psychopaths.

The pattern of psychophysiological responses in this study leaves many questions unanswered with respect to the objective measurement of situational empathy in psychopathic individuals. Future work extending the use of psychophysiological indices of empathic emotional responding to samples of criminal psychopaths is needed to determine the merit of this approach for measuring situational empathy. At the current time, it is unclear whether the failure to detect deficient psychophysiological reactivity in the psychopathic participants was a function of the choice of emotional stimuli, the approach to measuring empathic emotional responding, the possibility of relatively low

levels of psychopathic traits in the current sample compared to criminal psychopath samples, or some combination thereof. Additional research is warranted in order to test these various possibilities and allow for more definite conclusions about the merit of utilizing facial EMG, heart rate, and the startle reflex as objective indices of situational empathic responding in psychopathic individuals. This is particularly important, given that reliable and valid objective measures of empathy would be quite valuable for use with psychopathic and other offender populations. Objective measures have great potential for defining the psychopath's empathic capacities and allowing for a greater understanding of the nature and quality of their dispositional and situational empathic deficits, without relying on self-report in a population that is notorious for deceitful and manipulative responses (e.g., Hare, 1998). Knowledge of the psychopaths' empathic strengths and weaknesses is critical for forensic clinical research and practice, as it can be used to inform risk assessment, treatment planning, and violence prevention efforts.

CONCLUSION

The research reported above describes an attempt to develop and validate an objective measure of empathy, as well as discusses the application of this measure to a sample of psychopathic individuals in order to better understand the construct of empathy in this population. Overall, the results of the first set of studies suggest that the approach is valid, and the use of psychophysiological indices of emotional responding has promise for measuring situational empathy in a more objective manner. In particular, non-psychopathic male and female undergraduates demonstrated patterns of psychophysiological responses to the empathy-inducing film stimuli which both matched their self-reported emotional experiences as well as the emotional valence of the films. Moreover, several of these indices were able to discriminate high and low trait empathy individuals, whereby low empathy participants exhibited less facial expressiveness and modulation of the acoustic startle reflex to the empathy-inducing stimuli than their high empathy counterparts. Such findings indicate that these psychophysiological indices are able to measure emotional experiences indicative of a situational empathic response, and hence, they may have merit for assessing situational empathy in psychopaths and other offender populations.

The second chapter then outlined a study which specifically examined dispositional and situational empathy in psychopathic individuals using both subjective self-report measures as well as the objective measure of situational empathic responding described in the first chapter. In this study, male undergraduates with psychopathic traits

demonstrated significantly lower self-reported dispositional empathy than non-psychopathic male undergraduates, and these deficits were particularly prominent with respect to affective empathy. Despite lower overall levels of dispositional empathy however, psychopathic participants did not differ from their non-psychopathic counterparts on the measures of situational empathy, both of a subjective and objective nature, with the exception of zygomatic muscle activity. Here, psychopaths demonstrated significantly less smiling mimicry to the emotional films, despite similar self-reports of empathic emotional experience compared to the non-psychopathic participants; such a pattern indicates a dissociation between reported and experienced situational empathy in individuals with psychopathic traits.

Taken together, the results of the above studies suggest the promise of this approach for the objective measurement of empathic emotional responding, and future work should attempt to replicate and extend these findings with other populations, specifically criminal psychopaths. Hopefully, this measure will be able to better assess empathy in psychopaths, since little is currently known about the empathic capabilities of this population, and current methods of assessment are fraught with methodological difficulties. Enhanced knowledge regarding the nature and quality of empathy deficits in psychopaths and other violent offenders will contribute to our understanding of the mechanisms involved in the perpetration of violence, particularly of an instrumental nature. Such information can help inform forensic research and practice and would allow us to improve upon current approaches to managing offenders in order to reduce violence risk, and ultimately, make our society safer.

Table 1.1.

Mean Intensity and Discreteness Scores by Film Type for Selected Films

	Happiness Intensity		Sadness Intensity		Anger Intensity		Fear Intensity		Confusion Intensity		Discreteness*	
Film Type	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Happy	5.44	0.50	0.37	0.11	0.24	0.08	0.21	0.07	0.62	0.28	5.07	0.55
Sad	0.31	0.09	5.15	0.72	1.80	0.76	1.86	0.69	2.40	0.36	3.56	0.51
Neutral	0.73	0.16	0.77	0.38	0.41	0.55	0.57	0.40	2.65	0.81	--	--

* *Note.* Discreteness scores for happy and sad films reflect the target emotion rating minus the mean of the other emotion ratings, while the discreteness score for neutral films reflects the mean ratings for all emotion terms.

Table 1.2.

Self-Report Measures of Emotional Response: Means by Film Type and Level of Empathy

	Happy		Neutral		Sad	
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*
SAM Valence						
High Empathy	6.64	1.09	4.81	0.34	3.17	0.93
Low Empathy	6.18	0.70	4.80	0.32	3.86	0.50
SAM Arousal						
High Empathy	5.14	1.27	3.33	1.16	4.42	1.54
Low Empathy	4.74	1.19	3.33	1.35	4.09	1.15
Perceived Others--Valence						
High Empathy	8.47	0.50	1.86	0.58	4.66	0.43
Low Empathy	8.28	0.63	1.90	0.54	4.65	0.24
Perceived Others--Arousal						
High Empathy	7.22	1.27	3.94	1.03	4.93	1.84
Low Empathy	6.89	1.42	4.13	1.18	4.78	1.98

Note. Group *n*'s are as follows: Low Empathy (n=24), High Empathy (n=35).

Table 1.3.

Psychophysiological Measures of Emotional Response: Means by Film Type and Level of Empathy

	Happy		Neutral		Sad	
Measure[a]	*M*	*SD*	*M*	*SD*	*M*	*SD*
Corrugator EMG						
High Empathy	-0.73	0.76	0.30	0.58	0.43	0.56
Low Empathy	-0.70	0.62	0.10	0.73	0.60	0.52
Zygomatic EMG						
High Empathy	0.56	0.71	-0.18	0.75	-0.38	0.69
Low Empathy	0.08	0.92	0.09	0.79	-0.17	0.75
Film-Related Heart Rate						
High Empathy[b]	0.05	0.22	0.10	0.25	-0.14	0.20
Low Empathy	0.08	0.26	0.04	0.21	-0.12	0.26
Startle Magnitude						
High Empathy	0.20	0.35	-0.04	0.28	-0.17	0.20
Low Empathy	0.03	0.26	0.04	0.33	-0.05	0.24

Note. Unless otherwise indicated, group *n* 's are as follows: Low Empathy (*n* =24), High Empathy (*n* =35).

[a] The values used in this table represent within-subject *z* -scores for each measure.

[b] *n* =33.

Table 1.4.

Correlations among IRI total and subscale scores and self-report and psychophysiological emotional responses to happy films (Panel A) and sad films (Panel B)

Panel A: Happy films	Pleasantness Rating	Arousal Rating	Perceived Other Pleasantness	Perceived Other Arousal	Self-Other Difference: Pleasantness[a]	Corrugator	Zygomatic	Film-related HR	Startle Magnitude
IRI Total	.22	.14	.16	.07	-.13	-.05	.33*	-.09	.28*
IRI Perspective Taking	.27*	.17	.21	.13	-.16	-.05	.37**	-.05	.26*
IRI Empathic Concern	.28*	.20	.23	.10	-.16	-.03	.32*	-.07	.26*
Panel B: Sad films									
IRI Total	-.42**	.15	-.02	.10	.45***	-.10	-.16	-.03	-.22
IRI Perspective Taking	-.40**	.14	-.07	.14	.39**	-.11	-.23	-.07	-.24†
IRI Empathic Concern	-.43**	.13	-.07	.05	.44**	-.07	-.13	-.07	-.23†

[a] Because pleasantness ratings were made on a continuum from 1(extremely unpleasant) to 9 (extremely pleasant), the direction of self-other difference scores has connotations for happy versus sad films. For happy films, negative self-other difference scores indicate that others are perceived to be experiencing more pleasantness compared to oneself. For sad films, positive self-other difference scores indicate that others are perceived to be experiencing more unpleasantness compared to oneself.

*p <.05. **p <.01. ***p <.001

Table 2.1.

Interpersonal Reactivity Index total and subscale scores: Means by psychopathy group

	IRI Total Score		IRI Subscale[a] : PT		IRI Subscale: EC		IRI Subscale: FS		IRI Subscale: PD	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Non-psychopathic Controls (*n*=15)	72.07	13.04	18.73	6.10	21.67	5.51	21.67	3.13	10.00	3.30
Psychopaths (*n*=16)	49.25***	17.16	14.13	7.01	12.19***	6.29	17.44*	7.16	5.50**	4.32

* $p<.05$. ** $p<.01$. *** $p<.001$.

[a] Subscale abbreviations are as follows: PT= PerspectiveTaking; EC= Empathic Concern; FS= Fantasy; PD= Personal Distress.

Table 2.2.

Correlations among PPI total and Factor scores and IRI total and subscale scores

	IRI Total Score	IRI Subscale[c]: PT	IRI Subscale: EC	IRI Subscale: FS	IRI Subscale: PD
PPI Total Score[a]	-0.66***	-0.38*	-0.73***	-0.32	-0.55***
Factor I: Fearless Dominance	-0.65***	-0.46**	-0.60***	-0.34	-0.61***
Factor II: Self-Centered Impulsivity	-0.37*	-0.18	-0.51**	-0.14	-0.26
Factor III[b]: Coldheartedness	-0.75***	-0.35	-0.86***	-0.42*	-0.63***

[a] Because the PPI is traditionally interpreted using standard scores (Lilienfeld & Widows, 2005), *T* scores, as opposed to raw scores, were used in these analyses.

[b] Although Coldheartedness is not typically considered a Factor in its own right, the PPI authors argue that it should be considered as such, given its centrality to the core construct of psychopathy (Lilienfeld & Widows, 2005)

[c] Subscale abbreviations are as follows: PT= PerspectiveTaking; EC= Empathic Concern; FS= Fantasy; PD= Personal Distress.

*p<.05. **p<.01. ***p<.001

Table 2.3.

Self-Report Measures of Emotional Response: Means by Film Type

	Happy		Neutral		Sad	
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*
SAM Valence						
Non-psychopathic Controls	6.71	0.95	4.75	0.43	3.31	0.95
Psychopaths	6.74	1.01	4.72	0.60	3.66	1.00
SAM Arousal						
Non-psychopathic Controls	5.61	1.50	3.32	1.10	3.73	1.34
Psychopaths	5.59	1.08	3.14	1.11	4.16	0.76
Perceived Others--Valence						
Non-psychopathic Controls	8.16	0.60	1.99	0.70	4.68	0.41
Psychopaths	8.24	0.58	2.01	0.57	4.75	0.38
Perceived Others--Arousal						
Non-psychopathic Controls	7.47	1.16	3.83	1.06	3.77	1.75
Psychopaths	7.44	1.08	4.13	0.93	4.33	1.48
Self-Other Difference Score						
Non-psychopathic Controls	1.44	0.77	-0.07	0.47	-1.32	0.70
Psychopaths	1.50	0.93	0.03	0.58	-1.64	0.93

Note. Group n's are as follows: Non-psychopathic Controls (n=15), Psychopaths (n=16).

[a] Because pleasantness ratings were made on a continuum from 1(extremely unpleasant) to 9 (extremely pleasant), the direction of self-other difference scores has different connotations for happy versus sad films. For happy films, negative self-other difference scores indicate that others are perceived to be experiencing more pleasantness compared to oneself. For sad films, positive self-other difference scores indicate that others are perceived to be experiencing more unpleasantness compared to oneself.

Table 2.4.

Psychophysiological Measures of Emotional Response: Means by Film Type

	Happy		Neutral		Sad	
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*
Corrugator EMG						
Non-psychopathic Controls	-0.57	0.81	0.13	0.76	0.44	0.59
Psychopaths	-0.70	0.76	0.35	0.65	0.35	0.59
Zygomatic EMG						
Non-psychopathic Controls	0.54	0.72	-0.05	0.80	-0.49	0.65
Psychopaths	-0.05	0.84	-0.13	0.89	0.18	0.77
Film-Related Heart Rate						
Non-psychopathic Controls	0.03	0.23	0.12	0.16	-0.15	0.23
Psychopaths	0.10	0.31	0.06	0.33	-0.16	0.24
Startle Magnitude						
Non-psychopathic Controls	0.14	0.37	-0.06	0.23	-0.12	0.28
Psychopaths	0.13	0.34	0.02	0.29	-0.14	0.21

Note. Group *n* 's are as follows: Non-psychopathic Controls (n=15), Psychopaths (n=16).

Table 2.5.

Correlations among PPI total and Factor scores and self-report and psychophysiological emotional responses to happy films (Panel A) and sad films (Panel B)

	Pleasantness Rating	Arousal Rating	Perceived Other Pleasantness	Perceived Other Arousal	Self-Other Difference: Pleasantness[c]	Corrugator	Zygomatic	Event-related HR	Startle Magnitude
Panel A: Happy films									
PPI Total Score[a]	.02	0.08	0.08	0.02	0.10	-0.05	-0.40*	0.07	0.02
Factor I: Fearless Dominance	-0.11	-0.07	-0.05	-0.10	0.15	-0.03	-0.25	0.08	0.15
Factor II: Self-Centered Impulsivity	0.22	0.17	0.17	0.07	-0.02	-0.09	- 0.42**	-0.01	-0.13
Factor III[b]: Coldheartedness	-0.26	0.09	-0.11	0.10	0.20	0.08	-0.27	0.18	0.05
Panel B: Sad films									
PPI Total Score	0.23	0.19	0.02	0.17	0.31	-0.10	0.49**	0.05	0.00
Factor I: Fearless Dominance	0.26	0.20	0.14	0.24	0.24	-0.04	0.26	0.01	-0.15
Factor II: Self-Centered Impulsivity	0.06	0.13	-0.13	0.12	0.22	-0.07	0.46**	0.05	0.05
Factor III: Coldheartedness	0.42*	0.10	0.11	-.07	0.41*	-0.25	0.55**	0.10	0.20

[a] Because the PPI is traditionally interpreted using standard scores (Lilienfeld & Widows, 2005), *T* scores, as opposed to raw scores, were used in these analyses.

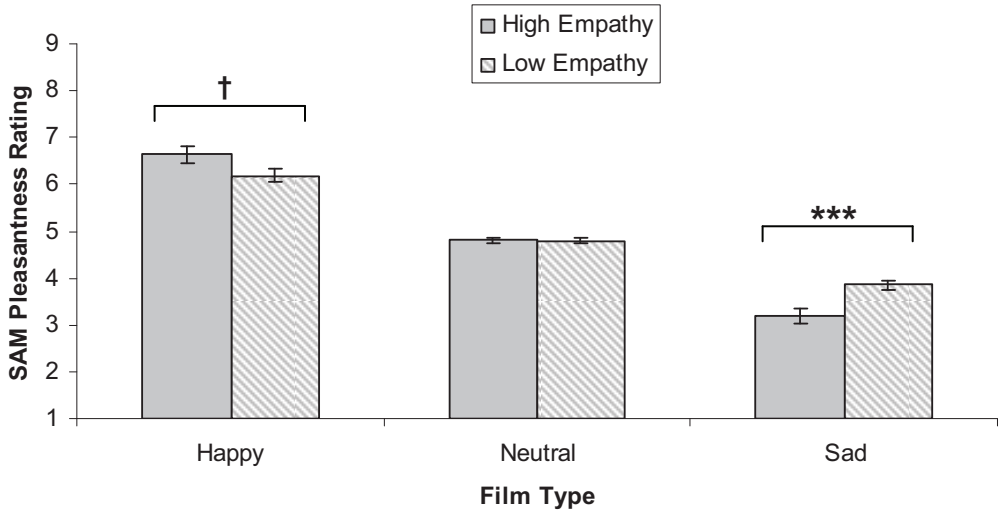
[b] Although Coldheartedness is not typically considered a Factor in its own right, the PPI authors argue that it should be considered as such, given its centrality to the core construct of psychopathy (Lilienfeld & Widows, 2005)

[c] For correlational analyses, self-other difference scores reflect the absolute value of Perceived Other minus participant's own pleasantness ratings. Thus, larger numbers are indicative of greater differences between self and other emotion, regardless of film valence.

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

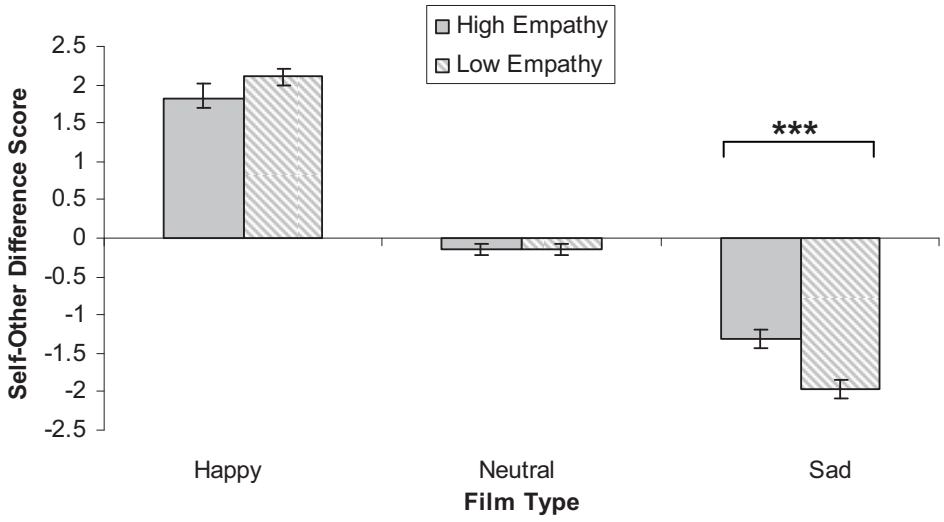
FIGURES

Figure 1.1. Self-reported pleasantness ratings by film type and empathy level (high or low empathy).



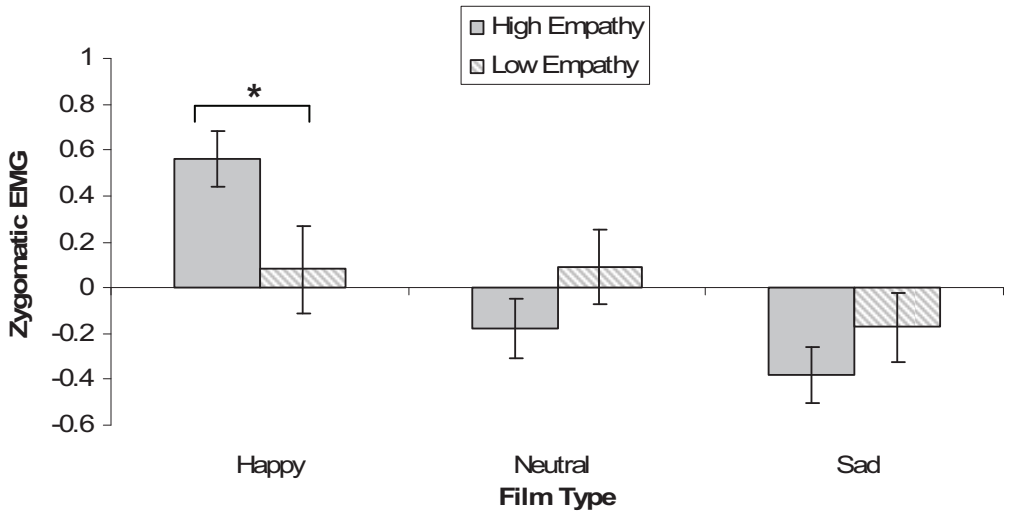
† $p<.06$. * $p<.05$. ** $p<.01$. *** $p<.001$

Figure 1.2. Self-other difference scores for pleasantness ratings across film types and empathy level (high or low empathy).



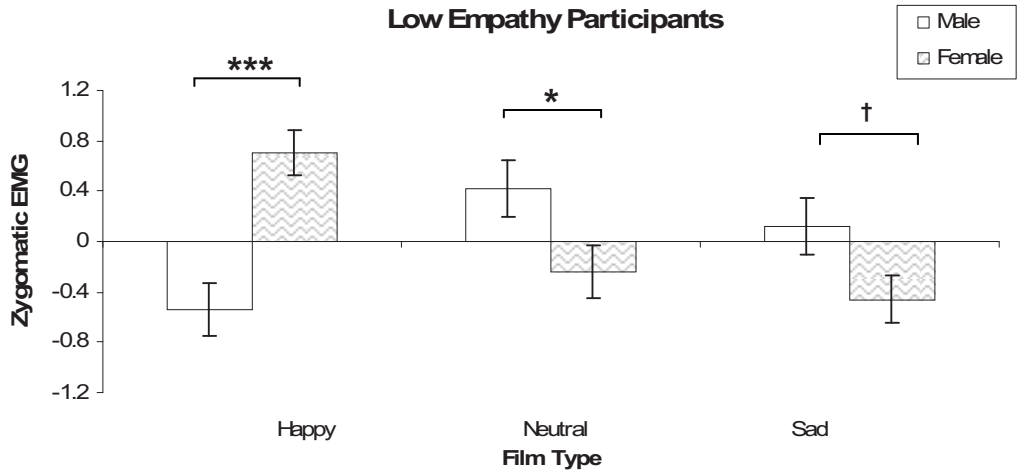
*p<.05. **p<.01. ***p<.001

Figure 1.3. Within-subject *z*-transformed zygomatic EMG activity by film type and empathy level (high or low empathy).



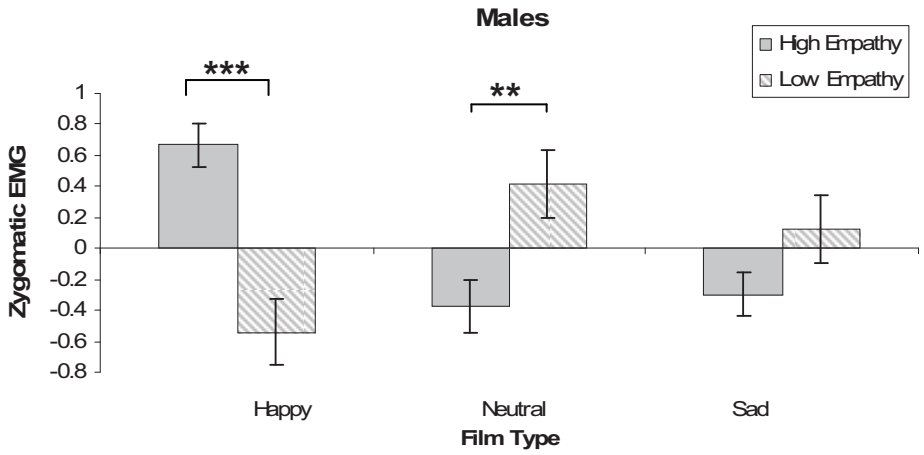
*p<.05.

Figure 1.4. Within-subject *z*-transformed zygomatic EMG activity for low empathy participants, by film type and sex (male or female).



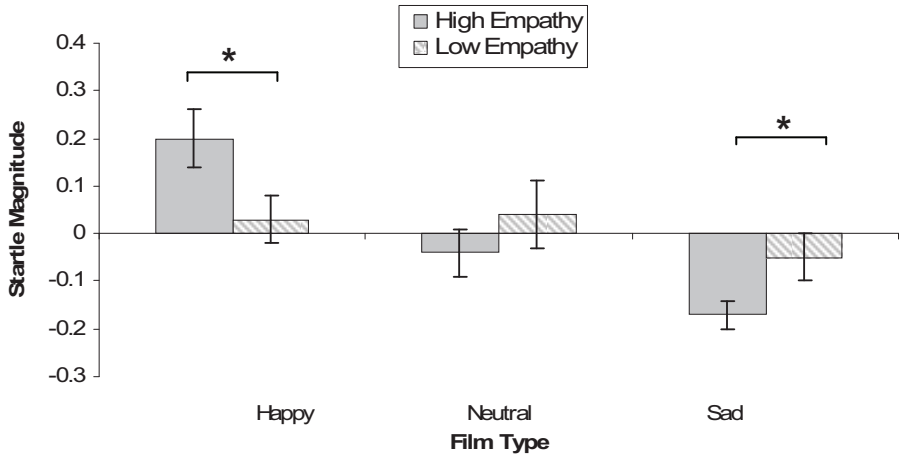
† $p<.06$. * $p<.05$. ** $p<.01$. *** $p<.001$

Figure 1.5. Within-subject *z*-transformed zygomatic EMG activity shown separately for male participants, by film type and empathy group (high or low).



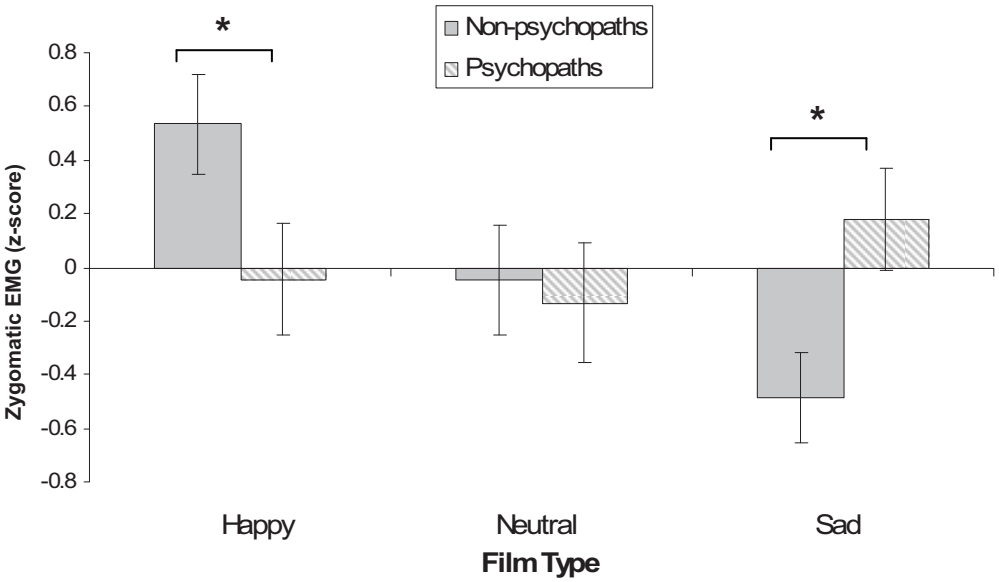
*p<.05. **p<.01. ***p<.001

Figure 1.6. Within-subject *z*-transformed startle response magnitude by film type and empathy level (high or low).



*p<.05.

Figure 2.1. Within-subject *z*-transformed zygomatic EMG activity by film type and psychopathy group (non-psychopathic controls or psychopaths).



* $p<.05$.

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