Journal of Personality Disorders, 30(5), 613-632, 2016

MOTOR EMPATHY IN INDIVIDUALS WITH PSYCHOPATHIC TRAITS: A PRELIMINARY STUDY

Yelena Khvatskaya, MS, and Mark F. Lenzenweger, PhD

The present laboratory study examined motor empathy in male and female individuals, who were either high or low on psychopathic traits, drawn from a nonclinical university population. Past findings suggest that psychopathic individuals are impaired in affective empathy, but findings on impairments in cognitive empathy are mixed. Research on motor empathy in psychopathy is scarce. The authors hypothesized that individuals high on psychopathic traits would have deficient motor empathy (similar to affective empathy) related to valenced emotion stimuli because of the automatic nature of motor empathy. Potential participants completed the Psychopathic Personality Inventory-Revised (PPI-R). Participants were chosen for the study on the basis of their PPI-R scores. All participants viewed photographic images drawn from a well-established set of stimuli (the International Affective Picture System) and were video recorded while doing so. Intensity for eight emotions (anger, contempt, disgust, fear, sad, joy, surprise, and neutral) in participants' facial expressions was measured objectively using an automated program, the Computer Expression Recognition Toolbox. Individuals high on psychopathic traits as compared with low PPI-R scorers displayed significantly less emotional congruence when viewing negative images. The study results suggest that deficits in motor empathy related to psychopathic trait levels are relatively restricted to negative emotions.

Psychopathy is variously conceptualized as a multifaceted or multidimensional disorder that includes dysfunction in affective processes, a self-centered and manipulative interpersonal style, and a propensity for engaging in risky and antisocial behaviors (Hare, 2003). The nature of the core dysfunction in psychopathy (if there is but one) remains the focus of considerable theoretical discussion (Patrick, Fowles, & Krueger, 2009; Skeem, Polaschek, Patrick, & Lilienfeld, 2011). We suggest that understanding more fully the nature of abnormal affective functioning in psychopathy, which includes shallow affect and lack of empathy, might help to explain the maintenance of various traits and behaviors characterizing psychopathy. Lack of empathy,

From Department of Psychology, State University of New York at Binghamton (Y. K., M. F. L.); and Department of Psychiatry, Weill Cornell Medical College (M. F. L.).

This research was completed in partial fulfillment of the requirements for the MS in clinical science at The State University of New York at Binghamton by Ms. Khvatskaya.

We thank Robert Rosenthal, PhD, for a useful consultation on effect sizes and meta-analysis.

Address correspondence to Mark F. Lenzenweger, Department of Psychology, The State University of New York at Binghamton, Science IV, Binghamton, NY 13902. E-mail: mlenzen@binghamton.edu

or callousness, is perhaps one of the most well-known defining features of psychopathy (Cleckley, 1976; Patrick et al., 2009; Skeem et al., 2011). Callousness (i.e., empathic deficits) has obvious clinical significance in adults as well as clinical and developmental significance for children (Viding & McCrory, 2012). The disturbance in empathic awareness of others is also a central principle in the rich Section III model of personality disorders in the *DSM-5* (Krueger, 2014).

Importantly, many of the interpersonal and emotional deficits present in individuals with psychopathy are thought to be developmental in nature (Blair, 2005): They emerge early in life and persist well into adulthood. Dysfunction in empathy and emotion regulation is one of the best predictors of antisocial behavior, and specifically aggression, for both adolescent boys and girls involved with the criminal justice system or diagnosed with severe conduct disorder and behavioral problems (Penney & Moretti, 2007). In addition, Kahn, Byrd, and Pardini (2013) suggest that callous-unemotional traits significantly add to the prediction of future offending, even after controlling for other risk factors. The relationship between empathy and aggression in the general population was also found to be negative, but weaker (Vachon, Lynam, & Johnson, 2014), in a meta-analysis of studies that defined empathy more generally and considered a much broader population, including students and community, nonviolent, and violent offender samples. It is very likely that in psychopathy the disruption in emotional processes is multifaceted. Thus, it is reasonable to conjecture that some aspects of empathic functioning might be impaired in relation to psychopathy while others might not be. For example, psychopathic individuals might harbor deficits in their personal experience of emotions, and thus distress at the emotional experiences of others may not resonate with or be readily perceptible by them (Preston & de Waal, 2002). Alternatively, given psychopathic individuals' well-known ability to charm and manipulate others, it is possible that they are able to recognize feelings of others without experiencing those emotions, and they are able to use this knowledge to their advantage.

A better understanding of the empathic deficits in psychopathy may further our knowledge of other features that characterize psychopathic individuals' interpersonal style, such as egocentricity, manipulativeness, and lying, and their usual lack of remorse. While it is unlikely we will be able to easily treat affective deficits in psychopathy, understanding these deficits can guide the way for attenuating other associated characteristics that are perhaps aided by dysfunction in emotional experiences.

THE NATURE AND STRUCTURE OF EMPATHY

Both clinical experience and the existing empirical research corpus suggest that empathy is a *multidimensional* construct. There are three well-known components of empathy, namely, cognitive, affective, and motor, which are defined by Blair (2005). *Cognitive empathy* is the ability to represent the mental state, including emotional state, of another individual. It is often discussed from within the "theory of mind" theoretical perspective. Cognitive empathy is the ability to *identify* emotions that others are experiencing or displaying. Cognitive empathy also includes the ability to understand the emotion one might typically be expected to have in a specific situation. In short, it is the ability to "put yourself in the other's shoes" or identify emotions based on facial, body, or situational clues. *Affective empathy* refers to an individual actually having or *experiencing* an emotional reaction in relation to the affective state of another person. In this way, affective empathy is most consistent with what the term *empathy* generally implies—the ability to emotionally experience (or "feel") what another is experiencing. Lastly, *motor empathy* is the inclination to automatically mimic another person's facial expression, vocalization, posture, and movement. Effectively, motor empathy is the synchronization of physical attributes of experienced emotion in the other and the self. De Waal (2012) proposes that when one attends to another's emotions, neural representations (which Preston and de Waal, 2002, termed the *perception-action mechanism*) of these emotions are automatically activated in the observer; thus he or she is basically "bodily sharing" another's emotions and needs. These multiple forms of empathy share anatomical and neural system overlap (superior temporal cortex), but each also functions independently. Cognitive empathy is thought to be implemented by temporo-parietal, temporal pole, and paracingulate cortex functions; motor empathy is thought to be implemented by superior temporal, inferior parietal, and inferior frontal cortex functions; and emotional empathy is thought to be implemented by, depending on the emotion, amygdala insula or ventrolateral frontal cortex functions (Blair, 2005). Finally, whereas each of the different forms of empathy may rely on different brain regions, they most likely work somewhat in parallel with each other. Clearly, these remain early days for understanding the neural circuitry underlying a complex psychological experience such as empathy, but the research literature in the area focused on empathy is growing.

Blair (2005) proposes that affective and motor empathy are rather *automatic* (they do not require effort, they are not controlled processes), while cognitive empathy may be more of a conscious *effort*, or an active thought process, on the part of the individual (therefore requiring effort). Thus, if the empathic dysfunction known to be part of psychopathy is as firmly ensconced within the psychological functioning of the person as some would suggest, then it is likely to be manifested within the affective and motor components of empathy (which reflects effortless, automatic processing) in relation to emotional stimuli. Moreover, whereas cognitive empathy can be learned with enough practice, affective and motor empathy (as the experience of others' emotions) might be difficult to evoke effortfully (or consciously).

In this context, we emphasize that the three types of empathy are likely not completely distinct or independent components. Moreover, what many refer to as "empathy" in clinical discourse includes the three types mentioned here and their interrelated manifestations. Nonetheless, this structure of empathy suggests that it is important to measure each component separately and to consider the relationship of each to psychopathy (or any other individual difference or pathology construct). As an example, consider Blair's (2011) review of empathy deficits in psychopathy and autism, which separates performance on tasks as a function of affective versus cognitive empathy. The two disorders are chosen by Blair because they are somewhat complementary, in that affective, but not cognitive, empathy is impaired in psychopathy, whereas cognitive, but not affective, empathy is impaired in autism.

RESEARCH ON EMPATHY IN PSYCHOPATHY

Bearing in mind this theoretical framework for empathy, we review research on empathy specifically in relation to psychopathy. A number of studies have examined empathy in psychopathy, but the results have been contradictory, particularly with regard to the different components of empathy. The empirical literature is clearly mixed. Some findings suggest little to no evidence for impairment in "theory of mind" or cognitive empathy in relation to psychopathy (Blair, 2011). For example, Richell and colleagues (2003), in a study of incarcerated men, found no generalized impairment in "theory of mind" in psychopathic individuals. Moreover, Book, Quinsey, and Langford (2007) compared inmates and individuals from the community on perception of affect and found that psychopathy was associated with greater accuracy on judgment of emotional facial expressions, specifically fearful expressions. Ali and Chamorro-Premuzic (2010) examined accuracy in recognizing mental states (or feelings expressed) from viewing facial expressions of the eye region, or listening to a voice. They reported that primary psychopathy was associated with impaired performance only for neutral faces and there were no deficits associated with negative stimuli. But some studies do demonstrate cognitive deficits in individuals with psychopathic traits. Brook and Kosson (2013) used a more ecologically valid task—video vignettes—and found that psychopathy was inversely associated with empathic accuracy. In fact, psychopathy Factor 2 scores had unique and greater association with empathic accuracy, while the relationship between psychopathy Factor 1 scores and empathic accuracy was marginally significant. Other findings on impairments in cognitive empathy in psychopathy often appear in studies that examine these deficits in children and adolescents with callous-unemotional traits or antisocial behaviors (Dawel, O'Kearney, McKone, & Palermo, 2012; Marsh & Blair, 2008). Cognitive empathy deficits may diminish over the course of psychological development, perhaps explaining results that suggest little or no impairment on some theory of mind tasks at some ages but not others. However, emotions probably still remain a "second language" (i.e., may not be well understood) to psychopathic individuals, which is consistent with findings that point to emotional processing deficits, especially when a task involves greater stimulus complexity (Sadeh & Verona, 2012).

Moving on to affective empathy, we find that the empirical picture is a bit more consistent in terms of findings. For the most part, across different studies, psychopathic individuals do demonstrate deficits in affective empathy (Blair, 2005), which represents an empirical basis that is in line with the clinical definition of the disorder. Psychopathic individuals demonstrate (a) an increase in heart rate when viewing negative pictures, (b) reduced differentiation and skin conductance response to all (pleasant, unpleasant, and neutral) sounds, and (c) no differences in blink magnitude for pleasant or unpleasant slides, but greater blink magnitude for neutral pictures than emotional pictures (Casey, Rogers, Burns, & Yiend, 2013; Patrick, Bradley, & Lang, 1993; Patrick, Cuthbert, & Lang, 1994; Verona, Patrick, Curtin, Bradley, & Lang, 2004). In contrast, low psychopathic features individuals show a different pattern of physiological arousal. It is entirely possible that subcomponents of psychopathy are related differentially to deficits in affective empathy. For example, consider that Ali, Amorin, and Chamorro-Premuzic (2009) found that "primary psychopathy" was positively associated with experiencing positive affect (assessed by self-report) when viewing sad images, whereas "secondary psychopathy" was positively associated with negative affect when viewing neutral images. In sum, psychopathic individuals do appear to show more empathic dysfunction within the specific realm of affective empathy.

Lastly, we consider motor empathy. Essentially *no* research has been conducted on deficits in motor empathy among psychopathic individuals. Fecteau, Pascual-Leone, and Théoret (2008) studied psychopathy and the mirror neuron system. They found that the level of cortical excitability modulation elicited by pain observation was positively correlated with the Coldheartedness scale (as measured by Lilienfeld's Psychopathic Personality Inventory [PPI]), which indicates an association between greater responsiveness at the sensorimotor level and elevated coldheartedness (a psychopathic trait). However, the meaning of this finding is ambiguous because higher excitability only provides evidence for higher engagement in the experience. It is unclear whether psychopathic individuals were (a) deriving pleasure from viewing others in pain, (b) were more engaged in viewing others in pain, or (c) were experiencing pain when viewing others in pain.

In summary, individuals with psychopathic traits perform comparably to control groups on "theory of mind" tasks and do not evidence lack of ability to cognitively represent mental states of others. Past research has consistently demonstrated deficits in affective empathy among individuals with psychopathic traits. To our knowledge, there has not been any research specifically on deficits in motor empathy in psychopathy, which is the aim of the present study.

FACIAL EMOTION AS A WINDOW ON EMPATHY PROCESSES

What is the most effective way to tap motor empathy in the laboratory? To advance this study, we consulted the facial emotion research methodological literature. Facial expression of emotions is perhaps one of the ways to measure automatic reactions associated with emotional arousal or responsiveness in an individual. Emotional expressions are crucial to the development and maintenance of interpersonal relationships, for example, in forming attachments and regulating aggression (Ekman, 1992). Importantly, there is robust evidence that there are distinct and universal facial expressions for anger, sadness, fear, disgust, and enjoyment (Ekman, 1992). There are also distinctive patterns of autonomic nervous system activity for different emotions, such as anger, fear, disgust, and sadness (Ekman, 1992). In addition, and critically important, past research indicates that different facial expressions evoke specific emotional responses in observers (Keltner & Ekman, 2000), and it is assumed that these emotions can be interpreted from the observer's facial expression. Several studies have used this methodological approach in the past, specifically examining empathy, and found that this procedure allows differentiation between conscious (i.e., effortful) interpretation of emotional stimuli and somatic (i.e., automatic) reactions to facial stimuli (Sonnby-Borgström, 2002; Sonnby-Borgström, Jönsson, & Svensson, 2003). One method for detecting emotions in facial expressions is the Facial Action Coding System (FACS; Ekman & Friesen, 1978, as cited in Ekman & Keltner, 1997), which allows for scoring of all observed facial movement using 44 established and validated "Action Units," and then, given certain recognizable patterns of activity in the facial region, facial expression can be rated and categorized as displaying one of the basic emotions. The FACS approach is relatively unobtrusive as a laboratory procedure. Another method is facial electromyography (EMG). However, this approach can be experienced as highly intrusive due to the application of electrodes to the facial surface. Therefore, in an effort to assess facial expressions in the least invasive (yet highly valid) manner, we used the FACS to analyze facial expressions in the present study, but we employed an automated computerized procedure to avoid the pitfall of the rating approach.

PRESENT STUDY

The present study sought to investigate differences in cognitive and motor empathy among individuals high and low on psychopathic traits in relation to valenced emotional stimuli. From the outset, we viewed this study as hypothesis-generating in nature. Considering what is known about psychopathy clinically as well as what is known about the condition in terms of empathy as reviewed here, we hypothesized that individuals with elevated psychopathic features should perform similarly to low psychopathic features individuals on *cognitive* empathy tasks, but demonstrate deficits in *motor* empathy tasks (given the deficits in affective empathy found in the past). Thus, we hypothesized that there would be no differences between individuals who are high versus those who are low on psychopathic features in their ability to identify (i.e., name) emotions displayed in the FACS images. We did anticipate finding differences between these two groups in the degree to which they revealed emotion, via their motoric facial expression, congruent with what they were seeing in terms of visual emotional stimuli. Finally, we also hypothesized that, specifically for negative emotions, individuals high on psychopathic traits would not demonstrate emotion on their faces (motor empathy) congruent with the one displayed in the image as intensely as individuals who are low on psychopathic traits. This hypothesis was guided largely by the clinical observation that psychopathic individuals are indifferent to the misfortune or suffering of others (e.g., Cleckley, 1976; McCord & McCord, 1964; Patrick et al., 2009).

METHOD

PARTICIPANTS

We selected participants, all resident in a nonclinical university population, for this study based on their elevation on an established measure of psychopathic features. In our view, such participants might provide a useful window on how individuals with psychopathic features function emotionally more generally (i.e., outside the confines of correctional settings). Because many studies of psychopathy, including some mentioned here, draw their samples from incarcerated (prison) populations, we attempted to extend and increase the generalizability of previous findings on cognitive empathy and examine motor empathy in a nonclinical student population at the State University of New York at Binghamton. The SUNY Binghamton undergraduate population is 63.3% White, 5.9% African American, 11.0% Hispanic/Latin, 16.6% Asian American, 0.12% Native American, 0.05% Native Hawaiian/Pacific Islander, and 2.8% Biracial.

The study was conducted in two phases. In Phase I, a total of 862 participants completed a screening of psychopathic features (using the Psychopathic Personality Inventory-Revised [PPI-R], Lilienfeld & Widows, 2005; see Measures section). PPI-R total scores were calculated for each participant assessed in Phase I. We selected participants for the laboratory phase of the study (Phase II) using these total PPI-R scores. For selection, we used the norms explicitly calibrated to college students (ages 18–24) provided in the PPI-R (Lilienfeld & Widows, 2005; Table A1b, p. 70, Table B1b, p. 114). To be considered for study inclusion, participants had to have obtained a score above the top 10th percentile or below the bottom 10th percentile on the PPI-R using Lilienfeld's community/college sample norms. Given the well-established existence of different mean levels of PPI-R total scores for males and females, we considered it reasonable to use different cut scores for males and females in selection (see PPI-R) and we did so.[1] Thus, males who scored below 258 or above 339 and females who scored below 237 or above 313 on the PPI-R received an e-mail inviting them to participate in the second part of the study. We used relatively stringent cutoff scores in the identification of our subject groups in order to maximize our chances of selecting individuals who have elevated levels of psychopathic personality traits. We used an extreme groups selection strategy to ensure that the subjects we selected possessed either high or low levels of various psychopathic traits to study how these individuals reacted to emotional stimuli.

The final sample of participants that completed both parts of the study (screening and laboratory phase) is the focus of this study. As noted earlier,

1. We opted to select males and females using sex-specific cut scores on the PPI-R for our study. We do not see the selection using separate norms for males and females as a "necessity"; rather, it is our substantive and methodological preference. One could espouse an alternative preference, in which sex effects on the selection index are ignored and not used to set cut scores. Clearly, we do not know (nor does anyone else) if the differences in scores across males and females on the PPI-R reflect the "state of nature," measurement artifact, or otherwise. It is relatively common in experimental psychopathology research to select males and females for research using separate cutoff scores, if substantial differences across the sexes exist on a selection measure.

we studied participants who met PPI-R cutting scores that identified the top 10th percentile and bottom 10th percentile per PPI-R norms for community (nonforensic) samples. Thus, the final sample that completed the laboratory phase of this study and are included in the analysis consisted of 47 participants. The high psychopathy group included 13 participants with a mean PPI-R score of 334.23 (SD = 27.63), and the low psychopathy group consisted of 34 subjects with a mean PPI-R score of 222.03 (SD = 16.82).[2] Participants overall ranged in age from 18 to 28 years with a mean age of 18.87 (SD = 1.61) years. The sample consisted of 31 females (66%), 10 in the high psychopathy group, and 16 males (34%), 3 in the high psychopathy group. The majority of the participants described themselves as White (76.6%), with fewer describing themselves as Asian (14.9%), Black (4.3%), and other (4.3%). Due to technical difficulties with computer equipment and/or administration errors, we excluded three participants who did not have complete data available on primary task. Participants were not provided with any substantial honorarium or other incentive. Rather, those completing the laboratory phase of the study received only a small amount of research participation credit through the departmental subject pool system.

MEASURES

Psychopathic Personality Inventory-Revised (PPI-R). The PPI-R (Lilienfeld & Andrews, 1996; Lilienfeld & Widows, 2005) is a well-known and extensively used psychometric measure of psychopathic features. It contains 154 questions, answered using a 4-point Likert scale: 1 (*false*), 2 (*mostly false*), 3 (*mostly true*), and 4 (*true*). The inventory yields a total score, interpretable as a global index of psychopathy, as well as scores on eight subscales reflecting specific constituent traits. The subscales can also be summed into two broad factors. The PPI-I or Fearless Dominance Factor includes Social Potency, Stress Immunity, and Fearlessness subscales. The PPI-II or Impulsive Antisociality Factor includes Impulsive Nonconformity, Machiavellian Egocentricity, Carefree Nonplanfulness, and Blame Externalization subscales. The Coldheartedness subscale does not load on either of the factors and thus stands alone as a separate psychopathic trait. The PPI-R has substantial internal consistency (αs range from .78 to .87 in a student–community sample) and test–retest reliability (rs range from .82 to .95).

International Affective Picture System (IAPS). The IAPS (Lang, Bradley, & Cuthbert, 2008) contains a well-known and extensively used set of normative emotional stimuli that range widely on the dimensions of valence, arousal,

2. In this study, a total of 862 people started Part I (screening), and 837 people actually completed all the questionnaires. Out of that initial pool, 158 participants were at or below the cutoff for the group of individuals with low psychopathic traits and 52 were at or above the cutoff for the group of individuals with high psychopathic traits (accounting for roughly 25% of the original screening sample). Attempts were made to solicit participation from all remaining eligible participants for this laboratory study. However, as is well known, for various reasons, not all participants who qualify for participation in a psychopathology study actually participate. For example, as noted in the text, we could provide only a modest incentive for the laboratory phase of the study, namely, a small amount of research pool participation credit, and perhaps this was insufficient as an incentive for many potential participants.

and dominance. These images varied on type and intensity of emotion. The IAPS provides ratings for each picture on the valence scale (happy-unhappy), arousal scale (excited vs. calm), and dominance scale (controlled vs. in-control), each ranging from 1 to 9. The split-half coefficients for the valence and arousal dimensions were highly reliable for computer administration format (0.94 and 0.93, respectively). For this study, we used 10 positive (IAPS nos.: 8540, 8490, 8380, 8370, 4626, 4623, 2347, 2071, 1811, 1710), 10 negative (IAPS nos.: 9410, 9940, 9412, 2205, 2352.2, 6540, 9908, 9050, 2141, 9400), and 10 neutral (IAPS nos.: 7004, 7187, 7080, 7000, 7490, 5740, 7090, 7026, 2620, 5731) images. For positive pictures, the mean valence was 7.64 (SD = 1.56), the mean arousal was 5.66 (SD = 2.28), and the mean dominance was 6.04 (SD = 2.03). For negative pictures, the mean valence was 2.09 (SD = 1.47), the mean arousal was 6.25 (SD = 2.11), and the mean dominance was 3.17 (SD = 2.12). For neutral pictures, the mean valence was 5.30 (SD = 1.23), the mean arousal was 2.48 (SD = 1.93), and the mean dominance was 6.39 (SD = 2.01). Extensive descriptions of the stimuli, which were developed with support from the National Institute of Mental Health, can be found at http://csea.phhp.ufl.edu/Media.html.

Computer Expression Recognition Toolbox (CERT). The CERT (Littlewort et al., 2011) is a software program/tool for real-time fully automated coding of facial expression. It provides sufficiently accurate estimates of facial expression using the FACS, one of the most widely used expression coding systems, developed by Ekman and Friesen (1978). For example, smile detector outputs measured with the CERT program correlated highly (r = .89) with human judgments of smile intensity. The accuracy rate of CERT program performance for categorizing facial expressions in a seven-alternative forced-choice test was 87.21%, and on a spontaneous facial expression dataset the CERT achieved an accuracy rate of nearly 80%. One methodological benefit of the CERT approach is that it uses what is essentially a counting procedure via algorithms, as opposed to a rating approach implemented by human judges. It uses a set of 10 facial features to recognize and estimate the intensity of Action Units defined by FACS, which is then used to implement a set of seven basic emotion detectors and neutral expression, scored from 0 to 1 in intensity. There is also preliminary evidence of concurrent validity with EMG; that is, CERT outputs are significantly correlated with EMG measures of zygomatic and corrugators activity.

STATISTICAL ANALYSES

Given our use of the extreme groups design, we used nonparametric statistical testing (Mann–Whitney procedure) to compare mean levels of performance for the two subject groups on the dependent variables of interest. We hypothesized that the high PPI-R participants would display emotion on their faces that was *less* congruent with what they were viewing as contrasted, in general, with the low PPI-R subjects. Our central hypothesis concerned *negative* emotional stimuli, such that the psychopathic participants would display emotion on their faces that was less congruent with the negative emotional stimuli they were viewing (i.e., their congruence score for negative stimuli would be smaller than that found for the low PPI-R subjects). Statistical tests were conducted using a two-tailed procedure; Cohen's *d* was used as an effect size measure. Although neutral IAPS stimuli were included in the visual presentations seen by the participants, our hypotheses regarding congruence concerned valenced stimuli (positive vs. negative), and therefore the present report does not concern the facial emotion of the participants while viewing neutral stimuli. The neutral stimuli were addressed in the cognitive empathy assessment that focused on the ability of the participants to correctly identify positive, negative, and neutral emotions as depicted in the IAPS stimuli. In supplemental individual difference (correlational) analyses, we used both Pearson and Spearman correlations to evaluate associations.

PROCEDURE

As noted, this study was conducted in two phases. In Phase I, interested participants received a computer link to complete the PPI-R online. In Phase II, selected participants were invited to attend a laboratory research session, and all who participated were tested in a comfortable and conventionally lighted laboratory room in the Laboratory of Experimental Psychopathology at SUNY-Binghamton. The Phase II laboratory session lasted approximately 45 minutes. After completing the consent form, participants were asked to simply view a series of photographic images (IAPS stimuli) on a computer screen while they were being videotaped. They were not asked to do anything with the images at this point. Each IAPS image appeared on the screen for 3 seconds. To prevent carryover of emotions from one image to the next (a common methodological consideration), after each image was shown, the participants were asked to solve a simple math problem that appeared on the screen for 5 seconds. The presentations of the IAPS images were counterbalanced in terms of valence. After completing the visual image task, participants were asked to again view the 30 images and for each one select the emotion depicted in each picture they had previously viewed—emotion identification task (i.e., cognitive empathy task). At this time, participants chose how long they viewed each image by pressing the "next" arrow when ready to go on to the next image. In this task, all participants viewed the images in the same order. Participants were then thanked for their participation and dismissed. Several participants who asked about the purpose of the experiment after completion received a debriefing of what the task was measuring. No information was provided regarding what personality traits were used for subject selection for the second phase of the study. This was done in order to (a) shield the participants from falsely inferring what subject group they might be in and (b) avoid the possibility of unnecessarily fueling a potentially self-fulfilling prophecy regarding psychopathic personality features in the study participants. The latter concern was guided by the reality that the PPI-R (like all self-report inventories) is necessarily fallible as a psychometric instrument and will necessarily generate some classification errors; thus, classifications are not made with perfect certainty. The participants were told they would be able to receive additional information about the study results after data collection was completed. All participants completed the study, no one withdrew from participating in the experiment during the protocol, and no complications arose. This study and all procedures were reviewed and received prior full approval from the SUNY-Binghamton Internal Review Board.

DATA EXTRACTION AND REDUCTION

MOTOR EMPATHY

To examine the differences in motor empathy between the two groups, we calculated the mean score for each of the classified emotions (joy, surprise, anger, contempt, disgust, fear, sadness, neutral) expressed on the face of the participant across the IAPS stimuli (10 positive, 10 negative, and 10 neutral). We also calculated a mean negative emotion by averaging the intensity of five negative emotions, namely, anger, contempt, disgust, fear, and sadness. In what follows, unless otherwise specified, when we refer to "negative emotion," it is the mean (average) intensity of these five negative emotions. Thus, each participant had a score for joy, surprise, and negative emotion expressed in response to the positive, negative, and neutral IAPS images. Given that surprise, as an emotion, is less clearly demarcated than joy and the negative emotions, we do not report on the surprise ratings in this set of analyses. It is unclear how surprise might relate to empathy, and we sought to avoid unsupported interpretations of the results related to the emotion of surprise. Next, we computed the degree to which the emotion shown on the participant's face was congruent with the emotion known to have been displayed in the IAPS stimuli viewed. Thus, we expected a predominantly positive emotional facial display relative to negative emotion when a participant was viewing a positive IAPS stimulus and a predominantly negative emotional facial display relative to positive emotion when a participant was viewing a negative IAPS stimulus. For example, a participant was said to display "congruent" emotion for negative pictures, or negative congruence, when the intensity of expressed negative emotion was *greater than* the intensity of expressed emotion of joy when viewing negative images. In this example, a higher congruence score indicates that experienced negative emotion is more intense than experienced emotion of joy in response to negative images. A lower congruence score indicates that there is little difference between positive and negative experienced emotions in response to negative images. The congruence scores were calculated at a *within-person* (individual) level. Congruence scores are therefore based on the differences of the two emotion scores for each person. They are no overall group-derived scores because we were not simply comparing individuals with high psychopathic traits to normal individuals in terms of displayed emotion, but rather we were specifically interested in congruence between stimuli viewed and emotions expressed *within* each participant in terms of positive and negative emotion. In short, we used each participant's own levels of emotional expression to indicate what emotion the participant felt most intensely when looking at a particular image, and our congruence score analysis captured that element of the individual's performance.

COGNITIVE EMPATHY

One way of measuring *cognitive empathy* was to assess accuracy in correctly identifying the emotion displayed in a given image (from here on referred to as "identification task"). As part of the questionnaires that participants completed after the motor empathy task, they were asked to again view the 30 images they saw previously and indicate what emotion they identified in the image. Participants were allowed to view the image for as long as they liked. They were asked to choose one of the emotions: anger, contempt, disgust, fear, joy, sad, surprise, or neutral. Bradley and Lang (2007) provide a list (Table 2.2, p. 36) of the most frequent specific emotion descriptors selected when viewing different picture contents in the IAPS; this list was used to assign an emotion to each image used, and that emotion was considered as the correct response. For some of the images, several different emotions (choices) were considered correct based on the Bradley and Lang table. We used this information to calculate an accuracy score for each group of images (negative, neutral, positive) for our participants.

RESULTS

Our sample contained men and women. Therefore, because there are sex differences across some psychopathic behaviors, we used a two-way ANOVA to test the effect of sex on the primary dependent variables (congruence of emotion scores). There were *no* main effects for sex for negative congruence or positive congruence. Moreover, there were *no* significant interactions between PPI-R group and sex for these same variables. Highly similar results were found using a nonparametric analysis approach as well. The data were collapsed across sex to examine the differences between the two groups: individuals high and low on psychopathic traits.

PRIMARY GROUP ANALYSES: MOTOR EMPATHY (EXPRESSED EMOTION IN RELATION TO EMOTIONAL STIMULI)

We were specifically interested in the performance of the high psychopathic traits study participants in relation to negative IAPS stimuli, as noted previously. We tested our a priori hypotheses using nonparametric Mann–Whitney *U* tests. A nonparametric statistical testing approach was used because our subject groups were defined at the end (tail) regions of the PPI-R score distribution (i.e., the full range of PPI-R scores was not used to construct study groups). Using the congruence scores computed as noted, we compared the two groups in terms of their expression of negative or positive emotion when viewing negative or positive emotion valenced images, respectively. These results are presented in Table 1. There was a statistically significant difference (effect size: $d = .61$) between the two groups on the negative congruence score, that is, the difference in intensity of negative emotion versus joy when

TABLE 1. Motor Empathy Congruence Scores in Relation to Negative or Positive Valenced Emotional Images

Congruence Measure	High PPI-R Group (n = 13)		Low PPI-R Group (n = 34)		U	z	p	d
	M	SD	M	SD				
Negative vs. Positive for Negative Stimuli	.065	.040	.090	.043	138	−1.974	.048	.61
Positive vs. Negative for Positive Stimuli	−.067	.039	−.079	.068	168	−1.260	.207	.23

Note. PPI-R = Psychopathic Personality Inventory–Revised. U = Mann-Whitney U test statistic. z = z value corresponding to the U statistic. p = probability level (two-tailed) for z value. d = effect size measure (Cohen's d). Negative refers to mean negative emotion (anger, contempt, disgust, fear, and sadness); positive refers to positive emotion (joy).

viewing negative images. When viewing negative stimuli, individuals who were high on psychopathic traits demonstrated significantly less differentiation between experience of negative versus positive emotions than persons who were low on psychopathic traits. This was in accord with our central hypothesis for the study. However, there were no significant group differences in expression of positive emotion (i.e., joy) when viewing positive images. As mentioned previously, the emotion of surprise was not included in the analyses due to its ambiguity in relation to how it is best classified.

In addition to examining the relative emotional performance within each subject (i.e., the congruence scores), we also compared the intensity of experienced negative and positive emotions displayed on the subjects' faces when they were looking at negative and positive images across the high psychopathic and low psychopathic feature groups. In this comparison, the two groups of subjects were contrasted at the interindividual level of analysis. The results of these interindividual contrasts (see Table 2) were similar to those obtained using the within-subjects approach described above results. When viewing negative images, individuals in the high psychopathic group exhibited significantly smaller intensity of experienced negative emotions than individuals in the low psychopathic group (U = 133, z = –2.093, p = .036, d = .75).

SUPPLEMENTARY INDIVIDUAL DIFFERENCE ANALYSES WITH PPI-R AND MOTOR EMPATHY

We supplemented our primary group differences analysis using a correlational approach to examine individual differences in psychopathy in relation to our motor empathy data. Correlational analyses allowed us to look at the variation present on the PPI-R across the high and low psychopathic individuals more sensitively, for example, by examining relationships between specific traits and empathy, taking individual differences into account. We focused on the negative congruence scores (negative emotion minus joy while viewing negative stimuli) in these analyses. We correlated the negative congruence score (negative emotion minus joy) with the PPI-R total score as well as the two major PPI-R factors known as Fearless Dominance and Impulsive Antisociality. Given our subject selection strategy and its possible impact on distributional assumptions, we evaluated these associations using

TABLE 2. Motor Empathy Scores Across the Two Subject Groups in Relation to Negative or Positive Valenced Emotional Images

Emotion Expressed	High PPI-R Group		Low PPI-R Group		*U*	*z*	*p*	*d*
	(*n* = 13)		(*n* = 34)					
	M	*SD*	*M*	*SD*				
Negative emotions in response to negative stimuli	.076	.039	.104	.037	133	−2.093	.036	.75
Positive emotions in response to negative stimuli	.079	.036	.106	.040	139	−1.950	.051	.71
Negative emotions in response to positive stimuli	.011	.013	.014	.017	148	−1.736	.083	.21
Positive emotions in response to positive stimuli	.012	.019	.026	.042	192	−0.690	.490	.24

Note. PPI = Psychopathic Personality Inventory-Revised. *U* = Mann-Whitney *U* test statistic. *z* = *z* value corresponding to the U statistic. *p* = probability level (two-tailed) for *z* value. *d* = effect size measure (Cohen's *d*). Negative emotions refers to mean negative emotion (anger, contempt, disgust, fear, and sadness); positive emotion refers to the positive emotion (joy).

both the Pearson product-moment correlation coefficient (r) and Spearman's rho (ρ). The two sets of correlational results were highly comparable. The negative congruence score of interest correlated (Pearson, Spearman) significantly (two-tailed) with the total PPI-R score ($r = -.30$, $p = .038$; $\rho = -.29$, $p = .051$), PPI-R Fearless Dominance ($r = -.29$, $p = .05$; $\rho = -.32$, $p = .028$), and PPI-R Impulsive Antisociality ($r = -.29$, $p = .05$; $\rho = -.26$, $p = .08$). These individual difference results accord well with the group difference results and indicate that both of the major factors underlying the PPR-R are associated with the negative congruence score. The correlations of the motor empathy score in relation to the specific subscales of the PPI-R were also examined in a supplemental set of analyses, and those results are contained in the appendix. In short, the only significant associations were found for the negative congruence score in relation to PPI-R impulsive nonconformity ($r = -.33$, $p = .022$; $\rho = -.38$, $p = .009$) and PPI-R social potency ($r = -.27$, $p = .063$; $\rho = -.32$, $p = .031$); the motor empathy score was *not* related significantly to the PPI-R Coldheartedness subscale for either form of correlation ($r = -.19$, $p = .201$; $\rho = -.19$, $p = .205$).

COGNITIVE EMPATHY (ABILITY TO IDENTIFY EMOTION)

While motor empathy (specifically emotional congruence) was the main focus of this study, we were also interested in the differences in the participant groups in performance on a cognitive empathy task. It was important to establish that the high psychopathic features participants did not differ from the low psychopathic features participants in their ability to identify positive, neutral, and negative emotions. There were *no* significant differences between individuals who were high versus low on psychopathic traits on the total score for this IAPS-based emotion identification/cognitive empathy task (Mann–Whitney $U = 213.00$, $z = -0.192$; $p = .847$, two-tailed). This result is in line with past research and suggests that individuals who are high on psychopathic traits are as accurate as individuals low on psychopathic traits in identifying (not experiencing) others' emotions. All of the valenced IAPS images (positive and negative) contained faces of actors depicting emotion as well as some contextual or situational cues.

DISCUSSION

The present study examined differences in cognitive and motor empathy between individuals who are high and low on psychopathic traits. We defined these individuals as scoring in the top or the bottom 10th percentile on the Psychopathic Personality Inventory-Revised, a well-known and psychometrically sound measure of psychopathic features. The present study is the first, to our knowledge, to assess motor empathy in psychopathy using facial expressions as a way of measuring emotions felt or expressed. Our findings suggest that individuals high on psychopathic traits may not have difficulty reflecting experiences of joy and happiness in others (as depicted in the IAPS images). However, these same individuals do not show congruent negative emotions, such as anger, fear, contempt, disgust, or sadness, as clearly as people low on psychopathic traits when looking at others experiencing painful or threatening events. Our individual difference analyses are also supportive of higher levels of PPI-R–assessed psychopathic features being associated with motor empathy deficits. Finally, an interindividual (between-groups) analysis of the motor empathy task performance was consistent with our congruence (within-subjects) analysis of the laboratory performance of our subjects.

These laboratory results accord well with what is known clinically about psychopathy. It has long been seen by clinicians and sophisticated observers of psychopathy (e.g., Cleckley, 1976; Hare, 2003; Lilienfeld & Andrews, 1996; Lykken, 1995; McCord & McCord, 1964; Patrick et al., 2009) that these individuals have a different experience of emotions (shallow affect), specifically ones that are centered around other people (lack of empathy).[3] The present study contributes empirical data indicating that not only do individuals with psychopathic traits experience different physiological arousal in response to negative emotions of others (affective empathy), but they also do not exhibit facial expression, vocalization, posture, and movement (motor empathy) that reflect these negative feelings in response to others' feelings as low psychopathic features individuals would.

The present study has several strengths. First, it assessed motor empathy using a nonintrusive, objective, automated (computerized) laboratory measure of experienced affect. As a method, it might be better at distinguishing true emotion from general arousal, for example, in comparison to results obtained using skin conductance response. The data were also derived in a counting manner consistent with ratio measurement rather than through a human rating system/approach (see Lenzenweger [2010] on the merits of a counting rather than a rating approach). A vast amount of research on facial expressions suggests that this general methodological approach is a rigorous and valid one for detecting what the individual is actually feeling in response

3. In this sample, while we were not focused on self-reported empathy, we did include a self-report measure of affective empathy known as the Interpersonal Reactivity Index (IRI; Davis, 1980, 1983). We found a significant negative relationship between the Coldheartedness subscale of the PPI-R and the score on theIRI, as well as two subscales of the IRI, Perspective-Taking and Empathic Concern. Such associations accord well with the clinical impressions and theoretical positions that suggest diminished empathy among psychopathic individuals.

to others' feelings (Dimberg, Thunberg, & Elmehed, 2000; Keltner & Ekman, 2000). In addition, using images drawn from the well-known IAPS catalog, which depicted emotionally valenced scenes, allowed us to more closely simulate real-life experiences. Thus, the use of such ecologically rich stimuli enhances the probability that the group differences that we observed are compelling, perhaps even genuine, deficits present in highly psychopathic individuals. Lastly, looking at psychopathic traits in the low psychopathic features population can help us better understand this disorder as it occurs more generally (outside of correctional populations). Consideration of the current findings together with past research suggests that empathy deficits are clearly prominent in relation to the psychopathy construct irrespective of the population from which the psychopathic individuals were drawn.

LIMITATIONS, REFINEMENTS, AND FUTURE DIRECTIONS

A limitation of the present study is the relatively small sample size, particularly for the high psychopathic features group. The number of people who scored in the top 10th percentile on the PPI-R was rather small (by definition), even though we screened more than 800 people for possible inclusion given the distribution of PPI-R total scores. This was an initial study in this area suggesting that motor empathy deficits are linked to negative emotional stimuli. The results accord well with a broader body of evidence suggesting that psychopathy is associated specifically with deficits in processing and experiencing negative emotions. Another methodological consideration is the specificity of motor empathy deficits to psychopathy. It would be important in future research to include another comparison group that might have some deficiencies in affective experiences in order to evaluate specificity issues. For example, individuals with schizoid personality disorder often present as deeply detached and exhibit flat emotional experiences (American Psychiatric Association, 2013). Comparing the high psychopathic group to a schizoid group would help to clarify whether the observed deficits are specific to psychopathy.

We used the classic extreme groups research strategy to explore this problem in this study. It is a recognized method for gleaning an initial impression of the presence (or lack thereof) of an effect. The principal concern with the classic extreme groups strategy is that it may *overestimate* the correlation between the grouping variable (e.g., nonpsychopathic vs. psychopathic group membership) and the dependent variable of interest. Preacher, Rucker, MacCallum, and Nicewander (2005) stated that the extreme groups approach is a valuable tool for discovering the presence and the direction of an effect when the researcher has limited resources. Due to some limitations of the CERT, the facial recognition program that we used, one step of the data preparation had to be done manually for each participant, which greatly increased the cost of research, in terms of time. While we are aware of cautionary commentary on the extreme groups design (Preacher et al., 2005), we see our use as being legitimate per their commentary. Moreover, we see our approach as consistent with the long tradition of exploratory (hypothesis-generating) research in psychopathology and individual differences that has used the extreme-groups design (e.g., Kagan on temperament [Schwartz, Snidman, & Kagan, 1999]; Buchsbaum, Coursey, & Murphy [1976] and the biochemical high-risk paradigm; Lenzenweger [1994, 2010] and the psychometric high-risk paradigm). Nonetheless, there is the possibility that the association between the grouping variable in this study (i.e., group membership) and our dependent variables may be somewhat overestimated. This is an empirical question, and only additional empirical research could settle this issue. Finally, it is always possible that an observed effect has arisen by chance in a study, and therefore we encourage replication efforts in this area (with, ultimately, a meta-analytic synthesis of the findings across all studies; see Rosenthal, Rosnow, & Rubin [2000]).

Using additional measures of emotions might help us gain a more precise understanding of the deficits in empathy and affective experiences in psychopathy. For example, obtaining *f*MRI data with facial expression data might aid us in understanding brain activity or responses in a psychopathic individual when he or she is in the presence of another individual in an emotional state. In this, way we might be able to describe neurological deficits that prevent detection of emotion and which result in failure to experience emotion.

While psychopathic individuals will probably experience emotions similar to others when something generally good happens (benefits the majority of people), their experience of positive emotion, such as love, will be very different from what low psychopathic features individuals experience because this emotion, at least in part, revolves around the object of love and not the self. Similarly, psychopathic individuals might experience similar anger when the reason for anger concerns them; they might not experience the same anger as that found in low psychopathic features individuals when an offense is directed toward an individual other than the self (a friend, family member, and so on).

A question that flows from these results concerns how psychopathic individuals can function as well as they do given these deficits. It would be interesting to understand how these individuals learn to identify emotions that others experience without understanding the meaning of these emotions. How do psychopathic individuals come to learn appropriate ways to act in emotional situations? That is, what cues do they use to appear "normal," without the ability to rely on internal cues, physiological and cognitive? Having more knowledge about how psychopathic individuals function and relate to the world will be helpful in finding effective methods of treating this disorder. We offer our results as suggestive regarding the nature of empathy found in psychopathic individuals. The potential of motor empathy deficits as a putative candidate as an endophenotype (Gottesman & Gould, 2003; Lenzenweger, 2013) for psychopathy should be considered, and future studies might be directed at evaluating this possibility.

APPENDIX. Supplemental correlational analyses between Psychopathic Personality Inventory–Revised subscales and expression of congruent emotion: Negative stimuli

	Mean negative emotion intensity greater than joy	Mean negative emotion intensity greater than joy
	(Pearson *r*)	(Spearman ρ)
Machiavellian Egocentricity	–.25	–.29
Impulsive Nonconformity	–.33*	–.38 **
Blame Externalization	–.12	–.13
Carefree Nonplanfulness	–.14	–.08
Social Potency	–.27	–.32 *
Fearlessness	–.26	–.28
Stress Immunity	–.22	–.23
Coldheartedness	–.19	–.19

Note. Values are Pearson product-moment correlation coefficients (*r*) (left column) and Spearman rho (ρ) coefficients (right column). $^{*}p < .05$. $^{**}p < .01$ (two-tailed).

REFERENCES

Ali, F., Amorim, I. S., & Chamorro-Premuzic, T. (2009). Empathy deficits and trait emotional intelligence in psychopathy and Machiavellianism. *Personality and Individual Differences, 47*, 758–762.

Ali, F., & Chamorro-Premuzic, T. (2010). Investigating Theory of Mind deficits in nonclinical psychopathy and Machiavellianism. *Personality and Individual Differences, 49*, 169–174.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

Blair, R. J. (2005). Responding to the emotions of others: Dissociating forms of empathy through the study of typical and psychiatric populations. *Consciousness and Cognition*, *14*, 698–718.

Blair, R. J. (2011). Fine cuts of empathy and the amygdala: Dissociable deficits in psychopathy and autism. *Quarterly Journal of Experimental Psychology*, *61*(1), 157–170.

Book, A. S., Quinsey, V. L., & Langford, D. (2007). Psychopathy and the perception of affect and vulnerability. *Criminal Justice and Behavior, 34*, 531–544.

Bradley, M. M., & Lang, P. J. (2007). The International Affective Picture System (IAPS) in the study of emotion and attention. In J. A. Coan & J. J. B. Allen (Eds.), *Handbook of emotion elicitation and assessment* (pp. 29–46). New York, NY: Oxford University Press.

Brook, M., & Kosson, D. S. (2013). Impaired cognitive empathy in criminal psychopathy: Evidence from a laboratory measure of empathic accuracy. *Journal of Abnormal Psychology*, *122*, 156–166.

Buchsbaum, M. S., Coursey, R. D., & Murphy, D. L. (1976). The biochemical high-risk paradigm: Behavioral and familial correlates of low platelet monoamine oxidase activity. *Science, 194 (4262)*, 339–341.

Casey, H., Rogers, R. D., Burns, T., & Yiend, J. (2013). Emotion regulation in psychopathy. *Biological Psychology*, *92*, 541–548.

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

Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology*, *10*, 85.

Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology*, *44*, 113–126.

Dawel, A. O'Kearney, R., McKone, E., & Palermo, R. (2012). Not just fear and sadness: Meta-analytic evidence of pervasive emotion recognition deficits for facial and vocal expressions in psychopathy. *Neuroscience and Biobehavioral Reviews*, *36*, 2288–2304.

de Waal, F. M. (2012). A bottom-up view of empathy. In F. M. de Waal & P. Ferrari (Eds.), *The primate mind: Built to connect with other minds* (pp. 121–138). Cambridge, MA: Harvard University Press.

Dimberg, U., Thunberg, M., & Elmehed, K. (2000). Unconscious facial reactions to emotional facial expressions. *Psychological Science*, *11*(1), 86–89.

Ekman, P. (1992). An argument for basic emotions. *Cognition and Emotion*, 6, 169–200.

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

Ekman, P., & Keltner, D. (1997). Universal facial expressions of emotion: An old controversy and new findings. In U. Segerstrale & P. Molnar (Eds.), *Nonverbal communication: Where nature meets culture* (pp. 27–46). Mahwah, NJ: Erlbaum.

Fecteau, S., Pascual-Leone, A., & Théoret, H. (2008). Psychopathy and the mirror neuron system: Preliminary findings from a non-psychiatric sample. *Psychiatry Research, 160*, 137–144.

Gottesman, I. I., & Gould, T. D. (2003). The endophenotype concept in psychiatry: Etymology and strategic intentions. *American Journal of Psychiatry, 160,* 636–645.

Hare, R. D. (2003). *Hare Psychopathy Checklist–Revised (PCL–R): 2nd edition technical manual*. Toronto, ON: Multi-Health Systems.

Kahn, R. E., Byrd, A. L., & Pardini, D. A. (2013). Callous-unemotional traits robustly predict future criminal offending in young men. *Law and Human Behavior*, *37*, 87–97.

Keltner, D., & Ekman, P. (2000). Facial expression of emotion. In M. Lewis & J. Haviland-Jones (Eds.), *Handbook of emotions* (2nd ed., pp. 236–249). New York, NY: Oxford University Press.

Krueger, R. F. (2014). Personality disorders are the vanguard of the post-*DSM-5.0* era. *Personality Disorders: Theory, Research, & Treatment*, *4*, 355–362.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2008). *International Affective Picture System (IAPS): Affective ratings of pictures and instruction manual* (Technical Report A-8). Gainesville, FL: University of Florida.

Lenzenweger, M. F. (1994). The psychometric high-risk paradigm, perceptual aberrations, and schizotypy: An update. *Schizophrenia Bulletin*, *20*, 121–135.

Lenzenweger, M. F. (2010). Schizotypy and schizophrenia: The view from experimental psychopathology. New York, NY: Guilford Press.

Lenzenweger, M.F. (2013). Thinking clearly about the endophenotype vs. intermediate phenotype vs. biomarker distinctions in developmental psychopathology research. [Invited essay for 25th anniversary issue.] *Development & Psychopathology*, *25*, 1347–1357.

Lilienfeld, S. O., & Andrews, B. P. (1996). Development and preliminary validation of a self-report measure of psychopathic personality traits in noncriminal populations. *Journal of Personality Assessment*, 66, 488–524.

Lilienfeld, S. O., & Widows, M. R. (2005). *Psychopathic Personality Inventory-Revised: Professional manual*. Lutz, FL: Psychological Assessment Resources.

Littlewort, G., Whitehill, J., Wu, T., Fasel, I., Frank, M., Movellan, J., & Bartlett, M. (2011). The Computer Expression Recognition Toolbox (CERT). In *2011 IEEE International Conference on Automatic Face & Gesture Recognition and Workshops (FG 2011)* (pp. 298–305). Piscataway, NJ: IEEE.

Lykken, D. (1995). *The antisocial personalities*. Hillsdale, NJ: Erlbaum.

Marsh, A. A. & Blair, R. J. R. (2008). Deficits in facial affect recognition among antisocial populations: A meta-analysis. *Neuroscience and Biobehavioral Reviews*, *32*, 454–465.

McCord, W., & McCord, J. (1964). *The psychopath: An essay on the criminal mind*. Oxford, England: D. Van Nostrand.

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

Patrick, C. J., Cuthbert, B. N., & Lang, P. J. (1994). Emotion in the criminal psychopath: Fear image processing. *Journal of Abnormal Psychology*, *103*, 523–534.

Patrick, C. J., Fowles, D. C., & Krueger, R. F. (2009). Triarchic conceptualization of psychopathy: Developmental origins of disinhibition, boldness, and meanness. *Development and Psychopathology*, *21*, 913–938.

Penney, S. R., & Moretti, M. M. (2007). The relation of psychopathy to concurrent aggression and antisocial behavior in high-risk adolescent girls and boys. *Behavioral Sciences and the Law*, *25*, 21–41.

Preacher, K. J., Rucker, D. D., MacCallum, R. C., & Nicewander, W. A. (2005). Use of extreme groups approach: A critical reexamination and new recommendations. *Psychological Methods*, *10(2)*, 178–192.

Preston, S. D., & de Waal, F. B. M. (2002). Empathy: Its ultimate and proximate bases. *Behavioral and Brain Sciences, 25*, 1–72.

Richell, R. A., Mitchell, D. G. V., Newman, C., Leonard, A., Baron-Cohen, S., & Blair, R. J. R. (2003). Theory of Mind and psychopathy: Can psychopathic individuals read the 'language of the eyes'? *Neuropsychologia, 41*, 523–526.

Rosenthal, R., Rosnow, R. L., & Rubin, D. B. (2000). *Contrasts and effect sizes in behavioral research: A correlational approach*. Cambridge, England: Cambridge University Press.

Sadeh, N., & Verona, E. (2012). Visual complexity attenuates emotional processing in psychopathy: Implications for fear-potentiated startle deficits. *Cognitive, Affective, & Behavioral Neuroscience, 12,* 346–360.

Schwartz, C. E., Snidman, N., & Kagan, J. (1999). Adolescent social anxiety as an outcome of inhibited temperament in childhood. *Journal of the American Academy of Child and Adolescent Psychiatry*, *38*, 1008–1015.

Skeem, J. L., Polaschek, D. L. L., Patrick, C. J., & Lilienfeld, S. O. (2011). Psychopathic personality: Bridging the gap between scientific evidence and public policy. *Psychological Science and the Public Interest*, *12*, 95–162.

Sonnby-Borgström, M. (2002). Automatic mimicry reactions as related to differences in emotional empathy. *Scandinavian Journal of Psychology, 43*, 433–443.

Sonnby-Borgström, M., Jönsson, P., & Svensson, O. (2003). Emotional empathy as related to mimicry reactions at different levels of information processing. *Journal of Nonverbal Behavior, 27*, 3–23.

Vachon, D. D., Lynam, D. R., & Johnson, J. A. (2014). The (non)relation between empathy and aggression: Surprising results from a meta-analysis. *Psychological Bulletin*, *140*, 751–773.

Verona, E., Patrick, C. J., Curtin, J. J., Bradley, M. M., & Lang, P. J. (2004). Psychopathy and physiological response to emotionally evocative sounds. *Journal of Abnormal Psychology*, *113*, 99–108.

Viding, E., & McCrory, E. J. (2012). Why should we care about measuring callous-unemotional traits in children? *British Journal of Psychiatry*, *200*, 177–178.

This article has been cited by:

1. Jeremy G. Gay, Michael J. Vitacco, Amy Hackney, Courtney Beussink, Scott O. Lilienfeld. 2018. Relations among psychopathy, moral competence, and moral intuitions in student and community samples. *Legal and Criminological Psychology* **23**:2, 117-134. [Crossref]
2. Corine Dijk, Agneta H. Fischer, Nexhmedin Morina, Charlotte van Eeuwijk, Gerben A. van Kleef. 2018. Effects of Social Anxiety on Emotional Mimicry and Contagion: Feeling Negative, but Smiling Politely. *Journal of Nonverbal Behavior* **42**:1, 81-99. [Crossref]