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Vocal Affect Recognition and Psychopathy: Converging Findings Across Traditional and Cluster Analytic Approaches to Assessing the Construct

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Abstract

Deficits in emotion processing have been widely reported to be central to psychopathy. However, few prior studies have examined vocal affect recognition in psychopaths, and these studies suffer from significant methodological limitations. Moreover, prior studies have yielded conflicting findings regarding the specificity of psychopaths' affect recognition deficits. This study examined vocal affect recognition in 107 male inmates under conditions requiring isolated prosodic vs. semantic analysis of affective cues and compared subgroups of offenders identified via cluster analysis on vocal affect recognition. Psychopaths demonstrated deficits in vocal affect recognition under conditions requiring use of semantic cues and conditions requiring use of prosodic cues. Moreover, both primary and secondary psychopaths exhibited relatively similar emotional deficits in the semantic analysis condition compared to nonpsychopathic control participants. This study demonstrates that psychopaths' vocal affect recognition deficits are not due to methodological limitations of previous studies and provides preliminary evidence that primary and secondary psychopaths exhibit generally similar deficits in vocal affect recognition.

Keywords

psychopathy; affect; subtype; emotion; offenders

Psychopathy is a personality disorder syndrome characterized by emotional traits such as callousness, lack of remorse, and superficial charm, as well as impulsivity and poor behavioral control (Hare, 2003). Cleckley (1941) suggested psychopaths suffer from a semantic disorder in which meaning-related associative and elaborative processes are deficient. Because they have difficulty understanding the emotional impact of their actions for themselves or others, they do not learn to modify their behaviors on the basis of their emotional consequences (Cleckley, 1941).

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Based on the central role of lack of empathy and shallow affect in clinical descriptions, several studies have examined psychopaths' ability to process emotional information. Studies have shown that psychopaths are less reactive to threatening cues (Lykken, 1957), interpersonal distress cues (Blair, Jones, Clark, & Smith, 1997), and affective vocalizations (Verona, Patrick, Curtin, Bradley, & Lang, 2004). They also fail to exhibit startle potentiation while viewing negative affective slides (Patrick, Bradley, & Lang, 1993) and display performance deficits in paradigms in which emotional responses appear to aid learning, including passive avoidance (Newman & Kosson, 1986) and aversive conditioning (Lykken, 1957). These findings suggest emotional cues have an attenuated impact on psychopaths' physiological responses and behavior.

Consistent with Cleckley's (1941) perspective, other studies suggest psychopaths have difficulty using affective language. They perform poorly at sorting affective metaphors on valence (Hervé, Hayes, & Hare, 2003) and fail to exhibit affective facilitation of lexical decision (Williamson, Harpur, & Hare, 1991). On the basis of these findings, Lorenz and Newman (2002) suggested that affective words have less emotional significance for psychopaths than for nonpsychopaths.

Studies Examining Psychopathic Offenders' Ability to Classify Affect

Several studies have reported relatively general deficits for psychopaths in paradigms requiring participants to identify nonverbal (nonsemantic) emotional information, such as facial affect (e.g., Blair et al., 2004; Kosson, Suchy, Mayer, & Libby, 2002). However, whereas Kosson et al. (2002) reported especially pronounced deficits in recognizing facial disgust, Blair et al. (2004) reported specific deficits in recognizing fearful and sad affect. Variability of past findings may suggest that psychopaths are a heterogeneous group with different types of specific emotional deficits or that different methods of assessing emotion processing may yield evidence for different kinds of affect recognition deficits. Both of these perspectives are explored in the current study.

Few studies have investigated psychopaths' ability to decode vocal affect. Because both semantic (i.e., content of language) and prosodic (e.g., tone of language) elements contribute to decoding vocalizations and given evidence that psychopaths are deficient in processing affective language, extant studies have attempted to isolate prosodic from semantic cues. Methods for filtering out semantic cues have included using neutral words or sentences spoken in various intonations (Seron, Van der Kaa, Vanderlinden, Remits, & Feyereisen, 1982), meaningless sentences spoken in various intonations (Schlanger, Schlanger, & Gerstman, 1976), and filtered speech that preserves paralinguistic features (Pell & Baum, 1997).

Patterson (1990), using filtered speech, reported a deficit for psychopaths in decoding negative affect in content-filtered speech that preserved the rhythm and sequence of speech but not in randomized spliced speech that preserved pitch and intensity variation. In contrast, psychopaths outperformed nonpsychopaths when decoding positive affect from vocalizations alone. However, because all group differences were limited to high-anxiety psychopaths and both forms of content masking bias observers' affective ratings (Van Bezooijen & Boves, 1986), the generalizability of these findings is uncertain.

Blair et al. (2002) asked psychopathic offenders to identify the affective tone of neutral words spoken in a tone of voice expressing fear, anger, disgust, or happiness. Psychopaths exhibited deficits in overall ability to classify affect and performed especially poorly in classifying fear vocalizations. Although not emphasized by the authors, effect sizes also suggested large effects for group differences in disgust and sadness. Similar deficits in

recognizing vocal sadness and fear have also been observed in youth with psychopathic traits (Blair, Budhani, Colledge, & Scott, 2005; Stevens, Charman, & Blair, 2001).

Although these findings suggest that psychopaths are deficient at understanding prosodic elements of vocal affect, there are important limitations to prior studies. In several studies, participants judged emotion on the basis of the tone of voice in which neutral words were spoken (Blair et al., 2002, 2005). However, prosodic judgments are usually analyzed at the level of sentences, not words (Ross, 2000), and based on affectively valenced rather than neutral expressions. In a study using sentences (Stevens et al., 2001), a specific deficit in decoding sadness was found, raising the possibility that different deficits may be evident with sentences than with words. However, the repetition of a single sentence 16 times in different tones may also have introduced artificiality.

In summary, several studies provide evidence that psychopaths are less responsive than nonpsychopaths to emotional information. However, findings addressing the ability to recognize specific emotions are somewhat inconsistent, with some studies suggesting relatively general, and others more specific, deficits in affect recognition. Moreover, few studies have specifically examined vocal affect recognition in criminal psychopaths, and those studies used methods of presenting affective cues with low ecological validity. Thus, the first part of the current study was designed to test competing hypotheses about the specificity of psychopaths' affect recognition deficits and examine the robustness of vocal affect recognition deficits, while improving upon the methods of prior studies.

Heterogeneity of Psychopathy

Another chief purpose of this study was to examine the possibility that different subgroups of offenders exhibit different emotional processing deficits. Although most studies treat psychopathy as a homogeneous construct (Blair et al., 2002, 2004; Kosson et al., 2002; Patrick et al., 1993), both clinical descriptions (Kahn, 1931; Karpman, 1941; Kraepelin, 1913; Schneider, 1923) and prior research (Lykken, 1957; Schmauk, 1970; Widom, 1976) suggest meaningful subgroups of psychopaths who differ in their clinical features and underlying pathophysiology. Consequently, the second part of this study examined whether different subgroups of psychopaths display different emotional processing deficits.

Although theorists have generated different labels for these subgroups (e.g., dissocial, paranoiac, symptomatic, idiopathic), there is some consistency in their defining features (Blackburn, 1994; Cleckley, 1941; Karpman, 1941; Schmauk, 1970). Extant empirical and clinical literatures provide converging evidence for two consistent and meaningful subgroups: primary and secondary psychopaths (Blackburn, 1994; Karpman, 1941; Schmauk, 1970). The *primary psychopath* is typically conceptualized as having a callous interpersonal style and shallow, superficial emotions, as well as a general poverty of affective reactions (Craft, 1966; Karpman, 1941; McCord & McCord, 1964). Hare (1970, 1996) argued that the primary psychopath was the only "true" psychopath.

In contrast, *secondary psychopaths* are characterized by an antisocial lifestyle, a short temper, and irresponsible actions (Karpman, 1941). Compared with primary psychopaths, secondary psychopaths are characterized as risk-takers prone to guilt (Karpman, 1941). Several researchers have revealed behavioral and physiological differences between primary and secondary psychopathic groups differentiated on anxiety scale scores (Schmauk, 1970; Widom, 1976), and Newman has reported similar behavioral differences between low-anxiety and high-anxiety psychopaths (Newman, Schmitt, & Voss, 1997), which reportedly parallel distinctions between primary and secondary psychopaths (Lorenz, 2002).

Evidence for Distinct Subgroups of Psychopathic Offenders

No single approach is widely accepted for identifying subgroups of psychopaths. However, several recent cluster analyses have identified subgroups that resemble theoretical conceptualizations of the primary and secondary psychopath in the literature. Using both hierarchical and nonhierarchical clustering methods, Vassileva, Kosson, Abramowitz, and Conrod (2005) reported evidence for four distinct offender groups that replicated across independent subsamples. These were labeled primary psychopaths, secondary psychopaths, nonpsychopathic criminals with alcohol and drug problems, and criminals with psychopathic features.

Primary psychopaths were distinguished by higher scores on the core affective and interpersonal factor of the Psychopathy Checklist—Revised (PCL-R; Factor 1; Hare, 1991, 2003) and Interpersonal Measure of Psychopathy (IM-P; Kosson, Steuerwald, Forth, & Kirkhart, 1997) compared with individuals in other clusters. These offenders also had histories including more violent charges, consistent with previous descriptions of primary psychopathy (Hare, 1970; Karpman, 1941). *Secondary psychopaths* were found to have more severe alcohol and drug dependence, higher scores on the psychopathy dimension associated with antisocial behavior (PCL-R Factor 2), and elevated trait anxiety, characteristics found in prior descriptions of secondary psychopaths (Blackburn, 1994; Karpman, 1941). A third cluster, nonpsychopathic criminals with alcohol and drug problems, consisted of individuals who lacked psychopathic features and were not troubled by anxiety but were prone to alcohol and substance abuse. The final cluster consisted of individuals who were neither clearly psychopathic nor nonpsychopathic and were designated *criminals with psychopathic features*.

Not only did Vassileva et al. (2005) replicate previously described criminal subgroups resembling primary and secondary psychopathy, but they replicated the subgroups using two different methods of cluster analysis (i.e., Wards and *k*-means) in two independent samples. Recently, other researchers have replicated similar clusters of offenders using more ethnically homogeneous samples (Swogger & Kosson, 2007) and using model-based clustering methods with preselected samples of high-PCL-R inmates (Hicks, Markon, Patrick, Krueger, & Newman, 2004; Skeem, Johansson, Andershed, Kerr, & Louden, 2007).[1] These findings provide evidence for the existence of distinct and reliable subgroups of psychopathy. However, comparisons of individuals in different clusters in emotional processing have not previously been reported.

Although groups derived from cluster analyses have not been examined, Lorenz (2002) compared emotional processing in groups of offenders defined on the basis of Welsh Anxiety Scale (WAS) scores and explicitly described as primary versus secondary psychopaths. In her study, low-anxious (primary) and high-anxious (secondary) psychopaths were compared on performance of an affective lexical decision task, an emotional Stroop, and a measure of emotional intelligence. Both primary and secondary psychopaths exhibited less affective facilitation on a lexical decision task than control participants (with matched WAS) and interference on the emotional Stroop comparable to that seen in control participants. Lorenz suggested these findings challenge the assumption that only primary psychopaths exhibit emotional deficits (cf. Patterson, 1990). However, this conclusion is limited by use of a single self-report measure to differentiate psychopathic subgroups. It

[1]Because model-based cluster analysis does not dictate the number or nature of the clusters that emerge, Hicks et al.'s (2004) and Skeem et al.'s (2007) identification of two clusters and the similarity of these clusters to those identified in previous clinical descriptions and other recent cluster analyses suggest some convergence in findings across methods and laboratories.

remains important to examine mechanisms underlying psychopathy in subgroups identified using more sophisticated methods.

The Current Study

Part One

As previously discussed, many studies suggest psychopaths have deficits in decoding emotional cues. However, researchers have often interpreted findings as suggesting more specific deficits with implications for mechanisms underlying psychopathy. To address this issue, we designed the first part of the study to test competing hypotheses about the specificity of psychopathic offenders' vocal affect recognition deficits. In addition, because semantic and prosodic processing appear to depend on partially distinct neural systems (Schlanger et al., 1976; Seron et al., 1982), the current study was designed to test whether psychopathic offenders' deficits are similar under conditions requiring use of semantic versus prosodic emotional cues.

Additionally, the first part of the study addressed methodological limitations of prior studies. To implement more naturalistic conditions, we used full sentences instead of words. We also corrected for a possible confound in prior studies related to presentation of multiple kinds of negative stimuli and only one category of positive stimuli (Blair et al., 2002; Kosson et al., 2002). If prosodic cues for positive affect are quite distinct from those for negative affect, psychopaths' apparent deficits in recognizing only negative emotions may reflect the fact that cues for happiness were easier to process in prior studies than cues for specific negative emotions. To address this confound, we presented an equal number of positive and negative affective stimuli.

In summary, if psychopathic inmates display pervasive emotional processing deficits, they should classify vocal affect less accurately than nonpsychopathic inmates in general and under both semantic and prosodic conditions. However, if they are characterized by more specific emotional deficits, then they may be expected to classify only sadness stimuli less accurately than nonpsychopathic control participants. Finally, if psychopaths' emotion processing deficits reflect particular difficulty decoding verbal information, they may perform poorly only under conditions requiring semantic processing.

Part Two

If Part One of this study indicated vocal affect deficits in psychopaths as identified by the PCL-R, we planned to further examine vocal affect recognition in more homogeneous subgroups of offenders identified using a cluster analytic approach. To this end, participants completing the vocal affect task were examined according to the subgroups identified by Vassileva et al. (2005).

This part of the study was designed to examine whether primary and secondary psychopaths exhibit similar or different vocal affect recognition deficits, compared with nonpsychopathic offenders and inmates with some psychopathic features. If the cluster identified as the primary psychopathic subgroup is consistent with traditional conceptualizations of psychopathy, primary psychopaths should exhibit vocal affect recognition deficits similar to those seen in individuals selected on the basis of high PCL-R scores. The absence of affect recognition deficits in the primary psychopathy cluster would suggest that the cluster analytic method is not an optimal approach for identifying subgroups of psychopathic offenders.

Evidence for similar affect recognition deficits in primary and secondary psychopaths would be consistent with Lorenz (2002) and suggest that there may be generality to her finding of

similar emotional deficits in these subgroups across different approaches to subdividing psychopathic offenders and different measures of affective processing.

An especially intriguing possibility is that different patterns of deficits may be evident in primary versus secondary psychopaths (Skeem, Poythress, Edens, Lilienfeld, & Cale, 2003). For example, primary psychopaths may exhibit a more specific or pervasive deficit for identifying sadness including deficits in using prosodic cues. However, if secondary psychopaths are pseudo-psychopaths, they should exhibit either adequate emotional processing or a very different pattern of deficits than primary psychopaths.

Evidence for a pattern of deficits in subgroups with psychopathic traits similar to those found in Part One would suggest that findings are relatively robust across very different approaches to the assessment of psychopathic features. Indeed, one of the important strengths of using the cluster analytic method is that participants are assigned to subgroups on the basis of algorithms designed to minimize within-cluster variability and across-cluster similarity rather than only on the basis of PCL-R scores. Therefore, cluster-derived groups may bear limited resemblance to groups identified using a single measure.

Method

Participants

One-hundred-seven male inmates at the Lake County Jail in Waukegan, IL were eligible to participate who were (a) between the ages of 18 and 45, (b) sentenced for a felony or misdemeanor conviction, (c) incarcerated for 2 weeks or longer, and (d) if data were available for the vocal affect measure and the classification variables used in the study. Inmates who exhibited psychotic symptoms, had estimated IQ scores below 70, were unable to read English, or reported using psychotropic medication were excluded. In Part One of the study, we assigned participants to psychopathic and nonpsychopathic groups using the traditional method of PCL-R total scores (Hare, 1991, 2003); 34 inmates with PCL-R ratings of 30.0 or higher were classified as psychopathic, 35 with PCL-R scores of 20.0 or lower were classified as nonpsychopathic, and 38 with PCL-R scores above 20.0 and below 30.0 were classified as middle-scoring offenders. Because PCL-R total scores do not differentiate subtypes of psychopathy, Part Two group assignment was based on a cluster analysis of PCL-R factor scores and scores on several additional measures considered relevant for subtyping offenders (see *Measures*).

We removed the data of 5 individuals performing at or below chance (i.e., 20% correct overall) on either condition of the vocal affect task from analyses because it could not be ascertained whether they understood task instructions or were motivated to perform the task correctly. These procedures yielded 34 psychopathic participants, 34 nonpsychopathic participants, and 34 participants with intermediate scores in the sample examined in Part One of the study. The ethnic distribution of the sample was 44.1% European American, 46.1% African American, 8.8% Latino, and 1.0% other. Cluster analyses for the second part of the study included 19 offenders classified as primary psychopaths, 29 classified as secondary psychopaths, 30 classified as nonpsychopathic criminals with alcohol and drug problems, and 24 classified as criminals with some psychopathic features.

Vocal Affect Recognition Task

The vocal affect recognition task consisted of two stimulus conditions of aurally presented sentences designed to isolate either semantic or prosodic cues to emotional communication. Within each condition, 30 stimulus sentences presented an equal number of trials for each of the four transcultural emotions of sadness (e.g., “The house seemed empty without her”),

anger (e.g., “I clenched my fist just thinking of what he had said to me”), happiness (e.g., “After breakfast, I strolled down the sandy beach”), and surprise (e.g., “I can't believe he remembered my birthday”), as well as neutral content (e.g., “I went to find my shoes in the closet”). There were six sentences in each category. The stimuli for this task were presented through speakers at a fixed volume level, according to a computer program written for this purpose. To ensure an equal number of positive- and negative-valence stimuli, only surprise sentences conveying positive surprises were used.

In the semantic–affective condition, all sentences were spoken in a neutral, flat tone of voice to minimize prosodic cues. After each sentence, participants were asked to identify the emotion conveyed by the speaker's words and choose from a list of the four emotions and the neutral category.

In the prosodic–affective condition, the same 30 sentences were used but with normal prosodic cues and spoken in Bulgarian to minimize recognizable linguistic or semantic cues, leaving only the paralinguistic cues of rhythm, pitch, and stress of pronunciation. After each sentence, participants chose the emotion (or the neutral option) being communicated by the speaker's tone of voice. The use of the Bulgarian language, in place of electronic filtering, was implemented to allow examination of the ability to decode prosodic cues in naturalistic (albeit foreign) language, compared with methods used in prior studies. No participants were able to speak Bulgarian. The dependent variable in both conditions was accuracy.

Measures

The Psychopathy Checklist—Revised (PCL-R)—The PCL-R (Hare, 1991, 2003) is a 20-item measure of traits and behaviors associated with psychopathy, with each item rated on a 3-point scale (*absent*, *inconsistent*, *present*) based on information obtained from a semistructured interview, behavioral observations, and collateral file material. Raters for this measure included several graduate students given intensive PCL-R training by David S. Kosson. Total PCL-R scores provide valid measures of psychopathy in European American (Hare, 1996; Hemphill, Hare, & Wong, 1998) and African American offenders (Cooke, Kosson, & Michie, 2001; Sullivan & Kosson, 2006). Preliminary construct validity has also been reported among incarcerated Latino males (Sullivan, Abramowitz, Lopez, & Kosson, 2006).

In this sample, interrater agreement for PCL-R scores was excellent (average intraclass r = .94; one-way random-effects model, n = 26 pairs of raters). Because Vassileva et al. (2005) had used factor scores for the original two-factor model of psychopathy in their cluster analysis, these factor scores were used to assign participants to clusters for Part Two of the study. Scores on items comprising each factor were summed separately in the cluster derivation to treat separately the affective/interpersonal (Factor 1) and antisocial behavior/impulsive lifestyle aspects of psychopathy (Factor 2). In this sample, intraclass correlations were .86 for Factor 1 and .87 for Factor 2 (average one-way random-effects model).

Structured Clinical Interview for DSM–IV Axis I Disorders (SCID-I), Alcohol and Substance Use Modules (First, Spitzer, Gibbon, & Williams, 1997)—This measure is a semistructured interview for assessing the impact of alcohol and drug use in terms of abuse and dependence criteria in the Diagnostic and Statistical Manual of Mental Disorders (*DSM–IV*; American Psychological Association, 1994). Answers for each symptom are coded 1 (*not present*) to 3 (*definitely present*). The number of symptoms present determined whether individuals met criteria for a substance abuse or dependence diagnosis. As in Vassileva et al. (2005), scores of 0 (*no disorder*) to 1 (*abuse*) to 2–4 (*mild*, *moderate*, or *severe dependence*) were assigned based on the diagnoses for use of alcohol and other substances, and these scores were used in cluster analyses.

Interpersonal Measure of Psychopathy (IM-P; Kosson et al., 1997)—The IM-P assesses interpersonal behaviors reported to be characteristic of psychopaths. It consists of 21 items rated on a 4-point scale to assess how well each item describes a participant's behavior. IM-P scores correlate highly with scores on Factor 1 of the two-factor PCL-R model (Kosson, Gacono, & Bodholdt, 2000; Kosson et al., 1997). Kosson et al. (1997) reported evidence that IM-P scores are both reliable and valid. Internal consistency was indicated by coefficient alpha of .91; good interrater agreement for the current sample is indicated by an average intraclass correlation coefficient of .89.

State–Trait Anxiety Inventory, Trait scale (STAI-T)—Scores on the STAI-T (Form Y; Spielberger, 1983) have been found to be valid and reliable for identifying persons with high levels of trait anxiety. The STAI-T consists of 20 items rated on a 4-point scale.

Shipley Institute of Living Scale—Revised (SILS; Zachary, 1986)—The SILS is a brief intelligence test comprised of vocabulary and analytical reasoning scales. Prior studies have reported that SILS full-scale IQ estimates correlated .74 to .85 with actual Wechsler Adult Intelligence Scale—Revised full-scale IQ scores (Zachary, 1986). Data from participants with estimated IQs below 70 were excluded.

Experimental Procedures

Recruitment of participants was achieved by telephone contact during which a general description of the study was provided. Interested inmates received additional details about procedures and provided written informed consent. Participants earned $5 or $8 for completing the study (compensation was increased during the study commensurate with minimum wage increases).

We conducted a semistructured interview to gather information regarding education, relationships, family life, and medical, work, and criminal histories. Afterwards, participants completed the SCID-I substance use disorders module and the SILS. We conducted reviews of available institutional files and completed the PCL-R on the basis of information obtained during both the interview and file review. The vocal affect recognition task and several tasks unrelated to the current study were completed on a separate day. The semantic and prosodic conditions were administered to participants in counterbalanced order.

Classification Procedures

In Part Two of the study, we computed standard scores for the clustering variables used by Vassileva et al. (2005). We then conducted a discriminant function analysis and used the classification coefficients, based on all six variables for each of the four clusters, to calculate four classification functions for each participant, one for each offender subgroup. The largest of these four classification functions for each participant indicated the cluster in which each individual best fit (see Appendix).[2] Means, standard deviations, and group comparisons for the variables that define each cluster identified in this analysis are listed in Table 1.

Results

In Part One of the study, we conducted planned comparisons of psychopathic and nonpsychopathic groups, consistent with most previous studies of emotional function and

[2]We assessed the replicability of Vassileva's et al.'s (2005) four-cluster solution in the current sample. Using *k*-means cluster analyses based on the Ward's analysis centroids obtained by Vassileva et al., four clusters were extracted that converge relatively well with the classification scheme identified by Vassileva et al. Additional details are available from the authors upon request.

psychopathy. Additional comparisons of middle-scoring groups with these groups were also conducted, with appropriate correction for alpha inflation. In Part Two of the study, we conducted planned comparisons of primary and secondary psychopathy clusters versus other clusters.

Part One

There were no significant differences between psychopathy groups on any demographic variables (age, education, intelligence, socioeconomic status, or handedness; all *t*s < 1.5, *ns*). To test the generality versus specificity of affective deficits, we used planned comparisons to examine the vocal affect recognition performance of psychopaths and nonpsychopaths for each of the five emotion categories as well as for overall performance in the semantic and prosodic conditions.

A preliminary 3 (group) × 2 (condition) × 5 (emotion category) analysis of variance revealed main effects for psychopathy, $F(2, 95) = 3.78$, $p < .05$; condition, $F(1, 95) = 86.96$, $p < .001$; and emotion, $F(3.6, 339.6) = 54.69$, $p < .001$; a Condition × Emotion interaction, $F(3.6, 346.9) = 226.08$, $p < .001$; and a trend toward a Condition × Group interaction, $F(2, 95) = 2.57$, $p = .08$. Where Levene's test suggested heterogeneity of variance, Welch's *t* test was used instead of the *t* test, and degrees of freedom were adjusted as recommended by SPSS.

Planned Comparisons—In the semantic condition, averaging across all emotion categories, psychopaths classified affective stimuli less accurately than did nonpsychopaths, $t(66) = –2.86$, $p = .006$, $d = 0.70$. Significant differences were also found between psychopaths and nonpsychopaths for the emotions of happiness, $t(66) = –3.09$, $p = .003$, $d = 0.76$, and sadness, $t(55) = –2.79$, $p = .007$, $d = 0.69$. Group differences were not significant for anger or surprise sentences (both *t*s < 1.30, *ns*, *d*s < 0.30), but the difference approached significance for neutral vocalizations, $t(66) = –1.88$, $p = .06$, $d = 0.46$. Effect sizes for all comparisons are found in Table 2.

In the prosodic condition, averaging across emotion categories, the difference between psychopaths and nonpsychopaths approached significance, $t(66) = –1.96$, $p = .05$, $d = 0.48$. The only specific emotion for which the difference between groups was significant was surprise, $t(50) = –2.17$, $p = .04$, $d = 0.53$. However, the group difference also approached significance for the neutral category, $t(66) = –1.89$, $p = .06$, $d = 0.46$. For all other emotions, group differences were small in magnitude (all *t*s < 1.1, all *d*s < 0.25).

Additional Comparisons—Although they are not based on a priori hypotheses, we also report comparisons between middle-scoring and nonpsychopathic and psychopathic participants, using the Tukey test to correct for alpha inflation. Middle-scoring participants performed more poorly than nonpsychopathic offenders only on happiness trials in the semantic condition. However, effect sizes (see Table 2) indicate moderate differences between middle-scoring participants and nonpsychopathic offenders on sadness and overall semantic condition performance, as well as between middle-scoring participants and psychopathic offenders on surprise trials in the prosodic condition.

Part Two

In the second part of the study we examined differences between clusters in vocal affect recognition. A preliminary 4 (cluster) × 2 (condition) × 5 (emotion category) analysis of variance again revealed main effects for condition, $F(1, 94) = 80.39$, and emotion, $F(3.6, 338.7) = 52.32$, both *p*s < .001; and a Condition × Emotion interaction, $F(3.7, 347.7) = 222.8$, $p < .001$. In addition, there was a significant main effect for cluster, $F(3, 94) = 3.43$, $p < .05$. For both the semantic and prosodic conditions of the vocal affect task, planned

comparisons were conducted using independent *t* tests to determine emotional processing performance differences between the following pairs of clusters: primary psychopaths versus nonpsychopathic criminals, secondary psychopaths versus nonpsychopathic criminals, and primary versus secondary psychopathic criminal offenders. In addition, we report comparisons of criminals with psychopathic features versus other groups. Means and standard deviations for each subgroup and condition are listed in Table 3.

Planned Comparisons

Primary psychopaths versus nonpsychopathic control participants: Primary psychopaths performed significantly worse overall in the semantic condition, $t(47) = 2.96$, $p = .005$, $d = 0.89$. They were also less accurate than nonpsychopathic control participants in recognizing sad, $t(26) = 2.57$, $p = .016$, $d = 0.76$, and neutral sentences, $t(47) = 2.25$, $p = .029$, $d = 0.67$. Although the group differences for happy and angry sentences were not significant, $ts(47) = 1.64, 1.50$, $ps = .11, .14$, respectively, the effect sizes for these differences were not trivial ($ds = 0.49, 0.45$, respectively). No significant differences were found for recognition of surprise, $t(47)$ 1.03, $p = .30$, $d = 0.30$.

A deficit for primary psychopaths that approached significance was also observed in the prosodic condition collapsing across all emotions, $t(47) = 1.98$, $p = .05$, $d = 0.59$. However, the only specific category for which the comparison proved significant was the neutral category, $t(47) = 2.43$, $p = .019$, $d = 0.72$. The effect sizes for other emotion categories were small ($ds < 0.32$).

Secondary psychopaths versus nonpsychopathic control participants: Like primary psychopaths, secondary psychopaths were also worse than nonpsychopathic control criminals at classifying emotion overall in the semantic condition, $t(49) = –2.16$, $p = .04$, $d = 0.57$. Also consistent with analyses for primary psychopaths, secondary psychopaths exhibited a deficit that neared significance in recognizing vocal sadness, $t(47) = –2.03$, $p = .05$, $d = 0.53$. Interestingly, whereas the contrast of primary psychopaths and control participants for happiness had been nonsignificant, secondary psychopaths were poorer than nonpsychopaths at recognizing happiness, $t(57) = –2.38$, $p = .02$, $d = 0.63$. Although not significant, the group difference in recognizing surprise approached significance, $t(56) = –1.72$, $p = .09$, $d = 0.46$.

In contrast to the semantic condition and analyses for primary psychopaths, no group differences for the prosodic condition approached significance. However, the effect sizes for group differences in sadness and anger were not trivial ($ds = 0.43$ and 0.40, respectively).

Primary psychopaths versus secondary psychopaths: Comparison of primary and secondary psychopaths in the semantic condition indicated no significant differences in overall classification of emotion, $t(46) < 1$, *ns*, $d = 0.19$, or for any specific emotion (all $ts < 1.40$, *ns*). However, the group difference in recognition of sadness yielded a moderate effect size ($d = 0.41$). Although the comparisons between primary and secondary psychopaths in the prosodic condition also revealed no group differences, the effect sizes for comparisons involving sad and neutral sentences were moderate and small-to-moderate ($ds = 0.48$ and 0.39, respectively).

Comparisons involving inmates with some psychopathic features: Men in this group were not different from men in other groups in the semantic condition. However, in the prosodic condition, they performed better overall than primary, $t(41) = –2.77$, $p < .01$, $d = 0.95$, and secondary psychopaths, $t(51) = –1.99$, $p = .05$, $d = 0.63$. They were also superior to primary psychopaths at identifying prosodic condition neutral sentences, $t(41) = –2.70$, p

= .01, d = 0.84. Although no other comparisons proved significant, effect sizes for differences between criminals with psychopathic features and primary psychopaths were in the small-to-moderate range for several semantic condition emotions (overall performance, d = 0.48; sadness, d = 0.46; anger, d = 0.36; and surprise, d = 0.39) and for prosodic condition sadness (d = 0.52). There were also small-to-moderate and moderate effect sizes indicating nonsignificantly better performance for this group over secondary psychopaths (semantic surprise, d = 0.54) and nonpsychopaths (prosodic overall, d = 0.44; prosodic sadness, d = 0.44) and indicating nonsignificant superiority of nonpsychopaths over inmates with psychopathic features (semantic neutral, d = 0.52).

Correlational Analyses

We also report correlations between PCL-R total and factor scores and vocal affect recognition performance. As shown in Table 4, correlations between PCL-R total score and performance were generally consistent with, but weaker than, planned comparisons reported in Part One. Correlations with factor scores suggest that Factor 1 scores may have contributed more to semantic condition differences and Factor 2 scores more to prosodic condition differences; however, none of the differences between these correlations proved significant.

Discussion

Part One analyses demonstrated overall vocal affect recognition deficits for psychopathic offenders under both conditions requiring use of semantic cues and conditions requiring use of prosodic cues, despite methodological improvements over prior studies. They also provided evidence that emotional deficits were specific to some components of emotional information, with the pattern dependent upon the conditions examined. The evidence for an overall deficit in recognizing vocal affect in the semantic–affective condition is consistent with suggestions that psychopaths are characterized by generally deficient processing of affective cues (Blair et al., 2004; Kosson et al., 2002). Similarly, the evidence for a specific deficit in recognizing vocal sadness in this same condition is consistent with Blair's violence inhibition mechanism hypothesis (Blair & Frith, 2000) and with some prior findings suggesting specific deficits in recognizing sadness (Blair, Colledge, Murray, & Mitchell, 2001; cf. Blair et al., 2004). However, a deficit in identifying vocal happiness based on semantic cues has not been previously reported (cf. Hastings, Tangney, & Stuewig, 2008). Similarly, the evidence for a deficit in recognizing surprise based on prosodic cues is novel.

Although these latter deficits differ from those previously reported for psychopaths, no prior studies have examined vocal affect processing as in the current study. For example, Blair et al. (2002) did not assess vocal affect recognition based on semantic cues or recognition of surprise. Moreover, recognizing emotion in neutral words in English may depend on different mechanisms than recognizing emotion in sentences spoken in a foreign language. Moreover, no prior studies included an equal balance of positive- and negative-valence sentences.

Middle-scoring participants also demonstrated poor performance on happiness trials in the semantic condition (see Table 2). Thus, even subclinical psychopathy may be sufficient to interfere with processing semantic cues for happiness, whereas the full psychopathy syndrome appears necessary to observe deficits in using prosodic affective cues. However, offenders obtaining intermediate PCL-R scores may also be characterized by greater levels of schizotypy (Raine, 1992) than those with low and high scores. Consequently, this deficit should be interpreted cautiously pending replication with more stringent exclusion criteria.

Current findings for the second part of the study indicate that both primary and secondary psychopaths demonstrate somewhat similar emotional processing deficits, including significant overall impairment and a specific deficit in recognizing sadness in the semantic condition. Additionally, both groups were either significantly impaired or characterized by trends toward deficits in recognizing happiness. The only difference was that primary psychopaths were also deficient at classifying neutral sentences in the semantic condition.

However, these subgroups differed in the classification of affect based on prosodic cues. Primary psychopaths exhibited overall impairment in recognizing vocal affect in the prosodic condition relative to both nonpsychopathic control participants and criminals with psychopathic features, whereas secondary psychopaths were poorer only than criminals with psychopathic features. Only primary psychopaths were also poorer than both nonpsychopathic groups at recognizing neutral sentences based on prosodic cues. Although primary and secondary psychopaths were not significantly different from each other, some effect sizes for group differences in the prosodic condition were small-to-moderate or moderate (see Results).

The general pattern of deficits for primary psychopaths is consistent with evidence from several studies suggesting relatively general emotional processing deficits for psychopaths (Blair et al., 2004; Kosson et al., 2002), as well as evidence for a general deficit in processing vocal affect in the only recent study of PCL-R-diagnosed psychopaths to address this issue directly (Blair et al., 2002). Although, as noted earlier, the results for specific emotion categories within the prosodic condition are not entirely consistent with those of Blair et al. (2002), these results may not be as discrepant as they at first appear, given the different categories examined and the effect sizes reported in Blair et al. (2002). One possible explanation for the deficit in classifying neutral sentences is that primary psychopaths may have difficulty accurately judging the valence of vocal stimuli, similar to deficits in judging valence previously reported for psychopathic offenders (Hervé et al., 2003). Differences in experimental conditions may also contribute to different patterns of findings. For example, psychopaths' deficits may be more general in situations requiring processing of complete sentences. Indeed, overall accuracy was substantially lower in the current prosodic condition than in Blair et al. (2002). In any case, the clear evidence for emotional processing anomalies appears consistent with predictions based on the premise that the primary psychopathic cluster of Vassileva et al. (2005) is aptly described by the label primary psychopathy.

The performance of secondary psychopaths was also consistent with significant deficits in the ability to discriminate vocal affect, at least in the semantic condition. As noted earlier, some prior studies suggest that affective deficits/anomalies associated with psychopathy are relatively more robust for verbal than for nonverbal conditions (Day & Wong, 1996; Williamson, Harpur, & Hare, 1990). From this perspective, current results are consistent with the hypothesis that this cluster may also exhibit affect recognition deficits characteristic of psychopathy.

Although these cluster-analysis-based groups do not map directly onto the subdivision used by Lorenz (2002), the similarity between the primary and secondary psychopathic clusters in semantic condition performance appears consistent with that between low- and high-anxiety psychopaths reported by Lorenz. In the three tasks she examined, responsiveness to affective stimuli was assumed to depend upon semantic processing. Further, that both psychopathic clusters had difficulty identifying sadness in the semantic condition is consistent with the Part One finding that psychopathic offenders, as a whole, were poor at recognizing vocal sadness. These findings are also partly consistent with evidence pointing to specific deficits in recognizing sadness and fear across a variety of conditions (Blair et al., 2002, 2004).

Unlike in Blair et al.'s (2002, 2004) studies, psychopaths also exhibited deficits in recognizing other emotions.

Comparisons for criminals with some psychopathic features revealed no significant deficits in vocal affect recognition. Collapsing across emotion categories, they outperformed primary psychopaths in the prosodic condition and were marginally superior to secondary psychopaths in the prosodic condition. These differences provide further evidence that the prosodic condition deficits seen in psychopathic inmates are not characteristic of men with some features of psychopathy, sometimes referred to as subclinical psychopaths. However, in the semantic condition, the performance of such inmates was intermediate between that of nonpsychopathic and primary psychopathic offenders in several categories. Effect sizes for several of the differences between this group and primary psychopaths were small-to-moderate. It is possible that future studies with larger samples will show that individuals with subclinical psychopathy outperform primary psychopaths in semantic emotional processing.

Findings for correlations with PCL-R total scores were similar to, but weaker than, planned comparisons in Part One. In contrast, correlations involving factor scores suggested somewhat different relationships than those obtained in Part Two. These correlations suggest that other variables contributing to cluster membership played a greater role in the Part Two findings than the PCL-R factor scores.

Several limitations of the current study must be emphasized. First, given that psychopaths may exhibit somewhat different emotional processing deficits in different situations, the inclusion of another emotional processing task would have assisted in determining whether the observed affective deficits generalize to other situations. Second, we acknowledge that the inclusion of a fear category in the current study could have allowed for direct comparisons with some prior studies. Third, several group comparisons failed to achieve statistical significance despite moderate effect sizes. It appears likely that some additional group differences would be significant with larger samples. Fourth, the large number of planned comparisons conducted is likely to have inflated alpha levels to some degree. Even though several of the Part One findings are consistent with those reported in other samples, novel findings should be viewed cautiously until replicated in independent samples. In addition, we note that performance on prosodic condition surprise trials was near chance. However, participants' poor performance should have reduced the discriminating power of these trials, making it more difficult to detect group differences; poor performance is not an obstacle to interpreting psychopathic inmates' significant deficits in classifying surprise.

Finally, although the use of cluster analysis has advantages over selecting individuals on the basis of a single measure, it too has limitations. Cluster analyses reduce within-group variability but do not ensure that members of a cluster achieve particular scores on the measures included in the variate. In short, not all individuals assigned to the two psychopathic subgroups had PCL-R scores of 30 or greater; consequently, not all these individuals would be considered psychopathic in extreme group analyses based on established PCL-R cutoffs. Nevertheless, the classification functions (see Appendix) show that high scores on PCL-R Factor 1 and PCL-R Factor 2 were among the chief determinants of membership in the primary and secondary psychopathic clusters. In this context, the similarity of the pattern of emotional processing deficits found for these subgroups to that in Lorenz (2002) suggests some consistency in emotional processing dysfunction across different paradigms and different methods of identifying subgroups.

One additional contribution of the current study is that it provides additional validation of the subgroups of psychopathy (i.e., primary and secondary) obtained via cluster analytic

methods. Despite many suggestions that psychopathy is heterogeneous and a variety of methods for identifying subgroups, few studies have examined basic affective mechanisms associated with psychopathy in identified subgroups. Although additional research is necessary to examine other affective and cognitive tasks, current results demonstrate that subdividing psychopathy has substantial promise for revealing similarities and differences within the larger group of offenders with psychopathic traits.

Current findings suggest the possibility of distinct mechanisms underlying deficient affective processing in psychopathy. Evidence for deficits in using both semantic and prosodic affective cues provides tentative clues to mechanisms underlying psychopathic offenders' impaired understanding of human communication, which may contribute to their maladaptive interpersonal behavior. If replicated in independent samples, such findings may also prove important in the development of treatment approaches tailored to address specific deficits. Moreover, evidence that some of psychopaths' deficits are specific may contribute to the design of interventions that utilize psychopaths' relative strengths in emotion recognition to compensate for their weaknesses.

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Appendix

Group Classification Functions

Primary psychopath = –6.229 – 1.068(Alcohol) – 0.276(Drug) + 1.122(Factor 1) + 0.697(Factor 2) + 4.624(IM-P) – 0.145(STAI-T).

Secondary psychopath = –3.314 + 2.505(Alcohol) + 0.676(Drug) + 0.532(Factor 1) + 0.43(Factor 2) – 0.829(IM-P) + 0.341(STAI-T).

Control = –3.807 – 0.178(Alcohol) – 0.366(Drug) – 1.965(Factor 1) – 1.664(Factor 2) – 1.011(IM-P) + 0.001(STAI-T).

Antisocial = –2.682 – 1.956(Alcohol) – 0.199(Drug) + 0.74(Factor 1) + 0.806(Factor 2) – 1.013(IM-P) – 0.292(STAI-T).

Standard scores were used in computing all classification functions. Abbreviations: Alcohol and Drug = scores on the Structured Clinical Interview for the *DSM–IV*, Alcohol and Substance Use Module (0 = *no abuse*,1 = *abuse*, 2–4 = *mild to severe dependence*); Factor 1 and Factor 2 = Psychopathy Checklist—Revised factors; IM-P = Interpersonal Measure of Psychopathy; STAI-T = Spielberger State–Trait Anxiety Inventory, Trait scale.

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Table 1

Means, Standard Deviations, and Comparison Results for Cluster Characteristics

	Primary psychopaths		Secondary psychopaths		Control participants		Criminals with psychopathic features		
Variable	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	**Comparisons at $p < .05$**
Demographic variable									
Age	28.00	5.80	24.58	5.84	24.59	6.80	22.35	4.14	
Education	11.30	1.87	11.40	1.71	11.41	1.74	11.15	1.54	
IQ	88.77	11.77	89.08	14.23	92.34	10.75	92.38	10.44	
PCL-R	30.55	4.29	27.31	5.84	16.20	4.25	27.00	4.82	
Cluster variable									
Alcohol	–0.20	0.81	1.32	0.45	–0.19	0.79	–0.66	0.38	s > c, f, p
Anxiety	–0.07	0.99	0.37	0.57	0.39	0.88	–0.18	1.01	s > c
Drug	0.27	0.98	0.38	0.91	–0.47	0.88	–0.08	0.19	p, s > c
Factor 1	1.07	0.54	0.10	0.94	–1.13	0.63	0.28	0.78	p > s, c, f; s, f > c
Factor 2	0.43	0.72	0.49	0.85	–0.85	0.93	0.41	0.82	p, s, f > c
IM-P	1.57	0.71	0.01	0.69	–0.57	0.46	–0.09	0.51	p, s, f > c; p > f

Note. Only significant group comparisons are listed. p = primary psychopathic cluster; s = secondary psychopathic cluster; c = control cluster; f = inmates with psychopathic features cluster. PCL-R = Psychopathy Checklist—Revised; IM-P = Interpersonal Measure of Psychopathy.

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Table 2

Mean Percentage Correct (and Standard Deviations) for Psychopaths, Nonpsychopaths, and Middle-Scoring Participants

Condition	Psychopaths (n = 33–34)	Nonpsychopaths (n = 34)	d [a]	Middle-scoring (n = 33–34)	d [b]	d [c]
Semantic						
All emotions**	.58 (.17)	.69 (.14)	0.70	.61 (.18)	–0.17	0.50
Happiness**	.50 (.16)	.61 (.16)	0.76	.50 (.22)	0.00	0.57
Sadness**	.67 (.28)	.82 (.17)	0.69	.69[1] (.28)	–0.07	0.56
Anger	.42 (.24)	.47 (.23)	0.21	.40 (.22)	0.09	0.31
Surprise	.75 (.17)	.81 (.20)	0.30	.80 (.21)	–0.26	0.05
Neutral†	.60 (.32)	.74 (.26)	0.46	.66 (.36)	–0.18	0.25
Prosodic						
All emotions*	.46 (.10)	.50 (.08)	0.48	.50 (.10)	–0.40	0.00
Happiness	.26 (.17)	.31 (.21)	0.25	.31 (.17)	–0.29	0.00
Sadness	.65 (.21)	.61 (.18)	0.22	.65 (.26)	0.00	–0.18
Anger	.85 (.20)	.89 (.15)	0.22	.86 (.15)	–0.06	0.20
Surprise*	.16 (.10)	.24 (.19)	0.53	.23 (.15)	–0.55	0.06
Neutral†	.38 (.19)	.47 (.20)	0.46	.46 (.22)	–0.39	–0.05

Note. Six sentences were presented for each emotion category per condition.

[a] Effect size for psychopathic vs. nonpsychopathic participants.

[b] Effect size for middle-scoring vs. psychopathic participants.

[c] Effect size for middle-scoring vs. nonpsychopathic participants.

[1] Middle-scoring participants differ from nonpsychopathic participants using the Tukey test, $p < .05$.

† $p < .10$.

* $p \leq .05$.

** $p < .01$, all for psychopathic vs. nonpsychopathic groups comparisons.

Table 3

Mean Percentage Correct (Standard Deviations) for Participants in Four Clusters

Condition	Primary psychopaths (*n* = 19)	Secondary psychopaths (*n* = 28–29)	Nonpsychopaths (*n* = 29–30)	Criminals with psychopathic features (*n* = 24)
Semantic				
All emotions	.56 (.16)[a]	.60 (.19)[a]	.69 (.13)[b]	.64 (.17)
Happiness	.53 (.13)	.48 (.23)[a]	.60 (.17)[b]	.54 (.18)
Sadness	.61 (.30)[a]	.69 (.27)[a]	.81 (.17)[b]	.76 (.25)
Anger	.35 (.25)	.45 (.24)	.45 (.21)	.44 (.24)
Surprise	.76 (.19)	.73 (.20)	.82 (.20)	.83 (.17)
Neutral	.57 (.33)[a]	.67 (.33)	.76 (.25)[b]	.63 (.35)
Prosodic				
All emotions	.44 (.09)[a]	.47 (.09)[ab]	.49 (.08)[bc]	.53 (.10)[c]
Happiness	.26 (.22)	.27 (.14)	.31 (.20)	.32 (.18)
Sadness	.56 (.28)	.68 (.18)	.60 (.19)	.69 (.22)
Anger	.85 (.17)	.83 (.19)	.90 (.15)	.88 (.17)
Surprise	.20 (.14)	.21 (.16)	.19 (.16)	.24 (.16)
Neutral	.33 (.18)[a]	.41 (.20)	.47 (.20)[b]	.49 (.20)[b]

Note. Six sentences were presented for each emotion category per condition. Within each emotion condition, groups with different superscripts (e.g., a vs. b or b vs. c) indicate a significant difference, $p \leq .05$.

Table 4

Correlations of Psychopathy Checklist—Revised Total and Factor Scores With Indices of Vocal Affect Recognition Accuracy

Condition	Total	Factor 1	Factor 2
Semantic			
All emotions	−.174†	−.187†	−.055
Happiness	−.197*	−.146	−.146
Sadness	−.165†	−.192*	−.056
Anger	−.052	−.151	.043
Surprise	−.083	−.069	−.019
Neutral	−.105	−.107	−.008
Prosodic			
All emotions	−.146	−.048	−.189†
Happiness	−.099	−.032	−.129
Sadness	.134	.123	.109
Anger	−.078	−.039	−.098
Surprise	−.183†	−.097	−.203*
Neutral	−.184†	−.138	−.196*

† $p \leq .10$.

* $p \leq .05$.